The Comparison of Lepidoptera Population Interested in the Traps with Plant-based Attractants in the Oil Palm of Plantation

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Abstract: The insect of populations from the Lepidoptera order were evaluated on three different blocks in the palm oil of plantation of PTPN IV Adolina, Serdang Bedagai Sumatera Utara. The three blocks were located contiguous with an eight-year plant life. The observations were made for 24 hours of the day from April to May 2018 by using two types of traps with four types of attractants derived from the pulp and the jackfruit leather and the pulp and the pineapple leather. There were 611 Lepidopteran which was collected from the traps during this study. The Jackfruit was the most abundant with a total of 347 Lepidopteran, then it followed by pineapples, the pineapple peel and jackfruit leather respectively 111, 85 and 57 Lepidopteran. This study showed that the population abundance of Lepidoptera order was higher in the jackfruit compared with the pineapple, the pineapple peel, and the jackfruit leather in both the types of traps.

1 INTRODUCTION

The oil palm *(Elaeis guineensis* Jacq.) as a plant producing palm oil Crude Palm Oil/ CPO and Kernel Palm Oil/ KPO, is one of the excellent plantations of which were part of foreign non-oil for Indonesia (Widanengsih, 2015). Palm oil pest attacks are the most common constraints faced by oil palm farmers, especially insect pests. Insect pests can lead to significant reductions in palm oil production, even in the case of the death of palm oil (Tambunan *et al.*, 2013). For example, the main pests in oil palm crops are nettle caterpillars and bagworms (Suhunan *et al.*, 2015) from the Lepidoptera.

Herbivorous insects from the Lepidoptera are potentially destroy to oil palm plantations, because in the larval stages of these insects feed on oil palm leaves. These palm oil-eating insects are known as palm-eaten worms. Controls that have been done using chemical pesticides that we know are harmful to the environment. Therefore it is necessary to keep searching for environmentally friendly control to control these pests.

Plant pest control can be done using traps that use the plant part as attractant. The possibility of pest control using traps with fruit as attractants have been reported (Amzah and John, 2014; Syamsul *et al.,* 2016; Suartini *et al.,* 2015; and Mustikawati *et al.,* 2016).

This study was designed to compare composition and insect populations of the Lepidoptera in PTPN IV palm oil plantations based on their interest in two types of traps with four different plant-based attractants.

2 MATERIALS AND METHODS

2.1 Research Site Description

The research has been conducted in PTPN IV palm oil plantation, in Afdeling III on N block (repeat I), L (repeat II) and K (repeat III) owned by PTPN IV Adolina Serdang Bedagai Regency. The three blocks are 8 years old (planting year 2010), with the respective area of 13.03 Ha, 19.37 Ha, and 13.50 Ha. The study was conducted from April to May 2018.

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2.2 Experimental Set-up

This study was designed using Randomized Block Design (RBD) with two factors. The first factor is the trap model (P), with two treatment levels; a box trap without hole at the top of the trap (P_1) and a modified box trap with 5 holes in the top of the trap (P_2). The second factor is plant-based attractants (A). With five levels of treatment namely; without attractant (A_0), pineapple pulp (A_1), pineapple peel (A_2), jackfruit pulp (A_3), and jackfruit leather (A_4), so that the treatment obtained by 10 combinations. The study was conducted in three replications, so that 30 treatments were obtained.

2.3 Implementation of Research

2.3.1 Trap Preparation

Thick bamboo cut along 50 cm split into 6 parts with a machete. It takes as many as 14 bamboo blades to create one square trap, and two of them are ± 75 cm long. The bamboo blades are attached to the nails so that they are square. Furthermore from the outside of the trap box is covered with gauze with 10 cm from the bottom/foot trap as the entry point of target insects (Dedek Haryadi, 2018, personal communication). As for the trap modification, at the top of the trap made 4 cms diameter as much as five holes, as well as insect entry (Figure 1).

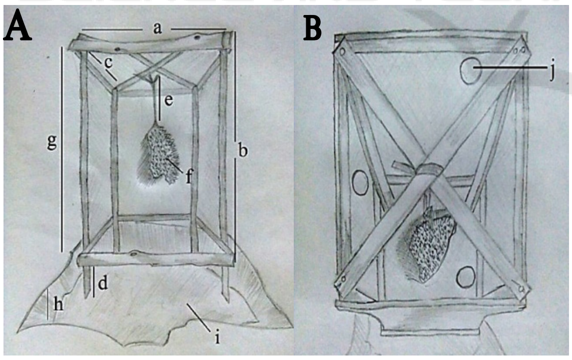

Figure 1: Traps using plant-based attractants; A. The basic trap model; B. Modified trap model (top view). Caption; a. Trap length, 50 cm; b. High trap, 40 cm; c. Trap width, 50 cm; d. Foot height, 10 cm; e. Length of rope for binding and hanging attractant, 35 cm; f. Attractant hung on plastic ropes; g. The trap surface area covered with gauze; h. The depth of the soil scraped to put detergent water as an insect trapper, 5 cm; i. Place detergent water laid; j. Absorption diameter at the top of the modified trap, 4 cm

