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Abundance of Pests and Predators in Rice Cultivation Practical Lands at The CBSUA Campus

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Abstract: This study investigated the abundance of pests and predators in rice cultivation practicum fields at the Central Bicol State University of Agriculture (CBSUA) campus to better understand ecological interactions within the rice agroecosystem. Rice is a strategic food crop that is highly vulnerable to pest attacks; therefore, information on pest populations and their natural enemies is essential for supporting Integrated Pest Management (IPM) strategies. The objectives of this study were to identify pest and predator species present in the practicum field, quantify their abundance, and evaluate community structure based on diversity and dominance indices. Field observations were conducted on 25 and 27 October 2025 using sweep net sampling and direct visual observation. Data collected included the number of individuals for each pest and predator species, which were subsequently analyzed to determine abundance indices, the Shannon–Wiener diversity index (H'), and the Simpson dominance index (C). The results showed that four pest species belonging to two orders (Hemiptera and Orthoptera) were identified, with a total of 18 individuals. The most abundant pests were *Leptocorisa oratorius* and *Eucriotettix tricarinatus*. Three predator species from three different orders (Coleoptera, Araneae, and Odonata) were recorded, totaling 26 individuals, dominated by *Micrapis crocea*. Pest and predator communities exhibited moderate diversity (H' = 1.23 and 1.00, respectively) and low dominance indices, indicating a relatively balanced agroecosystem. Overall, the higher abundance of predators compared to pests suggests strong potential for natural pest regulation. These findings highlight the importance of conserving predator populations to support sustainable rice production through IPM implementation.

Keywords: abundance, pests, predators, rice agroecosystem, integrated pest management

1. Introduction

The agricultural sector plays a crucial role in supporting national food security. One of the main commodities supporting this sector is rice. Rice is the primary food source for most Indonesians and many other Asian countries. According to data from the International Rice Research Institute, rice consumption in Indonesia reached 38.2 million tons in 2018, making Indonesia the third-largest rice consumer in the world (International Rice Research Institute, 2020). Meeting this consumption level depends on annual rice production. According to data from the Central Statistics Agency (BPS), rice production in Indonesia reached over 59 million tons in 2018, declining to 54 million tons the following year. Central Java recorded the highest rice production, with 10.4 million tons in 2018 and 9.6 million tons the following year (BPS, 2020). One factor that can hinder increased rice production is pest attacks on rice paddies.

Pests are a biotic factor that often causes significant losses in rice cultivation. Pests attack rice plants from the seedling stage to harvest, thus impacting rice production. A study of the pest-predation model in rice cultivation in Karawang showed that pest attacks such as planthoppers, stem borers, and grasshoppers can inhibit plant growth and even cause crop failure if not properly controlled (Padilah et al., 2021). Uncontrolled rice stem borer infestations resulted in an attack intensity of 5.83%, while control with synthetic insecticides resulted in an attack intensity of 0.76% (Asikin & Lestari, 2020).

In agricultural ecosystems, other living things act as natural enemies of pests, namely predators and parasitoids. Predators are animals or insects that prey on other living things. Predators are usually larger than their prey. Predators function to naturally suppress pest populations, thus maintaining a balanced population without excessive reliance on

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pesticides (Heviyanti & Syahril, 2018). For example, research in Lampung's rice paddy agroecosystems found various predatory arthropods that could potentially suppress rice pests (Budiarti et al., 2020).

The rice cultivation practicum field at the Central Bicol State University of Agriculture (CBSUA) campus in Pili City, Philippines, is an educational field used for student learning, research, and practical activities in agricultural crop production management. This field is an interesting ecosystem to study because it has intensive cultivation activities and can realistically reflect the condition of the rice agroecosystem. By observing the abundance of pests and predators in the field, we can obtain an overview of the population dynamics of plant pests and the potential role of predators in naturally suppressing pests.

2. Research Methods

2.1. Time and Place

This research was conducted on October 25 and 27, 2025, at the rice cultivation practicum field at the CBSUA campus in Pili City, Philippines (13º34'52"N 123º15'44"E). The cultivation practicum field at the CBSUA campus has a total area of approximately 366.87 meters, but the area planted with rice plants has an area of approximately 67.15 meters. Sampling time was carried out in the afternoon when pests and predators were active and came out.

