Ant Community (Hymnoptera: Formicidae) in people's sago plantations, West Tebing Tinggi Sub-District, Meranti Islands, Riau Province

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Abstract. Changes in natural ecosystems into plantations will cause changes in soil animal community. Ants are thought to be affected by environmental changes. This study aimed to see the diversity and evenness of ant species at sago plantation and forested habitat in Tebing Barat District, Kepulauan Meranti Regency, Riau. The study had been conducted from April to September 2020 using pitfall trap. It recorded 17 ant species of 7 tribes and 5 subfamilies, detailed as 12 species at sago plantations and 13 species at forested habitat. The overall habitat had moderate and diversity (H' = 1-3).

Keywords: ants, species diversity, Tebing Tinggi Barat

1. Introduction

Riau Province has peat lands that covers approximately 4.044 million hectares or 45% of total province area [1]. About 1.83 million hectares or 57% of total peat land has been converted into agricultural areas, settlements or barren land [2]. Meranti Islands Regency is one of sago producing centers in Indonesia, which possesses 60,000 ha of sago production area [3]. Most of natural peatland is also covered with forest which harbor high biodiversity. One dominant organism in peat lands is ant, a member of Order Hymenoptera which has high diversity and complexity as social organism [4].

Ants are ideal objects for regular monitoring program as they have narrow tolerance for environmental changes. The number and composition of ants in certain area indicate ecosystem quality [5]. Previous studies examined the diversity and abundance of ants in peat lands in different habitats, which later can be used to determine the quality of ecosystem therein [6, 7, 8].

The Meranti Islands with its peatland is considerably unique as it is inhabited by ants. Considering the islands dominated by sago trees, especially on the peatland, assumingly that any change happened to this natural condition will affect the ant community that reside therein. There is no data on ant diversity ever recorded from Tebing Tinggi Barat Regency, Meranti Islands, especially from sago plantation and forested area that are two typical habitats there. Meanwhile, the diversity of ants in Sumatra have been previously reported [9-17]. Hence, this study aims to investigate the composition of the ants at two prominent habitats in Tebing Tinggi Barat Sub District, Meranti Islands, Riau Province.
2. Materials and Methods

2.1 Study sites
This research was conducted in Tebing Tinggi Barat Subdistrict, Meranti Islands Regency. Sampling campaign lasted from April to September 2020. In this regency, a subdistrict consists of several rural areas marked with variably lands uses, which in turn created differences in the types of existing vegetation. The research was conducted at two habitat types, sago plantations and forested area.

![Map of study site](Source: ESRI Satellite)

2.2 Sampling
This research was conducted by using purposive sampling with application of pitfall trap method at three points in each location. In one point, five pitfall traps were set. Location for traps were determined based on its suitability to support ant community. The traps were filled with Kahle's solution and collected again after 72 hours. The physical and chemical aspects of environmental factors were measured at each research site, which included humidity, soil temperature, and litter height. After 72 hours, the traps were dismantled and the solution was filtered using fine cloth. Ants and other organisms that lodged within the cloth then removed into plastic clips filled with 70 % ethanol.
2.3 Data analysis
Ant specimens were identified using appropriate references [18, 19, 20]. Ecological indices were calculated in this study were Shannon diversity index ($H'$) and Evenness Index ($E$) [21].

3. Results and Discussion
A total of 17 species belonging to five ant subfamilies were identified from 496 individuals collected. The highest number of species was observed from subfamily Formicine (seven species and four genera), followed by Ponerine (five species with five genera), Myrmicine (four species with three genera), Dolichoderinae (one species with one genus), and Dorylinae (one species with one genus) (Table 1). Formicine consists of large species number that often found at terrestrial areas. It has been recorded to have 3,030 identified species and widely distributed in various terrestrial environments [22].

Table 1. Inventory of collected species from sago plantations and forested area in Tebing Tinggi Barat, Meranti Islands, Riau. PS1 = sago plantation 1, PS2 = sago plantation 2, H1 = Forest 1, H2 = Forest 2.

| No. | Subfamily | Species | Total individuals | PS1 | PS2 | H1 | H2 | Total |
|-----|-----------|---------|-------------------|-----|-----|----|----|-------|
|     |           |         |                   |     |     |    |    |       |
| I.  | Dolichoderinae |         |                   |     |     |    |    |       |
| 1   |           | *Dolichoderus thoracicus* (Smith, 1860) | 21  | 11  | 1  | 1  | 34  |
| II. | Formicinae |         |                   |     |     |    |    |       |
| 2   |           | *Anoplolepis gracilipes* (F. Smith, 1857) | 11  | 18  | 5  | 1  | 35  |
| 3   |           | *Nylanderia* sp. (Emery, 1906) | 35  | 42  | 2  | 2  | 81  |
| 4   |           | *Nylanderia bourbonica* (Emery, 1906) | 34  | 35  | 69 |
| 5   |           | *Componatus* sp. (Mayr, 1861) | 14  | 1   | 15 |
| 6   |           | *Colobopsis* sp. (Mayr, 1861) | 1   | 33  | 3  | 37 |
| 7   |           | *Polyharcis abdominalis* (Smith, F., 1858) | 10  | 2   | 12 |
| III. | Myrmicinae |         |                   |     |     |    |    |       |
| 8   |           | *Crematogaster* sp. 1 (Lund, 1831) | 19  | 1   | 20 |
| 9   |           | *Crematogaster* sp. 2 ((Lund, 1831) | 1   | 5   | 6  |
They included ants, species, all forage at the bottom of trees and depend on species, Australia and Indomalaya was branches. Debris at ground level or less frequently on the ground with mounds around entrances. Have queen to medium in size with less than 100 are currently 42 species and subspecies previously reported to be common causing disturbed individuals. Ant can build nests in soil, leaf litter, or rotting logs. Nylanderia is also an omnivore generalist and forager group, while Anoplolepis gracilipes is known as invasive species which found in high individual number in this study. Invasive species are those that are not natives in a certain area but disturbed native organisms in that habitat by their adaptability and fecundity. Ant species mentioned above are also cosmopolitan species, including some species that recognizes as major global pests, causing ecological damage. They included Anoplolepis gracilipes, Linepithema humile, Pheidole megacephala, Solenopsis guminata, Solenopsis invicta Buren, and Wasmannia auropunctata.