2.3.2 Sampling Method

The traps placed on each block of oil palm for each treatment, where the block is repeated. The traps in each test is 10 pieces. Distance between traps 100 m. The location of 10 traps is randomized for each repeat on the block. Plastic transparent measuring 60 x 60 cm placed on the ground surface in a pile that had previously been scraped as deep as ± 5 cm. Then inserted detergent that had been diluted with water onto the plastic until flooded. Then place the trap above it, and on the inside of the trap is hung fruit as the attractant in accordance with the treatment using a plastic strap along ± 35 cm. The four types of plant-based attractants in this study were inserted into the gauze to prevent the attractant from falling into the trap water detergent. There is no reference library to determine how much the use of attractiveness is appropriate to be used as attractiveness. So in this study, used plant-based attractant as much as 200 g for each treatment to create uniformity. Insect sampling was performed 24 times with time interval sampling is daily (six days in a week) for four weeks. Insect loading is carried out using tweezers and inserted into a sample bottle which has been filled with 70% alcohol, and then covered with plastic wrap. The sample bottle is labeled according to the treatment and date of the data retrieval.

2.3.3 Turns The Attractant

Fruits are replaced every seventh day during insect sampling, it was four times. Fruit turnover at 17.00 wib afternoon. The next day the trapped insects were taken to count the number of insects of the trapped lepidopteran, and so on until the 24th insect sampling.

2.4 Data Analysis

All insects Lepidopteran trapped were counted on each type of trap. Then analyzed using Analysis of Variance (ANOVA) to compare the number of herbivorous cluster population from Lepidoptera which attracted to trap, attractant and interaction of both.

3 RESULTS AND DISCUSSION

3.1 Lepidoptera Composition in Oil Palm of Plantation

Lepidoptera that have been collected from a combination of traps there are 12 different species based on their morphological, temporarily sp1, sp2, sp3, sp4, sp5, sp6, sp7, sp8, sp9, sp10, sp11 and sp 12. The number of each of the twelve species during the study can be seen in Table 1. From Table 1 can be seen that sp 1 has the highest number (168 individuals) followed by sp 5 and sp 8 with the same number (73 individuals), sp 3 (63 individuals), sp 2 (55 individuals), sp 9 (44 individuals), sp 6 (43 individuals), sp 10 (35 individuals), sp 12 (25 individuals), sp 7 (19 individuals), sp 4 (11 individuals), and the least is sp 11 (2 individuals).

Table 1: Families of the Lepidoptera order attracted to two types of traps with different attractants

No	Families of Lepidoptera	Number Trapped
1.	sp 1 (Oecophoridae)	168
2.	sp 2 (Pyralidae)	55
3.	sp 3 (Pyralidae)	63
4.	sp 4 (Pyralidae)	11
5.	sp 5 (Pyralidae)	73
6.	sp 6 (Pyralidae)	43
7.	sp 7 (Pyralidae)	19
8.	sp 8 (Pyralidae)	73
9.	sp 9 (Pyralidae)	44
10.	sp 10 (Torticidae)	35
11.	sp 11 (Torticidae)	2
12.	sp 12 (Torticidae)	25
Total		**611**

According to Rhaind *et al.* (2002), the abundance of insects in oil palm cultivation is appropriate or distributed in accordance with their role in the oil palm ecosystem. Insects from the Lepidoptera order usually act as pests in oil palm crops, such as nettle caterpillars and bagworms (Suhunan *et al*., 2015).

3.2 Lepidoptera Population in Combination of Traps and Attractants

A total of 611individuals under the Lepidoptera order were collected in this study (Table 1). The results showed that the trap with the trappings of jackfruit pulp has the highest population followed by pineapple fruit, pineapple peel and jackfruit leather.

Traps P_1A_3 recorded the highest population of insects of the order Lepidoptera (197 individuals), followed by P_2A_3 (150 individuals), P_1A_1 (71 individuals), P_1A_2 (59 individuals), P_1A_4 (44 individuals), P_2A_1 (40 individuals), P_2A_2 (26 individuals), P_2A_4 (13 individuals), P_1A_0 (9 individuals) and P_2A_0 recorded the smallest number with two individuals (Figure 1).

