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Incidence of *Fusariumoxysporum* f. sp. *lycopersici* and effect of culture media, temperature and pH on colony growth and sporulation: Study on tomato crop

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ABSTRACT

Fusariumoxysporum f. sp. *lycopersici* is important tomato pathogen throughout the world, causing severe economic losses. The lower leaves of the potato plant usually turn yellow and die. One or more branches may exhibit such symptoms. The fungus can survive in the soil indefinitely even when no tomatoes are grown. In the experimental study, isolation, radial growth and sporulation of pathogen taken into consideration on different culture, temperature and pH ranges. The result shown that Potato dextrose agar medium was found to be most suitable medium for the growth and sporulation of *Fusariumoxysporum* f. sp. *lycopersici* and showed an average of 72.00mm of growth after 7 days of incubation at $28 \pm 32^{\circ}$ C, closely followed by Czapek's (dox) agar medium, Corn meal agar medium and Richard's agar medium showed 69.34mm, 63.00mm and 61.34mm of growth respectively. It is observed that 30° C was the optimum temperature for the maximum growth and sporulation of the pathogen followed by 25° C respectively. Pathogen grew over a wide range of pH from 2.5 to 6.5 but the maximum growth and excellent sporulation was recorded at pH 5.5 followed by 6.5.

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Introduction

Tomatoes are native to South and Central America, and are now cultivated widely throughout the world. Tomatoes are one of the most widely cultivated vegetable crops in India. They are important source of vitamins and an important cash crop for both smallholders and medium-scale commercial farmers. Tomatoes acting as taste enhancers in food are always in high demand both for fresh consumption and processing.

Fusarium or vascular wilt of tomato, the most prevalent disease, generally occurs in midsummer when air and soil temperatures are high. The stem remains firm and green on the outside, but exhibits a narrow band of brown discoloration in the vascular tissue. This discoloration can be viewed easily by slicing vertically through the stem near the soil line and looking for a narrow column of browning between the central pith region and the outer portion of the stem (Ned Tisserat, K-state Uni, Plant Pathology) [5]. The fungal pathogen *Fusariumoxysporum* affects a wide variety of hosts of any age (Smith *et al.* 1988) [8].

Fusariumoxysporum f. sp. *lycopersici* causes vascular wilt in tomato. The disease starts out as yellowing and drooping on one side of the plant. Leaf wilting, plant stunting, browning of the vascular system, leaf death, and lack of fruit production also occur [9].

Materials and Methods

The diseased plants of tomatoes were brought to the laboratory from different different fields of villages. Samples were sterilized before start the study and observations. Leaf and branches exhibit diseased symptoms cut into segments and segments were surface sterilized with 70% ethanol for 5 seconds followed by 4% NaOCI for 90 seconds, then washed in sterilized distilled water for 10 seconds.

The sterilized and unsterilized pieces having disease symptoms were transferred to sterilized potato dextrose agar

medium. At least 2-3 segments of leaf/branch were placed in a single petriplate. Distance between segments was uniformly maintained. The plates were incubated in BOD incubator and the temperature was maintained from $28\pm32^{\circ}$ C. After completion of the experiment pure culture of each fungal colony was developed by repeated isolations of hyphal tips.

After isolation of *Fusariumoxysporum* f. sp. *lycopersici*, study was conducted for observing it's colony growth and sporulation on different culture medium, temperature and pH ranges.

Result and Discussion:

It is found from the data presented in table 1 and graph 1 that the pathogen have grown in all the media. However the Potato dextrose agar medium was found to be most suitable medium for the growth and sporulation of *Fusariumoxysporum* f. sp. *lycopersici* and showed an average of 72.00mm of growth after 7 days of incubation at $28 \pm 32^{\circ}$ C, closely followed by Czapek's (dox) agar medium, Corn meal agar medium and Richard's agar medium showed 69.34mm, 63.00mm and 61.34mm of growth respectively. Whereas Malt extract agar, Oat meal agar and Sabouraud's dextrose agar medium have shown the minimum growth and sporulation.

