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RESEARCH ARTICLE

Cultural, morphological and pathogenic variability in *Fusarium oxysporum* f. sp. *lycopercici* isolates from major tomato growing areas of Karnataka

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ABSTRACT

Twenty three isolates of *Fusarium oxysporum* f. sp. *lycopercici* were collected from major tomato growing areas of Karnataka. They produced three kinds of spores, *viz.,* microconidia, macroconidia and chlamydospors. Mycelia of the pathogen were white cottony to pink often with purple tinge or reddish colouration of the medium. Total isolates were assigned into three groups, on the basis of colony diameter, colony characters, sporulation and degree of pathogenicity. Isolates Fol-1, Fol-4, Fol-6 Fol-9, Fol-11, F ol-13, Fol-15 and Fol-21 showed abundant aerial mycelium and sporulation with maximum colony diameter (75 to 90.0 mm). They showed strong virulence with 75 per cent severity and wilting symptoms were noticed 14 days after inoculation.

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INTRODUCTION

Tomato (*Solanum lycopersicum*, formerly *Lycopersicon esculentum* Mill.) is one of the most widely grown vegetable crops in the world. It is used as a fresh vegetable and can also be processed and canned as a paste, juice, sauce, powder or as a whole (Barone and Frusciante, 2007). Tomato is best adapted to warm and dry environments, but during the hot-wet season, yields are low due to poor fruit-setting caused by the high temperatures, as well as many severe disease problems. Tomato crop is attacked by various plant pathogens, among them Fusarial wilt of tomato caused by *Fusarium oxysporum* f. sp. *lycopersici* (Sacc.) Synder and Hansen is an economically important disease and is a destructive disease of tomato crop worldwide (Jones *et al*., 1991). Today, it has an extensive presence in all continents. Substantial crop losses in infected fields have given the disease international attention. The main aim of grouping of these isolates was to get an initial understanding of variation among the isolates of *F. o.* f. sp. *lycopersici* collected from major tomato growing areas of Karnataka.

MATERIALS AND METHODS

Present investigation was carried out during 2007 to 2010. Laboratory experiments were carried out at the Department of Plant Pathology, College of Agriculture, University of Agricultural Sciences, Dharwad (Karnataka). *F. o.* f. sp. *lycopersici* affected samples were collected during the year 2008- 2009 from different tomato growing regions of Karnataka. The details of location and designation given for each isolates are furnished in Table1.

Twenty three isolates of *Fusarium* spp. obtained upon isolation from wilted tomato plants were compared for variation in morphological and cultural characters on PDA medium. Twenty ml of medium was poured into each sterilized

Petriplate and five mm mycelial disc from actively growing seven days-old culture of each isolates of *Fusarium* sp. was inoculated at the centre of PDA and Petri plates were incubated at 27±1 °C for seven days. Observations on colony colour and linear growth measurements were recorded up to seven days. Spore measurements were taken with the help of filar micrometer.

The fungus was multiplied on PDA under aseptic conditions in Petriplates. When fully covered with fungal growth (seven days old) it was harvested with the help of a sterile scalpel and washed with 100 ml of sterile water. The contents of each plate were filtered through a muslin cloth to get a spore suspension. The suspension was adjusted to have a concentration of $5x10^6$ spores/ml of sterile water. Four holes of 4-5 cm deep were made with the help of a small sticks in the soil around collar region of each seedling four weeks grown in pot containing sterilized soil. Ten ml of the spore suspension was poured into the holes and covered with soil. Control plants were applied with sterilized tap water (Kesavan and Chowdhury, 1977).

Disease severity index was evaluated by using following scale (Bora *et al*., 2004): 0 = No symptoms; 1= <25% leaves with symptoms; 2= 26-50% leaves with symptoms; 3 = 51-75% leaves with symptoms; 4 = 76-100 leaves with symptoms.

RESULTS AND DISCUSSION

The morphological characters of *F. o*. f. sp. *lycopersici* isolates indicated that, mycelia of pathogen were cottony white to pink. Microconidia were abundant, oval-ellipsoid, straight to curved; macroconidia, sparse to abundant, three to five septate, fusoid-subulate and pointed at both ends and had pedicellate base. Three septate spores were predominant. Chlamydospores were both smooth and rough walled (Table 2). The present studies is in agreement with Gerlach and Nirenberg (1982) who found that *F. o*. f. sp *lycopersici* was identified based on its morphological characters.

