Jurnal Pembelajaran Dan Biologi Nukleus p-ISSN: 2442-9481
Vol 10 (1): 190-206, March 2024 e-ISSN: 2685-7332

Diversity of Soil Surface Arthropods Species in Taman Hutan Raya Sultan Syarif Hasyim, Riau Province

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Submitted December 28th 2023 and Accepted February 29th 2024

Abstract

Soil surface arthropods are an important part of an ecosystem in the soil which has a role as a bioindicator of ecosystem balance and acts as a decomposer which can decompose organic materials and enrich the organic material content in the soil. This research aims to determine the diversity of soil surface arthropods species in three vegetation types in Taman Hutan Raya Sultan Syarif Hasyim. Sampling was conducted in Taman Hutan Raya Sultan Syarif Hasyim Riau Province in August 2023. This research used a purposive sampling method with a sampling technique using pitfall traps placed in three vegetation types (natural forest, shrubs and oil palm plantation). The overall results include 9 orders, 15 families, 26 species and a total of 2,027 individuals per hectare. In natural forests, there were 7 orders, 12 families, 20 species and 853 individuals per hectare, with a diversity index (H') of 2.27 (medium). In shrubs, there were 6 orders, 8 families, 12 species and 715 individuals per hectare, with an (H') of 2.17 (medium). In oil palm plantations, there were 4 orders, 5 families, 9 species and 549 individuals per hectare, with an (H') of 2.03 (medium)

Keywords: *Arthropods, Bioindicator, Diversity, Dominance, Evennes*

https://doi.org/10.36987/jpbn.v10i1.5346

INTRODUCTION

Based on the Decree of the Minister of Forestry and Plantations No. 349/kpts-II/1999 dated May 26, 1999 Taman Hutan Raya Sultan Syarif Hasyim is a nature conservation area which has an area of 6,172 Ha. Since it was authorized as Tahura until now, Tahura Sultan Syarif Hasyim has experienced many environmental changes, this is due to the large number of forest encroachments and destruction of natural resources, resulting in changes in land cover. Riau Province Forestry Service (2015) states that Tahura Sultan

Syarif Hasyim has a variety of flora species, in addition to the diversity of flora species, Tahura Sultan Syarif Hasyim also has a fairly high diversity of fauna species that have many benefits for the ecosystem.

One of the fauna that has an important role for the ecosystem is arthropods, which are a very important component of the forest, because 80-90% of the total species in the ecosystem consists of arthropods themselves (Masdianur, 2014). The total of arthropods species ranges from 1,170,000 to 5 to 10 million includes more than 80% of all animal species known to be alive today. Total these species are still difficult to pin down because the calculations are based on model assumptions that are projected to other areas based on site-specific counts and then implemented globally.

Arthropods have a role as bioindicators of ecosystem balance, meaning that if there is a high arthropod diversity in the ecosystem, the ecosystem environment is considered stable or balanced and if the arthropod diversity in the ecosystem is low, the ecosystem environment is unstable or unbalanced, because arthropods are classified as animals that are responsive to pressure or changes in an ecosystem. Arthropods also play an important role in the decomposition process. Soil surface arthropods can weather organic materials and enrich the organic matter content in the soil (Fatmala, 2017).

Soil surface arthropods as biological components in soil ecosystems depend on environmental factors. The presence and density of arthropods populations depend on environmental changes. In addition, vegetation type also plays a significant role in arthropods species and population density, vegetation type affects the state of the floor (moist and thick) and litter diversity can directly affect arthropods diversity (Aziz & Aminatun, 2020).

The results of the reference study found that there is research on the macrofauna in this area, but there is no specific research on the presence of arthropods. Limited information about arthropods in Tahura Sultan Syarif Hasyim and seeing the current environmental conditions of Tahura, as well as the importance of the role of arthropods in the environment, therefore it is necessary to conduct research on the diversity of soil surface arthropods in Tahura Sultan Syarif Hasyim Riau Province.

MATERIAL AND METHOD

Location and Time of Research

This research was carried out at the Taman Hutan Raya Sultan Syarif Hasyim Riau Province and the Forestry Laboratory. This research was conducted in August 2023.

Tools and Materials

The tools used in this study were sample bottles, a set of pitfall traps, tweezers, thermohygrometer, microscope, soiltester, sieve, hoe, machete, phiband, Avenza Maps, haga meter, plastic rope, stationery and camera. The materials used in this study were detergent, sugar and 70% alcohol.

