# Ant Species Composition (Hymenoptera: Formicidae) at a Highland Agricultural Area for Wheat and Potato in Alahan Panjang, West Sumatera

**H Herwina[1], Mairawita[1], L Yulvita[1], D Putri[2], R Satria[3], M N Janra[4], Yaherwandi[5], and Y Sakamaki[6]**

[1] Animal Taxonomy Laboratory, Biology Department, Faculty of Mathematics and Natural Sciences, Universitas Andalas, Padang West Sumatra 25163, Indonesia
[2] Department of Biological Sciences, Graduate School of Science and Engineering, Tokyo Metropolitan University, Tokyo, Japan
[3] Department of Biology, Faculty of Mathematics and Natural Sciences, Universitas Negeri Padang, West Sumatra 25171, Indonesia
[4] Zoological Museum of Andalas University, Biology Department, Faculty of Mathematics and Natural Sciences, Universitas Andalas, Padang, West Sumatra 25163, Indonesia
[5] Department of Pests and Plant Diseases, Faculty of Agriculture, Universitas Andalas, Padang, West Sumatra 25163, Indonesia
[6] Entomological Laboratory, Faculty of Agriculture, Kagoshima University, Korimoto 1-12-24 Kagoshima, 890-0065, Japan

Corresponding author's: hennyherwina@sci.unand.ac.id

**Abstract**. A study about ant species composition in a highland of agricultural areas at Alahan Panjang Village, Solok District, West Sumatra Province was conducted in 2016 by using modified of quads protocol methods. A total of 18 ant species belonging to four subfamilies, eight tribes and 15 genera was collected. Myrmicinae was the highest in species number (eight species) followed by Formicinae (five species), Dolichoderinae (three species) and Ponerinae (two species). All ant species were different between two plantations except *Monomorium florica* (Jerdon, 1851) which was collected for both. *Carebara* cf. *pygmaeus* Emery, 1887 was the highest in the number of individuals which was found at Wheat site. Six functional group of ants were detected from all species collected.
**Keywords:** Ants, Highland Agricultural Area, Wheat, Potato, West Sumatrea

## 1. Introduction

Ants are the single most important arthropod group by their dominance in animal biomass [1]. Ants are an ideal organism for biodiversity study and they are one of the major components of biodiversity in the tropics [2]. Moreover, ants are a dominant element in tropical agroforestry ecosystems [3] and because of their ecological significance in forest ecosystems, ants are considered suitable bio-indicator species for biodiversity studies [4]. Ants that dominant in ecosystem also an important ecosystem engineer [5]. Some study about ant in Sumatra were reported but still scanty [6-8].

Most of ant species are highly sensitive to the microclimate fluctuations and to habitat structure, and thus respond strongly to environmental change [9, 4]. Researches on plantation ants have envolved; have reported about ant diversity in rubber plantation [10], about ant in oil palm plantation Sabah [11], and ant diversity in coffee plantation, Northern Thailand [12]. Some researches on ant in plantation of Indonesia were also reported, i.e ant species composition in banana plantation with BBTV symptoms [6], long-term change of ant community structure in cacao agroforestry [13] and ant species composition in *Macaranga* spp trees of palm oil plantation [8].

Wheat and Potato Plantation are one of the potential agricultural practise for students and local farmer in the area of the Community Learning and Action Centre (CLAC) Alahan Panjang, Lembah Gumanti, West Sumatra. CLAC was managed by Universitas Andalas to improve the ability of farmer to manage their land, to build university and people collaboration, to conduct more interdisciplinary researches for lectures and students. Wheat was planted in this location since 2011 [14] meanwhile Potato was cultivated traditionally since long time ago. The information about ant species in these plantations was not available.

## 2. Methods

### *2.1. Study Site and sampling methods*

Ants were collected from Wheat and Potato Plantations in the area of the Community Learning and Action Centre (CLAC) Alahan Panjang, West Sumatra with the elevation of 1616 m above sea level [14]. Wheat (*Triticum aestivum* L.) is one of world major cereals crop belongs to the family of Poaceae and is not original to the tropical region. Wheat plants have been important for their source for carbohydrate and proteins and this plant was introduced to Alahan panjang in 2011. Alahan panjang was the best place to cultivate Wheat compare to other eight location in West Sumatra [14]. Potato plantation was located also in CLAC, about 1 km separated.

