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IDENTIFICATION OF TYPES OF INSECT PESTS AND THE LEVEL OF DAMAGE CAUSED TO OIL PALM PLANTS IN AIR MERAH VILLAGE KAMPUNG RAKYAT DISTRICT SOUTH LABUHANBATU REGENCY

Dwi Sapria[1]*, Badrul Ainy Dalimunthe[2], Hilwa Walida[3], Yusmaidar Sepriani[4]
[1]Student of Agrotechnology Study Program, Faculty of Science and Technology, Universitas Labuhanbatu, Indonesia
[234]Lecturer of Agrotechnology Study Program, Faculty of Science and Technology, Universitas Labuhanbatu, Indonesia
Corresponding E-mail: dwi2003sapri@gmail.com

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Abstract

This study aims to identify pest insect species and the level of damage they cause to oil palm plants in Air Merah Village, Kampung Rakyat District, South Labuhanbatu Regency. The research method used is a descriptive quantitative approach with purposive sampling techniques. The results showed that six species of pest insects were found, classified into three orders: Lepidoptera, Coleoptera, and Orthoptera. The most commonly found species was Setothosea asigna. The level of plant damage varied, with an average percentage of 27.46%, categorized as moderate damage. Pest insects attacking oil palm plants have the potential to reduce plant productivity, making it necessary to implement proper pest control strategies to minimize their impact. This research provides essential information for farmers in mitigating pest attacks and improving oil palm production.

Keywords: ***Pest Insects, Oil Palm, and Damage Level***

INTRODUCTION

Indonesia is one of the world's largest producers of oil palm, significantly contributing to the national economy. The country's palm oil production reached 48.3 million tons in 2020 and is projected to continue increasing as global demand for palm oil rises (Directorate General of Plantations, 2022). South Labuhanbatu Regency, particularly Air Merah Village, is one of the key oil palm plantation centers that plays a crucial role in the industry. However, the productivity of oil palm in this region faces serious challenges due to insect pest infestations, which can significantly reduce harvest yields.

Oil palm (*Elaeis guineensis*) is a high-value plantation crop widely cultivated in Indonesia. This plant plays a crucial role in the vegetable oil industry, producing crude palm oil (CPO) and palm kernel oil (PKO), which are widely used across various industrial sectors (Abdul, 2023). However, during the cultivation process, oil palm plants are not free from threats posed by plant pests (OPT), particularly insect pests that can cause a decline in productivity.

Pest disturbances in oil palm, particularly by insects from the orders Lepidoptera, Coleoptera, and Orthoptera, have been widely reported in various studies. Insects such as *Setothosea asigna* and *Oryctes rhinoceros* often cause severe damage to oil palm leaves and stems (Hidayati et al., 2021). Uncontrolled pest infestations can reduce productivity by up to 30% if not addressed with effective control methods (Pratama, 2023). Therefore, identifying pest species and assessing the level of damage they cause is a crucial first step in developing pest management strategies.

This study aims to identify insect pest species and analyze the level of damage they cause to oil palm plants in Air Merah Village, Kampung Rakyat District, South Labuhanbatu Regency. The findings of this research are expected to provide recommendations for farmers and stakeholders to develop more effective pest control measures to enhance oil palm plantation productivity in the region.

LITERATURE REVIEW

1. Insects

Insects belong to the phylum Arthropoda and the class Insecta. They have a distinct body structure divided into three main parts: the head (caput), thorax, and abdomen. Insects typically possess three pairs of legs, one or two

pairs of wings, and antennae as their primary sensory organs (Cahyani et al., 2020). They inhabit a wide range of environments, from soil and water to extreme temperature conditions (Herlinda et al., 2021).

In agricultural ecosystems, insects play various roles, including as pests, predators, parasitoids, and pollinators. Several insect species are known as primary agricultural pests, such as *Setothosea asigna* (fire caterpillar), *Metisa plana* (bagworm), and *Oryctes rhinoceros* (rhinoceros beetle), which frequently attack oil palm plants (Sari & Setiawan, 2019). These pest insects can cause significant damage to plant parts, including leaves, stems, and fruits, ultimately reducing plantation productivity (Hidayati et al., 2021).

