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Field Evaluation of Eggplant (*Solanum gilo*) Accessions for Growth Performance, Yield, and Virus Resistance

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ABSTRACT

Background and Objective: Eggplant (*Solanum gilo*), an important vegetable crop in Nigeria, is widely cultivated for its nutritional and medicinal benefits, as well as its economic value to small-scale farmers. This study aimed to evaluate the growth and yield responses of ten eggplant accessions to viral infections under field conditions. **Materials and Methods:** The experiment was conducted from June to September, 2021 at the National Horticultural Research Institute (NIHORT) in Ibadan, Nigeria. A Randomized Complete Block Design (RCBD) with three replications was used, and disease incidence and severity were assessed at two-week intervals from the 2nd to the 8th week after transplanting (WAT). Data were analyzed by ANOVA, and means were separated using Duncan's Multiple Range Test (DMRT) at a 5% significance level. **Results:** The results revealed significant differences in virus disease incidence and severity among the ten accessions. Accessions V1, V8, and V9 exhibited the lowest virus incidence (ranging from 4.2 to 25.5%) and severity scores (ranging from 1 to 2) over the evaluation period, indicating potential resistance or tolerance to viral infections. Conversely, V5 and V7 showed the highest virus severity scores of 4 and 5 at 8 WAT, corresponding to severe symptoms and significant yield reduction. **Conclusion:** These findings highlight the variability in resistance among eggplant accessions and underscore the importance of selecting virus-resistant varieties to enhance productivity. Further research should focus on breeding and developing eggplant cultivars with improved viral resistance for sustainable production.

KEYWORDS

Eggplant, viral infections, disease incidence, disease severity, resistance, yield

INTRODUCTION

Eggplant (*Solanum gilo*) is a crucial vegetable crop in Nigeria, particularly in the eastern regions, where it has gained high popularity and is among the most consumed vegetables[1]. The crop plays a significant role in the culture and traditions of the local populations in Eastern Nigeria. Cultivated primarily for food and medicine, eggplant also serves as a major income source for many rural households[2]. Although eggplant is a perennial crop, it is commonly grown as an annual for commercial purposes and thrives in rich, deep, well-drained, sandy loamy soils. It is well-suited to the tropical climate[3]. Nutritionally, eggplant

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is an excellent source of dietary fiber, potassium, copper, and small amounts of protein, vitamins (B and C), minerals, and starch[4]. Its leaves are particularly rich in vitamins A and B (especially riboflavin), calcium, phosphorus, and iron[5]. Many small-scale farmers rely on the cultivation of both the fruits and leaves of eggplant for their livelihood and income generation. However, eggplants are susceptible to various pathogens, including fungi, bacteria, and viruses[6]. Plant viruses are significant disease-inducing agents affecting eggplants, transmitted through vegetative propagation, contact between infected and healthy plants, and various vectors, including insects and nematodes[7]. Notable viruses affecting eggplants include cucumber mosaic virus (CMV)[8], Tomato Spotted Wilt Virus (TSWV)[9], and eggplant mottled dwarf virus (EMDV)[10]. Despite its importance, eggplant farmers face considerable challenges in large-scale cultivation across the tropics due to its susceptibility to numerous pathogens. Viral diseases, in particular, are a major factor contributing to reduced yields and preventing the crop from reaching its genetic potential[11]. Investigating the impact of these viruses on eggplant growth and yield is essential for assessing the extent of damage and justifying investments in control measures. Therefore, this study aimed to evaluate the growth and yield responses of ten eggplant accessions to viral infections.

MATERIALS AND METHODS

Experimental site and material: The trial was conducted at the experimental field of the National Horticultural Research Institute (NIHORT), Ibadan, Nigeria, during the planting seasons from June to September, 2021. The study utilized ten eggplant (*Solanum gilo*) varieties, which were sourced from the Seed Unit of NIHORT. These varieties are newly purified lines developed through two cycles of selfing and selection from eggplant germplasm collected from farmers' fields in South Western Nigeria. The seeds used were harvested from selected individual segregants in earlier generations, characterized by desirable traits such as a high number of fruits per plant, intermediate plant height, and optimal fruit size and shape.

Experimental design: The experiment was conducted using a Randomized Complete Block Design (RCBD) with three replications. Eggplant seeds were sown in seed trays filled with sterilized potting mix and kept in an insect-free, climate-controlled nursery for six weeks. Following germination and establishment, seedlings were transplanted to the field.

Data collection

Disease evaluation: Disease incidence and severity were assessed to monitor viral infections.

Disease incidence: Disease incidence was calculated as the percentage of infected plants out of the total number of plants sampled[12]. Where:

$$\text{Disease incidence (\%)} = \frac{\text{Number of infected plants}}{\text{Total number of plants sampled}} \times 100$$

Disease severity was evaluated from the 2nd to the 8th week after transplanting. A modified scale was used:

1 = No visible symptoms
2 = Mild symptoms (less than 10% of total leaves) including mosaic, mottling, yellowing, vein banding or necrosis
3 = Moderate symptoms (greater than 10% but less than 50%)
4 = Severe symptoms (greater than 50% but less than 75%) with reduced leaf lamina or distortion
5 = Very severe symptoms (greater than 75%) with leaf distortion and general stunting

Growth parameters: Growth parameters were recorded bi-weekly from 2 to 8 weeks post-transplanting. Measurements included.

