The Inventory of Soil Ants in Residential Area of Palembang

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Article Info

Key word:
Ant
Ground ants
Musi river
Soil

Article history:
Received: 04/03/2020
Revised: 03/10/2020
Accepted: 14/10/2020

ABSTRACT

The purpose of this research is to find out the species of soil ants in the residential area. The sampling method is hand collecting and baited trap (tuna and honey). There are 8 species found: Acanthomyrmex sp., Solenopsis germinata, Monomorium pharaonis, Pheidole megacephala, Paratrechina longicornis. Tapinoma melanocephalum, Camponotus ligniperda, Diacamma intricatum. The most numerous species, namely Pheidole megacephala and the least species, namely Diacamma intricatum. Ant species diversity tends to increase, as human activity decreases.

Introduction

Flora and fauna are able to live in soil ecosystems. One species of fauna that has an important role in the ecosystem is ants (Formicidae). The ants belong to the class of insects and the order Hymenoptera. Ants have a beneficial and detrimental role. The beneficial role is to "engineer" ecosystems, pollinators, pest insect predators, and energy suppliers. The influence of ants on terrestrial ecosystems is very good, when compared with other insects (Hölldobler & Wilson, 1990).

The number of ant species were estimated at 12,500-15,000. It has a role in ecosystems such as predators and bird feed. The role of ants as predators, namely controlling the population of agricultural pests (Yudiyanto et al., 2014) for example *Oecophylla smaragdina* (a big arboreal ant in tropical Asia and Australia). *O. smaragdina* also well known as rangrang ants eat from eggs, larvae, cocoons and pest insects. One pest that is eaten by ants is aphids. Ants can "manipulate ecosystems" such as aerating the soil and circulating nutrients. The negative role of ants, which can invade by attacking and seizing tropical habitats. This condition has become a serious threat for fauna and local flora. Walker (2006) reports that *Wasmania punctata* is a species of ant that can reduce variations in other species. These ants behave invasively and easily spread and lead to the extinction of other species.

Some species of ants can adapt in disturbed habitats. However, humans who are around ants are not inhibiting factors for ants to live even ants can be associated with humans. Ants that have this problem are called tramp ants (Suarez et al., 1998).

Ants can live in various places including on the ground. Ground ant activity can affect soil conditions, such as disturbance to the physical structure of

the soil (Rodhiyah et al., 2012). Ant activity can be made while looking for food. Ground ants have a significant influence on the erosion process. The presence of ants is very important in the decomposition of soil matter. Ground ants are able to consume living or dead plants. The behavior of eating ants by cutting plants and animals into small pieces, so that the decomposition of organic substances becomes faster (Ruslan, 2009).

Human settlements are not a barrier for ants to live in. Shidqi (2015) reported that there were 4 subfamilies, 7 genera, and 14 species found in the Yogyakarta Parangtritis village. This discovery can be made as evidence that it is able to live and develop in areas inhabited by humans. One of the human settlements that are also found by various species of ants is a settlement on the banks of the Musi Gandus river in Palembang. This area is on the banks of the Musi river. Riyanto & Tibrani (2016), reported that there were 204 species, 70 families and 10 orders of insects in the.

Based on the survey in residential areas, there are settlements and rubber factories. residential areas have plantations and forests. The existence of human activities gradually causes biotic and abiotic damage, of course affects the function of the environment because the forest is converted into a settlement. This study determined the diversity of soil ants from the worker caste in the residential area of Palembang.

Materials and Methods

This research was conducted in the Musi river bank, Gandus sub-district of Palembang City. Samples were taken from various ant habitats of Lettu Karim Kadir RT 7 RW 2 (3 ° 00'51.4 "S 104 ° 41'44.3" E) up to Social roads RT 14 RW 4 (3 ° 01'02.3 "S 104 ° 41 ' 22.4 "E) Gandus sub-district, Palembang. The ant sampling locations include: river bank, houses, bushes, plantation and forests (Figure 1 and table 1). The study was conducted from May-December 2018.

Figure 1. Location Map of Sampling (Source : Google map area locator, 2018)

This research is a descriptive method. The ant sampling technique is purposive sampling. Purposive sampling intentional sampling technique with a specific purpose. Consideration based on what goals researchers want to achieve and what they want to know (Palys, 2008). The intended purpose, namely the sample taken and its location. Considerations include: 1) the ground ant habitat. 2) station conditions allow for operational sampling. 3) the station can represent the diversity of ant species.

