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Diversity of Mesofauna and Macrofauna in Wonosari Tea Plantation, Lawang

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Abstract
Species diversity in an ecosystem can indicate that an ecosystem is still good and natural and helps maintain the balance of an ecosystem. One example of an artificial ecosystem is a plantation. Plantations in Indonesia have existed since the 19th century, namely during the Dutch colonial government. The Dutch sent several plantation crops to various regions to increase economic interests, one of the plantation areas that existed since the Dutch colonial period was the tea plantation. Soil macrofauna plays a very large role in the process of carbon flow, nutrient redistribution, nutrient cycling, bioturbation and soil structure formation. Based on the description above, the purpose of this study uses observation and interview methods to determine the characteristics and diversity of macrofauna in the Wonosari Tea Plantation area, Lawang-Malang, East Java. It also aims to compare diversity in the area, where it is known that the diversity of a species affects ecosystem balance.

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1. Introduction

The Wonosari tea plantation was originally owned by the Dutch. However, after Indonesian independence, the plantation was taken over by the Indonesian government and is now managed by PTP XII. As we toured the plantation with our local guide, we were also shown robusta coffee, arabica coffee, and cocoa trees on the right side of the road. These trees are symbolic. This means that PTP XII not only owns tea plantations but also other plantations. PTP XII's coffee and cocoa plantations are located in the Ijen Crater in Banyuwangi, Jember, and Blitar (Fitriani, 2015). The world is home to a diverse range of flora and fauna. Countries with subtropical climates will have different flora and fauna diversity than countries with tropical or polar climates. One such tropical country is Indonesia. Straddling the equator, Indonesia is located in the tropics and boasts a relatively stable climate. Geographically, it is an archipelagic country, making it a rich source of flora and fauna. Indonesia boasts abundant biodiversity.

Species diversity in an ecosystem can indicate that an ecosystem is still healthy and natural and helps maintain its balance. One example of a man-made ecosystem is a plantation. Plantations in Indonesia have existed since the 19th century, during the Dutch colonial period. The Dutch sent several plantation crops to various regions to increase economic interests. One plantation area that existed since the Dutch colonial era was the tea plantation (Parwata, 2014). Macrofauna land very big its role in the process of carbon flow, redistribution of nutrients, nutrient cycles, bioturbation and formation of soil structure (Anderson, 1994). Soil fauna plays an important role in the soil ecosystem, because of the process of decomposition of organic material in Soil is also determined by the presence of soil macrofauna in the habitat so that it is beneficial for soil fertility (Buckman & Brady, 1982).

إِنَّ فِي خَلْقِ ٱلسَّمَٰوَٰتِ وَٱلْأَرْضِ وَٱخْتِلَٰفِ ٱلَّيْلِ وَٱلنَّهَارِ وَٱلْفُلْكِ
ٱلَّتِي تَجْرِي فِي ٱلْبَحْرِ بِمَا يَنفَعُ ٱلنَّاسَ وَمَآ أَنزَلَ ٱللَّهُ مِنَ ٱلسَّمَآءِ مِن
مَّآءٍ فَأَحْيَا بِهِ ٱلْأَرْضَ بَعْدَ مَوْتِهَا وَبَثَّ فِيهَا مِن كُلِّ دَآبَّةٍ
وَتَصْرِيفِ ٱلرِّيَٰحِ وَٱلسَّحَابِ ٱلْمُسَخَّرِ بَيْنَ ٱلسَّمَآءِ وَٱلْأَرْضِ
لَءَايَٰتٍ لِّقَوْمٍ يَعْقِلُونَ ﴿١٦٤﴾

Al-Qur'an give description about fauna and its fungctions with many explanations including:

> *"Indeed, in the creation of the heavens and the earth, the alternation of night and day, the ships that sailed on the sea brought what was useful for humans, and what Allah sent down from the sky in the form of water, then with that water He revived the earth after it had died (dry) and He spread on the earth all kinds of animals, and the circulation of winds and clouds controlled between the heavens and the earth; indeed (there are) signs (of the oneness and greatness of Allah) for a people who want to think"* (QS. Al- Baqarah [2]: 164).