Pest traps, in addition to the traps themselves that can make the trapped pest can also be added to the material or attractant so as to attract pests to enter the trap. This type of trap usually uses fruits or parts of plants that have a strong enough smell.

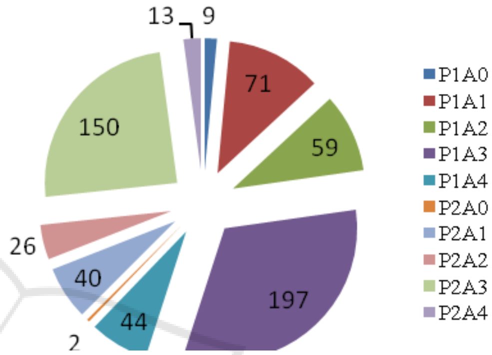

Figure 2: Comparison insects population of the Lepidoptera based on their interest to trapped with different attractants in oil palm plantations.

Plants with fruit that has a distinctive and strong smell include pineapple (*Ananas comosus* L. Merr.) and jackfruit (*Artocarpus heterophyllus* Lamk). Likewise, jackfruit leather has a fragrance that is not much different from the pulp. One of the chemical compounds that play a role in providing the color, smell and taste of the fruit is the Flavonoid that attracts the insects to come (Koes *et al.*, 1994). Flavonoids are contained in pineapple pulp (Jeragamreddy *et al.*, 2013), jackfruit pulp (Jagtap *et al.,* 2010), and jackfruit leather (Shrikanta *et al.,* 2013). Flavonoids are a group of polyphenol compounds that are present naturally in most fruit and vegetable crops, most of which are yellow, red and blue (Jagtap *et al.,* 2010). Flavonoids for plants act as insect attractants that play a role in the pollination process and attract the attention of animals that help spread seed (Hasiholan, 2012).

The use of traps in the management of insect pests is precise, specific, and ecological. And attractants were used in sampling of insect populations and for timing of insecticide applications in crops (Metcalf and Luckmann, 1982).

In this study, each of the different types of traps and attractants affected the insect population of Lepidoptera that entered the trap (it can be see in Table 2 above).The result of ANOVA showed that the use of box trap had significant effect on insect population of Lepidoptera where F count (5.01) > F table 5% (4.35). Likewise, the use of attractiveness had a very significant effect on the number of insect population of the lepidoptera order caught with F count (16.19) > F table 5% (2.87). However, the interaction between types of traps with attractants has F count (0.20) < F table 5% (2.87), this indicates that the number of Lepidoptera order population did not different significantly based on the combination of trap types and plant-based attractant types. Based on Table 2, on the use of the trap type, the highest Lepidoptera insect population was found in the trap box model with an average value of 25.33 individuals and this was significantly different from the modified trap box model with an average of 15.40 individuals. In contrast to the use of attractants that has a very significant difference, the highest population of Lepidoptera trapped using jackfruit pulp with an average value of 57.83, followed by pineapple pulp 18.50, pineapple peel 14.17, and jackfruit leather 9, 5 and control 1.83 individuals.

Table 2: The average value of Lepidoptera insect population trapped in two types of traps with four different types of attractants for 24 days sampling.

Treatment	Without attractant	Pineapple pulp	Pineapple peel	Jackfruit pulp	Jackfruit leather	Mean
Trap box model	3.00	23.67	19.67	65.67	14.67	25.33^a
Trap box models Modified	0.67	13.33	8.67	50.00	4.33	15.40^b
Mean	1.83^e	18.50^b	14.17^c	57.83^a	9.50^d	20.37

Description: The number followed by the same notation on the same line indicates is not different significant according to Duncan Multiple Range Test at 5% level.

Overall, the contributing factor to the large population of Lepidoptera is the difference in the source of the smell from the attractants used, so that the number of individual insects of the Lepidoptera order into the trap has a significant difference. From the side of the trap, the trap with the box model without hole above is more effective trapping insects Lepidoptera may be due to insects that have been entered directly trapped in water detergent for not finding a way out. Unlike the second model trap that has hole in the top, so that insects that have entered into the trap can fly through the hole to save themselves. While the interaction between trap with attractant are not significantly different can be caused by the duration of the sample of insect collection. A longer time for sample collection is needed so that more insects can be obtained using a combination of traps and plant-based attractants in this study.

4 CONCLUSION

There are 12 species of Lepidoptera insects that are attracted and trapped in oil palm plantation owned by PTPN IV Adolina Serdang Bedagai Regency. The interaction between type of trap and plant-based attractants did not significantly affect the Lepidoptera insect population trapped. The type of trap that effectively traps the Lepidoptera order insects is a trap box model without hole at the top of the trap (P_1) and the most effective plant-based attractant is derived from the jackfruit pulp (A_3).

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