Therefore, samples were taken from 7 stations, namely: river bank, houses, bushes, gardens and forests. Ant sampling uses the baited trap and hand collecting methods (Agosti et al. 2000). Baited trap is a method to collect the ants by putting honey or tuna on a paper. Wait until 15 minutes. After that, put the ants in a jar.

Procedure determination of sample location The first step is to determine the location of the sampling area after surveying. This can be observed directly by ants seen by researchers.

Determination of location based on different habitat conditions on the banks of the Musi River with the following categories:

Table 1. Research location in Musi River Area Gandus Palembang

Range to river bank	Plot	Location	Description
<100 m	6	River bank	River banks include the land affected by tides
	12	House	Human settlement, including the yard
	6	Bushes	Land which not planted with cultivation
100-200 m	12	House	Human settlement, including the yard
	6	Bushes	Dry land that is not planted with crops
	6	Plantation	Sugar cane plantation
	6	Forest	Habitat on the edge of the forest

Observation and sampling of ant samples

The observation and sampling of ants are carried out in the morning and evening (08.00 – 09.30 and 15.00 – 17.00). After the ant sample is obtained, the sample is immediately put into a jar containing 70% alcohol. Samples were identified in the Unsri FKIP Biology Education laboratory. Sampling uses two methods according to Hashimoto (2003), namely: the method of hand collecting, namely sampling using hand assisted tweezers, cotton and alcohol.

This method is used if the ant sample is able to be taken by the researcher. Baited trap method, which is sampling in hard-to-reach places such as holes, leaf litter, and wood. The bait used is canned tuna and honey placed on paper (Wielgoss et al., 2010 in Hasriyanty et al. 2013). Sampling is done for one hour, then observing the ants that visit the bait every 15 minutes.

Identification

The research data is made documentation and identified up to the genus level, if possible up to species. Identification is guided: Hölldobler & Wilson (1990), and Bolton (1994). Morphologies observed included total body length, number of antenna segments, presence of promesonotal sutures, spines in the propodeum, petiole, number of abdominal segments, abdominal weapons, and body color.

Data analysis

Ant species diversity data is written in tabular form. The number of species and the number of individual ants measured at the following stations: river bank, houses, bushes, gardens and forests.

Results and Discussion

Based on the results of the study found eight ant species from four sub families (Myrmicinae, Formicinae, Dolichoderinae, and Ponerinae). Species found were: *Acanthomyrmex* sp., *Solenopsis germinata, Monomorium pharaonis, Pheidole megacephala, Paratrechina longicornis., Tapinoma melanocephalum, Camponotus ligniperda, and Diacamma intricatum*. For more details can be seen in Table 2.

Table 2. Species and number of ants at the various stations on the banks of Musi river, Gandus district

Species	Station							Total	Perse-tase (%)
	Range< 100 m			Range 100 - 200 m					
	Rb	Hs	Bs	Hs	Bs	Gdn	Frst		
Acanthomyrmex sp.	0	0	0	0	0	8	11	19	0,97
S. germinata	0	55	179	163	27	69	77	570	29,0
M. pharaonis	0	0	0	0	13	6	0	19	0,97
P. megacepahala	452	90	56	9	0	0	0	607	30,9
P. longicornis	0	111	21	28	0	3	14	177	9,01
T. melanocephalum	0	0	0	0	539	0	15	554	28,2

Species	Station							Total	Perse-tase (%)
	Range< 100 m			Range 100 - 200 m					
	Rb	Hs	Bs	Hs	Bs	Gdn	Frst		
C. ligniperda	0	0	0	0	0	3	7	10	0,51
D. intricatum	0	0	0	0	0	0	8	8	0,41
Total	**452**	**256**	**256**	**200**	**579**	**89**	**132**	**1964**	**100**

Keterangan: Rb (River banks), Hs (house), Bs (Bushes), Gdn (Garden), Frst (Forest)

Based on Table 2 the number of ants obtained was 1,964 individuals. The most ant species, namely *P. megacephala* and *S. germinata*. Both of these ants include tramp ants. *P. megacephala* was obtained by 607 individuals (30.9%). The second most *S. germinata* obtained by as many as 579 individuals (29%). Meanwhile, the ants obtained in at least 10 individuals are *C. ligniperda* ants

