DOI :https://doi.org/10.36378/juatika.v5i1.2686
JUATIKA
JURNAL AGRONOMI TANAMAN TROPIKA
VOL. 5 NO. 1 January 2023
eissn 2656-1727
pissn 2684-785X
Hal : 193 – 206

Ant Community Structure in Palm Oil Plantation Bordering Secondary Forest

Arlen Hasan[1], Siska Efendi[1*], Yaherwandi[1], Awaluddin[2]
[1)]Agroecotechnology, Faculty of Agriculture,
Kampus III Andalas University in Dharmasraya. Jl. Lintas Sumatera Km 4 Pulau Punjung, Dharmasraya, West Sumatera 27612
[2)] Department of Plant Protection, Faculty of Agriculture,
Halu Oleo University Kendari
*e-mail: siskaefendi@agr.unand.ac.id

ABSTRACT

Deforestation or change of function from forest to non-forest plays a significant role in changing ecosystems and species. As one of the faunas in the forest, insects are an interesting aspect to be studied, especially ants. The research was conducted in Nagari Gunung Selasih and Sungai Kambut, Pulau Punjung District, Dharmasraya Regency, West Sumatra, from November 2017 to January 2018. The objective of this study aims to determine the diversity of ants in the palm oil plantation ecosystem bordering the forest ecosystem. This research takes the form of a survey using the Purposive Random Sampling method for the sampling point. Hand Collecting, Bait Trap, and Pitfall Trap sampling methods were applied for each plant. The air temperature is measured using an analog thermometer and humidity measurements with an analog hygrometer. The sample identification was obtained at the Animal Taxonomy Laboratory, Department of Biology, Faculty of Mathematics and Natural Sciences, Andalas University, Padang. The total ants (Hymenoptera: Formicidae) collected during the study were 3,046 individuals consisting of 5 subfamilies, 15 genera, and 29 species. The most dominant species was Anoplolepis gracillipes (F. Smith, 1857), followed by Odontoponera denticulate (F. Smith, 1858) and Odontomachus simillimus F. Smith, 1858. Based on the study's results, it can be concluded that the vast and diverse ant species are not directly affected by the distance from the forest ecosystem. Still, the composition of environmental factors such as temperature, humidity, light intensity, altitude, and management of existing habitats and vegetation strongly influences it.

Keywords: *Formicidae; Deforestation; Pests; Predator; Hymenoptera*

1. INTRODUCTION

The development of palm oil plantations yearly shows a significant increase in Indonesia. West Sumatra Province is one of the palm oil-producing provinces in Indonesia. Of the 19 regencies/cities in West Sumatra, 10 regencies and 3 cities produce palm oil plantations, with an annual production of 1.184.692,79 tons, 568.680,41 tons, 554.310 tons, and 567.930 tons during 2017-2020. The largest palm oil-producing districts in West Sumatra are Pasaman Barat and Dharmasraya, with total productions of 290.160 tons and 77.280,00 tons in 2015 (BPS West Sumatra, 2020). The government of West Sumatra has made many efforts to increase palm oil production. One of these efforts is through an extensification program by increasing the area of palm oil plantations. As the Dharmasraya Regency government did in 2020, it increased the area of palm oil plantations by 753 ha (BPS Dharmasraya, 2021).

Efforts to increase the area of palm oil plantations by clearing forest areas are expected to be a driving force to increase palm oil production. However, on the other hand, the forest's conversion to palm oil plantations causes many negative environmental impacts. One of the impacts of these activities is the reduction of biodiversity. Deforestation or changes in the forest's function into plantations also change ecosystems and species in the woods. As one of the existing fauna, insects are essential to study further (Yenti et al., 2020). Ants are insects with a reasonably stable population throughout the seasons and years. Their large and consistent numbers make ants one of the most crucial insect colonies in forest and agricultural ecosystems.

Because of their abundance, essential functions, and complex interactions with the ecosystems they inhabit. Ants are often used as bio-indicators in environmental assessment programs, such as forest fires, disturbance to vegetation, logging, mining, waste disposal, and land use factors (Yaherwandi *et al.* 2019; Romarta *et al.* 2020).

Habitat changes and disturbances can change the composition of existing ant species, affecting changes in trophic interactions and food webs in the ecosystem (Philpott et al., 2010). Rubiana (2014) states that the modification and transformation of habitat from forest to rubber and palm oil plantations cause changes to the structure of the ant community. Alamsari (2014) reported that ant diversity in palm oil plantations is considered higher than in rubber plantations, secondary forests, and primary forests and is dominated by predatory and omnivorous ants. The presence of predatory and omnivorous ants in an ecosystem can suppress insect pest populations because ants are predators with a wide range of prey (Melketa et al., 2022).

