Ant Community (Hymenoptera: Formicidae) at the Forest Park of Sultan Syarif Hasyim, Riau

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Abstract. Research on ant community (Hymenoptera: Formicidae) had been carried out at natural and disturbed area in Sultan Syarif Hasyim Forest Park, Minas District, Siak Regency, Riau Province, from 22-25 July 2020 using five sampling methods namely Pitfall Trap, Honey Bait Trap, Hand Collecting, Leaf Litter Sifting and Soil Core Sampling. This study aimed to determine the composition of ant species, diversity and evenness of ants across the habitats in the study site. The study identified 23 species from 15 genera, nine tribes and five subfamilies with a total of 2,458 individuals collected. The most common species was *Nylanderia* sp. 1, while Baited Trap collected most ant individuals at each location. The analysis revealed that *Nylanderia* sp. 1 became the most abundant species at two sampling area, indicated by index value 0.32. The natural and disturbed area had moderate diversity and similarity (H’ = 1.74, E = 0.59). Environmental conditions were thought to affect the composition of ants were soil pH, soil temperature, soil moisture, air temperature and humidity. In addition, the availability of food sources, interspecific competition, habitat quality and human activities were also included as influence for ant community.

Keywords: Ants, Diversity of Ants, Abundance of Ants

1. Introduction

Ants are eusocial insects belong to order Hymenoptera and Family Formicidae [1]. This insect group was found at most types of ecosystem except at polar region, while in tropics it reached more than 30% of total insect biomass [2, 3]. Ants play important roles in ecosystem. Its abundance in ecosystem and its preference for specific habitats make it as the best subject for monitoring habitat and impact of climate changes in the ecosystem[4, 5, 6]. Ants have been subject for many research topics in Indonesia, including about their diversity. In Sumatra, some studies covered this matter and undertaken in various localities in this island [7-16].

Sultan Syarif Hasyim Forest Park (herein after Tahura SSH) has important roles, mainly for being the lungs for people of Riau, while providing habitat for the wildlife diversity [17]. Tahura SSH is a conservation area designed to harbor a collection of indigenous as well as introduced plants and animals,
which in turn serve as tool for research, education and tourism that benefits the surrounding communities.

Human activities inside Tahura SSH, including tourism, have negatively impacted the ecosystems within. Hence, investigating the wildlife inside Tahura SSH will be a good way to know their dynamics, especially if connected to the effect imposed by human activities and ecological factors. The present study aims to confirm the role of ants as bio-indicator by comparing their composition at natural and disturbed habitats in Tahura SSH, in addition to provide information regarding their diversity.

2. Materials and Methods

2.1 Study sites

This study had been conducted between 22-25 July 2020 at Tahura SSH, in Subdistrict Minas, Siak Regency, Riau Province (0°40′21.0″N, 101°25′46.8″E). Specimens collected in this study were preserved and deposited in Animal Taxonomy Laboratory, Biology Department, Faculty of Mathematics and Natural Sciences, Universitas Andalas, West Sumatra. Species identification was conducted at Laboratory of Ecology, Biology Department, Faculty of Mathematics and Natural Sciences, Universitas Negeri Padang, West Sumatra.

![Figure 1. Study site at Tahura SSH, Minas, Siak, Riau, Indonesia with two different habitats (Source: Google Satellite Hybrid)](image)

2.2 Sampling

Ant sampling was conducted at two type of habitats, disturbed and forest habitat. In this study, forest represented the natural area. At each habitat, 180 m transect was established and equally divided into three sub-transects [15]. Ants were collected by simultaneously using five sampling methods; Pitfall Trap (PF), Hand Collecting (HC), Leaf Litter Sifting (LS), Soil Core Sampling (SC) and Honey Bait Trap (HBT). Soil pH, soil temperature, soil moisture, air temperature and air humidity were abiotic factors that recorded at research area. The sorting of specimens, specimen mounting, documentation and identification using identification guides were all commenced at laboratories mentioned above [16, 17].
2.3 Data analysis
Identified species were tabulated to count total species and individuals. Ecological indices then calculated to count species abundance (A), species diversity (H') and habitat evenness (E) [6, 21].