2. Oil Palm

Oil palm (*Elaeis guineensis*) is a high-value plantation crop and one of Indonesia's leading commodities. This plant belongs to the Arecaceae family and has a morphological structure consisting of fibrous roots, a single unbranched stem, and compound leaves (Novita et al., 2024). Oil palm plays a crucial role in the vegetable oil industry, producing crude palm oil (CPO) and palm kernel oil (PKO), which are widely used in both food and non-food industries (Abdul, 2023).

Oil palm productivity is significantly influenced by environmental factors and pest infestations. One of the primary threats to oil palm plantations is insect pests that damage leaves, stems, and fruits, leading to yield reduction. Infestations by *Oryctes rhinoceros* can cause severe damage to the plant's crown, while *Setothosea asigna* and *Metisa plana* attack the leaves, reducing the plant's photosynthetic capacity (Hidayati et al., 2021). Therefore, effective pest management strategies are essential to improve harvest yields and sustain the oil palm industry in Indonesia.

METHOD

This research was conducted from January to March 2025 in an oil palm plantation in Air Merah Village, Kampung Rakyat District, South Labuhanbatu Regency. The study area covers 10 hectares with 1,368 oil palm trees aged 2–3 years. The instruments used in this research include tweezers, sample bottles, a camera, an insect identification book, writing materials, and insect traps such as *pitfall traps*, *yellow pan traps*, and *sweep nets*. The materials used include 70% alcohol for specimen preservation, detergent for trapping, and distilled water for equipment cleaning.

This study employs a descriptive quantitative method with a *purposive sampling* technique. The number of sampled trees was determined using Slovin's formula, which is used to determine a representative sample from a known population, with a 5% error margin. The Slovin's formula is (Riswana, 2020):

$$n = \frac{N}{1 + Ne^2}$$

Symbol description:
n = sample size,
N = total population (1,368 trees),
e = error margin (0.05 or 5%)

Based on the calculation, 305 trees were observed at five observation points. Insect pest sampling was carried out using several methods: *hand collection* for direct capture, *pitfall traps* for capturing ground insects using detergent solution, *yellow pan traps* for flying insects attracted to yellow surfaces, and *sweep nets* for airborne insects around the plants.

Captured insects were identified based on morphological characteristics using identification books. Additionally, the level of plant damage was assessed by selecting nine leaves per sampled tree, including three from the top, middle, and bottom sections. The percentage of damage was calculated using the following formula (Hidayati et al., 2021):

$$\text{Plant Damage Level (\%)} = \frac{Number\ of\ damaged\ leaves}{Total\ leaves\ observed} \text{x}100$$

The results were categorized into mild damage (1–25%), moderate damage (26–50%), severe damage (51–75%), and very severe damage (>75%). The collected data were analyzed descriptively to determine insect occurrence frequency and the extent of plant damage at the five observation points.

RESULTS AND DISCUSSION

A. Types of Pest Insects

The research on types of pest insects was conducted based on the number of oil palm plant samples calculated using the Slovin formula, totaling 305 oil palm trees. These trees were distributed across five observation points in smallholder oil palm plantations in Air Merah Village, Kampung Rakyat District, South Labuhanbatu Regency. The data on the types of pest insects are as follows:

Table 1. Types of Pest Insects in Oil Palm Plantations in Air Merah Village

No	Local Name	Scientific Name	Order/Family	Attacked Plant Parts	Total Individuals
1	Fire Caterpillar	*Setothosea asigna*	Lepidoptera/ Limacodidae	Leaves	51
2	Bagworm	*Metisa plana*	Lepidoptera/ Lasiocampidae	Leaves	34
3	Rhinoceros Beetle	*Oryctes rhinoceros*	Coleoptera/ Scarabaeidae	Leaves and leaf base	29
4	Adoretus Beetle	*Adoretus compressus*	Coleoptera/ Scarabaeidae	Leaves and leaf base	31
5	Grasshopper	*Valanga nigricornis*	Orthoptera/ Acrididae	Leaves	43
6	Cricket	*Gryllus sp.*	Orthoptera/ Gryllidae	Leaves	37
			Total		225

