Abundance of Weaver Ants (*Oecophylla smaragdina*) in Three Forest Stands

Musyafa

Faculty of Forestry Universitas Gadjah Mada Yogyakarta, Jln.Agro No.1 Bulak sumur Yogyakarta 55281
*Corresponding Author

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Abstract— *Weaver ants, Oecophylla smaragdina (Hymenoptera: Formicidae) are aggressive predators and consume various species of pests of agricultural and forest plants. The ants build nests and live in the trees. This research was done to know the percentage of trees colonized by weaver ants, individual number of weaver ants, and the number of nest of weaver ant on teak, eucalypt, and acacia stands and also the occurrence of trophobionts on these trees. The research was done in May, July and September 2015. The abundance of weaver ants was determined by counting the number of nests ~~and the individual number of weaver ants on the trees~~* ***as the primary measure of colony presence. Foraging activity near the ground was also estimated by counting ants on tree trunks up to 1 meter in height.*** *Trophobionts which were living on the trees were also observed. The results showed that the percentage of trees colonized by weaver ants was the highest in eucalypt stand (7.0-8.6 %) followed by teak stand (1.1-4.2%) and no weaver ant nest found in acacia stand. The highest individual numbers of ant* ***activity on trunks*** *was found in teak stand (2-38 individuals) followed by eucalypt stand (8-20 individuals) and no weaver ant found in acacia stand. The number of nest was 1.0-5.4 nests/ tree on teak stand, 1.8-4.2 nests/tree on eucalypt stand and 0 on acacia stand. On teak stands, a decline of weaver ants* ***nest*** *population occurred in September (dry season)****,*** *whereas on acacia stands, there were no* ***nests found in any season****. Weaver ants symbiotically coexisted with* ***trophobionts*** *of Coccidae and Pseudococcidae on teak stand. Meanwhile, trophobiont was not found on eucalypt stands. Weaver ants probably obtain sugar from extraforal nectar on young leaf of eucalypt.*

Keywords— Oecophylla smaragdina; biological control; plantation forestry; tree phenology; trophobiosis; host tree suitability.

I. INTRODUCTION

Weaver ants *O.smaragdina*, (Hymenoptera: Formicidae) build nests in the trees. These insects live in tropical areas in Asia and Africa, and the ants are not found in subtropical areas. Weaver ants are social insects that live in colonies which consist of queen, male and worker ants (Hodleber, 1983).The queen lays eggs and it usually has a bigger body size (15-16 mm), and her body is brownish green. The queen ant stays in the nest, which is hidden and located at the higher part of a tree. During rainy seasons, it is common for a colony to have several queens, because during the rainy season there is plenty of food available for the ants. Male ants mate with the queen ant and they only live for one week, and they die after one week. Worker ants are infertile females and these ants are responsible for caring for the young, the pupae and the queen. These worker ants are also responsible for collecting food, defending the nest, and transferring larvae and pupae (Kaleka and Haryadi, 2012).

Weaver ants go through a complete metamorphosis process. The life cycle of an ant colony begins when a mated queen finds a favorable location for its first nest among the leaves of a tree or a shrub; she lays around 35 eggs within 5-10 days after it breaks off its wings (Lokker, 1990).

The larvae undergo several skin changes before they develop into pupae (Kaleka and Haryadi, 2012). The final instar of larvae (15 days old) can produce silk which is used to cover the cavities in the nest (Lokker, 1990). By the age of 17 days, the larvae develop into pupae, and the first worker ants appear after 28 days (Lokker, 1990; Putranto, 2012).

There are two types of food consumed by weaver ants, honey that comes from Homoptera other insects. The honey is collected from Homoptera members, such as Coccidae, Stictococcidae, Pseudococcidae, Coccidadae, Aphididae, Margarodidae, and

Ciicadellidae. The relations between Homoptera and the ants are mutualistic, in which the ants receive food that is rich in sugar and amino acids; and the bugs receive protection from predators and parasites. Weaver ants are generalist predators; they feed on almost all species of arthropods that they find. The common taxa of insects consumed by weaver ants are Heteroptera, Coleoptera, Orthoptera, Blattodea, mantid, Diptera and Arachnida (Locker, 1990).