Among the environmental factors, temperature is the most important which affects the metabolic activity of pathogen. In the present study, ten different temperatures ranging from 0^{0} C, 5^{0} C, 10^{0} C, 15^{0} C, 20^{0} C, 25^{0} C, 30^{0} C, 35^{0} C, 40^{0} C and 45^{0} C respectively were taken for study of their growth and sporulation of the pathogen. The result as given in table 2 and graph 2 indicated that the maximum growth of the pathogen was observed at 30^{0} C, followed 25^{0} C. The growth of the pathogen was significantly decreased at 35^{0} C, 20^{0} C, 40^{0} C, 45^{0} C, 15^{0} C, 10^{0} C and 5^{0} C.

The pH of the medium affects the rate of the growth and sporulation of the pathogen. In our study eight different pH



levels *viz.*, 2.5, 3.5, 4.5, 5.5 and 6.5 were taken and evaluation of most suitable pH for the optimum growth and excellent sporulation of the pathogen was studied. Table 3 and graph 3 indicated that the pathogen grew over a wide range of pH from 2.5 to 6.5 but the maximum growth and excellent sporulation was recorded at pH 5.5 followed by 6.5.

 Table 1: Growth of Fusariumoxysporum f. sp. zingiberi on different culture media

S. No.	Culture media	Radial Growth of colony in mm after one week of incubation			Average in mm	
		r1	r2	r3		
1	Potato dextrose agar medium	72	71	73	72.00	
2	Malt extract agar medium	62	64	52	59.34	
3.	Oat meal agar medium	51	54	62	55.67	
4.	Corn (maize) meal agar medium	63	62	64	63.00	
5.	Sabourd's dextrose agar medium	51	54	50	51.67	
6.	Czapek'sdox agar medium	72	66	70	69.34	
7.	Richard's agar medium	68	56	60	61.34	

Graph 1: Growth of *Fusariumoxysporum* f. sp. *lycopersici* on different culture media



Table 2: Effect of different temperatures on growth and sporulation of *Fusariumoxysporum* f. sp. *lycopersici*

S. No.	Temperature in ⁰ C	Radial growth of colony in mm after one week of incubation	Sporulation
1	0	0.0	Poor
2	5	1.45	Poor
3	10	6.35	Poor
4	15	12.54	Poor
5	20	48.05	Good
6	25	62.50	Excellent
7	30	64.15	Excellent
8	35	48.10	Good
9	40	21.05	Poor
10	45	18.00	Poor
		Av.29.89	

Graph 2: Effect of different temperatures on the growth of *Fusariumoxysporum* f. sp. *lycopersici*.



Table 3: Effect of different pH on the growth and sporulation of *Eusgriumacysporum* f sp. *lycongrsici*

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S.	pН	Radial growth of colony	(mm)	Sporulation			
No	level	after one week of icubation					
1.	2.5	5.00		Poor			
2.	3.5	8.05		Poor			
3.	4.5	10.00		Poor			
4.	5.5	38.00		Excellent			
5.	6.5	21.00		Good			
		Av. 16.41					





Several workers studied on *Fusarium*wilt of tomato. SiegridSteinkellner*et al.*,[7] andCai*et al.*, [3] isolated Thirtynine isolates of *Fusariumoxysporum* from tomato plants displaying wilt symptoms in a field in California 2 years after *F. oxysporum f. sp. lycopersici* race 3 was first observed at that location. These and other isolates of *F. oxysporum f. sp. lycopersici*were characterized by pathogenicity, race, and vegetative compatibility group (VCG). Of the 39 California isolates, 22 were in VCG 0030, 11 in VCG 0031, and six in the newly described VCG 0035. ZhihaoXuet *al.*,[10] and Barboza [2] also attempted a study on a group of differential tomato lines was used to identify the races of *Fusariumoxysporum f. sp. lycopersici* in Zhejiang, China.

Our experiments are agreement with Soil solarization tests against *Fusariumoxysporum f. sp. lycopersici*, the causal agent of tomato *Fusarium* wilt, were conducted by Radwan*et al.*, [6] for seven weeks through July and August 2008 and 2009. The longest length of time recorded for temperature above 45°C

under DPE sheets were 220 hours and 218 hours. The treatments reduced the pathogen population by 86% and the disease by 43% under the DPE treatment and to a lesser extent by the other treatments. While Fakher*et al.*,[4] also isolated *Fusariumoxysporum*f. sp. *radiceslycopersici*from tomato plantand evaluated the effect of mycelial growth on PDA and different temperatures. They observed the pathogen grew well PDA and on 20°C to 30°C. And Alen *et al.* [1] obtained that disease incidence was higher than that at 27°C-30°C.

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