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Effect of culture filtrates of tomato plant pathogenic fungi on seed germination and seedling growth of tomato (*Lycopersicon esclentum* Mill.)

P. V. Raithak*, B. D. Gachande
Botany Research Laboratory and Plant Disease Clinic, N.E.S. Science College, Nanded-431605, M.S., India.

Abstract
Pathogenic fungi, *Fusarium oxysporum* f.sp. *lycopersici* and *Alternaria solani* (Elis and Mart) Sorauer were isolated from infected tomato roots and fruits respectively from different varieties of tomato (*Lycopersicon esclentum* Mill.). The effect of culture filtrate of these fungi was observed on seed germination, root, and shoot length and vigour index. It was found that, culture filtrate obtained from *F. oxysporum* f. sp. *lycopersici* isolated from tomato varieties Laxmi (NP-5005) increased seed germination up to 80 % vigour index 904.0, root length 6.14 cm and shoot length 5.16 cm as compared to other varieties. *Alternaria solani* isolated from var. Priya (BSS-908) increased seed germination up to 70%, vigour Index 784.7, root length 5.93 cm and shoot length 5.28 cm as compared to other varieties.

Keywords: Tomato, pathogenic fungi, culture filtrate, seed germination, vigour index.

INTRODUCTION

Tomato (*Lycopersicon esclentum* Mill.) is a popular vegetable widely grown in the tropics. In tropical Asia, it is an important cash crop from small farmers [1]. Total area under tomato cultivation in India is about 3.56 lakh hectare with an average yield of 15.7 tons per hectare. The crop is affected by several fungal pathogens, of which *F. oxysporum* f. sp. *lycopersici* inciting wilt disease. *Fusarium* sp. is essentially soil borne [2-3]. Early blight disease of tomato is caused by *Alternaria solani* (Ell and Mart.). A large number of micro-organisms are known to produce toxic secondary metabolites secreted in their metabolic processes. These metabolites are products of amino acids, cyclic peptides, aromatic, phenols, terpenoids and plant growth regulator [4-5]. The most studied products of this pathogen are enzymes [6], toxins [7]. Enzymes are known to be involved in the breakdown of cell wall and maceration of plant tissue which play an important role in invasion of plants by pathogens [8]. The pathogen produces fusaric acid and alternaric acid having phytotoxic properties and its high production has been correlated to virulence of pathogenic strains [9-10].

MATERIALS AND METHODS

Collection of seed samples: Seed samples of four different varieties of tomato i.e. Laxmi (NP-5005), Kranti (112910), Priya (BSS-908) and Sartaj-plus (93673) were collected separately in paper bags from Nanded market (Kalash Seeds Pvt. Ltd., Jalana, M.S.)

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*Corresponding Author

P. V. Raithak

Botany Research Laboratory and Plant Disease Clinic,
N.E.S. Science College, Nanded-431605, M.S., India.
e-mail: praithak@yahoo.co.in

Isolation of pathogenic fungi: *F. oxysporum* f. sp. *lycopersici* and *Alternaria solani* isolates were isolated from infected tomato plant roots and fruits respectively by tissue segment method. The infected roots and fruit rind of different varieties of tomato were cut separately into small pieces with the help of sterile blade and surface sterilized with mercuric chloride solution (0.1%) for 20-30 seconds followed by three times rising with sterilized distilled water. The pieces were then placed on pre-sterilized blotting paper to remove excess moisture. The surface sterilized diseased pieces were then aseptically, transferred on czapek's dox agar medium and incubated at 28±2˚C for seven days. After incubation, colonies were observed and identified on the basis of morphological and reproductive characters. The pure cultures were maintained on Potato dextrose agar and preserved at low temperature in refrigerator for use as when required

Collection of culture filtrates: Production of toxins in culture filtrates by pathogenic fungi was studied by growing fungi i.e. *F. oxysporum* f. sp. *lycopersici* and *Alternaria solani* on liquid glucose nitrate medium of pH 5.6 for ten days. Twenty-five ml of medium was poured in 100 ml conical flasks, autoclaved and inoculated separately by adding one ml of standard spore suspension of test fungi. The flasks were incubated at room temperature (27±2˚C) for ten days. On incubation, the culture filtrates were collected in pre-sterilized culture bottles by filtering the contents through Whatman filter paper no. 1 and treated it as crude toxin preparation.