Weaver ants need food that contains protein, fat and carbohydrate or sugar. Protein is obtained from insects eaten by the ants, every time the ants find food, they will bring it into the nest (Kaleka and Haryadi, 2012). Weaver ants obtain sugar which comes from exudates secreted by insects and from flower nectars. The sugar liquid is used as energy source to build a new nest. Flower nectars are taken from plants such as *Hibiscus tiliceaus, Entada phaseoloides, Caesalpinia traceyi, Flagellaria indica dan Smilaxaustralis* (Bluthgen and Konrad, 2004). A research by Kartikasari (2013) shows that weaver ants prefer eucalypt trees as their hosts.

O. smaragdina has been used for biological pest control in orange plantations in the year 340 before Christ. On cacao plants, weaver ants can reduce the damage from capsid pest. Weaver ants are also effective in controlling Pseudococcidae pest. In Australia weaver ants are used to control pests that infest mango plants. In Asia, the use of ants as pest predators has been practiced for a long time and has been tested scientifically (Way & Kho; 1992). Weaver ants (*Oecophylla smaragdina*) are members of the ant family that prove to be the most effective predators in tropical area. Weaver ants can be the predators for more than 50 species of pests from 12 species of different plants (Way & Khoo, 1992). Weaver ants have been used for more than 1600 years in Vietnam and China to control pests on orange plants. Weaver ants are also effective to control pests that harm cashew plants in Papua New Guinea. These predators are also useful to control bagworm pest that attacks oil palm plantations.

In Indonesia weaver ants are not yet commonly used for pest control. Forest stands are often troubled by pests such as *Hyblaea puera* caterpillars on teak plants and *Hypsipill*a sp. shoot borer on mahogany plants. Information about the role of weaver ants as predators in the forest hasn't been available. In Wanagama Forest Gunung Kidul, Yogyakarta there are some forest stands such as teak stand, eucalypt stand and acacia stand. Weaver ant is potential predators of pest attacking these stands. Therefore it is necessary to evaluate the abundance of weaver ants in these stands. This research is expected to open the path towards using weaver ants for pest control on forest plants.

