Damage

by Damage Damage

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Damage Intensity of Pepper Stem-Borer (*Lophobaris piperis*) on Different Weed Control in Bangka Belitung Archipelago Province

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***Abstract*—Pepper Stem Borer (*Lophobaris piperis*) is one of main pest in pepper plant that can reduce the yield near to 72%. Ecologically, the development of *L. Piperis* can be influenced by the presence of weeds surrounding plants as temporary dwellings for both pests and natural enemies. This study aims to determine the damage intensity of *L. piperis* on pepper in various weed control techniques. This study used observation method with sampling techniques applying a combination of purposive - random sampling. Pepper plant samples were chosen deliberately with weed control provisions based on the desired technique of mechanical control, control using legume cover crops and without weed control. The results showed that the lowest damage intensity of pepper stem borer attack was identified on pepper plantations with weed control techniques using *Arachis pintoi* as cover crops. The highest level of *L. piperis* attack was found in pepper plantations with mechanical weed control techniques.**

***Keyword*—Pepper, Pepper Stem Borer, Weed Control, Arachis Pintoi**

I. INTRODUCTION

Indonesia is known as one of the main producing countries of pepper and has an important role in world trade. Indonesian pepper supply comes from the Bangka Belitung Province, namely muntok white pepper and from Lampung Province called lampung black pepper [1].

Stem borer attacks can cause damage to stems and branches with a damage level of 42.83%, for attacks on the base of the pepper stem, can cause plant death [2]. Stem beetles are called snout beetles, attacking young flowers, fruits, shoots, leaves and branches. The heaviest damage due to these pests is larval attack by broaching the stems or branches of plants so that the death of the upper part of the attacked stem or branch [3].

Pepper pest control generally still uses synthetic insecticides because it can kill pests immediately, and easily used. The use of synthetic insecticides often raises other problems that cause resistance and resurgence of target pests, killing natural enemies and other useful insects, the emergence of secondary pests and the presence of residues in crops, water and soil. This is even worse than the pest problem itself [4].

Pest control is basically an ecological problem, therefore effective pest control must start from an ecological approach. Pest control has an ecological base and relies on natural mortality factors such as natural enemies and weather. Priority control techniques that bring the smallest possible disruption to these factors is known as integrated pest control (IPM) [5]. Technical culture techniques that has positive impacts on reducing pest attacks, especially the use of natural enemies.

Integrated pest control is a pest control that does not damage the agroecosystem. This control can also avoid the risk of pesticide residues and increase the ecosystem services on plantation. The use of natural enemies is one of integrated pest control technique that environmentally safe and its considered as effective technique in pest control [6]. Technical culture techniques for pepper plants which include weed control techniques that utilize *Arachis pintoi* as cover crop is one of the integrated pest control. *Arachis pintoi* can also have function as weeds control, this technique can also control pests indirectly [7].

Based on the description above, the authors intend to make observations, identification and research on the effects of weed control that utilizes the *Arachis pintoi* ground cover against pepper stem borer pests. This activity is expected to contribute as source of information to the government, academics and the community.

II. METHODS

This research was carried out by survey method and direct observation on the sample sites. Determination of the sample and location of the observation using different method. Determination of the observation sites using random sampling method and the determination of the observation sample used purposive sampling method. The random sampling method is a random sampling technique, this method can be taken if the research analysis tends to be descriptive or general. Each element of the population must have the same opportunity to be selected as a sample. The method of purposive sampling is sampling technique which not based on strata, random or regional but based on the existence of certain objectives [8].

This study uses samples from three different locations with different weed control techniques, the first location is the location with weed control techniques that utilize *Arachis pintoi* as cover crop, the second location is the

location with weed control techniques and the third location is the location without weed control techniques.

Each location plot divided into five observation plots with each sub plot with 8m x 8m size and 1 x 2m plant spacing, which was obtained by observing 16 pepper plants each sub plot and 80 pepper plants each location.

The distribution of sub plots were placed in square method as shown in Figure 1 [9]. Before the survey and observation were carried out, locations with three different types of weed control techniques were left without spraying pesticides for a minimum two months.

A. Time and Observation Parameters

Observations had beed conducted in March to April 2017. Observations are carried out every one week with an entire eight observations. The parameters observed are as follows:

B. The number of attacked stem

Counting the number of stem that are attacked by pepper stem borer by observing the pepper stem at the observation location.