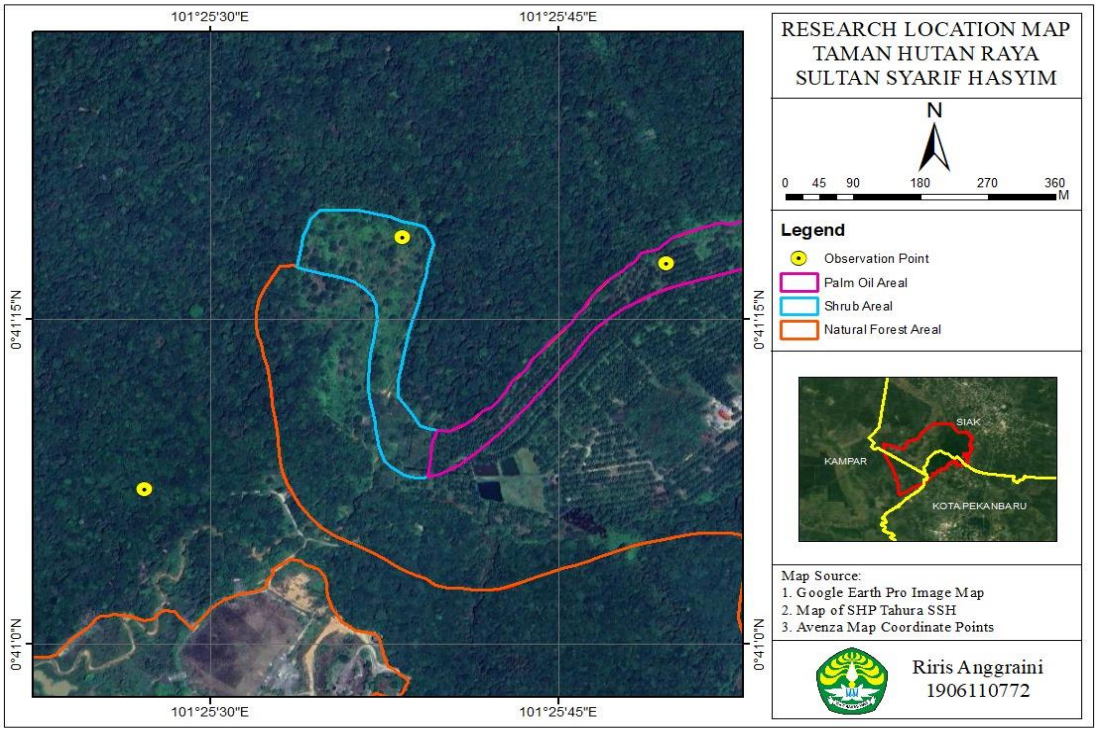

Figure 1. Research Location Map

Research Methods

The method used in this study was purposive sampling method, which is a sampling technique with certain considerations. The considerations used were that the samples were taken from all types of arthropods trapped in the trap and the samples were only surface arthropods. Sampling using pitfall traps. Pitfall traps are traps used to capture arthropods on the ground that are active during the day and night. Trapped arthropods were then collected and put into bottles containing 70% alcohol for identification in the laboratory.

Research Implementation

Determination of Sampling Location

The locations used as observation sites are in 3 vegetation typologies. The first location is natural forest with an area of 1,816.65 Ha, where sampling is placed in dense vegetation cover and medium vegetation cover. The second location is shrubs with an area of 3.39 Ha. The third location is oil palm plantations with an area of 3,039.55 Ha, sampling was placed on young oil palm plants (3-13 years old).

Sampling Technique

Arthropods sampling was carried out on the ground by installing pitfall traps placed on a 100 m long transect line with a distance of 10 m between traps. Transects were

made as many as 3 lines, with a distance of 15 meters between transects (Nadiyah, 2021). Sampling was carried out as many as 2 replicates at each location. Trap installation began at 07.00 am and was left for 2 x 24 hours (2 days). Traps were set by applying a sugar solution mixed detergent as high as 5-6 cm from the bottom of the trap cup and placed on the transect line (Khartika et al., 2021).

Vegetation Analysis Data Collection

Vegetation analysis data collection is carried out at each location, each location has 3 transect lines. Plots were placed systematically in each transect, in each transect there were 2-3 plots with a distance interval of 20 m. The size of each plot is different at each growth level, namely trees level (20 x 20 m), poles level (10 x 10 m), saplings level (5 x 5 m), and seedlings level (2 x 2 m).

Sample Identification

Arthropods trapped in the traps were observed morphologically, including mouth type, antenna type, limb type, abdominal shape, wing shape, and comparison of forewings with hind wings to identify arthropods. Next using the determination key from Borror et al. (2005) and insect determination key book from (Lilies et al., 1995), introduction insect ecology book (Herlinda et al., 2021), illustrations and descriptions from books and articles, Bud Guide.net website, iNaturalist website and Antwiki website were used.

Observations

The data recorded and collected during the study were as follows:

1. Physical-chemical conditions of the environment including air temperature, air humidity and pH of the soil.
2. Number of soil surface arthropods species
3. Number of individuals of soil surface arthropods species
4. Vegetation analysis

Data Analysis

Species Diversity Index

The species diversity index uses the Shannon-Wienner diversity index (H') (Magurran, 1988) with the following formula:

$$H' = \sum_{i=1}^{s} PiLnPi$$

Description:

H’	= Diversity index
Pi	= Proportion of Ith individual number (n/N)
Ni	= Number of individuals of the Ith species
N	= Total number of individuals

Criteria for the value of the Shannon-Wienner diversity index (H):

H'<1 = Low diversity
1<H'<3 = Medium diversity
H'>3 = High diversity

Species Evenness Index

The evenness of distribution of individual soil surface arthropods species in the community was calculated using the Evenness index (Evennes) (Odum & Barrett, 2005) with the formula:

$$E = \frac{H'}{\text{Ln } S}$$

Description:

E = Index of species evenness
H' = Shannon-Wienner index of individual species diversity
S = Number of species found

Community similarity index value criteria (Odum & Barrett, 2005),

0.00<E<0.50 = Low community
0.50<E<0.75 = Medium community
0.75<E<1.00 = High community

Species Dominance Index

To determine the dominant types of soil surface arthropods in the study area can be determined by using Simpson's dominance index (C) (Odum & Barrett, 2005) as follows:

$$C = \sum \left(\frac{ni}{N}\right)^2$$

Description:

C = Dominance index
Ni = Number of individual arthropod species
N = Total number of arthropod individuals