The objective of the research is to determine

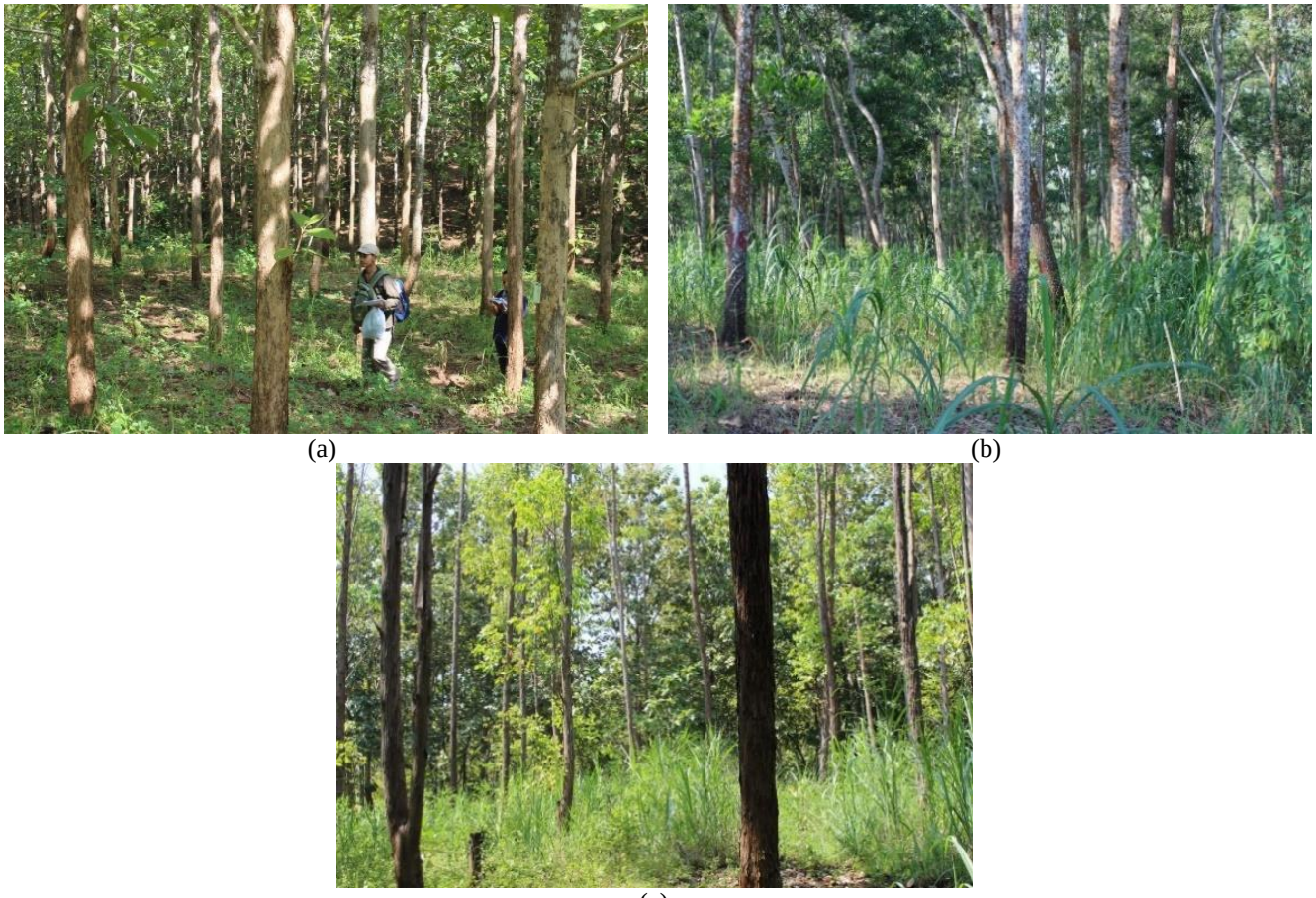
1) The percentage of trees colonized by weaver ant and the abundance of weaver ants (individual numbers of weaver ants and the number of weaver ant nest on teak, eucalypt and acacia stands).
2) Trophobionts that are involved in symbiosis with weaver ants.

II. MATERIALS AND METHODS

The research was conducted on teak (*Tectona grandis*), acacia (*Acacia mangium*), and eucalypt (*Eucalyptus pellita*) stands in May, July, and September 2015 in Wanagama Forest, Gunung Kidul, Yogyakarta.

2.1 Study Sites:

- **Teak stands:** The teak stands are located in plot 13; they are monoculture stands which were planted in 1990 in an area measuring 5 hectares. These stands have a rather dense crown, with a density of 1,060 trees/hectare. The teak plants have a diameter of 30.5 cm.
- **Eucalypt stands:** Eucalypt stands are located in plot 17 covering an area of 2.5 hectares. These plants are 35 years old, they have a density of 725 trees/hectare, and the diameter is 21.3 cm. The forest floor is full of grass which is regularly taken by the people around the forest to serve as forage for livestock. The eucalypt stands have a less dense crown, which lets more sunlight in.
- **Acacia stands:** The stands are located in plot 18 covering an area of 0.6 hectares. The plants are 25 years old, with a diameter of 19.7 cm. The density is 717 trees per hectare. The floor is full of grass, which is regularly taken by people who live around the forest to be used as forage for livestock; there are also Siam weed (*Chromolaena odorata*), peanut, *Lantana camara*, piper and *Streblus asper* plants. The acacia stands have a rather dense crown; therefore, the intrusion of sunlight is not too high, around 51%.



(a) (b)

(c)

FIGURE 1: Teak stand (a) acacia stand (b) and eucalypt stand (c) at Wanagama

2.2 Sampling Design:

A 20x20-meter measuring plot was established in the teak stand (10 replications), the eucalypt stand (8 replications), and the acacia stand (5 replications). The number of measuring plots was proportional to the area of each stand, with a sampling intensity of more than 5%. The distance between plots within a stand was 10 m.