C. This type of attacked stem

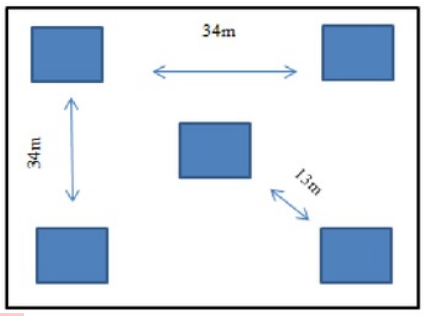
Classify the types of stem that are attacked by pepper stem borer. The observation parameter of the type of stem is divided into two classes, namely climbing tendrils and fruit tendrils.

D. Attack intensity

The intensity of stem borer pest attacks in the field was carried out by counting the number of plants attacked by stem borer pests against the total sample. The formula used to determine the intensity of stem borer pest attacks as follows [10]:

$$I = x\ 100\% \quad \text{.....(1)}$$

Information
I = intensity of attack
n = number of plants attacked
N = number of plants observed



description:
Main Observation Plot (50 x 50 m)
Sub plot (8 x 8 m)

Fig. 1. Determination of observation plots for each location

E. Absolute damage intensity

Calculating the damage intensity with the type of absolute damage caused by stem borer pests was used the following formula [10]:

$$P = \quad x\ 100\% \quad \text{.....(2)}$$

Information
P = intensity of damage
a = number of attacked tendrils
b = number of climbing / fruit tendrils that are not attacked

F. Relative damage intensity

Calculating the damage intensity caused by stem borer pests by using the following formula [10]:

$$P = \quad x\ 100\% \quad \text{.....(3)}$$

Information
P = damage intensity
N = Number of climbing / fruit tendrils from each attack category
V = Scale value of each attack category
Z = The scale value of each of the highest attack categories
N = Number of climbing / fruit tendrils observed

Rating Category:
0 = no damage
1 = damage level 1 - 20%
3 = damage level 21 - 40%
5 = damage level 41 - 69%
7 = damage level 61 - 80%
9 = damage rate over 80%

G. Symptoms of pepper stem borer attack

Observation of symptoms of pest attacks is done by observing plant samples that are damaged due to the attack of stem borer. Symptoms can be categorized into four categories: 1. One of the climbing or fruit tendrils has some yellowish area, 2. One of the climbing tendrils or some fruit tendrils has some brownish areas, 3. Whole tendrils area is yellowish, 4.The tendrils is browned and dried.

III. RESULTS AND DISCUSSION

Identification of stem borer attack on various pepper gardens with different weed control techniques can be seen in Table 1.

TABLE 1. ACCUMULATION OF STEM BORER ATTACKS ON VARIOUS PEPPER GARDENS WITH DIFFERENT WEED CONTROL TECHNIQUES.

Treatment	Accumulation of stem borer pests, weeks								Total
	1	2	3	4	5	6	7	8	
Weed Control	13	14	14	14	14	16	16	16	16
Without weed control	3	6	7	7	8	8	8	8	8
Arachis pintoi	3	4	4	4	4	4	4	4	4

Based on the results of Table 1 it is known that there are differences in the level of stem borer attack on various pepper plantations with different weed control techniques. Pepper garden with weed control techniques identified 16 attacks during eight weeks of observation, pepper plants without weeding identified as much as 8 attacks and pepper gardens with weed control techniques using *Arachis pintoi* identified 4 attacks. The lowest attack rate was identified in pepper gardens with weed control techniques utilizing *Arachis pintoi* and the highest attack rates identified in pepper plantation with weed control techniques with weeding.

The results of the study showed that there are different levels of pepper stem borer attack on various pepper plantations with different weed control techniques. The lowest percentage of attack intensity and damage intensity caused by pepper stem borer was identified in the pepper plantation with weed control techniques that utilize *Arachis pintoi* as cover crops.

The results of the observation of the intensity of the attack found the highest attack intensity occurred in the pepper garden with weeding by 20% and the lowest intensity of attack occurred in the pepper garden with a ground cover of Arachis pintoi by 5%.