With criteria:

C 0-0.5 = Low dominance
C ≥ 0.5-0.75 = Moderate dominance
C ≥ 0.75-1 = High dominance

Vegetation Analysis

Important Value Index (IVI) indicates the importance of a plant species and its role in the community and ecosystem. If the IVI of a species is high, then that species greatly affects the stability of the ecosystem. The formula used to determine IVI is as follows:

a. Density (K) $= \frac{Number\ of\ Individuals\ of\ Species\ in\ the\ Sample\ Unit}{Area\ of\ All\ Sample\ Units}$

b. Relative Density (RD) $= \frac{Density\ of\ a\ Species}{Density\ of\ All\ Species}\ x\ 100\%$

c. Frequency (F) $= \frac{Number\ of\ plots\ where\ a\ Species\ is\ found}{Number\ of\ Plots}$

d. Relative Frequency (RF) $= \frac{Frequency\ of\ a\ Species}{Frequency\ of\ All\ Species}\ x\ 100\%$

e. Dominance (D) $= \frac{Ares\ of\ Base\ Field\ of\ a\ Species}{Area\ of\ All\ Sample\ Units}$

f. Relative Dominance (RD) $= \frac{Dominance\ of\ a\ Species}{Dominance\ of\ All\ Species}\ x\ 100\%$

g. Important Value Index (IVI)
IVI = RD + RF (for seedlings and saplings level)
IVI = RD + RF + RD (for poles and trees level)

RESULT AND DISCUSSION

General Condition of the Research Site

Administratively, the Tahura Sultan Syarif Hasyim area covers 3 regencies/cities, namely Kampar Regency covering an area of 3,041.81 Ha, Siak Regency covering an area of 2,323.33 Ha and Pekanbaru City covering an area of 806.86 Ha. Overall, the area of Tahura Sultan Syarif Hasyim is 6,172 Ha (Forestry Service of Riau Province, 2015). The location of the Tahura Sultan Syarif Hasyim area is on the cross road between Pekanbaru and Dumai, where the gate is located at Km 20 which can be reached in approximately 15 minutes from Pekanbaru.

Geographically, Tahura Sultan Syarif Hasyim is located at $0^0$37' LU - $0^0$44' LU and $101^0$20' BT - $101^0$28' BT. Tahura Sultan Syarif Hasyim Riau Province has a location condition with choppy and undulating physiography of small hills, flat to undulating in the west and in the left part there is a downstream river in the form of an alluvial group and there is the Takuana buluh river in the east. Physiographic conditions vary with the height of the area from sea level ranging from 10-25 meters.

Species Composition of Soil Surface Arthropods

This study successfully identified soil surface arthropods species in 3 types of vegetation (natural forest, shrubs, and oil palm) in Tahura Sultan Syarif Hasyim. Based on the results of the study, there were 7 orders in natural forest, 6 orders in shrubs and 4 orders in oil palm using pitfall traps.

Table 1. Number of arthropods individuals in three observation sites

No	Location	∑Ordo	∑Family	∑Species	∑Individual/ha
1	Natural Forest	7	12	20	853
2	Shrubs	6	8	12	715
3	Palm Oil	4	5	9	459
	Total				**2,027**

Table 2. Composition and number of arthropods individuals found in Tahura Sultan Syarif Hasyim.

No	Ordo	Family	Species	S I	S II	S III
1	Hymenoptera	Formicidae	*Dinomyrmex gigas*	67	0	0
			Anoplolepis gracilipes	135	45	0
			Dinoponera gigantean	77	20	23
			Forelius pruiosus	105	48	21
			Odontomachus rixosus	0	0	26
			Monomorium minimum	34	38	0
			Camponotus sp.	10	12	25
2	Orthoptera	Acrididae	*Valanga nigricornis*	4	0	0
			Dichromorpha viridis	4	9	0
		Gryllidae	*Rugabinthus leopoldi*	8	0	15
			Anurogrillus muticus	0	0	0
			Gryllodes sigillatus	0	0	21
		Tetrigidae	*Tetrix subulate*	0	17	2
3	Blattodea	Corydiidae	*Eupolyphaga sineresis*	9	0	0
		Ectobiidae	*Luridiblatta trivittata*	11	17	0
		Blattidae	*Eurycotis floridana*	15	0	0
			Periplaneta americana	3	0	0
			Blattella asahinai	29	7	0
4	Hemiptera	Fulgoromorpha	*Dictyopharidae nepalensis*	2	0	0
		Nabidae	*Nabis rugosus*	3	0	0
5	Coleoptera	Scarabaeidae	*Onthophagus tuberculifrons*	1	1	0
6	Diptera	Sciaridae	*Lygistorrhina sanctaecatharinae*	5	0	0
		Rhagionidae	*Rhagio tringarius*	17	5	0
7	Polidesmida	Paradoxosomatidae	*Ortomorfa coarctata*	0	10	0
8	Isopoda	Trichoniscidae	*Trichoniscus pusillus*	7	0	5
9	Araneae	Araneidae	*Araneus inustus*	0	0	9
Total				546	229	147
Total (n/ha)				853	715	459

Categori: S I (Natural Forest), S II (Shrubs), dan S III (Palm Oil)

The orders identified in natural forests are Hymenoptera, Orthoptera, Blattodea, Hemiptera, Coleoptera, Diptera and Isopoda, there are 12 families with a total of 20 species with a total of 853 individuals/ha. Orders in shrubs are Hymenoptera, Orthoptera, Blattodea, Coleoptera, Diptera and Polidesmida, there are 8 families with a total of 12 species with a total of 715 individuals/ha. While the orders in oil palm are Hymenoptera, Orthoptera, Isopoda and Araneae, there are 5 families with a total of 9 species with a total of 459 individuals/ha.

