

# Relationship between the Number of *Oecophylla smaragdina* Fab. ant nests and the Intensity of *Prays endocarpa* Meyrick Attacks on Pamelos Citrus (*Citrus maxima* Merr)

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## ABSTRACT

This research on the relationship between the number of *O. smaragdina* nests and the intensity of *P. endocarpa* attacks has been conducted at the Pamelos citrus plantation of Gelengge in Pangkep Regency. The observation sample trees were those which had the *O. smaragdina* nests for three weeks in the Pamelos citrus trees. The sample trees were grouped into four categories namely: A) 1-2 nests per tree, B) 3-4 nests per tree, C) 5-6 nests per tree, and D) without nests (control). The observed parameters were the attack intensity of *P. endocarpa* on fruits on trees and on fallen fruits found under Pamelos citrus trees. The observation of the attack intensity was carried out after the Pamelos citrus fruits reached six weeks old, or after the fruits reached 50 mm-60 mm in size. The results showed the intensity of *P. endocarpa* attack on the fruits in the lowest tree was 36% in the trees with about 5-6 *O. smaragdina* nests, and the highest in the trees without nests was 66%. The attack intensity on the lowest falling fruit was 41.5% on the trees with 5-6 nests per tree, and the highest was 60.3% in the trees without the *O. smaragdina* nests. The regression analysis showed a relationship between the number of *O. smaragdina* nests with the attack intensity with the regression coefficients, respectively were  $r = 0.94$  and  $r = 0.98$ .

**Keywords :** *Prays endocarpa*, Nests, *Oecophylla smaragdina*

## I. INTRODUCTION

One of predator mostly found in many agricultural commodities is the ant *Oecophylla smaragdina* Fab. [1,2]. The *O. smaragdina* has been studied for their

utilization as predators against pests in some plants [3, 4, 5, 6, 7, 8, 9, 10, 11]

The abundance of *Oecophylla* ants in a planting area can be marked and measured based on the presence and number of nests [12]. These nests are

created by weaving the leaves on the trees they inhabit [11, 5]. The nest is a breeding ground or a place to coordinate in carrying out daily activities [11]. The number of nests created per tree can vary depending on the needs and environmental suitability of the *O. smaragdina* ants [13, 14].

One of the pests whose status *Prays endocarpa* Meyrick is the important pest of the Pamelo citrus (*Citrus maxima* Merr) is the [15, 16, 17, 18]. These pests attack pangelo citrus at a young fruits age and have the potential to cause large losses due to the fall of young fruits, and if those fruits grow until large, then they are abnormally shaped due to the appearance of lumps and the shape of thre are small holes around the surface of the fruits [15, 19, 20].

The presence of *O. smaragdina* in the Pamelo citrus plant can be used as predators against *P. endocarpa*. However, it is not yet known how effective *O. smaragdina* abundance can be reduce the *P. endocarpa* attacks. The research aims to determinate the relationship between the nests number is one of the abundance parameters of *O. smaragdina* that can be used to assess its relationship with and the *P. endocarpa* damage on pamelo citrus.

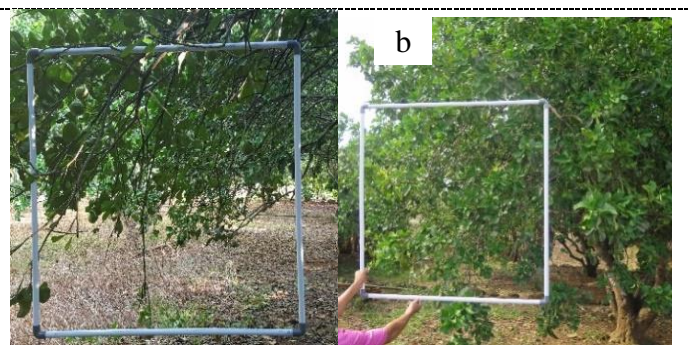
## II. METHODS AND MATERIAL

This research was conducted from September to November 2022 in the farmer's Pamelo citrus garden in Gellenge, Ma'rang District, Pangkajene Regency, South Sulawesi, Indonesia. The conducted research arranged in the period of flowering and small fruiting of citrus.

