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Size and the Composition of the Colony of Weaver Ants (*Oecophylla smaragdina*) and Ecology Role Toward the Palm

[1]Irham Falahudin, [2]Siti Salmah, [2]Dahelmi and [3]Ahsol Hasyim
[1]Faculty of Tarbiyah, Program of Biology Education Study,
Universitas Islam Negeri Raden Fatah Palembang, Sumartera, 30151, Indonesia
[2]Faculty of Mathematics and Science, University of Andalas, Sumarta Barat, Padang, 25163, Indonesia
[3]Department of Agriculture, Institution of Lembang Horticulture, Bandung, Indonesia

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Corresponding Author:
Irham Falahudin
Faculty of Tarbiyah,
Program of Biology Education Study,
Universitas Islam Negeri
Raden Fatah Palembang Sumartera,
30151, Indonesia

ABSTRACT
A weaver ant (*Oecophylla*) is one of insects which is classified into Hymenoptera order and Formicidae family. There are two species of weaver ant, i.e., *O. smaragdina* which is spreaded along India, South East Asia till Australia and *O. longinoda*, which is distributed through Africa. Every ant's nest has each own size which is different one to another. This nest's size distinction causes the difference in the population dynamics of each colony as well. A weaver ant is a social insect that forms a kind of group named colony. A colony of *Oecophylla* consists of reproductive and non reproductive class. This research aims at observing the dynamics of weaver ant colonization toward the economics value and palm ecology. The method used in this research was a survey. Meanwhile, the samples were drawn by using hand collecting technique. The results of the research showed that there were 8 colonies of weaver ants which have varied sizes. The biggest size of the mosaic nest of weaver ants (*Oecophylla smaragdina*) gained in this study was (69:14, 2 cm) and the smallest one was (13:11 cm). Each mosaic has 2 spaces in average. The dynamics of a weaver ant colony are also varied. The biggest number of populations of ants in one nest found in this research were 7508 ind/nest and the smallest one was 578 ind/nest. The more ants found in the nest the higher the economics value.

Key words: Size of colony ants, weaver ants (*Oecophylla smaragdina*), ecology role toward the palm

INTRODUCTION

A weaver ant is the oldest genus in the world which has a vast territorial range (Wilson and Taylor, 1967). Ant is one of social insects that has such kind of communication system in order to communicate one to another in the colony (Borror *et al*., 1989). It can be in the form of nudge, sound, visual and chemical (Romoser, 1981; Harlan, 2006). The system of visual and chemical communication can be in the form of pheromones which are used to identify the food location of insect. The activity of *O. smaragdina* happens all the time, however, its activity happens more in the afternoon compared to one in the night. The activity in the night happens more in the nest.

The ability to cooperate well was also identified in each ant's activity. There are few ants which have well economics value either material or non material. This ant's existence sometimes emerge troubles for humans but have benefits as well. The way of nest formation is one of keys to understand about the mosaic of an arboreal ant's nest. We can compare the importance of economical components and environment toward biological control (Djieto-Lordon and Dejean, 1999).

Fig. 1(a-e): (a) Weaver ants nest (*Oecophyla smaragdina*), (b) Males, (c) Females, (d) Queens and (e) Weaver ant's eggs

The ability of good cooperation seen in any ants activities. Some ants have economical value and another ants have ecological value in oil palm plantations. The ability of forming the nest is sort of adaption for arboreal ants. This potential adaptation is fluctuating toward the working ability of these kinds of ants. As a group of colony, each ant in the colony has a clear task. Therefore, a nest becomes the important part of the dynamics of those ants. This ability will influence the mosaic formation of a nest. There are some important factors that influence the process of nest formation on arboreal ants (Sanders *et al.*, 2007). They are, types of food and types of tree or branch, the place to live on. A Certain domination of certain species in a population will affect the form and the nest made. Sometimes, the manipulation of the mosaic of the nest is determined by the domination of ants live on that tree (Huang and Yang, 1987; Way and Khoo, 1992).

