

Original Research Article

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Morphological and Cultural Characteristic of *Fusarium oxysporum* f. sp. *vasinfectum* (FOV) under South Gujarat

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Cotton (*Gossypium* spp.) is one of the most important fiber crops playing a key role in economic and social scenario of the globe. It provides employment and sustenance to a population of nearly 42 Million people, who are involved directly or indirectly in cotton production, processing, textiles and related activities. In this experiment morphological and cultural character of FOV pathogen was studied. Morphological studies were carried out under different temperature on Potato dextrose broth (PDB) medium revealed growth and sporulation, variation in size of micro conidia, macro conidia and chlamydo spores of FOV. Macroconidia were straight, spindle as well as sickle shaped and had 1-6 septa. The size of macroconidia was maximum at 20°C (27.11×4.90µm) followed by 35°C (26.11×3.90µm), 40°C (25.90×4.20µm), 30°C (25.33×4.18µm), 25°C (23.11×3.70µm) and 15°C (21.42×3.57µm). A maximum colony diameter (87.33mm) was recorded at 30°C after ten days of incubation followed by (68.33mm) at 25°C, (49.33mm) at 20°C, (28.33mm) at 35°C, (26.00mm) at 15°C and (8.00mm) at 40°C. No colony diameter was recorded at 45°C temperature.

Introduction

Cotton (*Gossypium* spp.) is one of the most important fiber crops of the world. Currently, *Gossypium* includes 50 species, four of which are cultivated, fourty four is wild diploids, and two are wild tetraploids. Out of the four cultivated species, *Gossypium hirsutum* L. and *Gossypium barbadense* L. commonly called as new world cottons are tetraploids (2n = 4x = 52). Whereas, *G. herbaceum* L. and *G. arboreum* L. are diploids (2n = 2x = 26) and are commonly called as old world cottons. India with its unique distinction is the

only country in the world which cultivates all four cultivable species of cotton (Khadi *et al.*, 1970).

Cotton is an important fiber yielding crop of global importance, which is grown in tropical and subtropical regions of more than 80 countries of the world. The major cotton producing countries are USA, China, India, Pakistan, Uzbekistan, Egypt, Argentina, Australia, Greece, Brazil and Turkey. In total global cotton production 70 per cent cotton production comes from four countries, which includes China (27%), India (22%), USA

(13%) and Pakistan (8%). For many developing and underdeveloped countries cotton export is the main source of foreign exchange earnings (Anon., 2017).

Cotton is grown worldwide for its natural fiber and oil. Cotton seed contain 30 per cent starch, 25 per cent oil and 16.20 per cent protein. It is also being used in the manufacture of medicinal supplies, tarpaulin, cordage and belting.

The cotton hulls serve as roughage for livestock and the fuzz (short seed hair) is used in the manufacture of papers, plastics, carpets, rayon, explosives and cotton wool (Prasad, 2015).

Cotton crop has attained the status of cash crop. India ranks first in area and second in total production of cotton in the world. It chiefly grown in Maharashtra, Gujarat, Andhra Pradesh, Madhya Pradesh, Punjab, Tamil Nadu and Karnataka. India is the largest cotton growing country in the world with an area of around 122 lakh ha, production 377 lakh bales and productivity 524kg/ha (AICRP, 2017-2018). In Gujarat cultivated area of cotton is 26.18 lakh ha with the production of 104 lakh bales and productivity 675 kg/ha (AICRP, 2017-2018).

Among these diseases, *Fusarium* wilt caused by *Fusarium oxysporum* f. sp. *vasinfectum* (FOV) is one of the most important and serious diseases. It was the first vascular wilt described by Atkison (1892) and this disease is still causing enormous yield losses in several parts of the world and remains a threat to cotton production in the future (Feng *et al.*, 2000).

Looking to the frequent occurrence in one or other region and inflicting serious damage under South Gujarat region this aspect had been taken for the FOV study.

