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by Suparman Suparman

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Attack Level Of Coffee Fruit Borer Pest (Hypothenemus hampei) And Branch Borer Pest (Xylosandrus compactus) In Central Dempo District Pagaralam City

Arsi[1,3*], Suparman SHK[1], Bambang Gunawan[1] , Abu Umayah[1], Yulia Pujiastuti[1], Harman Hamidson[1], Chandra Irsan [1], Suwandi[1], Nurhasnah[2]
*e-mail : arsi@fp.unsri.ac.id

[1]*Program Studi Proteksi Tanaman, Fakultas Pertanian, Universitas Sriwijaya*
[2]*Program Studi Agroekoteknologi, Fakultas Pertanian, Universitas Sriwijaya*
[3]*Mahasiswa Doktor Program Studi Ilmu Pertanian, Fakultas Pertanian, Universitas Sriwijaya*

ABSTRACT

Pagaralam is a city in South Sumatra Province with five districts: North Dempo, Central Dempo, South Dempo, North Pagaralam and South Pagaralam. The main commodity is coffee. Coffee cultivation has a major problem, namely the attack of fruit and branch borer pests because it can reduce the quality and productivity of coffee. This study was to determine the level of attack by fruit borer and branch borer in the Dempo Tengah sub-district. Coffee farmers in Pagaralam use monoculture and polyculture cultivation systems. This field practice method is observation, observation in this study, and interviews with coffee farmers. The results showed that the attack of young coffee berry borer pests can cause the fruit to wither and fall off, while ripe fruit has holes in its seeds. Branch borer attacks cause branches to wither and dry. The highest percentage of fruit and branch borer attacks on coffee plants was found in young mixed-aged coffee plantations. In conclusion, fruit borer and coffee branch borer are more susceptible to attacking coffee at a young age, because young coffee plants have soft plant organs. Lush shade creates high humidity and low temperatures, which can make it easier for pests to breed.

Keywords: Branch Borer, Coffee, Shade, Coffee Fruit Borer.

INTRODUCTION

The coffee plant is an important commodity in agriculture and plantations. Coffee is one of the contributors to agricultural output in the Indonesian economy (Sianturi and Wachjar, 2016). The types of plants cultivated in Indonesia are arabica, robusta, and liberika coffee (Oktasari, 2014). Coffee thrives on temperature of 15-30ºC. Arabica grows well at an altitude of 700-1,400 masl, temperature of 15-24ºC, and pH of 5.3-6.0. Robusta grows well at temperatures of 24-30ºC, altitudes of 300-600 masl, and pH 5.5-6.0 (Kahpi, 2017).

The problem experienced by farmers is the low quality, quality, and productivity of coffee plants due to pests. The coffee berry borer is an insect that attacks coffee cherries (Meilin et al., 2017). This pest attacks the coffee cherries by scraping the bottom of the fruit, making holes in the fruit. The fruit borer enters the fruit, damages the coffee

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beans, and decreases its economic value (Erfandari et al., 2019). The coffee borer is included in the category of direct pests because these pests can directly damage the fruit (Muliasari et al., 2016).

Young fruit attacked by these borers will fall before ripening, while seeds from old or ripe fruit will have holes, which can cause severe damage to coffee beans and even reduce quality and productivity. *Hypothemus hampei* bores the fruit with the endosperm still soft to get food, while the hard endosperm of the seeds will bore and lay their eggs (Fintasari et al., 2018).

Branch borer pests are beetles that damage stems near the soil surface and then move up and down in the pith tissue so that they can wilt and die leaves. Attacks by branch borers can cause the death of the tips of the coffee plants (Khula and Minardi, 2021). The larvae in the boreholes of the coffee branch eat the amborsia fungus (*Fusarium solani*) which develops in the hole, then the fungus is carried by the *Xylosandrus compactus* pest when it drills the hole and the activity of the larvae eating the fungus causes damage to the plant tissue on the branch (Indriati et al., 2017).

Monoculture is cultivation that only grows one type is called a coffee plantation without shade. Agroforestry is cultivation that plants more than one type or is called a coffee plantation with mixed shade plants (Reswari and Prijono, 2021). Shade can determine coffee productivity by producing litter which contributes nutrients, especially nitrogen (Saragih, 2018). Feels like it will decompose and become organic matter in the soil, thus helping to add organic matter to the soil (Evizal et al., 2012).

