Seminar Nasional Magister Agroteknologi 2022
Volume 2023
http://dx.doi.org/10.11594/nstp.2022.31xx

NST Proceedings
OPEN ACCESS

Conference Paper

Arthropods Diversity at Paddy Generative Phase in Rainfed Rain Field

Abdul Azis Ambar, Rudy, Harsani, Nur Ilmi*

Agrotechnology, Faculty of Agriculture, Muhammadiyah University of Parepare, 91112, Indonesia

*Corresponding author:
E-mail:
henny_yuningsih@yahoo.com
nurilmi2014@gmail.com

ABSTRACT

Arthropods are the largest phylum in the animal kingdom and are found in various ecosystems, including rainfed rice fields. This study aims to determine the diversity of arthropods and their diversity index. As well as the status of each arthropod in rainfed rice fields. The research method used is purposive random sampling, by determining the location point for arthropod sampling, which refers to the method (Sari et al., 2020). Samples were obtained by using 2 traps, namely sweep net traps, to catch active flying arthropods, or netting with a net for 10 double swings. The second is a pit fall trap, to catch arthropods on the ground. Using a beaker with a volume of 150 ml and placed parallel to the ground. The results showed that there was a diversity of arthropods of 35 species, including 28 species as natural enemies and 6 species as pests, with a diversity index of 2.91 which means that it is in the moderate category.

Keywords: Diversity, Arthropods, rainfed rice fields

Introduction

Arthropods are the largest phylum in the animal world including insects, spiders, ticks, centipedes (Apriliani et al., 2018) Arthropods have a very important and diverse role, the role of arthropods in general is as a destructive pest (*phytophagus*), parasites and predators, Arthropods play an important role in the process of exchanging energy, water and nutrients in the ecosystem (Sunarsiah et al., 2016). Arthropods are also beneficial organisms, namely as pollinating agents in agricultural areas with specifics in rice fields. Rice fields are ecosystems with various interactions contained in them. Arthropod communities play a very important role in these ecosystems (Hendrival et al., 2017).

Rice is a food crop that is widely cultivated by farmers, as the main food ingredient of most Indonesians (Siregar et al., 2014). In addition to environmental factors, in the plant ecosystem requires a balance between living things that exist in the place. If there is no balance, various problems will arise, one of which is the attack of pests and plant diseases (Fitriani, 2016). As a result, it triggers farmers to carry out control with pesticides. The use of synthetic pesticides leads to the death of other insects, in addition to target pests. Beneficial insects such as natural enemies also die, while insects that have a role as natural enemies, are very helpful for humans in pest control efforts (Sari et al., 2020), besides that insects also help in maintaining the stability of food webs in an agricultural ecosystem.

Arthropod group based on the diversity of its functions in the agroecosystem of rice paddy, includes insect pests and natural enemies. Natural enemies are biotic components that regulate insect pest populations in agroecosystems. Arthropods that act as natural enemies in rice paddy agroecosystems include predators and parasitoids (Hendrival et al., 2017).

Based on the description above, it is necessary to identify the diversity and population of arthropod species, as a basis for determining the status of arthropods that will be used as biological controllers.

How to cite:
Ambar, A. A., Rudy, & Ilmi, N. (2023). Arthropods diversity at paddy generative phase in rainfed rain field. *Seminar Nasional Magsiter Agroteknologi 2022*. NST Proceedings. pages 7-14. doi: 10.11594/ nstp.2022.31xx

Material and Methods

The research was conducted on rainfed rice fields in Abbokongan Village, Kulo District in Sidenreng Rappang Regency. The study was conducted for 3 months, namely January to March 2022. The identification of Arthropods was carried out at the Tungro Disease Research Workshop Laboratory, Sidenreng Rappang Regency.

The tools and materials used in this study are: *Pitfall Trap, Sweep Net*, 70% alcohol, collection bottles as insect holders, tweezers, microscopes to help identify insects, digital cameras, label paper, raffia rope, plastic bags, bamboo, insect identification books, and writing stationery.

This study was conducted using *the purposive random sampling* method. Sampling by means of a diagonal system, then 10 points of sample plots with a size of 1x3 m are made. Each plot begins at each corner of the rice field area then follows a diagonal line. Samples were taken in rice fields with the age of rice plants having entered the generative period or 60 days after planting until they entered the ripening phase. Sampling is carried out once a week with an interval of 7 days.

