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The Diversity of Diseases Affecting Long Beans (*Vigna sinensis* L.) in the Banyuasin Region

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ABSTRACT

Long bean (*Vigna sinensis* L.) is a widely cultivated legume in Indonesia, offering significant economic potential due to its ease of cultivation. However, its productivity is often hampered by major pathogens like *Uromyces appendiculatus*, which causes rust disease, and various mosaic viruses. Rust disease manifests as small brown powdery spots on leaves, while viral infections can severely reduce or even eliminate fresh pod yields. This field study aimed to identify the primary diseases affecting long beans, determine their causative agents, and distinguish their specific symptoms. The research employed a survey method through purposive sampling on farmers' land. Observations were conducted across several different plots using a diagonal sampling technique at multiple points to collect plant samples. The results indicated that both fungal rust and viral mosaic are the predominant diseases impacting local crops. This inventory provides essential data for farmers to better recognize and differentiate symptoms, ultimately supporting more effective disease management and safeguarding the economic value of long bean production in the region.

Keywords: Diversity, long bean, plant, plant disease

INTRODUCTION

Long beans (*Vigna sinensis* or *Vigna unguiculata* subsp. sesquipedalis) are tropical legumes that provide plant-based protein and essential micronutrients for human consumption (Dahiya, 2015). This crop offers high economic value to smallholder farmers due to its short harvest cycle, enabling increased household income (Choi, 2024). In Banyuasin Regency, South Sumatra, long beans are intensively cultivated both as an intercrop and as a main crop (Damayanti, 2010). National productivity often fluctuates due to pathogen attacks that reduce the quality and quantity of pods (Vanlauwe, 2019).

The diversity of pathogens that attack includes fungi, bacteria, and viruses, thereby adding to the complexity of crop management (Jayasinghae, 2015). Long bean plants (*V. sinensis* L.) face a variety of pathogens, ranging from insect pests to mosaic viruses, which cause damage to leaves, stems, flowers, and pods. Insect attacks such as those by the black ladybug (*Brachyplatys* sp.), aphids (*Aphis craccivora*), grasshoppers (*Oxya* sp.), and Lasiocampidae caterpillars cause holes in the leaves, leaf curling, and hardening of the leaf veins, while infections by the Bean Common Mosaic Virus (BCMV) and Mungbean Yellow Mosaic Virus (MYMV) produce symptoms of yellow mosaic, vein hardening, and premature aging of plant tissues (Murwani, 2025). Research in Perean Village showed that mosaic virus symptoms appeared in 42.85% of plants and resulted in a 43.02% yield reduction, while yellowing symptoms occurred in 32.70% of plants with yield losses of up to 53.87% compared to healthy plants (Purwaningsih, 2026). In the Java region, simultaneous infection with BCMV, Cucumber mosaic virus (CMV), and other viruses can produce synergistic effects that exacerbate symptom severity, including intense yellow mosaic, leaf vein swelling, and pod deformation (Supyani, 2020).

Leaf rust caused by *Uromyces appendiculatus* disrupts photosynthesis and reduces plant biomass (Gonçalves, 2016). High humidity and hot temperatures in the Banyuasin wetlands accelerate pathogen spread (Ronner, 2018). Symptom inventory and spatial mapping are key steps in integrated disease management, reducing the use of pesticides that are not targeted effectively (Zhang, 2023). This study is expected to generate comprehensive data on the pathogen profile in Banyuasin to support the development of resistant varieties and sustainable agronomic practices (Chang, 2023).

MATERIAL AND METHOD

This study was conducted in Tanah Mas Village, Talang Kelapa Subdistrict, Banyuasin Regency, South Sumatra Province. The study utilized a series of laboratory instruments, including a microscope, microscope slides with cover slips, a pipette, a Bunsen burner, and scissors. A cell phone camera was also used for documentation purposes. Meanwhile, the required materials consisted of samples of long bean leaves showing symptoms, distilled water, alcohol, methanol, ZIP-lock bags, and tissues.

