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Ant Species Inventory Based on Habitat Fragmentation in Pangandaran Nature Reserve

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Abstract: *Ants are social insects that play a vital role in maintaining ecosystem balance and can serve as ecological indicators of environmental change. This study aimed to determine the variation of ant species in habitats with varying levels of disturbance. Data collection methods included pitfall traps and bait traps at three different locations over two days. Data analysis was performed by calculating the Shannon-Wiener diversity index and observing species composition and abundance. The results showed that 7,350 individual ants were identified in five subfamilies and eleven genera. The genus Anoplolepis was the most dominant in this study. The diversity index value was moderate in more protected areas and low in more disturbed areas. Community diversity was influenced by several environmental parameters such as temperature, light intensity, and humidity. The results also showed that ant preferences for protein and carbohydrate baits varied across genera. In conclusion, the level of habitat disturbance influences the composition and structure of ant communities, which can be used as a basis for monitoring ecosystem conditions.*

Keywords: *ant; bioindicators; community; conservation; Pangandaran*

1. INTRODUCTION

Pangandaran Nature Reserve is one of Indonesia's most important conservation areas, boasting high biodiversity, including insect communities such as ants. Ants (Formicidae) play a crucial ecological role as predators, seed dispersers, and indicators of environmental health. The presence and distribution of ant species are strongly influenced by their habitat conditions, making the study of ant communities crucial for understanding the dynamics of tropical forest ecosystems (Rahman et al., 2020).

Natural resource conservation in the Pangandaran Nature Reserve (CA) and Nature Tourism Park (TWA) is a form of in-situ conservation, namely the direct preservation of species in their natural habitat (Darmayani et al., 2022). In the context of ant species inventory, this activity not only aims to record biodiversity but also provides a scientific basis for designing area protection strategies. The presence of diverse ants reflects ecosystem health and demonstrates their important role as bioindicators sensitive to environmental change (Lake et al., 2023). Furthermore, natural ant habitats, such as weeds, also play a role in pest control in agroecosystems (AF et al., 2019).

Ants are ecological indicators that are highly sensitive to environmental change, particularly those caused by anthropogenic pressures. A study by Latumahina, (2016) on the response of ant communities to habitat destruction in the Sirimau Protected Forest, Ambon, showed that human activities such as land clearing, illegal logging, and forest fires cause habitat fragmentation and degradation, resulting in reduced species diversity and significant changes in ant community structure. A similar finding was found by Putra et

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al., (2021) in their research on the Ahmad Dahlan University campus in Yogyakarta. Land conversion for residential areas and public facilities significantly impacts the low levels of ant diversity. Fragmented habitats tend to be dominated by tramp species such as Monomorium minimum, which have a high tolerance for environmental disturbances.

Studies specifically linking habitat fragmentation to ant community structure in conservation areas in Indonesia, particularly the Pangandaran Nature Reserve, are still very limited. Few studies have quantitatively classified ant communities based on the level of microhabitat fragmentation, nor have they compared their composition between disturbed and undisturbed habitat zones in tropical forest ecosystems. Ants are social insects in the order Hymenoptera and family Formicidae, with approximately 12,000 known species. They live in colonies and regularly build nests in a variety of terrestrial habitats, from mountains to coasts. There are four castes in ant colonies: queens, soldiers, males, and workers. Ant species composition is highly responsive to habitat changes, which can also affect trophic interactions and food webs in ecosystems (Romarta et al., 2020).

Ant communities are an important group to observe because their distribution reflects the dynamics and stability of ecosystems. Previous inventories in Pangandaran National Park and Conservation Area (TWA) showed species variation influenced by microhabitat conditions. This is supported by the (Siriyah, 2016), research which stated that the position of the seasonal forest which is directly adjacent to the entrance to Baluran National Park as a tourist area causes high human activity, which is thought to affect the diversity of ants in the area. Human activities such as waste disposal, the opening of tourist routes, and vegetation encroachment can also disrupt ant communities. Environmental factors such as food availability, humidity, nutrients, and organic matter also influence the abundance and composition of ant communities (Ferdiansyah et al., 2024).