Observations of Arthropods were carried out in rainfed paddy fields in the generative phase. Sampling during the generative phase, using two methods, namely: 1) *sweep net* or netting with a net as much as 10 times double swings. The width of the swing is 1 meter wide and the distance between one swing line and the next is 40 cm (Directorate of Food Crop Protection 2018). The aim of this method is to catch arthropods that are actively flying. 2) *pitfall trap*, done by installing it by plugging the trap glass to the limit of the lip of the glass, parallel to the ground surface. The trap aims to trap arthropods that crawl on the ground. Traps made of media made of plastic in the form of a glass and measuring 150 ml.

All arthropods trapped in *sweep net and pitfall traps* were stored in insect collection tubes with 70% alcohol, for later inventories, species and numbers were counted in the laboratory. Arthropods are grouped according to their respective statuses/roles.

Observation parameters are:

- The diversity and status of arthropods were obtained by: taking all samples obtained from the traps used, then collected and grouped by type (species) and status (natural enemies or pests) using the key of determination referring to (Suyamto, 2005) and (Shepard et al., 2011).
- The Arthropoda Diversity Index is calculated based on the *Shannon-Winner formula* (Sunarsiah et al., 2016), namely:
-

$$H' = \sum_{i=1}^{S} (ni/N)\ ln\ (ni/N)$$

Note:

H' = *Shannon-Wiener* diversity index

ni = Number of individual species from type to i

N = Total number of individuals of all types of species

pi= (ni/N) = The proportion of the number of individuals of type i to the number of individuals of all types of species

The diversity index scale is divided into 5 categories, based on (Soedijo & Pramudi, 2021), namely:

1. H' < 1 is very low
2. 1 < H' ≤ 2 low
3. 2 < H' ≤ 3 medium
4. 3 < H' < 4 high
5. H' > 4 is very high.

Results and Discussion

Arthropod diversity and status

Based on observations in rainfed rice fields, several arthropods with various species with different populations and statuses were obtained, which can be seen in Table 1.

Table 1. Total diversity and status of arthropods trapped in rainfed rice fields

Arthropods	Species	Population	Status
1. Insects	*1. Nephotettix virescens*	13	Pest
	2. Nilaparvata lugens	6	Pest
	3. Leptocorisa oratorius	13	Pest
	4. Chrysodeixis chalcites	1	Pest
	5. Manduca sexta	1	Pest
	6. Naranga diffuse	2	Pest
	7. Cyrtorhinus caricis	8	Natural enemies
	8. Orthotylus marginalis	1	Natural enemies
	9. Brachymeria sp	1	Natural enemies
	10. Oxyrrhexis carbonator	1	Natural enemies
	11. Plebeia pulchra	1	Natural enemies
	12. Solenopsis richteri	18	Natural enemies
	13. Opius sp	1	Natural enemies
	14. Anagyrus sp	2	Natural enemies
	15. Crocheipes microplitis	1	Natural enemies
	16. Pheidole aberrans	1	Natural enemies
	17. Hypoponera opacior	4	Natural enemies
	18. Agabus bipustulatus	3	Natural enemies
	19. Ceolophora inaequalis	2	Natural enemies
	20. Endomychus biguttatus	1	Natural enemies
	21. Hippodamia tredecimpunctata	23	Natural enemies
	22. Octomaculata Harmony	25	Natural enemies
	23. Altica oleracea	1	Natural enemies
	24. Brachinus explodens	1	Natural enemies
	25. Drosophila melanogaster	1	Natural enemies
	26. Anopheles sp	13	Natural enemies
	27. Dashyhelea	1	Natural enemies
	28. Conocephalus longipennis	3	Natural enemies
	29. Anaxipha longipennis	8	Natural enemies
	30. Syntomoides imaon	2	Natural enemies
2. Araneae	*1. Araneus inustus*	18	Natural enemies
	2. Hibana Velos	3	Natural enemies
	3. Argiope catenulate	2	Natural enemies
	4. Lycosa pseudoannulata	1	Natural enemies
	5. Oxyopes salaticus	1	Natural enemies

The diversity of Arthropod populations in rainfed rice fields trapped during the generative phase resulted in 35 species, including 30 species in the Insecta group and 5 species in the Araneae group. The diversity of Arthropod species obtained is closely related to resistance to physical and environmental factors as well as competition from other species. This is supported by Purba et al. (2015) which states that the population of aboveground insect species is very dependent on the physical and chemical conditions of the environment, competition for space and foraging between one species and another.

