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**SHORT COMMUNICATION**

# EVALUATION OF BRINJAL (*Solanum melongena* L.) GERMPLASM FOR RESISTANCE TO FOOT ROT DISEASE

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## INTRODUCTION

Brinjal (*Solanum melongena* L) is an important commercial vegetable crop. There are many pests and diseases of brinjal in Sri Lanka. The major diseases are bacterial wilt and foot rot disease (Anon, 1990). Recently, the foot rot disease has been spreading rapidly, and at present, has become a serious problem to farmers in Sri Lanka. (*Personal communication with breeders at the Horticultural Crops Research & Development Institute, Peradeniya, Sri Lanka*). It is a fungal disease that can be caused by many fungi such as *Fusarium solani*, *Rhizoctonia solani*, *Phytophthora* sp., *Sclerotium* sp., and *Pythium* species (Anon, 1990; Rajapakse *et al.*, 2003). However, *Fusarium solani* was the major fungal pathogen associated with foot rot disease of brinjal in Sri Lanka (Rajapakse *et al.*, 2003).

There are several control measures to overcome this disease. They are improvement of soil drainage, drenching with fungicides for poorly drained soils, removal of infected plants and crop rotation with non-solanaceous plants (Anon, 1997 & 1990). Even though the soil borne diseases are economically impracticable to control using these methods, the use of resistant varieties provide the only means to produce acceptable yields.

Infection process and symptom development of soil borne fungi vary greatly with weather and soil conditions in the field (Agrios, 1997). Therefore, reliable results could be achieved by greenhouse studies when varieties are screened against specific pathogens. Laboratory and greenhouse studies were conducted to identify fungal pathogens associated with foot rot disease of brinjal (at the Horticultural Research and Development Institute, Gannoruwa), and selection of resistant varieties.

## MATERIALS AND METHODS

### Isolation of pathogens

Foot rot affected brinjal (*Solanum melongena* L) plants were collected from the field of Horticultural Research and Development Institute (HORDI) at Gannoruwa. Pieces of collar region were obtained from the diseased plants. These pieces were surface sterilized by 70% ethyl alcohol and kept on Potato Dextrose Agar (PDA) + 0.01% Streptomycin (w/v) medium to observe fungal growth around stem pieces. Different fungal colonies were observed under light microscope for identification. Conidial masses were then picked from colonies which were microscopically identified as *Fusarium,* and were re-isolated on PDA to obtain pure culture of *Fusarium solani.* Small pieces of fungal mycelium at the advancing edge of the colony, which were microscopically identified as *Rhizoctonia* were sub-cultured on PDA to obtain cultures of *Rhizoctonia solani.* Pathogens were further identified on the basis of microscopic observation of conidia and mycelia, and culture characters on PDA.

### Variety screening

Fifteen brinjal varieties/accessions (Table 2) were screened against fungal pathogens i.e. *Fusarium solani* and *Rhizoctonia solani* in the greenhouse. Sterilized soil was used for preparing nurseries and filling pots for screening studies.

In variety screening for *Fusarium solani,* 400 ml of spore suspension ($2.0\times10^6$ conidia/ml) were prepared from *Fusarium solani* cultures grown on PDA. Spore suspension was thoroughly mixed with 25Kg of soil in a sterilized plastic bin. It was then incubated at room temperature for 14 days to develop chlamydospores of fungi in soil. One hundred and fifty grams of incubated soil was mixed with 350g of sterile soil and filled into each pot. Two-week old nursery-raised seedlings were removed with minimum damage to the root system and transplanted as two seedlings per pot. Before transplanting, the roots of the seedlings were pre-inoculated by dipping in a spore suspension having a concentration of $2.0\times10^6$ conidia/ml.

In variety screening for *Rhizoctonia solani,* sawdust-based medium was used for bulk inoculum production of *Rhizoctonia solani* (Anonymous, 2004). Pots were then filled with sterilized soil (350g/pot) and 3-4g of inoculum and three-week old seedlings (2 seedlings/pot) were planted in the inoculated soil.