The role of ants in their natural habitat can have positive and negative effects on animals and humans. The positive ones are as predators, helping in organic matter decomposition, helping in pest controlling, and even helping pollination (Hakiki et al., 2020). Ants might not be viewed as economically beneficial to humans, but ecologically they are beneficial for other animals and plants since ants have a significant role in the food chain. Predators are the animals that kill, prey on, and consume whole or part of their prey, and they need a lot of quarries to continue to grow (Price et al., 2011).

Therefore, the diversity of predatory insects in an ecosystem is crucial to identify, especially in suppressing the insect pest population through biological control. An ecosystem's greater variety of predators can reduce yield losses due to insect pests (Furlong & Zalucki, 2010). Several oil palm pests that prey on ant predators, especially *Oecophylla smaragdina* (F), are *Setora nitens* and *Sethosea asigna*, while the bagworm species they prey on is *Brachycyrtta griseus* (Falahudin, 2011). Widihastutya et al. (2020) reported that Myopopone Castanea ants are predators of the larvae of the pest *Oryctes rhinoceros*. The existence of the same life niche between *M. Castanea* ants and *O. rhinoceros* larvae opens up excellent opportunities to utilize these ants as biological agents.

Fayle et al. (2010) research show that land conversion from primary forest to palm oil plantations can cause changes in predatory insect diversity, especially ants. Ants are significant predators and protect crops from pests if adequately understood and studied (Philpott & Armbrecht, 2006). This research aims to explore the diversity of ants in the palm oil plantation ecosystem bordering the forest ecosystem.

2. MATERIALS AND METHODS

Determination of research locations and sample plots

This research was conducted in Nagari Gunung Selasih and Nagari Sungai Kambut, Pulau Punjung District, Dharmasraya Regency. The Purposive Random Sampling method is used to determine the location of the study. The systematic Random Sampling technique is employed in determining the sample plants. The transect method determined sample plots in the palm oil and forest ecosystems. The transect length in the palm oil plantation ecosystem is 1 km. On this line, 10 sample plots were determined with the distance between plots 100 m. In the forest ecosystem, one sample plot was set 100 m distance from the edge of the forest with the size of 2 m x 2 m. The determination of sample plots in the forest illustrates ant diversity in natural ecosystems and as a source of ant diversity in oil palm plantations. It is assumed that one plot already represents the ant diversity situations in the ecosystem

Insect sampling

In the sample plots that have been determined, sampling is carried out 2 (two) times, with an interval of 15 days. Sampling was carried out using Hand Collecting, Bait Trap, and Pitfall Trap methods. The ants found in the sample plants were collected directly using hands, brushes, or tweezers. The collected insects were stored in collection bottles that had been filled with 96% alcohol. The Bait Trap Method (BT) used canned fish as bait. The bait is wrapped in paper, hung on the sample plant, and incubated for 15 minutes. The ants on the bait were then put into a collection bottle containing 96% alcohol (Romarta et al., 2020). The Pitfall Trap (PT) method is a glass-shaped trap with a 15 cm top diameter, an 8 cm bottom diameter, and a 20 cm height. The trap is installed in the ground with the surface position parallel to the ground surface. The trap is filled with water mixed with detergent as much as 1/3 of the trap. The traps that have been installed are incubated for 24 hours.

The collected insects were stored in collection bottles filled with 96% alcohol.

Ant Identification

The collected ants were identified using a stereomicroscope in the Laboratory. Identification is carried out at the species level, referring to Bolton (1994), Antwiki (2017), Nazarreta *et al.* (2021).

3. RESULTS AND DISCUSSION

Ant Abundance Based on Research Location

The total ants (Hymenoptera: Formicidae) collected during the study were 3,046 ants consisting of 5 subfamilies, 15 genera, and 29 species. The ant abundance in each location is 943 individuals and 23 species in Kampung Surau, 692 individuals and 20 species in Kubang Panjang, 517 individuals and 15 species in Muaro Mau, and 894 individuals and 16 species in Muaro Momong (Table 1).

