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IDENTIFICATION OF ANTS (*Formicidae*) IN THE MANGROVE FOREST AREA OF TATENGESAN VILLAGE, SOUTHEAST MINAHASA

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Abstract

Ants are a group of social insects that belong to the order Hymenoptera and the Family Formicidae. This study aims to determine the type of ants (*Formicidae*) in the Mangrove Area of Tatengesan Village, Southeast Minahasa. This research occurred in Tatengesan Village, Posumaen District, Southeast Minahasa Regency, North Sulawesi. The research method uses a purposive sampling method with the placement of the paths determined based on considerations taking into account the physical and biological conditions that affect the presence of ants in the field. Observation lines were made in as many as three transects, each with four observation plots. Data was collected using adhesive paper traps (*Fly Sheet*) and direct capture method (*hand collecting*) and analyzed using the Shannon-Weiner diversity index, species richness index, and species evenness index. Placement of self-adhesive paper on each transect, including lower tree stratum, highest tide limit, middle tree stratum, and upper tree stratum. Based on the results of the research on the observation transect, there were five genera, namely *Anoplolepis* with 25 individual ants, *Camponotus* with 31 individual ants, *Crematogaster* with 98 individual ants, *Oecophylla* 2168 ants, and *Tetraponera* 6 individual ants from 6 species of ants consisting of *Anoplolepis gracilipes*, *Camponotus atriceps*, *Camponotus sp*., *Crematogaster scutellaris*, *Oecophylla smaragdina*, and *Tetraponera nigra*. The highest number of genera obtained was Oecophylla, the highest number of species was Oecophylla smaragdina, and the number of individuals caught was 2168.

Key words: Identification, ants *(Formicidae),* mangrove forest, and Tatengesan Village

INTRODUCTION

The mangrove ecosystem is an area that stretches along the coast whose composition consists of several types of flora and fauna that interact with each other (Suriana et al., 2015). The flora in the mangrove area is several types of mangrove plants, while the fauna around the area are fish, shrimp, crabs, shellfish, birds, snakes, and insects, including ants.

As one of the highly diverse organisms, insects are Indonesia's biological wealth, which deserves attention. Ecologically, insects act as food chain components as herbivores, carnivores, decomposers, and pollinators. In addition, insects act as pollinators visiting flowers to take food in the form of sweet

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liquid (nectar) and protein-containing pollen; this indirectly helps pollination (Suriana et al., 2015).

Ants are social insects, a group belonging to Hymenoptera and the family Formicidae. Ants are divided into worker, male, and queen ants. Ants are commonly found in various habitats; apart from terrestrial areas, ants can also be found in coastal areas because there is a habitat that allows the existence of ants, namely mangrove vegetation, and ecologically, ant nests are spread from mangrove forests and trees on the coast (Mazlan et al., 2019).

The presence of ants in the mangrove community has an essential ecological meaning and role. This existence cannot be separated from the ecological role of ants as predators, prey, or indirectly helping the decomposition of the soil on the soil surface around mangroves. Ants can be used as a bioindicator of the condition of an ecosystem. Ants and plants have a reciprocal relationship, providing plant fertilizer with essential nutrients and functioning as pollinators (Mazlan et al., 2019). Some of these ants' roles are decomposers, pollinators, aerating the soil, predators, and indicators (Tawatao, 2014). Ants have several roles in mangrove ecosystems, including pollinators, predators, pests, decomposers, and herbivores (Abtar et al., 2013).

Tatengesan Village, Pusomaen District, Southeast Minahasa Regency, has a mangrove forest area used as an ecotourism site. The application of ecotourism for utilizing mangrove forests in Tatengesan Village has yet to be implemented optimally. Meanwhile, there is no data on the damage to several types of mangroves caused by ants in Tatengesan Village, Posumaen District, Southeast Minahasa Regency. Therefore, it is important to know the types of ants in the mangrove area because there are still many types of ants that have not been identified. Hence, efforts to study the diversity of ant species in Tatengesan Village are worthy of research because there has yet to be research related to identifying ants in mangrove plants in the village. Tatengesan Southeast Minahasa needs to find information about the types of ants in mangrove plants in Tatengesan Village, Southeast Minahasa. This study aims to determine the type of ants (*Formicidae*) in the Mangrove Area of Tatengesan Village, Southeast Minahasa.

