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The Existence of Insects and Their Role on Rice (*Oryza sativa* L.) Agriculture in Medang Village, Batu Bara District, North Sumatra

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Abstract: Research on insect diversity on rice (Oryza sativa L.) agricultural land in Medang Lama Village, Medang Deras District, Batu Bara Regency was carried out in June-December 2024.The research aims to analyze insect species and the role of insects at different growth periods, namely the vegetative period (25-30), the generative period (55-50), and the maturation period (85-90) days after planting (DAP), The method for determining sampling points is carried out using the Purposive Sampling method, while sampling uses the *Insecting Net*, *Visual Control, Hand Sorting and Light Trap* methods. The research results showed that the insects obtained were 31 species, 24 families and 7 orders. The highest number of insects was found during the generative period, 173 individuals, 81 individuals during the vegetative period, and the lowest during the maturation period, 56 individuals. During the vegetative period, 10 pest species, 5 predator species and 1 pollinator species were found. During the generative period, 13 pest species, 10 predator species and 6 pollinator species were found. During the ripening period, 6 pest species, 5 predator species and 3 pollinator species were found. Pest insects are predominantly from the Hemiptera order, predatory insects are predominantly from the Coloptera order and pollinator insects are predominantly from the Hymenoptera order. Insect pests attack more often during the vegetative and generative periods than during the ripening period of rice plants.

Keywords: Insect diversity; Planting age; Rice; The role of insect

Introduction

Rice plants (*Oryza sativa* L.) are widely cultivated by farmers as a staple food and one source of income for the majority of Indonesian people in the agricultural sector. In line with this, rice plant productivity has always been a major concern in order to achieve food sovereignty. Food sovereignty is an important issue for Indonesian society because it is a benchmark for the welfare of the Indonesian people (Wati, 2017). The agricultural sector plays an important role not only as a food requirement for the community but also as a contributor to the country's foreign exchange earnings because as a source of income and a provider of jobs for the Indonesian people, the lack of food sources can cause economic and social threats that can disrupt the economic stability of the Indonesian people.

Insects in rice plants are very important to know because they have a very important role, some act as pests, predators and pollinators. Insects are also important in maintaining the sustainability of the ecosystem, namely as soil fertilizers, therefore the types of insects are very important to know (Monsanto, 2013). Insect biodiversity affects the quantity and quality of the products produced. In natural ecosystems, there has generally been population stability between insect pests,

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predators and pollinators so that the presence of insect pests is no longer detrimental (Sumiyati et al., 2024). Understanding the diversity of insects associated with rice cultivation can provide information about the composition and structure of the ecosystem, which can be applied to integrated pest management (Sonico, 2022). Sumarmiyati et al. (2024) in Kutai Kartanegara Regency, East Kalimantan, found 60 insect species in rice plants with different morphological forms and consisting of predatory insects, beneficial insects and harmful insects. Some insects depend entirely on rice plants for their livelihood, for example pests, while others become predators and some become pollinator insects (Hutasuhut et al., 2021). Insect pests can cause damage to plants and reduce their quality and quantity, causing economic losses (Sianipar et al., 2015). There are several insect pests in rice plants, including *Nilaparvata lugens, Nephotettix virescens, Leptocorixa acuta, Scirpophaga incertulas, Nhympula depunctalis, Reccilia dorsalis, Sogatella furcifera and S. obscura.* These pests can cause destruction to rice both directly and indirectly (Jumar, 2000).

The productivity of rice plants (*Oryza sativa* L.) in North Sumatra has fluctuated, this shows that in 2021, rice production in North Sumatra was recorded at ± 2200 tons. In 2022, rice production was ± 2100 tons (BPS North Sumatra, 2021). The results of a survey conducted in Medang Lama Village, Medang Deras District, Batu Bara Regency are one of the largest rice-producing regencies in North Sumatra. Lack of data and information for farmers and the scientific community regarding insect species and roles, thus becoming one of the problems in recognizing, understanding, and utilizing insect diversity for human survival and the sustainability of trophic flow balance in agroecosystems (Untung, 2006). So far, no research has been conducted, so there is no data on the existence of insect species and the role of insects in rice fields (Oryza sativa L.) in Medang Deras District, Batu Bara Regency, so it is necessary to conduct more in-depth research in the Batu-Bara Regency area.