Table 1. Ant Abundance Based on Research Location

Subfamily / Spesies	**Gunung Selasih**		**Sungai Kambut**	
	***KS**	***KP**	***MM**	***MMg**
Dorylinae				
Dorylus laevigatus (F. Smith, 1857	10	0	0	0
Formicinae				
Anoplolepis gracillipes (F. Smith, 1857)	272	118	119	318
Camponotus (Tanaemyrmex) sp. 1	0	11	11	11
Camponotus (Tanaemyrmex) sp. 2	5	0	0	0
Colobopsis leonardii (Emery, 1889)	0	0	25	18
Colobopsis saundersi (Emery, 1889)	1	0	0	0
Colobopsis sp.	21	0	0	0
Dinomyrmex gigas (Latreille, 1802)	5	4	0	0
Polyrhachis (Myrma) illaudata (F. Smith, 1858)	14	6	4	57
Polyrhachis (Myrma) sp. 1	0	1	0	0
Polyrhachis (Myrma) sp. 2	15	1	0	3
Polyrhachis (Myrmhopla) abdominalis F. Smith, 1858	11	8	16	4
Myrmicinae				
Carebara affinis (Forel, 1915)	1	1	0	3
Cataulacus hispidulus F. Smith, 1865	0	0	15	0
Crematogaster (Crematogaster) borneensis Andre, 1896	1	17	12	3
Crematogaster (Crematogaster) rogenhoferi Mayr, 1879	59	133	82	51
Crematogaster (Orthrocrema) longipilosa Forel, 1907	1	3	0	127
Pheidole longipes (Latreille, 1802)	157	6	0	0
Pheidole plagiaria F. Smith, 1860	75	75	27	35
Pheidole sp.	0	5	1	0
Ponerinae				
Brachyponera pilidorsalis (Yamane, 2007)	2	0	0	0
Brachyponera sp.	1	4	0	0
Diacamma holosericum (Roger, 1860)	0	0	2	3
Leptogenys cf. peqeuti (Andre, 1887)	20	2	0	0

Odontomachus rixosus (F. Smith, 1857)	24	26	36	28
Odontomachus simillimus F. Smith, 1858)	38	129	117	162
Odontoponera denticulate (F. Smith, 1858)	150	117	34	37
Odontoponera transversa (F. Smith, 1857)	59	25	16	34
Pseudomyrmicinae				
Tetraponera pilosa (F. Smith, 1858)	1	0	0	0

*Note: KS=Kampung Surau; KP=Kubang Panjang; MM=Muaro Mau; MMg=Muaro Momong

Table 1 shows that the species *A. gracillipes* had the highest abundance, followed by *Odontomachus simillimus* and *Odontoponera denticulata*. These three species are "tramp" species that easily adapt to disturbed areas or areas with heavy human activities such as plantations. *A. gracilipes* is known by the common name "Yellow Crazy Ant." *This species* is aggressive towards other ant species and is commonly involved in deadly fights. In addition, these ants excel in number dominance because they have a somewhat large population. A large population can suppress local population growth leading to the loss of local species in an area (Bahagiawati et al., 2010)

Based on this research data, the species *Dorylus laevigatus*, *Camponotus (Tanaemyrmex) sp. 2*, *Colobopsis saundersi*, *Colobopsis sp*, *Polyrhachis (Myrma) sp. 1*, *Cataulacus hispidulus*, *Brachyponera pilidorsalis*, and *Tetraponera pilos* are rare species and only found in one location. These species existence in the ecosystem is affected by more dominating tramp species that can move and make nests easily (Latumahina, 2011). In contrast, the rarely-found species are only found in ecosystems with suitable climatic components and food sources (e.g., honeydew, flower nectar from surrounding vegetation, or folate compounds produced by palm oil plants flowers that can invite certain species) to support their lives.

Figure 1. a) *Dorylus laevigatus* (F. Smith, 1857, b) *Anoplolepis gracillipes* (F. Smith, 1857), c) *Colobopsis sp.*, d) *Camponotus (Tanaemyrmex) sp. 1*, e) *Camponotus (Tanaemyrmex) sp. 2*, f) *Dinomyrmex gigas* (Latreille, 1802), g) *Colobopsis leonardii* (Emery, 1889), h) *Colobopsis saundersi* (Emery, 1889), i) *Polyrhachis (Myrma) illaudata* (F. Smith, 1858)

Ant Community Based on Distance from Forest Ecosystem

The number of ants collected from the forest ecosystem is 721 individuals and 18 species. The abundance figure was varied according to the distances from the forest ecosystem. The largest number was found at 900 m from the forest, that is, 285 ants and 13 species. In comparison, the lowest one was identified at a distance of 1000 m from the forest, with 153 ants and 13 species (Table 2).

The highest number of species (16) is found at 500 m from the forest, and the lowest one (10) is at a distance of 200 m. Based on the number of ants found, the highest number was 285 at a distance of 900 m from the forest, in which many Agracillipes were found. The lowest one was 153 at a distance of 1000 m from the forest, where only 63 *Agracillipes* were located. It is certain that at different distances from the forest, the availability of hosts and environmental conditions have a considerable role in the abundance of certain insects (Rizali et al., 2008).