House location with a distance of < 100 m from the banks of the Musi river obtained 256 individual ants from three species. Likewise, the bush station obtained 256 individual ants consisting of three species. The home station ant species and bush station are different species. Ant species found around the house are *S. germinata*, *P. megacephala*, and *P. longicornis*. Then at a distance of 100-200 m, 200 ants were obtained for the home, 83 individual ant gardens, and 132 individual ant forests. The most widely obtained ant species, namely forest with a number of species six, namely: *Acanthomyrmex sp.*, *S. germinata*, *P. longicornis*, *T. melanocephalum*, *C. ligneperda*, and *D. intricatum*. Meanwhile, the fewest stations are the banks of the Musi river by one species, namely: *P. megacephala*. Descriptions of species found in residential areas on the banks of Musi River, Gandus District, Palembang.

Acanthomyrmex sp.

This species of ant has a total length of ±6,1 mm (a), the mandible is triangular (b), the antenna consists of 12 segments (c), dimorphic caste. The mesosoma does not have a promononotal suture (d) pronotum and the mesonotum is fused. The proppedeum and its thighs (e), the petiole consists of 2 segments: petiole and post petiole (f), the blunt end of the abdomen (g), the color of the head, abdomen, and thorax are predominantly black (Figure 2). These ants include the family: Formicidae, subfamily: Myrmicinae, genus: Acanthomyrmex, species: *Acanthomyrmex sp.*

Figure 2. *Acanthomyrmex sp.* (Lateral view)

Solenopsis germinata

These ants have a total length of ± 3.7 mm (a), a mandibular long triangle (b), small eyes (c) and have a border species in the middle (d). The number of antenna segments is 12 and the club has 2 segments (e). The mesosome does not have a promesonotal suture or pronotum and the mesonotum is fused (f). There is no thorn in the propodeum (g). Waist consists of two segments: petiole and post petiole (h). The chest stands out. The abdomen consists of four segments (i). All parts of his body are covered with hair, there is a sting in the last segment of the stomach (j) (Figure 3). This ant belongs to the family: Formicidae Subfamily: Formicinae, genus: Solenopsis, species: *S. germinate.*

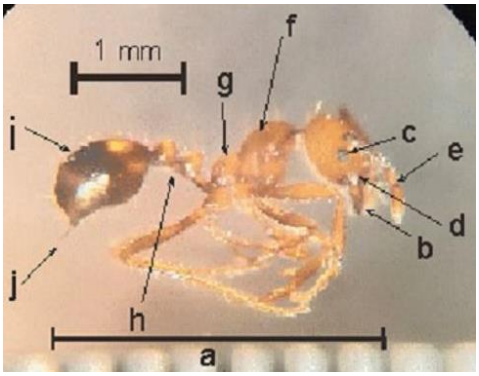

Figure 3. *Solenopsis germinate* (Lateral view)

Monomorium pharaonis

These ants have a total length of ± 1.8 mm (a), a mandible triangle (b), has clipe (c), the antenna consists of 11 segments (d). The mesosome does not have a promesonotal suture (e), the pronotum and the mesonotum fuse, thus becoming the pro mesonotum. Waist consists of: 2 petiole (*petiole* and *post petiole*) (f). The head and mesosomes are black, the abdomen is orange, and there are no thorns in the propodeum (g). The abdomen consists of four segments (h) and in the last segment there is a sting (i). For more details, see (Figure 4). Family: Formicidae, subfamily: Myrmicinae, genus: Monomorium, species: *M. pharaonis*

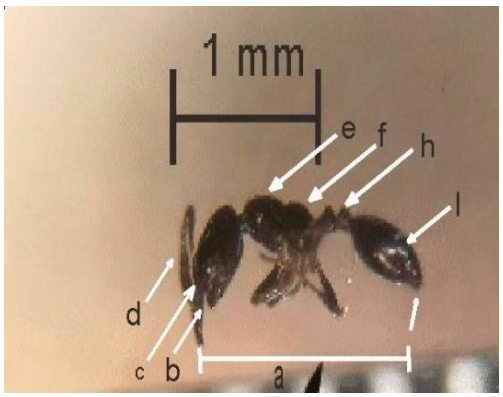

Figure 4. *Monomorium pharaonis* (Lateral view)

Pheidole megacephala

These ants have a total length of ± 4.6 mm (a), dimorphic cast (major and minor workers), mandibular length (b), the antenna consists of 11 segments (c). The mesosome has no promesonotal suture (d), the pronotum and mesonotum are fused and there are spines on the surface of the propodeum (e). Waist consists of two segments; petiole and post petiole (f). The petiole has a slightly tapered node, and the post petiole has a rounded node. The abdomen consists of 4 segments (g) and at the end of the last segment is sting (h). The mesosoma head, legs, petiole and post petiole are reddish brown, while the abdomen is brown (Figure 5). These ants belong to the family: Formicidae, subfamily: Myrmicinae, genus: Pheidole, species: *P. megacephala*.

