

Effect of Age on Susceptibility of Tomato Plants to *Sclerotium Rolfsii* (Sacc.) Caused Collar Rot Disease

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ABSTRACT

An experiment was carried out with an objective to find out the most vulnerable crop growth stage of tomato to collar rot disease caused by *Sclerotium rolfsii* in pot culture condition. Five crop growth stages i.e. 0, 15, 30, 45 and 60 days after seed sown were evaluated by artificial inoculation method. Thirty days old seedling stage showed maximum susceptibility with 86.25 percent of disease incidence as well as 79.45 percent of disease severity followed by stage just emerged with 76.25 per cent disease incidence and 66.11 percent of disease severity where as lowest susceptibility was recorded in 60 days old plant stage with 42.5 percent of disease incidence and 39.86 percent disease severity. Susceptibility was revealed highest in younger stage and it decreased with the increasing of age of plants.

Key words: Tomato, *Solanum lycopersicum*, Collar Rot, *Sclerotium rolfsii*, Susceptible Stage.

INTRODUCTION

Tomato has been cultivated globally for its fleshy fruits, special nutritive value and protective properties¹. Tomatoes are the richest source of lycopene which is important for the health of the prostate gland in men. It is the world's largest vegetable crop after potato and it tops in the list of canned vegetables². India is the second largest producer of tomato with a record yield of 18.73 million tonnes³. West Bengal has about 56.50 thousand hectares area under tomato cultivation with production of 11.41 lakh tonnes and it contributed about 6.09% share of total production in India⁴. The major tomato growing districts of West Bengal are Darjeeling, Jalpaiguri, North Dinajpur, Nadia, Purulia, Bankura, 24 Parganas, Malda,

Murshidabad and Coochbehar etc.⁴. As it is a relatively short duration crop and gives a high yield potentiality, it is economically attractive and the area under cultivation is increasing daily. Due to its extensive cultivation in non-traditional areas, several biotic and abiotic factors have emerged as a major constraint in its successful cultivation. The conditions suitable for growth and development of the crop are also favourable for the quick development, proliferation and spread of disease. Among the biotic factor, *Sclerotium rolfsii* (Sacc.) is one of the most devastating soil borne sclerotia forming phytopathogenic fungus which causes wilting, blight, basal stem rot and fruit rot of tomato crop^{5,6 and 7}.

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S. rolfsii infects at all crop growth stage including the germinating stage of the seed causing pre-emergence rot and young plant shown collar rot. The time taken for wilting varied from 8 to 15 days. The younger plants were found more susceptible as the infection was more and rapid⁸. As the fungus is soil inhabitant, saprophytic in nature and infect the crop plant all growing stage with different rates of infections. It is essential to know the most susceptible stage of crop growth to take suitable management precautions. By keeping these things in mind, the study was undertaken to know the effect of age on susceptibility of tomato plants to *Sclerotium rolfsii* (Sacc.) caused collar rot disease.

MATERIALS AND METHODS

Collection, Isolation and Identification of Pathogen

The *Sclerotium rolfsii* infected tomato plant was collected from Agriculture Farm of Palli Siksha Bhavana, Visva- Bharati, West Bengal during 2015-16. The fungus was isolated from the stems of infected tomato plants by tissue segment method⁹ on potato dextrose agar (PDA) medium. The plant specimen was washed with tap water; small pieces of tissue of about 0.5 to 1 cm from infected collar region with some healthy tissue were cut with sterile scalpel. The pieces were surface sterilized with 0.01% mercuric chloride solution for about 30 seconds and rinsed in sterilized water for three times subsequently to eliminate all the traces of mercuric chloride and then dried between folds of sterilized filter paper. After that the surface sterilized pieces were transferred onto PDA medium in Petri dishes. Plates were incubated at $27 \pm 1^\circ\text{C}$ and observed periodically for growth of the fungus. The colony of the fungal pathogens grew from the infected pieces were isolated. Fungal isolates were pure cultured following hyphal tip technique¹⁰, identified based on its mycelia and sclerotial characters¹¹. Repeated culture has been done from tip of the single hyphae to obtain pure culture of the identified *Sclerotium rolfsii* and the pure culture was stored in the PDA slants at 10°C for further use.

Preparation of inoculums

The pathogen, *Sclerotium rolfsii* was multiplied on wheat grains (200 g) soaked overnight in water for pot experiment. About 100 g of soaked wheat grains were taken in 500 ml capacity Erlenmeyer flask and tightly plugged with non absorbent cotton. The flasks were then sterilized by autoclaving at 15 Psi with 121°C for 20 minutes. After sterilization, the wheat seeds in flasks were inoculated with 5 mm mycelial disc from 7 days old pure culture of *Sclerotium rolfsii* at each flasks and flasks were incubated for a 15 days at $27^\circ\text{C} \pm 2^\circ\text{C}$ for proper mycelial growth.