RESEARCH METHODS

This research was conducted in the mangrove forest area in Tatengesan Village, Southeast Minahasa Regency, from July to August 2022. The mangrove area is around 220 Ha, where it is determined that there are three transects and four plots on each transect with a size of 6 x 6 m with a spacing of 3 m between plots.

The tools used in this study were adhesive paper (*fly sheets*), small sample bottles, tweezers, scissors, plastic rope, stakes, tape measure, cell phone cameras, stationery, label paper, and ant identification essential books (Hashimoto, 2003), and the Google Lens software app. Meanwhile, the material used in this study was 70% alcohol to preserve the ants.

The type of research used is quantitative descriptive research by conducting data collection activities, analyzing data, and interpreting data to describe the events that occurred (Rachmasari et al.,

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2016). Data collection techniques with direct observation in the field. The sampling technique in this study was purposive (Tarinedja & Hidayati, 2014).

The population of this study was all types of ants found in the mangrove forest area of Tatengesan Village, Southeast Minahasa. This study's samples were ants obtained from the hand-collecting method and adhesive paper traps (*fly sheets*) on three observation transects in Tatengesan Village, Southeast Minahasa.

This study uses descriptive data analysis techniques that describe the data obtained so that it is more apparent. Data on the number of ants counted were recorded and statistically analyzed to determine the Species/Species Diversity Index (Shannon-Wiener), species richness index (d), and Evenness Index obtained. Descriptive analysis and quantitative data is an analysis that is used by describing or describing the data that has been collected, which is displayed in the form of pictures and tables.

Research procedure

Determination of Sampling Locations

Observing research locations that aim to find information on places as research objects by recognizing field conditions and the location of coordinates. The transect is a mangrove area on land close to the residents' settlements. The transect is the mangrove area between transect I and transect III. Moreover, Transect III is a mangrove area close to the beach, inundated with water, and only has mangrove species.

Research Plot Placement

This study used the transect method with plots. determine the transect made on Transect 1, drawn towards settlements with a size of 25x25 meters, on Transect 2, drawn with a size of 25x25 meters. Whereas Transect 3, it is pulled from near the shoreline with a size of 25x25 meters. Then, on each transect, observation plots were made with a size of 6x6 meters with a distance between plots of 3 meters.

Trap Setting and Sampling

Traps were set in the morning at 07.00-17.00 WITA and in the afternoon traps were set at 17.00-07.00 WITA.

a. Fly sheet

The installation of adhesive paper traps (Fly sheet) was placed in each plot, wherein 5 adhesive paper traps (Fly sheet) were placed. Traps were placed on the lower strata of the trees, the middle strata of the trees, and the upper strata of the trees. The number of traps on each transect is 20 traps. Sampling using adhesive paper traps (Fly sheet) was carried out 2 repetitions a week, for setting traps in the morning they would be taken in the afternoon and for setting traps in the afternoon they would be taken in the morning.

b. Direct arrest (hand-collecting)

The hand-collecting method was carried out for one hour on each observation path, especially for

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ants and their nests that live in mangroves and around low plants, between rocks, the ground surface, mounds, and broken wood (Hashimoto, 2001). The time used for sampling is one hour, namely at 11.00-12.00 WITA (Ikbal et al., 2014).

Ant Observation

The trapped ants were then recorded for their number and morphological characteristics (color and shape) and photographed with a cellphone. Then, it is stored or put into a sample bottle that has been provided, filled with sufficient alcohol, and labelled according to where the ant was found.

Measurement of Ant Environmental Factors and Sample Identification

Measurement of environmental factors for ants is done by measuring temperature and humidity. Temperature and humidity were measured using the Soil 4 in-1 tool by placing the tool in the middle of the sampling plot. The identification process was carried out by referring to the book Inventory and Collection, Identification Guide To The Ant Genere of Borneo (Hashimoto, 2003) and Google Lens.

RESULTS

Species of Ants in Tatengesan Village Mangrove Area

Based on the results of research on mangrove forest areas in the three research transects which were divided into 12 plots and each transect consisting of 4 plots. From the results of sampling and data collection, 5 genera were found, namely Anoplolepis, Camponotus, Crematogaster, Oecophylla, and Tetraponera from 6 species of ants consisting of Anoplolepis gracilipes, Camponotus triceps, Camponotus sp, Crematogaster scutellaris, Oecophylla smaragdina, and Tetraponera nigra with a total of 2,328 individual (Table 1). The genus Oecophylla was the most genus of 2,168 individuals found in all research transects, while the genus Tetraponera was the least numerous of 6 individuals found only in transect I.

