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Diversity of Insect Types in New Rice Fields

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Abstract. Insects as a component of the rice field ecosystem have an important role in the food web, namely as herbivores, carnivores (predators and parasitoids) and detritivores. This research aims to examine insect diversity in new rice fields. The research was carried out by taking insect samples using yellow traps, farm cops, pitfalls and light traps. The collected insects are then identified in the laboratory. The research results showed that 28 species of insects were obtained using the yellow trap, 34 species of farmcop, five species of pitfall and seven species of light trap. The composition of insects based on their role is 49% herbivores, 29% natural enemies (22% predators and 7% parasitoids), and 22% other insects. Insect diversity index 3.28 with evenness 0.91. The insects found in the new rice fields are 9 orders, 32 families, 41 species and 1317 individuals consisting of herbivores, natural enemies and other insects. Insect diversity is relatively high, with an even distribution of species. The results obtained can be used for pest management in rice plantations.

Keywords: diversity; farmcop; insect; new rice fields

INTRODUCTION

Insects are a group of organisms with numerous species that can be found in almost every ecosystem. Their roles in plants are varied, ranging from being biological control agents, herbivores, and decomposers, to facilitating pollination stages (Siriyah et al., 2018; Sari et al., 2020). In rice field ecosystems, there are various types of insects, including pests, natural enemies, and other insects. Pest insects are herbivorous insects that can cause damage to rice plants. Natural enemies are biotic components that regulate the population of pest insects in agroecosystems. An increase in the population of pest insects is typically followed by a rise in the population of natural enemies and an increase in their feeding or parasitism capabilities (Untung, 2006).

The diversity of insects in an ecosystem varies and is influenced by both abiotic and biotic factors in the environment that can support insect life (Aveludini, 2021). Agroecosystems generally have low biotic and genetic diversity and tend to become more uniform, such as in rice fields. The agroecosystem is unstable and constantly changes due to human actions in managing and cultivating the ecosystem for its benefit. Under such conditions, pest populations can easily increase in these ecosystems. In agricultural ecosystems, insect populations sometimes explode and become pests because their biotic and abiotic control factors have been significantly reduced (Susilo, 2007).

The level of insect species diversity indicates the quality of ecosystem management. A higher diversity value indicates a more complex food web system in an ecosystem, reflecting the complexity of life within that ecosystem. A community is said to have high species diversity if it consists of many species with similar or nearly similar abundances. Conversely, species diversity is considered low if the community comprises very few species, or if only a few species dominate (Soegianto, 1994). Diversity accounts for the number of species and the balance or evenness of their distribution (Latumahina et al., 2024).

The presence of insects in agricultural lands, especially in rice paddies, presents land management challenges. In agricultural lands, farming practices strongly influence insect diversity (McLaughlin & Mineau, 1995;

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Downie et al., 1999). In newly established rice fields, insects from previous plants may act as either natural enemies or pests for the rice crops. Therefore, it is crucial to investigate further the types and diversity of insects in newly established rice fields. This study aims to assess the diversity and identify the species of insects found in freshly established rice fields.

METHODS

The research was conducted in West Malangke District, North Luwu Regency, from June to August 2024. Insect sampling was carried out on 4 plots of land, each measuring 500 m^2. Insects were collected every 5 days for 10 rounds, starting when the plants were 7 days after transplanting. The collection of insects using a farmcop method was done by selecting 10 sample plant clusters arranged diagonally from one side. Each plant cluster was covered with a mica tube with a diameter of 40 cm and a height of 80 cm. Insect collection using yellow traps was conducted by placing the traps in each observation plot. The yellow traps were positioned in the middle of the observation plot. For pitfall trapping, 10 traps were placed diagonally in each predetermined plot. Light traps were used to capture insects that respond to light during nighttime. The traps were set up in rice fields with predetermined samples, between 6:00 PM and 9:00 PM local time. The collected insects were brought to the laboratory for identification based on their morphology.

Data Analysis

The level of insect diversity in rice plants was calculated using the Shannon-Wiener diversity index, and the species evenness index was determined using the Evenness Index.

RESULTS AND DISCUSSION

Based on the traps used, the number of insects collected through yellow traps, farmcop, pitfall, and light traps is presented in Table 1. Collecting insects using the farmcop method resulted in the highest individual abundance and species richness compared to other traps. The species richness obtained from farmcop was 30 species, while the lowest species richness was recorded with the pitfall trap, capturing only 5 species. Yellow traps caught insects from the orders Lepidoptera, Orthoptera, Hemiptera, Hymenoptera, Coleoptera, Odonata, with the highest number from the order Diptera. The insects captured using farmcop were generally from Hemiptera, Coleoptera, Lepidoptera, Araneida, Dermaptera, Hymenoptera, Orthoptera, and Diptera. Pitfall traps mainly captured insects from the orders Orthoptera, Hemiptera, Dermaptera, and Coleoptera. Light traps predominantly captured insects from the order Lepidoptera, with a few from Diptera, Hymenoptera, and Coleoptera.