This field study employed a survey or field observation method using purposive sampling, with the research subjects being long bean farmers' fields. The plots observed consisted of 5 diagonal points across four different fields, and 10 plant samples were collected at each point.

How It Works

Selecting a Field Practice Location

The first step was to identify the field site where observations would be conducted. The selected field site was located on a long bean farm owned by a farmer in the village of Tanah Mas.

Field Observations

Determine the severity and prevalence of disease in long beans; observations were carried out four times at four-week intervals.

Sample Selection

For sample selection, leaves from long bean plants exhibiting disease characteristics and symptoms were collected.

Disease Identification

Disease identification in plants is conducted in the laboratory by scraping symptomatic plant tissue with a needle and placing it on a microscope slide. The sample is then examined under a microscope to observe the microscopic characteristics of the disease.

Observed Parameters

The observed parameters include the intensity, percentage, symptoms of infection, and microscopic form of the disease affecting long beans. The formula for disease intensity is as follows:

$$I = \frac{\sum(n \times V)}{N \times V} \times 100\%$$

Notes:
I = Disease severity (varying)
n = Number of leaves in each severity category
v = Score for each severity category

N = Total number of leaves
V = Score for the highest severity category

Scoring:
0 = no attack
1 = 1% to 25%
2 = >25% to 50%
3 = >50% to 75%
4 = >75% to 100%

The formula for calculating the disease incidence rate is as follows:

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

Notes:
n = Number of infected plants
N = Total number of plants observed

Data Analysis

The data obtained from this field study was processed and presented using Microsoft Excel in a statistically accurate manner in the form of figures, and graphs.

RESULT AND DISCUSSION

Infection intensity is a key parameter for evaluating the severity of pathogen or pest infections in crop commodities. Utilizing this data allows for the more precise identification of locations or plant populations with higher levels of susceptibility. Data on the intensity of mosaic disease outbreaks caused by the Bean Common Mosaic Virus (BCMV) can be seen in Figure 1. Disease percentage serves as a quantitative indicator to measure the ratio of infected plants to the total population. This data is crucial for practitioners and researchers in evaluating the severity of pathogen attacks in a given area. The following data on the percentage of Bean Common Mosaic Virus (BCMV) attacks is presented in Figure 2.

The severity of pest and disease attacks on vegetation is measured using an attack intensity indicator. This parameter serves as a database for mapping regions or groups of plants with high susceptibility. Detailed data on the attack intensity of leaf rust (*Uromyces appendiculatus*) is presented in Figure 3. The disease percentage is a quantitative indicator that describes the ratio of infected plants to the total population. This parameter is crucial for both practitioners and researchers in evaluating the severity of pathogen infestation in a given field. Data on the percentage of leaf rust (*U. appendiculatus*) infestation can be seen in Figure 4.

Based on observations in long bean cultivation fields, plants infected with leaf rust (*U. appendiculatus*) are characterized by the appearance of small brown pustules on the underside of the leaves, typically surrounded by a yellow chlorotic halo. Advanced infections can lead to necrosis, leaf abscission, and tissue death, and may potentially spread to the stem and petiole. On the other hand, infection by the Bean Common Mosaic Virus (BCMV) triggers the formation of irregular green-yellow mosaic patterns as well as dark green thickening in the leaf vein areas. In severe infections, symptoms can progress to leaf deformation in the form of curling, as well as necrosis of the leaf veins and stems if the infection becomes chronic. The visual characteristics of both diseases are shown in Figures 5 and 6.

Based on four weeks of field observations of long bean (*V. unguiculata* ssp. sesquipedalis) crops, there was significant spatial variation in disease incidence.