Ant sampling was conducted by using a modification of Quadra Protocol and Collection Method [15]. Three from four method of Standardized Quadra protocol (hand collecting (HC), soil core sampling (SC), and honey bait trap (BT)) were applied by using two transect along 60 m at each plantations, except leaf litter sifting (LS) do to the unavailability of litter in the locations. The transect was applied one in the middle of plantation and another at the edge of plantation. The hand collection method sampled ants at lower vegetation, under the logs, rocks, and ground surface; any sighted ant was then picked using forceps. Hand collecting was applied for 30 minutes in each transect. For the soil core method, five of soil core masses (dimension 20 x 20 x 15 cm) were drilled from the ground at equal intervals along each sub transect. The soil core masses were sorted with hand-sieve onto the white tray where ants detected and collected. In the last method, 15 traps for each transect were prepared using baits of honey drop placed on a piece of paper and set on the forest floor at four meters interval along the sampling transect. Attracted ants then collected with forceps and put into the vial filled with 96 % ethanol.

### *2.2. Identification*

Ants were sorted to genus and morpho-species level at the Animal Taxonomy Laboratory of the Department of Biology of Andalas University. Ant specimens were identified using several identification guides [16-18]. The ant specimens are housed in the Laboratory of Animal Taxonomy, Department of Andalas University, Indonesia.

### *2.3. Data Analysis*

Identified ants were grouped according to their taxonomic orders; subfamily, tribe, genus and species. Individual and species number were counted and listed into a table. The Shannon-Wiener index was used to calculate species diversity indices with following formula [19]:

$$H' = -\sum_{i=1}^{n} pi \ln pi$$

Where, H' is index of species diversity and pi is proportion of the total sample belong to the 1th-species.

## 3. Results and Discussion

### *3.1. Ant Species Composition*

A total of 11 species of ant was collected at Wheat plantation which belonging two four subfamilies, eight genera and 728 individuals. The highest number of species were found in Myrmicinae (four species), followed by Dolichoderinae dan Formicinae (three species respectively) and Ponerinae (only one species). Potato plantation contained only three subfamily of ants with the total of eight species and seven genera and 172 Individuals. Myrmicinae also the highest in the number of species (five species), followed by Formicinae (two species) and Ponerinae with only one species.

For both plantations, a total of 18 ant species belonging to four subfamilies, eight tribes and 15 genera was collected. Myrmicinae was the highest in species number (eight species) followed by Formicinae (five species), Dolichoderinae (three species) and Ponerinae (two species). All ant species were different between two plantations except *Monomorium florica* (Jerdon, 1851) which was collected for both plantations (Figure 1).

Screven (2018) reported that *M florica* was the species with the highest indicator value in ant study at a tropical peat swamp in Borneo [20]. C*amponotus, Tetramorium* and *Monomorium* were genera with two species respectively meanwhile the other genera only contained of one species each (Table 1). The differences of ant species between the two plantations probably because of the variation of habitat conditions. The variation in the number of species and individual of ant in certain location probably caused by several factors, i. e the temperature of study location, nest site availability, food supply, microhabitat structure and resource capture [21].

The high species number in Myrmicinae at Wheat Plantation, Potato Plantation as well as the total of the two ant data was common results in several previous studies [6, 8, 22-25]. The total number of subfamily was higher in Wheat plantation compare to Potato Plantation. This result probably was affected by the habitat differences between locations. Wheat plantation was located about 1 km apart from CLAC office, surrounded by paddy plantation and other wild grasses meanwhile Potato plantation just next to the CLAC office with many human activities around and almost no ground vegetation available. However, an invasive ant species (*Selenopsis geminata*) was collected only in Potato Plantation (Table 1). This ant was known as generalized forager and tropical climate specialist [26]. S geminata was also recognized as fire ant and usually will disturbed the farmer during the activities in the plantation if their nest just around.