Threats to ant communities include habitat fragmentation, loss of shrub vegetation for nesting, soil compaction, and climate change due to the loss of tree canopy. Without proper management, these conditions can reduce diversity and lead to local extinctions. Research by Meilina et al., (2017) shows that intensification of land management can reduce the diversity of macrofauna, including ants. This is reinforced in the Fundamentals of a book (Darmayani et al., 2022), which states that habitat fragmentation and destruction are the main causes of the decline in biodiversity, especially small fauna. Protection of ant communities is also regulated in Law No. 32 of 2009 concerning Environmental Protection and Management, specifically in chapter 69 verse (1).

An inventory of ant species based on the level of habitat fragmentation has important implications for conservation area management. Information on ant composition and distribution can inform the development of biodiversity-based management strategies, while simultaneously maintaining the continuity of ecological processes in protected areas. Due to their easy availability and rapid ecological responses, ants are effective ecological indicators for long-term monitoring (Maulidya et al., 2022).

Based on this, this study was conducted to inventory ant species in Pangandaran Nature Reserve based on the level of habitat fragmentation. The aim of the study was to identify the variation of ant species in habitats with different levels of disturbance, as well as to examine their distribution and community composition, in order to determine the effect of fragmentation on ant presence as an indicator of ecosystem health.

2. RESEARCH METHOD

This research was conducted over two days, from May 26-27, 2025. The research took place in the Pangandaran Village Nature Reserve, Pangandaran District, Pangandaran Regency, West Java. Three areas were used for data collection: the area affected by erosion/landslides, the deer breeding area, and the northwest block (tourist access route). Each area consisted of three observation plots separated by a distance of 100 meters.

Pangandaran Nature Reserve is a nature conservation area located in Pangandaran Regency, West Java. It borders Pangandaran's West Coast to the west, the Pananjung Strait to the north and east, and Pangandaran's East Coast to the south. The Pangandaran Nature Reserve

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covers approximately 530 hectares and consists of lowland tropical rainforest, coastal areas, and coral cliffs. The area is divided into a core flora and fauna conservation zone and a restricted use zone for education, research, and guided nature tourism. The reserve is a natural habitat for various endangered species such as bulls, langurs, deer, and various endemic bird species (BBKSDA Jawa Barat, 2013).

Tools and materials

This research utilized a number of tools, including a stereo microscope, a lux meter, a hygrometer, a soil tester, safety pins, string, chopsticks, duct tape, plastic bottles, label paper, Styrofoam, and plastic cups. The materials used in the study included 70% alcohol, water, detergent, granulated sugar, brown sugar, fried fish, cardboard, and paper glue. Ant sampling was conducted as part of the research procedure.

Sampling Techniques

The methods used for ant sampling in this study were pit traps and bait traps. Five pit traps and five bait traps were installed in each plot. The bait traps used fried fish and granulated sugar, while the pit traps used a mixture of detergent water and brown sugar solution. The purpose of using these two types of traps was to capture ants and compare the effectiveness of each trap in attracting ants. Sampling was carried out for 24 hours, then the captured ants were collected using 70% alcohol. The ant sampling process was carried out in the Pangandaran Village area, Pangandaran District, Pangandaran Regency, West Java, on May 26-27, 2025. The ant samples that had been preserved using 70% alcohol were then taken to the laboratory for identification. Observation and identification activities were carried out in Laboratory 2 of Biology Education, UIN Syarif Hidayatullah Jakarta. Identification was carried out using a stereo microscope to clarify the morphological appearance of the ants. Ant samples were identified from the subfamily level to the genus level.