Table 1. Ant amount obtained from three transects in the Mangrove Forest Area of Tatengesan Village, Southeast Minahasa

No	Genus	Species	Transect			Total Individuals
			I	II	III	
1	*Anoplolepis*	*Anoplolepis gracilipes*	-	5	20	25
2	*Camponotus*	*Camponotus atriceps*	-	-	8	8
3		*Camponutus* sp.	-	23	-	23
4	*Crematogaster*	*Crematogaster scutellaris*	98	-	-	98
5	*Oecophylla*	*Oecophylla smaragdina*	278	1084	806	2168
6	*Tetraponera*	*Tetraponera nigra*	6	-	-	6
		Total	382	1112	834	2328

Based on the results of research conducted in the Mangrove Forest Area of Tatengesan Village, Southeast Minahasa regarding environmental conditions when sampling ants with parameters of temperature and humidity (Table 2). The microclimate on each transect ranges from 25-28°C with a temperature of around 25-28°C and is a category that includes the optimal temperature for the life of

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ants in maintaining their life.

Table 2. Microclimate in Research Locations

Measured Parameters	Average		
	Transect 1	Transect 2	Transect 3
Temperature (°C)	28°C	26°C	25°C
Air Humidity (%)	67%	80%	93%

Characteristics and Morphology of Ants in the Mangrove Forest Area of Tatengesan Village, Southeast Minahasa

1. Anoplolepis gracilipes

This ant in Fig. 1(A) has a yellow body, long legs, and claws, long antennae consisting of 11-12 segments, the whole body has fine books, the body looks bright and shiny, the abdomen is round and elongated, the jaw is triangular, the jaw has teeth. *Anoplolepis gracilipes* ants are known to have aggressive behavior and disturb other types of ants around them based on a study of interspecific aggressiveness (Fung, 2008).

2. Camponotus atriceps

This ant species in Fig. 1(B) is typically found in a variety of moist, forested habitats, including wet lowlands, tropical rainforests, pine forests, and mountains. *Camponotus atriceps* is a carpenter ant that is found nesting in dead wood in mangrove swamps. It has the characteristics of a dark red-brown body, a pair of antennae, and a relatively short and wide head, and the mesosoma is usually densely hairy (Hernández et al., 2010).

3. Camponutus sp.

Camponutus sp. in Fig. 1(C) is an ant with a body length of 8 mm, blackish brown, 1 pair of antennae, 3 pairs of legs, there is fine hair on the abdomen. The shape of the mouth is triangular, the body has smooth nodules, the antenna has 11 segments, the body is blackish brown, the body is small and there are teeth in the jaws (Gulan and Cranston, 2010).

4. Crematogaster scutellaris

These ants in Fig. 1(D) have specific morphological characteristics, namely having two petioles, the eyes are generally small and round, and the pronotum is joined to the mesonotum. Crematogaster is known as cocktail ants or acrobat ants because this type of ant can lift the abdomen when disturbed and threatened. The genus Crematogaster is arboreal and nests on dead tree branches or under bark or moss (Meilina et al., 2017).

5. Oecophylla smaragdina

Oecophylla smaragdina in Fig. 1(E) has characteristics with a red body which is commonly known as a weaver ant. This ant has 12 antenna segments, the mandible is in the shape of an elongated triangle, and the petiole is elongated and lower, between the mesosoma and the stomach there is one segment called the petiole, the first segment of the stomach is united with the second segment and the eyes are

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located between the two sides of the head. This type of ant is found in large numbers because of the available food resources and the activity of this type is often found underground and also in trees (Sulistyorini et al., 2023).

6. Tetraponera nigra

These ants in Fig. 1(F) can be identified by morphological characteristics, namely having a slender body with a body length of 12 mm and black, one pair of antennae, and three pairs of legs and segments, there are two septa between the thorax and abdomen. Thorax curved, pronotum near the head is rather small. The back of the head is slightly rounded while the front is rather small, and the top is convex. This genus has mandibular basal margins lacking teeth adjacent to the joint. Large eyes with a width twice the height (Suin, 2003).

