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Community Structure and Composition of Rice Weed (*Oryza sativa L.*) in Banyubiru Village, Semarang Regency

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Abstract

Weeds are a term used for disturbing plants that live with cultivated plants and if not controlled will reduce the quantity and quality of crop yields. The purpose of this study was to analyze the composition and community structure of weeds in rice aged 8 weeks. The benefits of this research are expected to provide information about the types of weeds and their characteristics. This research was conducted in Banyubiru Village, Semarang Regency; and the Unnes Biology Plant Taxonomy Laboratory. The method used in this study was random sampling using 9 plots measuring 1 m x 1 m. The results showed that there were 11 families, 17 species and 526 individuals with the highest Importance Value Index found in the species Cyperus diiformis L, namely 0.79. The weed diversity index is moderate, namely H' = 1.25.

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INTRODUCTION

Rice is still the main staple food for the majority of Indonesia's population. Rice comes from the rice plant (*Oryza sativa* L.) which is an important food commodity in Asia, especially Indonesia, because the majority of the population makes rice a staple food. Rice production must be kept stable to meet the demand for food due to population growth (Calha et al., 2023). One of the important things in increasing rice production is minimizing crop losses caused by weeds (Kurniadie et al., 2018). Yield losses caused by weeds exceed yield losses caused by pests and plant diseases. In addition, competition with weeds also reduces the quality of rice grains (Antralina et al., 2015).

Weeds are nuisance plants that grow with rice and if not controlled will reduce the quantity and quality of crop yields (Scavo et al., 2022). Weeds are a serious threat to rice plants because of the same growth requirements as rice plants, for example the need for nutrients, water, sunlight and space to grow. This resulted in competition between weeds and rice plants. Both will compete with each other for all the aspects needed to grow, especially if the number is very limited. The threat of competition with weeds is increasingly supported by their propagation both vegetatively and generatively (S. Utami & Pudyaningrum, 2012).

Based on previous research conducted by Haris et al., (2019) in Bulusari Village, Sayung District, Demak Regency, in the inorganic farming system, 10 types of weeds were found, such as *Digitaria ciliaris* (Retz.) Koel, *Echinochloa colonum* (L) Link, *Leptochloa chinensis* (L.) Nees, *Oryza rufipogon* Griff, *Cyperus* sp., *Cyperus cephalotes* Vahl, *Eclipta prostrata* (L.) L, *Portulaca oleracea* L., *Physalis angulata* L. dan Euphorbia hypericifolia L. with the highest IVI belonging to the species *Oryza rufipogon* Griff and H' of 0,69.

Semarang Regency is one of the largest rice production centers in Central Java. The area of rice fields is spread over 19 districts. The research was conducted in Banyubiru village which is a center for organic farming. Its location is close to the Rawa pening lake, a spring and is located in the basins of Mount Merbabu, Telomoyo and Ungaran; cause agriculture can be pursued throughout the year (Badan Pusat Statistik Provinsi Jawa Tengah., 2022).

This study aims to determine the composition and community structure of rice weeds on organic agricultural land by calculating the importance value index and diversity index. The benefits expected from this research are that it can be used as a guideline in integrated agriculture to increase rice productivity in a sustainable manner.

METHOD

Time and Place of Research

The research was conducted in January 2023 on paddy fields with an organic farming system in Banyubiru Village, Banyubiru District, Semarang Regency. Identification was carried out at the Plant Taxonomy Laboratory, Biology FMIPA UNNES.

Tools and materials

The tools used are cameras, tape measure, rope, pegs, scissors, plastic bags, stationery, envelopes, labels and weed identification books. The materials used were alcohol, envelopes and rice weed samples.

Method

Weed sampling was carried out by random method. Rice weeds in paddy fields are allowed to grow with rice plants until they are 8 weeks old. The plots used for the study were 1 m x 1 m in size with 9 plots. Record the types of weeds that grow and count the number of individuals for each type of weed. The types of weeds were brought to the Plant Taxonomy laboratory for identification. Identification of rice weed samples using the book "Weed of Rice in Indonesia" by Soerjani *et al* . (1987).

