Journal of Biotechnology and Natural Science
Vol. 2, No. 2, December 2022, pp. 49-55
ISSN 2808-2508

# Inventory of Collembola Species Around Ahmad Dahlan University Campus 4 and its Surroundings

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ARTICLE INFO

**Article history**
Received: December 1th 2022
Revised: December 7th 2022
Accepted: December 9th 2022

**Keywords**
Ahmad Dahlan University
Collembola
*Folsomia* sp.
*Sminthurus* sp.
Spring tails

**ABSTRACT**

Collembola has an important value for the environment as a bioindicator in maintaining the balance of the ecosystem. Land conversion in the UAD campus 4 area can reduce the diversity of Collembola. This study aims to find out the level of diversity of Collembola species that exist on campus 4 of UAD and its surroundings, and also find out which areas have the highest and lowest number of individuals. The research area for sampling in this study is the UAD 4 campus area, vacant land, housing and rice fields. Sampling was carried out as many as four repetitions. The collembola trapped in the pitfall trap is then moved in a microtube. The collembola that has been obtained is then identified up to the species level. The data obtained were analyzed by descriptive analysis. The types of collembola obtained at campus 4 UAD and its surroundings are *Folsomia* sp,, *Isotoma* sp., *Isotomurus* sp., *Entomobrya* sp., *Sminthurus* sp., *Hypogatrusa* sp, and *Lepidocyrtus* sp. The collembola species that is most commonly found are from Entomobrya famili with 106 individuals and the least individual from Sminthuridae family with 4 individuals.



*How to Cite: Kamalia, L.A. (2022). Inventory of Collembola Species Around Ahmad Dahlan University Campus 4 and its Surroundings, Journal of Biotechnology and Natural Science, 2(2), 49-55.*

## 1. Introduction

Various types of development can be found around campus 4 UAD, such as student boarding houses, housing, food stalls, minimarkets and others. This has led to land conversion and reduced green open space (Herlanda, 2017) with changes in function change, can still be found in the campus area 4 of UAD and its surroundings, one of which is soil organisms (Selvany, et al. 2018). One of these groups of soil organisms is Collembola or commonly referred to as springtails (Husamah et. al., 2016). Collembola is often used as a bioindicator of soil conditions because it is very sensitive to habitat changes, both structurally and community functions (Trianto & Marisa, 2020).

Research on the diversity of Collembola in the rice field area of Pagelaran District, Tanggamus Regency, Lampung by Indrayanti (2008) found Collembola which comes from the families Entomobrydae, Isotomidae, and Hypogastruridae. Another study by Niwangkita (2017) in the plantation area of Desa Tulungrejo, Bumiaji, Batu City obtained 5 families, 10 genera and 11 species from Collembola. The families are Hypogastruridae, Neanuridae, Tomoceridae, Isotomidae and Entomobrydae. Research on the diversity of Collembola species has never been conducted in the area of campus 4 of UAD and its surroundings. So that this study was conducted as preliminary information and determinants of health indicators based on the type and number of Collembola individuals found around campus 4 UAD.

## 2. Methods

This research was conducted in April - September 2022 around campus 4, Ahmad Dahlan University (UAD), Yogyakarta. The identification of specimens of the Collembola Order was carried out at the Ecology and Systematics Laboratory, Faculty of Applied Science and Technology, Ahmad Dahlan University, Yogyakarta. The Equipment used for this research are luxmeter, digital camera, shovel, Optical GPS, 4in1 Soil Survey Instrument. The materials used are collembola samples obtained from the field, label paper, 70% alcohol to preserve the obtained specimens and detergent solution for pitfall traps. The sampling location was determined using the purposive sampling method of each plot area of 35 x 50m$^2$. The entire area is created 16 plots with coordinate points (Figure 1).

