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Research Article

Study of Diversity Collembola in Peatlands in Palangka Raya, Central Kalimantan

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ABSTRACT
The Study of Collembola Diversity in Peatland and Its Role as an Environmental Bioindicator is an exploratory study of the biological diversity in peatland areas. Collembola is a group of insects that have the potential as environmental bioindicators. The research objective was to determine the value of collembola diversity on peatlands. Collembola sampling was carried out by making Pitfall traps and Modified Barlles Funnels. Collembola samples obtained from peatlands were identified and analyzed for index diversity (H'), uniformity (E), and dominance (C) using the Shannon-Wiener formula. The identification results obtained for Collembola were 52 individuals from seven genera at two different locations including Seira sp, Folsomia sp, Lepidoneilla sp, Willowsia sp, Ceratrimeria sp, Paranula sp, and Dicyrtomina sp. Collembola diversity analysis obtained the diversity index (H': 1.75 and H': 1.18) in the moderate category. The uniformity index (E: 0.98 and E: 0.66) is in the high category. While the dominance index (C: 0.20 and C: 0.40) is in a low category. It can be interpreted that peatlands are still in good condition to support the life of other organisms.

Key words: *Collembola; Diversity; Modified Barlles; Peatlands; Pitfall trap.*

Introduction

Peatlands have unique ecosystem and biodiversity characteristics, and in the last ten years, there has been a significant increase in peat ecosystem damage (Subiksa, 2008). This damage disrupts the function of the soil as a support for living systems, as a result, all living things in it are disturbed (Falahudin et al., 2015). Hydrological damage and land fires also frequently occur and cause damage, especially to peatland areas (Marlina, 2017). The composition and abiotic factors of peatlands due to land damage have caused a decrease in the diversity of soil microfauna, especially Collembola (Suhardjono, 2012; Falahudin et al., 2015). Collembola is a primitive organism that is very sensitive to changes in environmental conditions (Husamah et al., 2016), changes in environmental conditions cause an imbalance in an ecosystem and can even lead to the extinction of certain types of insects, especially Collembola.

Collembola is one of the soils microfauna that has a very important role in the process of decomposition of organic matter in the soil (Ganjari, 2012), as a fungus eater, as an indicator of changes in soil conditions, as a counterweight to soil fauna, as a predator of pests and as a pollinator (Ponge et al., 2003). Collembola's role as a decomposer of organic matter in the soil is very prominent (Cassagne et al.,

2003), this can be demonstrated by the presence of soil fractions in the form of mycelium, spores, parts of animal carcasses, and other materials that have been fermented in their digestive tract.

Collembola has an abundance that varies in each environment, research (Indriyati & Wibowo, 2011), presents the abundance of Collembola in organic rice fields. Research by Husamah et al., (2016), regarding the community structure of Collembola in three types of habitats along the Brantas Hulu watershed, Batu City, in forest habitat types has a high diversity value with a value of 2.78. Research (Leroy et al., 2007), found Collembola from two families found in the composting process. This research is supported by (Ganjari, 2012), in the vermicomposting process which is dominated by Collembola Pseudosinella sp. Based on previous research, this study aims to explore the surviving Collembola and also to study the diverse structure of Collembola on peatlands.

Materials and Methods

The research was carried out from August to November 2022. The research was carried out by the Biology Lab, Center for Peat Science and Technology Development and Innovation (PPIIG), University of Palangka Raya. The object of research is the diversity of Collembola or spring-tailed insects which are explored from peatlands, especially the peatlands of the City of Palangka Raya.

Collembola sampling was carried out using two methods of Pitfall trap and Modified Barlles Funnel. Pitfall traps are installed in each plot, each with 4 traps in one plot with a 5-meter distance from each trap, traps are made by inserting a glass trap into the hole and giving a trapping solution, and then covering it so that water does not enter the trap, letting the trap sit for 3 days and on the third day, the trap was opened and observed. Catching Collembola was also carried out using a Modified Barlles Funnel previously determined by the location of litter and soil sampling with a distance of 50 meters arranged in a zig-zag manner. For each location, 500-gram litter and soil were taken into the Modified Barlles Funnel with light treatment so that Collembola trapped in the litter and soil moved to the bottom of the Modified Barlles Funnel, at the bottom of a container filled with 70% alcohol was prepared, this treatment is done for 3 days. After obtaining various types of Collembola, then identify them.

The Collembola samples obtained were then observed using a microscope. Samples were identified to find out the Collembola obtained. Several steps can be taken in identifying Collembola samples according to Janssens (2009). The data obtained was analyzed for its diversity index calculated using the Shannon-Wiener formula, Evenness Index using the Evenes formula, and the Dominance calculated concerning Shannon-Wiener (Fatiqin, 2019).

Results and Discussion

Based on the results of observations of Collembola Diversity on Peatlands in the City of Palangka Raya, the data obtained are as presented in table 1.

