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IDENTIFICATION OF PEST AND DISEASE ATTACKS ON CORN PLANTS IN MAGUWOHARJO VILLAGE FIELDS

IDENTIFIKASI SERANGAN HAMA DAN PENYAKIT PADA TANAMAN JAGUNG DI LAHAN DESA MAGUWOHARJO)

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Abstract

Corn (*Zea mays* L.) is one of the most important cereal crops in the world, after wheat and rice. Corn cultivation often faces serious challenges due to pest and disease attacks that cause significant losses for farmers. This study aimed to identify the incidence and damage intensity caused by major pests (fall armyworm and grasshopper) and diseases (leaf blight and downy mildew) in corn fields at Maguwoharjo Village. A quantitative survey using a simple random sampling method with diagonal clustering was applied to 500 corn plants, representing 10% of the population. Observations were made weekly from 6 to 10 weeks after planting (WAP), recording symptoms and calculating infestation levels to better inform targeted pest and disease management strategies. The results of the study show that grasshoppers and armyworms are the main pests, with an incidence rate of 70% and an attack intensity of 40% for grasshoppers, and an incidence rate of 50% with an attack intensity of 17% for armyworms. In addition, leaf blight and smut diseases also have significant incidence rates, reaching 100% and 84%, with attack intensities of 47% and 35%, respectively. This research provides important information for the development of integrated control strategies to reduce losses due to pest and disease attacks on corn crops.

Keywords: *Armyworm, Downy Mildew, Grasshopper, Leaf Blight*

Introduction

Corn (*Zea mays* L.) is one of the most important cereal crops in the world, after wheat and rice. This plant originates from the Americas, where it has been cultivated for thousands of years by Mesoamerican civilizations. Corn plays a crucial role in various aspects of life, serving as a staple food for humans, animal feed, and a raw material for industry. Corn has an annual life cycle. Its stem is upright and unbranched, with distinct nodes. The leaves are long and alternate, with parallel veins. The most distinctive part of corn is its fruit, which is in the form of an ear. An ear of corn consists of kernels attached to the central cob and covered by husks. Corn kernels are rich in carbohydrates, particularly starch, making them a vital source of energy.

Corn cultivation often faces serious challenges due to pest and disease attacks that cause significant losses for farmers. The decline in yield occurs not only in quantity but also in quality. Infected corn often shows poor physical quality, such as suboptimal kernel size or even rot, which directly affects the market value of the product. To overcome this problem, farmers generally rely on the use of chemical pesticides. However, the use of chemical pesticides has limitations, since their specificity is not always effective against all types of pests and diseases. In addition, repeated and improper application can trigger resistance in target organisms, requiring higher doses and greater costs (Susanti, 2022).

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Dependence on chemicals has broad negative impacts. From an ecological perspective, pesticide residues can contaminate ecosystems, including soil and water sources, and threaten beneficial non-target organisms, such as pollinators and natural predators of pests. From a health perspective, pesticide exposure can endanger farmers who are not equipped with adequate personal protective equipment. Moreover, chemical residues remaining on harvested crops can be harmful to consumers (Abror, 2023).

Corn plants are often affected by various pests and diseases that can reduce yields. One significant disease is leaf blight, which causes corn leaves to turn yellow and dry due to fungal infection, thereby disrupting the photosynthesis process. Downy mildew, caused by the fungus *Peronosclerospora maydis*, also frequently attacks corn, characterized by leaves turning yellowish-white with parallel stripes along the veins, which inhibits plant growth. In extreme cases, losses due to diseases such as leaf blight and downy mildew can reach 50% or more (Arsi *et al*., 2024).

The fall armyworm (*Spodoptera frugiperda*) is a major pest that damages corn leaves, stems, and cobs by feeding on plant tissues, particularly in young plants and seedlings, with the potential to cause plant death. Fall armyworm attacks corn from the vegetative phase to the generative phase. Symptoms of infestation include window panning, where leaves appear transparent due to the loss of the epidermal layer, leaf holes, and frass resembling sawdust found on both stems and cobs. This damage inhibits plant growth, and if the larvae reach the growing point, it can result in plant death (Ariska *et al*., 2021). Another frequently encountered pest is the grasshopper (*Valanga nigricornis*), which attacks the leaves. This grasshopper attacks the leaves, with symptoms including the corn leaves being eaten from the edge to the center. The grasshopper attacks the leaves, leaving only the veins and stems. Under certain conditions, this insect can even eat the veins and stems, damaging the plant and reducing yields (Patty, 2012).