The study of animal ecology at least covers three major aspects in learning the form of life of that animal. Those aspects entail descriptive, quantitative and synthetic analytic (Falahudin *et al*., 2012). Ant is kind of motile organism. In other words, it can move from one spot to another. There are different kinds of animal living in certain community with certain characteristics. There are some that live on earth named terrestrial, on trees called arboreal and in the water named aquatic. Being motile or not is indicated by environmental factors such as temperature, air and food supply.

Ant weaver is a social insect that has a clear task and function. It can be seen from its life cycle. When the eggs are ovulated, the diploid will grow into females if not it will become the males (haploid). Ants are holometabolous where the process of the metamorphosis develops completely. Its life cycle starts from egg, larva, pupa and the mature step (Fig. 1a-e). This life cycle is affected by the food. The eating

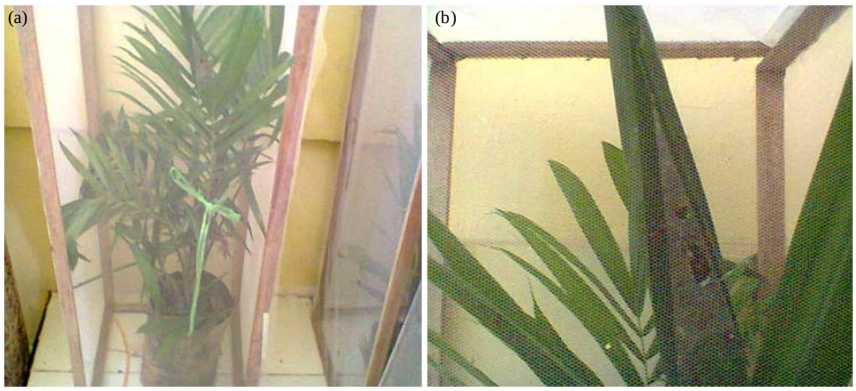

Fig. 2(a-b): (a) Colony formation and (b) New colony

process in the larva step named trophallaxis. It seems of real interest that the "Calling" behavior seems to be well established, entirely in a sexual context, at so primitive a grade of formicid evolution (Haskins, 1978).

The ability of weaver ants to form the nest is such valuable knowledge for us as humans. Besides considering the good place, the ants also pay attention on the sanitation and sufficient resources. The important role of the process of weaver ant's nest formation is the formation patterns (Fig. 2a-b). It can be as the indicator of nature especially in agriculture (Peck *et al.*, 1998). Ant's community ecology has a tradition of detailed studies in small plots but the use of ants as bioindicators requires a predictive understanding of community structure and dynamics at a range of spatial scales. Such an appreciation of ant communities and their most effective use as bioindicators is best served (Andersen, 1993) and niche segregation nest a colony (Parr and Gibb, 2010). The ability to form a nest is called colonization. The Process of colonization happens all the time. The ability to form this nest will become the change of the dynamics of population of weaver ants. Therefore this process of nest formation done by weaver ants will impact the ecology and economics value to humans. The ecology value of the process of weaver ant's nest is as the agent of natural control. Meanwhile, the economics value gathered by the people in the society is the selling point of the nest, egg and larva that are highly valuable, around 80.000-100.000 kg^{-1} rupiahs.

Thus, from the previous explanations, the writer was interested in doing the research about the arboreal ants (Oecophylla smaragdina) in terms of the formation of their nest and its relationship to the value of agriculture ecology.

MATERIALS AND METHODS

This research was located in the area of oil palm plantation in Gasing village, Tanjung api-api, Banyuasin Regency, existed in between latitude 104,40°-105,15°E and 1,3°-4°S in South Sumatera Province. This research was conducted around 4 months since march till June 2013.

The materials used in this research were: palm, weaver ant's nest, chloroform, glue and magic chalk. Besides, the tools utilized in this research were the 1 kg of plastic bag, gauze, tweezers, scissors, sample bottle, gloves and camera.