2.3 Data Collection:

Within each plot, every tree was surveyed. For each tree, the diameter at breast height (DBH) was measured. The primary measure of weaver ant colony presence was the count of all visible nests in the tree canopy. As a supplementary index of ground-level foraging activity, the number of worker ants present on the tree trunk up to a height of 1 meter from the ground was counted. **This trunk count is an index of localized activity and is not a measure of total colony size.** A systematic visual search for trophobiont hemipterans (scale insects, mealybugs) was conducted on the trunk and major branches of all trees, with particular attention to those hosting ant nests or trails.

2.4 Data Presentation:

Data are presented descriptively as means and ranges. Trends between stands and across seasons are discussed qualitatively. Formal statistical comparison was limited by the low absolute number of colonized trees and the absence of colonies in acacia stands.

III. RESULTS AND DISCUSSION

3.1 Colonization and Nest Abundance:

The percentage of trees hosting weaver ant nests was highest in the eucalypt stand (7.0–8.6%), followed by the teak stand (1.1–4.2%). No weaver ant nests were found in the acacia stand during any sampling period (Figure 2). The mean number of nests per colonized tree was higher in teak (ranging from 1.0 to 5.4 nests/tree) than in eucalypt (1.8 to 4.2 nests/tree), though both showed considerable variation (Figure 3).

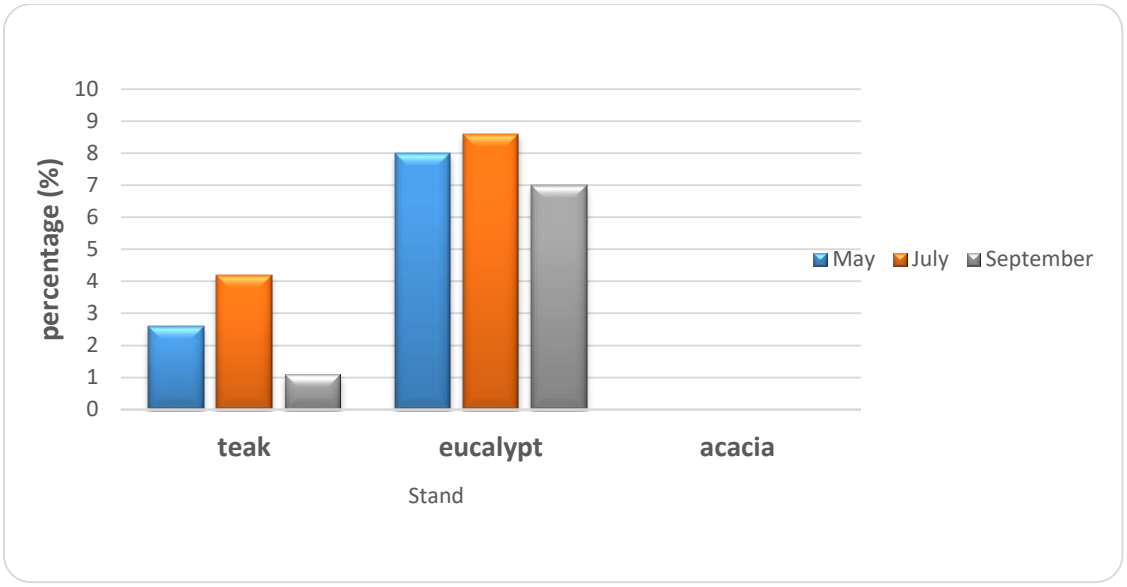


FIGURE 2: Percentage of teak, eucalypt and acacia tree that become weaver ant hosts

At the teak stand, the number of colonized trees and nests per tree declined in September (late dry season), coinciding with leaf senescence. In contrast, colony presence in the evergreen eucalypt stand remained stable across all months (Figures 2 & 3). The deciduous nature of teak likely creates a seasonal bottleneck, as leaf fall destroys nest sites and may reduce prey and carbohydrate availability. Eucalypt, with its persistent foliage and observed extrafloral nectar sources on young shoots (Figure 6), provides a more stable environment for colony maintenance.