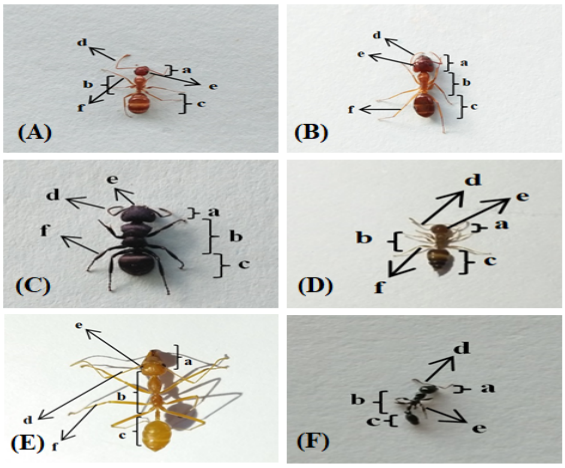

Figure 1. Ants Species: (A) *Anoplolepis gracilipes*, (B) *Camponotus atriceps*, (C) *Camponotus* sp., (D) *Crematogaster scutellaris*, (E) *Oecophylla smaragdina*, (F) *Tetraponera nigra*; a. Caput, b. Thorax, c. Abdomen, d. Antenna, e. Eyes, and f. Legs (Personal Documentation, 2022)

DISCUSSION

Ant Species in the Mangrove Forest Area of Tatengesan Village, Southeast Minahasa

The difference in the number of individuals and the number of species from the sampling of ants in each observation transect is due to factors that influence the presence of ants. These factors are environmental factors and habitat factors.

Transect 1 is close to human settlements so there are a lot of human activities that can disturb the presence of ants which is higher, so the number of individuals obtained is less than in Transect 2 and Transect 3. Meanwhile, transect 2 and transect 3 are not disturbed by a human activity because they are far away, from residents' settlements so that there is a relatively long interval of time that can provide an opportunity for disturbed ant communities to recover. Which stated that habitats that were disturbed due to the presence of humans would have lower ants diversity when compared to habitats that were not disturbed (Putra et al., 2021).

In addition, the existence of ants is closely related to habitat conditions and several main limiting

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factors that affect the presence of ants, namely low temperatures, habitats that do not support nesting, limited food sources, and unsupportive home ranges. Mangrove species and other species of plants in mangrove forest areas will affect the availability of food for ants (Haneda and Yuniar, 2015).

Diversity, Richness, and Evenness Index

The results of calculating the species diversity index, species richness and evenness of insect species in the mangrove area of Tatengesan Village can be seen in Table 3.

Table 3. Diversity, Richness, and Evenness Index

Arrest Line	Species Diversity Index (H')	Richness Index (d)	Evenness Index (e)
Transek 1	0,646	0,336	0,588
Transek 2	0,129	0,285	0,188
Transek 3	0,188	0,297	0,171

The diversity index of ants in the Mangrove Forest Area of Tatengesan Village, Minahasa Tenggara was classified as low, with the diversity index on transect I obtained a diversity index value of 0.646, then on transect II a value of 0.129 obtained, and on transect III a value of 0.188 was obtained. Insect species diversity is influenced by food quality and quantity factors, including the number of suitable host plants, host plant density, host plant age, and stand composition (Haneda and Kusmana, 2013).

The wealth index in the Mangrove Forest Area of Tatengesan Village, Southeast Minahasa is classified as low. On Transect I, it was 0.336, on Transect II it was 0.285 and on Transect III it was 0.297. The highest species richness index is in transect I, this is due to the relatively moderate temperature and humidity in the fishing line, environmental conditions that are suitable for their habitat, and adequate food factors to carry out their breeding, plus there are dead or fragile trees which have the potential to become breeding grounds life share ants.

The evenness index of ant species in the Mangrove Forest Area of Tatengesan Village, Southeast Minahasa is included in the low category. The low evenness of ant species in an area is affected by the uneven distribution of ants. The evenness value indicates the distribution pattern of a species within a community, the greater the value, the more balanced the distribution pattern of a species within a community and vice versa (Haneda and Kusmana 2013).

CONCLUSION

Based on the results of research conducted in the Mangrove Forest Area of Tatengesan Village, Southeast Minahasa, it can be concluded that 2,318 ants were caught in the mangrove forest area of Tatengesan Village. It consists of 5 genera, namely *Anoplolepis* with 25 individual ants *Camponotus* 31

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individual ants, *Crematogaster* 98 individual ants, *Oecophylla* 2168 ants, and *Tetraponera* 6 individual ants from 6 species of ants consisting of *Anoplolepis gracilipes, Camponotus atriceps, Camponotus* sp. *Crematogaster scutellaris, Oecophylla smaragdina,* and *Tetraponera nigra*. The highest number of species was Oecophylla smaragdina which caught as many as 2168 individuals.

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