

Original Research Article

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Physiological studies of *Fusarium oxysporum* f. sp. *melonis*

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ABSTRACT

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The effect of temperature on growth and sporulation of *Fusarium oxysporum* f. sp. *melonis* was showed maximum growth and sporulation at 25°C. Optimum temperature for growth of pathogen was 20-25°C. However, at 35°C growth and sporulation of the pathogen was drastically reduced. The continuous dark condition was found to be the best condition for growth and sporulation of the pathogen followed by continuous light and control condition (under room temperature). The pathogen *Fusarium oxysporum* f. sp. *melonis* was grow under a wide range of hydrogen ion concentration. The pH range required for maximum growth was found to be 5.0 to 6.0.

Introduction

Muskmelon is an important fruit crop in tropical and subtropical regions, but it is also grown extensively in temperate zone countries. The crop is prone to be affected by several diseases viz., powdery mildew, downy mildew, damping-off, *Fusarium* wilt, bacterial wilt, anthracnose, *Alternaria* leaf blight and root knot nematode.

Muskmelon crop was susceptible to numerous fungal diseases and reduced yield and fruit quality. Among these, wilt caused by *Fusarium oxysporum* f. sp. *melonis* (Snyd. and

Hans) is a serious soil borne fungal disease which results in heavy loss.

Hence, the present investigation was conducted to find out the effect of temperature, light and pH on growth and sporulation of *Fusarium oxysporum* f. sp. *melonis*.

Materials and Methods

An experiment was conducted with respect to effect of temperature, light and pH on growth and sporulation of *Fusarium oxysporum* f. sp. *melonis* at College of Horticulture, Bengaluru.

Effect of temperature on the growth and sporulation of *Fusarium oxysporum* f. sp. *melonis*

The isolate of *Fusarium oxysporum* f. sp. *melonis* was grown on potato dextrose agar medium to determine the effect of temperature on the growth and sporulation of the pathogen. Different temperature levels were tried viz., 20, 25, 30, 35°C and room temperature. 20 ml of the medium was poured into the sterilized 90 mm diameter Petri plate and allowed for solidification under aseptic condition. With the 5mm disc of the pathogen from a seven days old culture was placed on the surface of potato dextrose agar. Inoculated plates were incubated at different temperature and each treatment was replicated 5 times. The colony diameter and sporulation were recorded at different intervals.

Effect of light on the growth and sporulation of *Fusarium oxysporum* f. sp. *melonis*

The experiment was conducted during 2018 to study the effect of light and darkness on the growth and sporulation of the pathogen. The fungus was inoculated on potato dextrose agar by exposing the inoculated culture Petri plates to continuous light, continuous dark, alternating with 12 hours light and 12 hours complete darkness along with control *i.e.*, under normal room temperature. The inoculated Petri plates were incubated at 26°C±1°C for 10 days. The colony diameter and sporulation were recorded.

Effect of hydrogen ion concentration (pH) on the growth and sporulation of *Fusarium oxysporum* f. sp. *melonis*.

An experiment was conducted to find out the effect of different levels of pH on the growth of *Fusarium oxysporum* f. sp. *melonis*. Potato dextrose broth was used as a basal medium.

pH of the liquid medium was adjusted by 0.1N alkali (NaOH) or 0.1N acid (HCl). The pH of the medium used was 4.0, 5.0, 6.0, 7.0, 8.0 and 9.0. Pure culture of the pathogen was inoculated to each of the 100ml corning flask containing 30 ml of basal medium. The inoculated flasks were incubated at 26°C±1°C. Each treatment was replicated three times. Dry mycelial weight of the fungus was recorded. The data was analyzed statistically.

Results and Discussion

Pathogen was inoculated on potato dextrose agar medium as described in material and methods and incubated at different temperatures of 20, 25, 30 and 35°C and room temperature for 12 days. The average radial growth and sporulation were recorded and are presented in Table 1, Figure 1 and Plate 1.

