Ant Diversity in Campus Universitas Negeri Padang, Padang, West Sumatra

J R Okanti¹, H Herwina², R Satria¹
¹Department of Biology, Faculty of Mathematics and Natural Sciences, Universitas Negeri Padang, Padang 25131, West Sumatra, Indonesia
²Department of Biology, Faculty of Mathematics and Natural Sciences, Universitas Andalas, Padang 25175, West Sumatra, Indonesia

Corresponding author’s email address: rijalsatria@yahoo.co.id

Abstract. Measuring biodiversity of ants in urban area is an essential part in management concept of invasive and tramp species. The aim of this study was to investigate ground-dwelling ant species diversity in the campus of Universitas Negeri Padang. Honey baited trap was applied to collect ants at two sites in this area. A total 11 species of ants belonging to 9 genera, 3 subfamilies were identified in the main campus of Universitas Negeri Padang. The highest diversity was by the subfamily Myrmicinae (with four genera, Monomorium, Pheidole, Solenopsis, Tetramorium), and followed by Formicinae (three genera, Nylanderia, Oecophylla, Paratrechina), and Dolichoderinae (two genera, Dolichoderus, Tapinoma). The location of campus Universitas Negeri Padang which is near the coastline and in the center of the city, have affected the biodiversity of ants. In the present study, invasive and tramp species were recorded in this area.

Keywords: Ants, Formicidae, Urban area, West Sumatra, UNP

1. Introduction

The biodiversity is a variability of living organism in a particular habitat or ecosystem. It deals with the complex support system, including interaction and interdependence on each parts of them. The habitat transformation and disturbance have significant threat to biodiversity. The disturbances was known as any event that remove the biomass [1], and reducing the available resources or changing the microclimate or structure of the habitat [2, 3, 4]. The previous studies have examined the effect of urbanization on biodiversity [5, 6, 7, 8, 9, 10, 11] and implicate urbanization as the major threat to biodiversity.

Ants are one of the social insects that belongs to the family Formicidae. Due to the widespread distribution, high abundance, ease of sampling and relatively well-known taxonomy and ecology, the ants have particular function in ecosystem and used as a tool in several ecological studies [4, 12, 13, 14, 15]. The inventory of ants in urban area of Sumatra was done by several studies [16, 17], but still no data of ant diversity in the campus Universitas Negeri Padang which is located in center of Padang City and close to the coast. However, the diversity of ants in Sumatra was conducted by several studies [18, 19, 20, 21, 22, 23, 24, 25, 26].

The present study was revealed the diversity of ants in the lowland of urban area near the coast line. The area near the coastline have a great potential to be invaded by the invasive species. Some invasive species were recognized in the present study.
2. Materials and Methods

2.1 Study sites
The main campus of Universitas Negeri Padang (UNP), Air Tawar Barat, Padang, West Sumatra, Indonesia (0°53'49.8"S, 100°21'02.4"E) was located in lowland area near the coastline (ca. 250 m). The total area of UNP covers approximately 45.06 Ha with 166,465 m² for buildings. This university has eight faculties, and including green open areas.

2.2 Sampling
The materials for the present study was collected by using honey baited trap and hand collecting methods. For honey baited trap, the 20 traps were placed along 100 m transect line, with interval 5 m for each traps. A total two transect line was used for collecting ants. The trap was set in daytime (9.00 AM−11.00 AM). Every ants who come to the traps were collected by forceps and put in the vial filled with 70% ethanol. While for hand collecting method, the ants along transect were directly collected using forceps and put in the vial filled with 70% ethanol for 30 minutes.

2.3 Data analysis
The ant specimen was identified using Hashimoto [27], Bolton [28] and Antwiki [29]. The total number of individuals of each ant species collected was recorded. The Shannon’s diversity index (H') was derived from data collected from the each sites.

3. Results and Discussion
A total 11 species of ants belonging to nine genera, three subfamilies were identified from a sample of 1,310 workers in the main campus of Universitas Negeri Padang. The highest diversity was by the subfamily Myrmicinae with six ant species represented by four genera. This was followed by Formicinae (three species, three genera), and Dolichoderinae (two species, two genera) (Table 1).

The subfamily Myrmicinae was the largest subfamily that containing the most genera and species, and distributed worldwide [29]. The Dominance of Myrmicinae was also recorded by previous studies, Herwina et al. [18] in Banana plantation of West Sumatra; Astuti et al. [17] in the campus of Andalas University; Hasriyanty et al. [30] in Palu, Sulawesi Tengah; Herwina, Dari, et al. [24] in Mount Talang; Herwina, Mairawita, et al. [25] in wheat and potato plantations; Herwina, Sakamaki, et al. [26] in oil palm plantation.

This result showed that some species of tramp and invasive ants was recorded from the campus of Universitas Negeri Padang (UNP). In the present study, three following species were recognized as tramp and invasive species: Paratrechina longicornis, Solenopsis geminata, and Tapinoma melanocephalum. These species were recorded with high number of individual on this study. Based on Pfeiffer et al. [31], the tramp ant species is dispersed by human activities and distributed worldwide, but are mostly confined to human-modified habitats. However, the invasive species is more dangerous and negatively affected the native ants and found in natural ecosystems. The tramp ant species can inflict serious damage once introduced to a new habitat. The damage that cause by invasive ants can cost billions of dollars and reduced the population of native species [32, 33, 34]. The invasive ants also appear in the IUCN’s list of world’s 100 worst invasive alien species [35]. The characteristics of tramp ants are polygynous which the colony have multiple queen caste; unicolonial; reproduce by budding; worldwide distribution through human commerce, and live in human-modified habitat [36].