The verse also mentions the word "Ya'qiluun"means people who think, the meaning of people who think is a group of people who want to think about the creation of all kinds of animals and plants on earth, another meaning of the people in question is biologists or biological scientists (Shihab. 2003).
Soil fauna, both mesofauna and macrofauna, play a role in decomposing organic matter, thus restoring and maintaining the productivity of the surrounding soil. The activities of soil fauna can increase infiltration, aeration, soil aggregation, and distribute organic matter in the soil, which then requires efforts to increase the diversity of both mesofauna and macrofauna (Wulandari, 2007).
Determination of soil fertility can also be seen from the presence of mesofauna and macrofauna due to their sensitive response to changes in soil characteristics, changes in nutrient cycling, decomposition processes, water storage; and changes in land and climate (Suheriyanto, 2012). Mesofauna and macrofauna are sensitive to soil management patterns and changes in climate and have a relationship with beneficial or detrimental soil properties so that they can be used as bioindicators (Husamah *et al*., 2011).
According to previous research on mesofauna and macrofauna in the Wonosari Lawang tea plantation, each tea plantation plot contained 9 classes and 19 orders, dominated by the Insecta order (Mocha *et al*., 2019). Other related research on the diversity of soil arthropods in agroforestry areas *Pinus merkusii* with carrot plants and without carrot plants produce as many as 16 Orders and as many as 37 families of land arthropods (Nenobahan, 2016).
Based on description on objective This study used observation and interview methods to investigate the characteristics and diversity of macrofauna in the Wonosari Tea Plantation, Lawang-Malang, East Java, and aimed to compare the diversity in the area. It is well known that species diversity influences ecosystem balance. The research we conducted was entitledDiversity of Mesofauna and Macrofauna in Wonosari Tea Plantation, Lawang

2. Methodology

The type of research we conducted was observational research and interviews with informants. This observation isOvert or covert observation is a technique in which researchers openly disclose to informants, the community, or the public that they are conducting an observation, thus ensuring the entire research process is known. Undercover observation is conducted when the researcher is keeping data confidential during the observation, so the researcher does not disclose the observations to maintain data confidentiality. Study thus implemented in Wonosari Tea Plantation, Lawang, District. Malang, East Java. The research was conducted on May 4, 2022. The tool used in this study was a digital camera.cellphone, recording equipment, plastic, wood. Meanwhile, the materials used are tea plants and the soil around the tea plants.

3. Results

Based on the results of observational research conducted at the Wonosari Lawang Tea Plantation (PTPN XII), the following results were obtained:

Table 1: Mesofauna and Macrosaunal Dat

No	Kelas	Ordo	Famili	Spesies
1	Arachnida	Araneae	Linyphiidae	Linyphia triangularis
2	Arachnida	Araneae	Nesticidae	Nesticus rivularis
4	Arachnida	Araneae	Clubionidae	Clubiona germanica
5	Arachnida	Araneae	Philodromidae	Philodromus cespitum
6	Arachnida	Araneae	Philodromidae	Philodromus maximus
7	Arachnida	Parasitiformes	Macrochelidae	Macrocheles maris-moruae
8	Collembola	Entomobryomorpha	Entomobryidae	Orchesella cincta
9	Collembola	Entomobryomorpha	Entomobryidae	Pseudosinella alba
11	Gastropoda	Stylommatophora	Ariantidae	Arianta arbustorum
12	Gastropoda	Stylommatophora	Achatinidae	Achatina fulica
13	Gastropoda	Stylommatophora	—	Laevigata niger
14	Hymenoptera	Formicidae	Formicidae	Camponotus chromaiodes
15	Hymenoptera	Formicidae	Formicidae	Oecophylla smaragdina
16	Lepidoptera	—	Erebidae	Calliteara pudibunda
17	Lepidoptera	—	Gracillariidae	Caloptilia theivora
18	Lepidoptera	—	Tortricidae	Cydia leucostoma
19	Insecta	—	Aphididae	Myzus persicae
20	Insecta	—	Aphididae	Aphis gossypii
21	Hemiptera	—	Elateridae	Sannus indocera
22	Hemiptera	—	—	Bemisia tabaci
23	Orthoptera	—	Acrididae	Bemisia tabaci
24	Neuroptera	—	—	Valanga nigricornis
25	Coleoptera	—	Coccinellidae	Coccinella transversalis

Based on the observation data, four classes were found during the observation: Arachnida, Collembola, Gastropoda, and Insecta. Within the Arachnida class, two orders were found, namely Aranae and Parasitoformes. 7 types of species were found. In the Collembola class, only 1 type of order was found, namely Entomobryomorpha and 2 types of species. The Gastropoda class found 1 type of order, namely Stylommatophora and 2 families from Arionidae and Achatinadae and 2 types of species were found. And in the Insecta class, the most were found among the mesofauna and macrofauna of the other classes, namely 5 orders were found, including Hymnoptera, Lepidoptera, Hemiptera, Orthoptera and Neopthera.

Hymnoptera found 1 type of family, namely Formicidae with 3 different species. Lepidoptera found 3 families, namely Eribidae, Gracillaridae, Tortricidae and 3 species were found. In the Hemiptera class, 3 orders were found, namely Aphidoidae, Flatidae, and Aleyrodidae and there were 4 different species. In the Orthoptera order with the family achididae and 1 species with the species nameValanga nigricornis.