The order with the highest number of individuals is the Hymenoptera order. Orders that are relatively many families found are the orders Orthoptera, Blattodea, Hemiptera, Diptera. While the order with the least family found is the order Coleoptera, Polidesmida, Isopoda, Araneae and Lithobiomorpha. The most common family found in

the three locations is the Formicidae family. The Formicidae family is a family found at each observation location point with various sizes and colors. This is because the Formicidae family is a group of insects that live in a community called a colony. The Formicidae family is a group that is very common and widespread in various habitats. The abundance of the Formicidae family or ants is because the Formicidae family has the largest abundance and has been found from 15,000 types of ants in the world (Ayu, 2018).

The overall abundance of soil surface arthropods in natural forests was found to be 853 individuals/ha. Based on the observations, the most common order found was the order Blattodea. The Blattodea order has a habitat in warm and humid areas, the amount of litter in the observation location is a suitable habitat for the Blattodea order. The Blattodea order has a role as a dissolver of litter in the ecosystem and is active at night, and during the day hides in a dark place (Sijabat et al., 2020).

One of the most commonly found Blattodea orders is the Blattidae family with a total of 47 individuals. The Blattidae family belongs to a class of insects that act as decomposers, from this decomposition process humus will be formed as a source of nutrients for the soil (Kamila et al., 2022). In addition to the Blattidae family, the dominating family is the Formicidae family, Anoplolepis gracilipes species with 135 individuals. Based on habitat observations, the ant species Anoplolepis gracilipes is more often found in humid environments and not exposed to direct sunlight such as under trees, under piles of dry leaves, in root cavities and plant stems (Apriyadi, 2014).

The least found order is the Coleoptera order with one family, the Scarabaeidae family with the species found is Onthophagus tuberculifron. The Scarabaeidae family was found due to lack of food availability and unsuitable habitat in the area. Jaya & Widayat (2018) stated that the abundance of fecal beetles (Scarabaeidae family) was highest in the use of omnivorous, carnivorous and low herbivorous fecal baits.

The abundance of soil surface arthropods in shrubs was found to be 715 individuals/ha. The most common order found was the Hymenoptera order. The order Hymenoptera is the most dominant order found at this location, this is because this location is more open so that more sun is received by the soil surface which results in higher temperatures at this station. This situation is thought to support the abundance of Hymenoptera, especially the Formicidae family, where this family is more tolerant in overcoming changes in environmental factors.

The total arthropods abundance in oil palms was found to be 459 individuals/ha. The most common order is the order Hymenoptera and the Formicidae family with a total of 95 individuals and among these families there is no dominating species. The large number of the Formicidae family in oil palm is because this group is able to adapt well to the human environment and is able to adapt to areas with a lot of human activity, one of which is oil palm plantations (Romarta et al., 2020).

The second most commonly found order is the Orthoptera order with a total of 38 individuals from the Gryllidae and Tetrigidae families. Orthoptera order lives in various ecosystems including forests, shrubs, residential environments, agricultural land and so on (Erawati & Kahono, 2015). Santi et al. (2023) stated that the majority of insects whose

habitat in oil palm plantations are flying insects that are active during the day and besides that the presence of the Gryllidae family acts as a predator on oil palm plantations.

The least number of orders found in oil palms are the Isopoda and Araneae orders. The Isopoda order found was only one species with a total of 5 individuals, while the Araneae order found was also only one species with a total of 9 individuals. The diversity, evenness and richness of each species are influenced by the complexity of the habitat structure. The different vegetation structures that make up each habitat type also affect the diversity of each species (Karmilasanti & Fajri, 2020).

Differences in the composition of soil surface arthropods in the three locations are influenced by different environmental conditions, thus supporting the survival of each arthopod that inhabits the place. The natural forest location has many types of vegetation and there is a lot of litter and weathered wood branches, so this habitat is very supportive in terms of meeting food needs. The location of shrubs is dominated by shrubs such as resam which almost the entire surface of the ground is covered by these shrubs, at this location there is also a river flow that encourages arthropods life to survive. Then in oil palm the least number and species were found compared to the location of natural forest and shrubs, this is because in this location there is not too much vegetation but there are many piles of palm fronds which are a place for arthropods to find food. This statement is in accordance with the statement of Aziz & Aminatun, (2020) which states that the abundance of arthropods occurs because the environment is favorable for their life. The presence of arthropods in a place depends on biotic and abiotic factors and the presence of arthropods will be abundant in habitats that are able to provide food, optimal temperature and the presence or absence of natural enemies.

Species Diversity Index

Data on arthropods species diversity was calculated using the Shannon-Wienner diversity index (H'). The diversity index of soil surface arthropods can be seen in Table 3.