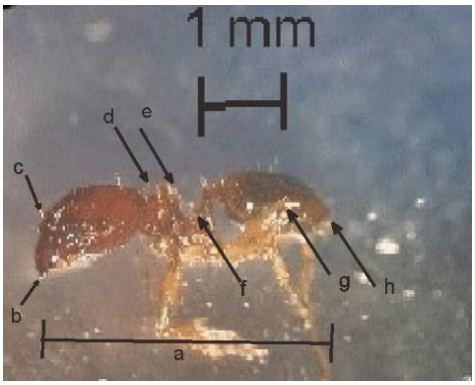

Figure 5. *Pheidole megacephala* (Lateral view)

Paratrechina longicornis

These ants have a total length of ± 2.7 mm (a), a mandibular length (b), and have a clot (c). The number of antenna segments is 12 (d). This ant has a promesonotal suture (e), and the pronotum and mesonotum do not fuse. Waist (waist) only one segment, namely petiole (f). Petiole and propodeum do not have thorns. The abdomen has five segments, the last segment has acidopore instead of sting. All parts of his body are covered with hair. The head, mesosoma and legs are black, but the feet are a bit brighter, when compared to other body parts (Figure 6). Family: Formicidae, subfamily: Formicinae, genus: Paratrechina, species: *P. longicornis*

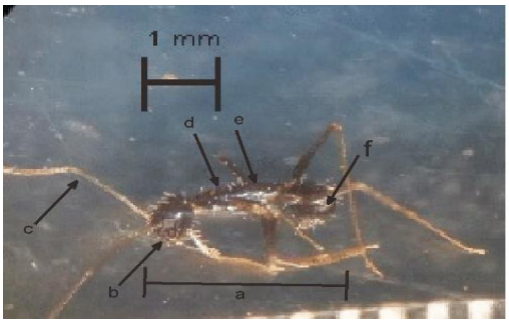

Figure 6. *Paratrechina longicornis* (lateral view)

Tapinoma melanocephalum

These ants have a total length of ± 2 mm (a), there are 11 antennas (b), and the mandible is triangular (c). This ant has a promusonotal suture (d) pronotum and mesonotum does not fuse, and there are no spines in the propodeum (e). Waist (waist) only one segment, namely petiole (f). Petiole hangs in the first gastric segment, clearly visible from a dorsal perspective. The abdomen has 5 segments (g) and the end is not pungent and acidopore, but to protect itself will emit a distinctive odor from the body. The color of the blackish brown head, abdomen legs and very pale antenna tends to be transparent (Figure 7). Family: Formicidae, subfamily: Dolichoderinae, genus: Tapinoma, species: *T. melanocephalum*.

Figure 7. *Tapinoma melanocephalum* (Lateral view)

Camponotus ligniperda

These ants have a total length of ± 6.5 mm (a), mandibular triangles (b), the number of antennal segments there are 12 (c), the spiny Mesosome (e), no promesonotal suture (d), and pronotum and mesonotum do not fuse: petiole (f). The casing has a slightly tapered node and a standing position. The abdomen has five segments (g) and at the end there is acidopore (h). The head and abdomen are reddish brown, (Figure 8). Family: Formicidae, subfamily: Formicinae, genus: Camponotus, species: *C. ligniperda*

Figure 8. *Camponotus ligniperda* (Lateral view)

Diacamma intricatum

These ants have a total length of ± 11.1 mm (a), a mandibular long triangle (b), and there is a clipe (c). The number of antenna segments is 12 (d). Waist (waist) only one segment, namely petiole (e). Propodeum has no spines (f). The box has a pair of spines (h). The abdomen has five segments (i). Pretarsal claw forefoot not prickly. The last segment precisely in the hypopigidium has a sting (j). Head, mesosoma, abdomen, and black legs (Figure 9). Family: Formicidae, subfamily: Ponerinae, genus: Diacamma, species: *D. intricatum*.