Plant height: Measured from soil level to the apex of the plant.

Yield data: Quantified based on fruit count and weight per plant.

Statistical analysis: Data were analyzed using Analysis of Variance (ANOVA) to determine significant differences among treatments. Means were separated using Duncan's Multiple Range Test (DMRT) at a 5% significance level.

RESULTS AND DISCUSSION

Virus disease incidence in eggplant accessions: At 2 weeks after transplanting (WAT), there was no significant difference ($p \geq 0.05$) in virus disease incidence among the ten eggplant accessions (Table 1). By 4 WAT, accessions V1, V8, and V9 exhibited significantly lower virus incidence, with ratings of 4.2, 8.4, and 4.2%, respectively, compared to the other accessions ($p \leq 0.05$). This trend persisted at 6 WAT and 8 WAT, where V1, V8, and V9 maintained lower disease incidences of 12.5, 10.5, and 8.4% at 6 WAT, and 23.3, 25.5, and 10.0% at 8 WAT, respectively (Table 1). The consistently lower virus incidence in these accessions indicates their potential resistance or tolerance to viral infections.

Virus disease severity in eggplant accessions: At 2 and 4 WAT, there were no significant differences ($p \geq 0.05$) in disease severity among the accessions (Table 1). However, significant variation in disease severity was observed at 6 WAT. Accessions V5, V6, V7, and V10 had the highest severity scores of 3, indicating moderate symptoms. By 8 WAT, V5 and V7 showed the highest disease severity scores of 4 and 5, respectively, indicating severe symptoms. Conversely, V1, V8, and V9 had significantly lower severity scores of 2, 2, and 1, respectively ($p \leq 0.05$), demonstrating better resistance or tolerance to the virus (Table 1).

Plant height response to virus in eggplant accessions: No significant differences ($p \geq 0.05$) in plant height were observed among the accessions at 2 and 4 WAT (Table 2). By 6 WAT, accession V2 had the lowest plant height of 13.4 cm. At 8 WAT, significant differences emerged, with V1, V8, and V9 showing the tallest plant heights of 48.8, 47.1, and 45.3 cm, respectively ($p \leq 0.05$), compared to other accessions (Table 2). The taller plants in these accessions may indicate better growth performance despite viral stress.

Table 1: Virus disease incidence and Virus disease severity of 10 eggplant accession

Virus	Virus disease incidence (%)					Virus disease severity			
Accessions	2 WAT	4 WAT	6 WAT	8 WAT	Accessions	2 WAT	4 WAT	6 WAT	8 WAT
V1	0.0^{a}	4.2^{a}	12.5^{a}	23.3^{a}	V1	0.0^{a}	0.0^{a}	0.68^{a}	2.00^{a}
V2	0.0^{a}	10.5^{b}	25.4^{b}	38.3^{b}	V2	0.0^{a}	1.00^{a}	2.00^{b}	4.21^{bc}
V3	0.0^{a}	14.8^{b}	25.7^{b}	32.1^{b}	V3	0.0^{a}	1.00^{a}	2.00^{b}	3.31^{b}
V4	0.0^{a}	10.4^{b}	28.8^{b}	38.5^{b}	V4	0.0^{a}	1.00^{a}	2.00^{b}	3.33^{b}
V5	0.0^{a}	18.8^{b}	20.5^{b}	41.7^{bc}	V5	0.0^{a}	1.38^{a}	3.00^{c}	4.11^{bc}
V6	0.0^{a}	19.1^{b}	27.8^{b}	40.5^{bc}	V6	0.0^{a}	1.33^{a}	3.00^{c}	3.67^{bc}
V7	0.0^{a}	12.5^{b}	24.7^{b}	42.1^{bc}	V7	0.0^{a}	1.00^{a}	3.00^{c}	5.00^{c}
V8	0.0^{a}	8.4^{a}	10.5^{a}	25.4^{a}	V8	0.0^{a}	0.68^{a}	1.00^{a}	2.00^{a}
V9	0.0^{a}	4.2^{a}	8.4^{a}	10.0^{a}	V9	0.0^{a}	0.0^{a}	1.44^{a}	1.33^{a}
V10	0.0^{a}	10.5^{b}	27.1^{b}	38.3^{b}	V10	0.0^{a}	1.33^{a}	3.00^{c}	3.00^{b}

Means within each column followed by the same letter(s) are not significantly different at $p \leq 0.05$ using the Duncan's Multiple Range Test (DMRT) and WAT: Weeks after transplanting

Table 2: Effect of virus on growth and yield parameters of ten accessions on eggplant