Data analysis

Shannon-Wiener The level of species diversity was analyzed using the Shannon-Wiener Diversity Index formula.

$$H' = -\sum si = 1 (Pi \ln Pi)$$

Information:
H': Shannon-Wiener diversity index
ni: Number of individuals of each species
N: Total number of individuals of all species
Ln: Natural logarithm (natural number)

The value of the diversity index according to Shannon-Wiener ranges from 1-3 and can be categorized as follows (Indriani et al., 2009):

H’ = <1: Low level of diversity
H’ = 1-3: Medium level of diversity
H’ = > 3: High level of diversity

The dominance of a species in a community can occur among just one species, a few species, or a large number of species. This can be measured using a dominance index value, which indicates how high or low the level of dominance is (Indriyanto, 2015).

$$(ID) = \sum (ni/N) 2$$

Information:
ID = Dominance Index
ni = Type-i Importance Value Index
N = Total Important Value Index of all types

3. RESULTS AND DISCUSSION

Ant identification results in the Pangandaran Nature Reserve (CA) and Nature Tourism Park (TWA) areas showed four subfamilies, eleven genera, and a total of 7,350 ant individuals (Table 1). The subfamilies found included Formicinae, Dolichoderinae, Myrmicinae, and Pseudomyrmecinae. The Formicinae subfamily dominated the ant communities in both areas with the highest number of individuals, namely 6,381 individuals from five genera, or approximately 82.39% of the total collection.

The calculated value of the Shannon-Wiener diversity index (H') shows a significant difference in the level of ant diversity between the Nature Reserve (CA) and the Nature Tourism Park (TWA). The H' value in the CA is 1.28 indicating a moderate level of diversity, while the H' value in the TWA is only 0.42, which is considered low. The higher H' value in the CA reflects a more diverse ant community with a relatively even distribution of individuals across genera, although there is still dominance by the genus Anoplolepis.

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This indicates that the ecosystem in the CA is relatively stable and not too affected by anthropogenic disturbances. Conversely, the low H' value in the TWA indicates a very strong dominance by one genus, which indicates low species diversity and high environmental pressure. This condition can be caused by tourism activities, changes in vegetation cover, or other habitat disturbances.

A similar pattern was reported by Noor & Raffiudin, (2000) who found that disturbed ecosystems, such as tourism areas and agricultural lands, tend to exhibit lower Shannon–Wiener diversity index values and higher dominance of certain ant genera. Their study in the Telaga Warna Nature Reserve, West Java, showed that areas influenced by human activities had low diversity index values (H' ≈ 0.70) and strong dominance by a single genus, indicating high environmental pressure and habitat disturbance.

Table 1. Percentage of ants in each subfamily found in the Pangandaran nature reserve and nature tourism park

Subfamily	Number of Individuals	Genus	Percentage (%)
Formicinae	6097	5	82.39
Dolichoderinae	471	1	6.41
Myrmicinae	582	2	7.92
Ponerinae	53	2	0.72
Pseudomyrmecinae	147	1	2.0
Total	7350	11	99.44

The genera found in the Pangandaran Natural Reserve and Natural Park areas consist of 11 genera spread across five main subfamilies. The Formicinae subfamily is the group that dominates the ant population with a total of 6,097 individuals from 5 genera, contributing approximately 82.95% of the total. The Myrmicinae subfamily ranks second with 582 individuals from 2 genera, namely Crematogaster and Solenopsis, which cover 7.92% of the population. Furthermore, the Dolichoderinae subfamily is recorded to consist of 1 genus (Tapinoma) with 471 individuals or 6.41%. The Pseudomyrmecinae subfamily, represented by the Tetraponera genus, consists of 147 individuals or 2.00%. Finally, the Ponerinae subfamily consists of 2 genera, namely Odontoponera and Odontomachus, with a total of 53 individuals or 0.72%. This composition shows the high dominance of Formicinae, but the presence of other subfamilies also enriches the diversity of the ant community in this conservation area.

The dominance of the Formicinae subfamily in this study aligns with research by Putri et al., (2015), entitled "Ant Inventory in the Anai Valley Nature Reserve Conservation Area," which showed Formicinae as the subfamily with the largest number of species. This indicates that the Formicinae subfamily has a high adaptability to natural and semi-disturbed habitat conditions, especially in conservation areas with complex vegetation structures.