Based on Table 1, it can be seen that the pest insects found consist of six species and belong to three different orders, with a total of 225 individuals. The identified insects include two species from the order Lepidoptera, two species from the order Coleoptera, and two species from the order Orthoptera. The types of pest insects found at observation point 1-5 can be seen in image 1-5.

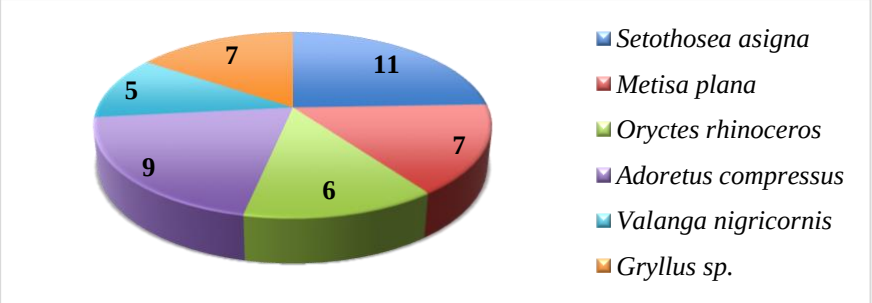

Image 1. Types of Pest Insects at The First Observation Point in Oil Palm Plantation in Air Merah Village

Based on Image 1, the pest insect species found at first observation point include *Setothosea asigna, Metisa plana, Oryctes rhinoceros, Adoretus compressus, Valanga nigricornis*, and *Gryllus sp.* The pest insect species with the highest number of individuals at this point is *Setothosea asigna* with a total of 11 individuals. The species with the lowest number of individuals is *Valanga nigricornis*, with a total of 5 individuals.

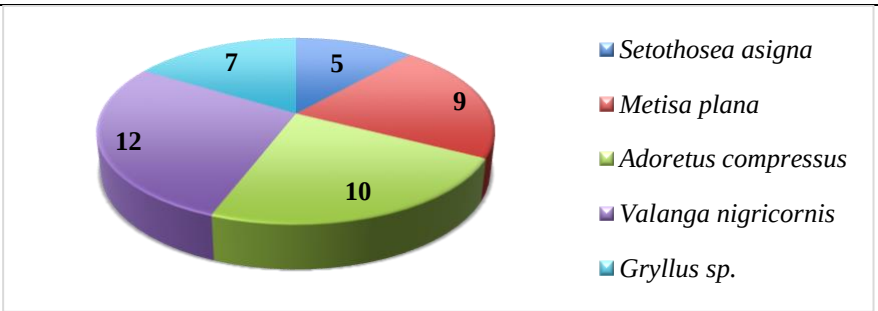

Image 2. Types of Pest Insects at The Second Observation Point in Oil Palm Plantation in Air Merah Village

Based on Image 2, the pest insect species found at the second observation point include *Setothosea asigna*, *Metisa plana*, *Adoretus compressus*, *Valanga nigricornis*, and *Gryllus sp.* The pest insect species with the highest number of individuals at this point is *Valanga nigricornis*, with a total of 12 individuals. The species with the lowest number of individuals at this point is *Setothosea asigna*, with a total of 5 individuals.