	Plant height (cm)				Yield of fruits/plot (kg)	
Accessions	2 WAT	4 WAT	6 WAT	8 WAT	Accessions	Yield
V1	9.2^{a}	15.5^{a}	30.1^{a}	48.8^{a}	V1	55.33^{a}
V2	5.3^{a}	10.2^{a}	13.4^{b}	28.3^{b}	V2	13.2^{b}
V3	8.1^{a}	12.0^{a}	16.5^{b}	30.1^{ab}	V3	20.0^{b}
V4	7.2^{a}	14.6^{a}	20.5^{ab}	35.2^{ab}	V4	28.1^{b}
V5	7.6^{a}	11.5^{a}	19.3^{b}	30.3^{ab}	V5	14.3^{b}
V6	8.1^{a}	12.2^{a}	17.8^{b}	29.5^{b}	V6	26.0^{b}
V7	7.5^{a}	11.8^{a}	20.0^{ab}	31.2^{ab}	V7	17.9^{b}
V8	10.0^{a}	16.5^{a}	33.3^{a}	47.1^{a}	V8	32.8^{a}
V9	9.2^{a}	18.5^{a}	29.5^{a}	45.3^{a}	V9	36.9^{a}
V10	8.0^{a}	15.3^{a}	22.5^{ab}	33.5^{ab}	V10	21.0^{b}

Means within each column followed by the same letter(s) are not significantly different at $p \leq 0.05$ using the Duncan's Multiple Range Test (DMRT) and WAT: Weeks after transplanting

Effect of virus on yield parameters in eggplant accessions: The number of fruits per plot varied significantly among the accessions ($p \leq 0.05$). Accessions V2, V5, and V7 produced the lowest fruit yields of 13.2, 14.3, and 17.9 kg, respectively. In contrast, V1, V8, and V9 yielded the highest fruit quantities of 55.33, 32.8, and 36.9 kg, respectively (Table 2). These results suggest that V1, V8, and V9 are more productive under viral stress compared to other accessions. The findings indicate that V1, V8, and V9 are superior in terms of virus resistance, disease severity, plant height, and yield among the tested eggplant accessions. These accessions could be valuable for breeding programs aimed at improving viral resistance and overall productivity in eggplant cultivation.

Virus disease incidence and severity: The observed differences in virus disease incidence and severity among the ten eggplant accessions highlight the variability in resistance or tolerance to viral infections. At 2 weeks after transplanting (WAT), no significant differences were detected in virus incidence, which aligns with findings that early stages of viral infection often show minimal differences in symptom expression[13]. By 4 WAT, accessions V1, V8, and V9 demonstrated significantly lower virus incidence compared to others. This suggests inherent resistance or tolerance traits in these accessions, which is consistent with reports of genetic variability in disease resistance within Solanum species[14,15]. Significant differences in disease severity became apparent by 6 WAT, with accessions V5, V6, V7, and V10 showing higher severity scores. By 8 WAT, these accessions experienced the most severe symptoms, corroborating studies that indicate a progressive worsening of viral symptoms over time[16]. Conversely, V1, V8, and V9 exhibited lower disease severity scores, indicating better resilience. This supports findings that certain eggplant varieties possess traits that reduce symptom severity and enhance tolerance to viral infections[17].

Plant height response to virus: The plant height data suggest that initial viral infection does not significantly affect plant growth, as indicated by similar heights at 2 and 4 WAT. However, by 6 WAT, V2 showed the lowest plant height, potentially reflecting the impact of viral stress on plant development[18]. At 8 WAT, significant differences in plant height emerged, with V1, V8, and V9 being the tallest. This may be attributed to their superior tolerance to viral stress, which allowed them to maintain better growth performance compared to other accessions this is in tandem with earlier reports on viral stress in crop plants[19].

Effect of virus on yield parameters: The yield data further demonstrate the impact of viral stress on eggplant productivity. Accessions V2, V5, and V7 produced the lowest fruit yields, which aligns with studies showing that viral infections can lead to reduced fruit production and quality[20]. In contrast, V1, V8, and V9 achieved the highest yields, suggesting that these accessions have not only better disease resistance but also the ability to maintain productivity under viral stress. This finding is supported by research indicating that breeding for viral resistance can significantly improve yield outcomes in affected crops[21].

CONCLUSION

The research findings demonstrated significant variations in virus incidence, severity, plant height, and yield among the ten eggplant accessions. Accessions V1, V8, and V9 consistently showed the lowest disease incidence and severity, coupled with superior growth and yield, highlighting their strong resistance or tolerance to viral infections. Conversely, V5 and V7 exhibited the highest severity and the lowest yields, thus, emphasizing their susceptibility to viral stress. The findings highlighted the critical role of selection of virus-resistant accessions to boost eggplant crop productivity. Hence future studies should prioritize breeding programs to improve the resistance of vulnerable eggplant accessions and investigate the genetic mechanisms that underlay viral resistance to support more resilient eggplant production systems in different agroecological zones.

SIGNIFICANCE STATEMENT

This study identified variations in growth, yield, and viral resistance among eggplant accessions, offering valuable insights into breeding programs and sustainable farming practices, particularly for small-scale farmers. It will enable researchers to explore critical aspects of genetic diversity and resistance mechanisms in eggplants that have been largely understudied. Consequently, this could lead to the development of new theories on the genetic foundations of viral resistance in *Solanum* species.

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