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Ant preference for different types of bait at sugarcane plantations in East Java, Indonesia

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Abstract. *Rahardjo BT, Muhammad FN, Setiawan Y, Febryadi A, Ihsan M, Wibowo D, Fernando I. 2023. Ant preference for different types of bait at sugarcane plantations in East Java, Indonesia. Biodiversitas 24: 2099-2106.* The occurrence of ants is important in agroecosystems since they may provide both ecosystem services or disservices depending on the species composition. Therefore, it is necessary to investigate the kind of ant species that are present in agroecosystems. This study aimed to assess the effectiveness of three types of bait to measure ant abundance and diversity in sugarcane plantations. This research was conducted from July to September 2022 in four locations in East Java, Indonesia, i.e., Karangploso, Kalipare, Gandusari, and Pasirian. At each location, one plot was determined and divided into nine subplots. Ant sampling was conducted using modified pitfall traps that may contain one type of bait or without bait as control treatment. There were three types of assayed bait, i.e., tuna, eggs, and sugar. Nine traps for each treatment were installed in each location. This study obtained 6,650 individual ants from 20 morphospecies, 16 genera, and 4 subfamilies. At each location, species richness and abundance were not significantly different among bait types. However, those variables differed between the bait groups and the control. Tuna and egg baits were preferred by ants, as indicated by the higher number of trapped individuals than in sugar bait and the control traps. The species composition of the different baits was different at all locations except Kalipare. Each ant species had a different preference for the type of bait. Formicine ants preferred sugar bait, while ponerine ants preferred tuna and egg baits. Hence, it can be concluded that the bait type selection needs to be considered for ant monitoring. Therefore, using various types of baits is recommended to monitor the assemblage of ants in an ecosystem.

Keywords: Ant diversity, ant sampling, egg, species composition, sugar, tuna

INTRODUCTION

Ants are one of the most abundant organisms on earth. Ants play various ecological roles, from predators to herbivores (Davidson et al. 2003). The existence of ants is very important in agroecosystems, as many of them are keystone species (Diamé et al. 2017). Ants can be beneficial or harmful to plant cultivation activities (Frizzo et al. 2020). In agroecosystems, ants can be biological agents for pests and diseases (Anjos et al. 2022). Predatory ants are divided into generalists with a wide range of prey and specialists with a very narrow range of prey for arthropods with varied hunting strategies (Azorsa et al. 2022). However, ants also indirectly can become pests in a plant through trophobiosis (Fanani et al. 2020). Trophobiotic interactions occur when phytophagous insects such as hemipterans, which generally act as pests, provide honeydew for ants. Therefore, ants may protect them from predators or parasitoids (Moura and Carvalho 2021). Deterring natural enemies is a major ecosystem disservice by ants (Anjos et al. 2022). Ants can even spread plant diseases such as cacao black pod rot caused by *Phytophthora palmivora* (E.J.Butler, 1910) (Rizali et al. 2017).

In sugarcane plantations, the occurrence of ants is of great importance. Sugarcane is one of the most important commodities in Indonesia. In 2021, 2.35 million tons of sugar was produced in Indonesia, or 10.3 percent higher than in 2020, which was 2.13 million tons (BPS 2021). However, sugarcane cultivation is continuously facing problems due to pest attacks such as stripped sugarcane stem borer *Chilo sacchariphagus* Bojer, 1856 (Lepidoptera: Crambidae) (Ramasubramanian et al. 2021), sugarcane top borer *Scirpophaga excerptalis* (Walker, 1863) (Lepidoptera: Pyralidae) (Wei et al. 2021), sugarcane wooly aphid *Ceratovacuna lanigera* Zehntner, 1897 (Hemiptera: Aphididae) (Srikanth et al. 2021), etc. Ants have been known to act aggressively towards or prey on insect pests attacking sugarcane (Santos et al. 2018). However, some ants live in mutualistic ally with certain sugarcane pests, such as the symbiosis between the invasive tawny crazy ant *Nylanderia fulva* and sugarcane aphid *Melanaphis sacchari* (Zehntner 1897; Pazmiño-Palomino et al. 2020).

