Assessment of relative performance of different genotypes of brinjal against fruit rot infection by artificial inoculation of *Phomopsis vexans*

Niranjan Prasad HP, Atul Kumar, Sandeep Kumar Lal, Partha Shah, Jameel Akhtar and Shailendra Kumar Jha

**Abstract**

During crop production, brinjal is prone to various diseases. Among them, leaf blight and fruit rot disease caused by *Phomopsis vexans* is one of the most detrimental diseases causing a huge loss in terms of production, productivity including quality of the crop which is still a major challenge to pathologists and breeders. The most suitable approach is the use of resistant genotypes as a source for the development of high-yielding cultivars to avoid seed-borne disease incidence. Many researchers have identified resistant sources but limited success has been achieved in developing resistant cultivars. Regular identification of resistant sources is necessary for successfully protecting the crop from disease. In the present studies, an extensive screening of thirty-four genotypes which includes a few elite lines, a few local genotypes, a few hybrids and many released varieties has been done against fruit rot pathogen through artificial inoculation of conidial suspension. Based on the screening, the wide spectrum of genotypes was classified into five different categories namely highly resistant (Pant Samrat, G-204, G-175, G-131, G-9 and DB-7) resistant (G-203, G-31, Pusa Upkar, Arka Nidhi and Bhangar Local) moderately resistant (G-43, Kashi Sandesh, Pusa Udmatt, G-23, DB-9, Pusa Safed, Pant Riturai and Arka Kusumarkar) susceptible (G-160, G-145, G-65, G-10, G-5, G-22, Pusa Shymla and Pusa Kaushal) and highly susceptible (G-17, G-109, G-60, G-181, G-164, Pusa Kranti and Pusa Bindu) on the basis of the percentage of fruit infection. Screening against pathogens and then classifying them into different categories based on the level of response to pathogens gives complete information to breeders to utilize in the development of resistant genotypes.

**Keywords:** Brinjal, *Phomopsis vexans*, fruit rot, disease severity, genotypes

**Introduction**

Brinjal (*Solanum melongena* L.) which is also known as the “king of vegetables” is an important solanaceous crop of sub-tropics and tropics [1]. In India, brinjal accounted for 12.8 million tonnes of production in an area of 0.749 million hectares [2]. West Bengal is the leading producer of brinjal, followed by Maharashtra and Bihar. The cultivated brinjal is of Indian origin [3] and because of its popularity, its cultivation spread worldwide rapidly. It is rich in Vitamins A and B and consumed by all sections of people [4]. Brinjal is known to be invaded by many phytopathogens which are major constraints for the limited production and productivity of this crop. Among them, fruit rot caused by *Phomopsis vexans* is considered to be the most destructive disease of brinjal. The pathogen has been reported in warmer regions in most countries [5]. Being a seed-borne pathogen, *Phomopsis vexans* causes damping-off of seedlings, and seedling blight at the nursery stage and as the disease progress elongated blackish to brown lesion appears on the stem and branches. On leaves, it forms small circular, buff olive to cinnamon-buff spots with irregular blackish margins and on fruits, the disease appears as minute sunken greyish spots with a brownish halo, which later enlarge and produce buff olive to cinnamon-buff spots with irregular blackish margins and on fruits, the disease appears on the stem and branches.
Materials and Methods

Study area
The present study was undertaken in the Division of Seed Science and Technology ICAR-Indian Agricultural Research Institute, New Delhi, India between 2017−2018 and revalidation was done between 2019-20 by using healthy fruits from thirty-four brinjal genotypes collected from a field of the Division of Vegetable Science, ICAR-Indian Agricultural Research Institute, New Delhi.

Table 1: List of brinjal genotypes used in the screening against brinjal fruit rot.

<table>
<thead>
<tr>
<th>Bhangar Local</th>
<th>G-175</th>
<th>Kashi Sandesh</th>
<th>Pusa Shymla</th>
<th>G-109</th>
</tr>
</thead>
<tbody>
<tr>
<td>G-204</td>
<td>G-160</td>
<td>Pant Samarth</td>
<td>Pusa Upkar</td>
<td>G-60</td>
</tr>
<tr>
<td>G-203</td>
<td>G-145</td>
<td>Pant Ritunjaj</td>
<td>Pusa Uttam</td>
<td>G-181</td>
</tr>
<tr>
<td>G-5</td>
<td>G-131</td>
<td>Pusa Kaushal</td>
<td>Pusa Safed</td>
<td>G-164</td>
</tr>
<tr>
<td>DB-7</td>
<td>G-65</td>
<td>Pusa Kranthi</td>
<td>G-23</td>
<td>G-17</td>
</tr>
<tr>
<td>Arka Nidhi</td>
<td>G-31</td>
<td>Pusa Bindia</td>
<td>G-43</td>
<td>G-22</td>
</tr>
<tr>
<td>Arka Kusumarkar</td>
<td>G-10</td>
<td>G-9</td>
<td>DB-9</td>
<td>-------</td>
</tr>
</tbody>
</table>

Preparation of fungal inoculum
The Phomopsis vexans pathogen used for inoculation was collected from diseased fruit samples from the field of Indian Agricultural Research Institute, New Delhi and cultured on potato dextrose agar (PDA) media. The sporulation pathogen culture plate was flooded with 10 ml sterile double distilled and gently scraped the colony surface using a spatula. The mycelial fragments were removed through filtration of suspension using cotton gauze and spores’ concentrations were determined hemocytometerer. Depending on the amount of spore present, the concentration of the resulting suspension was adjusted to 1×10⁴ conidia per ml.