Meanwhile, in the Coleoptera order, the Neopthera family was found with 1 species. Typhaea stercoreaand the family Coccinolleideae with 1 speciesCoccinella transversalis. This is documentation mesofauna and macrofauna found around tea plantations :

Fig 1: Species *Valanga sp* and *Cydia sp*

Fig 2: Species *Philodromus sp* and *Myzus sp*

Fig 3: Species *Componotus sp* and *Thypea sp*

Fig 4: Species *Phyllodromus sp* and *Coccinella sp*

Based on an interview with one of the sources, whose name is Mr. Salim, who is a Tour guideand also Wonosari tea plantation farmers said that two species of tea are planted on the plantation, namely *Camellia sinensisa* type of oolong tea typical of Indonesia and *Camellia japonicaoriginating* from Japan. These two tea species are not differentiated between fields or garden plots, but are instead mixed. To identify the type, the dark green tea is Indonesian tea, and the light green tea is Japanese.

Fig 6: Interview with the Resource Person

Furthermore, according to sources, the dominant fauna around the plantations are several species of birds and snakes. Meanwhile, the most common small-sized fauna are aphids and small caterpillars, appearing both during the dry and rainy seasons. During the rainy season, a problem that occurs in the plants is water pox, caused by certain macrofauna, such as aphids and others.

To maintain soil fertility on plantations, according to sources, the specific animals believed to fertilize the soil are not widely used. However, special soil treatments are carried out, such as the application of tea compost, manure, and urea annually, and this treatment is applied equally to each plot. Special treatment is only given to plots of land severely infested with pests that can cause damage to the tea plants, namely the application of pesticides. However, plants treated with pesticides are not harvested for approximately a month with the aim of neutralizing the chemical compounds contained in pesticides.

During this observation, numerous fauna, commonly known as aphids, were found attached to leaves. Aphids typically form large colonies on leaves. Females reproduce parthenogenetically (without mating). These aphids produce honeydew through their styluses, forming a black, sooty mold that covers the leaves, hindering photosynthesis. The styluses provide nutrients for the fungus that causes sooty mold. The resulting symptoms do not affect cob production, although they almost completely cover the corn husk, as they only affect a few layers of the husk (Sari *et al*., 2020).

The role of soil fauna is very important in the process of decomposition of organic matter in peat soil and maintaining ecosystem balance, as well as sustainable peat management, so that the use of chemicals in peatland management can be reduced by involving the function of soil macrofauna, therefore it is necessary to explore the types and number of soil mesofauna individuals as decomposers of organic matter (3, nd).

4. Conclusion

Based on the research results regarding the effect of providing granulated sugar concentration, the following conclusions can be drawn:

1. There is a variety of mesofauna and macrofauna around the Wonosari tea plantation, Lawang
2. This research found 4 classes, 9 orders, and 17 families. Of the 4 classes, the most common was Insecta.
3. According to sources, the most commonly found snakes and birds

5. References

1. Husamah H, Rahardjanto A, Hudha AM. Soil animal ecology (theory and practice). Malang: UMM Press; 2011.
2. Fitriani FN. Insect diversity on tea plants (Camellia sinensis L.) on the PTPN XII Bantaran Blitar tea plantation. 2015:1–23.
3. Mocha E, Susetryorini RE, Agus M, Budiyanto K, Wahyuni S, Fauzi A. Diversity of soil mesofauna and macrofauna families in the PTPN XII Wonosari Singosari Tea Plantation. 2019:313–318.
4. Nenobahan FM. Diversity soil macrofauna in production forests (Pinus merkusii with and without carrot plants). Journal of Forestry Sciences. 2016;1(2):45–51.
5. Sari SP, Suliansyah I, Nelly N, Hamid H. Identification of football pests (Hemiptera: Aphididae) on hybrid corn plants (Zea mays L.) in Solok District, West Sumatra. Journal of Agro Science. 2020;5(2). doi:10.36355/jsa.v5i2.466
6. Shihab MQ. Tafsir Al-Misbah: message, impressions and harmony of the Qur'an. Vol. 11. Jakarta: Lentera Hati; 2003.
7. Suheriyanto D. Fauna diversity soil in Bromo Tengger Semeru National Park as a bioindicator of high sulfur soil. Science. 2012;1(2):29–38. doi:10.18860/sains.v0i0.2307
8. Wulandari S. The role of mesofauna and soil macrofauna in the decomposition of plant organic matter under sengon (Paraserianthes falcataria) stands. Biotechnology. 2007;4(1):20–27. doi:10.13057/biotek/c040104