Table 1. Total number of species and individual of ants collected in Universitas Negeri Padang, Air Tawar Barat, Padang, West Sumatra. (*): invasive and tramp species [31, 37]; BT: honey baited trap, HC: Hand Collecting.

| Subfamily       | Species                                  | Number of Individual |
|-----------------|------------------------------------------|----------------------|
| Dolichoderinae  | Dolichoderus thoracicus (F. Smith, 1860) | BT 1                  |
|                 |                                          | HC 9                 |
Tapinoma melanocephalum (Fabricius, 1763)* 480 5

Formicinae

Nylanderia sp. 71 1
Oecophylla smaragdina (Fabricius, 1775) 48 87
Paratrechina longicornis (Latreille, 1802)* 122 47

Myrmicinae

Monomorium sp.1 4 0
Monomorium sp.2 2 0
Pheidole sp. 90 1
Solenopsis geminata (Fabricius, 1804)* 258 8
Tetramorium sp.1 34 2
Tetramorium sp.2 32 8

Total 1142 168

Tapinoma melanocephalum was recorded with the highest number of individual in the present study, followed by Solenopsis geminata and T. melanocephalum. The study of pest ants in Malaysia by Lee [38], found that this species was most dominant species trapped in the residential premises. Although this species primarily occurs outdoors, but many nests were reported indoors [17, 38, 39].

The tropical fire ants, Solenopsis geminata was known from their aggressive nature and formidable stings. This species is primarily found outdoors, but also occurs indoor [17]. The mound of nest of this species easily found on the gardens of campus UNP. This species has worldwide distribution, but the origin of this species was identified from Southwestern Mexico. This species introduced to the Old World was correlated with historical trading routes in the 16th century by Spanish to Asia [40].

Paratrechina longicornis is a ubiquitous household pests. This species was found everywhere in human-modified habitat, including outdoor and indoor [39]. Some previous studies reported the displacement of several species and other insect by P. longicornis [41]; highly adaptable in any area and associated with trees [42]; found in healthcare facilities as structure-invading pest ants [43, 44, 45].

The present study have clearly different of species composition than the previous study by Astuti et al. [17] which is conducted in campus Universitas Andalas, Padang, West Sumatera, and Riyanto [16] in Campus Universitas Sriwijaya, Palembang, South Sumatera, Indonesia (in Table 2). The difference of this species composition probably by habitat and vegetation in each study areas. In the Campus Universitas Negeri Padang (the present study) was located near the coastline, but in other hand the Campus Universitas Andalas (study by Astuti et al.) located in near the forest with high abundance of plants diversity. However in Riyanto [16], he only observe a certain species.
Table 2. Comparison of species composition in the present study and previous study by Astuti et al. [17] and Riyanto [16].

| Subfamily       | Species                        | Present Studies | Astuti et al. (2014) | Riyanto (2007) |
|-----------------|--------------------------------|----------------|----------------------|----------------|
| Dolichoderinae  | Dolichoderus thoracicus (F. Smith, 1860) | ✓             | ✓                    | ✓              |
|                 | Tapinoma melanocephalum (Fabricius, 1763)* | ✓             | ✓                    | –              |
|                 | Technomyrmex albipes (F. Smith, 1861) | –             | –                    | –              |
| Formicidae      | Anoplolepis gracilipes (F. Smith, 1857)* | –             | ✓                    | –              |
|                 | Nylanderia sp.                  | ✓             | –                    | –              |
|                 | Oecophylla smaragdina (Fabricius, 1775) | ✓             | –                    | –              |
|                 | Paratrechina longicornis (Latreille, 1802)* | ✓             | ✓                    | –              |
| Myrmicinae      | Monomorium floricola (Jerdon, 1851) * | –             | ✓                    | –              |
|                 | Monomorium sp.1                 | ✓             | –                    | –              |
|                 | Monomorium sp.2                 | ✓             | –                    | –              |
|                 | Pheidole plegiaria Westwood, 1860 | –             | ✓                    | –              |
|                 | Pheidole sp.                    | ✓             | –                    | –              |
|                 | Solenopsis genticulata (Fabricius, 1894)* | ✓             | ✓                    | ✓              |
|                 | Tetramorium hiepera (Bolton, 1876) | –             | ✓                    | –              |
|                 | Tetramorium sp.1                | ✓             | –                    | –              |
|                 | Tetramorium sp.2                | ✓             | –                    | –              |
| Ponerinae       | Platythyrea paradiela (F. Smith, 1876) | –             | ✓                    | –              |
|                 | Ponera sp.                      | –             | ✓                    | ✓              |
|                 | Odontomachus similimus (F. Smith, 1858) | –             | ✓                    | –              |
| **Total species** |                                | 11            | 11                   | 3              |

4. Conclusion
The present study was recognized that three invasive species of ants found in the campus Universitas Negeri Padang. The location of the campus Universitas Negeri Padang near the downtown and seashore is probably affected the diversity of ants, including the tramp and invasive species.

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