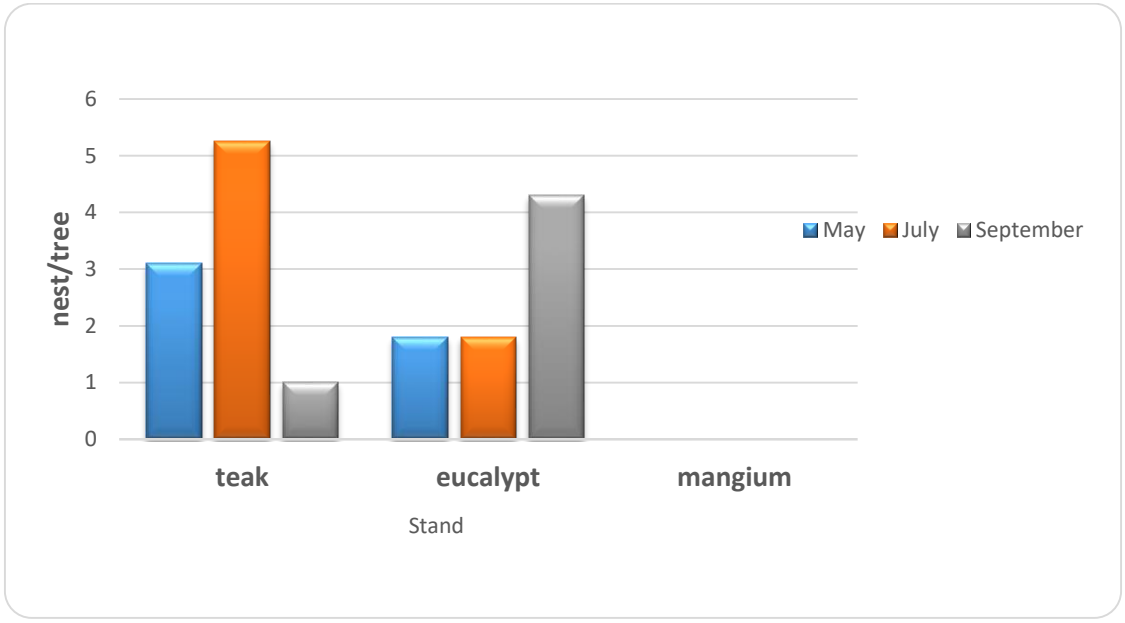


FIGURE 3: The number of weaver ant nests per tree on teak, eucalypt and acacia stands

3.2 Trunk Foraging Activity:

Counts of ants on the lower trunk (0-1 m height) varied between stands and seasons (Figure 4). The highest counts were recorded in teak in July (up to 38 individuals), followed by eucalypt. Activity declined in both stands by September. **It is crucial to interpret these counts as an index of ground-level foraging traffic, not as a census of colony size.** The observed patterns may reflect seasonal shifts in colony resource allocation or ground-based prey search, but the methodological limitation precludes definitive conclusions about total ant abundance. The concurrent decline in both trunk activity and nest counts in teak during September supports the interpretation of an overall seasonal contraction in colony activity.