Method

Research Time

This research was conducted from July to December 2024.

Research Location

On rice (*Oryza sativa* L.) agricultural land in Medang Lama Village, Medang Deras District, Batu Bara Regency, North Sumatra Province. Sample identification was carried out at the Animal Systematics Laboratory, Department of Biology, University of North Sumatra.

Tools and Materials

The tools used in this research consisted of a digital camera, hygrometer, soil tester, thermometer, lux meter, sticky labels, insecting net, light trap, medium sample cup, tweezers, 1.5 kg plastic, plastic rope, cloth meter, and tools write. The material used to preserve samples is 70% alcohol.

Sampling

The method for determining sampling points was carried out using the Purposive Sampling method in the rice planting area. Insect sampling in this study was carried out using direct observation methods (Visual Contral) and Hand Sorting of flightless insects (larvae) on rice plants. For insects that actively fly, use the Insecting Net. This method is very good to use to collect low-flying insects on the canopy of rice plants, or bushes. For insects that are active at night, use the Light Trap method (Oktarima, 2015).

Research Implementation
In the Field

Carrying out research in the field using the Purposive Sampling method which is considered to represent the presence of insects, plots are made measuring 5 x 5 m in 3 plots using a measuring tape and making markers by installing 4 stakes 1 meter high, which are tied and stretched by plastic rope (raffia). At these sampling points, insects were observed and taken from rice plants in the vegetative period aged 25-30, generative 55-60, and ripening aged 85-90 days after planting (DAP). Sampling was carried out at 06.00-09.00 WIB, insects that could not fly were taken by hand (*hand sorting*), then put into sample bottles. Insects that are actively flying are taken by flicking the insect net 10 times at each observation point, and put into a sample bottle. For insects that are active at night, insects are collected using light traps installed at research points from 18.00-06.00 in the morning (12 hours). The insects obtained are put into a sample bottle. Then all the insect samples obtained were grouped into types based on morphological characteristics, then put into sample bottles, and taken to the Animal Systematics laboratory of the USU FMIPA Biology Study Program for identification.

In the Laboratory

Insects obtained from the research location contained in each sample bottle were removed, and regrouped based on the same morphological characteristics, in order to obtain valid species. Furthermore, identification and determination were carried out by paying attention to morphology using a magnifying glass and binocular stereo microscope, digital camera, and using several identification reference

books as follows: Borror et al. (1996), and Arlen (2020), then the ecological role of insects was determined, including pest insects, pollinating insects, predatory insects, pathogenic insects, and so on.

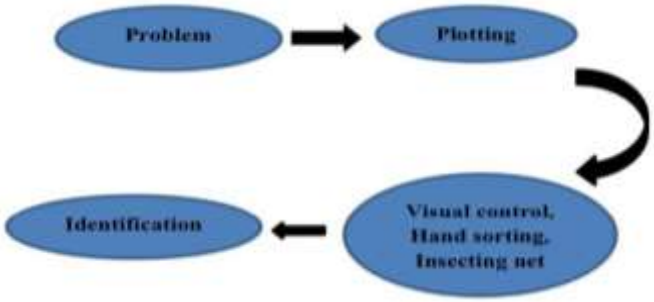

Figure 1. Research flow diagram

Result and Discussion

The Presence of Insect Species in Rice Fields (*Oryza sativa* L.)