Table 1 shows the results of the number of various individuals, the highest number of individual species is shown in LK 1 of the order Entomobryomorpha with the number of individuals 8 with characteristics close to the genus *Lepidoneilla sp* and *Willowsia sp*, at location LK 2 of the order Entomobryomorpha with the number of individuals 12, where the individual found at location LK 2 based on the characteristics shown from the genus *Willowsia sp*. While the least number of individuals came from the Symphypleona order which was only found in 1 individual in the LK 1 area, the orders Symphypleona and *Seira sp* were not found in LK 2. The diversity obtained from Collembola observations in the peatland area of Palangka Raya City, as a whole could be influenced by environmental conditions.

Table 1. Results of the Collembola Diversity analysis on peatlands

No.	Ordo	Genus	Location 1	Location 2	Number of Individu
1	Entomobryomorpha	*Seira* sp	7	0	7
		Folsomia sp	3	1	4
		Lepidoneilla sp	8	1	9
		Willows sp	8	12	20
2	Poduromorpha	*Ceratrimeria* sp	3	2	5
		Paranula sp	2	5	7
3	Symphypleona	*Dicyrtomina* sp	1	0	0
	N	Total number	32	21	52
	H	Diversity	1,75	1.18	Average
	E	Uniformity	0,98	0,66	High
	C	Domination	0,20	0,40	Low

*Information: * LK 1 (Peatland area in G Obos 24)*
** LK 2 (UPR campus forest area)*

Entomobryidae is Collembola with more than 1625 identified species (Husamah et al., 2016). Entomobryidae can be found in the litter layer or near the surface and can adapt and survive, this is by research (Niwangtika, 2014) that the Entomobryidae family is Collembola which lives a lot on the soil surface and litter that begins to decompose and the types of food for Entomobryidae are very varied.

The species diversity index value is used to compare the species composition of different ecosystems or communities (Niwangtika, 2014). Based on the research results in table 1, peatland as a location for sampling litter and peat soil with the installation of Pitfall Traps and Modified Barlles Funnels shows moderate diversity values with LK1 H': 1.75 and LK2 H': 1.18. This diversity value means that the location of the peatlands is still in fertile condition so that it can support Collembola's life. By Erniyani et al., (2010). Regarding the study of soil fertility, it is known that the higher the diversity index of soil microfauna, the better/higher the level of soil fertility. According to Larasati et al., (2016), a large soil animal diversity index means a high decomposition rate and vice versa.

The evenness index value of peatlands in table 1 shows that the evenness index value is high or stable with a value of 0.98 at location 1 and 0.66 at location 2. The evenness index value is important information regarding whether or not there is the dominance of a species that inhabits an area (Krebs, 1989; Fatiqin, 2019), so it can be concluded that the research location, especially peatlands, has a high evenness value. Based on these categories, the distribution of species at the research location is even distribution and there is no dominance of certain species.

A high evenness index value indicates an even distribution of species abundance, while a low evenness index value indicates a tendency to be dominated by certain Colembolla species (Priyono & Abdullah, 2013). If a peatland area is known to have a population level occupying the area that is not dominated by certain species, then the evenness index tends to be high, this can be influenced by the environmental components of an ecosystem so that high evenness of species can indicate habitat quality (Fachrul, 2007).

Table 1 shows the dominance index (C) data of Collembola on peatlands which can be categorized as low referring to the standard Shannon-Wiener criteria if the value obtained is ($0 < C \leq 5$), so it can be seen that the distribution of Collembola on peatlands does not find dominant species. The dominance index of an area can be

analyzed based on its abiotic factors such as the thickness of the litter and the condition of the humus soil which is the habitat for Collembola. According to Suhardjono et al., (2012), Collembola has a wide and varied distribution pattern both at the family, genus, and species levels. According to Rahmadi et al., (2004), the distribution of Collembola is influenced by the characteristics of the vegetation cover because it affects soil conditions and the behavior of soil animals.

Conclusion

The study of Collembola diversity on peatlands obtained a total of 52 individuals from seven genera including *Seira sp, Folsomia sp, Lepidoneilla sp, Willowsia sp, Ceratrimeria sp, Paranula sp,* and *Dicyrtomina sp.* From the two research locations, it was found that the index of diversity was in the moderate category (location 1 H': 1.75) and (location 2 H': 1.18). The Collembola evenness index at location 1 (E: 0.98) and location 2 (E: 0.66) is in the high category. Meanwhile, the Collembola dominance index at location 1 (C: 0.20) and location 2 (C: 0.40) is in a low category.

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References

Cassagne, N., Gers, C., & Gauquelin, T. (2003). Relationships between Collembola, soil chemistry and humus types in forest stands (France). *Biology and Fertility of Soils*, *37*(6), 355–361. https://doi.org/10.1007/s00374-003-0610-9

Erniyani, K., Wahyuni, S., & Puu, Y. M. S. W. (2020). Struktur Komunitas Mesofauna Tanah Perombak Bahan Organik Pada Vegetasi Kopi Dan Kakao. *AGRICA*, *3*(1), 1–8. https://doi.org/10.37478/agr.v3i1.488

Fachrul, M. F. (2007). *Metode Sampling Bioekologi*. Bumi Aksara.