2.2. Materials and Tools

The materials and tools used in this study were rice plant pests and predators in the rice paddy field practicum at the CBSUA Campus. The tools used in this study were a sweep net, a camera, the Google Lens application, and writing instruments.

2.3. Observation Parameters

This study employed a field survey with a quantitative descriptive approach. Pest and predator sampling was conducted using direct counts with the aid of sweep nets and visual observation. The data collected included the number of individuals for each pest and predator species, which were then analyzed to determine abundance levels, the Shannon–Wiener diversity index (H'), and the Simpson dominance index (C).

2.4. Data Analysis

Data analysis parameters included pest and predator diversity, pest and predator dominance index, and pest and predator abundance. Population diversity was used to determine the types of pests and predators present in the cultivated area. The following formula was used to compare the diversity of pest and predator species (Jannah, 2021):

$$H' = -\sum_{i=1}^{s}\left\{\left(\frac{ni}{N}\right) Ln\left(\frac{ni}{N}\right)\right\}$$

Information:
H' = Shannon-Weiner Diversity Index
ni = I-th species
N = Total number of individuals
Shannon-Weiner Diversity Index Criteria:
H' < 1,0 = Low diversity index
1,0 ≤ H'3 = Medium diversity index
H' > 3 = High diversity index

The magnitude of the dominance index between pests and predators is calculated using the Simpson formula with the following formula (Supriadi *et al*., 2015)

$$C = \sum_{i=1}^{s}\left(\frac{ni}{N}\right)^2$$

Information:
C = Dominance index
ni = The number of individuals of a species
N = Number of individuals of all species
Simpson's dominance index criteria:
C < 0,5 = Low dominance index
0,5 < C < 0,75 = Medium dominance index
0,75 < C < 1 = High dominance index

The population abundance of each pest and predator species was calculated using the following formula (Putra et al., 2019).

Population Abundance (A) = $\frac{Each\ individual\ species}{Total\ each\ individual\ spesies}\ x\ 100\%$

3. Result and Discussion

3.1 Composition and Abundance of Pest Species

The composition and abundance of pest species identified in the rice cultivation practicum field at the CBSUA campus are presented in Table 1. A total of four pest species belonging to two orders (Hemiptera and Orthoptera) and three families were recorded, with a total of 18 individuals. The dominant pest species were *Leptocorisa oratorius* (Alydidae) and *Eucriotettix tricarinatus* (Tetrigidae), each represented by six individuals.

Table 1: Types of Pests and Number of Individuals Found

Ordo	Family	Species	Total
Hemiptera	Cicadellidae	*Nephotettix nigropictus*	5
	Alydidae	*Leptocorisa oratorius*	6
Orthoptera	Tetrigidae	*Eucriotettix tricarinatus*	6
	Acrididae	*Gesonula mundata*	1
	Total		**18**

The abundance index values shown in Table 2 indicate that *L. oratorius* and *E. tricarinatus* each contributed 33.33% to the total pest population. The relatively high abundance of *L. oratorius* is closely associated with the rice growth stage during observation, particularly the availability of panicles, which serve as a primary food source for this species. Meanwhile, *E. tricarinatus* showed good adaptability to the rice field microhabitat, enabling it to persist under prevailing environmental conditions.

Table 2: Pest Abundance Index

Species	Total Population	Abundance Index
Nephotettix nigropictus	5	27,78
Leptocorisa oratorius	6	33,33
Eucriotettix tricarinatus	6	33,33
Gesonula mundata	1	5,56

Nephotettix nigropictus accounted for 27.78% of total pest abundance. Although its population was lower than the dominant species, its presence is ecologically significant due to its role as a vector of viral diseases in rice plants. In contrast, *Gesonula mundata* exhibited the lowest abundance (5.56%), indicating that this species was not competitive or well-adapted to the study area conditions. Overall, variation in pest abundance reflects differences in feeding behavior, habitat preference, and adaptability to environmental factors within the rice agroecosystem.

3.2 Composition and Abundance of Predator Species

The predator community identified in the study area is summarized in Table 3, which shows three predator species from three different orders (Coleoptera, Araneae, and Odonata) with a total of 26 individuals. Notably, the total number of predators exceeded that of pests, indicating a potentially strong natural control component within the rice field ecosystem.

