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Field Screening of F_2 Population (Muktakeshi × Pant Samrat) to Observe Phomopsis Fruit Rot in Brinjal

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ABSTRACT

Brinjal is one of the most popular vegetables of India and equally widespread throughout the world. However, this crop is affected a lot by various diseases which are the major production constraints and Phomopsis fruit rot and blight is second most devastating diseases of brinjal in India. Development of resistant genotypes is the most economical and environment friendly way to control the disease, for which proper screening of the segregating lines is crucial. For this the F_2 line of Muktakeshi × Pant samrat were screened in field conditions. Among the 181 plants producing fruits, Phomopsis fruit rot was observed in fruits of 160 plants, while 21 plants remained immune.

Keywords Phomopsis fruit rot, Eggplant, F_2, Resistance Breeding, Population improvement, Gene action.

INTRODUCTION

Brinjal (*Solanum melongena* L.) is a solanaceous vegetable. Brinjal is accessible on the market all year, but notably during the winter. As a result, eggplant is recognized as a cash crop. This vegetable is extensively farmed in India, with West Bengal, Odisha, and other states dominating in production (Anonymous 2023), with a broad variety of variability in yield performance. In brinjal Phomopsis blight is a fungal disease. *Phomopsis vexans* is the causative agent (Harter 1914). This disease is also known as Phomopsis rot, Phomopsis leaf blight, fruit rot, brown spot, stem blight, and brinjal tip over (Punithalingam and Holliday 1972). The pathogen has been observed to be seed-borne both externally and internally. The illness was originally documented in Gujrat in 1914, and has subsequently spread to other regions of India. The disease has become a severe impediment to extensive eggplant farming. Crop losses are visible as a result of this illness, with losses ranging from 15-20% in general to 30-60% in extreme cases (Kumar *et al.* 2020, Tripathi *et al.* 2024). If infected at the seedling stage, it is a dangerous disease that can

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produce damping off signs. When the leaves become infected, tiny circular spots form that become grey to brown with a light center, infected leaves may become yellow and eventually die. A lesion may also form on the petiole and stem, producing blighting of the afflicted areas. The spot enlarges with time resulting in a concentric circular region. The fruits eventually get mummified and rotting.

However, eggplant is susceptible to a variety of illnesses, the most damaging of which is fruit rot caused by *Phomopsis vexans.* Phomopsis fruit rot and blight is second most devastating diseases of brinjal in India (Tripathi *et al.* 2024) *Phomopsis vexans* organism survives in soil detritus and seed from infected fruits for around 14 months (Kalda *et al.* 1977). This disease spreads via spores produced by the fruiting body pycnidia. It can be found in or on eggplant crop detritus, soil, and seeds. It spreads via fungal spores distributed by raindrops, infected equipment, and insects. Development of resistant genotypes is the most economical and environment friendly way to control the disease, for which proper screening of the segregating lines is crucial. Therefore this study was conducted with the objective of Investigating Phomopsis Incidence in Field Conditions within the F_2 Population (Muktakeshi × Pant samrat) of Brinjal.

MATERIALS AND METHODS

In the experimental plots of Vegetable Research Farm, Department of Horticulture (Vegetable and Floriculture), Bihar Agricultural College, Bihar Agricultural University, Sabour, Bhagalpur (Bihar), 181 F_2 plants of the cross combination Muktakeshi x Pant samrat were transplanted in main season of 2021-22 along with 10 plants each of the Phomopsis susceptible parent Muktakeshi and Phomopsis resistant parent Pant Samrat. A row to row spacing of 75 cm and plant to plant spacing of 60 cm were maintained and the transplanting was during second fortnight of July 2021.

Plant tagging for scientific studies

For the purpose of data collection, each plant was assigned a number. Different intervals of observations were recorded during the investigation.

Disease scoring

The disease incidence on the fruit was observed and scoring was done according to the scale developed by (Islam and Sitansu 1993) which has been detailed in Table 1.

The goodness of fit for the observed F_2 with the expected Mendelian ratio was tested using chi-square (χ^2) as per (Panse and Sukhatme 1967).

RESULTS AND DISCUSSION

In field conditions, Phomopsis was prevalent from the month of January, 2022 onwards, and during this period of time there was fruiting in 181 plants. No symptoms of Phomopsis on vegetative parts was observed in the field. Scoring was done according to the scale which has been detailed in Table 1. Among the 181 plants producing fruits, Phomopsis fruit rot was observed in fruits of 160 plants, while 21 plants remained immune.

Chi-square goodness of fit test was conducted. According to the Chi-square goodness of fit test, the chi test value was estimated to be 0.003, while the critical chi value was 3.84 and which suggested that the hypothesis that there is governance of two genes with duplicate gene action (15:1) was accepted, and that the resistance was governed by two recessive genes with duplicate gene action as mentioned in (Table 2) chi-square goodness-of fit test for genetic governance of Phomopsis resistance under field conditions. Which is supported by (Kalda *et al.* 1976), according to (Narayanswami *et al.* 2023) the resistance is governed by two independent recessive genes with complementary epistasis. However,

Table 1. Disease scoring and reaction of genotypes towards Phomopsis fruit rot in brinjal (Islam and Sitansu 1993).

Disease incidence (%)	Scale	Reaction
0-1	1	Highly resistant
1-10	2	Resistant
10-25	3	Moderately resistant/ tolerant susceptible
25-50	4	Susceptible
>50	5	Highly susceptible

Table 2. Chi-square goodness-of fit test for genetic governance of Phomopsis resistance under field conditions hypothesis: Governance by ratio 15:1.

Categories	Observed	Expected	D=O-E	D^2	Sum	Chi test	Critical chi
Total susceptible plants	60.00	169.69	9.69	3.85			
Total resistant plants	21.00	11.31	9.69	3.85			
Total no. of plants studied	181.00				187.70	0.003	3.84

prior research has shown that resistance is driven by polygenic recessive genes (Kalda *et al.* 1976), and that dominant effects were more apparent than additive effects, while additive interactions were also substantial in most situations.

CONCLUSION

Natural screening at field showed that 160 plants were susceptible and 21 resistant to Phomopsis fruit rot at the time when the disease occurred. The chi-square goodness of fit test suggested that the hypothesis that there is governance of two genes with duplicate gene action (susceptible: resistant :: 15:1) was accepted, and that the resistance was governed by two recessive genes.

This study can be further proceed for generations advancement having resistance to Phomopsis fruit rot. Molecular characterization can also be used on the basis of above results.

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