Environmental factors during observation were also measured to determine environmental conditions during data collection. These environmental factors include light intensity measured with a lux meter, pH and soil moisture with a soil tester, air temperature with a thermometer, air humidity with a hygrometer and altitude with an altimeter.

Data analysis

The data obtained were analyzed by calculating type dominance, Important Value Index (IVI) and Shannon-Wiener Diversity Index

$$\text{Dominance of Plant Types} = \frac{\text{Number of individuals in a family}}{\text{Number of individuals in all families}}$$

Dominant families if they have a percentage of> 20% total individuals, codominant 10% - 20%, and not dominant <10% (Soerjani M, 1987).

Important Value of Weed Type Species density (Irwanto, 2007),

$$\text{Absolute density (AD)} = \frac{\text{Number of Individuals of a Type}}{\text{Area of observation plot}}$$

$$\text{Relative Density (RD)} = \frac{\text{Absolute density of a type}}{\sum \text{Total absolute density of all types}} \times 100\%$$

Frequence (Indriyanto, 2006)

$$\text{Absolute Frequence (AF)} = \frac{\text{The number of plots occupied by a type}}{\text{The total number of observation plots}}$$

$$\text{Relative Frequence (RF)} = \frac{\text{Absolute frequence of a Type}}{\text{Absolute Frequence of All Types}} \times 100\%$$

IVI = RD + RF

Information :
IVI = Important Value Index
RD = Relative Density
RF = Relative Frequence

Shannon-Wiener Diversity Index (Krebs C J, 1989):

$$H' = - \sum (ni / N) \ln (ni / N)$$

Information :
H' = Shannon-Wiener diversity index
ni = Number of i-type individuals
N = Total number of individuals of all types

The level of species diversity uses the Fachrul (2007) criteria, namely:
a. H ' value > 3 : the species diversity is high.
b. The H' value 1 ≤ H ≤ 3 : the species diversity is moderate.
c. H ' value <1 : species diversity is low or small.

RESULT AND DISCUSSION

Weed Composition

The results showed that in rice aged 8 weeks weeds were found consisting of 11 families, 17 species and 526 individuals. (Figure 1).

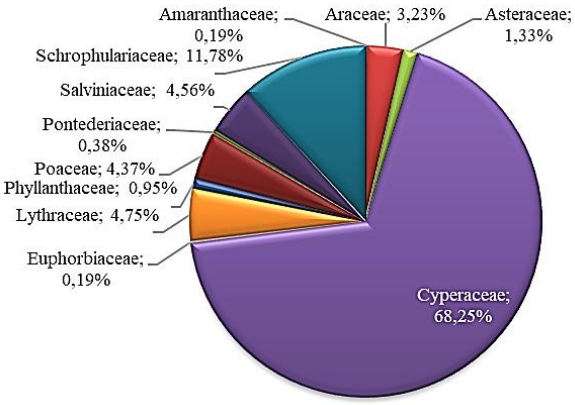

Figure 1. Percentage of Rice Weeds in Banyubiru Village, Semarang Regency.

In Figure 1 it can be seen that at the age of 8 weeks the dominant family is Cyperaceae. Cyperaceae's dominance is due to its ability to produce large quantities of seeds. (Az-Zahro et al., 2022) stated that weeds that are able to reproduce vegetatively and generatively have a higher ability to survive. Meanwhile, the non-dominant families are Amaranthaceae, Asteraceae and Euphorbiaceae because they require more space to grow, of course it will be difficult to grow if there is not enough space available. Sravani (Satria Fitri et al., 2014) explained that *Ischaemum rugosum* Salisb L. is a weed that has many branches and reaches 1 m in height. The dominant nature of certain weed species can cause adverse effects on the ecosystem occupied by that species (in this case, rice). Domination is closely related to invasion. (Solfiyeni et al., (2016), stated that invasion is the ability of a certain species to become dominant, thus threatening ecosystems, habitats, and other species found in a location.