Generally, ants need nutrients containing macronutrients (proteins, carbohydrates, and lipids), micronutrients (vitamins and minerals), and water. They all directly affected the ongoing physiological functions (Cohen and Weinstein 2018). Protein obtained from food is broken down into amino acids and converted into other proteins that can be used for various biological functions for ants, such as cell structure, enzymes, transport, storage, or receptor molecules (Kraus et al. 2019). Carbohydrates include: simple sugars (e.g., the monosaccharide sucrose, fructose, glucose, maltose), starch, and other polysaccharides (e.g., cellulose), can be used by ants as respiratory fuel, provide a carbon basis in molecular synthesis, and become the building materials of the cuticle (e.g., polysaccharide chitin) (Miyamoto and Amrein 2017). Meanwhile, lipids are an important source of energy needed by ants. Lipids are important components of cell membranes, nutrient transport, and defense compounds, function as pheromones, and are involved in hormone synthesis (Kraus et al. 2019).

The ant biodiversity measurement in an ecosystem is very necessary. A complete picture of ant species composition in an ecosystem is obtained from several sampling methods combined (Wang et al. 2001). One method commonly used for sampling ants is the bait trap (Hacala et al. 2021). Bait traps are used because ants have a habit of foraging. The bait trap application has various baits made from protein and carbohydrates. Insects have been shown to have separate appetites for protein, carbohydrates, or fat (Dussutour and Simpson 2008). Bait traps that are often used to lure ants include mashed boiled eggs, peanut butter, tuna fish (Biale et al. 2017), minced meat, sesame, fruit jam (Mashaly et al. 2013), and liquid honey (Wauters et al. 2014). The research results of Arganda et al. (2014) showed that *Linepithema humile* (Mayr 1868) preferred carbohydrate-based feed over protein-based feed. The nutritional needs of each species' colonies cause the ants' choice of bait. For example, the Argentine ant *L. humile* highly prefers sugar because its protein needs in colonies have been met due to foraging (Rust et al. 2000).

The purpose of this study was to determine the abundance and diversity of ants in sugar cane plantations and the effectiveness of types of bait in traps for ant sampling. This study tested three types of bait for their effectiveness in sampling ants in sugarcane plantations. The hypothesis tested in this study was that there were differences in species richness, abundance, and composition of ants on different types of bait.

MATERIALS AND METHODS

Study area

This research was conducted from June to September 2022. Ant specimens were collected at four sugarcane cultivation centers in East Java, Indonesia, i.e.: (i) *Balai Penelitian Tanaman Pemanis dan Serat* (BALITTAS) Karangploso Sub-district, Malang District (7°54'23"S; 112°37'27"E); (ii) *Instalasi Penelitian dan Pengembangan Teknologi Pertanian* (IP2TP) Kalipare Sub-district, Malang District (8°12'02"S; 112°27'01"E); (iii) Sukosewu Village, Gandusari Sub-district, Blitar District (8°01'49"S, 112°17'14"E); and (iv) IP2TP Madurejo Village, Pasirian Sub-district, Lumajang (8°13'21"S; 113°08'53"E) (Figure 1). The temperature in all study locations ranged from 19-23°C, while the average humidity ranged from 80-85% (BMKG 2023). The observation sites were selected systematically based on two criteria: A minimum land area of 2,500 m^2 and the age of the sugarcane crops ranging from 5-10 months.