Twenty three isolates of *F. o*. f. sp *lycopersici* were classified into three groups (Table 3). The first group isolates showed abundant aerial mycelium, initially white, cottony, fluffy, turned to pale pink to purple, chlamydospores round to slightly elliptical, single or two celled, with abundant sporualation and maximum colony diameter ranging between 75.0 to 90.0 mm.Group second isolates showed, moderate to

Table 1: *Fusarium oxysporum* f. sp. *lycopersici* isolates from major tomato growing areas of Karnataka

District	Location	Isolate number
Dharwad	Saidapur	Fol-1
	Garag	Fol-2
Bangalore	Nelamangala	Fol-3
	Doddaballapur	Fol-4
Tumkur	Gubbi	Fol-5
	Hosalli	Fol-6
Gadag	Bannikoppa	Fol-7
	Lakkundi	Fol-8
Haveri	Hangal	Fol-9
	Ranebennur	Fol-10
Belgaum	Arabhavi	Fol-11
	Khanapur	Fol-12
	Gokak	Fol-13
Mysore	Mysore	Fol-14
	Hunsur	Fol-15
Chikkballapur	Chikkballapur	Fol-16
	Chintamani	Fol-17
Shimoga	Shimoga	Fol-18
	Sagar	Fol-19
Ramanagar	Ramanagar	Fol-20
Kolar	Kolar	Fol-21
Chikkmanglur	Chikkmangalur	Fol-22
Davanagere	Davanagere	Fol-23

Table 2 : Morphological, cultural and pathogenic variability in isolates of ***Fusarium oxysporum*** f. sp. ***lycopersici*** on potato dextrose agar