Table 2. Comparison of the number of ants in the Pangandaran nature reserve (CA) and nature tourism park (TWA) areas

No	Subfamily	Genus	CA	TWA
1	Formicinae	Anoplolepis	1.178	4.839
2		Camponotus	9	39
3		Plagiolepis	1	3
4		Prolasius	10	2
5		Polyrhachis	16	1
6	Ponerinae	Odontomachus	9	-
7		Odontoponera	29	13
8	Myrmicinae	Crematogaster	178	-
9		Solenopsis	311	93
10	Dolichoderinae	Tapinoma	54	368
11	Pseudomyrmecinae	Tetraponera	129	18

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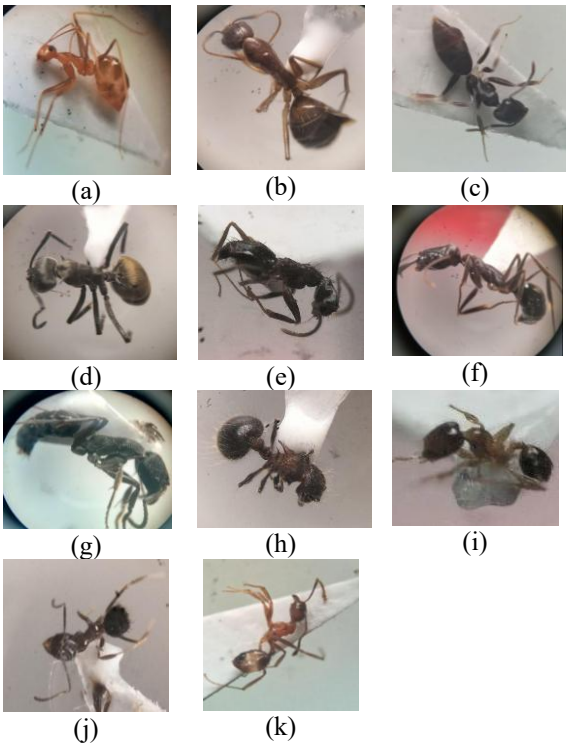


***Figure 1**. Morphology of ants found in the CA (Nature Reserve) and TWA (Tourism Park) areas of Pangandaran: (a) Anoplolepis, (b) Camponotus, (c) Plagiolepis, (d) Polyrhachis, (e) Prolasius, (f) Odontomachus, (g) Odontoponera, (h) Crematogaster, (i) Solenopsis, (j) Tapinoma, (k) Tetraponera

The results of the Shannon-Wiener diversity index (H') calculation show a significant difference in the level of ant diversity between the Nature Reserve (CA) and Nature Tourism Park (TWA) areas. The H' value in CA is 1.28 indicating a moderate level of diversity, while the H' value in TWA is only 0.46 which is considered low. The higher H' value in CA reflects a more diverse ant community with a relatively even distribution of individuals between genera. This can be seen from the distribution of the number of individuals involving many genera such as Crematogaster (178 individuals), Solenopsis (311), Tapinoma (54), and Tetraponera (129), in addition to the dominance of Anoplolepis (1,178).

In contrast, in TWA, the ant community is strongly dominated by a single genus, Anoplolepis, with 4,839 individuals, while other genera have much lower numbers of individuals, such as Camponotus (39), Solenopsis (93), and Tapinoma (368). This strong dominance by a single genus indicates low species diversity and high environmental stress. This condition is likely caused by tourism activities, changes in vegetation cover, or other habitat disturbances that hamper community stability and favor certain species that are more tolerant of disturbance.

The dominance of the genus Anoplolepis in the TWA area indicates an unbalanced ant community. This is consistent with the literature (Latumahina et al., 2014) entitled "*Abundance and Diversity of Ants in the Sirimau Protected Forest in Ambon*" which states that Anoplolepis is an invasive ant with a high number of individuals, capable of forming supercolonies, and easily dominating disturbed habitats. The presence of this invasive ant is generally associated with human activities and environmental changes, thus suppressing the presence of other genera. This condition results in low diversity and indicates environmental stress in the study area.

