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Effect of inoculum levels of *Rhizoctonia solani* on root rot of tomato (*Solanum lycopersicum* L.) cv. Hisar Arun (Selection 7)

Aradhna Sagwal, Satish Kumar, Kushal Raj, Pooja Yadav and Preeti Vashisht

Abstract
Tomato (*Solanum lycopersicum* L.).) grown widely throughout the world under various agro-climatic conditions. The Root rot in tomato caused by *Rhizoctonia solani* has been considered as most devastating disease in monocropping areas of Haryana. *Rhizoctonia solani* causes pre-emergence and post-emergence plant mortality in seedlings and black lesions in root. The Pathogenicity level of *R. solani* was studied during 2018-19 at different mycelial inoculum levels i.e. 100, 200, 500, 1000 and 2000 mg/kg soil on tomato cv. Hisar Arun (Selection 7) under screenhouse conditions. The maximum pre-emergence plant mortality of 30 per cent and maximum post- emergence mortality of 40 per cent was observed when mycelial suspension of 2000 mg/kg soil was used followed by total mortality of 43.4 per cent at an inoculum level of 1000 mg/kg soil. The minimum plant mortality of 17.0 per cent was observed at 100 mg/kg soil inoculum of *R. solani*, thus found that total plant mortality was directly proportional to inoculum levels of the fungal pathogen and total mortality gradually increases with increase in inoculum levels of pathogen from 0.1 to 2.0 g/kg soil.

Keywords: Inoculum, pathogen, *Rhizoctonia*, root rot, tomato

Introduction
Tomato, scientifically known as *Solanum lycopersicum* L. holds significance as a vital vegetable crop, valued not only for its economic contributions but also for its nutritional significance. Tomato is a native of Andean regions of South America. Tomato is rich source of lycopene and used in the treatment of cancer (Giovannucci, 1999) [1]. Tomato (*Solanum lycopersicum* L.) is susceptible to a range of fungal, bacterial, nematode and viral diseases, leading to decreased yield and low quality. Among these diseases, the root-rot disease complex caused by concurrent presence of *R. solani* and *M. javanica*, has become a prominent issue.

The root rot fungus is characterized by light brown vegetative, septate hyphae and the branching occurs almost at right angles to the hyphal cell with constriction at the point of branching. The fungus produced sclerotia that have a barrel-shaped appearance, light brown coloured and round, which are formed in culture and/or on the surface of infected roots. *Rhizoctonia solani* survives predominantly as sclerotia/mycelia in diseased plant parts or in soil and considered as main inoculum for infection. *Rhizoctonia solani* is responsible for causing mortality in both pre-emergence and post-emergence stages of seedling growth. This is evidenced by the emergence of black lesions in the roots and stems, indicative of root and stem rot. The disease presents itself as complete decay of seeds, with emerging radicles often succumbing before reaching the surface. These symptoms are categorized as pre-emergence. In the post-emergence stage, the disease progresses through the breakdown of host cell walls facilitated by the pectinase enzyme. The resulting lesions tend to expand more downward than upward, leading to disintegration of root tissues as the disease advances. Consequently, the barks withers, and the lower leaves of the plant begin to dry out, ultimately resulting in premature overall plant drying.

Materials and Methods
The study was carried out in the Department of Plant Pathology, Chaudhary Charan Singh Haryana Agricultural University, Hisar during 2018-19. The experiment was conducted on most popular and moderately resistant variety of tomato Hisar Arun (Selection 7).

Koch's postulates were proved to know the pathogenic capacity of fungus. Fungus was raised on sterilized potato dextrose broth (PDB) for 7 days in 250 ml flasks each containing 30 ml broth kept at 28±2 °C. The mycelial mat of *Rhizoctonia solani* present on media's surface was harvested, washed with sterilized water, air dried and fine suspension was made by macerating with sterilized water in a homogenizer. 15 cm diameter sized earthen pots were kept on screen house benches and measured concentration of fungal suspension thus obtained was added in the upper layer of sterilized soil and then mixed with a thin layer of sterilized soil. Ten seeds of tomato cv. Hisar Arun (Selection 7) were sown in each pot after two days of inoculation of fungus suspension. Observations were taken for pre-emergence mortality and post- emergence mortality in tomato seedlings on 30 days after sowing. Fungal pathogen was reisolated from diseased seedlings and the cultural and morphological characters were compared with original fungus to bring it in pure form.

The effect of different mycelial inoculum concentrations (mg/kg soil) on root rot disease of tomato. The mycelial mat of *R. solani* thus obtained on PDB after three days was collected, washed, air dried, homogenized, diluted with sterilized water and the suspension thus obtained was mixed thoroughly with sandy loam soil at the rate of 100, 200, 500, 1000 and 2000 mg/kg soil in 15 cm diameter earthen pots (one kg capacity) to find out the extent of increase in disease severity. Seeds of tomato cv. Hisar Arun (Selection 7) at the rate of 10 seeds/pot were sown. Sowing was done two days after pathogen inoculation so that pathogen established in the soil. Each treatment was replicated thrice and a control set was also maintained for check as they were without pathogen inoculum. The observations on pre-emergence and post-emergence plant mortality in tomato seedlings were recorded 30 days after sowing.

$$\text{Per Cent Plant Mortality} = 100\text{-}\left(\frac{\text{Plants stand in inoculated treatment}}{\text{Plants stand in uninoculated control}} \times 100\right)$$

The experiment was laid out in Completely Randomized Design (CRD) having three replications of each treatment. opstat (https:// www.hau.ac.in/page/o-p-stat) was used for the statistical analysis.