The method employed in this research was a recognition survey method. The study of the dynamics of weaver ants (*Oecophylla smaragdina*) colonization was done at the oil palm plantation at the top and or where the ants were nested on the branch. The study was carried too saw characteristic ecology from the fluctuation of a weaver ants colony. By employing a survey technique area (Sanders *et al*., 2007), we could find out whether there is a new colony of weaver ants or not in each location. And then the samples of the colony to define their dynamics were drawn by using hand collecting technique (Agosti *et al.*, 2000). That is the method of drawing the samples directly by using hands. This colony was gathered and then it was counted to find out the number of ants population. After that, the nest was measured to determined the mosaic. Procedures done were as follows.

Mosaic nest: Determined the acreage and cruiseded areas in the survey of oil palm plantation. After that started point of the survey, then walked around to observed and taking the ant's nests by cutting the nests. Then putting them into the plastic bag the which has been covered into cottons drabbled with ether/chloroform. The nests were taken from 7 till 12 o'clock in the morning. After that, they were brought to the laboratory to have a nest for morphology analysis. The nests were Analyzed morphometric to measure the length, width, height and number of forming spaces.

Dynamic population of weaver ants (*Oecophylla smaragdina*): The first step in completely done, the next step was to count the population of the colony found in the nests. Every nest was measured, they were separated from other nests. Next, the ants were counted and classified; females, all males, queens, eggs and larvae. The order to determine the dynamics of population in every nest. The data collected were tabulated to predict the economics value gained from every nest.

RESULTS AND DISCUSSION

As the social insect, the weaver ant (*Oecophylla smaragdina*) has daily activities, that are grooming activities, food searching and colony movement. Given the incredible abundance of ants (*Oecophylla*) in most habitats and their propensity to forage on the leaf and steam, it is not surprising that these mutualisms are so common (Coley and Barone, 1996). This food searching activity is closely related to territorial range. The territorial area can be absolute and spatiotemporal. Absolute territory the area which is guarded from the enemies that can come anytime. Some ants like *Oecophylla smaragdina*, *Formica rufa*, *Iridiomyrmex purpureus* are ants with absolute territory (Holldobler and Wilson, 1983). Gibb (2003), have investigated the effects of fragmentation due to urbanisation on the species composition and functional roles of ants in South-Eastern Australia. Spatiotemporal territory is a certain area which is guarded from the intruder that can intrude anytime. The form of the territory can be in two or three dimensions (Holldobler and Wilson, 1990).

The results of the research on the mosaic nest and the colony dynamics are listed in Table 1 and 2 as follows.

The ability of the territory ants also affects to the process of mosaic nest formation. This relates to the ability to create a new nest. Contrarily, *Oecophylla* are relatively well represented on arboreal, especially in tropically countries. Despite extremely changeable daily climatic conditions, the scarcity of nesting sites and the unpredictable availability of prey in these exposed environments (Schulz and Wagner, 2002). This very high abundance, however, is couples with only a moderate diversity in Africa (Dejean *et al.*, 2007), American (Wilson, 1987), Asian (Stork, 1991; Floren and Linsenmair, 1997) and Australian (Bluthgen *et al.*, 2004) Tropical rainforest.

There were 8 nests with varied shapes found in this research (Table 1). The bigger size of the nest found, the bigger numbers of colonies collected. The ability of ants in forming a permanent colony cannot be separated from the food supply available and also the supported condition of the environment. From Table 1, it can be seen clearly that there are several big size of the colony found in the nest that is colony of number 2, 6, 1, 3 and 7. Each colony has big amounts of ants that are 7508, 4390, 1468 and 2816. The process of a new colony movement will be seen clearly from the shape of young and old nest, if the nest is opened and when it was analyzed, there was no the queen and there were only little populations found (Fig. 2a-b). The formation of a new nest is influenced by dietary factors and ecological characteristics. Biomass also affects the composition of the ant colony of ants found in the nest (Gibb and Hoculi, 2003).

From Table 2, it can be seen that the dynamics of ant's populations found in the nests at the oil palm plantation were also varied. The big nest, there were found few eggs and larva with the total number with other 8 nests found were about 5494 eggs and 5762 larva (Fig. 1e). From those amounts, it can result a high economics value for people in the society. The nests found were observed every 10 till 15 days in 4 months. Along that range of time, the young nest has usually been formed (Fig. 1a). In around 10 days, those nests can be harvested. Each nest's weight is about 1 kg/nest (Fig. 1e).