**Table 1** List of Subfamily, genera and species of ant collected in Potato and Wheat plantations at Alahan Panjang, West Sumatra. N=total number of individual, S = total number of species, H = Shannon Wiener Diversity Indices

| No | Subfamily | Genera | Species | Wheat Plantation | Potato Plantation | N |
|---|---|---|---|---|---|---|
| 1 | Dolichoderinae | *Iridomyrmex* | *Iridomyrmex anceps* (Roger, 1863) | 95 | | 95 |
| 2 | | *Tapinoma* | *Tapinoma melanocephalum* (Fabricius, 1793) | 8 | | 8 |
| 3 | | *Technomyrmex* | *Technomyrmex kraepilini* Forel, 1905 | 21 | | 21 |
| 4 | Formicinae | *Camponotus* | *Camponotus (Myrmamblys) bedoti* (Emery, 1893) | 2 | | 2 |
| 5 | | | *Camponotus (Tanaemyrmex) arrogans* (Smith, 1858) | 1 | | 1 |
| 6 | | *Euprenolepis* | *Euprenolepis procera* (Emery, 1900) | | 26 | 26 |
| 7 | | *Nylanderia* | *Nylanderia* sp. 1 of HH | 1 | | 1 |
| 8 | | *Paraparatrechina* | *Paraparatrechina* sp. 1 of HH | | 36 | 36 |
| 9 | Myrmicinae | *Pheidole* | *Pheidole aristoteles* Forel, 1911 | | 9 | 9 |
| 10 | | *Carebara* | *Carebara* cf. *affinis* (Forel, 1915) | 27 | | 27 |

| | | | | | | |
|---|---|---|---|---|---|---|
| 11 | | | *Carebara*cf. *pygmaeus* Emery, 1887 | 554 | | 554 |
| 12 | | *Tetramorium* | *Tetramorium* cf. *bicarinatum* (Nylander, 1846) | | 9 | 9 |
| 13 | | | *Tetramorium kheperra* (Bolton, 1976) | | 19 | 19 |
| 14 | | *Monomorium* | *Monomorium florica* (Jerdon, 1851) | 9 | 1 | 10 |
| 15 | | | *Monomorium* sp. 1 of HH | 2 | | 2 |
| 16 | | *Solenopsis* | *Solenopsis geminata* (Fabricius, 1804) | | 62 | 62 |
| 17 | Ponerinae | *Brachyponera* | *Brachyponera* sp. 28 of SKY | | 10 | 10 |
| 18 | | *Hypoponera* | *Hypoponera* sp. 1 of HH | 8 | | 8 |
| | | | N | 728 | 172 | 900 |
| | | | S | 11 | 8 | 18 |
| | | | H | 0.05 | 1.73 | 1.54 |

### *3.2. Ant Species Diversity*

The diversity index [19] of ant collected in this study was low, 1.54. *Carebara* cf. *pygmaeus* Emery, 1887 was the highest in the number of individuals, followed by *Iridomyrmex anceps* (Roger, 1963) which was found at Wheat plantation (Figure 1, Table 1). The dominance of total number of individual of *C. cf. pygmeus* (554 individuals) followed by *I. anceps* (95 individuals) were causing the low value of Shannon Wiener Diversity Index (0.05) in Wheat plantation compare to Diversity index of Potato Plantation (1.73). The dominance of this species also affected the total index diversity in this study (1.54). In Potato plantation, the highest number of individuals was found on *Selenopsis geminata*, followed by *Paraparatrechina* sp. 1 (62 and 36 individualas) (Table 1).

