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INCIDENCE AND INTENSITY OF PESTS AND DISEASES ATTACKING RICE PLANTS (*Oryza sativa* L.) IN WEDOMARTANI VILLAGE

(INSIDENSI DAN INTENSITAS HAMA DAN PENYAKIT YANG MENYERANG TANAMAN PADI (Oryza sativa L.) DI DESA WEDOMARTANI)

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Abstract

The increasing food needs of the Indonesian population underline the critical role of rice (*Oryza sativa* L.) in national food security, but production is often constrained by attacks from pests and diseases. This study aimed to determine the incidence and intensity of key pests (grasshoppers and rice bugs) and diseases (blast and tungro) in a rice field in Wedomartani Village through the application of a systematic W-pattern sampling technique. Observations were conducted four times over a 5-day interval, with samples taken from 50 rice plants. The quantitative approach used formulas to calculate the percentage of Disease Incidence and Disease Severity. The results showed a consistently increasing pattern of infestation for all pests and diseases throughout the observation period. Grasshopper incidence reached 100% by the third observation, with a peak intensity of 34.22% (moderate category) at the fourth observation. Rice bug incidence peaked at 98%, with an intensity of 18.22% (low category). Both blast and tungro incidence reached 100%, with blast severity peaking at 26.22% (moderate category) and tungro severity reaching 50.67% (moderately high category). The high levels of incidence and intensity are primarily supported by environmental conditions conducive to pest and disease development, such as high humidity for blast and the availability of preferred food sources for rice bugs. These findings affirm the urgent need for comprehensive Integrated Pest Management (IPM) strategies, including synchronized planting, field sanitation, and biological control, to secure optimal rice production in the area.

Keywords: *Grasshopper, Rice Bug, Tungro, Blast, Integrated Pest Management.*

Abstrak

Peningkatan kebutuhan pangan penduduk Indonesia menggarisbawahi peran penting padi (*Oryza sativa* L.) bagi ketahanan pangan nasional, namun produksinya sering terhambat oleh serangan hama dan penyakit. Penelitian ini bertujuan untuk mengetahui insidensi dan intensitas hama utama (belalang dan walang sangit) serta penyakit (blas dan tungro) pada pertanaman padi di Desa Wedomartani melalui penerapan teknik sampling sistematik pola W. Pengamatan dilakukan empat kali dengan interval 5 hari, dengan sampel diambil dari 50 tanaman padi. Pendekatan kuantitatif digunakan untuk menghitung persentase Insidensi Penyakit dan Keparahan Penyakit. Hasil penelitian menunjukkan pola serangan yang terus meningkat untuk semua hama dan penyakit selama periode pengamatan. Insidensi belalang mencapai 100% pada pengamatan ketiga, dengan intensitas puncak 34,22% (kategori sedang) pada pengamatan keempat. Insidensi walang sangit mencapai puncaknya pada 98%, dengan intensitas 18,22% (kategori rendah). Insidensi blas dan tungro sama-sama mencapai 100%, dengan keparahan blas mencapai puncak 26,22% (kategori sedang) dan keparahan tungro mencapai 50,67% (kategori sedang-tinggi). Tingginya tingkat insidensi dan intensitas ini utamanya didukung oleh kondisi lingkungan yang kondusif bagi perkembangan hama dan penyakit, seperti kelembaban tinggi untuk blas dan ketersediaan sumber makanan yang disukai bagi walang sangit. Temuan ini menegaskan perlunya strategi Pengendalian Hama Terpadu (PHT) yang komprehensif, termasuk penanaman serentak, sanitasi

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lapangan, dan pengendalian hayati, untuk mengamankan produksi padi yang optimal di wilayah tersebut.