Table 3. Diversity index of soil surface arthropods species

No	Location	∑Family	∑Individual/ha	H'	Criteria
1	Natural Forest	13	853	2.27	Medium
2	Shrubs	8	715	2.17	Medium
3	Palm Oil	5	459	2.03	Medium

Based on the results of data analysis obtained, the arthropods diversity index in natural forests amounted to 2.27, which indicates that arthropods diversity is moderate. The arthropods diversity index in shrubs is 2.17, which indicates that arthropods diversity is moderate. While in oil palm the diversity index is 2.03, which indicates that the diversity of soil surface arthropods in oil palm is moderate. According to previous research, Aminullah & Lagiono (2020) shows the results of the soil surface arthropod diversity index of 1.76 which is classified as moderate. This is due to environmental conditions that are quite suitable for the life of these arthropods and also the availability of sufficient food. In natural forests, the availability of food comes from the large amount of litter and rotting

branches that encourage the activity and number of arthropods in natural forests, in shrubs the availability of food comes from resam plants and the presence of river flow can support the activity of arthropods to survive. Then in oil palm, the availability of food comes from piles of palm fronds which causes a lot of organisms that become food for arthropods. Jatiningsih et al. (2018) stated that factors that support the life of arthropods such as food availability, habitat and abiotic factors such as light, temperature, humidity and oxygen availability also affect the importance of arthropods life. The presence of vegetation can support habitat suitability.

Species Evenness Index

The evenness index is an index that shows the degree of evenness of individual abundance between species. Data on the evenness index of soil surface arthropods can be seen in Table 4.

Table 4. Evenness index of soil surface arthropods species

No	Location	∑Family	∑Individual/ha	E	Criteria
1	Natural Forest	13	853	0.76	High
2	Shrubs	8	715	0.84	High
3	Palm Oil	5	459	0.92	High

Based on the results of data analysis, the value of the evenness index in natural forests is 0.76 which indicates that the distribution of species is even or high, in shrubs is 0.84 which indicates that the distribution of species is even or high and in oil palm is 0.92 which indicates the distribution of species is even or high. In accordance with the results of research by Arfiati et al., (2019), the evenness index obtained is close to the value of one which is categorized that the area has an even distribution of arthropods and is in a stable condition. The high evenness index is due to the ability of land surface arthropods to utilize various environmental conditions in each location where they live to maintain their lives.

Species Dominance Index

The dominance index is an index that shows whether or not there are species that dominate over other species in the same ecosystem. The greater the dominance index value, the greater the tendency for certain species to dominate. Arthropods dominance index data can be seen in Table 5.

Table 5. Dominance index of soil surface arthropods species

No	Location	∑Family	∑Individual/ha	C	Criteria
1	Natural Forest	13	853	0.14	Low
2	Shrubs	8	715	0.13	Low
3	Palm Oil	5	459	0.14	Low

Based on the results of data analysis, the dominance value in natural forests is 0.14 which indicates that the level of dominance is low, in shrubs has a dominance index of

0.13 which indicates that the level of dominance is low. While in oil palm has a dominance value of 0.14 which indicates that the level of dominance is low. Based on the results of the dominance index in all locations has a low dominance index, this indicates that there is no dominant species. The absence of dominance is because the environmental conditions at each location are still able to support various types of soil animal life, so there is no extreme competition that causes dominance of species. This is in accordance with the statement of Sulistyani et al. (2014) which states that a community that has moderate to high species diversity if the community is composed by many species with the same or almost the same species abundance.

Environmental Parameters

The parameters observed in this study were air temperature, air humidity, and soil pH. The sampling results can be seen in Table 6. Based on the results of temperature measurements during sampling, which ranged from 27-30ºC, the range between 27-30ºC is a good range for soil surface arthropods to carry out activities and find food. This range is very good for the development of soil surface arthropods species because the effective temperature for the survival of soil surface arthropods is at 15ºC (minimum temperature), 25ºC (optimum temperature) and 45ºC (maximum temperature) (Basna et al., 2017).

Table 6. Measurement of environmental parameters

No	Location	Temperature (ºC)	Moisture (%)	Soil pH
1	Natural Forest	27	79	6,60
2	Shrubs	30	76	6,60
3	Palm Oil	28	79	6,50

Soil moisture has an important role in determining the diversity of soil surface arthropods at the three stations. Based on the results of moisture measurements, it was found that the natural forest had a humidity of 79%, the humidity in shrubs was 76%, and in oil palm the humidity was 79%. Humidity affects the survival of soil surface arthropods. If the humidity conditions are too high, arthropods can die or migrate to other places, while low humidity will stimulate arthropods to move to places that have optimum humidity, with the reduction of an arthropods species resulting in a species that dominates (Fatmala, 2017).

The results of soil pH measurement using soiltester obtained pH value in natural forest is 6.6, in shrubs is 6.5 and in oil palm is 6.6. The amount of soil pH value is still classified as the optimum soil pH for arthropods life, so arthropods choose this place as their habitat. Soil surface arthropods can live well if they are in the neutral pH range, which is between 6-8 (Fatmala, 2017).

Vegetation Analysis

Vegetation Analysis of Natural Forest

There are approximately 127 species of flora that are native to the Tahura Sultan Syarif Hasyim forest, which are dominated by the Dipterocarpaceae, Lauraceae, Anacardiaciae, Myrtaceae families and are still found in many species such as meranti (*Shorea* sp.), keruing (*Dipterocarpus crinitus* Dyer.) and kulim (*Scrorodarcapus integer*). The results of the inventory and calculation of the Important Value Index in Tahura Sultan Syarif Hasyim can be seen in Table 7.