At a one-hectare Pamelo citrus field, five plots were created diagonally. Each plot consisted of ten samples of Pamelo citrus trees. The total sample of Pamelo citrus trees were 50 trees. When the citrus plants' fruits grew with a size of 10 mm - 15 mm, the tree was marked as a sample tree for the measurement of the *P. endocarpa* attack intensity on the Pamelo citrus fruits. The criteria for sample trees for the observation of attack intensity were those that had *O.*

*smaragdina* nests for three weeks (21 days) in the Pamelo citrus trees. Determined the number of nests per tree by repeating each for four times, namely: A=1-2 *O. smaragdina* ant nests per tree for three weeks; B= 3-4 *O. smaragdina* ant nests per tree for three weeks; C= 5-6 *O. smaragdina* ant nests per tree for three weeks and D= Without *O. smaragdina* ant nest (control) for three weeks

The parameters observed in this study The attack intensity of *P. endocarpa* were observed in the fruits that were still in the tree, and in the fruits that had fallen under the tree. The attack intensity on the fruits in the canopy is observed with a square frame-shaped (1 m x 1 m) auxiliary tool made of parallon pipe (Figure 1).



**Figure 1.** 1 m x 1 m square parallon pipe frame (a), Measuring the *P. endocarpa* attack intensity on the pamelo citrus plant (b).

The *P. endocarpa* attack intensity It was observed after the Pamelo citrus fruits were six weeks old, or when they were between 50 mm - 60 mm in size. The attack intensity was observed in the Pamelo citrus which were still in the canopy, and those which had fallen under the pamelo citrus trees. The *P. endocarpa* damage attack intensity on the pamelo citrus fruits that have fallen is done by picking up and observing the symptoms of *P. endocarpa* (Figure 2).



Figure 2. Observation of the *P. endocarpa* attack intensity on the Pamelo Citrus Fruits which have fallen under the Trees.

The *P. endocarpa* attack intensity on the fruits is calculated by this equation:

$$\text{Attack} = \frac{\text{Number of attacked fruits}}{\text{Number of observed fruits}} \times 100$$

### III.RESULTS AND DISCUSSION

The observation results of the *P. endocarpa* attack intensity on the Pamelo citrus fruits (*C. maxima*) in the canopy, and the different number of nests category, are shown in Figure 3 and Figure 4; while the attack intensity on the fruits falling from the Pamelo citrus trees, and the number of different nests category, are shown in Figure 5 and Figure 6. The observation results of the attack intensity on the fruits contained in the canopy show the highest attack intensity in the Without Nests (control) category, which is 66.0%, followed by Category A (1-2 nests) by 47.5%, Category B (3-4 nests) by 39.0%, and Category C (5-6 nests) by 36.0%.

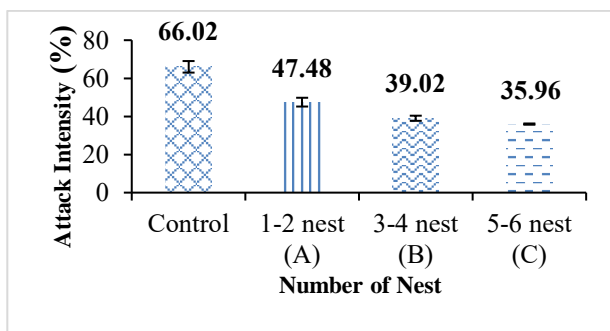


Figure 3. The *P. endocarpa* attack intensity on the fruits in the canopy of citrus plants (*C. maxima*) with different numbers

of *O. smaragdina* ant nests. Each bar shows an average with SEM (Standard Error of Mean).