2.3.1 Species Abundance Index

\[ D_i = \frac{n_i}{N} \times 100\% \]

Information:
- \( D_i \) = Species abundance index
- \( n_i \) = number of individual species i
- \( N \) = Total individuals of all species

2.3.2 Species Diversity Index

\[ H' = - \sum (p_i \ln p_i) \]

Information:
- \( H' \) = Shannon-Wiener Diversity Index
- \( p_i \) = the proportion of individual species i to all species (\( p_i = \frac{n_i}{N} \)),
- \( \ln \) = natural logarithm

2.3.3 Species Evenness Index

\[ E = \frac{H'}{\ln s} \]

Information:
- \( H' \) = Shannon-Wiener diversity index
- \( s \) = Number of species
- \( \ln \) = Natural logarithm

3. Results and Discussion
This study recorded 23 species from both study area, identified from 2,458 individuals collected. These species belonged to 15 genera and five subfamilies. These species were broken into 19 species, 12 genera, five subfamilies and 1,461 individuals collected from forested area, while 18 species, 13 genera, five subfamilies and 997 individuals were sampled from disturbed area. Honey Bait Trap showed remarkable performance during survey at both sampling area (Table 1).
Nylanderia sp. 1, with 748 individuals collected, and Anoplolepis gracilipes, with 338 individuals sampled, became the most species observed at forested disturbed area, respectively. Myrmicinae was the most dominant subfamily recorded in this study. This subfamily is known as the largest subfamily of ants, containing most genera and species, as well as distributed worldwide [18]. Its dominance was previously reported from banana plantation in West Sumatra [8], at several altitudes in Mount Talang [14]; at wheat and potato fields, and at oil palm plantation [15,16].

Table 1. Taxonomic and collection information of ant specimens collected from Tahura SSH, Riau.

| No | Subfamily | Specie | Natural Area | Disturbed Area |
|----|-----------|--------|--------------|---------------|
|    |           |        | PF HBT HC LS SC | PF HBT HC LS SC |
| I. Dolioloderinae | | | |
| 1 | Iridomyrmex anceps (Roger, 1863) | | 1 | 1 |
| 2 | Tapinoma sp. (Foerster, 1850) | 1 | 1 | 10 | 10 |
| II. Dorylinae | | | |
| 3 | Dorylus laevigatus (Smith, F., 1857) | 9 | 9 | 21 | 4 | 2 | 27 |
| III. Formicinae | | | |
| 4 | Anoplolepis gracilipes (Smith, F., 1857) | 108 | 108 | 318 | 20 | 338 |
| 5 | Camponotus gigas (Latreille, 1802) | 1 | 1 | 2 | 1 | 1 |
| 6 | Nylanderia sp. 1 (Emery, 1906) | 735 | 13 | 748 | 22 | 110 | 132 |
| 7 | Nylanderia sp. 2 (Emery, 1906) | 2 | 2 | 1 | |
| 8 | Paratrechina sp. (Motschoulasky, 1863) | 2 | 2 | 1 | |
| 9 | Pseudolasius sp. 1 (Emery, 1887) | 2 | 2 | 1 | |
| 10 | Pseudolasius sp. 2 (Emery, 1887) | 20 | 20 | 1 | 1 |
| IV. Myrmicinae | | | |
| 11 | Crematogaster modiglianii (Emery, 1900) | | 6 | 47 | 53 |
| 12 | Meranoplus bicolour (Guérin-Méneville, 1844) | 1 | 1 | 13 | 226 | 47 | 5 | 291 |
| 13 | Monomorium sp. (Mayr, 1855) | 1 | | 1 | |
| 14 | Pheidole plagiaria (Smith, F., 1860) | 44 | 1 | 45 | |
| 15 | Pheidole sp. 1 (Westwood, 1839) | 38 | 155 | 10 | 2 | 205 | 12 | 41 | 53 |
| 16 | Pheidole sp. 2 (Westwood, 1839) | 23 | | 23 | 5 | 5 | |
| 17 | Pheidole sp. 3 (Westwood, 1839) | | 1 | | 1 | 3 | 3 |
| 18 | Pheidole sp. 4 (Westwood, 1839) | 3 | 126 | 9 | 138 | 1 | 61 | 62 |
### V. Ponerinae

| No | Subfamily | Species | Natural Area | Disturbed Area | Total Individual | Total Species | Total Genus | Total SubFamily |
|----|-----------|---------|--------------|---------------|-----------------|---------------|-------------|----------------|
|    |           |         | PF  | HBT | HC  | LS | SC | PF  | HBT | HC  | LS | SC | PF  | HBT | HC  | LS | SC | PF  | HBT | HC  | LS | SC |
| 19 | L. Ponerinae | Leptogenys sp. 1 (Roger, 1861) | 1  |     |     | 1  |    |     |     |     |     |    |    | 1   |     |     | 1  |    |    |     |     | 1  |     | 1  |    |    | 1  |
| 20 | L. Ponerinae | Leptogenys sp. 2 (Roger, 1861) | 71 | 17  | 1  |    |    | 89 | 9   | 9   | 9   |    |    | 9   |     |     | 9  |    |    | 9   |     | 9  |     | 9  |    |    | 9  |
| 21 | L. Ponerinae | Odontoponera denticulata (Smith, F., 1858) | 32 | 7   | 2  | 1  | 42 | 5   | 1   | 1   | 7   |    |    | 7   |     |     | 7  |    |    | 7   |     | 7  |     | 7  |    |    | 7  |
| 22 | L. Ponerinae | Odontoponera transversa (Smith, F., 1857) | 14 | 5   | 3  | 22 | 1  |    |    |    |    |    |    |    | 1   |     |     | 1  |    |    | 1   |     | 1  |     | 1  |    |    | 1  |
| 23 | L. Ponerinae | Ponera sp. (Latreille, 1804) | 1  |     | 1  |    |    |    | 2   |    |    |    |    |    | 2   |     |     | 2  |    |    | 2   |     | 2  |     | 2  |    |    | 2  |