Table 7. The results of the calculation of the Important Value Index (IVI) on the five dominant species

Level	Local Name	Scientific Name	RD (%)	RF (%)	RD (%)	IVI
Seedling	Meranti	*Shorea* sp.	9.49	9.37	-	18.87
	Kedondong Hutan	*Spondias pinnata*	6.70	9.37	-	16.07
	Bintagur	*Calophyllum inophyllum*	7.82	7.29	-	15.11
	Kandis	*Garcinia xanthochymus*	6.14	7.29	-	13.43
	Simpur	*Dillenia indica*	4.46	6.25	-	10.71
Saplings	Petatal	*Ochanostachy amentaceae*	7.76	8.33	-	16.10
	Jelutung pipit	*Kibatalia maingayi*	7.76	6.66	-	14.43
	Keranji	*Dialium* sp.	5.82	8.33	-	14.15
	Pisang-pisang	*Kandelia candell*	6.79	6.66	-	13.46
	Sendok-sendok	*Endospermum diadenum*	6.76	6.66	-	13.46
Poles	Balam	*Palaquium burchii*	10.90	7.89	9.39	28.20
	Medang	*Phoebe hunanensis*	7.27	7.89	7.60	22.76
	Siluk	*Gironniera nervosa*	5.45	5.26	6.81	17.53
	Mempening	*Lithocarpus ewyckii*	5.45	5.26	6.35	17.07
	Meranti	*Shorea* sp.	5.45	5.26	5.24	15.96
Trees	Terap	*Artocarpus elasticus*	12.50	12.50	11.28	36.28
	Mempening	*Lithocarpus ewyckii*	10.00	9.37	10.97	30.35
	Jelutung pipit	*Kibatalia maingayi*	10.00	9.37	9.84	29.22
	Berangan	*Castanopsis* sp.	7.50	6.25	8.80	22.56
	Meranti	*Shorea* sp.	7.50	6.25	7.30	21.05

Description: RD (Relative Density), RF (Relative Frequency), RD (Relative Dominance), IVI (Important Value Index).

Based on the results obtained that the species that have the highest IVI starting from the growth level of seedlings, saplings, poles and trees, namely the seedling level is the type of Meranti (*Shorea* sp.) with an IVI of 18.87, the pile level is the type of Petatal (*Ochanostachy amentaceae*) with an IVI of 16.10, the pole level is Balam (*Palaquium burchii*) with an IVI of 28.20 and the tree level is Terap (*Artocarpus elasticus*) with an IVI of 36.28. The magnitude of IVI at the observation level is different, this is due to different relative density values, relative frequency, and dominance values. The greater IVI value indicates

the more dominant a species is compared to other species, this is because this species is able to grow and adapt to the existing habitat in Tahura Sultan Syarif Hasyim.

The number and type of vegetation affect the diversity of soil surface arthropods species found, the number of vegetation types can affect the state of the forest floor such as moisture and litter thickness. This is in accordance with the statement of Kinasih et al. (2017) which states that litter thickness will affect the diversity of soil surface arthropods where the thicker the litter, the higher the diversity of soil surface arthropods. This is also related to the discovery of the Blattidae family, where this family requires quite a lot of litter for its residence. Blattidae is an insect that likes to hide and live in leaves (Kinasih et al., 2017).

Vegetation Analysis on Shrubs

The results of the analysis showed that there were 3 plant species present in the shrubs at the research site, namely kekalai grass (*Stenochlaena palustris*), chrysanthemum grass (*Scleria sumatrensis*) and resam (*Dicranopteris linearis*).

Table 8. The results of the calculation of the Important Value Index (IVI) in shrubs

Local Name	Scientific Name	Total	RD (%)	RF (%)	IVI
Resam	*Dicranopteris linearis*	78	50.32	36.36	86.69
Rumput kelakai	*Stenochlaena palustris*	46	29.67	31.82	61.50
Rumput krisan	*Scleria sumatrensis*	31	20.00	31.82	51.82

Description: RD (Relative Density), RF (Relative Frequency), IVI (Important Value Index).

The shrub that is the sampling location is a shrub that is densely overgrown by resam. Resam plants are known as invasive plants because they dominate the soil surface which causes inhibition of growth in other plants (Swandi & Salmi, 2023). The number of individuals of the Formicidae family found is due to the dense vegetation in the location. Vegetation determines soil moisture and soil moisture determines the presence of soil surface arthropods, besides that dense vegetation also provides food (Thei, 2022). In addition to the Formicidae family, the abundance of the Gryllidae family is also quite a lot found in this location. This is supported by the statement of Sumini et al. (2021) which states that the abundance of predators of the Gryllidae family is influenced by the presence of wild plants.

Vegetation Analysis on Palm Oil

The results of the inventory on 1x1m plots are 5 species of understory plants including belulang (*Echinochloa colonum*), fern (*Nephrolepis biserrata*), rumput israel (*Asystasia gangetica*), senggani (*Melastoma malabathricum*), and sidaguri (*Sida rhombifolia*). The results of the calculation of the Important Value Index (IVI) in oil palm can be seen in Table 9.

Table 9. The results of the calculation of the Important Value Index (IVI) in oil palm.

Local Name	Scientific Name	Total	RD (%)	FR (%)	IVI
Rumput israel	*Asystasia gangetica*	27	21.25	27.59	48.85
Belulang	*Echinochloa colonum*	32	25.19	17.24	42.44
Senggani	*Melastoma malabathricum*	21	16.53	20.69	37.23
Pakis	*Nephrolepis biserrata*	28	22.04	13.79	35.84
Sidaguri	*Sida rhombifolia*	19	14.96	20.69	35.65

Description: RD (Relative Density), RF (Relative Frequency), IVI (Important Value Index).