Kata Kunci: *Belalang, Walang Sangit, Tungro, Blast, Pengendalian Hama Terpadu*

Introduction

The food needs of the Indonesian people continue to increase every year in line with the growing population. One of the main food commodities that plays an important role in supporting national food security is rice *(Oryza sativa* L.). According to the Central Statistics Agency (2022), the total rice production in Indonesia in 2021 was 54.42 million tons of milled dry grain (GKG), a decrease of 233.91 thousand tons from the 2020 production. One of the reasons for the decline in milled dry grain yield was the attack of plant pests and diseases. Losses due to pests and diseases can reach significant levels if proper control measures are not taken. One of the factors that causes ineffective control is the lack of accurate field data on the population and intensity of pest and disease attacks.

To support successful pest control, appropriate identification and monitoring activities are required through the application of sampling techniques. Sampling techniques serve to obtain representative data on the types, populations, and distribution of pests in crop fields (Eliott *et al.,* 2020). This data forms the basis for developing more effective and efficient control strategies in accordance with the principles of Integrated Pest Management (IPM).

The principles of Integrated Pest Management (IPM) include efforts to grow healthy crops, preserve and utilize natural enemies, conduct regular monitoring of pests, and place farmers as the main actors in the implementation of IPM. This principle aims to reduce pest populations to below the economic threshold, maintain ecosystem sustainability, and ensure optimal crop productivity (Sudewi *et al.,* 2020). To support the application of this principle, this study aims to identify the major pests and diseases that commonly affect rice crops and to describe the sampling techniques used to assess their incidence and intensity in the field.

Plant pests include various pests and diseases that can reduce rice productivity. Locusts and green leafhoppers are important pests that can damage plant tissue and transmit diseases. Locusts damage rice by eating the leaves, and they usually appear continuously from the beginning of planting until harvest season (Sarumaha, 2020). Green leafhoppers damage rice plants by sucking fluids from leaf tissue; this activity not only weakens the plants but also acts as the main vector for the spread of the tungro virus (Muzam and Nugroho, 2020). In addition to pests, blast disease (*Magnaporthe oryzae*) and tungro caused by the Rice Tungro Virus (RTV) are also serious threats at certain growth stages. To accurately detect the presence of these pests, sampling techniques are used as a systematic approach capable of producing representative data. Within the framework of Integrated Pest Management (IPM), sampling data serves as an important basis for determining the level of infestation and the need for control.

Materials and Methods

This study used a field survey design with both quantitative and qualitative approaches. The survey was conducted to identify the level and type of pest and disease attacks on rice plants. The quantitative approach was used to calculate the percentage of pest and disease attacks on rice plants, while the qualitative approach was used to describe the symptoms of pest and disease attacks on rice plants and the organisms that cause them.

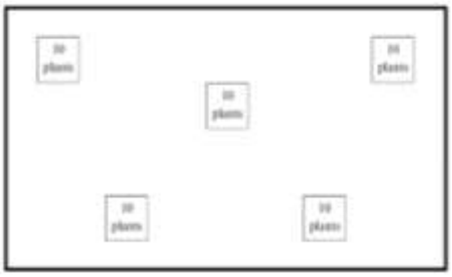

Figure 1. Sampling pattern

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The research population used is rice plants in a field in Wedomartani, Ngemplak, Sleman. The sample was taken using a systematic sampling technique with a W pattern. The observer walked across the field following a W-shaped path, and samples were taken at regular intervals along this path. A total of 50 rice plants located along the W transect line were selected as observation units, ensuring that the samples represented different sections of the field.

Observations of pests and diseases on rice plants were conducted from October to November, with an interval of 5 days, and were carried out four times. Each observation aimed to record the presence, population, and intensity of pest and disease symptoms at different growth stages of the rice plants. For rice bug and grasshopper pest observation, visual inspection was used to directly record the presence of pests by examining the leaves, stems, sheaths, and panicles for signs of feeding damage such as chew marks, discoloration, wilting, or deformation. For disease observation, visual inspection was also performed to identify the presence and severity of blast and tungro symptoms on leaves, stems, and other affected plant organs.