The identification of pests and plant diseases is a fundamental step in Integrated Pest Management (IPM) for sustainable agriculture. Identifying pests and diseases in plants is a crucial aspect of effective and sustainable agricultural management. This process involves recognizing and understanding the organisms that can cause damage to crops. Accurate identification allows farmers and researchers to precisely determine the types of pests and diseases attacking plants, thereby clarifying the causes of damage. This serves as the main foundation for designing targeted control strategies, avoiding excessive pesticide use, and minimizing negative impacts on the environment and human health. With proper identification, crop damage can be minimized, productivity can be increased, and the sustainability of agricultural production can be better maintained (Lapinangga *et al*., 2024).

The research aims to gain a deeper understanding of the symptoms and extent of damage caused by pests and diseases to plants at the research site. By accurately identifying these conditions, the research helps to determine the most appropriate and effective control methods so that pesticide use can be optimized. This approach is expected to assist farmers in managing pest and disease attacks more efficiently, reducing excessive pesticide application, while simultaneously increasing crop productivity and preserving environmental sustainability.

Materials and Methods

This study uses a quantitative approach with a survey design to assess the population and level of infestation of Plant Pests and Diseases (Plant Pest Organisms/OPT) in corn plants in Maguwoharjo Village. Samples taken were 10% of the population, namely 50 samples with a total sample of 500 plants. Sampling was carried out using the Simple Random Sampling method with a diagonal observation pattern in clusters by observing plants randomly in the field and identifying symptoms of damage caused by corn pests and diseases. Observations began at the end of October when the plants were approximately 6 WAP and ended in mid-November or when the plants were approximately 10 WAP. Observations were carried out at weekly intervals. Data collection was carried out through direct field observation and calculation of infestation intensity.

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Figure 1. Diagonal cluster pattern

After making observations, the incidence and intensity of damage will be calculated using the formula:

Incident of attack

$$I = \frac{n}{N} \times 100\%$$

Description:
I = Incidence of attack (%)
n = Number of affected offspring
N = Number of offspring observed

Intensity of damage

$$IP = \frac{\sum(n \times v)}{Z \times N} \times 100\%$$

Description:
IP = Attack Intensity (%)
n = Number of leaves attacked
N = Number of leaves observed
Z = Highest damage score scale value

Table 1. Pest and Disease Attack Intensity Score in Corn:

Range	Category
0	Plants asymptomatic and infected (0%)
1	Plants with symptoms and infected with a percentage (≤ 25%)
2	Plants with symptoms and infected with a percentage (> 25-50%)
3	Plants with symptoms and infected with a percentage (> 50-75%)
4	Plants with symptoms and infected with a percentage (≥ 75%)

Source: Arsi *et al.,* 2024.

Table 2. Pest and Disease Attack Intensity Criteria.

Range	Category
I ≤ 25%	Low Attack Intensity
25% < I ≤ 50%	Moderate Attack Intensity
50% < I ≤ 85%	Severe Attack Intensity
I > 85%	Intensity of Puso Attacks

Source: Hawiyah *et al.,* 2022.

Results and Discussion

Pest attacks

The main pests identified during observation based on visible symptoms were grasshoppers and armyworms. Grasshoppers (*Valanga nigricornis*) are active insects during the day. In the morning, they fly and circle to find a location, and at dusk, they land on a location to mate, lay eggs, and eat the plants they land on. Adult grasshoppers initially attack the edges of corn leaves, then move towards the center of the leaf until they reach the leaf veins (Figure 2). Symptoms of a grasshopper attack include tears in the leaves and in severe attacks, only the leaf veins are visible. Bite marks from grasshopper attacks

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differ from those from caterpillar bites. The holes from grasshopper attacks have jagged and rough edges, while the bite marks from caterpillars are smoother (Rohman *et al.,* 2020).