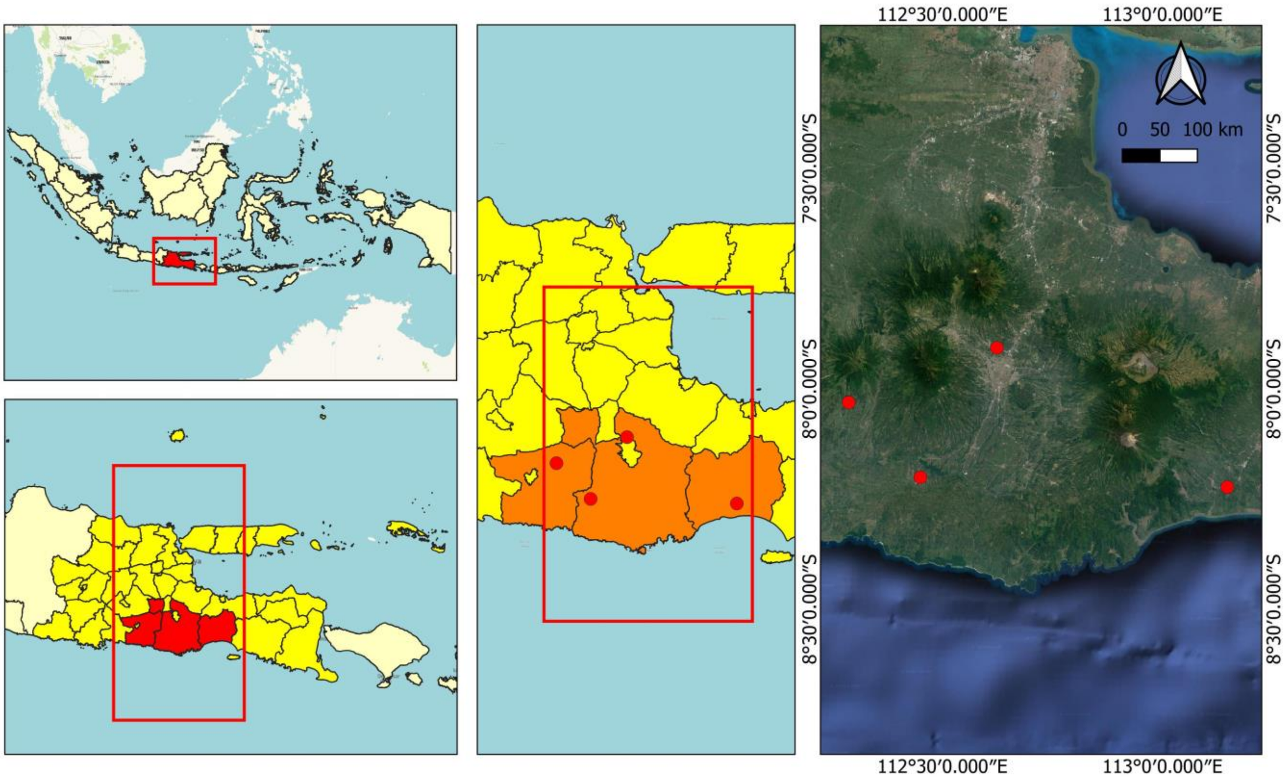

Figure 1. Research location of four sugarcane plantations (Karangploso, Kalipare, Pasirian, and Gandusari), East Java, Indonesia

Plot design

At each location, a plot of 42 m x 18 m was created (Figure 2.A). Each plot was divided into nine subplots with a size of 3 m x 3 m. The distance between subplots in the same column was 3 m, while the distance between subplots in the same row was 15 m. Each subplot has four pitfalls with different baits: tuna, eggs, sugar, and control (without bait) (Figure 2.B). The distance between the traps was 1.5 m. Within each subplot, the positions of each type of bait were not randomized and were arranged in the same position/manner consistently.

Bait effectiveness test

Traps were set on each subplot. The trap component consists of a 200 mL plastic cup with a roof made of styrofoam. A plastic roof was installed over each trap to prevent rainwater from entering the cup. The trap adopts the pitfall model with additional bait (Figure 3). Therefore, three types of bait were tested: tuna, eggs, sugar, and the control (water). The cup was filled with detergent water up to 1/2 of the glass height. On the roof of the trap, 50 g of bait was placed. In addition, 10 g of bait was also dissolved in the detergent solution. The tuna meat was finely chopped in tuna bait before being set into the trap. In egg bait, the eggs were boiled first, then crushed. Furthermore, in the sugar trap, granulated sugar was placed directly on the roof of the trap. In addition, in control, there was only detergent water.

Trap tests were carried out eight times per location from July-September 2022. At each site, there were 36 trap units (9 subplots x 4 traps). The interval for each observation was one week. Sampling was carried out 24 hours after the traps were set. Ants in the pitfall were picked up with a gauze filter. The ants obtained were stored in a 2 mL microtube containing 70% alcohol and labeled.

The sampled ants were first sorted based on their subfamily. Then, identification was carried out to the genus and morphospecies level (Lattke 2000) based on Nazaretta et al. (2021). Where possible, identification was carried out down to the species level using references in AntWeb (AntWeb 2023). Finally, the population of each species was calculated. Sortation and identification were performed at the Pest Laboratory, Department of Plant Pest and Disease, Faculty of Agriculture, Universitas Brawijaya.