Materials and Methods

Morphological characteristics

The isolate was cultured in liquid media in 100ml flask containing 20ml of Potato dextrose broth (PDB) in different temperature as 15, 20, 25, 30, 35, 40 and 45°C for fifteen days. After incubation, average measurements were taken by the micrometry method.

The morphological characters like size (length and width) of macroconidia, microconidia and chlamyospore were recorded. The observations were recorded in three repetitions of each isolate in different temperature. The study was carried out using ocular and stage micrometer after mounting them on the slides containing sterile distilled water at required magnification. Data were analyzed statistically using complete randomized design (CRD).

Cultural characteristics

The isolate was cultured on Potato dextrose agar (PDA) media in different temperature as 15, 20, 25, 30, 35, 40 and 45°C for ten days. The 5mm disc of *F. oxysporum* f. sp. *vasinfectum* isolate were inoculated on PDA Petri plate and incubated at different temperature. After ten days of incubation period, diameter of the fungal mycelial growth, colony characters, sporulation and pigmentation were recorded.

The results were tabulated and the data were analyzed statistically using complete randomized design.

Results and Discussion

Morphological characteristics

Morphological studies were carried out under different temperature on Potato dextrose broth

(PDB) medium revealed variation in growth and sporulation, size of micro conidia, macro conidia and chlamydo spores of *F. oxysporum* f. sp. *vasinfectum*. The results are presented in Table 1.

Growth and sporulation

The maximum dry mycelium weight (194.00mg) with sporulation (17.67million/ml) was observed at 30°C while at 45°C there was no growth and sporulation observed (Table 1 and Fig. 1).

Macroconidia

Macroconidia were straight; spindle as well as sickle shaped and had 1-6 septa. The size of

macroconidia was maximum at 20°C (27.11×4.90µm) followed by 35°C (26.11×3.90µm), 40°C (25.90×4.20µm), 30°C (25.33×4.18µm), 25°C (23.11×3.70µm) and 15°C (21.42×3.57µm). At 45°C temperature no macroconidia were produced (Table 1).

Microconidia

Microconidia were hyaline, round to oval in shape and had 0-1 septa. The size of microconidia was maximum at 25°C (7.14×4.10µm) followed by 35°C (6.35×4.10µm), 30°C (6.24×3.90µm), 15°C (5.90×3.50µm), 40°C (5.35×3.57µm) and at 20°C (5.20×3.70µm). At 45°C temperature no microconidia were produced (Table 1).

Table.1 Growth, sporulation and size of microconidia, macroconidia and chlamydo spores of *Fusarium oxysporum* f. sp. *vasinfectum* under different temperature on PDB (Potato dextrose broth) medium after fifteen days of incubation

Temp °C	*Dry mycelium weight (mg)	*Sporulation (million/ml)	Microconidia		Macroconidia		Chlamydo spore Size (µm)
			Size (µm)	No. of septa	Size (µm)	No. of septa	
15	71.67	12.33	5.90 × 3.50	0-1	21.42 × 3.57	1-3	7.90 × 7.02
20	130.67	14.00	5.20 × 3.70	0	27.11 × 4.90	3-6	7.67 × 7.15
25	174.67	16.00	7.14 × 4.10	0-1	23.11 × 3.70	2-3	7.98 × 7.38
30	194.00	17.67	6.24 × 3.90	0-1	25.33 × 4.18	2-3	8.87 × 7.85
35	79.00	15.00	6.35 × 4.10	0-1	26.11 × 3.90	3-6	8.03 × 7.19
40	19.00	10.33	5.35 × 3.57	0	25.90 × 4.20	2-3	7.55 × 6.67
45	0.00	0.00	-	-	-	-	-
S. Em. ±	0.69	0.31					
C.D.at 5%	2.09	0.94					
C. V. %	1.25	4.38					

* On PDB (Average of three Repetitions)