The results of research carried out on rice (*Oryza sativa* L.) agricultural land at different observation times, namely vegetative age 25-30, generative age 55-60, and ripening age 85-90 days after planting (DAP). In Medang Lama Village, Medang Deras District, Batu Bara Regency, North Sumatra Province, 31 species of insects, 24 families and 7 orders were obtained, as shown in Table 1. Shows that the insects most commonly found are during the generative period with a total of 29 species, followed by the vegetative period with a total of 16 species, and the fewest found during the maturation period are 14 species. The large number of insect species found during the generative period is due to the fact that during the generative period plants are visited by more insects, due to the availability of large amounts of food as a source of nutrition for insects, a place to play/protect, and to lay eggs. Untung (2006) stated that during the generative period, the morphology of rice plants, such as the size and shape of the leaves, is favored by insects as places to perch, lay eggs and obtain food. This is also in line with the opinion of Jumar (2000) who states that food is a source of nutrition that insects need to live and grow, if the food is available in good quality, then the insect population is found to increase. On the other hand, if food conditions are poor, the insect population will also decrease.

Based on the observation times in table 1, it can also be seen that there were insect species found at all observation times, namely the vegetative, generative and maturation periods of 8 species consisting of *Ceriagrrion cerinobellum*, *Orthetrum* sp, *Leptocorisa oratorius*, *Sehirus cinctus*, *Bactocera* sp, *Amata heubneri*, *Dolichoderus* sp, and *Oecophylla smaragdina*. These species were found at the third observation time, indicating that these species have a wide range of tolerance and good adaptability, compared to species that were only found at 2 observation times, let alone only found at 1 observation time. Rizal et al. (2015) stated that the Odonata order is insects with a wide distribution, starting from forests, gardens, rice fields, rivers and lakes.

Table 1. Classification of Insect Classes (Insects) Found on Rice (Oryza sativa L.) Agricultural Land in Medang Lama Village, Medang Deras District, Batu Bara Regency, Sumatra Province

Ordo	Species	VG	GN	MT
Hemiptera	Nilaparvata lugens	+	-	+
	Sogatella furcipera	+	+	-
	Leptocorisa oratorius	+	+	+
	Gonocerus acuteangulatus	+	+	-
	Cofana spectra	+	+	-
	Andrallus spinidens	+	+	-
	Sehirus cinctus	+	+	+
Hymenoptera	Vespula vulgaris	-	+	+
	Rhynchium sp	-	+	-
	Scolia sp	-	+	-
	Sceliphron sp	-	+	-
	Dolichoderus sp	+	+	+
	Oecophylla smaragdina	+	+	+
Coleoptera	Harmonia axyridis	-	+	-
	Cocccinella arcuate,	-	+	-
	Coccinella sexmaculata	+	+	-
	Chlaenius sp,	-	+	+
	Paederus fuscipes	-	+	-
	Adoratus sp,	-	+	+
Lepidoptera	Amata heubneri	+	+	+
	Leptosia nina	-	+	-
	Scirpophaga incertulas	+	+	-
	Spedoptera litura	-	+	-
	Junonia sp	-	-	+
Orthoptera	Acrida cinera	-	+	-
	Trimerotropis sp	-	+	+
	Oxya sp	-	+	-
	Melanoplus packardii	+	+	-
Odonata	Ceriagrrion cerinobellum	+	+	+
	Orthetrum sp	+	+	+
Diptera	Bactocera sp	+	+	+

Information: VG = vegetative (age 25-30 DAP); GN= Generative (age 55-60 DAP); MT = Maturation (age 85-90DAP); + = Optained ; - = Not optained

From table 1 it can be seen that the most obtained were from the Hemiptera order consisting of 7 species, namely *Nilaparvata lugens, Sogatella furcipera, Leptocorisa oratorius, Gonocerus acuteangulatus, Cofana spectra, Andrallus spinidens,* and *Sehirus cinctus,* then followed by the Hymenoptera order consisting of 6 species, namely *Vespula vulgaris, Rhynchium sp, Scolia sp, Sceliphron sp, Dolichoderus sp,* and *Oecophylla smaragdina, Coleoptera* 6 species, namely *Harmonia axyridis, Coccinella arcuate, Coccinella sexmaculata, Chlaenius sp, Paederus fuscipes,* and *Adoratus sp,* Lepidoptera consisting of 5 species, namely

Amata heubneri, Leptosia nina, Scirpophaga incertulas, Spedoptera litura and *Junonia sp;* Orthoptera consists of 4 species, namely *Acrida cinera, Trimerotropis sp, Oxya sp,* and *Melanoplus packardii*. The lowest number of species was obtained from the Diptera order consisting of 1 species of Bactocera sp (Table 1). The large number of species of the Hemiptera order found in rice plants during the generative and vegetative periods is due to the abundant availability of food during this period, because species from the Hemiptera order act as phytophagous or herbivorous insects. The results of Mahfuzah et al. (2023) study found 9 species from the Hemiptera order in rice plants which generally act as insect pests. According to Borror et al. (1996), the Hemiptera order is a pest insect that is very widely distributed and is the largest insect group compared to other insect orders.