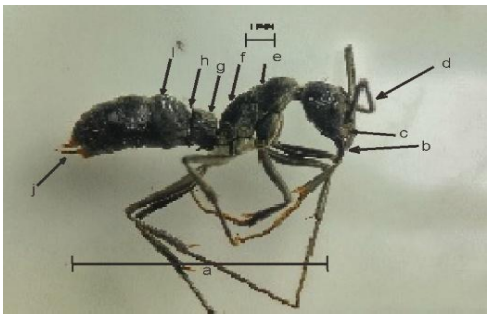

Figure 9. *Diacamma intricatum* (Lateral view)

Results of research at the location of the banks of the Musi River, Gandus Village, Gandus District, Palembang

City, were found in as many as 8 ant species (Table 2). There are eight species that are grouped in the Myrmicinae sub-group, namely *P. megacephala, S. germinata, M. pharaonis,* and *Acanthomyrmex sp.* One species is grouped in the Ponerinae sub-group, namely *D. intricatum*. Two species belong to the Formicinae sub-group, namely *P. longicornis* and *C. ligniperda*. One species belongs to the Dolichoderinae sub-family, namely *T. melanocephalum*. The ant species with the most number of individuals are *P. megacephala* and at least the *C. ligniperda* species. The station with the fewest species is river bank (<100 m) and the most species are gardens and forests (100 - 200 m).

The kinds of ants in this study have similarities with the research results of Hasriyanty et al. (2013) in Bogor and the results of research Rizali et al. (2008) in Palu, Central Sulawesi. The kind of ants that dominate are the ants which belong to the category of invasive ants. Invasive ants are ants that have large populations and can master the composition of ant species in certain habitats (Hasriyanty et al., 2013). Ants originating from the Myrmicinae and Formicinae subfamilies are a species of ant that is quite dangerous for native species in certain environments. The ant tends to be invasive, because the ant species from the two subfamilies have weapons. Myrmicinae has a sting and Formicinae has acidopore. The existence of this invasion will control the habitat that was visited. These migrant ants can gradually reduce and replace the abundance of native ant species in their habitat (Holldobler and Wilson, 1990). The ants found in this study were not only invasive, but there were also tramp ants. Tramp ants are ants that have been able to associate with humans.

The number of ant species found is not as many as the number of species found in Bogor and Palu. This might be because the time of sampling from the two previous researchers was much longer. In research on the banks of the Palembang Gandus River, the sample was taken for one month, October. Meanwhile Hasrianty et al. (2013) conducted sampling for three months and Rizali et al. (2008) who examined ants in Palu for three months as well. The composition of ants obtained varied with a total of 1964 individuals found from 7 different stations. The most common species of ant is 607 individuals of *P. megacephala* and the least ants are *Diacamma sp* of 8 individuals. *P. megacephala* has the main characteristic that is a large head with a ratio of head and total body length is 1: 4. The worker ants are dimorphic (major and minor workers). The major worker ants are approximately twice as large, compared to the minor worker ants. These ants are included in the Myrmicinae sub-family and are very successful in nature. This fact can be seen in Table 2. These ants control the banks of the Palembang Musi Gandus river and overall in a variety of habitats, Pheidole is found more frequently than other ants. This happens because *P. megacephala is* an omnivorous ant that eats corn, honey, dead insects, soil invertebrate animals, and food scraps (Warner & Scheffrahn, 2016). The facts in the field of ant food is quite a lot because residents who are on the banks of the Musi Gandus river in Palembang sometimes throw garbage, such as leftovers on the banks of the Musi river. The rest of the food, rubbish and wood piled up can be a place for *P. megacephala* to live.

Based on the observations of researchers, *P. megacephala* lodged in litter, under houses, and walls. These ants also nest underground *kaca piring* plants (*Gardania augustra*) in residential areas. *P. megacephala* makes holes as a place to live in the vicinity of these plants. This activity causes hollow soil and oxygen to

enter the ground. Oxygen in the soil can help the process of metabolism of cells in plant roots, so plants grow more fertile (Hölldobler & Wilson, 1990). In addition, ants bring food into the nest. The rest of this food can support the growth of plate glass plants. Widyati (2013) reports that ants can act as environmental engineers in the process of decomposition and distribution of organic matter. Decomposition of leftovers can be this organic material which is a natural fertilizer for plants such as plate glass plants. Therefore, the presence of ants on the ground has a positive effect on the physical condition of the soil and the transportation of soil nutrient sources.