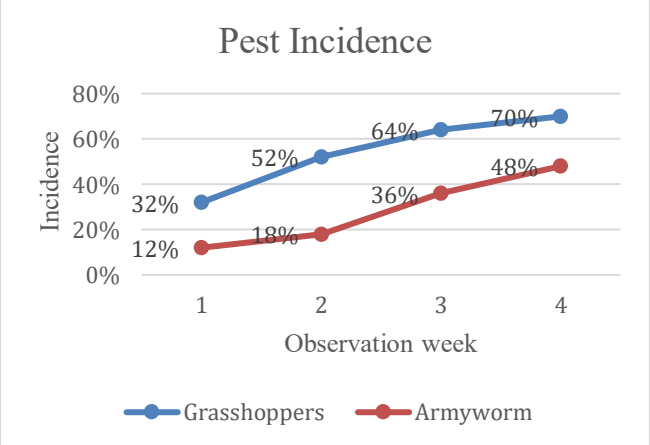
Symptoms of *S. frugiperda* attacks found on corn plants that are still in the vegetative phase include the presence of larval movement marks on the leaves, the presence of coarse powder resembling sawdust, and residual larval feces on the surface of the leaves (Figure 3). This is in accordance with the opinion of Id *et al* (2019), *S. frugiperda* infestation in corn can be seen from the presence of residual feces in the leaf funnel. *S. frugiperda* pests are able to attack the growing points of plants which can result in the failure of shoots/young leaves of the plant to develop (Maharani *et al*., 2019). *S. frugiperda* attacks the shoots of plants that have not fully opened (rolled up) causing the growing leaves to have a cut-like shape (Apriyandi *et al.,* 2021).

Figure 2. Symptoms of a Grasshoppers Attack

Figure 3. Symptoms of Armyworm Attack

Table 3. Incidence of Grasshoppers and Armyworm Attacks on Corn Crops (%)

Pest	Week of Observation			
	1	2	3	4
Grasshoppers	32.00	52.00	64.00	70.00
Armyworm	12.00	18.00	36.00	50.00



Graph 1. Incidence of Grasshoppers and Armyworm Attacks on Corn Crops

Based on Table 3, the incidence of grasshopper and armyworm attacks on corn plants showed an increase during the one-month observation period. This indicates that there was an increase in grasshopper and armyworm attacks on other sample plants. Grasshoppers began attacking plants at 10 days after planting and increased at 30-45 days after planting. The presence of grasshoppers can be caused by the availability of abundant other vegetation (grass) around the plants that can act as hosts for grasshoppers (Rahman *et al*., 2020). Meanwhile, armyworms also attack during the vegetative phase of plants, especially at 2 to 6 weeks of age when young leaves and shoots of plants are vulnerable to

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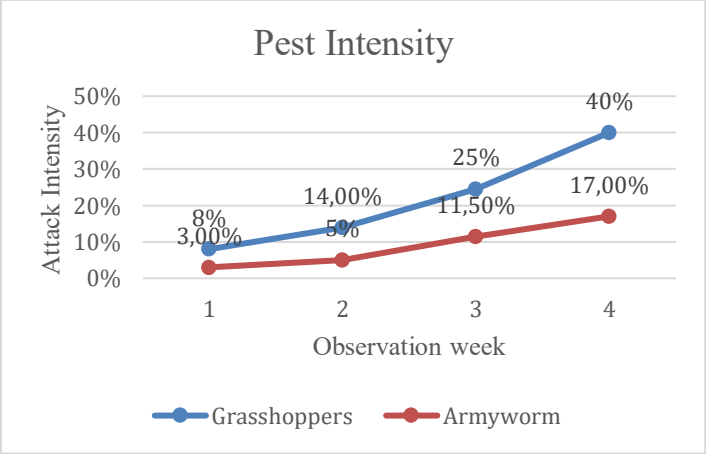
attack. The high incidence of armyworms is influenced by the availability of abundant host plants and irregular planting times. Uneven planting times in a field will result in the continued availability of hosts and food preferred by *S. frugiferda* (young corn plants) (Hartina and Toana, 2023). These two pests primarily attack leaves, resulting in reduced leaf area and negatively impacting photosynthesis and corn plant growth. This condition has the potential to reduce corn yields if pest control is not implemented promptly (Hawiah *et al*., 2022).

Table 4. Intensity of Grasshoppers and Armyworm Attacks on Corn Crops (%)

Pest	Week of Observation			
	1	2	3	4
Grasshoppers	8.00	14.00	24.50	40.00
Armyworm	3.00	5.00	11.50	17.00



Graph 2. Intensity of Grasshoppers and Armyworm Attacks on Corn Crops

Based on Table 4, the intensity of grasshopper attacks on corn crops during the four weeks of observation was consistently higher than that of armyworms. In the fourth week, the intensity of grasshopper attacks reached 40%, classified as moderate, while all observations of armyworms showed an intensity below 25%, classified as mild. The higher intensity of grasshopper attacks is thought to be related to the availability of primary hosts, namely wild grasses that thrive in corn fields (Rondo *et al*., 2016). This development is further supported by increased rainfall at the start of the rainy season, which increases grass populations and provides an ideal food source and habitat for grasshoppers to breed. Pest activity and reproduction are highly dependent on environmental suitability and adequate food sources, so land environments with dominant grass cover tend to trigger an increase in grasshopper populations (Ainun *et al*., 2023).