Effect of culture filtrates on seed germination and seedling growth: 40 seeds for each variety of tomato were surface sterilized with 0.1% mercuric chloride then washed three times with sterilized distilled water. 10 seeds of each variety were suspended in culture filtrates of pathogen isolated from same variety of tomato and incubated at room temperature (28±2˚C) for 24 hours after then seeds were removed from culture filtrate and washed with sterile distilled water. Next these seeds transferred in sterilized petriplates containing three layered wet blotter paper. Total 10 seeds (9+1) plated in each plate. At the same control was also maintained with distilled water for each variety. After seven days of incubation period plates were observed and germination percentage, root length and

shoot length were measured. The germination percentage and vigour Index were calculated by using the formula.

$$\text{Germination (\%)} = \frac{\text{Number of seed germinated}}{\text{Total no.of seeds sown}}$$

Vigour Index = shoot length + root length X germination percentage

RESULTS AND DISCUSSION

The culture filtrates of pathogen F. oxysporum f. sp. lycopersici and Alternaria solani (Elis and Mart) Sorauer were inhibited the seed germination and seedling growth. After seven days of incubation period the percentage of seed germination was very poor in variety Kranti (112910) (65%) Vigour Index (586.95), Root length (5.14 cm), Shoot length (3.89 cm) but in case of Laxmi (NP-5005) it was increased (80%) Vigour Index (904.0), Root length (6.14 cm), Shoot length (5.16 cm) next to the var. Sartaj-plus (93673), Priya (BSS-908).

The percentage of seed germination in culture filtrate of Alternaria solani were inhibited the seed germination and seedling growth was minimum in Laxmi (NP-5005) (60%), Vigour Index (504.0), Root length (3.5 cm), Shoot length (4.90 cm) it was increased in variety Priya-BSS-908 (70%), Vigour Index (784.7), Root length (5.93 cm), Shoot length (5.28 cm) next to the var. Sartaj-plus (93673), Kranti (112910).

The above results conformed the findings of Vidyasekaran et al. [11]. The similar results were also observed by Arun and Mathew [12], Gachande and Jadhav [13-14] in case of seeds of pigeon pea, gram varieties respectively. Soybean seeds soaked in culture filtrates of Fusorium soloni, F. oxysporum, Aspergillus flavus, A. niger, Alternaria tenuis and A. alternata for 24 hours showed reduction in percentage of seed germination was observed by Ibraheem et al. [15], Abrahum [16] was also reported the inhibitory effect of culture filtrates of fungi on seed germination.

Table 1: Effect of culture filtrates of plant pathogenic fungi on seed germination & seedling growth of tomato (*Lycopersicon esculentum mill*.)

Name of Tomato variety	Laxmi (NP-5005)			Kranti (112910)			Priya (BSS-908)			Sartaj-plus (93673)		
pathogenic fungi	*F. oxysporum* sp. *lycopersici*	*Alternaria solani*	control	*F. oxysporum* sp. *lycopersici*	*Alternaria solani*	control	*F. oxysporu* sp. *lycopersi*	*Altern aria solani*	control	*F. oxysporum* sp. *lycopersici*	*Alternaria solani*	control
% of seed germination	80	60	90	65	65	100	70	70	95	78	70	85
Root length in cm	6.14	3.5	6.5	5.14	5.03	10.18	5.53	5.93	6.02	5.32	5.65	8.0
Standard deviation	1.59	1.65	2.14	2.13	2.72	3.92	1.27	2.33	3.06	2.27	2.64	3.18
Standard error	0.42	0.42	0.50	0.55	0.82	0.95	0.29	0.64	0.88	0.58	0.70	0.85
Shoot length in cm	5.16	4.90	6.75	3.89	5.26	6.7	4.54	5.28	5.33	4.34	4.29	6.90
Standard deviation	2.21	1.8	2.50	2.44	2.73	4.26	2.12	1.86	2.28	2.63	2.65	2.90
Standard error	0.5	0.47	0.74	0.65	0.70	1.03	0.50	0.43	0.61	0.63	0.70	0.77
Vigor Index	904	504	1192.5	586.95	668.85	1688	704.9	784.7	1078.25	753.48	695.8	1266.5

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