Robusta coffee does not require full sun in its cultivation, because it requires shade to prevent direct sunlight. Shading too dense plants will cause high humidity and low temperatures, fruit formation will decrease, and plant-disturbing organisms will increase in the plantation area (Sugiarti, 2019). Shade plants for coffee plantations from legume groups such as Lamtoro and Gamal contribute to soil fertility in plantations (Suherman et al., 2016).

Pest control uses plant cultivation, natural enemies, physical and mechanical, and chemical control (Girsang et al., 2021). Biological pest control uses entomopathogenic fungi (Rahayu et al., 2019). These entomopathogenic fungi are *Metarhizium anisopliae, Beauveria bassiana, Botrytis stephanoderis,* and *Spicaria javanica* (Maharani et al., 2013). Controlled pests are Coleoptera, Lepidoptera, Homoptera, Hemiptera, and Isoptera (Ulya et al., 2016). This research was to determine the level of attack by fruit borer and branch borer in different plantation systems and plant ages.

MATERIAL AND METHOD

The research from May to September 2022, in Dempo Tengah District, Pagaralam City, South Sumatra (Figure 1).

Figure 1. Research location

The materials used are tape measure, scissors, neat rope, stationery, ziplock plastic, vials, and alcohol. Methods are observation, sampling, and documentation. Observation of samples in the laboratory. The method of work carried out in this study is as follows: The land used is at an altitude of 700-900 masl which is divided into several types of land including young coffee plantations with Gamal shade (GM), old coffee plantations with mixed shade (CT), young coffee plantations with mixed shade (CM) there are 3 plots observed, and young coffee plantations without shade/open (TM). One plot/garden has a size of 1000 m^2 with a length of 40 m and a width of 25 m. In this plot, there are 5 subplots with the size of each subplot being 10 m x 10 m (Figure 2).

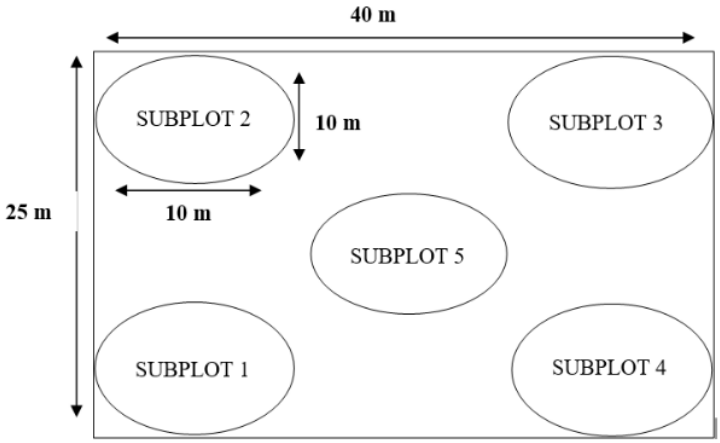

Figure 2. Sketch of Coffee Plantation Land as a Field Practice Research Plot

Determination of plant samples, that is, in every plot there are 50 samples of coffee plants that are observed for symptoms of pest attack. In 1 subplot plot, there are 10 coffee plants observed for symptoms of pest attack (Figure 3).

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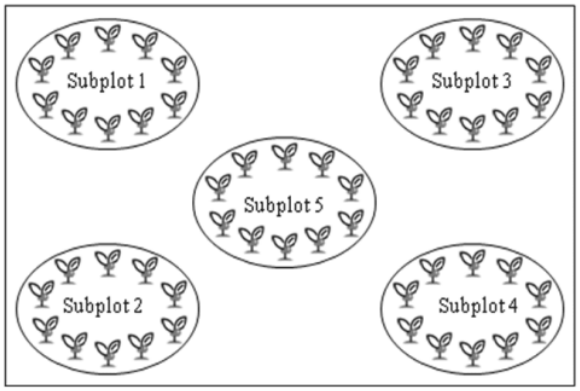

Figure 3. Sketch of plant sampling for each sub-plot in the observed plot

Interviews with coffee farmers regarding the age of coffee plantations, coffee plant age, spacing, types of shade plants, coffee productivity, pest and disease attack rates/year, impacts of pests and diseases and their management.

