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Submission date: 23-Jan-2022 07:09AM (UTC+0700)

Submission ID: 1746115576

File name: C20.pdf (378.18K)

Word count: 2920

Character count: 15842

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To cite this article: T Abdullah *et al* 2021 *IOP Conf. Ser.: Earth Environ. Sci.* **807** 022092

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The population of *Solenopsis* sp. (Hymenoptera: Formicidae) in four condition of rice field embankment

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Abstract. Fire red ants (*Solenopsis* sp.) as the predators often found in rice fields. Although many farmers not yet know well this potential insects, in Philippines, this adaptive predator has been used to control golden apple snail with satisfying results. In a period of two days, predatory ants able destroyed 50% the eggs of golden apple snail *Pomacea canaliculata* attached to the leaves of rice plants. The purpose of the research is to study the effect of characteristic differences vegetation of rice field bund to the diversity of ants in the habitat. Research data collection was conducted in Manggala district, Makassar. Identification and observation of ants species was held at the Pest Laboratory, Department of Plant Pests and Diseases, Faculty of Agriculture, Hasanuddin University, Makassar. The research was held from March to May 2018. The results was showed that the bund contain banana tree vegetation had the highest *Solenopsis* sp. population with 288 individuals. The lowest on the embankment with broad leaf vegetation only 29 individuals. The highest number of individual ants was found in *Solenopsis* sp. with 353 individuals, then the lowest is *Tetramorium* sp. with 2 individuals. The difference conditions of vegetation bund showed greatly affects in the number of ants due to differences in the conditions needs of each ant species for their suitable habitat.

1. Introduction

Rice as the important of staple food for most Indonesian people. In general, rice is a cereal crop playing an important role covering carbohydrate needs. The demand of rice related to increasing number of population. The rice field embankment is the boundary between one rice field and another. Rice field is very useful for farmers in increasing their income and harvest diversification. According to [1, 2], the embankment not used by farmers and namely unvisible sleeping land. A small number use as a breeding ground for natural enemies, expected to reduce the population of insect pests that disturb the main crops in rice fields. In general, crops grown on rice embankments including: beans, maize, bananas, taro, flowering plants and many plants that do not interfere with the growth of the main crop. In these plants, many natural enemies found very useful to suppress insect pest populations, such as: predators, parasitoids and pathogens [1, 3, 4].

Ant (Hymenoptera: Formicidae) are predators that are often found in rice fields. According to [5, 6] stated that the ant species commonly found in rice are: *Solenopsis geminata*, *Anoplolepis gracilipes* and *Tetramorium* sp. Ant is the dominant terrestrial animal group in the tropics. Ant playing an important role as: predator, scavenger, herbivore and detritivore. It has a unique role in their



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interactions with other plants or insects. According to [7-9] reported that since their appearance, ants have developed into the dominant creatures in the terrestrial ecosystem. About 750,000 species of insects in the world, they are 9,500 or 1.27% are ants. The research of [10-12] reported that these spectacular insects are found in many human-managed ecosystems or agroecosystems and natural habitats.

Solenopsis sp. is a genus of ant subfamily Myrmicinae. Worker ants has length 3 mm and length 6 mm for queen ants. Its body is slightly reddish brown. Generally ant live in colonies of up to 100,000 individual. Every colony of *Solenopsis* sp. led by queen ants produce between 150 and 200 eggs every day. *Solenopsis* sp. create a mound in the open and exposed to sunlight [7]. According to [13, 14] also stated that the ant nests of *Solenopsis* sp. in the form of dynamic mounds located on agricultural land and the surrounding environment. Research of [15] reported that in Philippines, *Solenopsis* sp. able to control the golden snail with satisfactory results. Within two days, *Solenopsis* sp. able to destroy 50% of *Pomacea canaliculata* eggs attached to the leaves of rice plants. Although the effectiveness of ant predatism has been known, Indonesia has not yet utilized it as a biological control for rice pests, even though this predator has a high potential to suppress the population of rice pests, especially the egg phase has the potential to reduce rice production.