Table 2. Ant Community in Palm Oil Plantation at Various Distances from Forest Ecosystem

Subfamili / Spesies	Jarak dari Hutan (m)										
	Hutan	100	200	300	400	500	600	700	800	900	1000
Dorylinae											
Dorylus laevigatus (F. Smith, 1857	0	0	0	0	0	0	0	10	0	0	0
Formicinae											
Anoplolepis gracillipes (F. Smith, 1857)	113	147	54	56	12	68	35	90	54	136	62
Camponotus (Tanaemyrmex) sp. 1	0	1	0	1	0	1	20	10	0	0	0
Camponotus (Tanaemyrmex) sp. 2	0	2	0	0	0	1	0	0	0	0	2
Colobopsis leonardii (Emery, 1889)	15	0	1	0	17	8	0	0	1	0	1
Colobopsis saundersi (Emery, 1889)	1	0	0	0	0	0	0	0	0	0	0
Colobopsis sp.	0	0	0	0	0	0	0	2	0	0	19
Dinomyrmex gigas (Latreille, 1802)	9	0	0	0	0	0	0	0	0	0	0
Polyrhachis (Myrma) illaudata (F. Smith, 1858)	11	9	9	7	2	17	10	5	1	5	5
Polyrhachis (Myrma) sp. 1	1	0	0	0	0	0	0	0	0	0	0
Polyrhachis (Myrma) sp. 2	1	1	1	2	1	0	2	0	1	7	3
Polyrhachis (Myrmhopla) abdominalis F. Smith, 1858	7	13	0	2	1	0	5	1	2	4	4
Myrmicinae											
Carebara affinis (Forel, 1915)	0	0	0	3	0	0	1	0	1	0	0
Cataulacus hispidulus F. Smith, 1865	0	0	2	0	0	0	13	0	0	0	0
Crematogaster (Crematogaster) borneensis Andre, 1896	0	0	0	0	3	0	10	0	1	19	0
Crematogaster (Crematogaster) rogenhoferi Mayr, 1879	229	0	0	0	0	0	0	0	84	12	0
Crematogaster (Orthrocrema) longipilosa Forel, 1907	9	15	15	3	7	23	13	1	18	27	0
Pheidole longipes (Latreille, 1802)	158	1	0	0	0	2	1	0	0	1	0
Pheidole plagiaria F. Smith, 1860	17	14	14	18	22	81	25	3	11	0	7
Pheidole sp.	0	0	0	0	0	2	0	1	2	1	0
Ponerinae											
Brachyponera pilidorsalis (Yamane, 2007)	0	0	0	0	0	1	0	1	0	0	0
Brachyponera sp.	0	2	0	0	0	2	0	0	0	0	1
Diacamma holosericum (Roger, 1860)	3	1	0	0	0	0	1	0	0	0	0
Leptogenys cf. pequeti (Andre, 1887)	7	0	0	12	0	0	0	3	0	0	0
Odontomachus rixosus (F. Smith, 1857)	7	1	1	6	53	13	2	4	4	1	22
Odontomachus simillimus F. Smith, 1858	26	25	93	28	68	12	41	62	45	41	5
Odontoponera denticulate (F. Smith, 1858)	42	30	48	33	27	37	40	53	8	3	17
Odontoponera transversa (F. Smith, 1857)	65	7	0	3	3	3	0	18	2	28	5
Pseudomyrmicinae											
Tetraponera pilosa (F. Smith, 1858)	0	0	0	0	0	1	0	0	0	0	0

Based on the data in Table 2, it can be seen that the distance from the forest ecosystem is not the main factor affecting the ants' presence. It can be observed from the data gained that several species are found at the closest distance to the forest and rediscovered at the furthest distance from the forest or even only located at a certain distance from the forest ecosystem.

According to Febriani *et al.* (2020), the arrival of insects to a place can come from planted plants or naturally growing plants around the experimental land (host plants). Another factor that may spur ants' presence is ants' ability to walk in the footsteps of their species. The ability to follow this trail is due to guiding pheromones in their systems. According to Borror *et al.* (1992), insects have trail-guiding pheromones to guide their species to find food sources.

Figure 2. a) *Polyrhachis (Myrma) sp. 1*, b) *Polyrhachis (Myrma) sp. 2*, c) *Polyrhachis (Myrmhopla) abdominalis* F. Smith, 1858., d) *Carebara affinis* (Forel, 1915), e) *Cataulacus hispidulus* F. Smith, 1865, f) *Crematogaster (Crematogaster) borneensis* Andre, 1896, g) *Crematogaster (Crematogaster) rogenhoferi* Mayr, 1879, h) *Crematogaster (Orthrocrema) longipilosa* Forel, 1907, i) *Pheidole longipes* (Latreille,1802)