The collected data were analyzed descriptively to determine the incidence of pests and diseases (%) and the intensity of pests and diseases (%) using the IRRI scale (0-9). Based on Hafidhi *et al.* (2020), to quantify mean pest population and disease attack levels, the following formulas were used:

- The pest and disease incidence (%) was calculated using the formula:

  Pest and disease incidence (%) = $\frac{Number\ of\ affected\ plants}{Total\ number\ of\ observed\ plants}$ x 100
- The Pest and disease intensity (%) was determined using the IRRI 0–9 scale following the formula:

  Pest and disease intensity (%) = $\frac{(\sum(ni \times vi))}{(N\ x\ Vmax)}$ x 100

  Description:
  ni = number of plants in the i-th score category
  vi = intensity score
  N = total number of observed plants
  Vmax = maximum score (i.e., 9)

Assessment of plant damage due to pest attacks based on Wagiyanti et al. (2024) is described as follows:

Table 1. Description of plant damage

Scale	Description
0	no damage
1	damage of 1-25% (light)
2	damage of 25-50% (moderate)
3	damage of 50-75% (heavy)
4	damage of 75-100% (failure)

Assessment of disease severity is carried out using the Standard Evaluation System for Rice by IRRI (2013), with a description of disease symptom scores as follows:

Table 2. Description of tungro symptom severity score

Scale	Description
1	no symptoms
3	1-10% plant height reduction, with no distinct leaf discoloration
5	11-30% plant height reduction, with no distinct leaf discoloration
7	31-50% plant height reduction, with yellow to orange leaf discoloration
9	more than 50% height reduction, with yellow to orange leaf discoloration

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Table 3. Description of blast symptom severity score

Scale	Description
0	no disease
1	1 –5% attack of leaf area
3	> 5 –≤ 11% attack of leaf area
5	> 11 –≤ 25% attack of leaf area
7	> 25 –≤ 75% attack of leaf area
9	> 75 –≤ 100% attack of leaf area

Results and Discussion

Incidence of Pest and Disease in Rice

Table 4. Pest Incidence of Rice Bug and Grasshopper (%)

Pest	Obervation			
	1	2	3	4
Grasshopper	70%	92%	100%	100%
Rice Bug	26%	52%	68%	98%

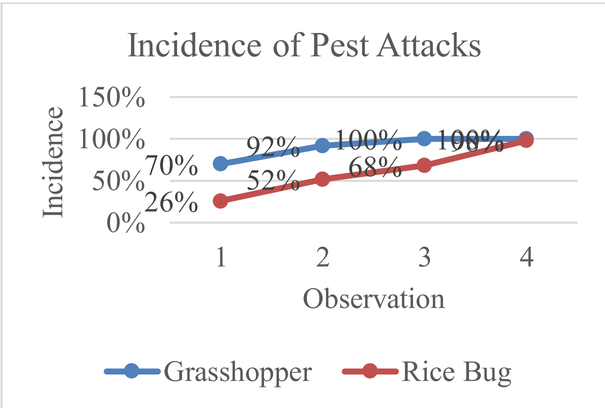

Figure 1. Pest Incidence

The incidence of grasshopper (*Valanga nigricornis*) infestation in rice showed a clear increasing pattern throughout the observation period. Based on Table 1, the first observation recorded 70% of plants being attacked, which increased to 92% in the second observation and reached the highest level of 100% in both the third and fourth observations. This increase in incidence indicates that the grasshopper population developed rapidly as the availability of fresh foliage increased during the vegetative phase of the rice crop. This finding is consistent with Anjani and Pribadi (2021), who reported that grasshoppers generally attack rice plants continuously from planting until harvest.

The rapid rise in incidence to 100% by the third observation suggests that environmental conditions at the study site were highly favorable for grasshopper development. The abundance of weeds provided an ideal food source and breeding habitat. Open field conditions also facilitated the movement and spread of grasshopper populations. Additionally, non-synchronous planting resulted in rice plants at varying growth stages within the same area, allowing grasshoppers to continuously find suitable food throughout the cropping period, thereby accelerating population growth. Climatic factors such as optimal rainfall, as well as suitable temperature and humidity, also played a significant role in supporting this population outbreak (Yudiawati *et al.,* 2025).

