Prey preference of *Myopopone castanea* (hymenoptera: formicidae) toward larvae *Oryctes rhinoceros* Linn (coleoptera: scarabidae)

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Abstract. Myopoponecastanea (Hymenoptera: Formicidae) ant is a predator for larvae Oryctes rhinoceros (Coleoptera: Scarabidae) which is a pest on oil palm. These ants are able to prey on all stadia of O. rhinoceros larvae. This study was conducted to determine prey preference of M. castaneatoward its prey O. rhinoceros larvae.. The study was conducted using a Factorial Complete Random Design with two factors (using log and no log) and five replications. Preferences test was done by choice test and no choice test. The results of no choice preference test on the log treatment, M. castaneaprefer preyed on firstinstar larvae of O. rhinoceros ($\overline{X}$ = 2.6 individual) with a preference index was 0.194 and on no log treatment, M. castanea prefer for both first instar larvae and second instarlarvae ($\overline{X}$ = 4.6 individual) with a preference index 0.197. The results of the choice preference test using logs, showed that M. castanea prefer the firstinstar larvae of O. rhinoceros ($\overline{X}$ = 2.6individual), with a preference index (0.35), and on no log treatment, M. castaneaprefer the second instar larvae($\overline{X}$ =1.4 individual) with a preference index 0.189. Both first and secondinstarlarvaeof O. rhinoceros were preferred by predator M. castanea

1. Introduction

Ants have an important role in the ecosystem, which can act as pollinators, seed dispersal, and also as predators of herbivore insects [1]. Various species of the ants group have been widely used as biological agents for plant pest control, such as weaver ant or green ant (*Oecophylla smaragdina*) can prey on caterpillars (*Setora nitens*) with 83% high predation rate [2], *Dolichoderus thoracicus*, is able of suppressing *Helopeltis sp* attacks on cocoa plantations in Sulawesi [3]. Marheni [4] found that *Myopopone castanea* ant (Hymenoptera: *Formicidae*) is a predator of *Oryctes rhinoceros* pest (*Coleptera: Scarabidae*) which is one of the pests of oil palm plants. These ants usually live on the ground and decayed logs. In the palm oil plantations, these ants can be found in the fallen palm trunks and have been decayed due to old or because of stem rot disease. *O. rhinoceros* larvae in oil palm plantations usually live in decayed palm oil trunks and organic material piles. The similarity of living places between *M. castanea* and *O. rhinoceros* larvae reveal great opportunities to exploit these predatory ants as potential biological agents for *O. rhinoceros*. Based on the observations of Marheni [8] the ability to prey *M. castaneae* ants on *instar* larvae *O. rhinoceros* in the laboratory using 20 working ants could reach 4-5 prey/day. *M. castaneae* ant attacks its prey alive by biting and stinging it to death then eating its *hemolymph* liquid. The initial symptoms that were indicated on the larvae of *O. rhinoceros* were the larval cuticle which turns into brownish and gradually darkened. The body of the larvae will be blackened and damaged due to the bite and sting of *M. castaneae* ants so that remaining only the cuticle part. This ant is also able to eat the first *instar* larvae of *O. rhinoceros* until it runs out [5].

Predators are the generalist (have much prey). Despite it is generalist, predators will form selection against its prey and this selection takes place naturally. Rasool *et al.,* [6] suggest that preference is a selection against the proportions of available prey in a particular environment. Preferences could be predicted by using the equations developed by Strauss [7]. Linear index of prey preferences or preference index (*Li*) is the difference between the proportion of prey predator (*ri*) prey and the proportion of available prey *(pi*). Components that may affect the prey preference are interest and conformity to the prey, prey recognition, decision of attack or not, and ability to capture and consume the prey.
This study aims to determine the preference of *M. castanea* ants against the prey *instar* of larvae *O. rhinoceros*.

2. Materials and methods
The study was conducted from December 2016 - March 2017 at the Plant Pest Laboratory of the Faculty of Agriculture, University of North Sumatra Medan.