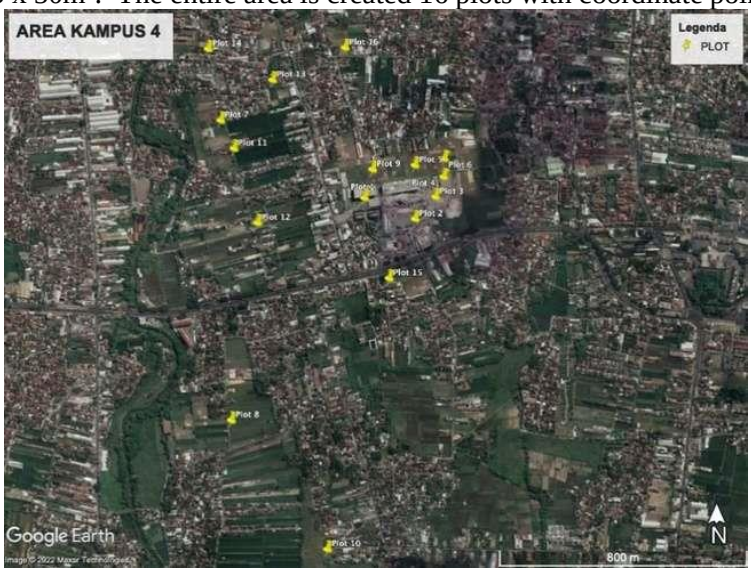


**Fig. 1.** Coordinate for 16 Plots around Ahmad Dahlan University campus 4

Collembola samples were collected using *pitfall traps* in the morning (at 07:00 WIB) and dimbil in the afternoon (15:00 WIB) (Aryoudi *et. al.*, 2015). Samples that have been stored in microtubs containing 70% alcohol are then taken to the laboratory for identification. Abiotic measurements including soil temperature, soil moisture and soil pH and light intensity are also carried out in the morning, afternoon, afternoon. The data obtained from the field was then analyzed using descriptive analysis. Descriptive analysis was used to describe each of the spesises collembola obtained during the study based on the guidelines of the BugGuide.net *website*, Jurnal Ansari et al. (2016), Princess et al. (2019), Utomo et al. (2019), Suhardjono (2012) and the book Borror et al. (1992).

## 3. Results and Discussion

Based on the results of research that has been carried out, seven types of Collembola consisting of four families in the UAD campus 4 area, rice fields, vacant land and housing were obtained. Collembola found (Table 1).

Table 1. Type Collembola obtained in the UAD campus 4 area, vacant land, rice fields and housing

| No | Famili | Species | Paddy | Vacant Lots | Housing | Campus |
|---|---|---|---|---|---|---|
| 1 | Isotomidae | *Folsomia* sp. | ✓ | ✓ | ✓ | ✓ |
| | | *Isotomia* sp. | ✓ | ✓ | ✓ | ✓ |
| | | *Isotomurus* sp. | ✓ | ✓ | ✓ | ✓ |
| 2 | Entomobrydae | *Lepidocyrtus* sp. | ✓ | ✓ | - | - |
| | | *Entomobrya* sp. | ✓ | ✓ | ✓ | ✓ |
| 3 | Hypogastruridae | *Hypogastrura* sp. | ✓ | ✓ | - | - |
| 4 | Sminthuridae | *Sminthurus* sp. | ✓ | - | - | - |

Noted:
✓ : Found
- : Not found

Based on the table above, in the rice field area, 7 types of Collembola were found, 5 types of vacant land, 3 types of housing and 4 UAD 5 types of campus areas. These varied results are due to the different conditions of each sampling area. Collembola obtained in the rice field area has more types than other research areas. Collembola found in rice fields acts as a nutrient distribution in plants (Xiao dong, 2012) and can describe land productivity (Hadley, 2007). In addition, the presence of collembola is also strongly influenced by litter in the *top* soil area or soil surface (Ponge *et al.*, 2003). This is because the presence of litter can be used as a source of food for Collembola. The more litter contained in an ecosystem, the more types of collembola will be obtained in the ecosistem (Suhardjono, 2012).

Total individuals' species of collembola found in residential areas are lower than rice fields. There is a change in land function from plantation or agricultural land to housing, causing a reduction in trees, bushes and grass that can produce and as a source of litter as food from Collembola (Husamah, 2015). In addition, land function change can result in changes in vegetation and soil which is the habitat of Collembola, so that it can affect the existence of Collembola (Ponget et al., 2003).

The results of this study were found in four families of Collembola, namely Isotomidae, Entomobrydae, Hypogastruridae and Sminthuridae. Compared to research from Widyastuti et al. (2016), this study found fewer Collembola Families obtained. The research of Widaystuti et al. (2016) found seven Collembola families, namely Neanuridae, Hypogastruridae, Entomobrydae, Isotomidae, Cyphoderidae, Onycopoduridae, and Dicyrtomidae. The results of this study are also different from the research of Maisar et al. (2018) which received five Collembola Families, namely Entomobrydae, Isotomidae, Tomoceridae, Sminthuridae and Neanuridae.