The number of arthropod species in trapped rainfed rice fields obtained 35 species. Arthropods with the status of natural enemies were found to be greater than those with the status of pests, each with 29 species with a percentage of 82.8% (natural enemies), while arthropods with a pest status of 6 species with a percentage of 17.2 % (in Table 1).

The existence of groupings obtained, in the form of natural enemies and pests on rainfed land, is in accordance with the division of arthropods in agriculture into 3, namely herbivorous, carnivorous, and omnivorous arthropods. Herbivorous arthropods are a group that eats plants and the presence of their population causes damage to plants which are referred to as pests. Carnivorous arthropods consist of all species that prey on herbivorous arthropods which include groups of predators, parasitoids and act as natural enemies of herbivorous arthropods (Nurhadi, 2014).

The magnitude of natural enemies found in rainfed rice fields compared to pests, because in rainfed land the use of chemicals (pesticides and fertilizers) is not too intensive. In line with that (Pradhana et al., 2014) stated that the application of chemical pesticides that were intensive and not on target resulted in a decrease in the population of arthropods, especially pests. Likewise the statement (Tauruslina A, 2015), states that natural enemies can weaken and kill thereby reducing the reproductive phase of arthropods.

Diversity Index (H') of Arthropods.

The index values of arthropod diversity based on groups of Insects and Araneae trapped in rainfed rice fields during the generative phase are presented in Tables 2, 3 and 4.

Table 2. Diversity index (H') of arthropods trapped in rainfed rice fields during the generative phase

No	Species	Population	ni/N	ln.ni/N	pi.lnpi	H'
1	Nephotettix virescens	13	0.07065	-2.65	-0.1872	2.91
2	*Nilaparvata lugens*	6	0.03261	-3.4231	-0.1116	
3	*Leptocorisa oratorius*	13	0.07065	-2.65	-0.1872	
4	*Chrysodeixis chalcites*	1	0.00543	-5.2158	-0.0283	
5	*Manduca sexta*	1	0.00543	-5.2158	-0.0283	
6	*Naranga diffuse*	2	0.01087	-4.5217	-0.0492	
7	*Cyrtorhinus caricis*	8	0.04348	-3.1355	-0.1363	
8	*Orthotylus marginalis*	1	0.00543	-5.2158	-0.0283	
9	*Solenopsis richteri*	18	0.09783	-2.3245	-0.2274	
10	*Brachymeria sp*	1	0.00543	-5.2158	-0.0283	
11	*Carbonator oxyrrhexis*	1	0.00543	-5.2158	-0.0283	
12	*Plebeia pulchra*	1	0.00543	-5.2158	-0.0283	
13	*Opius sp*	1	0.00543	-5.2158	-0.0283	
14	*Anagyrus sp*	2	0.01087	-4.5217	-0.0492	
15	*Micropitis croceipes*	1	0.00543	-5.2158	-0.0283	
16	*Pheidole aberrans*	1	0.00543	-5.2158	-0.0283	

17	*Hypoponera opacior*	4		0.02174	-3.8286	-0.0832
18	*Ceolophora inaequalis*	2		0.01087	-4.5217	-0.0492
19	*Endomychus biguttatus*	1		0.00543	-5.2158	-0.0283
20	*Hippodamia tredecimpunctata*	23		0.125	-2.0794	-0.2599
21	*Octomaculata harmony*	25		0.13587	-1.9961	-0.2712
22	*Agabus bipustulatus*	3		0.0163	-4.1166	-0.0671
23	*Altica oleracea*	1		0.00543	-5.2158	-0.0283
24	*Brachinus explodens*	1		0.00543	-5.2158	-0.0283
25	*Araneus inustus*	18		0.09783	-2.3245	-0.2274
26	*Hibana velos*	3		0.0163	-4.1166	-0.0671
27	*Argiope catenulate*	2		0.01087	-4.5217	-0.0492
28	*Lycosa pseudoannulata*	1		0.00543	-5.2158	-0.0283
29	*Oxyopes salaticus*	1		0.00543	-5.2158	-0.0283
30	*Drosophila melanogaster*	1		0.00543	-5.2158	-0.0283
31	*Anopheles sp*	13		0.07065	-2.65	-0.1872
32	*Dashyhelea*	1		0.00543	-5.2158	-0.0283
33	*Conocephalus longipennis*	3		0.0163	-4.1166	-0.0671
34	*Anaxipha longipennis*	8		0.04348	-3.1355	-0.1363
35	*Syntomoides imaon*		2	0.01087	-4.5217	-0.0492