The ability of forming the colony is affected by ecology factor. The other supporting factors are the availability of resources and pheromone. Resources are everything consumed by organisms which can be differentiated as materials, energy and spaces. Resources determine the abiotic and biotic factors needed by animals. Every animal is varied based on spaces and time. Invasive ants compete with and prey upon a diversity of other organisms, including some vertebrates and may enter into or disrupt mutualistic interactions with numerous

Table 1: Size and the mosaic nest of weaver ants of oil palm plantation

No. of nest	Length (cm)	Width (cm)	Quantity of space	Quantity (ind/nest)
1	54	95	2	1468
2	69	14,2	2	7508
3	47	18	1	1318
4	33	13,1	2	1434
5	33	11	1	578
6	65	17,2	2	4390
7	45	15,5	2	2816
8	33	13,1	1	1623
Average	47,375	13,95	2	2641,875

Table 2: Composition of weaver ant's colony (*Oecophylla smaragdina*) of oil palm plantation

No. of nest	Amount of males/colony	Amount of females/colony	Amount of eggs/colony	Amount of larva's/colony	Total
1	383	201	397	487	1468
2	1115	1642	2738	2013	7508
3	318	300	145	555	1318
4	289	587	201	357	1434
5	115	132	173	158	578
6	1102	1320	758	1210	4390
7	876	765	650	525	2816
8	356	378	432	457	1623
Total	4554	5325	5494	5762	21,135

plants and other insects as factor of forming the colony (Holway *et al*., 2002). Therefore, every animal will be varied based on space and time. Thus every animal will always try to adapt to the environment changing. In the process of adaptation, the animal which is able to adapt to the environment will be survived, meanwhile others that cannot adapt to that environment will be death or emigrate or even extinct (Leonotis, 2012).

Economically, in four months, the harvesting process can be done twice for one tree. This can bring economical advantage to farmers of oil palm plantation and also keep the stability of environment toward caterpillar pests like *Thosea* sp. (Kalshoven, 1981; Pracaya, 2002). The eggs and the larva of the nest can be collected and have the high economics value. Besides, weaver ants in oil palm plantation can add the variations in agroecosistem in order to increase the population (Van Driesche and Bellows Jr., 1996), with these ways as follow: (1) To provide the alternative host and preys when there is the scarcity of the host's population, (2) To provide the source of food (The pollen and the nectar) of mature parasitoid and (3) Keep the pests that can be received in order to make sure the continuation of natural predators.

The fluctuation of the dynamic nests also gives the ecological value toward the oil palm. In facultative associations, a plant offer nectar, food bodies and other rewards to lure ants that nest else, where to patrol its leaves and remove any herbivores they encounter (Coley and Barone, 1996) in palm oil. Fellers (1987) and Davidson (1998) said that, the explanation some of us favor, species that are ecologically or numerically dominant may differ sufficiently in their natural histories, foraging modes and resource use, such that they might not directly compete for resources (Sanders *et al.*, 2007).

The bigger the nest the more weaver ants populations that can become the pests' control of the palm. The nests' changes can also indicate that the environment is being contaminated or not that can be seen from the number of populations and the forming nests on the palm (Altieri, 1999). Besides contributing to economy, the ants also contribute to ecological value and natural balance.

CONCLUSION

From the findings and discussion of this research it can be concluded that the mosaic's size of weaver ant (*Oecophylla smaragdina*)'s nest was varied. The biggest size was (69:14, 2 cm) and the smallest one was (13:11 cm) with the form was like a triangle and with 2 spaces in average. The dynamics of weaver ant's (*Oecophylla smaragdina*) populations were also varied with the most total number of populations were around 7508 ind/nest and the least ones were about 578 ind/nest. The more or less the population will depend on the mosaic and the size of the nest which is influenced by ecological factor that is resources and a good condition of the environment. The more ants populations in a nest the higher the economics and the ecological value.

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