Table 3: Types of Predators and Number of Individuals Found

Ordo	Family	Species	Total
Coleoptera	Coccinelidae	*Micrapis crocea*	13
Araneae	Tetragnathidae	*Tetragnatha extensa*	4
Odonata	Coenagrionidae	*Ischnura senegalensis*	9
	Total		**26**

As presented in Table 4, *Micrapis crocea* (Coccinellidae) was the most abundant predator, accounting for 50.00% of the total predator population. The dominance of this species highlights the important role of lady beetles as active predators of soft-bodied insects such as planthoppers and leafhoppers in rice fields. *Ischnura senegalensis* contributed 34.62% of the predator abundance, suggesting that the rice field environment supports predators with both aquatic and terrestrial life stages. Meanwhile, *Tetragnatha extensa* represented 15.38% of the predator population and functions as a passive predator by capturing flying insects using its web. The presence of predators from different taxonomic groups indicates that predation occurs through multiple mechanisms, including active hunting and passive trapping, which enhances the overall effectiveness of natural pest suppression.

Table 4: Predator Abundance Index

Spesies	Total Population	Abundance Index
Micrapis crocea	13	50,00
Tetragnatha extensa	4	15,38
Ischnura senegalensis	9	34,62

3.3 Diversity and Dominance of Pest and Predator Communities

The diversity and dominance indices of pest and predator communities observed in the rice cultivation practicum field at the CBSUA campus are presented in Table 5. The Shannon–Wiener diversity index (H’) for the pest community was 1.23, which is classified as moderate diversity. This value indicates that the pest community was composed of several species with relatively even distribution of individuals, rather than being dominated by a single species. Moderate diversity within pest communities is generally associated with greater ecological stability and reduced risk of sudden pest population outbreaks (Gurr et al., 2016).

Table 5: Diversity Index (H’) and Dominance Index (C) of Pests and Predators

	Pests	Predators
Individual total (N)	18	26
Total species (ni)	4	3
Diversity index (H’)	1,23	1,00
Dominance index (D)	0,29	0,40

The Simpson dominance index (C) for pests was recorded at 0.29, which falls within the low dominance category. This low dominance value indicates that no single pest species exerted overwhelming control over the community structure, reflecting balanced interspecific interactions and effective predation pressure from natural enemies that collectively suppress pest population development (Ali et al., 2020). Such conditions suggest that biological interactions within the agroecosystem remain functional and capable of regulating pest populations naturally.

Similarly, the predator community exhibited a moderate diversity index (H’ = 1.00). Although the number of predator species was lower than that of pests, the relatively even distribution of individuals among species indicates a stable predator community structure. The predator dominance index (C) was 0.40, also categorized as low dominance. This suggests that predator populations were not overly dependent on a single dominant species, despite the higher abundance of *Micrapis crocea*. The presence of multiple predator taxa, including *Ischnura senegalensis* and *Tetragnatha extensa*, contributes to functional complementarity in predation strategies.

Low dominance and moderate diversity among predator communities are considered favorable conditions for Integrated Pest Management (IPM), as reliance on multiple natural enemy species enhances ecosystem resilience and reduces the risk of pest resurgence if one predator species declines (Sigsgaard et al., 2017). Overall, the combination of moderate diversity and low dominance indices in both pest and predator communities indicates that the rice agroecosystem at the CBSUA campus is in a relatively balanced ecological state, with strong potential for sustainable pest regulation through natural enemy conservation.

4. Conclusion

Based on the results of the study of pest and predator abundance in the rice cultivation practicum area at the CBSUA Campus, it can be concluded that the rice field agroecosystem is in a relatively balanced ecological condition, indicated by moderate levels of diversity and low dominance in the pest and predator communities. The pest community consists of four species from two orders without excessive species dominance, with *Leptocorisa oratori*us and *Eucriotettix tricarinatus* as the most abundant pests, while *Gesonula mundata* is the lowest. The predator community consists of three species from three orders with a higher number of individuals than pests, dominated by *Micrapis crocea*, followed by *Ischnura senegalensis* and *Tetragnatha extensa*, and shows moderate diversity and low dominance. These conditions indicate the potential for effective natural pest control, so that the rice practicum area at the CBSUA Campus has good prospects for the implementation of Integrated Pest Management (IPM) based on natural enemy conservation to maintain ecosystem stability and support sustainable rice production.

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Conflict of Interest

The authors declare no conflict of interest.

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