2.1 Insect Test Collected
The research was conducted by collecting predator ants *M. castanea* from decayed palm oil stems from palm oil plantations in the southern Binjai, Binjai City. *M. castanea* ants obtained from the field then cultivated in the laboratory of Pest Plant, Faculty of Agriculture, University of North Sumatra. The colony of the ants maintained in a glass box with a size of 70 x 30 x 30 cm. Inside the glass box was placed two pieces of decay palm stems with size 20 x 20 x 3 cm and symmetric forms as the nest of the ants. At the centre of the palm stem, there was a small hole to place the prey larvae *O. rhinoceros*. Every day the log was sprayed with water to moist the nest of the ants. The allocation of prey for *O. rhinoceros* larvae was administered according to the ant quartile requirement. When the prey is dead and begins to dry, soon it will be given the new prey of *O. rhinoceros* larvae.

2.2 Preference Test
The preference test of *M. castanea* ant prey was done into two ways, the choice preference test and the no choice preference test. The design used in this test was a Completely Randomised Design of two factors (using logs and without logs) with five replications. This test had been done inside a glass box measuring 40cm x 20cm x 20cm. In the log-treated treatment, 2 pieces of logs from the decayed palm stem measuring 15 cm x 15 cm x 4 cm were made symmetrically and had been dredged slightly in the middle to place the *O. rhinoceros* larvae, whereas in a log-free treatment, inside the glass box provided a layer of soil and some flakes of decayed stem palm that has thickness of ± 1.5 cm.

In the choice preference test, inserted 40 worker ants of *M. castanea* and 20 larvae into each glass box. *M. castanea* ant was first unfed (starvation) for 24 hours. The next day, inoculated six larvae of *O. rhinoceros* consisting of two first-*instars* larvae, two second-*instars* larvae and two third-*instars* larvae. Observations were made a day later by counting the number of dead larvae.

In the preference test with no choice, in each box of glass inserted 40 worker ants *M. castanea* and 20 ants larvae which have been starved for 24 hours. Five boxes were given six individuals first-*instar* larvae prey *O. rhinoceros*, the next five boxes provided six individuals second- *instar* larvae prey *O. rhinoceros* and the last five boxes provided six individuals third-*instar* larvae. Observations were made a day later by counting the number of dead larvae. The data were analysed statistically with ANOVA and tested at 5% level. The preferred degree (preference index) of the predator is thought to be using the equation developed by Strauss [7] as follows:

$$Li = ri - pi \qquad (1)$$

Information:

L = the linear index of prey selection

i = stadia of eaten prey

ri = prey proportion of preyed predator
(number of eaten prey stadia i/total predation)

pi = proportion of available prey
(number of available prey stadia i/total of available prey)

3. Results and Discussion

3.1 Prey Preference

The results of the no-choice preference test revealed that 3 instars of prey were tested using the log, *M. castanea* ants preferred the first-*instar* larvae of *O. rhinoceros*, with the average number was 2,6 larvae. For the no-log treatment, *M. castanea* ants preferred both first-*instar* larvae and second-*instar* larvae with the ability to respectively an average of 4.6 larvae (figure 1). The result of the choice preference of the treatment using logs indicated that *M. castanea* ants preferred first-*instar* larvae (x = 1,2 larvae), whereas, for the no-log treatment preference test, *M. castanea* preferred second *instar* larvae with the average number ($\overline{X}$) = 1.4 larvae (figure 2).