The variables observed in this study were the percentage of coffee berry borer and coffee branch borer in old mixed shade (CT) coffee plantations, mixed shade (CM) young coffee plantations with 3 plots/garden, old Gamal coffee plantations (GT), and young coffee plantations without shade (TM). Symptoms of fruit borer attack are holes in the coffee fruit's disc (navel). Young fruit will turn yellow until it withers and will fall, while ripe fruit will have holes in its seeds. Symptoms of branch borer attack are small holes in the branches and when they are split, there are burrow marks on the branches. Plants that are attacked by this pest will cause the plant branches to wither, and dry to death.

Formula

The formula used to calculate the level of attack by this coffee plant borer is to use the percentage formula (Purba *et al.*,2015).

$$S(\%) = \frac{n}{N} \times 100\%$$

Keterangan :

S = Attack precentage (%)

n = trees attacked

N = trees on plot

Data Analysis

Data analysis used in this research is descriptive data analysis using tables and graphs.

RESULTS AND DISCUSS

Coffee plantations in Dempo Tengah are located at an altitude of 700-900 meters above sea level. The type of coffee cultivated is Robusta. Robusta coffee is easy to cultivate, easy to care for, and resistant to pests and diseases. Robusta can grow in the highlands or lowlands, it is more optimal if it is planted in the highlands. The price of Robusta coffee is more affordable in the market, so the demand is higher than other coffees. Based on observations of coffee cherries attacked by the coffee berry borer (*Hypothenemus ha*mpei) there will be holes at the ends of the fruit that change color to yellow or wither and eventually turn black and dry. Fruit borer pests attack in the imago phase. These pests are small beetles with biting and chewing mouth types (Figure 4).

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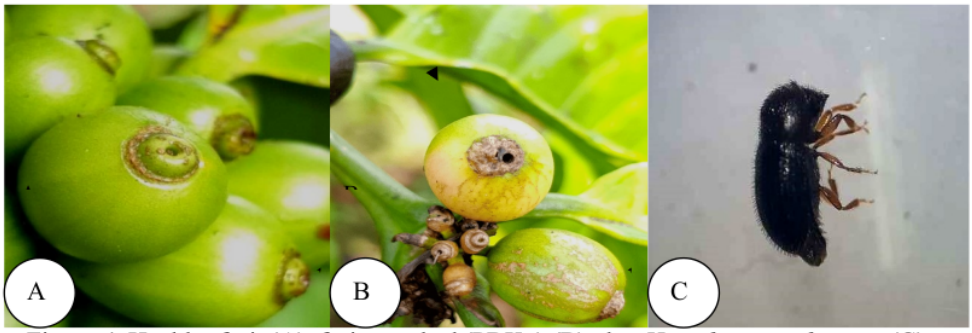

Figure 4. Healthy fruit (A), fruit attacked (PBKo) (B), dan *Hypothenemus hampei* (C)

Hypothenemus hampei attacks the fruit at various stages of coffee maturity, when the green, yellow to red fruit is ripe. For young fruit, the level of damage to coffee beans due to PBKo pests is not severe compared to yellow and red fruit. This is because the fruit that is still young and soft is drilled by pests to get food and then abandoned. Ripe fruit is used as a source of food for shelter (Fintasari et al., 2018). Therefore, the level of damage to ripe fruit is more than young fruit.

Hypothenemus hampei and *Xylosandrus compactus* mostly attack coffee plants in mixed gardens with young plants. Because young plants have plant organs that are still soft, it is easier for these pests to bore on the plants (Adri et al., 2022). The branch borer attack is not determined based on the presence or absence of shade because the factor that influences the branch borer attack is the level of density of coffee plants (Indriati et al., 2017). Meanwhile, for PBKo pests, the level of shade density greatly affects their distribution because shade that is too dense will result in high humidity and support the development of the *Hypothenemus hampei* pest (Girsang et al., 2020). When fruit that is attacked by PBKo pests is split open, there are holes in the coffee beans that are traces of borers. The coffee beans are damaged, and the quality is down. The level of damage caused by the PBKo pest borer is different, as shown in Figure 5.