The incidence pattern of rice bug (*Leptocorisa acuta*) attacks increased more gradually. In the first observation, the infestation level was relatively low at 26%, then rose to 52% in the second observation. The incidence continued to increase as the crop entered the generative phase, reaching 68% in the third observation and surging to 98% in the fourth observation, which coincided with the grain-filling stage. This pattern is typical for rice bugs, as this pest is most active and damaging during the

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panicle formation to grain-filling stages, when the nutrient content of the developing grains is at its optimal level (Ishak *et al.,* 2024).

The high incidence of rice bug infestation in this study may also be influenced by environmental and agronomic conditions. The presence of wild grasses around the study area provides an alternative habitat where rice bugs can shelter and reproduce before moving onto rice plants. Another contributing factor may be the irregular planting schedule in the surrounding fields, which results in rice plants entering the generative phase earlier in some areas and attracting rice bug populations migrating from other fields. Rice bugs that have developed functional wings are capable of flying from harvested fields to unharvested ones in search of food sources (Sumini *et al.,* 2019).

Table 5. Disease Incidence of Blast and Tungro (%)

Disease	Obervation			
	1	2	3	4
Tungro	76%	100%	100%	100%
Blast	78%	96%	100%	100%

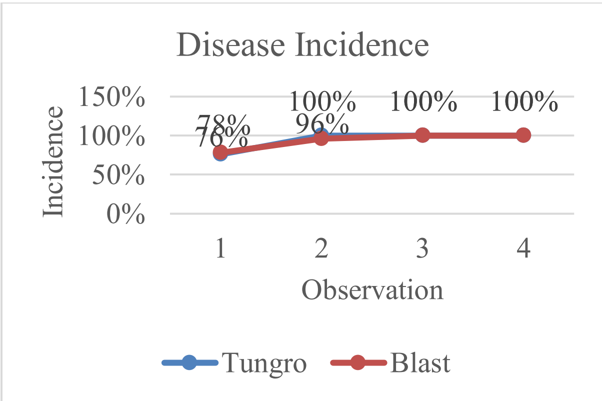

Figure 2. Disease Incidence

Field observations showed typical blast lesions such as spindle-shaped spots with grey centers and brown margins, which were widely distributed across leaves during the peak incidence period (IRRI, 2025). Based on Table 2, blast incidence showed a consistently high level of infection across all observations. At the first observation, 78% of plants exhibited blast symptoms, increasing to 96% at the second observation and reaching 100% at the third and fourth observations.

The increasing incidence up to the third observation indicates that disease development intensified as the crop entered the late vegetative to maximum tillering stage, which is known to be the most vulnerable phase to *Pyricularia oryzae* infection. This pattern is consistent with findings by Akhsan & Palupi (2015), who reported that blast intensity increases progressively during the vegetative phase, as young rice tissues are more susceptible to infection and microclimatic humidity increases as tillers develop. Their study also showed that the longer the crop remains in the field, the higher the blast intensity and spore abundance of *Pyricularia grisea*, indicating that disease development is strongly influenced by crop growth stage and environmental conditions.

The high incidence recorded in this study can be explained by environmental conditions that favor blast development. This disease commonly appears under high humidity, moderate temperatures ranging from 20–28°C, and shaded or poorly aerated areas where leaf surfaces remain moist for longer periods. Such conditions likely supported the rapid increase in incidence observed from the first to the third observation. This explanation is consistent with the findings of Suganda *et al.* (2016), who reported that blast incidence can rise sharply when environmental conditions are conducive, particularly under humid conditions. The literature also states that incidence levels above 90% fall into the "very high" category, confirming that field conditions strongly supported blast development during the observation period.