Experiments were arranged in a Completely Randomized Design (CRD) with 15 treatments and 10 replicates. Seedlings planted in the uninoculated soil served as the control treatment. Susceptibility of different accessions to pathogens was measured by visual observations of the yellowing of leaves and colonization ability of pathogen in collar regions of the plants. .

Evaluation of disease, based on leaf yellowing was done as follows.

| Yellowing of leaves | Disease severity in accessions |
|---|---|
| 1 leaf | Low |
| 2-3 leaves | Moderate |
| All the leaves | Severe |

Colonization ability of the pathogens in collar region of each accession was used as an indicator of resistance/susceptibility of accessions. Three plants from each accession were randomly selected. The pieces of collar region and 2cm above it were obtained and the pieces were cut into portions of about 3mm. They were surface sterilized and cultured on PDA+0.01% Streptomycin medium. About 8 pieces per plant were cultured per PDA plate and incubated at 27°C ±1 for 10 days. Number of pieces that gave rise to mycelia of *Fusarium solani* or *Rhizoctonia solani* were counted.

Observations were ranked 10 days after incubation as follows.

| Pathogen colonization | Rank |
|---|---|
| Number of collar /stem pieces affected with fungi | |
| 1 -3 collar /stem pieces | 1 |
| 4 - 7 pieces | 2 |
| All pieces | 3 |

The non-parametric data were analyzed using Kruskal–Wallis test with the help of statistical software package Minitab.

## RESULTS AND DISCUSION

Foot rot disease caused by several fungi is one of the major reasons for yield loss of brinjal in Sri Lanka. Two different fungi were mainly identified from diseased plants at Gannoruwa. Fungal species were identified by comparison of culture characters and microscopic observations of pathogens with published data (Agrios, 1997; Anon, 1964, 1981; Booth, 1971). *Fusarium solani* and *Rhizoctonia solani* were commonly found on the collar region of diseased plants. Disease symptoms and culture characteristics of both pathogens are reported in Table 1.

**Table 1. Characteristics of fungal pathogens associated in collar region of brinjal.**

| *Pathogen* | *Colony colour on PDA* | *Mycelial characters on PDA* | *Microscopic observations* |
|---|---|---|---|
| *Fusarium solani* | White at early stages. Later become slightly pink. | Centre of heavy, fluffy mycelium and a border flat and white in colour. Reverse colony colour: Pink. No presence of concentric rings in colony. Margin of the colony: irregular | *Micro conidia* Shape:Hyaline, cylindrical Size: 6-9× 3-4 µ Septations: 1 or 2. One-septate spores are more abundant *Macro conidia* Shape: Cylindrical to falcate, often slightly wider towards the apex and with a well-marked foot cell. Size: 40-90× 5-8 µ Septations: 4 to 9. Four septate conidia are more abundant |
| *Rhizoctonia solani* | Colony colour: light brown, Reverse colony colour: light brown | Mycelium: Show suppressed growth. Concentric rings are present. Margin of colony: smooth | No spores The mature hyphae branched at right angles (90°) from the main hyphae. |

There was a difference among the accessions in leaf yellowing when plants were inoculated with pathogens. The observations are given in the Table 2.

**Table 2. Degree of leaf yellowing in different accessions.**

| *Accessions* | *Level of leaf yellowing (Fusarium solani)* | *Level of leaf yellowing (Rhizoctonia solani)* |
|---|---|---|
| 07795 | Low | Low |
| 02887 | Moderate | Moderate |
| 02270 | Low | Moderate |
| 07149 | Moderate | Low |
| 07694 | Moderate | Moderate |
| 08104 | Low | Low |
| 05124 | Severe | Severe |
| SA7MTE2 | No | No |
| 08891 | Moderate | Low |
| 01247 | Low | Low |
| 07145 | Severe | Severe |
| 08890 | Low | Low |
| 07157 | Low | Low |
| Padagoda | No | No |
| SM164 | Severe | Severe |