A. gracilipes is a species with a very high frequency of presence and appears at any distance from the forest ecosystem. According to Bolton (1994), *A. gracilipes* is found on tree stems and leaves and shrubs in dryland agricultural areas, so the abundance and frequency of this species are very high compared to other species. *A. gracilipes* has the highest ants quantity due to its wide foraging area, so it is called a scavenger predator because it preys on various fauna in the litter and canopy (small isopods, myriapods, mollusks, arachnids, and soil insects). The abundance of *A. gracilipes* is higher than other species because it has a wide foraging area high ability to form supercolonies so that it spreads over a wide area (10-150 ha) with a density of up to 20 million workers/ha. Each nest contains an average of 4000 ants roughly. The working caste ant produces continuously, although it fluctuates, throughout the year. This species can also adapt to various habitats in agricultural areas and plantations. The worker's caste ants are very large, reaching 4,000 ants per colony, making this species have a high survival ability, very densely populated colonies, and can form large colonies in open ground, under rocks, and rotten wood. On the ground, especially those close to human activities can survive in highly disturbed areas (Passera, 1994). This species can adapt and spread widely in agricultural areas, affecting the composition of native ants that live in agricultural areas.

Figure 3. a) *Pheidole plagiaria* F. Smith, 1860, b) *Pheidole sp.*, c) *Brachyponera pilidorsalis* (Yamane, 2007), d) *Brachyponera sp.*, e) *Diacamma holosericum (*Roger, 1860), f) *Leptogenys cf. peqeuti* (Andre, 1887), g) *Odontomachus rixosus* (F. Smith, 1857), h) *Odontomachus simillimus* F. Smith, 1858, i) *Odontoponera denticulate* (F. Smith, 1858), j) *Odontoponera transversa* (F. Smith, 1857), k) *Tetraponera pilosa* (F. Smith, 1858)

Furthermore, from this study, several species are only found at a certain distance from the forest ecosystem. *Dinomyrmex gigas* and *Colobopsis saundersi* are the species found only in forest ecosystems and not found in palm oil plantations. These two species belong to the same genus, the Componotus, so they have almost the same characteristics. From this study, the two species were only found in forest ecosystems. *D. gigas* is the largest ant and is widely distributed in Southeast Asia forests, one of which is the forest on the island of Sumatra. These ants consume insects and bird droppings, so these ants are often found in the woods because of the availability of food sources (Atwiki, 2017).

The species *Dorylus laevigatus* was only found at a distance of 700 m from the forest ecosystem and was not found in the forest ecosystem. The same result was also reported by Rubiana (2014) that this species is only found in palm oil ecosystems; this is thought to be due to environmental factors such as temperature and humidity. High temperatures and high sunlight intensity during the day cause the soil temperature to increase so that the soil becomes dry, so these ants will come out to the ground to find food. Biologically, this species is subterranean; it is in the soil and is carnivorous.

Furthermore, *Tetraponera pilosa* was only found at a distance of 500 m from the forest. At a distance of 500 m from the forest, palm oil plants bloom; the folate compounds produced by these flowers attract *T. pilosa*. Then based on biology, this species is arboreal, living on trees—supported by Suwondo's (2007) opinion that food availability can determine abundance so that it affects the species found in the area.

Ant Diversity and Evenness Index

Table 4 shows that the diversity index at the four research sites is almost the same, namely 2.23 in Surau Village, 2.17 in Kubang Panjang, 2.19 in Muaro Mau, and 2.02 in Muaro Momongan. The ant diversity index in this study was included in the medium category>1 and <3. The index of ant diversity in this ecosystem is moderate because the ant community comprises many individuals with almost the same abundance of individuals. Only a few species are dominant, so the species diversity is moderate.

Furthermore, based on several distances from the forest ecosystem, the highest diversity index is at a distance of 600 m, which is 2.25, and the lowest is at a distance of 200 m, which is 1.6. The highest evenness index at a distance of 600 m is 0.87, and the lowest at a distance of 1 m is 0.67. While the highest dominance index at a distance of 100 m is 0.33, and the lowest is 0.13 at a distance of 600 m.

Table 3. Number of Species (S), Number of Individuals (N), Diversity Index (H'), dan Evenness Index (E) of Ants at the Research Site

Index	Research Site			
	Kampung Surau	Kubang Panjang	Muaro Mau	Muaro Momong
S	23	20	15	16
N	943	692	517	894
H’	2.23	2.17	2.19	2.02
E	0.85	0.85	0.85	0.81

According to several distances from the forest ecosystem, this study's ant diversity index is almost the same, ranging from 1.6 to 2.1. It is included in the moderate category >1 and <3. The lowest diversity and evenness index is found at a distance of 100 m from the forest ecosystem, with the highest dominance index value of 0.33. Asih *et al.* (2021) support this opinion that diversity and evenness will be of high value if the dominance index value is relatively low and vice versa. An ecosystem with high dominance indicates that the species dominate the area, which results in low diversity and evenness for other species. Dominant species to other species will consume more food, occupy more space for reproduction, and require more space, which affects the distribution of different species.