The diversity of insects in newly established rice fields is shown in Table 2. The diversity and evenness of insect species are 3.28 and 0.91, respectively. These data indicate that the area's insect diversity level is high, and the distribution of individuals among species is relatively even. According to Odum (1998), species diversity is influenced by the proportion of individuals in each species. A community with many species but uneven individual distribution has low diversity. The relatively high insect diversity is likely related to the surrounding ecosystem, which includes various cultivated plants that provide abundant food resources. Habitat conditions also influence insect diversity (Taurislina et al., 2015; Zereg et al., 2025). The diversity and abundance of food in these habitats determine the abundance of insects. Increases in beneficial insect populations can occur in the short term, but may take time to increase their diversity in agroecosystems (Heri et al., 2021).

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Table 1. The number of individuals (N) and species (S) for each insect order and family found in each trap.

No	Ordo	Family	Yellow trap		Farmcop		Pitfall		Light trap	
			N	S	N	S	N	S	N	S
1	Lepidoptera	Crambidae	20	2	16	2			63	2
		Noctuidae	5	1	12	1			20	1
2	Orthoptera	Acrididae	15	1	20	1				
		Tettigoniidae	5	1			16	1		
3	Hemiptera	Delphacidae	23	2	71	2				
		Cicadellidae	21	3	52	3				
		Alydidae	15	1	48	1				
		Pentatomidae			73	2				
		Lygaeidae			5	1				
		Coreidae			35	1	40	1		
14	Diptera	Muscidae	20	1	9	1				
		Chloropidae	31	1						
		Culicidae	39	1	12	1				
		Calliphoridae	17	1					1	11
		Tipulidae	14	1	15	1				
		Syrphidae	12	1						
5	Dermaptera	Carcinophoridae			20	1	16	1		
6	Hymenoptera	Scelionidae	9	1	21	2				
		Eulophidae			2	1				
		Trichogrammatidae	8	1	13	2				
		Braconidae	15	2	23	2				
		Colletidae	12	1					19	1
7	Coleoptera	Coccinellidae	13	2	50	2				
		Carabidae	7	1	14	1				
		Staphylinidae			64	1				
		Chrysomelidae	38	1	17	1			21	1
		Dytiscidae			21	1	20	1		
8	Araneida	Oxyopidae			25	1				
		Lycosidae			19	1				
		Tetragnathidae			30	1				
9	Odonata	Coenagrionidae	9	1						
		Gomphidae	7	1						
Total	9	32	355	28	687	34	122	5	153	7

The newly established rice fields in the region were previously palm oil plantations with minimal pesticide exposure, contributing to the high insect diversity. Diversity is associated with ecosystem stability; a relatively diverse ecosystem tends to be in a normal state (Odum, 1998). The use of chemicals in agricultural land management can lead to environmental contamination, resulting in the death or migration of certain arthropod species. This reduces the abundance and diversity of arthropods in rice fields treated with insecticides (Herlinda et al., 2008).

The roles of the insect species found are illustrated in Figure 1. Of the 1,317 species identified, 49% were herbivorous insects, 29% were natural enemies (22% predators and 7% parasitoids), and 22% were other insects. Table 3 provides further details on the roles of the insects found. Species from the orders Lepidoptera, Hemiptera, Orthoptera, and Diptera dominated herbivorous insects. Natural enemies,

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consisting of predators and parasitoids, were mainly from the orders Hymenoptera, Coleoptera, Orthoptera, Dermaptera, Araneida, and Odonata. Other insects were from families within the orders Hymenoptera, Coleoptera, and Diptera.

Table 2. The results of the Shannon diversity index (H') and species evenness (E) analysis for the insect species.