D. intricatum is included in the Ponerinae sub-family. This sub-family has the main characteristic of thorns in propodeum, sting in the hypopygium, and the first narrowed gastral segment. The number of *Diacamma* sp found was only 8 individuals. These ant species are found in small numbers, because of foraging behavior that is different from other ants. *D. intricatum* roams the ground solitary / not colonized. Relatively large body size of ± 11 mm and long legs, very supportive of rapid movement.

Acanthomyrmex sp. including the Myrmicinae sub-group, with their main characteristics, namely petiole and armed propodeum in the form of thorns (Bolton, 1994). These ants are generally measuring ± 6.1 mm. Antennas consist of 12 segments, petiole there are 2 segments (petiole and post petiole), four abdominal segments. Achantomyrmex was found in gardens and forests of 8 and 11 individuals, respectively (Table 2). These ants are active on the ground, dead branches, leaves and stems of plants. *Acanthomyrmex* sp. eat various species of food, such as: fruit, seeds, small invertebrates, and also sugar (Moffet, 1985).

S. germinata are also called fire ants. These ants have a characteristic stinger in the final abdominal segment. These ants are found in the most individuals. Solenopsis is also distributed in all habitats at the study site. A total of 570 ants were obtained, with details as follows: 179 bushes (<100 m), 163 tails house (100-200 m), 77 tails forest, 69 tails garden, 55 tails house (<100 m), and 27 bushes (100-200 m). *S. germinata* is not found in riverbank land. Solenopsis has the potential to be a nuisance. These ants are often present in foods that are not packaged properly, such as cakes, side dishes, and sugary drinks.

M. pharaonis belongs to the Myrmicinae subclass. These ants have 12 antenna segments and body length ranges from 1,5 to 2 mm. Based on Table 2 Monomorium found 13 individuals in the bush and 6 individuals in the garden. These ants are little found despite finding food in a colony. The size of these ants is very small compared to ants in general. This causes the movement of ants to be very slow and to get limited food. *M. pharaonis* are diurnal ants that look for food during the day. These ant nests contain worker castes, queens, and winged female or male ants. Worker female ants and sterile laborers who work in charge of looking for food, guarding larvae to develop, and guarding nests, and male ants are tasked with reproducing (Morris, 2000).

P. longicornis is a sub-family of Formicinae. This ant has seta (hair) all over its body. Another feature of Paratrechina is having acidopore. *P. longicornis* can move quite quickly and irregularly, so that these ants are known as crazy ants. These individual ants are found in various stations, including: 111 individual houses (<100 m), 28 individual houses (100-200 m), bush (<100 m), 14 individual forests, 3 individual gardens.

T. melanocephalum is known as "odorous ant" or odor ants. At the time of the study, this species of ant sample smelled a pretty strong odor, even though

it had been preserved for about 2 weeks. The main characteristics, namely the head and black mesosoma, while the white gastric. Tapinoma is found abundantly in the bush. This is thought to have many food sources. Food sources are not only foods that are in people's homes, but also leftovers that are thrown away. The bushes are quite close to a stall that sells food, so a lot of garbage. *T. melanocephalum* becomes a nuisance in homes and places with sweet substances. *T. melanocephalum* is very abundant in as many as 539 individuals, but only found in bushes 100-200 m. These ants make nests in the bush precisely below ground.

C. ligniperda is a sub-family of Formicinae. These ants are only found in gardens and forests. This species is quite few found, because its size is quite large, which is around 5-6 mm. The size is large enough to make the behavior of these ants in looking for food tends to be solitary. It is not uncommon for *C. ligniperda* to separate from the group and return to the nest, if it has brought food. Therefore, there is a small chance of being trapped in a baited trap. Foraging activities like this make only a few *C. ligniperda* found in the habitat.

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Conclusion

Based on the results of the study found as many as 8 Ants species consisting of four sub-families (Myrmicinae, Formicinae, Dolichoderinae, and Ponerinae). Species found were: *Acanthomyrmex* sp., *S. germinata*, *M. pharaonis*, *P. megacephala*, *P. longicornis*, *T. melanocephalum*, *C. ligniperda*, and *Diacamma intricatum.*

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