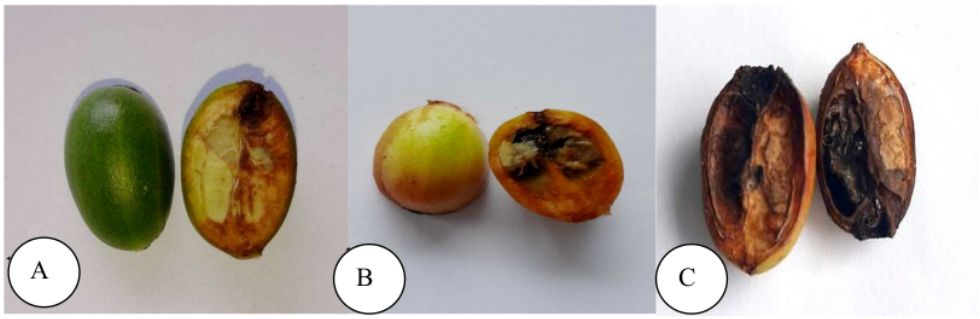

Figure 5. Green fruit attacked PBKo (A), yellow fruit (B), and red fruit (C)

Based on the results of observers, branches attacked by pests when split will have marks and turn black starting from the base to the ends of the branches (Figure 6).

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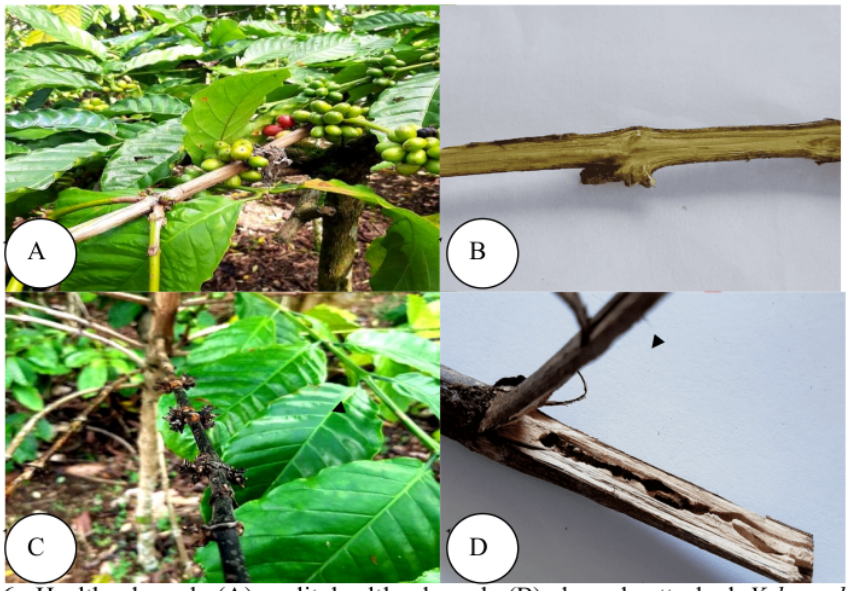

Figure 6. Healthy branch (A), split healthy branch (B), branch attacked *Xylosandrus compactus* (C), dan split branch attacked *Xylosandrus compactus* (D).

Xylosandrus compactus is a pest that attacks the imago stage. The part of the branch that is attacked by this pest will have a small hole in the middle of the branch which is the entrance for the pest to the coffee branch. If the branches affected by this pest are cut, you can see the holes used for grinding (Figure 7).

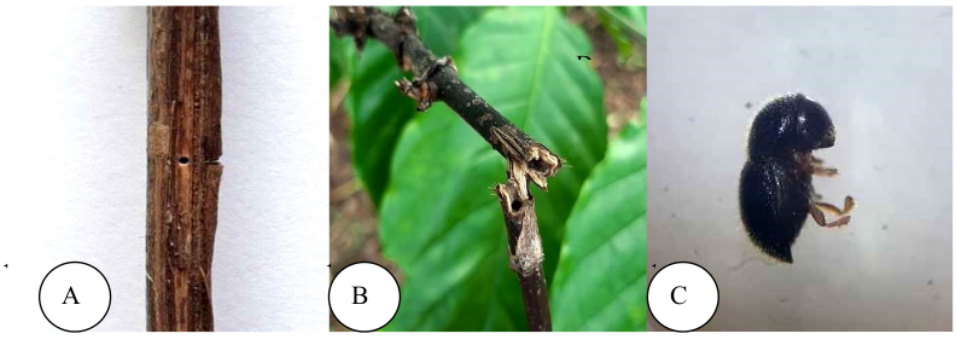

Figure 7. Grinding hole *Xylosandrus compactus* (A) Grinding hole *Xylosandrus compactus* on branch (B) dan *Xylosandrus compactus* (C).