Results revealed that, the radial growth of the fungus was maximum (24.00 mm) at 25°C at 4th days after incubation, followed by 21.00 mm at 20°C and room temperature. While at 6th days of incubation, the radial growth was maximum (44.00 mm) at room temperature followed by 40.00 mm at 25°C and 32.00 mm at 20°C. At 8th days of incubation, the maximum growth of the fungus (71.00 mm) was recorded at room temperature. At 10th days of incubation the best growth of the fungus was recorded at room temperature (82.00 mm) followed by 71.00 mm at 25°C and 69.00 mm at 20°C. At 12th days after incubation, the radial growth of the pathogen was maximum 87.00 mm at 25°C followed by 84.00 mm at room temperature, 75.00 mm and 73.00 mm at 20°C and 30°C respectively.

The least radial growth of the pathogen was 62.00 mm at 35°C with differed significantly from the growth at different level of temperatures. Similar experiment was conducted by Ramteke and Kamble (2011) reported that growth of *Fusarium solani* was

optimum at 25°C and no growth was observed at 5°C and 40°C. In the present investigation, maximum growth (87.00mm) and sporulation was recorded at 25°C followed by room temperature (84.00mm) and 20°C (75.00mm). The lowest growth was recorded at 35°C (62.00mm).

Somu and Thammaiah (2015) reported a temperature of 25°C as the optimum for growth and sporulation of *Fusarium oxysporum* f. sp. *cubense*.

Mycelial radial growth and sporulation of *F. oxysporum* was maximum at 25°C after seven days of inoculation, which was reduced drastically below 15°C and recorded zero growth at 40°C (Naik *et al.*, 2010). Mycelial radial growth and sporulation of *F. oxysporum* was maximum for all the isolates at 25°C after seven days of inoculation, which was reduced drastically below 15°C and above 35°C. No growth and sporulation was observed at 5 °C temperature for all the isolates (Nath *et al.*, 2017).

Farooq *et al.*, (2005) who observed that temperature of 25°C and 30°C were the best for *Fusarium oxysporum* f. sp. *ciceri* were it has attained maximum growth.

The effect of temperature on *Fusarium oxysporum* f. sp. *spinaciae*, revealed that radial growth and spore germination was maximum at 25°C followed by 15°C (Bhale, 2012). Mohammed *et al.*, (2016) who observed that the growth of *Fusarium oxysporum* was maximum (84.00 mm) at 25°C followed by 30°C.

In the present investigation, maximum sporulation was recorded when the pathogen inoculated plates were incubated at room temperature, 20, 25 and 30°C temperature. However, moderate sporulation was recorded at 35°C.

Effect of light on the growth and sporulation of *Fusarium oxysporum* f. sp. *melonis*

The results were presented in Table 2, Figure 2 and Plate 2. At 4th days of incubation, the growth of the fungus was maximum of 40.00 mm in continuous dark followed by control (38.90 mm) and continuous light (36.40 mm).

While at 6th days of incubation, the maximum growth was recorded in continuous dark (46.50 mm) followed by continuous light (41.70 mm), control (41.60 mm) and it was least in alternate light and dark (39.30 mm).

At 8th days of incubation, the maximum growth (56.60 mm) was recorded in continuous dark followed by control (54.60 mm) and continuous light (50.80 mm).

At 10th days after incubation, the growth of the fungus was maximum in continuous dark (62.50 mm) followed by control (60.3 mm) and 59.50 mm in continuous light.

The minimum growth of the fungus (50.4 mm) was recorded in 12 hours dark and 12 hours light condition. Heavy sporulation was recorded when culture was exposed to continuous dark, continuous light and control conditions. Moderate sporulation was noticed when culture was exposed to 12 hours light and 12 hours darkness.

Similar observations were recorded by Ramteke and Kamble (2011) the growth *Fusarium solani* was reduced under different light spectra when compared to darkness.

Resistant isolate had higher growth rate as compared to sensitive isolate. Bhale (2012) observed that the continuous light and white light were found ideal for maximum radial growth and spore germination of *F. oxysporum*.