Table 3. Ant Genus Preferences Based on Bait Type

Genus	A	B	C	D	E
Anoplolepis	759	88	4.384	217	569
Prolasius	-	5	2	3	2
Plagiolepis	-	-	4	-	-
Odontomachus	3	4	2	-	-
Solenopsis	-	147	194	63	-
Tetraponera	10	34	100	21	-
Camponotus	14	3	17	-	14
Polyrhachis	-	-	-	1	16
Crematogaster	13	149	1	15	-
Tetraponera	10	34	82	21	-
Tapinoma	47	250	6	62	57

**A: Fish Bait, B: Granulated Sugar Bait, C: Brown Sugar Water, D: Detergent Water, E: Hand Collect*

Table 3 shows that Anoplolepis is very dominant with a total of 759 individuals in fish bait, followed by Tapinoma (47 individuals), and Camponotus (14 individuals). According to (Latumahina, *et al.*, 2014), Anoplolepis gracilipes has the characteristics of a brownish yellow color, a cylindrical abdomen, a slightly concave rear and fine spines, with a rounded thorax, and front antennae consisting of 11 segments (Aminullah, *et al.*, 2016). This species predominantly lives on moist soil surfaces. The condition of the area

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covered with vegetation and litter and exposed to the sun are supporting factors for the presence of the Formicidae family (Kaffah et al., 2019). According to Iqbal et al., (2014), Anoplolepis ants are predators of small insects such as thrips and mealybugs.

Crematogaster ants dominated the granulated sugar bait with 149 individuals, this is in accordance with the opinion of Iqbal et al., (2014) that Crematogaster sp. (Myrmicinae) is generally found on vegetation (plants) although it is also found above ground level. These ants are omnivorous, eating live and dead insects, grains, melons, fruits, plant exudates, and household food. Solenopsis, a type of tramp ant, was also found quite high in sugar bait with 147 and 194 individuals, and 63 individuals in detergent water. This reflects its opportunistic nature and adaptation to food sources in environments affected by human activity, as also stated by Way & Heong, (2002) and Way & Khoo, (1998).

The table of ant preferences based on bait type shows that Tetraponera and Odontomachus were found in the sugar bait, and Tetraponera was also found in the detergent water, with 34, 82, and 21 individuals, respectively. This indicates that these two genera prefer sweetness and protein. According to Toro et al., (2012), Tetraponera, Odontomachus, and other genera from the Ponerinae subfamily prefer protein, as indicated by their dominance in the fish bait in the study. Meanwhile, Anoplolepis (217 individuals), Solenopsis (63 individuals), Crematogaster (15 individuals), and Tapinoma (62 individuals) were also found in abundance in the detergent water. Although Anoplolepis dominated again, it is important to note that detergent is not the preferred bait, but rather serves as a trapping device (pitfall trap), so these results reflect general abundance rather than bait preference.

Subfamily Formicinae

1. Anoplolepis

Ants of the genus Anoplolepis dominate research findings, particularly in the Pangandaran Nature Tourism Park (TWA). Anoplolepis gracilipes has distinctive morphological characteristics, including a brownish-yellow body, a cylindrical abdomen with a slightly concave rear end and fine spines, a rounded thorax, and 11-segmented anterior antennae (Aminullah et al., 2016). The species Anoplolepis gracilipes is known as a species of ant that dominates soil surfaces with high humidity levels. Its presence often indicates ecosystems with specific environmental conditions that favor its activity.

Environments with dense vegetation, abundant litter, and direct exposure to sunlight are factors that support the presence of ants from the Formicidae family, including Anoplolepis gracilipes (Kaffah et al., 2019). According to Iqbal et al., (2014), this ant has a high adaptability, allowing it to survive and reproduce well in various habitats, particularly those that provide sufficient moisture and food sources. This adaptation makes Anoplolepis gracilipes a competitive species with the potential to dominate ant communities in certain environments.