Data analysis

Data were analyzed using ANOVA (Analysis Of Variance) and ANOSIM (Analysis Of Dissimilarity). Differences in species richness and abundance of ants in each type of bait, including the control in all locations, were analyzed using ANOVA. Since ANOVA is a parametric test, the normality test was carried out using the Shapiro-Wilk test. If the data were not normally distributed, then the data were transformed using log(x). Tukey's post hoc test and Bonferroni's corrections were carried out if a significant difference was found in the ANOVA. Ant species' composition on different bait types at different locations was analyzed using ANOSIM with the Bray-Curtis Index. The results of the ANOSIM analysis were also visualized with the NMDS (Non-metric Multidimensional Scale). All analyses were performed using R-statistics (R Core Team 2022) by adding the agricolae and vegan packages.

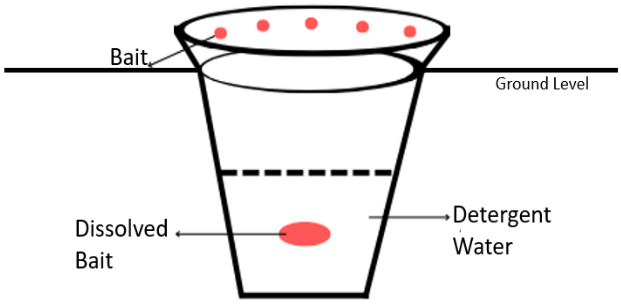

Figure 3. Trap design for bait effectiveness test. The cups were half filled with detergent water. Bait was placed on the trap roof and dissolved in the detergent water

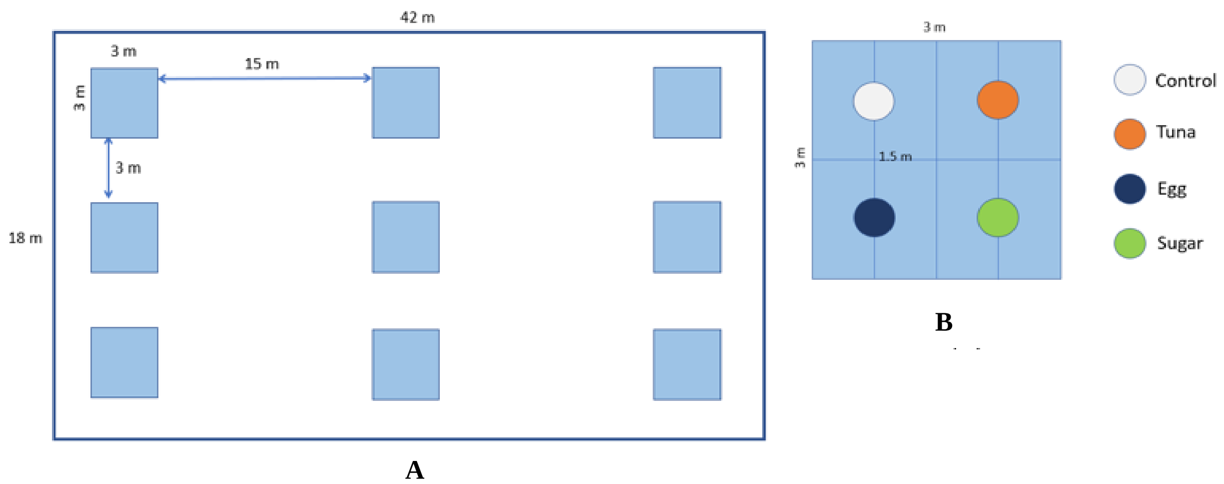

Figure 2. Plot design at each location. A. The main plot was 42 m x 18 m in size. B. Each plot consisted of 9 subplots with 3 m x 3 m size. Four traps were placed at each subplot

RESULTS AND DISCUSSION

Ant community in the sugarcane plantation

The total number of ants found was 6,560 individuals belonging to 20 morphospecies, 16 genera, and four subfamilies (Table 1). The most common ant species found were *Diacamma* sp.1 with 1,284 individuals (19.6% of the total population), followed by *Odontoponera* sp.1 (1,056/16.1%), *Tapinoma melanocephalum* (Fabricius, 1793) (881/13.4%), and *Polyrachis dives* Smith, 1857 (825/12.6%). Locations with the highest species richness were Pasirian (19 spp.), followed by Gandusari (17 spp.), Kalipare (16), and Karangploso (16). At the same time, the highest abundance was found in Karangploso (2,384 ind.), followed by Pasirian (2,355), Gandusari (1,385), and Kalipare (436).

Effectiveness and preference of ants on different baits

Based on ANOVA, it was shown that abundance is affected by the type of bait while species richness is not. Across sites, baited traps caught more ants than those without bait (Tables 2 and 3). There was no significant difference in each type of bait. However, if cumulatively analyzed for all locations, the highest abundance of ants was obtained with tuna bait.