The low intensity of armyworm attacks in this study was primarily influenced by the incompatibility of weather conditions during the observation period with the climate preferences required by *S. frugiperda*. Ecologically, *S. frugiperda* thrives optimally in warm, humid environments with moderate rainfall, thus increasing larval feeding activity and survival (Arsi *et al*., 2023). In contrast, the study was conducted at the beginning of the rainy season, when rain fell almost daily, potentially causing some eggs and larvae to be washed away or killed by the high rainfall. This finding aligns with Widhayasa and Darma (2022), population fluctuations and armyworm attacks on corn are closely related to weather factors, with the dry season showing higher attack rates than the rainy season because high rainfall acts as a form of natural physical control in the field by reducing the population and activity of armyworms.

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Pest control for grasshoppers and armyworms on corn crops can be carried out using an Integrated Pest Management (IPM) approach, which includes land preparation and sanitation such as turning over and cleaning plant debris to break the pest life cycle, monitoring populations to determine the right time for action, and utilizing natural enemies such as birds, spiders, and parasitoids to control pest populations biologically. In addition, the use of pest-resistant corn varieties and crop rotation are also important to prevent repeated attacks. When pest attacks are severe, selective insecticide spraying at the appropriate dosage can be carried out while still paying attention to the preservation of natural enemies so that pest resistance does not occur. This approach aims to maintain the balance of the ecosystem and ensure that corn productivity remains optimal (Sembel, 2010).

Disease attacks

Leaf blight is one of the important diseases of corn plants that attacks the leaves, and severe infestations can significantly reduce production yields (Hamidson *et al*., 2023). The symptoms of leaf blight appear as brown spots on the leaves (Figure 4). The initial infection shows symptoms of small, oval-shaped spots that elongate into ellipses and then develop into necrotic lesions (called blight), which are grayish-green or brown in color. These spots first appear on the lower leaves and then spread to the upper leaves. Severe infection caused by leaf blight can result in rapid wilting or drying of corn plants (Riri *et al*., 2023).

Downy mildew is characterized by small chlorotic spots on the leaves that develop into parallel bands aligned with the main leaf veins, appearing white to yellowish on the leaf surface (Figure 5). In addition, chlorotic lines follow this pattern. Downy mildew infection stunts plant growth and disrupts cob formation. In severe cases, plants may fail to form cobs altogether (Muis *et al*., 2018).

Figure 3. Symptoms of Leaf Blight Disease Attac

Figure 4. Symptoms of Downy Mildew Disease Attack

Table 5. Incidence of Leaf Blight and Downy Mildew Disease Attacks on Corn Plants (%)

Disease	Week of Observation			
	1	2	3	4
Leaf Blight	68.00	84.00	98.00	100.00
Downy Mildew	26.00	54.00	76.00	84.00

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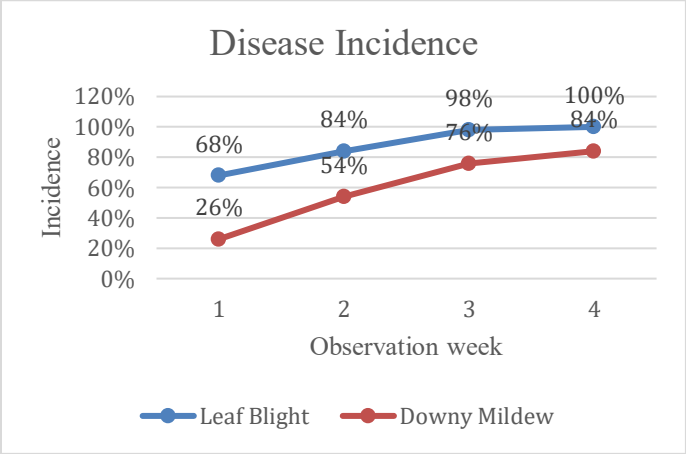
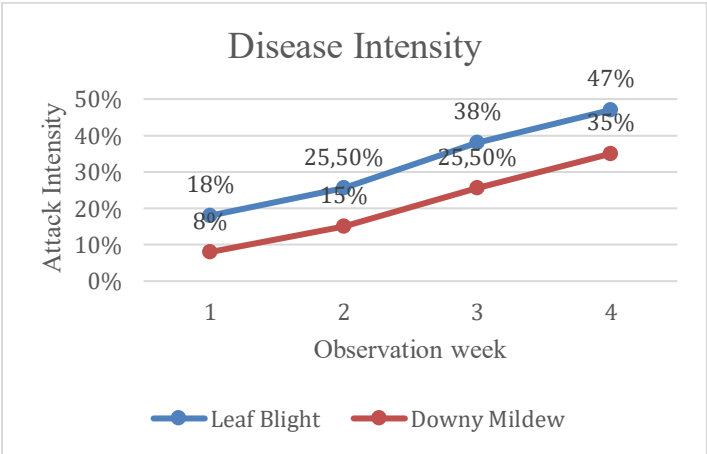