In coffee plantations with a higher percentage of branch borer attacks, the percentage of fruit borer attacks can be lower. Branch borer pests will drill into the branch network and coffee twigs, thus cutting off the flow of food to the top of the branches resulting in wilting, drying of branches, yellowing leaves, and black

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twigs, causing twig death and inhibiting coffee fruiting (Harni et al., 2015). The impact of branch borer attacks can cause PBKo pests to decrease due to a lack of food sources. Reduced food sources due to decreased fruit quality and productivity.

Robusta coffee requires shade and a little sunlight. Maintaining humidity and temperature stability and increasing biodiversity in plantations can help suppress pest attacks. However, too much shade can raise humidity and lower temperatures, making coffee plantations vulnerable to pests. As shown in Figure 5.5 the percentage of pest attacks on 3 fields with the same type of plant, namely mixed gardens, has a different percentage of borer attacks due to differences in treatments such as sanitation and pruning of coffee or shade. Therefore it can be estimated that planting shade alone is not enough to reduce pest attacks, but it is necessary to treat coffee plantations.

Based on the data obtained from interviews, coffee farmers stated that PBKo and branch borer pests attack a lot from June to July. This month is the harvest season. Apart from that, other pests that attack the coffee plantations of the farmers in Dempo Tengah are caterpillars and ants. However, the attack has less impact on decreasing coffee production compared to borer pests. The types of shade that are widely used in the Dempo Tengah area are gamal, lamtoro, cloves, and fruits.

Data on fruit borer and coffee branch borer attack symptoms were calculated and expressed in percentage form (Table 1).

Table 1. Percentage of fruit and branch borer attacks on different coffee plantation cropping systems.

Farm land	Code	PBKo (%)	Branch Borer (%)
CT	1	28	40
CM1	2	8	64
CM2	3	32	16
CM3	4	8	84
GT	5	26	58
TM	6	26	38

The plantations used in this study were land with different types of shade trees, including mixed shade gardens, gamal shade and no shade (Table 2).

Table 2. Percentage of fruit and branch borer attacks on each land type.

Farm land type	PBKo (%)	Branch Borer (%)
CT	28.00	40.00
CM	48.00	164.00
GT	26.00	58.00
TM	26.00	38.0

The highest percentage of PBKo pests was found in mixed shade gardens 2 and the lowest percentage in mixed shade gardens 1 and 3. The highest percentage of branch borer pests was found in coffee plantations with mixed shade 3 and the

lowest percentage was found in mixed shade gardens 2. Based on the data obtained, mixed-shaded land types with young plant ages had a high percentage of attacks by coffee berry borer and coffee branch borer (Figure 8).

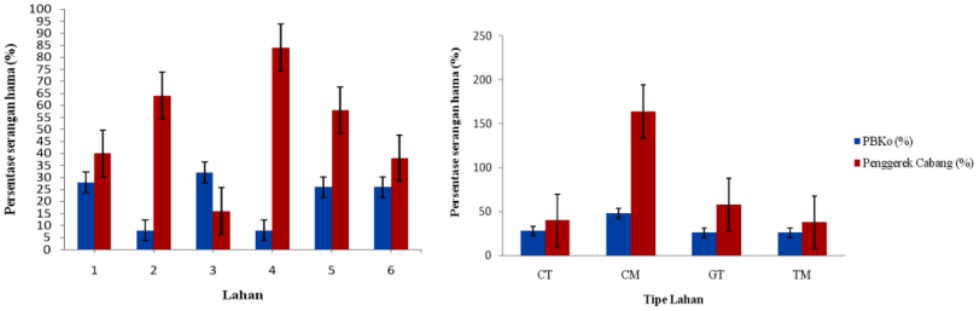

Figure 8. Percentage of fruit and branch borer attacks on each land type

CONCLUSION

The highest percentage of fruit and branch borer attacks was found in mixed shade coffee plantations with young plants because the plant organs were still soft. Branch borer attacks cause drying, wilting and even death, fruit development is disrupted and pests lose food sources. Therefore the fruit borer population is lower in coffee plantations with high branch borer populations.

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