2. Camponotus

Ants belonging to the genus Camponotus exhibit common morphological characteristics, namely a body size ranging from 10 to 12 mm. These ants have a single, flat petiole, with a rough or abrasive body surface, including the head and pedicel. The ant's mandibles are short, triangular, while the abdomen exhibits longitudinal lines with clearly visible basal intersegmental structures. The ant's head is square, and its nest is typically built in the ground under vegetation. (Arsyad, 2004)

Camponotus are small ants that nest in old, defoliated trunks. These ants utilize crumbs as a food source. They also feed on dead insects. Nests of this type of ant are often found in large areas, including covered or uncovered soil, among rocks, logs, plant roots, and twigs of bushes or trees. This is in accordance with research that the genus Camponotus is found in abundance in fish bait and brown sugar, which indicates that these ants like food crumbs as a source of energy.

3. Prolasius

Prolasius is a small, brown to black ant with long antennae. It lives in small colonies in litter or low bushes. This ant is omnivorous, consuming sweet honeydew and nectar, and utilizing dead insects as a protein source (Siriyah, 2016). Furthermore, Prolasius is quite sensitive to changes in humidity and temperature, making it an indicator of microclimate changes. This is consistent with research showing that Prolasius are often found in the Pangandaran nature reserve,

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with a temperature of 29.3°C, which has not experienced significant changes in the area.

Its habitat includes litter, moist soil, and secondary forest with moderate to dense vegetation (Hansen & Greenslade, 2021). The presence of Prolasius in ant communities can support the decomposition of organic matter and aid in the distribution of small plant seeds. They are also known to contribute to the balance of ant communities because they are not as aggressive as Anoplolepis, allowing them to coexist with other genera.

4. Plagiolepis

In this study, only four individuals of Plagiolepis were found on brown sugar bait in a nature reserve (CA). The number of Plagiolepis can be influenced by food availability and suitable environmental conditions. This aligns with Robinson, (2014) statement, which states that ant activity and reproduction are determined by a suitable environment and sufficient food sources.

Plagiolepis sp. prefers areas with higher temperatures. This statement aligns with the environmental conditions in the plots. Environmental factor measurements indicated an air temperature of 30°C, which is considered high. Furthermore, *Plagiolepis* sp. is classified as an invasive ant species due to its widespread distribution and ability to reduce other ant populations. *Plagiolepis* sp. is able to control its home range using a chemical compound called formic acid, which it uses to obtain carbohydrates and amino acids from plant nectar. *Plagiolepis* sp. is an ant that nests in the soil, trees, and dead wood.

5. Polyrachis

The genus Polyrhachis is a group of ants in the subfamily Formicinae that are widely distributed in tropical and subtropical regions, particularly in Southeast Asia and Australia, with habitats ranging from rainforests and scrublands to tall trees. These ants are known for their distinctive morphology, such as prominent pronotal or mesonotal spines and relatively shiny, medium-sized bodies. Polyrhachis are arboreal or terrestrial, depending on the species, and often construct nests from materials such as soil, plant fibers, or even larval silk. Dietarily, these ants are omnivorous—they feed on nectar, the sweet secretions of aphids (honeydew), and small insects as a source of protein. Although research findings indicate that Polyrhachis are mostly found using hand collection methods and not pitfall traps, these ants do have distinct dietary preferences. A study by Andersen et al., (2013) identified the diversity of Polyrhachis species in Asia and described their association with specific microhabitat environments, confirming the importance of this genus in the ecosystem as a predator and seed disperser.

Subfamily Myrmicinae

1. Crematogaster

According to Loken & Oliver, (2016), *Crematogaster* sp. is characterized by habitats rich in vegetation, such as mountain forests, under rocks, and on twigs. As a predator, Crematogaster also plays a crucial role in controlling pest populations by preying on a variety of small insects, including larvae and other harmful insects. The ecological role of Crematogaster ants is crucial in maintaining ecosystem balance. They function as biological control agents by preying on plant pests, where the presence of these ants can suppress populations of destructive insects (Prayoga et al., 2021).