Graph 3. Incidence of Leaf Blight and Downy Mildew Disease Attacks on Corn Plants

Based on Table 5, the incidence of leaf spot disease and downy mildew disease increased up to 100% and 84%. This high value indicates that almost all samples suffered from leaf spot disease and downy mildew disease. Both diseases are caused by fungi, namely *Bipolaris maydis* for leaf spot disease and *Peronosclerospora maydis* for downy mildew disease. The transmission activity of these diseases occurs in the form of conidia and is generally disseminated by wind through the air (Hamidson *et al*., 2023). This supports the rapid transmission of leaf spot disease from one plant to another easily. The spread of pathogens through wind and air can transmit pathogens over long distances (Sukorini and Roeswitawati, 2023).

Table 6. Intensity of Leaf Blight and Downy Mildew Disease Attacks on Corn Plants (%)

Diseases	Week of Observation			
	1	2	3	4
Leaf Blight	18.00	25.50	38.00	47.00
Downy Mildew	8.00	15.00	25.50	35.00



Graph 4. Intensity of Leaf Blight and Downy Mildew Disease Attacks on Corn Plants

Based on Table 6, the intensity of leaf blight and downy mildew attacks has increased. In the latest observation, the level of leaf blight attacks reached 47% and downy mildew reached 35% with a moderate category. The severity of the disease can usually be influenced by environmental factors. Leaf blight disease easily develops at air temperatures between 18-27°C and in humid conditions (Ramadona

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et al., 2023). Similarly, downy mildew infection is supported by high humidity (Sulfitri *et al*., 2024). This is supported by the high rainfall during the observation period, which caused the land to be foggy and humid. Conditions that support the growth of these fungi often occur during the rainy season, where high humidity can increase the risk of infection and exacerbate attacks (Sumarlin *et al*., 2018). According to Amara *et al* (2020), abiotic environmental factors, such as humidity and temperature, have a significant influence on the development of downy mildew and leaf blight, which can trigger an increase in the intensity of attacks.

This disease is caused by fungi, so it spreads easily and quickly. To overcome this, environmentally friendly control measures that take into account the ecology of the environment are needed. Integrated Pest Management (IPM) is an effective solution because it integrates monitoring of environmental conditions, land sanitation, the use of disease-resistant varieties, and good humidity management. All of these are very important to reduce the impact of this disease and maintain corn productivity. In addition, creating an optimal agronomic environment, such as adjusting planting distances to improve air circulation and regulating fertilization, also plays a role in preventing fungal growth. With this integrated and sustainable approach, fungal disease attacks on corn can be minimized without damaging the ecological balance in agricultural land (Muis *et al*., 2018).

Conclusion

This study highlights the vulnerability of corn crops in Maguwoharjo Village to pest and disease pressures, emphasizing the need for timely and well-coordinated management practices. The observed patterns indicate that both insect pests and fungal diseases can develop rapidly under favorable environmental conditions, reinforcing the importance of early identification and preventive action in maintaining crop health. The findings support the implementation of Integrated Pest Management (IPM) as a sustainable approach to reduce dependence on chemical inputs and preserve ecological balance. Future research is recommended to evaluate the long-term effectiveness of IPM components used in local farming systems, assess the contribution of natural enemies in regulating pest populations, and explore the potential of resistant varieties to enhance resilience against major pests and diseases.

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