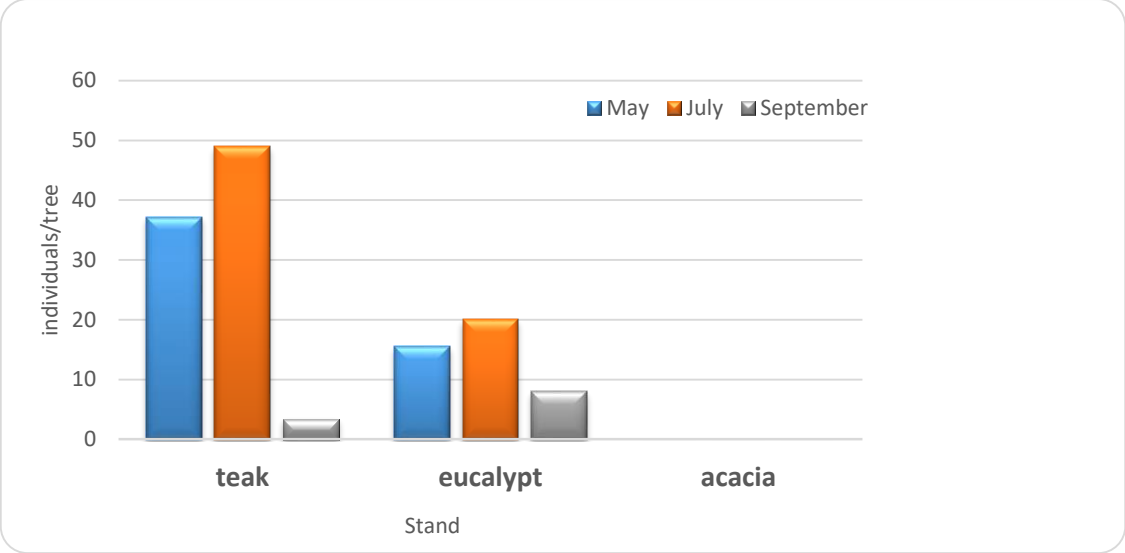


FIGURE 4: The number of individual weaver ants per tree (at the height of 1 m) on teak, eucalypt and acacia stands

3.3 Absence of Colonies in Acacia:

The complete absence of weaver ant nests in acacia stands was notable. This contrasts with other studies noting acacia as a potential host. Possible explanations observed or hypothesized in our study site include: (1) intensive collection of ant larvae ("kroto") for bird food, which may locally extirpate colonies, and (2) the presence of other ant species (e.g., *Pheidole* sp.) observed on acacia, which may compete with or disrupt founding *O. smaragdina* queens. The lack of both nests and trunk-foraging ants strongly suggests that acacia is not functioning as a host tree for weaver ants in this plantation context under current conditions.

3.4 Trophobiont Associations:

Trophobiont hemipterans of the families Coccidae and Pseudococcidae were found in association with weaver ant trails and nests on teak trees (Figure 5). This mutualistic relationship provides ants with carbohydrate-rich honeydew and provides the hemipterans with protection. No such trophobionts were found on eucalypt trees. On eucalypt, ants were frequently observed aggregating on young, expanding shoots (Figure 6), a behavior strongly indicative of harvesting extrafloral nectar (EFN). This suggests a flexible foraging strategy where ants obtain carbohydrates from tended hemipterans on teak and directly from plant EFN on eucalypt, highlighting the influence of host tree traits on ant symbiotic relationships.

FIGURE 5: Coccidae tropobion on the teak plant.

FIGURE 6: Weaver ants at the shoot of eucalypt plant to obtain nectars.

IV. STUDY LIMITATIONS AND FUTURE RESEARCH

This study provides a foundational survey of weaver ant presence. A key limitation is the method of counting ants only on the lower trunk, which precludes estimates of total colony size or arboreal activity. Furthermore, the low number of colonized trees limited detailed statistical analysis. Future studies should incorporate standardized whole-tree surveys to better estimate colony abundance and spatial distribution. Experimental work is also needed to test the hypotheses generated here, particularly regarding the absence of ants from acacia and the relative importance of extrafloral nectar versus honeydew in different stands.

V. CONCLUSION

Weaver ant (*Oecophylla smaragdina*) colony occurrence, as measured by nest presence, varied significantly among teak, eucalypt, and acacia plantation stands. Eucalypt supported the most consistent colonization, likely due to its evergreen foliage and extrafloral nectar sources. Colonies in deciduous teak declined during the dry season leaf-shedding period. No colonies were found in acacia, suggesting it is not a functional host in this system, possibly due to anthropogenic pressure or biotic competition. The ants exhibited a flexible trophic strategy, engaging in mutualism with trophobionts on teak while potentially exploiting direct plant resources on eucalypt. These findings underscore that host tree species identity and phenology are key determinants of weaver ant distribution in managed forests, with important implications for their potential role in conservation biological control.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

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