The accession/varieties inoculated separately with both *Fusarium solani* and *Rhizoctonia solani* showed yellowing of leaves after 8 and 10 weeks of transplanting respectively, except SA7MTE2 and Padagoda. Pathogenic *Fusarium* spp. exists in soil as chlamydospores (Booth, 1971). The occurrence of chlamydospores in the cultures used for inoculation is an essential requirement for the survival of the pathogen in the soil. However,

typical symptoms of foot rot i.e. leaf yellowing followed by wilting and death of plants, were not observed. Leaf yellowing was not observed in the control treatment of the experiment. Zerlik (1979) showed that in experiments carried out in the greenhouse with sterilized soil for soil borne pathogens, late yellowing had only been recorded for foot rot disease. It was concluded that it was due to the nature of late genesis of foot rot disease under the greenhouse conditions. The differences of the leaf yellowing could be due the variations of the pathogens – host association among the accessions.

Presence of *Fusarium solani* or *Rhizoctonia solani* in pieces of collar region was detected by culturing test. The distribution of the mycelia was different among the pieces that represent different areas of the stem and collar region and it may be due to the differences of resistance/susceptibility among accessions/varieties. The accessions SA7MTE2 and Padagoda did not show the presence of mycelia of both *Fusarium solani* and *Rhizoctonia solani.* The presence of mycelia in all the cultured pieces was detected in the accessions 07145 and 05124. Table 3 shows the results of the Kruskal-Wallis test for the plants 27 days after transplanting.

**Table 3. Kruskal-Wallis test for the plants inoculated with *Fusarium solani* and *Rhizoctonia solani.***

| *Accessions* | *Fusarium solani* | | *Rhizoctonia solani* | |
|---|---|---|---|---|
| | *Average rank* | *Z* | *Average rank* | *Z* |
| 07795 | 20.5 | 0.83 | 2.8 | -0.46 |
| 02887 | 20.5 | 0.83 | 17.0 | 0.25 |
| 02270 | 10.5 | -0.83 | 8.5 | -1.16 |
| 07149 | 20.5 | 0.83 | 21.8 | 1.04 |
| 07694 | 20.5 | 0.83 | 21.8 | 1.04 |
| 08104 | 10.5 | -0.83 | 17.0 | 0.25 |
| 05124 | 27.5 | 2.00 | 26.5 | 1.83 |
| SA7MTE2 | 2.5 | -2.16 | 3.0 | -2.08 |
| 08891 | 20.5 | 0.83 | 17.0 | 0.25 |
| 01247 | 10.5 | -0.83 | 12.8 | -0.46 |
| 07145 | 27.5 | 2.00 | 26.5 | 1.83 |
| 08890 | 10.5 | -0.83 | 5.7 | -1.04 |
| 07157 | 10.5 | -0.83 | 12.8 | -0.46 |
| Padagoda | 2.5 | -2.16 | 3.0 | -2.08 |
| SM164 | 10.5 | -0.83 | 12.8 | -0.46 |
| | | P=0.024 | | P = 0.026 |

According to the results, the probability values of the Kruskal – Wallis test are lower than the maximum probability value of 0.05. It reveals that there is a statistically significant difference in the responsiveness among the brinjal varieties/accessions to infection by *Fusarium solani* and *Rhizoctonia solani.*

According to the Kruskal-Wallis test, the lowest average ranks were given by the varieties SA7MTE2 and Padagoda. Therefore, these two varieties show a weak association with both pathogens compared to other accessions. This finding is further confirmed by the symptom expression in these varieties (Table 2). Padagoda is a recommended brinjal variety in Sri Lanka. It has been reported that this variety shows considerable resistance to another serious soil borne disease i.e. bacterial wilt caused by *Ralstonia solanacearum*. However, resistant mechanisms of brinjal against pathogens are still unclear (Agrios, 1997). The highest average ranks were shown by the accessions 05124 and 07145, which indicate that they show strong associations with both pathogens than the other tested accessions / varieties (Table 3).

## CONCLUSIONS

Variety/accessions Padagoda and SA7MTE2 are resistant, and 05124 and 07145 are susceptible to *Fusarium solani* and *Rhizoctonia solani* compared to other tested varieties/accessions.

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