The attack of pepper stem borer is influenced by the stability of the ecosystem on the pepper plantation itself. Pepper plantations with good ecosystem stability have low level of pest attack. According to [11], an environment with a good ecosystem will provide ecological-based pest control. Pepper plantations that utilize the *Arachis pintoi* as a weed control technique have the lowest level of pepper stem borer attack. This is presumably because the stability of the ecosystem in the pepper plantation with *Arachis pintoi* is in good condition. According to [12], the *Arachis pintoi* cover crop has higher variety of insect species, including parasitoid, predator and pepper pest insects. The diversity of insects in the pepper plantation indicates that the plantation has good ecosystem stability compared to pepper gardens with full weeding technique.

The existence of the *Arachis pintoi* on pepper plantations has a role as shelter and food provider for parasitoid and natural enemies of pepper stem borer. *Arachis pintoi* is a type of legume and always flowering throughout the year by producing nectar and pollen [13]. Pepper stem borer has natural enemies namely parasitic wasp, this insect can parasitize larvae from *L. piperis*. Wasps generally eat nectar for survival [14]. The survival of pepper stem borer parasites in pepper plants that use *Arachis pintoi* can run normally and sustainably, and can increase its population.

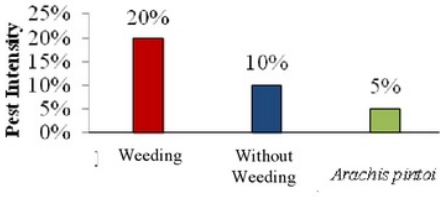


Fig. 2. The intensity of pepper stem borer attacks

The higher the population of pepper stem borer parasitoid, the higher the breeding process or parasitation.

According to [3] several natural enemies of *L. piperis* larvae have been identified, namely *Spathius piperis*, *Euderus* sp., *Dinarmus coimbatorensis*, and *Eupelmus curculionis*. In general field conditions, these natural enemies can suppress the pepper stem borer population by 37%. Development of various parasitoid using conservation techniques is expected to increase the role of natural enemies in pest control. The techniques that have been developed are limited weeding, planting of *Arachis pintoi* as ground cover crops, and pepper-coffee mixed planting systems. In the pepper plantation planted with *Arachis pintoi*, the parasitization rate of *S. piperis* in L. piperis larvae ranged between 25-50%. *Arachis pintoi* also has multifunctionality and has been developed in North Lampung and West Kalimantan.

The absolute damage intensity was known to be the highest damage intensity occurred in pepper plantation with weeding approaching 8.61% and the lowest attack intensity occurred in pepper plantation with *Arachis pintoi* was 2.33%.

The percentage of absolute and relative damage in the two types of tendrils observed were far different because the number of tendrils observed was different. The total number of climbing tendrils observed amounted to 415 tendrils while the total number of fruit tendrils observed totaled 5884 tendrils.

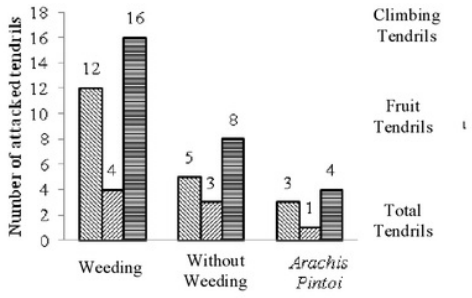


Fig. 3. Number and type of tendrils attacked

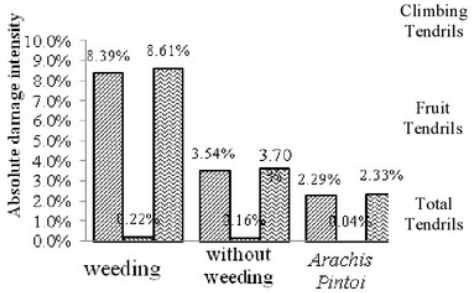


Figure 4. Absolute damage intensity

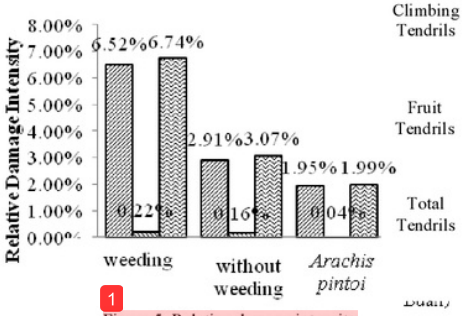


Figure 5. Relative damage intensity

Symptoms of stem borer attack on various pepper gardens with different weed control techniques showed in Table 2.