Table.2 Colony diameter, sporulation and cultural characteristics of *Fusarium oxysporum* f. sp. *vasinfectum* under different temperature on PDA medium after ten days of incubation

Temp (°C)	Colony diameter* (mm)	Sporulation category**	Cultural characteristics		
			Colony characters	Colour	
				Mycelium	Substrate
15	26.00	++	Flat mycelial growth with regular margin	whitish	Light pink
20	49.33	+++	Moderate fluffy aerial growth with regular margin	White, orange and purple	Pinkish white
25	68.33	++++	Profuse fluffy aerial growth with regular margin, whitish orange mycelium	White, orange and purple	Orange to pinkish
30	87.33	++++	Profuse fluffy aerial mycelial growth, cottony raised and purple mycelium	Whitish purple	Dark purple
35	28.33	++	Flat mycelial growth with regular margin	Whitish	slight pink
40	8.00	+	Submerged growth with irregular margin	Whitish	No color
45	0.00	-	No growth	-	-
S. Em. ±	0.67				
C.D. at 5%	2.02				
C. V. %	3.02				

Average of three repetitions

**Sporulation category: - Absent, + Scanty, ++ Moderate, +++ Good, ++++ Abundant (on PD)

Fig.1 Dry mycelium weight and sporulation at different temperature

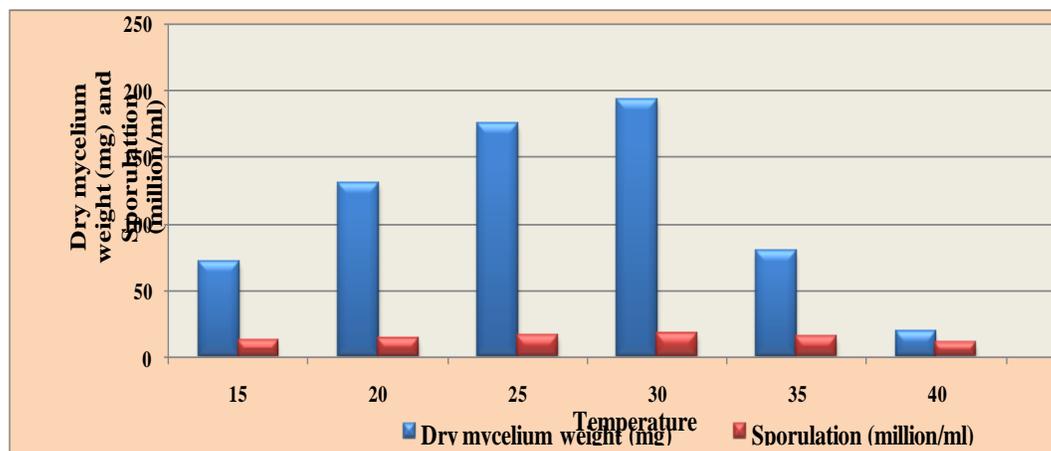
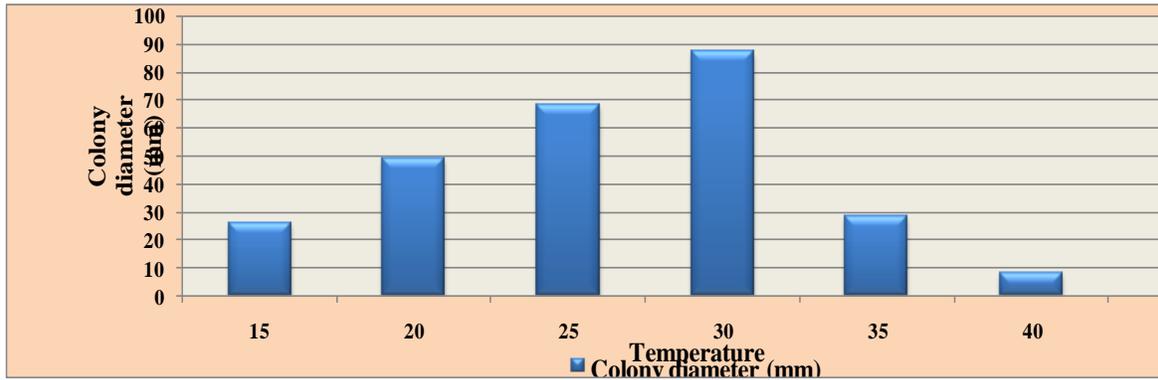
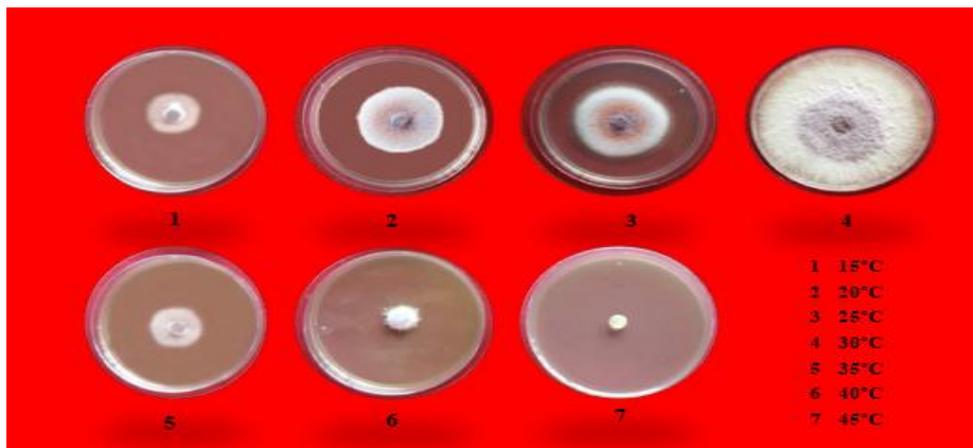