Insects on rice plants that are rarely found are from the order Diptera (flies), species from this order are not the main pests of rice plants. These insects are mostly decomposing insects and parasitoid insects, in addition, the habitat of the Diptera order is not suitable for the rice field environment. This is in line with the research of Mahfuzah et al. (2023) who also found 1 species of the Diptera order, namely Tipulla sp in the rice field ecosystem in Reh Village, Darussalam District, Aceh Besar Regency. Likewise, the research of Sumarmiyati et al. (2019) which found 1 species of the Diptera order, namely Asilidae in rice fields in Kutai Kartanegara Regency, East Kalimantan.

Based on the observation time, table 1 also shows that there are insect species found at all observation times, namely the vegetative period (25-30 DAP), generative (55-60 DAP), and maturation (85-90 DAP) as many as 8 species consisting of Ceriagrrion cerinobellum, Orthetrum sp, Leptocorisa oratorius, Sehirus cinctus, Bactocera sp, Amata heubneri, Dolichoderus sp, and Oecophylla smaragdina. The discovery of these species at all three observation times indicates that these species have a wide tolerance range and good adaptability, compared to species that were only found at 2 observation times, let alone only found at 1 observation time. Rizal et al. (2015) stated that the Odonata order is an insect with a wide distribution, ranging from forests, gardens, rice fields, rivers and lakes. According to Ilham et al. (2018) insects have a lot of diversity and high adaptability in various habitats, the great diversity in morphological, physiological and behavioral characteristics of adaptation to their environment, causes the most types of insects to be found on earth. Sugiura (2020), stated that insects adapt by changing color and body shape such as camouflage and mimicry, insects can also develop other physical defenses such as hair and spines on the body.

The Role of Rice Plant Insects (*Oryza sativa* L.)

The role of insects in the three observation areas showed that there were 14 species of pests, 10 predators and 7 species of pollinator insects (Table 2). Of the 14 species of insect pests found on rice plants, the most numerous belonged to the order Hemiptera, namely there were 7 species of pests from the order hemiptera (*Nilaparvata lugens*, *Sogatella furcipera, Leptocorisa oratorius, Gonocerus acuteangulatus, Cofana spectra, Sehirus cinctus*). The large number of pest insect species from the order Hemipetra was found to indicate that these insects are the main insect pests that attack rice plants. The main pests are pests that often appear in each planting season and can cause damage and economic losses. Baihaqi et al. (2021) explains that the main pests that are often found on rice plants are planthoppers and grasshoppers. Purwatiningsih et al. (2019) stated that these insects from the order Hemiptera visit rice plants, aiming to obtain nectar from flowers, which is their food source. Apart from the main pests, there are also potential pests in this research, namely grasshoppers. According to Veronica (2019), potential pests are mostly herbivorous pests that do not cause losses in normal horticultural management. However, this pest has the potential to become a dangerous pest if its management changes and is found in large numbers.

Insect pests found will attack rice plants during the vegetative period until the ripening period, and attack rice plants in different parts, such as stems, leaves, flowers and fruits. Predators found at this research location can also control pests. Pebrianti et al. (2016) stated that insect diversity affects the diversity of parasitoids and predators. Other insects are hosts for existing parasitoids and predators.

Table 2 shows that there are insect pests from the order Coloptera, namely Adoratus sp, this species eats all kinds of plant parts and some are predators. According to Putri (2018) insects from the order Coleoptera are very common in rice fields, and insects from the order Coleoptera are very useful in the food web process.