Ordo	Family	Species	Σ	Pi	Ln Pi	H'	E
Lepidoptera	Crambidae	*Cnaphalocrosis medinalis*	28	0.021	3.863	0.082	0.022
Lepidoptera	Crambidae	*Scirpophaga innotata*	75	0.056	2.882	0.164	0.044
Lepidoptera	Noctuidae	*Spodoptera frugiperda*	37	0.028	3.575	0.1	0.027
Orthoptera	Acrididae	*Oxya* sp	35	0.026	3.649	0.096	0.026
Orthoptera	Tettigoniidae	*Conocephalus longipennis*	21	0.015	4.199	0.066	0.018
Hemiptera	Delphacidae	*Nilaparvata lugens*	63	0.047	3.057	0.146	0.039
Hemiptera	Delphacidae	*Sogatella furcifera*	53	0.04	3.218	0.129	0.034
Hemiptera	Cicadellidae	*Nephotettix virescens*	37	0.028	3.575	0.1	0.027
Hemiptera	Cicadellidae	*Cofana spectra*	21	0.015	4.199	0.066	0.018
Hemiptera	Cicadellidae	*Recillia dorsalis*	15	0.011	4.509	0.051	0.013
Hemiptera	Alydidae	*Leptocorisa acuta*	71	0.053	2.937	0.015	0.042
Hemiptera	Pentatomidae	*Nezara viridula*	65	0.049	3.015	0.148	0.04
Hemiptera	Pentatomidae	*Scotinophara coarctata*	38	0.028	3.575	0.103	0.027
Hemiptera	Lygaeidae	*Paraeucosmetus pallicornis*	5	0.003	5.809	0.022	0.005
Hemiptera	Coreidae	*Anoplocnemis phasiana*	41	0.031	3.473	0.108	0.029
Diptera	Muscidae	*Atherigona* spp	29	0.022	3.816	0.084	0.022
Diptera	Chloropidae	*Oscinella frit*	31	0.023	3.772	0.088	0.023
Diptera	Culicidae	*Culex* sp	51	0.038	3.27	0.126	0.034
Diptera	Calliphoridae	*Calliphora vicina*	28	0.021	3.863	0.082	0.022
Diptera	Tipulidae	*Tipula oropezoides*	29	0.022	3.816	0.084	0.023
Diptera	Syrphidae	*Platycheirus* sp	31	0.023	3.772	0.088	0.026
Dermaptera	Carcinophoridae	*Celisoches morio*	36	0.027	3.611	0.098	0.026
Hymenoptera	Scelionidae	*Telenomus rowani*	9	0.006	5.115	0.034	0.009
Hymenoptera	Scelionidae	*Gryon* sp	21	0.015	4.199	0.066	0.018
Hymenoptera	Eulophidae	*Tetrastichus schoenobi*	2	0.001	6.907	0.01	0.002
Hymenoptera	Trichogrammatidae	*Trichogramma japonicum*	3	0.002	6.119	0.013	0.003
Hymenoptera	Trichogrammatidae	*Oligosita* sp	18	0.013	4.342	0.059	0.015
Hymenoptera	Braconidae	*Apanteles* sp	29	0.022	3.816	0.084	0.023
Hymenoptera	Braconidae	*Opius* sp	9	0.006	5.115	0.034	0.009
Coleoptera	Colletidae	*Hylaeus* sp	31	0.023	3.772	0.088	0.024
Coleoptera	Coccinellidae	*Menochilus* sp	40	0.03	3.506	0.106	0.028
Coleoptera	Coccinellidae	*Micraspis* sp	23	0.017	4.074	0.071	0.019
Coleoptera	Carabidae	*Ophionea nigrofasciata*	21	0.015	4.199	0.066	0.018
Coleoptera	Staphylinidae	*Paederus fuscipes*	64	0.048	3.036	0.147	0.039
Coleoptera	Chrysomelidae	*Eumolpinae*,sp	76	0.057	1.117	0.064	0.017
Coleoptera	Dytiscidae	*Hydrophillus triangularis*	41	0.031	3.473	0.108	0.029
Araneida	Oxyopidae	*Oxyopes javanus*	25	0.018	4.017	0.076	0.021
Araneida	Lycosidae	*Lycosa pseudoannulata*	19	0.014	4.268	0.061	0.016
Araneida	Tetragnathidae	*Tetragnatha* sp	30	0.022	3.816	0.086	0.023
Odonata	Coenagrionidae	*Agriocnemis* sp	9	0.006	5.115	0.034	0.009
Odonata	Gomphidae	*Ophiogomphus Cecilia*	7	0.005	5.298	0.028	0.007
	Total		1317	0.978	162.75	3.281	0.941

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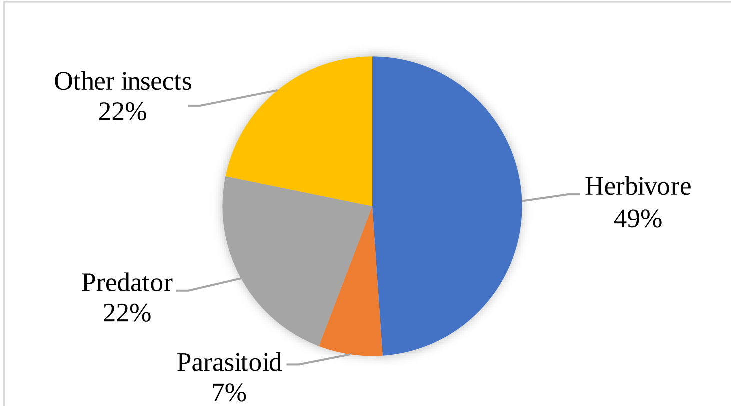