The oil palm plantation that is the sampling location is an oil palm with shade and spacing that is not too tight, with a soil surface that is not overgrown with various types of grass. The number of arthropods individuals found in this location is thought to be because this habitat is less supportive in terms of meeting food needs. In addition, according to Saddang et al. (2021) that in oil palm, arthropods are generally found in the crown of trees that are captured using sweep net traps. The age of oil palm plants also greatly affects the number of arthropods present. Older oil palms are able to provide more food sources. The more productive the age of the plant, the more arthropods are likely to be present due to the availability of food sources (Romarta et al., 2020).

CONCLUSION

The total soil surface arthropods found in Tahura Sultan Syarif Hasyim consisted of 9 orders 15 families 26 species and 2,027 individuals/ha. Natural Forest consists of 7 orders 12 families and 853 individuals/ha with (H') which is 2.27 (medium diversity), in Shrubs consists of 6 orders 8 families 12 species and 715 individuals/ha with (H') which is 2.17 (medium diversity), and in Oil Palm consists of 4 orders 5 families 9 species and 459 individuals/ha with (H') which is 2.03 (medium diversity) and The results showed that the three research locations with different vegetation had different arthropods abundances. Natural forest has more diverse vegetation so there are more individuals than shrubs and oil palm.Then in shrubs there is dense and dense vegetation so that it has more individuals than oil palm.

REFERENCES

Aminullah, R., & Lagiono. (2020). Keanekaragaman Arthropoda Permukaan Tanah Di Kawasan Wisata Air Terjun Lano Kecamatan Jaro Kabupaten Tabalong. *Jurnal Pendidikan Hayati*, *6*(1), 14–10. https://doi.org/10.33654/jph.v6i1.1041

Apriyadi, R. (2014). *Struktur Populasi Semut Invasif Anoplolepis gracilipes Smith (Hymenoptera:Formicidae) di Kebun Raya Bogor*. [Tesis]. Institut Pertanian Bogor.

Arfiati, D., Herawati, E. Y., Aminuddin Firdaus, Buwonoa, N. R., Winarnoa, M. S., & Puspitasari, A. W. (2019). Struktur Komunitas Makrozoobentos Pada Ekosistem Lamun Di Paciran, Kabupaten Lamongan, Jawa Timur. *JFMR-Journal of Fisheries*

and Marine Research, *3*(1), 1–7. https://doi.org/10.21776/ub.jfmr.2019.003.01.1

Ayu, M. G. S. C. (2018). *Keanekaragaman Semut (Hymenoptera: Formicidae) Pada Berbagai Tipe Penggunaan Lahan Di Hutan Pendidikan "Ub Forest", Malang*. [Skripsi]. Universitas Brawijaya.

Aziz, F. A., & Aminatun, T. (2020). Pengaruh Aplikasi Tanaman Barrier terhadap Dinamika Populasi Arthropoda Tanah pada Pertanaman Padi Gogo (Oryza sativa L.). *Arthropoda Tanah*, 1–15. https://eprints.uny.ac.id/id/eprint/71010

Basna, M., Koneri, R., & Papu, A. (2017). Distribusi Dan Diversitas Serangga Tanah di Taman Hutan Raya Gunung Tumpa Sulawesi Utara. *Jurnal MIPA UNSRAT Online*, *6*(1), 36–42. https://doi.org/10.35799/jm.6.1.2017.16082

Borror, D. J., A.Triplehorn, C., & F.Johnson, N. (2005). *Borror and DeLong's Introduction to the Study of Insects* (7th ed.). Thomson Brooks/Cole.

Erawati, N. V., & Kahono, S. (2015). Keanekaragaman dan Kelimpahan Belalang dan Kerabatnya (Orthoptera) pada Dua Ekosistem Pegunungan di Taman Nasional Gunung Halimun-Salak. *Jurnal Entomologi Indonesia*, *7*(2), 100–115. https://doi.org/10.5994/jei.7.2.100

Fatmala, L. (2017). *"Keanekaragaman Arthropoda Permukaan Tanah di Bawah Tegakan Vegetasi Pinus (Pinus merkusii) Tahura Pocut Meurah Intan sebagai Referensi Praktikum Ekologi Hewan."* [Skripsi]. Universitas Islam Negeri Ar-Raniry.

Forestry Service of Riau Province. (2015). *Taman Hutan Raya Sultan Syarif Hasyim Provinsi Riau*. https://dinaskehutanan.riau.go.id/taman-hutan-raya-sultan-syarif-hasyim-provinsi-riau/

Herlinda, S., Pujiastuti, Y., Irsan, C., Karenina, T., Budiarti, L., Rizkie, L., & Octavia, M. (2021). *Pengantar Ekologi Serangga*. UNSRI Press.

Jatiningsih, H., Atmanto, T., & Darma, I. S. (2018). Keanekaragaman Collembola (Ekorpegas) Gua Groda, Ponjong, Gunungkidul, Daerah Istimewa Yogyakarta. *Jurnal Prodi Pendidikan Biologi*, *7*(6), 407–419. https://doi.org/10.21831/edubio.v7i6.13914

Jaya, A. S., & Widayat, W. (2018). Pengaruh Umpan Terhadap Keefektifan Pitfall Trap untuk Mendukung Praktikum Ekologi Hewan di Laboratorium Ekologi FMIPA Unsyiah. *Jurnal Bioleuser*, *2*(3), 72–77. https://doi.org/10.24815/jobioleuser.v2i3.14963