Results and Conclusion

Different mycelial inoculum levels of *R. solani* were evaluated to find out their effect on disease incidence under screen house conditions. Results (Table 1.1) showed that total plant mortality of 17.0 per cent was observed at 100 mg/kg soil inoculum level of *R. solani*

Table 1: Effect of different mycelial inoculum levels (mg/kg soil) of *Rhizoctonia solani* on root rot disease of tomato cv. Hisar Arun (Selection 7) under screen house conditions

Inoculum level (mg/kg soil)	* Per cent Disease Incidence		Total mortality (%)
	[1]PEM (%)	[2]POEM (%)	
100	3.7 (8.8)	13.3 (21.1)	17.0
200	6.8 (13.6)	13.3 (21.1)	20.1
500	13.3 (21.1)	20.0 (26.6)	33.3
1000	16.7 (23.8)	26.7 (31.0)	43.4
2000	30.0 (33.2)	40.0 (39.1)	70.0
Check (No inoculum)	0.0 (4.05)	0.0 (4.05)	0.0
CD at 5%	(9.9)	(7.0)	-

The pots having 500 mg/kg soil inoculum level exhibited 13.3 per cent and 20.0 per cent of pre- and post-emergence mortality, respectively. Among the different inoculum levels of *R. solani*, the maximum pre-emergence plant mortality was 30.0 per cent and post-emergence plant mortality was 40.0 per cent when mycelial suspension at the rate of 2000 mg/kg soil was used as shown in fig 1. The maximum total mortality of 70.0 per cent was observed at inoculum level of 2000 mg/kg soil followed by total mortality of 43.4 per cent at an inoculum level of 1000 mg/kg soil. The disease incidence was directly proportional to the inoculum level. Total mortality gradually increased with increase in inoculum levels of pathogen from 0.1-2.0 g/kg soil as compared to control pots.

Hadwan and Khara (1992) [2] studied the relationship between inoculums level and damping off, root-rot incidence in tomato caused by *Rhizoctonia solani* and observed that with the increase in the inoculum level, there was an increase in the incidence of disease. Safiuddin *et al*. (2011) [4] studied pathogenicity of *R. solani* causing root rot in okra. They observed that with the increase in pathogen inoculum from 0.25-8.0 g mycelial mat/plant consequently increased disease incidence and found that the damaging threshold level of *Rhizoctonia solani* was 2.0 g mycelial mat/plant. They also observed that the percentage of root rot was increased from 0.3 to 35% with the increase in inoculum levels from 0.50 to 8 g/kg soil. Sagar *et al.* (2012) [5] studied the effect of different inoculum concentrations of *Rhizoctonia solani* causing root rot incidence on tomato cv. Pusa Ruby and found that there was increase in pre and post emergence rotting with the increase in inoculum levels of *R. solani* from 0 to 4.0 g /kg soil. Inoculum level of 1.0 g mycelium/kg soil caused 10.00 and 11.86 per cent of pre and post emergence root rot respectively and increased to 30.67 and 42.54 at 4.0 g mycelium/kg soil and identified that 2 g mycelium/kg soil was optimum inoculum threshold level. The results of the present investigation are in agreement with the reports of various workers described above.

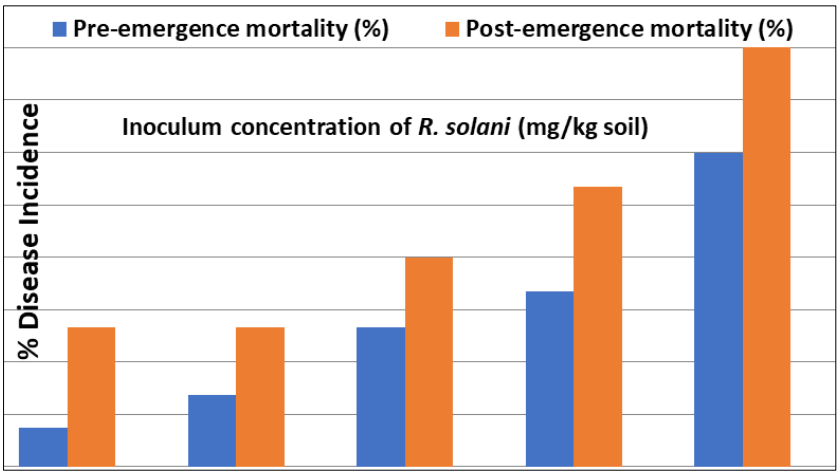

Fig 1: Effect of inoculum concentrations on pre and post emergence mortality.

Conclusion

The findings from the current study demonstrate a direct correlation between disease incidence and the inoculum level of *R. solani*. This suggests that the percentage of root rot disease in tomatoes escalated as the *R. solani* inoculum level increased.

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