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Plants with tungro exhibited the characteristic yellow–orange discoloration and stunted growth commonly associated with tungro virus infection (IRRI, 2025). Based on Table 2, tungro incidence also increased during the observation period, although the pattern differed from that of blast. At the first observation, 76% of plants showed the characteristic yellow–orange tungro symptoms. This figure increased to 100% at the second observation and remained stable at 100% in the subsequent observations.

The observed pattern, in which an initial increase is followed by stabilization, indicates that tungro transmission occurred early in the growth period and reached saturation once most plants had been infected. This pattern is consistent with the epidemiology of tungro disease, which depends on the presence of the green leafhopper (*Nephotettix virescens*) as its vector. Unlike blast, tungro does not spread rapidly unless vector populations are high and actively feeding. The increase from 76% to 100% likely reflects early vector activity, after which transmission stabilized because vector abundance did not increase further. This explanation aligns with the findings of Yuliani (2014), who reported that tungro incidence often increases gradually and tends to plateau once the majority of plants in the field have been infected. In addition, rice plants in the vegetative phase are known to be more susceptible to tungro infection, which supports the infection pattern observed in this study.

Intensity of Pest and Disease in Rice

Table 6. Pest Intensity of Grasshopper Rice Bug (%)

Pest	Obervation			
	1	2	3	4
Grasshopper	8.00%	15.11%	25.33%	34.22%
Rice Bug	2.89%	7.56%	11.11%	18.22%

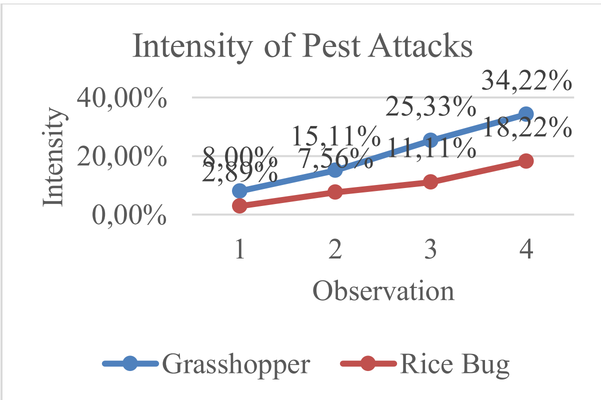

Figure 3. Intensity of Pest Attacks

Based on the observations, the intensity of grasshopper (*Valanga nigricornis)* infestation showed an increasing pattern as the plants aged. At the first observation, the intensity of leaf damage was 8.00%, which falls into the low category and is characterized by small bite marks on the leaf edges forming serrated patterns (Nurhadiah *et al.,* 2023). The intensity increased to 15.11% at the second observation and then rose significantly to 25.33% at the third observation. The highest value was recorded at the fourth observation with an intensity of 34.22%, which falls into the moderate category, defined as 25–50% damage intensity (Deptan, 2007).

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Figure 4. Grasshopper (*Valanga nigricornis*)

Figure 5. The Symptoms of Plant Damage Caused by Grasshoppers

This consistent upward trend indicates that the population and feeding activity of grasshoppers increased as the plants grew older. According to Nurhadiah *et al.* (2023), grasshoppers tend to attack rice during the vegetative phase, when leaf development and growth are relatively rapid, resulting in higher levels of damage. This condition can be influenced by various factors, such as the abundance of food sources in the field and environmental conditions. The life of insects is influenced by physical, biotic, and chemical environmental factors. Physical factors such as temperature, humidity, rainfall, and wind play significant roles. If all these factors support insect development, insect populations will increase (Wardani, 2017).

Based on the observations, the intensity of rice bug (*Leptocorisa acuta)* infestation also showed an increasing trend as the plants aged. At the first observation, the intensity was 2.89%, which is categorized as low. This low value occurred because, during the early growth stage of rice, panicles that serve as the main food source for rice bugs were not yet available. According to Ningsih *et al.* (2024), rice bugs typically feed by sucking the sap from rice grains in the milk stage, resulting in empty and unfilled grains. The intensity increased to 7.56% at the second observation and further increased to 11.11% at the third observation. The highest intensity occurred at the fourth observation, reaching 18.22%.