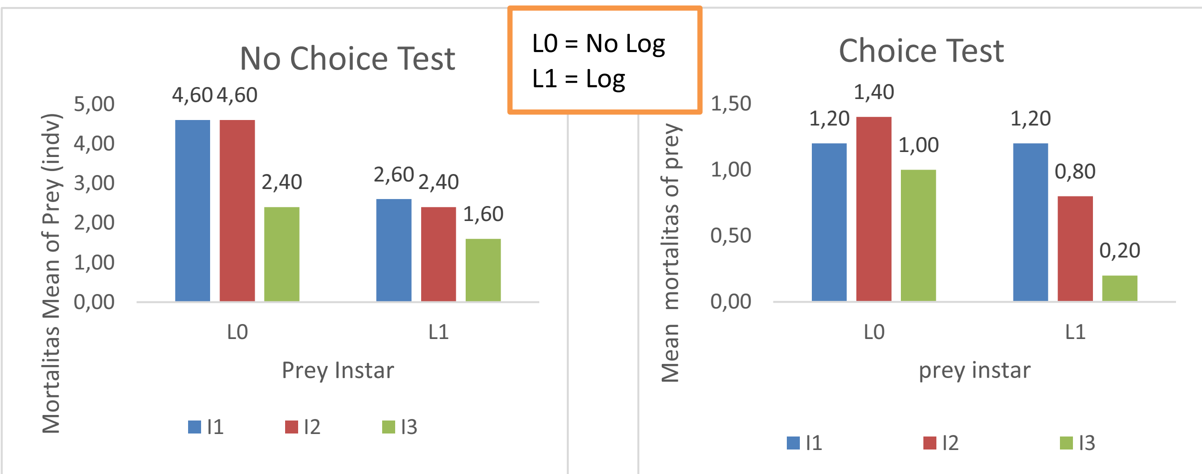

Figure 1. Prey Preference instar of *M. castanea* in *no choice test*

Figure 2. Prey Preference instar of *M. castanea* in *choice test*

On the no-choice preference test, both using log and no-log, *M. castanea* ants preferred both first-*instar* and second-*instar* larvae, as well as on the choice preference test. The ants preferred first and second *instar*

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since they have smaller form than the third *instar*. In addition, the prey morphology of the *instar* such as the cuticle of the prey is still thin, so it is easier to tear and suck the hemolymph liquid by the ants. As stated by Marheni [4] and Junaedi [5], the mortality level of the first and second *instar* that was preyed by *M. castanea* ants, was higher than the third *instar*. Due to its bigger form, the third prey *instar* larvae could fight more against the predator. During the observation of the research, within the prey process, there was five to seven ants that work together in paralyzing a prey. The third *instar* larvae was able to bite the *M. castanea* ants with its mandible. Thus, during its predation process, usually there was some predator ants died. Legaspi *et al.* [8] stated that even the acceptance rate for two types of prey is similar, but due to the ability to avoid both types of prey is different, the frequency meetings between predator and prey may differ. As a result, the prey preference of both prey is different. The preference by predators can also be affected by various physical factors such as light, color, shape, and prey size, as well as chemical factors in the form of odors produced by prey [9]. Legaspi *et al.* [8] stated that two important differentiators of the host or prey range are the host's taxonomy and ecology. In addition, the selection of hosts or prey by natural enemies can be influenced by physical and chemical factors of host or prey, generally these two factors can indeed determine the success of natural enemies in finding hosts or prey.

3.2 Preference Index

Preferred linear index of prey or preference index (Li) is the difference between prey proportion of preyed predator (ri) and the proportion of available prey (pi). The symmetric value of preference index is linear. The selection number of prey varies from -1 to +1. Negative Li values indicated that the prey tends not to be chosen or disliked by predators. In contrast, positive Li values indicated that predators tend to prefer these prey to be consumed.

The value of preference index on the no-choice test in the no-log treatment for the first-*instar* prey was 0.197, for the second-*instar* = 0.197 and for the third-*instar* = 0.07. Meanwhile for treatment using log, its preferred index logs for first-*instar* was 0.194, for the second-*instar* = 0.164 and for the third-instar = 0.042 (figure 3). Preference index value of choice test on no-log treatment for the first-*instar* prey was 0.133, for the second-instar = 0,189 and for the third- *instar* = 0,078. Meanwhile for treatment using log, the preference index of the first-*instar* was 0,345, for the second-instar = 0.164 and for the third-*instar* prey = -0.109 (figure 4). Negative values for the third-*instar* prey indicate that these instars prey tend not to be selected by *M. castanea* ants to be preyed if all three types of *instar* prey are available as its prey.