The results of the linear regression analysis (Figure 4) showed that there was a significantly large negative linear correlated between number of *O. smaragdina* ant nests and *P. endocarpa* attack intensity ( $r = -0,94$ ;  $P < 0,05$ ). The higher the number of *O. smaragdina* ant nests in the Pamelo citrus plant, the lower the number of symptomatic fruits in the citrus plant canopy (the lower the *P. endocarpa* attack intensity on the fruits on canopy). The linear correlation of that was follows equation:

$$y = -4.9323x + 61.919 \quad (r = -0,94)$$

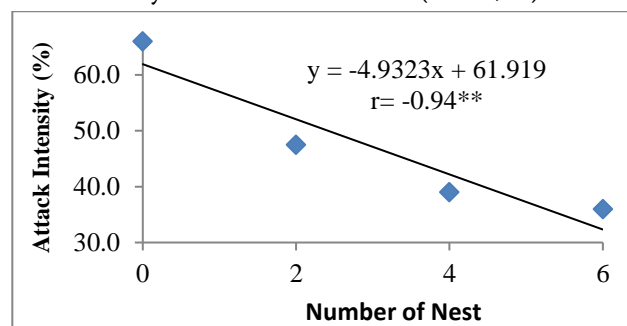
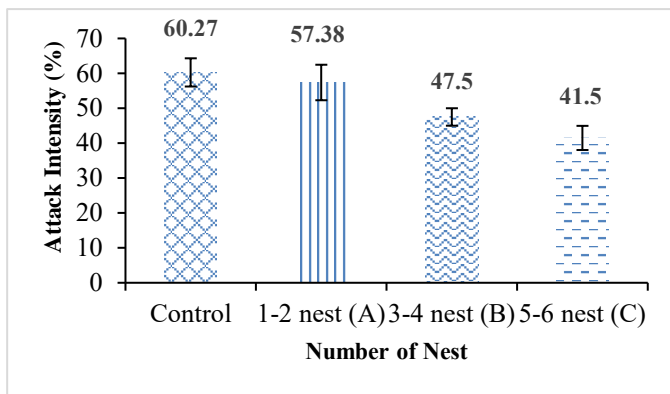


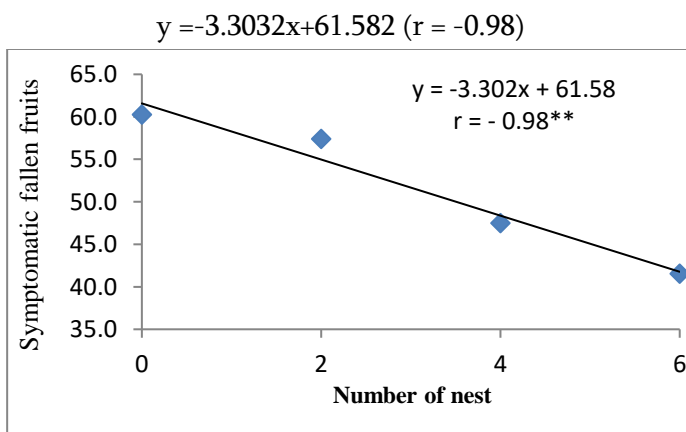
Figure 4. Graph of correlation regression of the *P. endocarpa* attack intensity observed in the Pamelo citrus plant canopy with the number of *O. smaragdina* ant nests

The observation results of the attack intensity on the fruits falling from the Pamelo citrus trees show the highest attack intensity average in the Without Nests (Control) category, which is 60.27%, followed by Category A (1 - 2 nests) of 57.38%, Category B (3 - 4 nests) by 47.50%, and finally Category C (5 - 6 nests) by 41.50%.



**Figure 5.** *P. endocarpa* attack intensity on the fruits falling from the Pamelo citrus (*C. maxima*) trees with different numbers of *O. smaragdina* ant nests. Each bar shows an average with SEM (standard error of mean)

Furthermore, the results of the linear regression statistical analysis (Figure 6) showed that there was a significantly large linear correlated between the number of *O. smaragdina* ant nests and the *P. endocarpa* attacks intensity on the fallen fruit ( $r = -0.98$ ;  $P < 0,05$ ). The higher number of *O. smaragdina* ant nests in the on Pamelo citrus plant, the lower the number of symptomatic fruits in the fallen fruits (the lower the *P. endocarpa* attacks intensity on the fallen fruits). The linear corellation relationship of that was follow equation:



**Figure 6.** Graph of correlation regression of the *P. endocarpa* attack intensity observed on the fallen fruits under the Pamelo citrus plant canopy with the number of *O. smaragdina* ant nests.