Table 3. Diversity index (H') of arthropods in insect groups trapped in rainfed rice fields during the generative phase

Species	Population	ni/N	ln.ni/N	pi.lnpi	H'
Nephotettix virescens	13	0.0818	-2.504	-0.2047	
Nilaparvata lugens	6	0.0377	-3.2771	-0.1237	
Leptocorisa oratorius	13	0.0818	-2.504	-0.2047	
Chrysodeixis chalcites	1	0.0063	-5.0689	-0.0319	
Manduca sexta	1	0.0063	-5.0689	-0.0319	
Naranga diffuse	2	0.0126	-4.3758	-0.055	
Cyrtorhinus caricis	8	0.0503	-2.9895	-0.1504	
Orthotylus marginalis	1	0.1132	-2.1785	-0.2466	
Solenopsis richteri	18	0.1132	-2.1785	-0.2466	
Brachymeria sp	1	0.0063	-5.0689	-0.0319	2.98
Carbonator oxyrrhexis	1	0.0063	-5.0689	-0.0319	
Plebeia pulchra	1	0.0063	-5.0689	-0.0319	
Opius sp	1	0.0063	-5.0689	-0.0319	
Anagyrus sp	2	0.0126	-4.3758	-0.055	
Crocheipes microplitis	1	0.0063	-5.0689	-0.0319	
Pheidole aberrans	1	0.0063	-5.0689	-0.0319	
Hypoponera opacior	4	0.0252	-3.6826	-0.0926	
Ceolophora inaequalis	2	0.0126	-4.3758	-0.055	
Endomychus biguttatus	1	0.0063	-5.0689	-0.0319	

Hippodamia tredecimpunctata	23	0.1447	-1.9334	-0.2797	
Octomaculata Harmony	25	0.1572	-1.85	-0.2909	
Agabus bipustulatus	3	0.0189	-3.9703	-0.0749	
Altica oleracea	1	0.0063	-5.0689	-0.0319	
Brachinus explodens	1	0.0063	-5.0689	-0.0319	
Drosophila melanogaster	1	0.0063	-5.0689	-0.0319	
Anopheles sp	13	0.0818	-2,504	-0.2047	
Dasyhelea	1	0.0063	-5.0689	-0.0319	
Conocephalus longipennis	3	0.0189	-3.9703	-0.0749	
Anaxipha longipennis	8	0.0503	-2.9895	-0.1504	
Syntomoides imaon	2	0.0126	-4.3758	-0.055	

Table 4. Diversity index (H') of the Araneae group of arthropods trapped in rainfed rice fields during the generative phase

Species	Population	ni/N	ln.ni/N	pi.lnpi	H'
Araneus inustus	18	0.72	-0.3285	-0.2365	
Hibana Velos	3	0.12	-2.1203	-0.2544	
Argiope catenulate	2	0.08	-2.5257	-0.2021	0.95
Lycosa pseudoannulata	1	0.04	-3.2189	-0.1288	
Oxyopes salaticus	1	0.04	-3.2189	-0.1288	

The results of the arthropod diversity index obtained in rainfed lowland rice during the generative phase are with a value of 2.91, shown in Table 2, with the diversity index in the "medium" category. From the observations found 2 types of arthropods in rainfed rice fields, namely insects and araneae, with each diversity value of 2.98 and 0.95. Both diversity indices fall into the “medium” category for the insect group and the “very low” category for the Araneae group, shown in Table 3 and Table 4.

The value of the diversity index (H') is influenced by the high number of individuals and the number of trapped species. If the value of the number of individual Arthropods is low or the habitat is only dominated by a few species, then the value of the diversity index will be smaller (Wijana, 2014).

The diversity index value in the "medium" category indicates that the diversity of arthropods in the insect group in rainfed rice fields is relatively stable, while the Aranea diversity index is in the "very low" category. According to Tauruslina (2015) stated that the habitat of the rice field ecosystem is thought to have influenced the presence of arthropods. Factors that also determine the high and low Arthropod population index are strongly influenced by internal and external factors. The influencing internal factors are the ability to breed and the ability to defend themselves, while the external factors are strongly influenced by temperature, humidity, light and wind (Hasan et al., 2014).