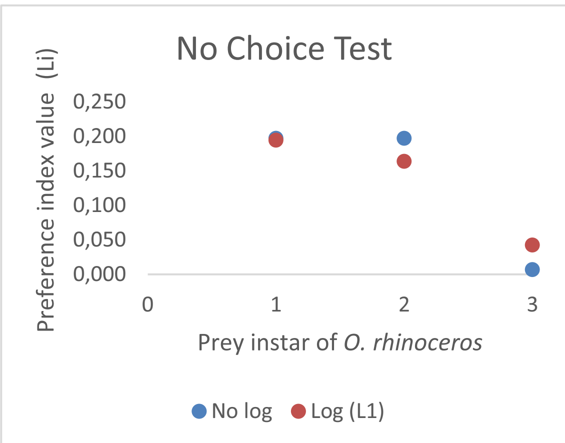

Figure 3. Preference index Value of *M. castanea* in no choice test

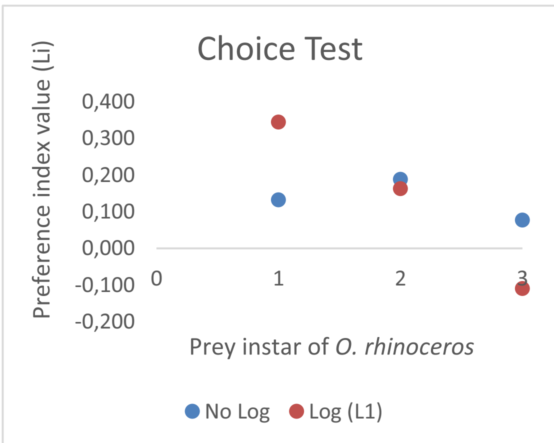

Figure 4. Preference index value of *M. castanea* in choice test

The preference index value on the no-choice with the log and no-log treatment, for each prey *instar O. rhinoceros* larvae, had positive value, meanwhile on the choice test, index preference of third-*instar* using log showed negative value. This suggests that the third-*instar O. rhinoceros* prey on log treatment is not favored by *M. castanea* ants. Third-*instar O. rhinoceros* larvae has a large form size and has the ability to avoid by dragging into the log to avoid the meeting of prey and predators. According to de Bach [10] natural enemies can select the match of host or prey and the selection takes place through a natural process. Jaworski *et al.* [11] stated that one of the factors that can influence the predator interaction with prey is the size of the prey form. Generally, predators consider the efficiency of predation when prey on its prey by choosing prey to be preyed. Bennett and Gratton [12] stated that in predating predators will use energy to search and then consume prey. This will cause predators to choose prey for consumption in order to maximize the ratio of energy and nutrient acceptance of the predating process [13].

4. Conclusion

In the preference test with no choice on the log treatment, *M. castanea* prefers to prey first-*instar* larvae of *O. rhinoceros* ($\overline{X}$ = 2.6 larvae) with a preference index of 0.194, and in no log treatment preferred both first and second *instar* with the ability to prey on each, $\overline{X}$ = 4.6 larvae with a preference index value of 0.197.

In the choice preference test on log treatment, *M. castanea* prefers prey on first-*instar* larvae ($\overline{X}$ = 1,2 larvae) with a preference index of 0.35, and in no log treatment, *M. castanea* prefers to prey second-*instar* larvae ($\overline{X}$ = 1,4) with index of preference 0,189.

M. castanea ants were able to prey on all *instar* types of larvae of *O. rhinoceros*, but prefer prey first and second-instar of *O. rhinoceros* larvae if the three types of *instar* prey present as its prey.

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