Evaluation of Age on Susceptibility to *S. rolfsii*

Experiment was carried out at Agricultural Farm of Palli Siksha Bhavana (Institute of Agriculture), Visva- Bharati, Sriniketan during the year 2015-2016 under pot culture condition. Five stages i.e. 0, 15, 45 and 60 days after sowing of the tomato crop were taken in consideration for their susceptible reaction with the collar rot causal pathogen *Sclerotium rolfsii*. These stages of crop were maintained in the plastic pots of 15×25 cm diameter filled with sterilized soil. Every stage was replicated four times and each replication was consisted with five numbers of pots. In zero stage 1 no. of healthy tomato seed (cv. Punjab Chuhara) were shown in each pot where as in other stages single seedling was maintained in each pots and recommended fertilizer dose was applied. Untreated control pots were also mentioned with same number of replications and pots for all stages. After raising all the stages, finally inoculum was added to collar region of plants at a time to all stage except zero stage where inoculum was mixed in soil at the time of seed sowing. Inoculated pots were kept in open place for observation and the pots were irrigated as when required. The disease incidence and collar rot disease severity was made at 15, 30, 45, 60 and 75 days after inoculation at respective stages, number of plants showed typical symptoms i.e. collar rot, lesion of stem, weathering of leaf and dead plants due to *S. rolfsii* was observed by adopting (1-9) scale

for *S. rolfsii*¹² (Table 1) and per cent disease incidence was calculated using following formula¹³.

$$\text{Disease severity} = \frac{\sum(ab)}{\dots\dots\dots} \times 100$$

AK

Where, a=No. of disease plants having the same degree of infection, b=Degree of infection, A=Total no. of examine plant, K=Highest degree of infection.

Table 1: Disease rating (1-9) scale for *S. rolfsii* (Nene and Thapliyal 1982)

S. No.	Disease Rating	Description
1.	1	Healthy
2.	2-3	10 or less of the plant symptomatic (wilt, dead or dying)
3.	4-5	11-20 of the plant symptomatic
4.	6-7	21-50 of the plant symptomatic
5.	8-9	>51 of the plant symptomatic

$$\text{Disease incidence (\%)} = \frac{\text{No of infected plant}}{\text{Total no. of observed plants}} \times 100$$

STATISTICAL ANALYSIS

The data were subjected to statistical analysis following Completely Randomized Design as per Gomez and Gomez¹⁴. Necessary transformations were made whenever required. Data were analyzed using Statistical Analysis Systems software STPR.3.

RESULTS AND DISCUSSIONS

The effect of age on susceptibility of tomato plants to *Sclerotium rolfsii* caused collar rot disease are presented in Table 2, depicted in Figure 1. The results revealed that, there was significant difference in disease incidence and percent disease index among the different stages of the plants. Highest disease incidence

86.25 per cent as well as highest disease severity 79.45 per cent was recorded in 30 days old plants followed by stage of just emerged and 15 days old plants stage, with 76.25 percent and 63.75 percent disease incidence as well as 66.11 percent and 61.81 percent disease severity respectively. Stage of 45 days old aged recorded 56.25 per cent disease incidence as well as 54.72 per cent disease severity. Where, the least disease incidence was observed in age group of 60 days old aged plants with 42.5 per cent disease incidence and 39.86 cent disease severity. However, few plants were not emerged from inoculums incorporated with seeds at the time of sowing. It may due to low germination or plant not emerged may be due to production of organic acid by *S. rolfsii*, which are toxic to living cell.

Table 2: Effect of Age on Susceptibility of Tomato Plants to *Sclerotium rolfsii* (Sacc.) Caused Collar Rot Disease

S. No.	Treatments (Days)	Disease incidence	Percent Disease Index (PDI)
1.	0	76.25 (61.09)*	66.11 (54.48)
2.	15	63.75 (53.09)	61.81 (51.84)
3.	30	86.25 (68.74)	79.45 (63.12)
4.	45	56.25 (48.62)	54.72 (47.72)
5.	60	42.5 (40.66)	39.86 (39.15)
6	Control	0.00 (0.00)	0.00 (0.00)
	Sem ±	2.35	1.19
	CD at 5%	6.98	3.55

*Data parenthesis is Angular Transformed Values.