| Total Individual | 188 | 1201 | 24 | 32 | 16 | 1461 | 70 | 839 | 48 | 33 | 7 | 997 |
| Total Species | 11 | 9 | 5 | 3 | 7 | 19 | 12 | 11 | 2 | 3 | 2 | 18 |
| Total Genus | 8 | 6 | 4 | 3 | 5 | 12 | 9 | 9 | 2 | 3 | 2 | 13 |
| Total SubFamily | 4 | 3 | 2 | 2 | 3 | 4 | 4 | 4 | 2 | 2 | 2 | 4 |

Information: PF (Pitfall Trap), HBT (Honey Bait Trap), HC (Hand Collecting), LS (Leaf Litter Sifting), SC (Soil Core Sampling)

#### 3.1 Species Abundance

As indicated by its sheer number collected, *Nylanderia* sp. 1 became species with the highest abundance at natural area (A = 0.51). *Nylanderia* sp. 1 averagely more abundant than other species at both study area (A = 0.32). The abundance of *Nylanderia* sp. 1 was thought to be related to its diet preference on sugary and protein substance, which contained in honey used as bait in Honey Bait Trap [19].

#### 3.2 Species Diversity

Tahura SSH can be said to be moderate in its ant diversity (*H* '= 1.74). This moderate status category derived from the difference of individual number from each ant species recorded at the study area. A certain community is said to have high diversity if it is composed of many species with the same or nearly the same species abundance [20].

#### 3.3 Evenness of Species

The two habitats surveyed in Tahura SSH can be categorized as fairly even (E = 0.59). It is stipulated that *E ≥ 0.75*, species are evenly distributed across habitats; if *0.50 ≤ E ≤ 0.75*, species were fairly distributed; while if *E ≤ 0.50*, species were unevenly distributed [21]. A high evenness index value indicates that the distribution of species individuals is evenly distributed across habitats, and vice versa, if the evenness index lower, the population among habitats are less even [22].

#### 3.4 Measurement of Environmental Factors

All environmental factors measured in this study are shown in Table 2. Some ant species have narrow tolerance to the dynamics in their habitats and respond quickly toward environmental changes. With their minuscule body size, ants necessarily depend on environment temperature and make them very sensitive to small change in any environmental factor. Measurement of environmental factors likely provide reason for any phenomena observed in ant community.

| No | Parameters | Natural | Disturbed |
|----|------------|---------|-----------|
| 1  | Soil pH    | 5.5     | 6.5       |
| 2  | Soil temperature (°C) | 25     | 30         |
The presence and density of ants were probably affected by soil pH. The surrounding area of ant nests usually have pH around 5-7, which presumed to be ideal range for ant communities [23]. While, the measured soil pH at study area resulted in pH of close to neutral. It means that both areas were feasible habitats for ants in term of this ecological factor. In tropic, ants are active with in the temperature range between 25-32°C [24]. The measured soil temperature at forested area was averagely 25°C while averagely 30°C in disturbed habitat, meaning that both sites were suitable for ant communities. Furthermore, the temperature and humidity of air were recorded 27°C and 83% at forested habitat and 29°C and 79% at disturbed habitat. Average temperature and humidity of air that suitable for ants were reported to 27°C and 85% [25], hence the measurements from study sites added indication of suitability for ant communities to live there.

In ecological aspects related to organisms and their communities, there are several limiting factors that limit the diversity and abundance of organisms [26]. These factors include temperature, air humidity, or soil conditions as well as other factors that maintain the foraging or breeding of the organisms. Hence, the difference in the number of ants found in certain area might be resulted from the variation of these limiting factors.

4. Conclusion
There were 23 ant species from 15 genera and five subfamilies recorded at Tahura Sultan Syarif Hasyim, Riau Province. *Nylanderia* sp. 1 was the most frequent species found at forested habitat with 748 individuals recorded, while *Anoplolepis gracilipes* with 338 individuals recorded the most at disturbed habitat. *Nylanderia* sp. 1 was also recorded as species with highest abundance in forested habitat. Tahura SSH was indicated to have moderate ant diversity with fairly species evenness between forested and disturbed habitat.

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