Isolates	Growth characters	Colony diameter (mm)	Sporulation	Micro conidia	Macro conidia	Disease severity index (%)	Location
Fol 1	Abundant aerial mycelium, initially white, cottony, fluffy, turned to pale pink	90.00		Fusiform with 1 septum (11.1-13.4 x 4.4-5.6 µm)	Fusiform with 5 septum (27.8-33.5 x 3.3-5.0 µm)	75.0	Saidapur
Fol 2	Moderate aerial mycelium, cottony, fluffy, white to pale pink	65.00		Fusiform with 1 septum (10.0-12.5x 4.1-5.3 µm)	Fusiform with 3 septum (26.5-33.5 x 3.4-4.8 µm)	53.0	Garag
Fol 3	Moderate aerial mycelium, cottony, fluffy, white to pale pink	88.00		Fusiform with 1septum (12.2-13.6 x 3.1-4.0 µm)	Fusiform with 5 septum (35.2-37.4 x 3.3-5.0 µm)	65.0	Nelamangala
Fol 4	Abundant aerial mycelium, initially white, cottony, fluffy, turned to pale pink	88.00		Fusiform with 1septum (12.0-13.8 x 3.4-4.0 µm)	Fusiform with 5 septum (39.2-42.0 x 4.3-4.9 µm)	75.0	Doddaballapur
Fol 5	Moderate aerial mycelium, cottony, fluffy, white to pale pink	75.00		Oval round (6.5-7.3x3.5-3.8 µm)	Fusiform with 3 septum (28.5-35.4 x 3.4-5.3 µm)	75.0	Gubbi
Fol 6	Abundant aerial mycelium, initially white, cottony, fluffy, turned purple	85.00		Oval round (5.3-5.4 x 2.3-3.5 µm)	Fusiform with 5 septum (32.0-35.2 x 3.9-5.0 µm)	75.0	Hosalli
Fol 7	Abundant aerial mycelium, cottony, fluffy, white to pale pink	60.00		Oval round (5.5-6.3x3.2-3.5 µm)	Fusiform with 5 septum (39.0-41.0 x 3.4-5.0 µm)	26.0	Bannikoppa
Fol 8	Abundant aerial mycelium, cottony, fluffy, white to pale pink	88.00		Fusiform without septum (11.0-13.5x 4.3-5.5 µm)	Fusiform with 3 septum (28.2-31.0 x 3.5-3.8 µm)	30.0	Lakkundi
Fol 9	Abundant aerial mycelium, initially white, cottony, fluffy, turned to pale pink	90.00		Oval round (6.5-7.4 x 3.0-3.5 µm)	Fusiform with 5 septum (38.0-40.0 x 3.5-4.2 µm)	75.0	Hangal
Fol 10	Abundant aerial mycelium, cottony, fluffy, white to pale pink	58.00		Fusiform with 1septum (12.4-13.8x3.5-4.0 µm)	Fusiform with 5 septum (40.0-42.3 x 3.8-4.9 µm)	75.0	Ranebennur
Fol 11	Abundant aerial mycelium, initially white, cottony, fluffy, turned to pale pink	75.00		Fusiform with 1septum (11.5-14.8 x 3.5-4.0 µm)	Fusiform with 3 septum (25.3-26.6 x 3.3-5.4 µm)	45.0	Arabhavi
Fol 12	Moderate aerial mycelium,cottony, fluffy, white to pale pink	65.00		Oval round 5.6-6.0 x 3.3-3.7 µm.	Fusiform with 3 septum (26.2-28.3 x 3.9-4.8 µm)	45.0	Khanapur
Fol 13	Abundant aerial mycelium, initially white, cottony, fluffy, turned to pale pink.	87.00		Fusiform with 1septum (12.3-14.2 x 3.6-4.6 µm)	Fusiform with 5 septum (34.0-35.6 x 3.6-4.8 µm)	75.0	Gokak
Fol 14	Moderate aerial mycelium, cottony, fluffy, white to pale pink	85.00		Oval round (5.4-5.7 x 3.4-3.8 µm)	Fusiform with 3 septum (25.2-27.3 x 3.4-5.0 µm)	35.0	Mysore
Fol 15	Abundant aerial mycelium, initially white, cottony, fluffy, turned to pale pink to purple	88.00		Fusiform with 1septum (10.8-13.5x 3.7-4.0 µm)	Fusiform with 3 septum (26.2-27.3 x 3.3-4.5 µm)	75.0	Hunsur
Fol 16	Moderate aerial mycelium, cottony, fluffy, white to pale pink	85.00		Fusiform without septum (10.5-12.2 x 3.4-4.8 µm)	Fusiform with 5 septum (27.2-28.3 x 3.4-4.5 µm)	45.0	Chikkballapur

Table 2: Contd......... ... ...

abandant aerial mycelium, cottony, fluffy, white to pale pink with good sporulation, chlamydospores terminal or intercalary, one or two celled, circular to oval, colony diameter varied from 60.0 to 90.0mm. Third group isolates exhibited cottony aerial mycelium, fluffy, white to pale pink, sporulation moderate to poor, one or two celled, terminal or intercalary chlamydospores, colony diameter ranged between 55.0 to 90.0 mm.

Twenty three isolates collected from different locations showed varying degrees of aggressiveness in inoculated plants: eight isolates (Fol-1, Fol-4, Fol-6, Fol-9, Fol-11, F ol-13, Fol-15 and Fol-21) showed strong virulence with 75 per cent severity and wilting symptoms were noticed 14 days after inoculation. Group second isolates (Fol-2, Fol-3, Fol-5, Fol-7, Fol-19 and Fol-22) were the next strong virulent isolates producing wilting symptoms 17 to 21 days after inoculation and showed 53-75 per cent severity. Third group isolates (Fol-8, Fol-10, Fol-12, Fol-14, Fol-16, Fol-17, Fol-18, Fol-20 and Fol- 23) were less aggressive and took more time to cause symptoms (24-30 days) and severity varied from 26-50 per cent. A similar study was found conducted by White (1972) by grouping *F. o*. f. sp. *lycopersici* isolates. The main aim of the groupings of these isolates was to understand pathogenic variation among the isolates of *F. o*. f. sp. *lycopersici*. Variation may be due to mutation in the genome of *F. o*. f. sp. *lycopersici* (Mishra *et al.*, 2010). This finding may be useful for breeding work, as in order to test varieties resistant to tomato wilt they need to be tested against different isolates prevalent in the particular region.

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