Based on ANOSIM, there were differences in the ant species' composition on different bait types. Kalipare was the only location where all types of bait had a similar species composition (R-Anosim=0.042; P=0.178). Whereas, in Karangploso (R-Anosim=0.332; P=0.001), Gandusari (R-Anosim=0.267; P=0.001), and Pasirian (R-Anosim=0.186; P=0.001), the species composition differed for different types of bait. The level of dissimilarity in the species composition of the different types of bait in all locations showed a fairly low value. The NMDS plot also showed that the species composition of each type of bait overlaps (Figure 4). Meanwhile, if all locations were combined, there were differences in species composition (R-Anosim=0.672; P=0.001) with higher values. The NMDS plot also showed that there was no overlap between bait types.

Table 1. List of ant species and their abundance on different bait at different locations

Morphospecies	Karangploso				Kalipare				Gandusari				Pasirian				Grand total
	T	E	S	C	T	E	S	C	T	E	S	C	T	E	S	C	
Anoplolepis gracilipes	29	28	9	20	1	2	0	1	7	6	2	4	19	18	6	12	164
Aphaenogaster sp.1	7	0	19	0	0	0	0	0	0	0	0	0	6	0	15	0	47
Camponotus sp.1	41	10	31	13	9	2	7	3	24	6	18	7	100	24	76	30	401
Camponotus sp.2	0	16	13	5	0	0	0	0	0	0	0	0	0	8	7	2	51
Camponotus sp.3	0	0	0	0	0	0	2	1	0	0	0	0	0	0	19	15	37
Crematogaster sp.1	76	18	36	13	0	0	0	0	51	12	24	9	16	3	7	2	267
Diacamma sp.1	170	100	73	32	34	20	14	6	114	67	49	21	265	156	113	50	1284
Dolichoderus thoracicus	93	65	11	10	43	30	4	5	85	59	10	9	67	47	8	7	553
Leptogenys sp.1	2	3	3	1	11	19	15	10	4	7	6	3	7	12	10	7	120
Meranoplus bicolor	0	0	0	0	0	0	0	0	13	4	9	46	0	0	0	0	72
Odontomachus sp.1	0	0	0	0	11	5	2	0	1	0	0	0	19	10	2	1	51
Odontomachus sp.2	4	9	1	1	7	12	1	1	5	9	1	0	3	7	1	0	62
Odontoponera sp.1	177	265	62	23	3	5	1	0	44	67	16	6	130	195	45	17	1056
Oecophylla smaragdina	33	42	15	17	1	1	0	0	26	32	11	14	1	2	1	1	197
Paratrechina longicornis	0	0	4	2	0	0	1	1	0	0	16	11	0	0	5	4	44
Pheidole megacephala	0	0	1	0	2	0	2	0	4	0	4	1	1	0	2	0	17
Polyrachis abdominalis	16	10	13	5	14	9	11	5	17	11	13	5	18	12	15	6	180
Polyrachis dives	76	64	131	16	7	6	12	2	76	39	82	10	81	67	139	17	825
Solenopsis geminata	1	2	1	0	2	7	2	2	10	29	9	9	32	90	29	26	251
Tapinoma melanocephalum	93	80	224	49	13	11	31	7	27	24	66	14	50	44	121	27	881
Grand total	818	712	647	207	158	129	105	44	508	372	336	169	815	695	621	224	6560

Note: T: Tuna, E: Egg, S: Sugar, C: Control

Table 2. Mean species richness and abundance of ants on different bait at different locations

Location	Karangploso		Kalipare		Gandusari		Pasirian		All	
	S	N	S	N	S	N	S	N	S	N
Tuna	6.62 a	90.50 a	5.12 a	17.87 a	7.50 a	58.87 a	7.12 a	101.87 a	12.00 a	258.87 a
Egg	5.37 a	78.75 a	3.87 a	13.87 ab	5.50 a	39.87 ab	7.50 a	86.87 ab	10.87 a	202.62 ab
Sugar	6.12 a	52.75 ab	3.37 a	9.50 ab	6.37 a	34.62 ab	7.25 a	77.62 ab	12.75 a	159.37 b
Control	6.62 a	19.75 b	2.50 a	4.37 b	5.50 a	18.25 b	6.50 a	28.00 b	11.87 a	63.75 c
ANOVA	$F_{3,28}$ = 0.695 P = 0.0563	$F_{3,28}$ = 7.008 P = 0.001	$F_{3,28}$ = 2.875 P = 0.053	$F_{3,28}$ = 3.814 P = 0.020	$F_{3,28}$ = 1.505 P = 0.235	$F_{3,28}$ = 3.382 P = 0.032	$F_{3,28}$ = 0.311 P = 0.817	$F_{3,28}$ = 3.615 P = 0.025	$F_{3,28}$ = 2.323 P = 0.096	$F_{3,28}$ = 17.21 P = <0.001