Fig.2 Colony diameter of pathogen at different temperature



Photograph.1 Growth and pigmentation of FOV in different temperatures



Chlamydospore

Chlamydospores were round, oval and terminal. The size of chlamydospores was maximum at 30°C (8.87×7.85µm). At 45°C chlamydospores were not produced (Table 1).

These results are in agreement with the results obtained by various research workers. Chaudhary *et al.*, (2011) reported that dry mycelium weight of *F. udum* was maximum at 30°C. Nath *et al.*, (2017) also reported morphological variability of *F. oxysporum* f. sp. *ciceri* under different temperature and found that at 30°C temperature pathogen was grown best.

Cultural characteristics

The cultural studies of *F. oxysporum* f. sp. *vasinfectum* was made by growing single spore culture on Potato dextrose agar (PDA) medium under the different temperature and colony diameter (mm), cultural characteristics, sporulation and pigmentation were recorded (Table 2 and Photograph 1).

A maximum colony diameter (87.33mm) was recorded at 30°C after ten days of incubation followed by 68.33mm at 25°C, 49.33mm at 20°C, 28.33mm at 35°C, 26.00 mm at 15°C and 8.00mm at 40°C. No colony growth was recorded at 45°C temperature. *F. oxysporum* f.

sp. *vasinfectum* was differed in colony characters at different temperature. At 15°C produced flat mycelial growth with regular margin, at 20°C produced moderate fluffy aerial growth with regular margin, at 25°C profuse fluffy aerial growth with regular margin, whitish orange mycelium, at 30°C produced profuse fluffy aerial mycelial growth, cottony raised and purple mycelium, at 35°C produced flat mycelial growth with regular margin and at 40°C submerged growth with irregular margin was observed (Fig. 2).

Findings of the cultural variations such as mycelial growth, colour and sporulation are in conformity with findings obtained by Chaudhary *et al.*, (2011) who reported maximum mycelial growth (89.23mm) and sporulation of *F. udum* at 30°C.

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