2. Solenopsis

Solenopsis is a type of tramp ant known for its high adaptability to environments that have been disturbed or altered by human activity. The presence and activity of tramp ants like Solenopsis often negatively impact the diversity of other local ant species, as this species tends to be more aggressive and competitive in competing for resources, especially food, leading to a decline in the number of native ants, which lose out in this competition.

Based on research conducted by Way & Heong, (2002) and Way & Khoo, (1998), it was discovered that *Solenopsis* sp. is a species of ant frequently found in rice fields, where it plays an important role as a natural predator that preys on various types of small pests, thus indirectly helping to control agricultural pest populations in the area. Interestingly, in addition to demonstrating its ecological role as a predator in agricultural habitats, Solenopsis was also detected in traps using brown sugar water and a combination of sugar and detergent water as bait, indicating that this ant has opportunistic and flexible feeding behavior. This strengthens the evidence that Solenopsis is able to utilize various

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food sources available in environments that have been affected by human activities, both natural and artificial, thus making it one of the most adaptive and dominant tramp ant species in various types of disturbed habitats.

Subfamily Ponerinae

1. Odontoponera

Odontoponera is a genus of medium-sized ants, with workers measuring 9–12 mm and queens measuring 11–13 mm. This species has short mandibles and legs, is unable to climb smooth surfaces, and is dark red to black in color. They have stingers and live on the ground, typically nesting in forests, soil, or embankments due to their adaptability to a variety of environments (Putra et al., 2017). Odontoponera worker ants are classified as epigeic, meaning they are active on the ground, with a generalist predatory and scavenger diet. They frequently prey on termites and make ants and termites a large part of their food source (AntWiki, 2023).

2. Odontomachus

Odontomachus are predatory ants that play a vital role in ecosystems, such as preying on other insects, assisting in seed dispersal, and loosening the soil (Amalia & Chairunnas, 2023). This study found that only 9 individuals of *Odontomachus* sp. were found in the Nature Reserve (CA) and none in the Nature Tourism Park (TWA). This indicates that environmental conditions in the CA are more favorable for the presence of *Odontomachus* sp. than in the TWA.

Based on bait type, Odontomachus were found in three types of traps: 3 individuals caught on fish bait, 4 individuals on sugar bait, and 2 individuals also caught on sugar bait. This finding suggests that, despite being known as a predator, Odontomachus is also responsive to sweet bait, likely due to its flexible foraging behavior in its natural environment.

According to Handayani & Winara, (2020), the presence of Odontomachus in the CA is thought to be closely related to the shrubby vegetation that dominates the area, which also provides habitat for soil fauna such as termites and earthworms. These animals are potential prey for *Odontomachus* sp. Conversely, the absence of these ants in the TWA is likely due to habitat disturbance from tourism activities, which leads to reduced bush cover and reduced prey availability.

Subfamily Dolichoderinae

1. Tapinoma

Tapinoma sp. are ants found on the soil surface. These small ants measure approximately 0-3 cm in length and have a blackish-brown body. Their distinctive feature is their abdomen (gaster) that directly covers the petiole, making them appear completely hidden when viewed from above. Furthermore, according to Abdullah et al., (2025), these ants build nests by digging holes in the soil surface. Tapinoma sp. natural nests are found on the soil surface, consisting of small holes dug above the surface. Besides being found on the soil surface, they have also been found in rotting mango branches.

In research conducted by Abudllah et al., (2023), Tapinoma sp. were studied on chili plants. The results showed that the ant population increased dramatically when fed with sugar solution or sweet artificial bait. These ants are omnivorous but particularly prefer sugar sources such as honey, nectar, or nectar from Homoptera insects. This is consistent with research showing that 250 Tapinoma ants were found on granulated sugar bait (Table 3). Tapinoma sp. spread in many places such as soil, under rocks, dead wood, even inside buildings, this is because they are very adaptive to the environment, able to move nesting locations regularly.