Pachycondyla sp. is the black ants, measuring up to 10 mm. These ant species found living in a variety of habitat, ranging from dry forest, urban environment, park, grassland, plantation, and riverside forests [16]. This species preys on worker termites (*Gnathamitermes tubiformans*) that living in trees. The type of vegetation that grows in rice fields is thought to affect the ant population as soil arthropods and natural enemies of plant pests [6]. The purpose of the research is to study the effect of characteristic differences vegetation of rice field embankment to the diversity of ant in the habitat. The use for researchers is that this information is used as a reference for carrying out further research related to the topic.

2. Methodology

2.1. Research site

The observation of ant used pitfall trap was held in four types of embankment condition in rice field Manggala district, Makassar. The identified of ant was held in Pests Laboratory, Plant Pests and Diseases Department, Faculty of Agriculture, Hasanuddin University from March to May 2018.

2.2. Land preparation

The land preparation began with searching embankment based on predetermined treatment. Measurements were taken on an embankment covering an areas (0.5 m x 2 m) then installed a rope divider with a stake at each corner. Before collected data used pitfall traps, an insecticide with active ingredient Dimetoat 400 g/l was applied to embankments with narrow leaves vegetation. Furthermore, the pesticide solution was sprinkled (10 ml of insecticide + 5 l water) used watering can in embankment limited by ropes. The observation was held at embankment three days in every afternoon.

2.3. Experimental design

The study used a single treatment based on a Randomized Block Design consisted of four types of embankment conditions as treatment, namely: embankment with banana trees, embankment with narrow leaf vegetation, embankment with broad-leaves vegetation and embankment with clean conditions, respectively. The five pitfall traps as replication were installed for each embankment.

2.4. Pitfall traps application in four types of embankment

The pitfall traps used made of plastic glass (diameter = 7 cm, height = 10 cm), with a distance between traps 1 m. The pitfall installation was carried out in the afternoon (16.00 pm) trapped ant in the habitat. Each embankment was planted with five pitfall, their surface parallel to the soil surface. Pour 50 ml of 70% alcohol into the pitfall. The top of pitfall covered with banana trees to prevent rain water enter

the pitfall. The installation started from embankment with vegetations of banana trees, broad leaves, narrow leaves vegetation and embankment with clean condition. Pitfall left for 24 hours in every treatment. Ant specimens was collected in plastic bottles to the laboratory for identification and counting of ants based literatures [17-19]. Data from field trap collected three times in 24 hours with an interval 6 days.

3. Results and discussion

3.1. *Solenopsis* sp. trapped in the pitfall at different types of embankment

Based collection result from pitfall trap, there are four types of ant found in four conditions, such as: *Solenopsis* sp., *Dolichoderus* sp., *Pachycondyla* sp., and *Tetramorium* sp. The highest number of ants is *Solenopsis* sp. the dominant in the embankment with banana trees about 275 individuals. The low number of *Solenopsis* (<50 individuals) was found on the embankment narrow-leaves vegetation (33 individuals), clean embankments (28 individuals) and broad leaves vegetation (17 individual). The average of *Solenopsis* sp. in different types of embankment vegetation was showed in table 1.

Table 1. The average of *Solenopsis* sp. in different types of embankment vegetation.

Types of embankment vegetation	Averages (individual/pitfall)
Banana trees	55.00 ^a
Narrow leaves	6.60 ^b
Broad leaves	3.40 ^b
Clean embankment	5.60 ^b
Total	70.60
¹⁹ SD _{0.05}	13.77

Numbers in the same column followed by same letters are not significantly different (LSD $\alpha = 0.05$)

Based LSD test $\alpha = 0.05$ in table 1 was showed the highest number of *Solenopsis* sp. in banana trees about 55 individuals per pitfall significantly compared to narrow leaves about 6.60 individual/pitfall, the clean embankment about 5.60 individual/pitfall. The lowest number of *Solenopsis* sp. in the embankment contain broad leaves about 3.40 individual/pitfall.