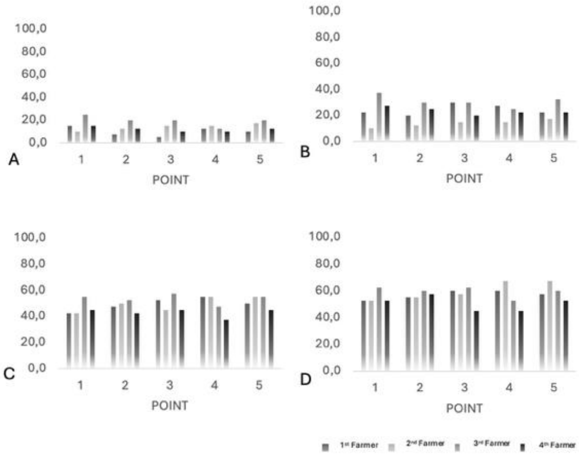

Figure 1. Intensity disease attack caused Bean Common Mosaic Virus (BCMV) from the First-Fourth week (A, B, C, D)

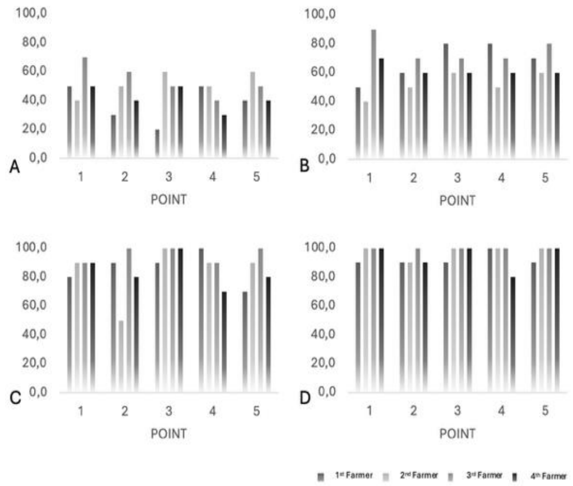

Figure 2. Percentage of mosaic disease outbreaks caused by (BCMV) from the First-Fourth week (A, B, C, D)

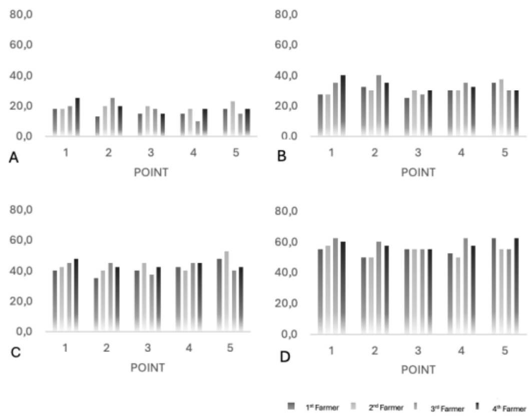

Figure 3. Intensity disease attack caused (*Uromyces appendiculatus*) from the First-Fourth week (A, B, C, D)

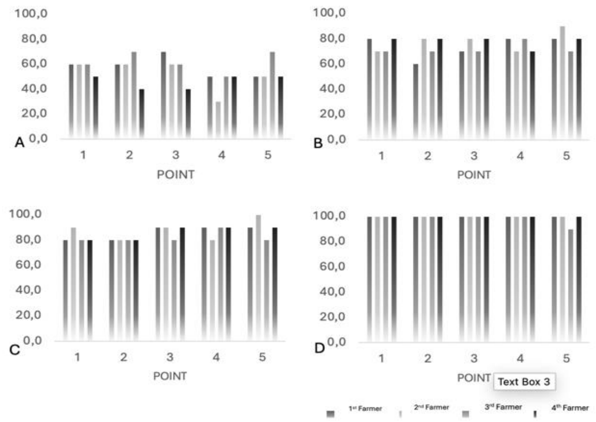

Figure 4. Percentage of mosaic disease outbreaks caused by (*Uromyces appendiculatus*) from the First-Fourth week (A, B, C, D)

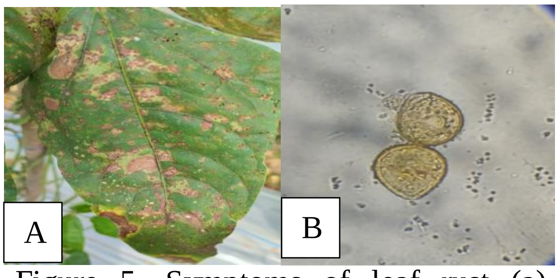

Figure 5. Symptoms of leaf rust (a), Microscopic *U. appendiculatus* (b)