Falahudin, I., Mareta, D. E., & Rahayu, I. A. P. (2015). Diversitas Serangga Ordo Orthoptera pada Lahan Gambut di Kecamatan Lalan Kabupaten Musi Banyuasin. *Bioilmi*, *1*(1), 1–7. https://doi.org/10.19109/bioilmi.v1i1.1124

Fatiqin, A. (2019). Plankton Biodiversity in The Burai River of Ogan Ilir District, Sumatera Selatan. *Biota*, *12*(1), 14–21. https://doi.org/10.20414/jb.v12i1.148

Ganjari, L. E. (2012). Kelimpahan Jenis Collembola Pada Habitat Vermikomposting. *Widya Warta*, *XXXV*(1), 131–144. http://portal.widyamandala.ac.id/jurnal/index.php/warta/issue/view/8

Husamah, Rohman, F., & Sutomo, H. (2016). Struktur Komunitas Collembola pada Tiga Tipe Habitat Sepanjang Daerah Aliran Sungai Brantas Hulu Kota Batu. *Bioedukasi: Jurnal Pendidikan Biologi*, *8*(2), 45. https://doi.org/10.20961/bioedukasi-uns.v9i1.3886

Indriyati, I., & Wibowo, L. (2011). Keragaman Dan Kemelimpahan Collembola Serta Arthropoda Tanah Di Lahan Sawah Organik Dan Konvensional Pada Masa Bera. *Jurnal Hama Dan Penyakit Tumbuhan Tropika*, *8*(2), 110–116. https://doi.org/10.23960/j.hptt.28110-116

Janssens, F. (2009). *Checklist of the Collembola: Key to common surface-dwelling species of Collembola from the UK*. *2*(1), 1–9. http://www.Collembola.org/key/fknl.pdf

Krebs, C. J. (1989). Ecological methodology. New York, NY: Harper and Row Publishers Inc., 654 p.

Larasati, W., Rahadian, R., & Hadii, M. (2016). Struktur Komunitas Mikroartropoda Tanah Di Lahan Penambangan Galian C Rowosari, Kecamatan Tembalang, Semarang. *Jurnal Biologi*, *5*(1), 1–9. https://doi.org/10.14710/bioma.18.2.79-88

Leroy, B. L. M. M., Bommele, L., Reheul, D., Moens, M., & De Neve, S. (2007). The application of vegetable, fruit, and garden waste (VFG) compost in addition to cattle slurry in a silage maize monoculture: Effects on soil fauna and yield. *European Journal of Soil Biology*, *43*(2), 91–100. https://doi.org/10.1016/j.ejsobi.2006.10.005

Marlina, S. (2017). Pengelolaan Ekosistem Gambut Pasca Kebakaran Lahan Gambut di Provinsi Kalimantan Tengah. *Media Ilmiah Teknik Lingkungan*, *2*(1), 26–30. https://doi.org/10.33084/mitl.v2i1.129

Niwangtika, W. (2014). *Kajian komunitas ekor pegas (Collembola) pada perkebunan apel (Malus sylvestris Mill.) di Desa Tulungrejo Bumiaji Kota Batu / Widyarnes Niwangtika*.

Ponge, J. F., Gillet, S., Dubs, F., Fedoroff, E., Haese, L., Sousa, J. P., & Lavelle, P. (2003). Collembola communities as bioindicators of land use intensification. *Soil Biology and Biochemistry*, *35*(6), 813–826. https://doi.org/10.1016/S0038-0717(03)00108-1

Priyono, B., & Abdullah, M. (2013). Keanekaragaman jenis kupu-kupu di Taman Kehati Unnes. *Biosaintifika: Journal of Biology & Biology Education*, *5*(2), 100–105. https://doi.org/10.15294/biosaintifika.v5i2.2749

Rahmadi, C., Suhardjono, Y. R., & Andayani, I. (2004). Collembola Lantai Hutan Di Kawasan Hulu Sungai Tabalong Kalimantan Selatan Pendahuluan Metode Penelitian Lokasi. *Biota*, *IX*(3), 179–185. https://doi.org/10.24002/biota.v9i3.2915

Subiksa, F. A. dan I. G. M. (2008). *Lahan Gambut:Potensi untuk Pertanian dan Aspek Lingkungan*. moz-extension://f209f0be-febb-3147-ad7b-730a686bd824/enhanced-reader.html?openApp&pdf=https%3A%2F%2Fwww.jstage.jst.go.jp%2Farticle%2Fjsem%2F20%2F6%2F20_738%2F_pdf%2F-char%2Fja

Suhardjono, R. Deharveng, L. Bedos, A. (2012). *Biologi Ekologi Klasifikasi Collembola (Ekor Pegas)*. vegamedia.