TABLE 2. ATTACK SYMPTOMS OF STEM BORER IN VARIOUS PEPPER PLANTATIONS WITH DIFFERENT WEED CONTROL TECHNIQUES.

Attack criteria	Total attacked tendrils		
	Weeding	Without weeding	Arachis pintoi
One of the climbing tendrils or fruit tendrils has yellowish area	9	3	1
One of the climbing tendrils and fruit tendrils has brownish area	4	5	3
One of the climbing tendrils and fruit tendrils on the whole area is yellow.	0	0	0
One of the climbing tendrils and fruit tendrils on the whole area is brown	3	0	0

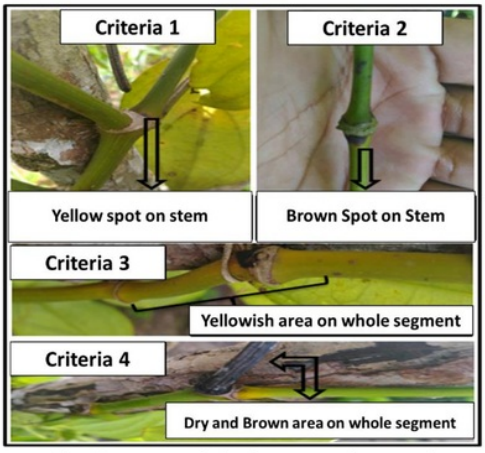


Fig. 6. Symptoms criteria of pepper stem borer attack

The percentage of attack intensity and damage intensity showed the highest pepper stem borer pest attack was pepper plantations with weed control techniques and the second highest identified on pepper plantations with no weeding. This is presumably because pepper plantation with weeding has lack ecosystem stability. According to [15] weeding in weeds is necessary to prevent nutrient competition between weeds and plants themselves. Weeding is good in terms of nutrient competition, but in terms of pest, weeding plants have a bad impact. Weeding on pepper plantations is bad because all weeds that might be used as a shelter to provide food for the natural enemy of pepper stem borer pests are not found in the pepper plantation itself. According to [6], poor ecosystems can trigger the development of plant pests at a higher level because there is no shelter or food provider for natural enemies. The absence of natural enemies in pepper plantations can stop pest control naturally so that pests can develop properly. Pest development will be accompanied by the level of damage caused by pests, the higher the pest develops the higher the intensity of damage caused by pests on pepper plantations.

Weeds on pepper plantations without weeding can be used as shelter but cannot provide food for the natural enemy of pepper stem borer pests, especially parasitoid insects. Alang-alang weeds and bandotan are some weeds that dominate pepper plantations without weeding. According to [16]. The composition and structure of weeds in pepper plantations is dominated by three types of weeds whose have flowers to produce nectar as parasitoid insect feed source. The three types of weeds are *Ageratum conyzoides, Asystasia intrusa and Paspalum conjugatum*. The results of the study indicate that weed control technique need to be selected because many types of weeds play a role in conserving useful insects, including pest parasitoids. The existence of this pepper stem borer parasitoid also needs to be maintained.

There are 4 symptom criteria from the attack of pepper stem borer. The criteria for visible attack symptoms are caused by the attack of pepper stem borer larvae. Pepper stem borer larvae eat plant tissue that causes damage to plant tissue, damaged plant tissue will begin to turn yellow and eventually dry out and die. According to [17], pepper stem borer larvae eat the pepper plant tissue from the eggs which hatch into larvae until the larvae become pupae, added by [18] the interval of the larvae to pupae is 28 days.

The attack symptoms identified in the pepper garden that use *Arachis pintoi* are criteria 1 and 2. Symptoms of this attack are symptoms of an initial attack before the segment from tendrils become yellow and brownish until it dries up. The larvae that have been parasitized by parasitoid so as not to cause more severe damage. The larvae that are parasitized will die in the grinding hole and become hosts of parasitoid insects.

IV. CONCLUSIONS

1. There are different levels of pepper stem borer attack on various pepper plantations with different weed control techniques.
2. There is a decrease in the level of pepper stem borer attack on weed control techniques using *Arachis pintoi* on pepper plantation.

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