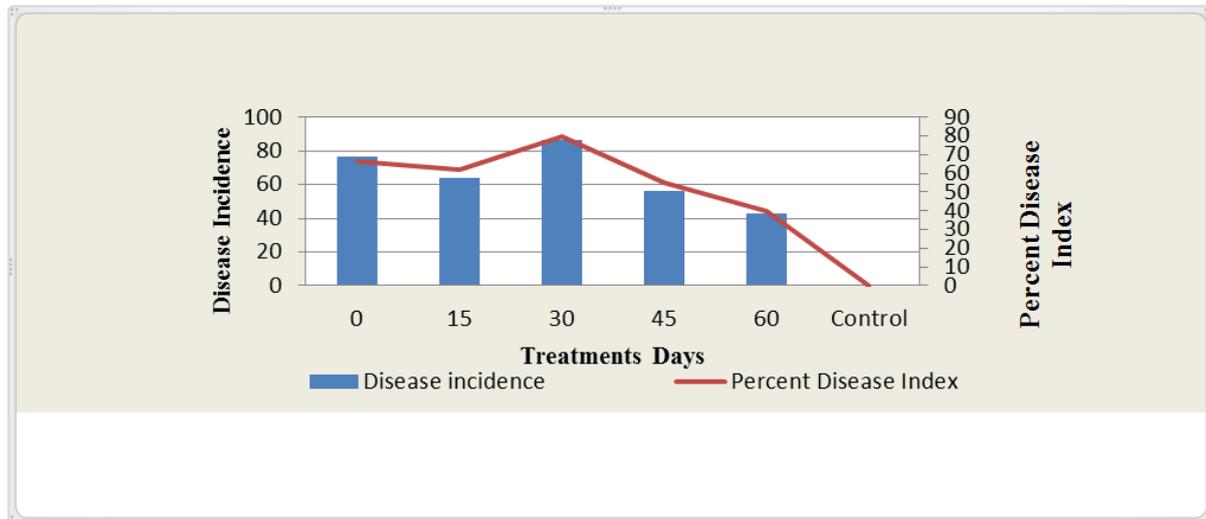


Figure 1: Effect of age of Tomato plants on collar rot disease development in pot conditions

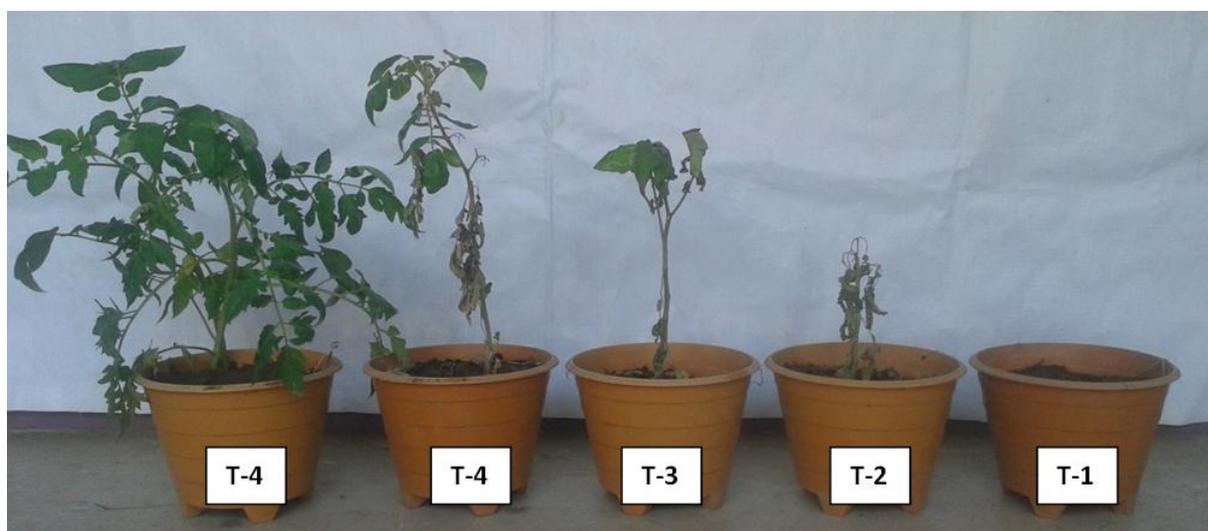


Photo Plate 1: Effect of age of Tomato plants on collar rot disease incidence in pot culture conditions

The present study revealed that the collar rot causing pathogen *Sclerotium rolfsii* may infect the tomato plant in all crop growing stage with different extent of virulence. The virulence of collar disease was highest in younger plants and lowest in old aged plants. The younger plants were found more susceptible as the infection was more and rapid. The time taken for wilting varied from 8 to 15 days. Susceptibility was decreased as the age of plant increased. In the present study the result of susceptibility of tomato plant to *Sclerotium rolfsii* in different stage of crop growth is in consistence with the observation of other workers^{15,16} and ¹⁷. Similar results was also reported by Singh and Dwivedi¹⁸ in Barley

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crop where he found seedlings stage was most susceptible to the attack of *Sclerotium rolfsii* during first fifteen days of the growth and the percent infection of the plant reduced with aging. Similarly while studying with groundnut diseases Kulkarni¹⁹ and his associated reported that the most susceptible growth stage of groundnut *Sclerotium rolfsii* infection, colonization, disease development, maximum mortality was recorded at 15 days old plant and the least mortality in 105 days old plants.

CONCLUSION

The tomato plant is susceptible to *Sclerotium rolfsii* in all growing stage with different

extent of virulence. Seedling transplanting stage (30 days old) and seed sowing stage (0 days old) are most vulnerable stage to collar rot infection, so precautions against the disease should be taken before this stages for better and economic crop production.

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