Table 4. Number of Species (S), Number of Individuals (N), Diversity Index (H'), Evenness Index (E), and Dominance Index (D) of Ants in Palm Oil Plantations Bounded by Forest Ecosystems

Index	Distance From Forest (m)										
	Forest	**100**	**200**	**300**	**400**	**500**	**600**	**700**	**800**	**900**	**1000**
S	18	15	10	13	12	16	15	15	15	13	13
N	721	269	238	174	216	272	219	264	235	285	153
H'	2.02	1.64	1.60	1.98	1.89	1.99	2.25	1.82	1.79	1.73	1.92
E	0.81	0.67	0.75	0.82	0.80	0.81	0.87	0.78	0.77	0.73	0.78
D	0.19	0.33	0.25	0.18	0.20	0.19	0.13	0.22	0.23	0.27	0.22

At 100 m from the forest ecosystem, a location is considered very close to the forest, so the level of diversity, both vegetation as a place to live and a source of food, is at this distance because it is almost the same as a forest ecosystem. In general, forests transformed into palm oil plantations do not originate from primary forests but from secondary forests, i.e., forests that have been cut down or damaged in various ways. Therefore, it is not surprising that the species richness in palm oil plantations at a distance of 100 m from the forest is a combination of ant species that have adapted to the transformed habitat so that the dominance index is high at the closest distance to the forest.

Ant Importance Value Index (INP) in Forest Ecosystems and Palm Oil Plantations

The Importance Value Index (INP) of ants in forest ecosystems and some distances from forest ecosystems has various values ranging from 0.01 to 0.50. 3 (three) species have the highest INP values, *A. graciliphes*, *O. denticulate*, and *O. simillimus* (Table 5). *A. graciliphes* has the highest INP value because this species is one of the invasive ants. Invasive ants normally enter a new habitat and dominate it. As a result of the invasion, environmental changes are detrimental to the native species because the new ants will compete with the native species. Invasive species can replace or reduce the abundance of native species, slowly changing the biological interactions and native ecosystem function and organizational structure (Holldobler & Wilson, 1990). This species has high aggressiveness, is active during the day and night, and can join other ant colonies. Therefore, with its invasive nature, many species of *A. graciliphes* are found in the field.

O. denticulata was found at all study sites and some distance from the forest ecosystem. According to Yamane (2009) *O. denticulata* prefers a more open place and *O. denticulata* is more commonly found in areas with a lot of human activity, such as agricultural areas, gardens, and yards. According to (Rizali *et al.* (2008) that *O. denticulata* is only found in urban areas or land that humans often visit. *O. denticulata* has a high abundance in residential areas because this species has high adaptability skills in disturbed areas close to human activities. Tiede *et al.* (2017) stated that this species is an epigaeic species whose primary habitat is on the ground surface.

O. simillimus is commonly found in open, moderate, highly disturbed habitats, such as coastal areas, plantations, villages, and grass on university campuses. According to Satria *et al.* (2015), *O. simillimus* is a common species found in gardens or green patches in residential areas, plantations and secondary forest zones. Their nests are usually found near the base of living trees, stumps, logs, rotting rock, and under paved floors around houses.

Table 5. Importance Value Index of Ants in Palm Oil Plantations Bounded by Forest Ecosystems

Subfamily / Spesies	Importance Value Index			
	***KS**	***KP**	***MM**	***MMg**
Dorylinae				
Dorylus laevigatus (F. Smith, 1857	0.02	0	0	0
Formicinae	0	0	0	0
Anoplolepis gracillipes (F. Smith, 1857)	0.41	0.29	0.36	0.5
Camponotus (Tanaemyrmex) sp. 1	0.02	0.05	0.06	0.04
Camponotus (Tanaemyrmex) sp. 2	0.04	0	0	0
Colobopsis leonardii (Emery, 1889)	0	0	0.08	0.06
Colobopsis saundersi (Emery, 1889)	0.01	0	0	0
Colobopsis sp.	0.05	0	0	0
Dinomyrmex gigas (Latreille, 1802)	0.02	0.02	0	0
Polyrhachis (Myrma) illaudata (F. Smith, 1858)	0.08	0.07	0.04	0.17
Polyrhachis (Myrma) sp. 1	0	0.02	0	0
Polyrhachis (Myrma) sp. 2	0.09	0.02	0	0.04
Polyrhachis (Myrmhopla) abdominalis F. Smith, 1858	0.06	0.04	0.14	0.03
Myrmicinae	0	0	0	0
Carebara affinis (Forel, 1915)	0.01	0.02	0	0.02
Cataulacus hispidulus F. Smith, 1865	0	0	0.06	0
Crematogaster (Crematogaster) borneensis Andre, 1896	0.01	0.06	0.06	0.02
Crematogaster (Crematogaster) rogenhoferi Mayr, 1879	0.07	0.21	0.19	0.08
Crematogaster (Orthrocrema) longipilosa Forel, 1907	0.01	0.02	0	0.27
Pheidole longipes (Latreille, 1802)	0.19	0.07	0	0
Pheidole plagiaria F. Smith, 1860	0.16	0.15	0.09	0.09
Pheidole sp.	0.04	0.05	0.02	0
Ponerinae	0	0	0	0
Brachyponera pilidorsalis (Yamane, 2007)	0.03	0	0	0
Brachyponera sp.	0.01	0.05	0	0
Diacamma holosericum (Roger, 1860)	0	0	0.04	0.03
Leptogenys cf. peqeuti (Andre, 1887)	0.06	0.02	0	0
Odontomachus rixosus (F. Smith, 1857)	0.09	0.08	0.19	0.06
Odontomachus simillimus F. Smith, 1858	0.06	0.32	0.4	0.33
Odontoponera denticulate (F. Smith, 1858)	0.28	0.34	0.19	0.15