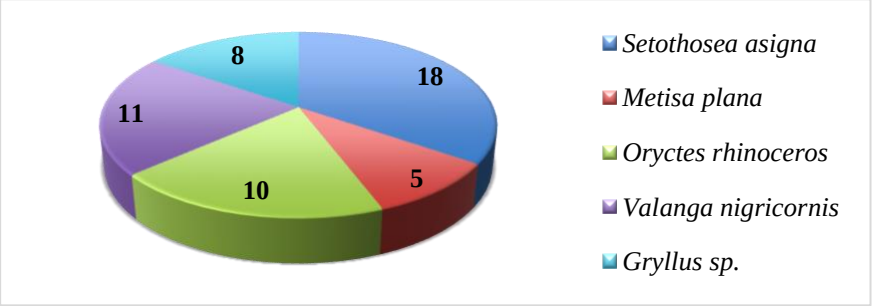

Image 3. Types of Pest Insects at The Third Observation Point in Oil Palm Plantation in Air Merah Village

Based on Image 3, the pest insect species found at the third observation point were *Setothosea asigna*, *Metisa plana*, *Oryctes rhinoceros*, *Valanga nigricornis*, and *Gryllus* sp. The pest insect species with the highest number of individuals at this point was *Setothosea asigna*, with a total of 18 individuals. The pest insect species with the lowest number of individuals at this point was *Gryllus* sp., with a total of 7 individuals.

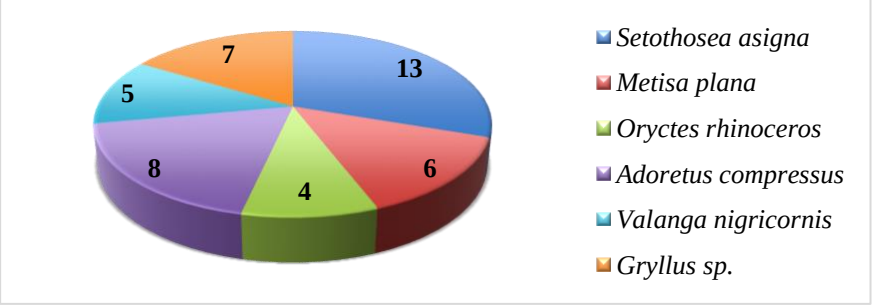

Image 4. Types of Pest Insects at The Fourth Observation Point in Oil Palm Plantation in Air Merah Village

Based on Image 4, the pest insect species found at the fourth observation point were *Setothosea asigna*, *Metisa plana*, *Oryctes rhinoceros*, *Adoretus compressus*, *Valanga nigricornis*, and *Gryllus* sp. The pest insect species with the highest number of individuals at this point was *Setothosea asigna*, with a total of 13 individuals. The pest insect species with the lowest number of individuals at this point was *Valanga nigricornis*, with a total of 5 individuals.

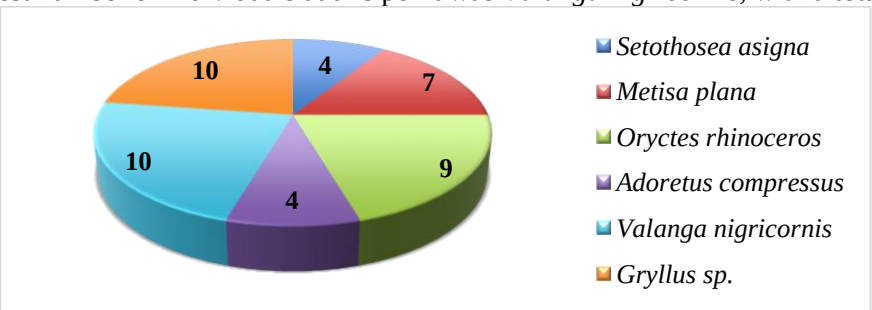

Image 5. Types of Pest Insects at The Fourth Observation Point in Oil Palm Plantation in Air Merah Village

Based on Image 5, the pest insect species found at the fifth observation point were *Setothosea asigna*, *Metisa plana*, *Oryctes rhinoceros*, *Adoretus compressus*, *Valanga nigricornis*, and *Gryllus* sp. The pest insect species with the highest number of individuals at this point was *Valanga nigricornis*, with a total of 10 individuals. The pest insect species with the lowest number of individuals at this point were *Setothosea asigna* and *Adoretus compressus*, each with a total of 4 individuals.