Collembola families not found in this study are the families Cyphoderidae, Tomoceridae, Neanuridae, Onycopoduridae, and Dicyrtomidae. The family Cyphoderidae was not found in this study because members of this family lived in anthills or termites (Suhardjono, 2012). Anthills and termites are usually found in damp places (Shattuck, 2001), in the ground and wet logs (Shattuck, 2001), as well as in dry logs (Suhardjono, 2012). The research location used in this study did not find any anthills or termites and wet or dry logs.

In addition to the family Cyphoderidae, the family Onycopoduridae was also not found in this study. This is because members of the family Onycopoduridae are usually found in caves (Suhradjono, 2012). The absence of cave ecosystems in the study area caused no members of the Onycopoduridae family to be found in this study.

The next family not found in this study is the Dycirtomida family. The family Dycirtomidae was not found in this study because members of this family lived on moss on tree trunks (Suhardjono, 2012). Meanwhile, in the research area, no mossy tree trunks were found. Mossy trees are usually found in humid and wet areas (Britannica, 2015), while the study site has dry habitat characteristics. Sothat damp logs were not found in the study area. This resulted in the non-discovery of collembola from the Dycirtomida e family.

The next family that was not found in this study but was found in the research of Widyastuti et al. (2018) and Maisar et al. (2018) is the family Neanuridae. The family Neanuridae was not found in this study because all members of the Family Neanuridae lived under decaying bark (Hamada, 2018). Maisar et al. (2009) found members of the Family Neanuridae because their research was conducted on mountainous areas that allowed for rotting bark and had moist soil as the living place of members of the Family Neanuridae. Widyastuti et al. (2018) also found the family Neanuridae in their research because the research was conducted in an oil palm plantation area that has rotting oil palm bunches. In addition, members of this famili have food in the form of mushrooms (Hopkins, 2015). The absence of mold at the study site resulted in the absence of members of this family in this study.

This study also obtained Collembola species which were only obtained in certain areas of this study. The first Collembola species found only in paddy fields and vacant lots were *Hypogastrura* sp. and *Lepidocyrtus* sp. two species favor habitats that have litter used as feed *Hypogastrura* sp. and *Lepidocyrtus* sp. (Suhardjono, 2012). The absence of these two Collembola species in campus and residential areas is because campus and residential areas have little vegetation and trees that produce a little litter as Collembola feed. This may be a factor in the non-discovery of *Hypogastrura* sp., and *Lepidocyrtus* sp. in residential areas and campuses.

The last species found only in certain areas of this study was *Sminthurus* sp. *Sminthurus* sp. has

a water surface habitat and litter. This research gets *Sminthurus* sp. only in rice fields. This is because the rice field area has water on the surface of the rice field. This is supported by research from Indriyanti and Wibowo (2008) and Muturi *et al.* (2009) also gained members of the Family Sminthuridae in rice fields.

The following are theclassifications and descriptions of each type of collembola member obtained in this study:

1. ***Folsomia* sp.**

*Folsomia* sp. (Figure 2) measuring approximately 4 mm, elongated cylindrical in shape, white with a smooth seta. The head has an oblong-shaped post-antennae organ. Furkula short (Suhardjono, 2012). *Folsomia* sp. in nature plays the role of an effective decomposer of soil organic matter.


**Fig. 2.** Sample *Folsomia* sp. obtained (Personal documents, 2022)

2. ***Isotoma* sp.**

According to Suhardjono, et al. (2012), *Isotoma* sp. (Figure 3) is a type of collembola member that has a body with a length range of 1-3mm. It has a non-stringent body and has 4 antennae.


**Fig. 3.** Sample *Isotoma* sp. obtained (Personal documents, 2022)

3. ***Isotomurus* sp.**

According to Suhardjono (2012), *Isotomurus* sp. (Figure 4) has antennae 4 internodes, tubuh not *setae* and if it has *setae* the shape is simple. Abdomen 6 internodes with reduced *urcula f*. Have a body size of 1.3 - 3 mm. Antennae with 4 internodes.