Figure 6. Rice Bug (*Leptocorisa acuta*)

Figure 7. The Symptoms of Plant Damage Caused by Rice Bug

This increase aligns with the rice plant entering the generative stage, during which panicles begin to form and food sources for rice bugs become more abundant. According to Erdiansyah *et al.* (2021), intensity increases because rice bug feeding activity is most intense during the grain-filling phase up to the full-grain stage, when the nutrient content of the panicles is at its highest. The highest value of 18.22% indicates that although the infestation is still in the moderate category, it is significant enough to affect grain quality. Several factors support the presence and development of rice bugs in the field, including varietal characteristics such as the number of tillers and grain color, as well as environmental and climatic conditions (Paputungan, 2020).

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Table 7. Disease Intensity of Blast and Tungro (%)

Disease	Obervation			
	1	2	3	4
Blast	10.00%	16.44%	23.33%	26.22%
Tungro	12.44%	32.44%	39.56%	50.67%

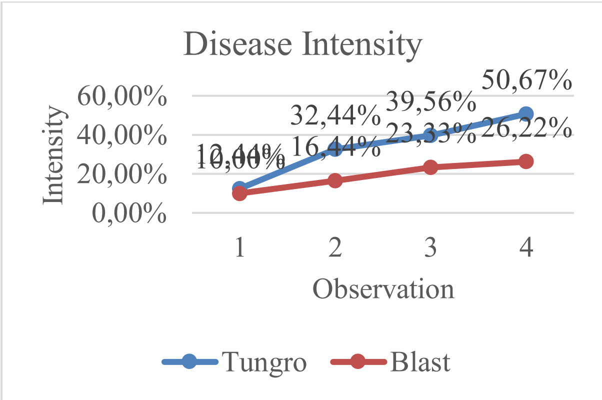

Figure 8. Disease Intensity

Based on the observations, the intensity of blast showed a gradual increasing pattern throughout the four observation periods. At the first observation, the blast severity reached 10.00%, which falls into the low category based on the IRRI scale. The intensity then increased to 16.44% at the second observation and continued rising to 23.33% at the third observation. The highest recorded value appeared at the fourth observation with an intensity of 26.22%, placing it in the moderate category according to IRRI severity levels (IRRI, 2013).

Figure 9. The Symptom of Rice Blast Disease

This upward trend aligns with the typical behavior of blast, which often intensifies under conducive environmental conditions. Blast development is strongly supported by high humidity, frequent leaf wetness, and temperatures ranging from 20–28°C, conditions proven to increase sporulation and lesion expansion (Prasad *et al.,* 2022). Furthermore, plants at the late vegetative to maximum tillering stage are known to be more vulnerable due to higher physiological susceptibility (Raveloson *et al.,* 2016). The moderate severity observed in this study is consistent with reports stating that field-level blast commonly ranges between 10–35% under natural tropical conditions (Agha *et al.,* 2023). According to Marzougui *et al.* (2021), progressive increases in blast severity are typical during periods of high rainfall and humidity, which enhance conidia germination and infection efficiency. The rise in severity from the first to fourth observation thus reflects a pattern commonly reported in blast epidemiology across rice-growing regions.

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Based on the observations, tungro severity exhibited a consistent upward pattern from the first to the fourth observation. At the first observation, the disease intensity was 12.44%, categorized as low. This value then increased substantially to 32.44% at the second observation, followed by 39.56% at the third observation, and reached its highest point at 50.67% during the fourth observation. These values indicate that tungro progressed from low to moderately high severity based on standard symptom scoring guidelines (Bangladesh Rice Research Institute, 2019).