In the oil palm plantations in Air Merah Village, several types of insect pests have the potential to damage the plants, including fire caterpillars (*Setothosea asigna*), bagworms (*Metisa plana*), rhinoceros beetles (*Oryctes rhinoceros*), Adoretus beetles (*Adoretus compressus*), grasshoppers (*Valanga nigricornis*), and crickets (*Gryllidae*).

1. Fire Caterpillar (*Setothosea asigna*)

Fire caterpillars from the Limacodidae family are known as major pests of oil palm in tropical regions (Siregar et al., 2021). These caterpillars have venomous spines that can cause skin irritation in humans (Rahmawati et al., 2020). Fire caterpillar attacks target young leaves by eating the leaf tissue, leaving only the leaf veins, which can result in 50-90% leaf loss (Turnip et al., 2021). Severe infestations reduce the plant's photosynthetic area, causing physiological stress and lowering productivity by up to 30% (Haron et al., 2022).

2. Bagworm (*Metisa plana*)

Bagworms from the Psychidae family are characterized by protective cases made from leaf debris (Rahman et al., 2020). These pests are more commonly found in oil palm plantations with dense canopies and high humidity levels (Kamarudin et al., 2021). Their life cycle consists of four stages: egg, larva, pupa, and adult, with the larval stage being the most destructive. Severe infestations can reduce fresh fruit bunch (FFB) production by 30-40% (Haron et al., 2022).

3. Rhinoceros Beetle (*Oryctes rhinoceros*)

Rhinoceros beetles from the Scarabaeidae family damage plants by feeding on meristematic tissue and leaf bases (Hasanah et al., 2021). Their larvae develop in decaying organic matter, such as dead oil palm trunks (Amran et al., 2020). The beetle's attack results in abnormal young leaf growth with a distinctive "V-cut" pattern, which can decrease productivity by up to 25% (Rasmin et al., 2021). Additionally, wounds caused by rhinoceros beetle attacks serve as entry points for pathogens like *Ganoderma*, which causes basal stem rot disease.

4. Adoretus Beetle (*Adoretus compressus*)

The Adoretus beetle, belonging to the Scarabaeidae family, is a pest that attacks oil palm leaves, particularly at the seedling and young plant stages (Devi et al., 2022). These beetles are nocturnal, hiding underground or in plant debris during the day. Their feeding causes irregular holes in the leaves, which, in severe cases, can lead to defoliation and hinder oil palm growth.

5. Grasshopper (*Valanga nigricornis*)

Grasshoppers from the Acrididae family are polyphagous pests that feed on various plant species, including oil palm (Sari et al., 2023). Grasshopper attacks result in irregularly perforated leaves, reducing the photosynthetic area. High grasshopper populations can cause defoliation, especially in young oil palm plants (Rahman et al., 2023). These insects are more active during the dry season when food sources are limited, increasing the risk of severe damage.

6. Cricket (*Gryllidae*)

Crickets from the Gryllidae family are known to attack young oil palm seedlings by chewing on soft leaves and stems. Cricket feeding weakens young plants, making them more susceptible to secondary infections by fungi or bacteria. These nocturnal insects often hide in the soil or plant debris during the day and emerge at night to feed (Amran et al., 2021). Although not as aggressive as other pests, cricket infestations can have a significant impact on seedlings and young oil palm plants.