Figure 1. Percentage of insect roles based on species found

Table 3. Roles of several insect orders and families found

Peranan	Ordo	Family
Herbivora	Lepidoptera	Crambidae, Noctuidae
	Orthoptera	Acrididae
	Hemiptera	Delphacidae, Cicadellidae, Alydidae, Pentatomidae, Lygaeidae, Coreidae, Muscidae, Chloropidae
Parasitoid	Hymenoptera	Scelionidae, Eulophidae, Trichogrammatidae, Braconidae
Predator	Orthoptera	Tettigoniidae, Coccinellidae, Carabidae, Staphylinidae, Dytiscidae, Oxyopidae, Lycosidae, Tetragnathidae, Carcinophoridae, Coenagrionidae, Gomphidae
Serangga lain	Hymenoptera	Colletidae
	Diptera	Culicidae, Calliphoridae, Tipulidae, Syrphidae
	Coleoptera	Chrysomelidae

Herbivorous insects commonly found in rice fields included species from the families Crambidae, Noctuidae, Acrididae, Delphacidae, Cicadellidae, Alydidae, Pentatomidae, Lygaeidae, Coreidae, Muscidae, and Chloropidae. *Scirpophaga innotata* from the family Crambidae, order Lepidoptera, was the most frequently encountered species in newly established rice fields. *Scirpophaga innotata* is a pest insect with a consistently high population in rice fields in the Luwu Raya area, causing damage to rice plants from the vegetative to the generative stages (Baehaki, 2013). The large population of Scirpophaga innotata is likely due to the high use of nitrogen in previous plantation areas. According to January *et al* (2020), too much nitrogen fertilization can increase stem borer damage. *Leptocorisa acuta* from the family Alydidae, order Hemiptera, was also commonly found in rice fields. This insect is another significant pest that damages rice plants by attacking the rice grains, causing yield losses of up to 25% per hectare (As'ad et al., 2019).

Natural enemies, including parasitoids and predators, were mainly from the families Scelionidae, Eulophidae, Trichogrammatidae, Braconidae, Tettigoniidae, Coccinellidae, Carabidae, Staphylinidae, Oxyopidae, Lycosidae, Tetragnathidae, Carcinophoridae, Coenagrionidae, and Gomphidae. The relatively high population of natural enemies is likely due to habitat structure and environmental factors influencing the diversity of natural enemies (Allifah et al., 2019). Parasitoids in newly established rice fields were dominated by the order Hymenoptera, specifically the species Apanteles sp. Parasitoid insects, mainly from the order Hymenoptera, typically live as parasites within the bodies of

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their insect hosts (Martuti & Anjarwati, 2022). Parasitoids commonly found in rice fields in the Greater Luwu area are *Telenomus rowani*, *Tetrastichus schoenobii* and *Trichogramma japonicum* (Rahmawasiah et al., 2022). Predatory insects were mostly from the order Coleoptera, with the species *Paederus fuscipes* being the most common. This insect preys on *Nilaparvata lugens*, *Recillia dorsalis*, *Nephotettix virescens*, and *Sogatella furcifera* (Ritanti & Haryadi, 2021). The presence of predatory insects facilitates non-chemical pest control, which can help reduce environmental harm (Kurnia et al., 2020).

Other insects, whose roles in the rice field ecosystem are unknown, were dominated by species from the family Chrysomelidae. Additionally, insects from the families Colletidae, Culicidae, Calliphoridae, Tipulidae, and Syrphidae were also found. Chrysomelidae were abundant in newly established rice fields because the area was previously a plantation converted into rice fields. Chrysomelidae are commonly found in rubber and palm oil plantations (Amrulloh et al., 2022). Some of the other insect species found in rice fields play roles as decomposers and pollinators, including species from the families Tipulidae, Colletidae, and Syrphidae. Various insect species are present due to the diversity of plants surrounding the rice fields. Maintaining plant diversity is one of the insect conservation efforts. To maintain insect diversity it is necessary to implement effective conservation practices (Noori et al., 2024). Regional plant diversity can increase insect diversity (Peng et al., 2022).

CONCLUSION

The insects in the newly established rice fields comprise 9 orders, 32 families, 41 species, and 1,317 individuals, including herbivores, natural enemies, and other insects. The insect diversity is classified as high, with an even distribution of species. The results obtained can be used as a basis for pest management in rice plantations.

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