The presence of *O. smaragdina* on the Pamelo citrus plants can inhibit the *P. endocarpa* attack intensity on the citrus fruits. This research measured the influence of the number of nests on the trees against the *P. endocarpa* attack intensity on the Pamelo citrus fruits (*C. maxima*) found in the canopy, and on the fallen fruits under the plants canopy.

This measurement used sample trees that had a consistent number of nests over the observation period (3 weeks).

The research results indicated a relationship between the number of *O. smaragdina* nests on the Pamelo citrus (*C. maxima*) trees against the *P. endocarpa* attack rate on the fruits found in the canopy and on the fallen fruits showed that the C category (5 - 6 nests) can be reduced the *P. endocarpa* attack rate on Pamelo citrus fruits on the canopy by 30.96% compared to those which were Without Nest control. While the existence of , the B category -B nest (3 - 4 nests) succeeded in decreasing the *P. endocarpa* attack rate on Pamelo citrus fruits on the canopy by 27%, and the A category (1 - 2 nests) by 18.54% when compared to those which were Without Nest (control. For the fallen fruits, the presence of the C Category- nest (5 - 6 nests) succeeded in reducing the *P. endocarpa* attack rate on the Pamelo as much as 18.77%, compared to those which were Without Nest (control). While the presence of the B Category -B nest (3 - 4 nests) succeeded in reducing the *P. endocarpa* attack rate on the Pamelo as much as 12.77%, and the A Category -A (1 - 2 nests) as much as 2.89% when compared to those which were Without Nest (control. This result is in line with the previous studies which reported that the use of predators can significantly reduce pest populations significantly, as reported by [7, 21, 22, 8, 23].

The presence of a nest that indicates the presence of *O. smaragdina* ants nests on a plant branch can dispel and disrupt the process of interaction between insect pests and plants or plant parts. The *O. smaragdina* ants search for food to meet their body's nutritional needs

by searching various plant parts, such as branches, twigs, fruit leaves, and flowers [24, 25]. The nest located on young leaves makes it easier for them (*O. smaragdina*) to find food and eat a sugar-rich ingredient, i.e., the nectar, and a number of insects by patrolling around various parts of the tree [24].

Predators have advantages when used as pest control agents since not only they prey on one stage of pest development, but almost all stages of pest development such as eggs, larvae, pupae, and adults imago, and can prey on an ongoing basis throughout his life. Predators have certain advantages which do not require synchronization with one vulnerable stage of the pest life cycle [26].

The presence of nests observed in this research were the nests that formed naturally at the research site, not being treated to increase the number of nests. The maximum number of nests formed naturally are 6 (six) nests. This number is still less than 10 nests per tree, which is the recommended number of nests to be able to offer the necessary protection to plants [27]. In order to be able to control *P. endocarpa* on the Pamelo citrus plants, it is recommended to increase the number of nests per tree. A management is needed to maintain a high and stable weaver ant population on field [28]. Some techniques to increase ant populations such as feeding [29], moving the nests [30], and reducing the use of pesticides [23] can be applied based on the knowledge of the *O. smaragdina* ant abundance.

#### IV. CONCLUSION

The presence of *O. smaragdina* ants on Pamelo citrus plants can inhibit the *P. endocarpa* attack intensity on the citrus fruits; the presence of the Category-C nests (5 - 6 nests) reduces the *P. endocarpa* attack rate on the citrus fruits on the canopy by 30.96 % with a coefficient correlation of  $r = -0.94^{**}$ , and 18.77 % on the fallen fruits with the correlation coefficient of  $r = -0.98^{**}$ .

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