Note: Means followed by the same letters within each column are not significantly different at P<0.05 according to Tukey's test. S: Species richness, N: Total individuals

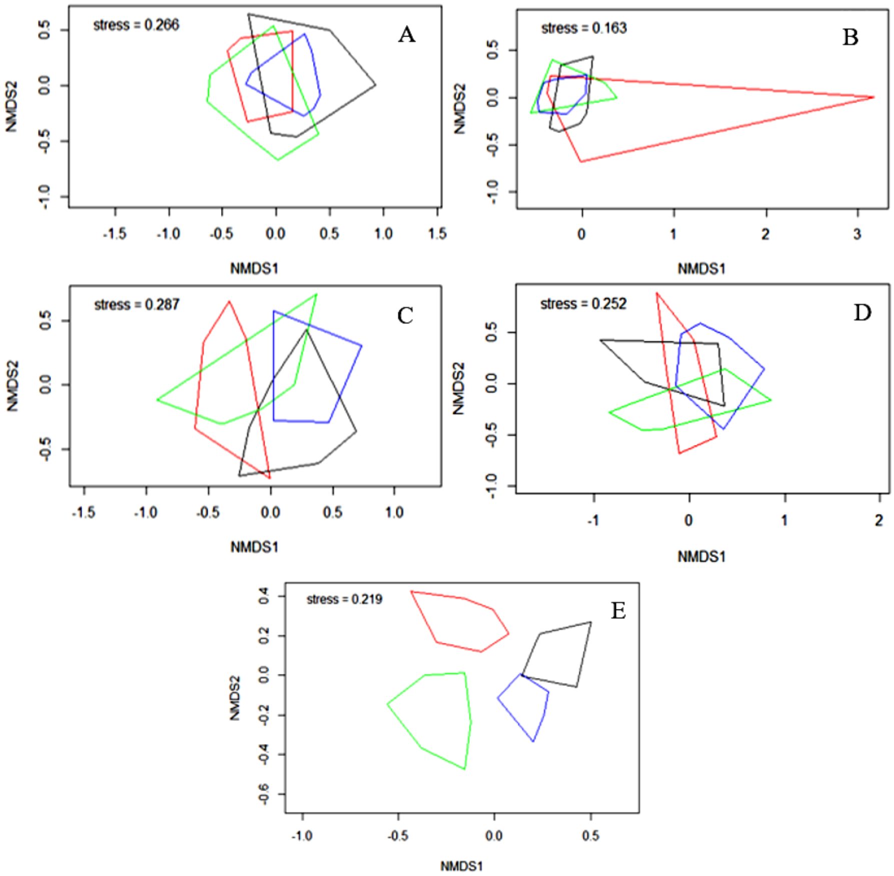

Figure 4. Ant species composition on different baits. A. Karangploso, B. Kalipare, C. Gandusari, D. Pasirian, E. All Sites. The NMDS indicates species composition based on the Bray-Curtis Index. Blue polygons represent tuna, and black represents egg baits. In addition, the green polygon represents the sugar feed, while the red represents the controls