Odontoponera transversa (F. Smith, 1857)	0.16	0.1	0.07	0.12
Pseudomyrmicinae	0	0	0	0
Tetraponera pilosa (F. Smith, 1858)	0.01	0	0	0

*Note : KS=Kampung Surau; KP=Kubang Panjang; MM=Muaro Mau; MMg=Muaro Momong

4. CONCLUSION

The level of abundance and diversity of ant species is not directly affected by the distance from the forest. Still, it is strongly influenced by the composition of physical factors such as temperature and humidity, existing vegetation, and habitat management. The diversity of ant oil palm plantations bordering forest ecosystems havee a diversity index value classified as moderate, >1 and <3. The most dominant species is *A. graciliphes* species, with an Important Value Index (INP) reaching 0.50. *A. graciliphes* are the species with the highest number of individuals compared to other species in forest ecosystems and palm oil plantations bordering forest ecosystems.

REFERENCES

Alamsari, W. (2014). Keanekaragaman Semut Pada Berbagai Tipe Penggunaan Lahan di Jambi [Institut Pertanian Bogor]. In *Fakultas Pertanian*. http://journal.stainkudus.ac.id/index.php/equilibrium/article/view/1268/1127

Asih, U. S., Yaherwandi, Y., & Efendi, S. (2021). Keanekaragaman laba-laba pada perkebunan kelapa sawit yang berbatasan dengan hutan. *Jurnal Entomologi Indonesia*, *18*(2), 115–126. https://doi.org/10.5994/jei.18.2.115

Bahagiawati, Utami, D., & Buchori, D. (2010). Pengelompokan dan Struktur Populasi Parasitoid Telur Trichogrammatoidea armigera pada Telur Helicoverpa armigera pada Jagung Berdasarkan Karakter Molekuler. *J Entomol*, *7*(1), 54–65.

Bolton, B. (1994). *Identification Guide to the Ant Genera of the World*. Harvard University Press.

Borror, D. J., Triplehorn, C. A., & Johnson, N. F. (1992). *Pengenalan Pelajaran Serangga Edisi Keenam*. Gadjah Mada University Press.

Falahudin, I. (2011). Peranan Semut Rangrang (Oecophylla smaragdina) Dalam Pengendalian Biologis Pada Perkebunan Kelapa sawit Irham Falahudin Program studi Tadris Biologi Fakultas Tarbiyah IAIN Raden Fatah Palembang email : irham_71@yahoo.com. *Annual International Conference on Islamic Studies*, 2604–2618.

Fayle, T. M., Turner, E. C., Snaddon, J. L., Khen, V., Chung, A. Y. C., Eggleton, P., & Foster, W. A. (2010). Oil palm expansion into rain forest greatly reduces ant biodiversity in canopy , epiphytes and leaf-litter. *Basic and Applied Ecology*, *11*, 337–345. https://doi.org/10.1016/j.baae.2009.12.009

Febriani, Yusniwati, & Efendi, S. (2020). Inventarisasi Hama Kelapa Sawit (Elaeis Guineensis Jacq.) Pada Daerah Endemik Serangan Di Kabupaten Dharmasraya. *Agrifor*, *19*(1), 1–10.

Furlong, M. J., & Zalucki, M. P. (2010). Exploiting predators for pest management: The need for sound ecological assessment. *Entomologia*

Experimentalis et Applicata, *135*(3), 225–236. https://doi.org/10.1111/j.1570-7458.2010.00988.x

Hakiki, A. F., Yaherwandi, & Efendi, S. (2020). Serangga Predator dan Parasitoid di Daerah Endemik Serangan Ulat Api Pada Perkebunan Kelapa Sawit Rakyat. *Jurnal Agrin*, *24*(1), 23–37.