Table 1. Structure of Rice Weed in Banyubiru Village, Semarang Regency

No		Famili	Scientific Name	IVI	H'
1	Broadleaf	Amaranthaceae	Amaranthus gracilis Desf.	.038	.012
2		Araceae	Pistia stratiotes L.	.032	.111
3		Asteraceae	Ageratum conyzoides L	.038	.012
4			Emilia sonchifolia (L) DC ex Wight	.038	.012
5			Eclipta prostrata (L)L	.077	.029
6			Galinsoga parviflora Cav.	.040	.021
7		Euphorbiaceae	Euphorbia hypericifolia L.	.038	.012
8		Lythraceae	Rotala indica (Willd.) Koehne	.155	.145
9		Phyllanthaceae	Phyllanthus debilis Klein ex. Willd	.081	.044
10		Salviniaceae	Azolla pinnata R.Br	.153	.141
11		Schrophulariaceae	Bacopa floribunda (R.Br.) Wettst	.225	.252
12	Sedge weed	Cyperaceae	Cyperus diiformis L	.790	.261
13	Grasses	Poaceae	Cynodon dactylon (L) Pers.	.038	.012
14			Echinochloa colanum (L) Link	.089	.070
15			Ischaemum rugosum Salisb	.038	.012
16			Leersia hexandra Sw	.094	.086
17		Pontederiaceae	Monocharia vaginalis (Burm f.) Presl	.040	.021
			Total Number of Individuals of all Types (N)	526	
			Total number of all types (S)	17	
			Species Diversity Index (H ')	1.25	

Important Value Index

In Table 1 it can be seen that the species that has the highest IVI is *Cyperus diiformis* L and the lowest IVI is *Pistia stratiotes* L. *Cyperus diiformis* L (Figure 2) has the highest Importance Value Index (IVI) because it has the most number of individuals and is found in almost all plots. This shows the important role or effect of the species (Amarullah et al., 2017). while *Pistia stratiotes* L has the lowest Importance Value Index (IVI) because it is the least found among other weed species. Whitmore (1975) in (Kastanja et al., 2021) stated that a low relative density value of a species indicates that the species has fewer individuals than other weed types, while the relatively low frequency value of a species is an indication that the distribution of this type is narrow.

Figure 2 *Cyperus diiformis* L

Species Diversity Index

Weed species diversity index is 1.25. This value indicates that species diversity is classified as moderate. These conditions indicate that the weed ecosystem is quite balanced, productivity is moderate, and ecological pressure is moderate. (Suryatini, 2018), states that the value of H' will increase if the number of species in the community increases and the distribution is more even. Species diversity is closely related to environmental conditions.

Environmental factor

Based on the measurement of environmental factors conducted at the research location, the results can be seen in table 2 below

Table 2. Measurement of Environmental Factors on Rice Fields

No.	Environmental Factors	Average
1	Light intensity	11.562 lux
2	Air temperature	27 ^{o}C
3	Humidity	86 %
4	Soil pH	7,2
5	Height of place	1302 m fsl

In Table 2 it is known that the light intensity at the study site was 11,562 lux. Utami (D. N. Utami & Halim, 2019) stated that high light intensity has an impact on growth and yield of good rice plants. Air temperature at the research site is 27^{o}C. According to (Zhang et al., 2023), the optimum temperature for the growth of rice plants is 24-28 ^{o}C. Air humidity at the study site was 86%. (Uluputty & Pertanian, 2014), stating that high air humidity is needed by weeds to germinate the soil pH at the location of this study is 7.2. (Roma-Burgos et al., 2021), stated that the soil pH that is best for growth and availability of nutrients is close to neutral (6.5-7.5). Soil pH determines whether or not nutrients can be absorbed easily by plants. The height of the study area is 1302 meters above sea level. (Suryatini, 2018), stated that the height of the place is not a limiting factor for the spread of weeds, because weeds are able to grow well to a height above 500 m above sea level.

CONCLUSION

Weed composition in rice aged 8 weeks consisted of 11 families, 17 species and 526 individuals with the highest Importance Value Index found in the species Cyperus diiformis L, namely 0.79. The weed diversity index is moderate, namely H' = 1.25. The dominant weed species was Cyperus diiformis L from the Cyperaceae family (78.96%). The highest Importance Value Index is found in species, namely 0.79. Weed species diversity index is classified as moderate, namely H' = 1.25.

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