Figure 6. Symptoms of bean mosaic virus (BCMV) on long bean leaves

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Disease severity, which represents the severity of infection based on the proportion of damaged leaf tissue relative to total leaf area, was highest on Farmer 4’s plot for leaf rust. Conversely, the intensity of Bean Common Mosaic Virus (BCMV) infection peaked on Farmer 1 and 2’s plots but was at its lowest on Farmer 4’s plot. Meanwhile, the incidence—which describes the distribution of infected plants within an area showed a different trend. Farmer 3’s plot recorded the highest incidence for both leaf rust (*U. appendiculatus*) and BCMV, while the lowest values were found in Farmer 4’s plot. This difference indicates that even though a plot may have a widespread population of infected plants, the intensity on individual plants can vary depending on micro-management factors and host resistance.

Rust disease causes significant losses in crop production, both in terms of quantity and quality, particularly in wheat, which is susceptible to yield reductions due to rust infection (Sharma, 2011). The rate of rust spread is strongly influenced by climatic factors such as high humidity, warm temperatures, rainfall, and sunlight intensity (Dudney, 2021). Rainfall increases leaf microclimate humidity, accelerating the growth of the Uromyces fungus, while direct sunlight exposure can prolong the incubation period and delay disease symptoms (Bueno, 2021). The Uromyces pathogen grows optimally at temperatures that are not too hot with high humidity, conditions commonly found during the tropical rainy season. The primary dispersal of spores occurs via wind currents, which carry spores from infected leaves to others, increasing the severity of the outbreak (Kolmer, 2005). In addition to wind, rain splash, insect activity, and seedlings transported from infected areas serve as additional vectors in expanding the spread. Understanding the interaction between environmental factors and these dispersal mechanisms is crucial for designing effective control strategies.

Infection with Bean Common Mosaic Virus (BCMV) during the vegetative to generative stages disrupts systemic physiological processes, reduces photosynthesis, slows growth (stunting), causes leaves to curl and harden, and significantly reduces pod weight; the most severe symptoms appear in young plants, indicating the presence of age-related resistance in mature plants (Çelik et al., 2023). BCMV transmission occurs via seeds and through aphid vectors (Aphididae) via a non-persistent mechanism; in seeds, the virus can persist in the seed coat, cotyledons, and embryo axis, while aphids mechanically spread it when sucking plant sap (Li, 2024).

Visually, infected plants exhibit thickened leaf veins, chlorotic mottling, and wrinkled leaf surfaces. Although the virus does not directly attack the pods, disruptions in assimilate synchronization during the filling phase lead to pod malformations and reduced seed viability. Understanding the physiological impacts and transmission pathways of BCMV is essential for developing control strategies based on resistant varieties and seed sanitation practices. Mosaic viruses caused by Cowpea aphid-borne mosaic virus (CABMV) and Bean common mosaic virus (BICMV). This disease causes yellow mosaic on leaves, reduces yield, and is a primary target for virus-resistant breeding (Airina et al., 2025). Geminiviruses a single infection causes yellowing (yellow mosaic), curling (cupping), and stunting of leaves. The most characteristic symptoms are seen in leaves that turn completely yellow. Potyviruses, cause light brown-green mosaic, curled or twisted leaves, and stunted growth. These symptoms are typically milder than those caused by geminiviruses. Cucumber mosaic virus (CMV), although rarely detected, a single

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CMV infection produces brown-green mosaic and stunted growth in plants. Dual infections combinations of geminiviruses and potyviruses or potyviruses and CMV increase symptom severity, resulting in more complex mosaics and significant yield reductions (Supyani et al., 2020).

CONCLUSION

Disease control practices at the farmer level in Tanah Mas Village still rely heavily on the use of synthetic pesticides, as they are considered more practical and provide immediate results. However, given the exponential rate of leaf rust and BCMV infections, a transition to an Integrated Pest Management (IPM) strategy is necessary. The use of resistant varieties (host-plant resistance) is recommended as a key component to sustainably break the infection cycle and reduce reliance on chemical inputs.

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