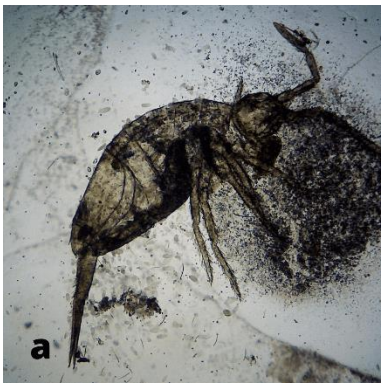


**Fig. 4.** Sample *Isotomurus* sp. obtained (Personal documents, 2022)

***4. Entomobrya* sp.**

*Entomobrya* sp. (Figure 5) belongs to the Family Entomobrydae. *Entomobrya* sp. It has a cylindrical body shape and is brown in color. Furka is curved and long.


**Fig. 5.** Sample *Entomobrya* sp. obtained (Personal documents, 2022)

***5. Lepidocyrtus* sp.**

Characteristics that *Lepidocyrtus* sp. (Figure 6) possesses body with long legs. Antennae bend. It has long tentacles.

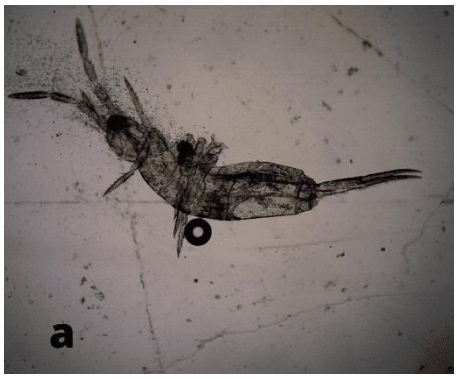


**Fig. 6.** Sample *Lepidocyrtus* sp obtained (Personal documents, 2022)

***6. Sminthurus* sp.**

*Sminthurus* sp. (Figure 7) is a species of the Family Sminthuridae that has a rounded body. The *abdominal segments* are not clearly indicated. It has eyes and antennae consisting of four internodes that become one. Have a bite-type mouth. *Abdomens* one - four are usually fused due to the absence of segmentation in the area. Usually has a strong and bright pigment on its body (Harzaq & Mandala, 2007). The habitat of *Sminthurus* sp is on the surface of fresh water, litter, and soil (Suhardjono, 2012).

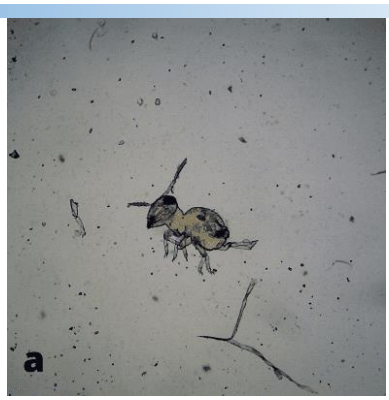


**Fig. 7.** Sample *Sminthurus* sp. obtained (Personal documents, 2022)

***7. Hypogastrura sp***.

*Hypogastrura* sp. (Figure 8) has the form of a short *furka*. *Furka* on the *posterior* does not exceed the tip of the body. This is used as a characteristic of *Hypogastrura* sp. to distinguish its morphology from species from other its families (Harza & Mandala, 2007). *Hypogastrura* sp is gilig-shaped, granulate, and dark gray in color. It has a length of up to 1 mm and has a smooth *seta*. The habitat occupied by *Hypogastrura* sp. is moist soil, litter and moist humus.

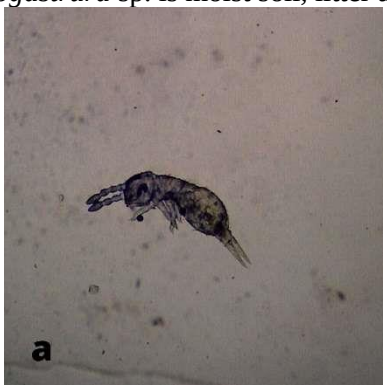


**Fig. 8.** Sample *Hypogastrura* sp. obtained (Personal documents, 2022)

## 4. Conclusion

Based on the results of the research conducted, it can be concluded as follows the types of collembola found around campus 4 of Ahmad Dahlan University totaled 7 species, namely *Isotoma* sp., *Folsomia* sp., *Isotomurus* sp., *Entomobrya* sp., *Lepidocrtus* sp., *Smintuhurus* sp. and *Hypogastrura* sp.

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