Kamila, A. N., Zuraidah, Nabila, J., Agustina, E., & Niar, A. (2022). Serangga Permukaan Tanah Padang Rumput di Kawasan Danau Laut Tawar Desa Waq Toweren Kabupaten Aceh Tengah. *Prosiding Seminar Nasional Batik*, *10*(2), 140–145. https://doi.org/10.22373/pbio.v10i1.14390

Karmilasanti, & Fajri, M. (2020). Struktur Dan Komposisi Jenis Vegetasi di Hutan Sekunder: Studi Kasus KHDTK Labanan Provinsi Kalimantan Timur. *Jurnal*

Penelitian Hutan Tanaman, *17*(2), 69–85. https://doi.org/10.20886/jpht.2020.17.2.69-85

Khartika, D., Latul, R., & Ahadi, R. (2021). Kelimpahan Jenis Collembola di Kawasan Kampus UIN Ar-Raniry Banda Aceh. *Prosiding Seminar Nasional Batik*, *9*(2), 59–65. https://doi.org/10.22373/pbio.v9i1.11502

Kinasih, I., Cahyanto, T., & Ardian, Z. R. (2017). Perbedaan Keanekaragaman dan Komposisi dari Serangga Permukaan Tanah pada Beberapa Zonasi di Hutan Gunung Geulis Sumedang. *Istek: Media Pengembangan Islam, Sains Dan Teknologi*, *X*(2), 19–32.

Lilies S, C., Subiyanti, & Sulthoni, A. (1995). *Kunci Determinasi Serangga*. Kanisius.

Magurran, A. E. (1988). *Ecological Diversity and Its Measurement* (1st ed.). Chapman & Hall.

Masdianur, M. (2014). *Keanekaragaman Arthropoda Hasil Koleksi Metode Canopy Knockdown di Hutan Alami Kawasan Wisata Alam Bukit Tangkiling*. STAIN Palangkaraya.

Nadiyah, F. A. (2021). *Keanekaragaman Arthropoda di Agroforestri di Desa Tambak Sari Kecamatan Purwodadi Kabupaten Pasuruan*. [Skripsi]. UIN Maulana Malik Ibrahim.

Odum, E. P., & Barrett, G. W. (2005). *Fundamentals of Ecology* (5th ed.). Thomson Brooks/Cole.

Romarta, R., Yaherwandi, Y., & Efendi, S. (2020). Keanekaragaman Semut Musuh Alami (Hymenoptera: Formicidae) pada Perkebunan Kelapa Sawit Rakyat di Kecamatan Timpeh Kabupaten Dharmasraya. *Agrikultura*, *31*(1), 42. https://doi.org/10.24198/agrikultura.v31i1.25622

Saddang, Toana, M. H., & Wahid, A. (2021). Keanekaragaman Arthropoda pada Pertanaman Kelapa Sawit (Elaeis guineensis Jacq) di Kecamatan Pasangkayu Kabupaten Pasangkayu. *Agrotekbis: Jurnal Ilmu Pertanian*, *9*(4), 917–926. http://jurnal.faperta.untad.ac.id/index.php/agrotekbis/article/view/1038%0A

Santi, I. S., Tarmadja, S., Priambada, K. J., & Elfatma, O. (2023). Keanekaragaman Serangga Perkebunan Kelapa Sawit di Provinsi Kalimantan Tengah. *Jurnal Ilmiah Hijau Cendekia*, *8*(1), 45–52. https://doi.org/10.32503/hijau.v8i1.2917

Sijabat, O. S., Berliana, Y., & Nadhira, A. (2020). Eksplorasi Makrofauna Tanah di Tanaman Kakao pada Musim Kemarau. *AGRINULA: Jurnal Agroteknologi Dan Perkebunan*, *3*(1), 28–36. https://doi.org/10.36490/agri.v3i1.83

Sulistyani, T. H., Rahayuningsih, M., & Partaya. (2014). Keanekaragaman Jenis Kupu-Kupu (Lepidoptera: Rhopalocera) di Cagar Alam Ulolanang Kecubung Kabupaten Batang. *Unnes Journal of Life Science*, *3*(1), 9–17.

Sumini, Bahri, S., Hermanto, & Sutejo. (2021). Keragaman Arthropoda Predator pada Tanaman Padi di Kecamatan Tugumulyo. *Jurnal Agrotech*, *11*(2), 50–55. https://doi.org/10.31970/agrotech.v11i2.72

Swandi, M. K., & Salmi, S. (2023). Gleichenia linearis (Burm.) C. B. Clarke Leaves Extract Potent as a Medicinal Plant Based on Its Phytochemical Profile and The Total Phenolic Content. *Berkala Sainstek*, *11*(2), 96–105. https://doi.org/10.19184/bst.v11i2.34875

Thei, R. S. P. (2022). *Arthopoda pada Ekosistem Tanaman Cabe di Lombok Barat*. LPPM Unram Press.

How To Cite This Article, with *APA style* :

Angraini, R., Yoza, D., & Pebriandi, P. (2024). Diversity Of Soil Surface Arthropods Species In Taman Hutan Raya Sultan Syarif Hasyim Riau Province. *Jurnal Pembelajaran dan Biologi Nukleus*, *10(1)*, 190-206. https://doi.org/10.36987/jpbn.v10i1.5346

Conflict of interest : The authors declare that they have no conflicts of interest.

Author contributions : All authors contributed to the study's conception and design. Material preparation, data collection and analysis were performed by all authors. The first draft of the manuscript was submited by [**Riris Angraini**]. All authors contributed on previous version and revisions process of the manuscript. All authors read and approved the final manuscript.