Table 3. Preference of each morphospecies to the tested bait

Subfamily/morphospecies	Tuna	Egg	Sugar	Control	ANOVA
Dolichoderinae					
Dolichoderus thoracicus	**36.00 a**	**25.12 a**	4.12 b	3.87 b	$F_{3,28}$ = 19.08; P = <0.001
Tapinoma melanocephalum	22.87 b	19.87 b	**55.25 a**	12.12 b	$F_{3,28}$ = 14.20; P = <0.001
Formicinae					
Anoplolepis gracilipes	7.00 a	6.75 a	2.12 a	4.62 a	$F_{3,28}$ = 2.578; P = 0.073
Camponotus sp.1	**21.75 a**	5.25 b	**16.50 ab**	6.62 b	$F_{3,28}$ = 4.241; P = 0.013
Camponotus sp.2	0.00 a	3.00 a	2.50 a	0.87 a	$F_{3,28}$ = 8.157; P = 0.082
Camponotus sp.3	0.00 b	0.00 b	**2.62 a**	**2.00 a**	$F_{3,28}$ = 3.138; P = 0.041
Oecophylla smaragdina	7.62 a	9.62 a	3.37 a	4.00 a	$F_{3,28}$ = 2.038; P = 0.131
Paratrechina longicornis	0.00 b	0.00 b	**3.25 a**	**2.25 ab**	$F_{3,28}$ = 4.816; P = 0.007
Polyrachis abdominalis	8.12 a	5.25 a	6.50 a	2.62 a	$F_{3,28}$ = 2.355; P = 0.093
Polyrachis dives	**30.00 ab**	22.00 bc	**45.50 a**	5.62 c	$F_{3,28}$ = 8.118; P = <0.001
Myrmicinae					
Aphaenogaster sp.1	**1.62 ab**	0.00 b	**4.25 a**	0.00 b	$F_{3,28}$ = 6.698; P = 0.001
Meranoplus bicolor	1.62 b	0.50 b	1.12 b	**5.75 a**	$F_{3,28}$ = 6.327; P = 0.002
Pheidole megacephala	**0.87 ab**	0.00 b	**1.12 a**	**0.87 ab**	$F_{3,28}$ = 3.029; P = 0.045
Solenopsis geminata	5.62 a	16.00 a	5.12 a	4.62 a	$F_{3,28}$ = 2.577; P = 0.073
Crematogaster sp.1	**17.87 a**	4.12 b	**8.37 ab**	3.00 b	$F_{3,28}$ = 4.611; P = 0.009
Ponerinae					
Diacamma sp.1	**72.87 a**	**42.87 ab**	31.12 b	13.62 b	$F_{3,28}$ = 8.157; P = <0.001
Leptogenys sp.1	3.00 a	5.12 a	4.25 a	2.62 a	$F_{3,28}$ = 0.980; P = 0.416
Odontomachus sp.1	**3.87 a**	**1.87 ab**	0.50 b	0.12 b	$F_{3,28}$ = 4.937; P = 0.007
Odontomachus sp.2	**2.37 ab**	**4.62 a**	0.50 b	0.25 b	$F_{3,28}$ = 4.667; P = 0.009
Odontoponera sp.1	**44.25 ab**	**66.50 a**	15.50 bc	5.75 c	$F_{3,28}$ = 8.729; P = <0.001

Note: P<0.05 is significantly different. Means followed by the same letters within each row are not significantly different at P<0.05 according to Tukey's Post Hoc Test

Fourteen out of 20 ant morphospecies found in sugarcane plantations preferred the baits tested. Out of the 14 species, 11 of them preferred two baits, while two species preferred only one type of bait, and one species preferred three types of bait. The bait with the highest number of ant preferences was tuna (10 spp.), followed by sugar (7), eggs (5), and the control (4). Each subfamily also shows different responses to different feeds. For example, in the Dolichoderinae subfamily, *Dolichoderus thoracicus* (Smith 1860) has a preference for tuna and eggs, while *T. melanocephalum* only has a preference for sugar. In the Formicinae subfamily, two species prefer tuna and sugar. The other two Formicinae species have a preference for sugar and the control. In the Myrmicinae subfamily, three species prefer sugar and tuna. Meanwhile, one species prefers three types of bait, and one species only prefers the control. Meanwhile, in the Ponerinae subfamily, all species prefer tuna and eggs.