Table 2 shows that there were 10 species of predators found at the research location, namely Dolichoderus sp, Paederus fuscipes Ceriagrrion cerinobellum, Orthetrum sp, Harmonia axyridis, Coccinella arcuate, Coccinella sexmaculata, Andrallus spinidens Chlaenius sp, and Oecophylla smaragdina. The most abundant predator insect species are from the Coccinilidae family. The presence of natural enemy insects that act as predators, parasitoids in an ecosystem can be a biological control for insect pests to suppress pest population explosions and not endanger plant growth and habitats for insects that visit rice plants. The presence of predator insects can also suppress pest

explosions. This statement is reinforced by Sari (Sari, 2016), that biological control is safe for the environment because it does not harm other living things that are not targets so that it does not cause pest resurgence or pest explosions. Veronica's opinion (2019), that if the natural enemies of predators are able to act as predators optimally, the population of pests and natural enemies will be balanced so that there will be no pest explosion and can reduce the insect population significantly.

Table 2. The Role of Insects Found in Rice (*Oryza sativa* L.) Agricultural Land in Medang Lama Village, Medang Deras District, Batu Bara Regency, North Sumatra

Species	Role
Nilaparvata lugens	Pest
Sogatella furcipera	Pest
Leptocorisa oratorius	Pest
Gonocerus acuteangulatus	Pest
Cofana spectra	Pest
Andrallus spinidens	Predator
Sehirus cinctus	Pest
Vespula vulgaris	Pollinator
Rhynchium sp	Pollinator
Scolia sp	Pollinator
Sceliphron sp	Pollinator
Dolichoderus sp	Predator
Oecophylla smaragdina	Predator
Harmonia axyridis	Predator
Cocccinella arcuate,	Predator
Coccinella sexmaculata	Predator
Chlaenius sp,	Predator
Paederus fuscipes	Predator
Adoratus sp	Pest
Amata heubneri	Pollinator
Leptosia nina	Pollinator
Scirpophaga incertulas	Pest
Spedoptera litura	Pest
Junonia sp	Pollinator
Acrida cinera	Pest
Trimerotropis sp	Pest
Oxya sp	Pest
Melanoplus packardii	Pest
Ceriagrrion cerinobellum	Predator
Orthetrum sp	Predator
Bactocera sp	Pest

Table 2 shows that the pollinator insects found in this study were 7 species (Leptosia nina, Amata heubneri, Junonia orithya, Vesvula vulgaris, Rhyncium sp, Scolia sp, Sceliphron sp). Pollinator insects will be present when the rice plant is flowering. Pollination of plants by insects is one of the keys to successful agricultural production. The role of pollinator insects is very beneficial in maintaining the existence of a plant species through the pollination process. The interaction between pollinating insects and flowering plants can be mutually beneficial because plants provide food sources, namely pollen and nectar. According to Widhiono et al. (2015), pollinating insects are very important for agricultural plants, the bodies of these insects are highly modified for the plant pollination process and have a very wide range of host plants so that these insects are able to pollinate various types of plants.

The level of presence of pollinator insects, pests and predators varies greatly in the three observations. This is because in the observation of rice plants did not use pesticides, treatment without using pesticides has a positive impact on insect life so that insects can continue their lives. This statement is reinforced by Sanjaya et al. (2012), that if the opportunity to utilize habitats for existing insect species such as predators can be optimized, then a condition will be created that will allow these insects to play an effective role in an environment.

Conclusion

The results of research that has been conducted on the existence of insects and their role in rice fields (*Oryza sativa* L.) in Medang Deras District, Batu Bara Regency, North Sumatra, can be concluded as follows: There were 31 species of insects, 24 families and 7 orders. In the vegetative period, there were 81 individuals, in the generative period there were 173 individuals, and in the maturation period there were 56 individuals. Insects in rice (Oryza sativa L.) agricultural land were found to consist of 14 insect species that act as pests, 10 insect species that act as predators, and 7 insect species that act as pollinators.

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Conflicts of Interest
The authors declare no conflict of interest.

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