At sago plantations, 12 species were recorded. Being monoculture habitat, sago plantation was dominated by several generalist species, namely Nylanderia sp. 1 and Nylanderia bourbonica. Generalist species from genera Brachymyrmex, Camponotus, Nylanderia, Pheidole, Solenopsis and Wasmannia were reported to survive the changing habitat conditions. These ants generally colonize by making polygon nests within soil, leaf litter, or rotting logs. Nylanderia is also an omnivore generalist and forager group, while Anoplolepis gracilipes is known as invasive species which found in high individual number in this study. Invasive species are those that are not natives in a certain area but disturbed native organisms in that habitat by their adaptability and fecundity. Ant species mentioned above are also cosmopolitan species, including some species that recognizes as major global pests, causing ecological damage. They included Anoplolepis gracilipes, Linepithema humile, Pheidole megacephala, Solenopsis guminata, Solenopsis invicta Buren, and Wasmannia auropunctata.

At forested habitat, 13 species were collected (Table 1). This habitat was dominated by species that previously reported to be common in tropical and subtropical forests, Diacamma scalpratum. The genus Diacamma prefers habitat with frequent rainfall, monsoons region, dry forests or savanna forests. There are currently 42 species and subspecies under this genus described worldwide. Their colonies are small to medium in size with less than 100 adult workers up to countless worker individuals and they do not have queen (reproduction through mating workers called gamergate). Nests are generally found in loose debris at ground level or less frequently on the ground with mounds around entrances. This species also known to nest under rocks or logs, associate with termite nests, in rotting logs, and arboreal sites in dead branches. The variability of habitat of this species may result in their commonness. Colobopsis sp. was identified from 33 individuals collected. Genus Colobopsis has 94 species, distributed across Australia and Indomalaya region. In this study, Colobopsis was observed nesting in dead branches. Depend on species, Colobopsis ant can build nests in high canopies, undergrowth, and fallen dead wood; all forage at the bottom of trees and or at tree branches.

Table 2. Measurements of environmental factors in study sites. PS1 = sago plantation 1, PS2 = sago plantation 2, H1 = Forest 1, H2 = Forest 2

| No. | Parameter            | Locations |
|-----|----------------------|-----------|
|     |                      | PS I  | PS II | H I  | H II |
| 1.  | Soil temperature (°C)| 27,75 | 27,5  | 22   | 23,25|
| 2.  | Soil moisture        | 6,5   | 6,5   | 6,5  | 6,5 |
| 3.  | Litter height        | 4     | 30    | 30   | 30  |
The existence of ants is also influenced by soil temperature, wherein at sago plantations and forested area, the measured temperature ranged from 20-28°C. This was within the temperature range that tolerated by ants. The temperature range of 25-32°C is the optimal and tolerable temperature for ants in tropics [30]. Soil temperature determines the presence and density of soil organisms. The thickness of leaf litter at sago plantations and forested area ranged from 4 to 30 cm. This pile of leaf litter provided decomposed and organic materials which serve as food source and nesting substrates; the thicker the leaf litter, the more likely ant species found [32].

Ant diversity in each site was variably. It can be categorized as moderate to high at sago plantation 1 (H’ = 1.824), sago plantation 2 (H’ = 1.925) and forested habitat 1 (H’ = 1.612). At forested habitat 2, ant diversity was low to moderate (H’ = 1.133). Species diversity at certain habitat closely related to individual number of each composing species and total species number at that habitat (Tabel 4.). Species diversity is identical to ecosystem stability, as if the diversity is high, then it indicates the stability of that ecosystem [33]. According to [34] Whenever species number and individual number of species were different significantly, it indicates species dominance, which will lower species diversity. This situation was observed at forested habitats where there was one species dominated.

### Table 3. Diversity and evenness of ant species across study sites. PS1 = sago plantation 1, PS2 = sago plantation 2, H1 = Forest 1, H2 = Forest 2

| Parameter | PS I  | PS II | H I  | H II |
|-----------|-------|-------|------|------|
| Diversity | 1,824 | 1,952 | 1,612| 1,133|
| Evenness  | 0,057 | 0,006 | 0,008| 0,025|

The evenness observed at four study sites ranged between 0.057 - 0.006 (Tabel 4). Hence, the species recorded from the four habitats were uneven. This followed the stipulation that if evenness value ≥ 0.75, species are evenly distributed; if evenness value in between 0.50 and 0.75, the species were fairly evenly distributed; and if evenness value less than 0.50 indicated that species across habitats were unevenly distributed [36].

### 4. Conclusion
The sago plantation and forested habitats in Meranti Island, Riau Province had moderate ant diversity. There was difference in species composition that dominated in each habitat due to the different vegetation condition, which later affect ant diversity.

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