Discussion

This study represents the ant survey with three different types of bait in sugarcane plantations in East Java. Our study found that *Diacamma* sp.1 was the most dominant species collected in the sugarcane plantations, accounting for 19.6% of the total population. Besides, *Odontoponera* sp.1 also were found as the second dominant species in this study. *Diacamma* sp.1 and *Odontoponera* sp.1 belong to the Ponerinae subfamily. Several studies reported that *Diacamma* and *Odontoponera* were the most abundant genera in agricultural fields (Widhiono et al. 2017; Triyogo et al. 2020; Hasan et al. 2023). Being the most abundant species in this study, this indicated that *Diacamma* sp.1 is a species that may be able to survive in various environments and have a suitable habitat in a sugarcane field. *Diacamma* sp.1 is a cosmopolitan species in any environment (Juniarti and Rusniarsyah 2022). This species is also reported as a generalist and is usually abundant in several agroecosystem and forest habitats (Widhiono et al. 2017; Subedi et al. 2021). Based on their functional group, this species was also reported as a generalist predator (Ke et al. 2011; Sosiak and Barden 2021). Therefore, it can be indicated that the sugarcane plantation also provides prey for *Diacamma* sp.1. Ganehiarachchi and Fernanado (2000) reported that *Diacamma* sp. is the natural enemy of the sugarcane planthopper *Pyrilia perpusilla* (Walker 1851) (Hemiptera: Lophopidae) in Sri Lanka. Meanwhile, the genus *Odontoponera* is included in the specialist predator group (Neoh et al. 2017). Moreover, *Odontoponera* sp. can be used as a bioindicator species and a natural enemy in an agroecosystem. This species is also sensitive to habitat disturbances (Widhiono et al. 2017).

Among all the species found, some species are recorded as invasive and tramp. Based on the grouping from Pfeiffer et al. (2008), *Anoplolepis gracilipes* (Smith, 1857), *Paratrechina longicornis* (Latreille, 1802), and *T. melanocephalum* were included in the invasive and tramp groups. The presence of invasive species can threaten existing local ant communities. Furthermore, if they are invasive, ants as social insects can be very damaging (Siddiqui et al. 2021). The damage caused by a tramp and invasive ant species can originate from their behavior and competitive displacement (Falcão et al. 2017). However, in the observed ant communities in all sugarcane plantation locations, only *T. melanocephalum* was quite a lot.

Our study showed that the ant species' composition on different bait types differed. This indicated that baits are selective and influenced by the ant species' feeding preferences (Nyamukondiwa and Addison 2014). Traps with bait also demonstrate an ability to attract a species and that food attractants improve trapping success (Browning et al. 2022). In line with Nyamukondiwa and Addison (2014), all collected ant species prefer tuna or sugar bait. Ant-feeding behavior appears to be primarily influenced by the energy content of the food solution for the main sugars found in nectar and honeydew (Detrain and Prieur 2014).

Specific preferences of ponerine ants on tuna bait indicated that the species might act as predators. *Odontomachus* ants, as members of the Ponerinae subfamily, act as predators of various types of arthropods, such as insects and spiders (Camargo and Oliviera 2012). In addition, one of the *Diacamma* species was also recorded as a predator of tomato plant pests, *Tuta absoluta* (Meyrick 1917) (Lepidoptera: Gelechiidae) (Sivakumar 2017). The research by Hanisch et al. (2020) regarding stable biotopes in ponerine ants proved that ponerine ants were located at the highest trophic level. Mashaly et al. (2013) also showed that ponerine ants prefer protein feed over carbohydrates and lipids. Therefore, it can be concluded that ponerine ants, as predators, prefer protein-based baits to carbohydrate-based baits.

In the other subfamilies, dolichoderine ants *T. melanocephalum* was the only species that preferred sugar. Cheng et al. (2019) also conducted a stable isotope analysis on *T. melanocephalum*. The result showed that *T. melanocephalum* preferred sugar if no other ant species were present as competitors. *T. melanocephalum*'s preference for sugar was evidenced by many trophobiotic relationships with hemipterans (Feng et al. 2015; Zhou et al. 2015). In addition, research from (Pérez-Rodríguez et al. 2021) proved that *T. melanocephalum* prefers sugar more than trophobiont hemipteran honeydew if the sugar was provisioned in the field. *T. melanocephalum* began to prey on the hemipteran after the sugar was provisioned. Another dolichoderine ant, *D. thoracicus,* preferred eggs and tuna over other baits. This follows the results of previous research by Saleh et al. (2018) which showed that *D. thoracicus* ants in cocoa plantation preferred salted fish and eggs over sugar, honey and syrup.

Different types of bait resulted in differences in the number of individual ants caught. Meanwhile, species richness did not differ between baits. The most effective bait type for sampling ants in sugarcane plantations was tuna. In addition, each species also had its preference for the tested bait. For example, ponerine ants preferred tuna and eggs, while *T. melanocephalum* preferred sugar. Due to differences in preferences of ant species in different baits, various types of baits are recommended to monitor the assemblage of ants in an ecosystem. In addition, tuna bait can be used to specifically monitor predatory ants, potentially becoming natural enemies of plant pests.

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