Pathogenicity Test
In order to ensure and confirms the identity of the disease and its causal agent, a pathogenicity test was conducted on the brinjal cultivar Pusa Kaushal using the pinpricking method to prove Koch's postulates. Fruits were pinched using a sterilized needle and then spot inoculated @ 20μl with freshly prepared spore suspension. Fruits were observed for symptom development ten days after inoculation. Re-isolation was made from infected fruits.

Severity assessment
Thirty-four brinjal genotypes were collected from the brinjal field Pusa, New Delhi and surface sterilized using 70% alcohol(Table:1). The fruits were pinched using a sterilized needle and then spot inoculated @ 20μl with freshly prepared spore suspension. Three replication were kept for all the genotypes and each replication contain a total of five fruits. Inoculated fruits were incubated at 27±1°C in an incubator. Fruits were observed daily for the percent of fruit rot and the area of lesions of a particular genotype was recorded. Percent of fruit infection was estimated by measuring the diseased area of the fruits. Re-isolation was made from infected fruits on PDA. For the assessment of Phomopsis disease incidence in brinjal, the disease scale has been constructed by McKinney [8] and Hossain et al. [9] was used.

PDI= (Sum of numerical values/total number of fruits observed × maximum grading) × 100.

Numerical values were obtained by multiplying the number of infected fruits by their respective grades. Based on PDI, each fruit was identified with the following grades. I - 0% PDI: free from the disease; II - 0.1–5.0% PDI: poorly affected; III - 5.1–20.0% PDI: moderately affected; IV - 20.1–50.0% PDI: severely affected; and V - >50.1% PDI: very seriously affected by the disease.

Results and Discussion

Pathogenicity Test by fruit inoculation
Susceptible fruits of the Pusa Kaushal genotype inoculated with Phomopsis vexans using the pin-prick method developed small, roughly circular, soft, light yellow color lesions surrounded by a brown ring after 8 days of inoculation.
whereas complete fruit rotting was recorded between 12th days after inoculation. Typical fruit rot symptoms developed on the fruits, which were similar to those observed by [11, 12] who proved the pathogenicity of *P. vexans* causing fruit rot with the above methods.

**Disease severity measurement**

![Fig 3: Highly Resistant and Resistant genotype of Brinjal](https://www.thepharmajournal.com)

1. Pant samrat  
2. G-203

Out of 34 genotypes studied six genotypes namely Pant Samrat, G-204, G-175, G-131, G-9 and DB-7 and showed highly resistant against *Phomopsis vexans* in which the mean value infection level was 0% and five genotypes G-203, G-31, Pusa Upkar, Arka Nidhi and Bhanger Local showed mean value of 1.92%, 2.65%, 3%, 4.45% and 4.56% respectively. Which are classified under resistant categories. Eight genotypes such as G-43, Kashi Sandesh, Pusa Uttam, G-10, G-5, G-22, Pusa Shymla and Pusa Kaushal were susceptible and G-17, G-109, G-60, G-181, G-164, Pusa Kranti and Pusa Bindu were found to be highly susceptible against *Phomopsis vexans* (Fig 3). Eight genotypes namely G-160, G-145, G-65, G-10, G-5, G-22, Pusa Shymla and Pusa Kaushal were susceptible and G-17, G-109, G-60, G-181, G-164, Pusa Kranti and Pusa Bindu were found to be highly susceptible against *Phomopsis vexans* (Fig 4). Genotypes like G-160 G-145, G-65, G-10 G-17, G-109, G-60, G-164 and Pusa Bindu started to show infection from the 8th day after inoculation and the entire fruit got infection on the 13th day after inoculation, whereas G-5, G-22 and G-181 started to show infection from 9th day after inoculation and the entire fruit got infection between the 19th to 20th day after inoculation. Kalda *et al.*[13] reported that out of 300 entries tested against *Phomopsis vexans* which includes *solanum spp*, brinjal cultivars and F1 hybrids two *Solanum melongena* lines were resistant. However, the rest other *solanum spp* showed variable reaction resistance to *Phomopsis* blight governed by recessive genes. The observation from our work revealed that different genotypes have different responses against pathogen infection during crop duration. Even among the susceptible genotypes the relative expression of the diseases to the pathogen infection varies. Resistant genotypes are the primary source and most important method of controlling fruit rot disease by producing preformed toxins infecting the immune cells of pathogens and protecting the plant from disease. A wide-ranging diversity of brinjal genotypes and recent advances in genome sequencing of brinjal help in accelerating the breeding of high-yielding variety(s) which are resistant to *Phomopsis* blight. This work provides insight into the breeding approach for the identification of resistance sources including identification of resistance source, inheritance of resistance and application of advanced breeding tools for utilization breeding program. Host resistance is the most important and practical method which is also an environment-safe control method against this pathogen. Therefore, there is an urgent need for screening the wild and elite varieties of Brinjal resistant to fruit rot and leaf blight disease.

**Conclusion**

Therefore, in conclusion, we can say that screening wide spectrum genotypes in the field under natural conditions and then classifying them into different categories namely highly resistant, resistant, moderately resistant, susceptible and highly susceptible gives complete information to breeders to utilize them in the development of resistant genotypes.

**Reference**

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