B. Level of Oil Palm Plant Damage Caused by Pest Insects in the Oil Palm Plantation of Air Merah Village

The research results on the level of damage to oil palm plants caused by pest insects in the oil palm plantation of Air Merah Village, Kampung Rakyat District, Labuhanbatu Selatan Regency, are as follows:

Table 2. Level of Oil Palm Plant Damage Caused by Pest Insects in the Oil Palm Plantation of Air Merah Village

No	Observation Point	Number of Leaf Samples	Number of Undamaged Leaves	Number of Damaged Leaves	Plant Damage Level (%)
1	The First	549	401	148	26,95
2	The Second	549	417	132	24
3	The Third	549	356	193	35,15
4	The Fourth	549	385	164	29,87
5	The Fifth	549	432	117	21,31
			Average		27,46

The observation results indicate that the highest damage level was found at observation point 3, with a percentage of 35.15%, followed by point 4 (29.87%) and point 1 (26.95%). Meanwhile, point 2 (24%) and point 5 (21.31%) experienced lower levels of damage. The average damage level across all observation areas reached 27.46%, which is categorized as moderate damage based on the Guidelines for Observing Plant Pest Organisms (OPT) in Horticultural Crops (Ministry of Agriculture, 2020).

The main cause of damage is the attack of fire caterpillars (*Setothosea asigna*) and bagworms (*Metisa plana*), which were found in greater numbers at observation points 3, 4, and 1. Fire caterpillars attack leaves by consuming leaf tissue, leaving only the leaf veins. Leaf damage of 50% in eight-year-old plants can reduce production by 30–40% for 2–3 years after the attack (Saputra et al., 2020). In severe cases, leaf loss can reach 90%, significantly disrupting the photosynthesis process and affecting plant productivity (Wijaya and Hidayat, 2021). Other studies indicate that fire caterpillar infestations can reduce production by 25% in the first year and by as much as 50–75% in the second and third years (Susanti et al., 2022). Meanwhile, bagworms attack oil palm plants by feeding on leaves, causing perforated and damaged leaf blades. In severe infestations, this pest can strip the plants bare, leaving only the leaf veins. Leaf loss can reduce yields by up to 10 tons of fresh fruit bunches (FFB) per hectare (Nugroho et al., 2021) and decrease photosynthetic efficiency, impacting biomass accumulation and long-term palm oil production (Rahmawati & Zulkarnain, 2023).

Apart from fire caterpillars and bagworms, the rhinoceros beetle (*Oryctes rhinoceros*) is also a major cause of damage at observation point 3. This insect bores into the base of young fronds, hindering photosynthesis and increasing the risk of pathogen infection. According to Darmadi (2018), the damage caused by rhinoceros beetles can inhibit the growth and productivity of oil palm plants. Additionally, rhinoceros beetle attacks can cause frond bases to break, making the plant more susceptible to secondary infections (Widodo et al., 2018). In immature plants, rhinoceros beetle infestations can delay production by up to two years, with plant mortality rates reaching 25% (Abidin et al., 2014). Infestations in young plants can also reduce yields by 60% in the first harvest (Handoko et al., 2017). Meanwhile, in mature plants, rhinoceros beetle damage can reduce yields by 20–25% (Abidin et al., 2014).

Overall, pest infestations in the oil palm plantation of Air Merah Village have resulted in moderate damage levels. The most severe damage occurred in areas with high populations of fire caterpillars, bagworms, and rhinoceros beetles. Effective pest control measures are essential to prevent further production declines and maintain the health of oil palm plants.

CONCLUSION

Based on the research findings, six pest insect species were identified, belonging to three orders with a total of 225 individuals. The identified insects come from the Lepidoptera order (*Setothosea asigna* and *Metisa plana*), Coleoptera order (*Oryctes rhinoceros* and *Adoretus compressus*), and Orthoptera order (*Valanga nigricornis* and *Gryllus sp.*). The species with the highest number of individuals was *Setothosea asigna*. The highest level of plant damage occurred at the third observation point (35.15%), followed by the fourth observation point (29.87%), the first observation point (26.95%), the second observation point (24%), and the fourth observation point (21.31%). The average damage percentage across all observation areas was 27.46%. The third, fourth and first observation point were classified as moderate damage, while the second and fifth observation point were categorized as light damage. Overall, the plant damage caused by pest insects in the oil palm plantation of Air Merah Village was classified as moderate damage.

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