Based the observation number of ants in the four types of embankments was showed the highest and dominant ants were *Solenopsis* sp. in all of habitat. *Dolichoderus* sp. and *Tetramorium* sp. only found in banana trees with very low population. Both types of ants have very limited spread compared to *Solenopsis* sp. and *Pachycondyla* sp. The difference number type of ant in four different conditions because the habitat affected the presence of ant. In general, the condition of agricultural habitat very suitable for the *Solenopsis* sp. According to [10, 20] stated that nests of *Solenopsis* sp. in the form mound commonly found on agricultural land and around human environment. Their role as predators and decomposers caused ant building nest near environment where humans live. Agricultural land attacked by pest insect has the potential as a food source for *Solenopsis* sp.

3.2. The presence of *Pachycondyla* sp. trapped in the pitfall at different types of embankment

Beside *Solenopsis* sp. trapped in the different embankment condition, the number of highest *Pachycondyla* sp. found in embankments with banana trees (5 individual) and broad leaves vegetation (2 individuals). The average of *Pachycondyla* sp. in different types of embankment vegetation was showed in table 2.

Based LSD test $\alpha = 0.05$ in table 2 was showed the averages number of *Pachycondyla* sp. in banana trees only 1 individual, significantly different compared to narrow leaves about 0.40 individual/pitfall. Population of *Pachycondyla* sp. not showed in the clean embankment and narrow leaves vegetation.

Table 2. The average of *Pachycondyla* sp. in different types of embankment vegetation.

Types of embankment vegetation	Averages (individual/pitfall)
Banana trees	1.00 ^a
Narrow leaves	0.00 ^c
Broad leaves	0.40 ^b
Clean embankment	0.00 ^c
Total	1.40
LSD _{0.05}	0.25

In observation average number of *Pachycondyla* sp. showed the four conditions of embankment has a highest average number in banana trees (1 individual/pitfall), significantly different from broad-leaves vegetation (0.40 individual/pitfall). Embankment with narrow leaves and clean vegetation were not *Pachycondyla* sp. The difference number and species of ants that live in the four embankment conditions is very influenced by vegetation of the habitat. The embankment with banana trees contain taro (*Caladium bicolor*), jajagoan (*Echinochloa crusgalli*) and *Ageratum conyzoides*. Embankment with narrow-leaves has jajagoan (*Echinochloa crusgalli*), *Cynodon dactylon* and *Cyperus kyllingia*. The embankment with broad-leaves contain taro (*C. bicolor*, *Amaranthus spinosus*, *Leptochloa chinensis*), *Mimosa pudica* and *A. conyzoides*. Then embankment with clean vegetation has few *Echinochloa crusgalli* and pruning remains on the edge of embankments. According to [7, 20] state that the response of ant is very sensitive to habitat. They has greatly affects the presence of each ant species in the observation areas.

The difference number of each type ant in embankment condition because the needs of ant are different based on the species. According to [21] stated that habitat is a place for living things to develop. Every ant species has specific habitat based on behavior and availability of food. An observations average number of *Solenopsis* sp. showed that the four embankment condition indicated the highest population in banana trees (55 individuals/pitfall), followed by narrow-leaves 6.60 individuals/pitfall, in clean embankment (5.60 individuals/pitfall) and broad leaves (3.40 individuals/pitfall). *Solenopsis* sp. in the moderate category according to the Way and Khoo population scale index [22]. The difference number of ants showed differences in the temperature conditions of the embankments as the suitable habitat for *Solenopsis* sp. Embankment contain banana trees providing more humid soil condition than habitat with broad-leaves vegetation. According to [2] stated that soil temperature is one of the factors that greatly determines the presence and density of soil organisms.

4. Conclusion

The highest number of *Solenopsis* sp. in banana trees (55 individuals/pitfall) and the lowest number of *Solenopsis* sp. in the embankment contain broad leaves (3.40 individual/pitfall). The averages number of *Pachycondyla* sp. in banana trees only 1 individual, significantly different compared to narrow leaves about 0.40 individual/pitfall. Population of *Pachycondyla* sp. not showed in the clean embankment and narrow leaves vegetation.

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