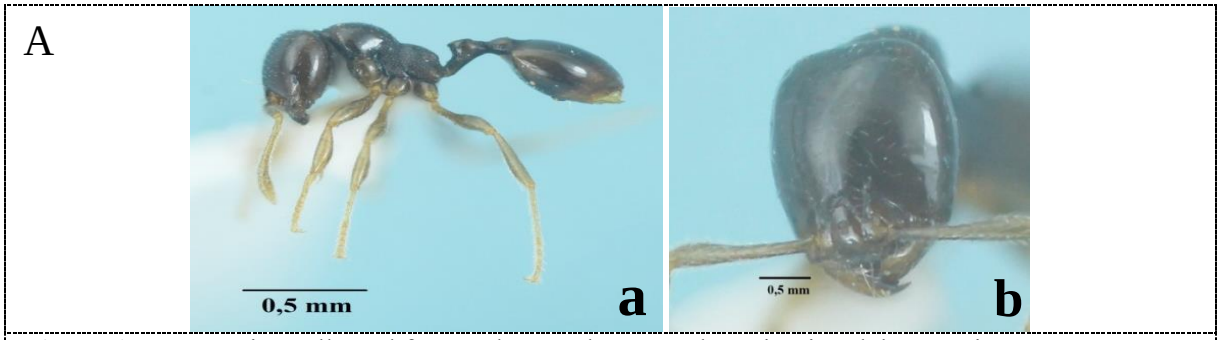


**Figure 1** Ants species collected from Wheat and Potato plantation in Alahan Panjang West Sumatra (left: lateral view, right: frontal view of head.). A= *Carebara pygmaea* Emery, 1887 the ants species with the highest in the number of individuals collected from Wheat plantation (a = full body from lateral view, b = front face)

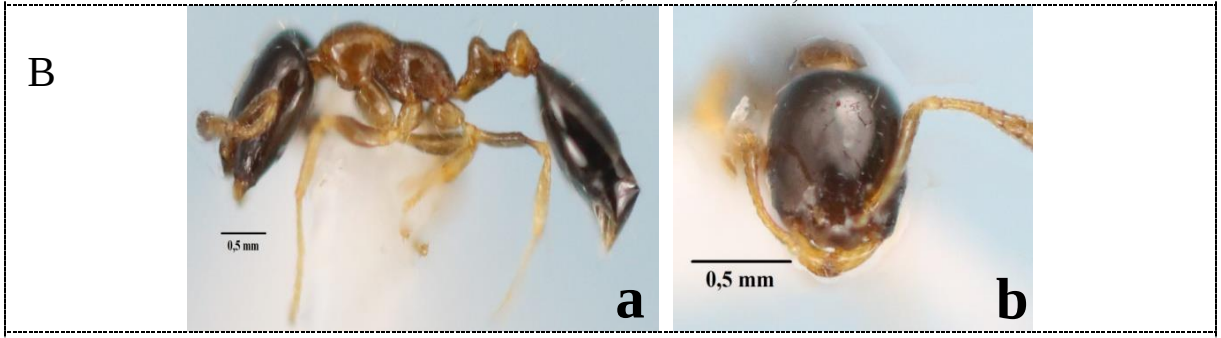


**Figure 1** Ants species collected from Wheat and Potato plantation in Alahan Panjang West Sumatra (left: lateral view, right: frontal view of head.). B = *Monomorium florica* (Jerdon, 1851), the only one ant species collected from both plantations (a = full body from lateral view, b = front face).

*3.3. Ant Species Biology and Functional Group*

Base on Ant Biology grouped by Brown (2000) [26], about 11 species (61 %) of ant species collected in this study was Generalized foragers, only two species recognized as harvester ant (*Eupronolepis* and *Tetramorium*). The ants species from this study showing six variation of functional group, from seven category of ant functional group base on Andersen (2000) [21]. One species from genus *Iridomyrmex* was recognized as Dominant Dolichoderinae which is dominant in an open dan hot area. Five species are opportunist ant (*Tapinoma, Technomyrmex, Tetramorium, Nylanderia* and *Paraparathrechina*. One species of *Camponotus was Subordinate Campotini* which was not dominant and under dominance of other species. *Pheidole* and *Monomorium* were Generalized Myrmicinae ant. Three species were Tropical Climate Specialis (*Euprenolepis, Monomorium and Selenopsis*). Two species were Cryptic species (*Hypoponera* and *Carebara*) which were small and minute species (Appendix).

## 4. Conclusion

The ant species from this study showing six variation of functional group. All ant species were different between two plantations except *Monomorium florica* (Jerdon, 1851) which was collected for both. The diversity index of ant in this study was low with the domination of some species. Invasive species *Selenopsis geminata* was found only in potato plantation.

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