Figure 10. Symptoms of Tungro Disease

This steady increase aligns with the known epidemiological pattern of tungro, where symptom development typically intensifies gradually because the virus depends on green leafhopper (*Nephotettix* spp.) activity for transmission. Although vector abundance was not directly measured, tungro progress commonly reflects the feeding and movement behavior of the leafhopper population (Cabauatan *et al.,* 2022). According to Yuliani *et al.* (2023), tungro spread often remains moderate unless leafhopper populations surge, as the virus is not airborne and relies entirely on vector-mediated transmission. The rising intensity through the vegetative phase is consistent with observations by De Costa *et al.* (2021), who reported that tungro symptoms become more severe as plants age due to cumulative viral replication and systemic spread. The intensity values in this study, peaking above 50%, also fall within the range documented in recent field surveys in Southeast Asia, where tungro severity can reach 40–60% under moderate vector pressure (Herlina *et al.,* 2022).

Application of Integrated Pest Management (IPM) on Rice Plants in Wedomartani

The implementation of Integrated Pest Management (IPM) in Wedomartani is carried out through several complementary strategies. Crop rotation serves as a crucial measure to break the life cycle of pests and pathogens while improving soil conditions, enabling rice plants in the following season to grow more healthily and vigorously. Farmers also use selective seeds to reduce the risk of seed-borne diseases and enhance plant resistance to pest attacks. Pest and disease control in the field is conducted using sulfur and silica, both of which are considered environmentally friendly inputs. Sulfur helps suppress the development of pathogenic fungi, while silica strengthens plant tissues, making them more resistant to piercing-sucking pests. Its occurrence is associated with environmental conditions such as the presence of weeds around the field and asynchronous planting patterns. These findings indicate that farmers in Wedomartani have implemented IPM principles effectively to reduce pest and disease pressure while minimizing excessive reliance on synthetic pesticides.

Integrated Pest Management (IPM) has begun to be implemented in Wedomartani Village, but only a few farmers have adopted it due to various limitations. One of the main obstacles is the farmers' limited understanding of IPM concepts and techniques, which leads them to prefer using chemical pesticides that are considered more practical. In addition, limited access to IPM-supporting resources and technologies, such as biological control agents or pest monitoring tools, also becomes a significant barrier. Economic factors also play a significant role, as limited capital makes it challenging for farmers to implement environmentally friendly control methods, leading them to opt for cheaper and more immediate solutions.

The infestation of grasshoppers and rice bugs in rice can be controlled more effectively through the implementation of Integrated Pest Management (IPM). Cultural practices are highly recommended, such as synchronized planting to break the pest life cycle and reduce the continuous availability of food sources. Field sanitation, including the removal of weeds and alternative host plants, is also essential to reduce pest habitats. Biological control is another important component of IPM, utilizing natural enemies of grasshoppers and rice bugs such as insect predators (spiders and orthopteran predators from the families Gryllidae and Tettigonidae) as well as entomopathogenic fungi like *Beauveria bassiana* and *Metarhizium* spp. (Wardoyo, 2025).

IPM implementation to control blast and tungro can be carried out by selecting resistant or tolerant varieties as the first and most effective step in managing rice diseases. Field sanitation and crop rotation are also crucial to reducing sources of disease inoculum. The proper and timely application of fungicides, especially when environmental conditions favor disease development, such as high humidity for blast, is necessary to keep infections under control. Routine monitoring systems and early preventive actions can significantly suppress the spread of diseases (Wardoyo, 2025).

Conclusion

This study showed that four major rice pests and diseases, such as grasshoppers, rice bugs, blast, and tungro, were present throughout the entire observation period. The incidence of grasshoppers and blast increased to 100% starting from the third observation, while tungro reached 100% from the second observation, and rice bugs reached 98% in the fourth observation. The intensity of attacks also increased as the rice plants developed. The highest intensities were recorded in the fourth observation, namely 34.22% for grasshoppers (moderate category), 18.22% for rice bugs (light category), 26.22% for blast (moderate category), and 50.67% for tungro (heavy category). Overall, the results indicate that pest and disease pressure in the study area was high and increased consistently throughout the observation period.

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