Holldobler, B., & Wilson, I. (1990). *The Ants*. Harvard University Press.

Latumahina, F. (2011). Pengaruh Alih Fungsi Lahan Terhadap Keanekaragaman Semut Alam Hutan Lindung Gunung Nona Ambon. *Jurnal Agroforestri*, *6*(1), 18–22.

Melketa, D. P., Satria, B., & Efendi, S. (2022). Keanekaragaman Serangga Predator Dan Parasitoid Pada Beberapa Tipe Ekosistem Perkebunan Kelapa Sawit. *Jurnal Riset Perkebunan*, *3*(2), 66–76.

Nazarreta, R., Buchori, D., Hashimoto, Y., Hidayat, P., Scheu, S., & Drescher, J. (2021). *A Guide to the Ants of Jambi (Sumatera, Indonesia)*. LIPI Press.

Passera. (1994). Causes of ecological success: The case of the ants. *Bioscience Society*, *30*, 313–323.

Philpott, S. M., & Armbrecht, I. (2006). Biodiversity in tropical agroforests and the ecological role of ants and ant diversity in predatory function. *Ecological Entomology*, *31*, 369–377.

Philpott, S. M., Perfecto, I., Armbrecht, I., & Parr, C. L. (2010). Ant diversity and Function in Disturbed and Changing Habitats. In L. Lach, C. Parr, & K. Abbott (Eds.), *Ant Ecology* (pp. 137–156). Oxford University Press Inc. https://doi.org/10.1093/acprof:oso/9780199544639.003.0008

Price, P. W., Denno, R. F., Eubanks, M. D., Finke, D. L., & Kaplan, I. (2011). Insect Ecology. In *Insect Ecology*. Cambridge University Press. https://doi.org/10.1017/cbo9780511975387

Rizali, A., Bos, M., Buchori, D., Yamane, S., & Schulze, C. (2008). Ants in tropical urban habitats: The myrmecofauna in a densely populated area of Bogor, west java, Indonesia. *Hayati*, *15*, 77–84.

Romarta, R., Yaherwandi, & Efendi, S. (2020). Keanekaragaman Semut Musuh Alami (Hymenoptera : Formicidae) pada Perkebunan Kelapa Sawit Rakyat di Kecamatan Timpeh Kabupaten Dharmasraya. *Agrikultura*, *31*(1), 42–51.

Rubiana, R. (2014). *Pengaruh transformasi habitat terhadap keanekaragaman dan struktur komunitas semut di jambi ratna rubiana* (pp. 1–39). Sekola Pascasarjana Institut Pertanian Bogor.

Satria, R., Kurushima, H., Herwina, H., Yamane, S., & Eguchi, K. (2015). Gen Semut Perangkap-Rahang Odontomachus Latreille Dari Sumatra, Dengan Deskripsi Spesies Baru. *Zootaxa*, *4048*, 1-36.

Suwondo. (2007). Dinamika Kepadatan dan Distribusi Vertikal Arthropoda Tanah pada Kawasan Hutan Tanaman Industri. *Jurnal Pilar Sains*, *6*, 41–50.

Tiede, Y., Schlautmann, J., Donoso, D. A., Wallis, C. I. B., Bendix, J., Brandl, R., & Farwig, N. (2017). Ants as indicators of environmental change and ecosystem processes.

Ecological Indicators, *83*, 527–537. https://doi.org/10.1016/j.ecolind.2017.01.029

Widihastutya, Cyccu, M., Astuti, R., & Fudholi, A. (2020). Biological aspects of Myopopone castanea on it ’ s prey Oryctes rhinoceros larvae. *Journal of Insect Physiology*, *125*(July), 104089. https://doi.org/10.1016/j.jinsphys.2020.104089

Yaherwandi, Herwina, H., Busniah, M., Efendi, S., & Hasan, A. (2019). The Influence of Forest Ecosystems to Ant Community on Smallholder Oil Palm Plantations at Dharmasraya Regency, West Sumatera Indonesia. *IOP Conference Series: Earth and Environmental Science*, *347*(1), 1–9. https://doi.org/10.1088/1755-1315/347/1/012104

Yamane, S. (2009). Odontoponera Denticulata (F. Smith) (Formicidae: Ponerinae), a Distinct Species Inhabiting Disturbed Areas. *ARI*, *32*, 1–8.

Yenti, N., Juniarti, & Efendi, S. (2020). Pengaruh Penggunaan Lahan Kakao Yang Diintegrasikan Dengan Kelapa Sawit Terhadap Keanekaragaman Serangga Predator Dan Parasitoid. *Journal of Socio Economics on Tropical Agriculture*, *2*(1), 44–53. https://doi.org/10.25077/joseta.v2i1.