Subfamily Pseudomyrmecinae

1. Tetraponera

The genus Tetraponera is a group of arboreal ants that specialize in feeding on plant tissue. Ants in this genus are often found damaging vegetative plant parts such as stems, twigs, and leaves, as they forage and build nests (Holldobler & Wilson, 1990). Tetraponera ants are often found in agricultural and plantation areas, presumably because cultivated plants are a primary choice as hosts. Furthermore, this genus also shows a preference for fruit-bearing plants, which likely provide optimal food sources and nesting sites.

Table 4. Environmental Parameters in the Nature Tourism Park Area of Pangandaran

Parameter	Average
Temperature	29,3 °C
Soil pH	7
Light Intensity	821,3 Lux
Wild Intensity	0 km/h

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Table 5. Environmental Parameters in the Pangandaran Nature Reserve Area

Parameter	Average
Temperature	30°C
Soil pH	7
Light Intensity	7.336 Lux
Wild Intensity	1.9 km/h

The average abiotic parameters indicate differences in environmental conditions between the Nature Reserve (CA) and the Nature Tourism Park (TWA), which may influence the diversity and activity of ant communities in each location. The temperature in the CA was recorded at 30°C, slightly higher than the TWA, which had an average temperature of 29.3°C. This temperature difference may impact the metabolism and daily activities of ants, given that ants are poikilothermic animals whose activity is strongly influenced by environmental temperature.

The soil pH in both areas was recorded as neutral, at 7. This neutral pH is optimal for various types of soil organisms, including ants, to carry out biological activities such as foraging and nest building. Despite the similar pH values, other abiotic parameters showed significant differences, particularly in light and wind intensity.

Similar results were also found in a study by Setiawan et al., (2024), in the Baluran National Park area, which showed that temperature, humidity, and soil pH play an important role in supporting the presence of ant communities. In the Evergreen area, the average temperature reaches 30°C with 69% humidity and neutral soil pH (7), which provides optimal conditions for ant development. Meanwhile, the Bekol Savanna area, with a temperature of 31°C and 46% humidity, shows less ideal conditions. These findings are consistent with conditions in the Pangandaran Nature Reserve, which has similar temperature and soil pH levels, namely 30°C and pH 7, and is supported by stable light intensity and wind, thus allowing the formation of microhabitats that support ant diversity (Setiawan et al., 2024).

4. CONCLUSION

The results of the study indicate that habitat fragmentation affects the diversity and structure of ant communities in Pangandaran Nature Reserve and Nature Tourism Park. The Nature Reserve (CA) area has a low Shannon-Wiener diversity index (H') value (1.28) with a relatively even distribution of individuals between genera, reflecting a stable ecosystem condition with low anthropogenic pressure. A total of 11 genera from 5 subfamilies were found, with Formicinae dominating but still followed by the presence of other genera such as Crematogaster, Oecophylla, and Tetraponera indicating an ecosystem that supports the coexistence of various types of ants. This is supported by environmental parameters in the CA that still vary such as light intensity, temperature, and the presence of wind that allow the formation of microhabitats supporting the diversity of ant species.

In contrast, the Nature Tourism Park (TWA) showed a low diversity index value (0.30–0.46), with a very high dominance of the genus Anoplolepis, which reached more than 80% of the total individuals netted. This condition indicates high environmental pressure due to tourism activities, changes in vegetation cover, and habitat disturbance that favor the dominance of invasive species and suppress other species. Habitat fragmentation and microhabitat changes in the TWA have impacted the homogenization of the ant community, reducing diversity and ecosystem function related to the ecological role of ants as bioindicators of ecosystem health. These data emphasize the importance of sustainable habitat management and protection efforts to maintain the stability of the ant community and support biodiversity conservation in the Pangandaran area.

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