Conclusion

Based on the results of the study it can be concluded:

1. The total diversity of arthropods trapped in rainfed rice fields during the generative phase is 35 species.
2. Arthropods trapped in rainfed rice fields were 6 species (17.8%), while natural enemies were 29 species (82.2%).

The diversity index of rice arthropods in rainfed rice fields during the generative phase, namely 2.91, was included in the "medium" category.

s

Acknowledgment

This work was supported by researcher crew are Abdul Azis Ambar, Rudy, Harsani and Nur Ilmi. Therefore, we are grateful for that and their assistance during the research process.

References

Apriliani, R. T., Utami, B., & Sulistiyawati, T. I. (2018). *Diversity and Abundance of Soil Arthropods in the Brantas River Basin, Kediri City*.

Fitriani. (2016). Arthropod diversity in rice ecosystems with pesticide applications. *Agrovital*, *1*(1), 6–8.

Hasan, E., Bahtiar, & Abdullah, A. (2014). Abundance and dominance of soil arthropods in the Jailolo protected forest area. *SSIOêduKASI*, *2*(2), 238–248.

Hendrival, Lukmanul, H., & Halimuddin. (2017). Composition and diversity of predator Arthropods in rice Agroecosystems composition and diversity of predatory Arthropods on Agroecosystems. *J. Floratek.*, *12* (1), 21–33. https://doi.org/10.24815/floratek.v12i1.8942

Nurhadi. (2014). Composition of Soil Surface Arthropods in the Sriwijaya Pelembang Fertilizer Factory Area. *Paper Knowledge. Toward a Media History of Documents*, *11*(1), 1–11.

Pradhana, R. A. I., Mudjiono, G., & Karindah, S. (2014). Diversity of insects and spiders in organic and conventional rice plantings. *HPT Journal*, *2*(2), 58–66.

Purba, G. L., Marheini & Syahrial, O. (2015). Trophic interactions of ground and soil insect types of several corn (*Zea mays* Linn.) Varieties. *Journal of Agroecotechnology Online*, *3* (3), 852–863.

Sari, A. R. K, Rahmawati, D., & Samrin, S. (2020). Diversity of pests and natural enemies in rice (*Oryza sativa*) planting in Wawotobi, Southeast Sulawesi. *Journal of Food Crops Agricultural Research*, *4* (3), 145. https://doi.org/10.21082/jpptp.v4n3.2020.p145-151

Shepard, B. M., Barrion, A. T., & Litsinger, J. A. (2011). Natural enemy of rice pests. In *Bogor IRRI,* 136.

Siregar, A. S., Bakti, D., & Zahara, F. (2014). Diversity of insect species in various types of rice fields. *Online Journal of Agroecotechnology*, *2* (2337), 1640–1647.

Soedijo, S., & Pramudi, M. I. (2021). Keanekaragaman *Arthropoda* laba-laba pada persawahan tadah hujan di Kalimantan Selatan. *Pros. Sem. Nas. Masy. Biodiv. Indon., 6*(1), 1307-1311

Sunarsiah, F., Herlinda, S., & Windusari, Y. (2016). Abundance of *Carnivorous Arthropods* in Ratun Rice Plantation in Lebak Rice Fields Applying Bacillus thuringiensis. *Bioinsecticide*, *18*, 22–28.

Suyamto. (2005). *Field problems of nutrient pests and diseases in rice*. 25–27.

Tauruslina A, E. (2015). Analysis of natural enemy biodiversity in lowland rice ecosystems in endemic and non-endemic areas of the brown planthopper Nilaparvata lugens in West Sumatra. *Prosiding Seminar Nasional Masyarakat Biodiversitas Indonesia (Pros Sem Nas Masy Biodiv Indon), 1*, 581–589. https://doi.org/10.13057/psnmbi/m010334

Wijana, N. (2014). Analysis of the composition and diversity of plant species in the forest of Bali Aga Tigawasa Village, Buleleng – Bali. *JST (Journal of Science and Technology)*, *3*(1), 288–299. https://doi.org/10.23887/jst-undiksha.v3i1.2907