Table.1 Effect of temperature on growth and sporulation of *Fusarium oxysporum* f. sp. *melonis* Mysore isolate-II

Temperature (°C)	Mean colony diameter(mm)					Sporulation at 12 days
	4 th day	6 th day	8 th day	10 th day	12 th day	
Room temp	21.00	44.00	71.00	82.00	84.00	++++
20	21.00	32.00	51.00	69.00	75.00	++++
25	24.00	40.00	55.00	71.00	87.00	++++
30	12.00	20.00	27.00	46.00	73.00	++++
35	7.00	15.00	21.00	48.00	62.00	+++
SEm±	0.41	0.44	0.31	0.77	1.53	
CD @1%	1.68	1.78	1.27	3.12	6.15	

+ = 1-25 conidia per microscopic field ++ = 25-50 conidia per microscopic field
 +++ = 50-75 conidia per microscopic field ++++ = >75 conidia per microscopic field

Table.2 Effect of light and darkness on the growth and sporulation of *Fusarium oxysporum* f. sp. *melonis* Mysore isolate-II

Treatment	Mean colony diameter(mm)				Sporulation at 10 days
	4 th day	6 th day	8 th day	10 th day	
Continuous light	36.40	41.70	50.80	59.50	++++
Continuous dark	40.00	46.50	56.60	62.50	++++
12 hours dark and 12 hours light	33.40	39.30	44.40	50.40	+++
Control	38.90	41.60	54.60	60.30	++++
SEm±	1.23	0.55	1.06	0.99	
CD @ 1%	5.11	2.30	4.38	4.11	

+ = 1-25 conidia per microscopic field ++ = 25-50 conidia per microscopic field
 +++ = 50-75 conidia per microscopic field ++++ = >75 conidia per microscopic field

Table.3 Effect of pH on growth of *Fusarium oxysporum* f. sp. *melonis* isolate Mysore-II was studied on Potato dextrose broth

pH	Mean dry weight of mycelium (mg)
4.0	271.80 (16.47)
5.0	395.50 (19.86)
6.0	300.33 (17.32)
7.0	244.80 (15.64)
8.0	230.63 (15.18)
9.0	209.50 (14.47)
SEm±	0.37
CD @1%	1.60

*Figures in the parenthesis are the square root transformed values.

Plate.1 Effect of temperature on growth and sporulation of *Fusarium oxysporum* f. sp. *Melonis*



Plate.2 Effect of light and darkness on growth of *Fusarium oxysporum* f. sp. *melonis* Mysore isolate-II

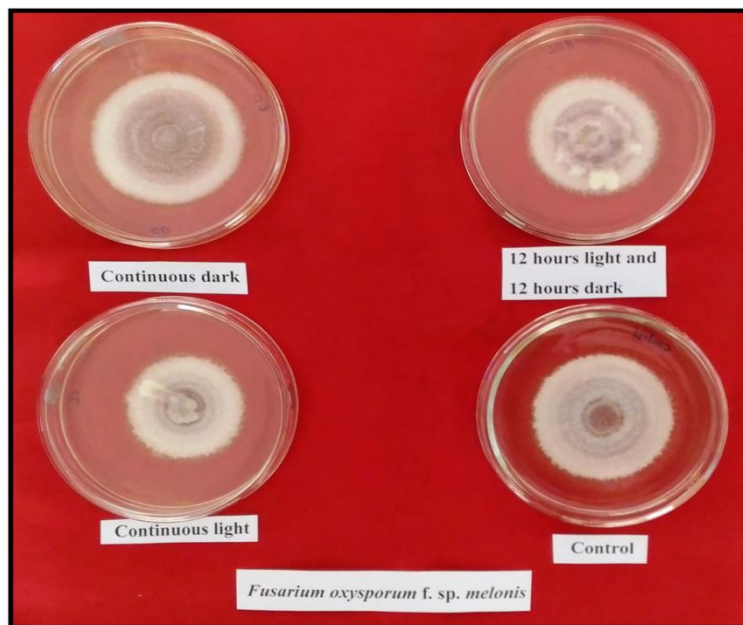


Plate.3 Effect of different pH levels on growth of *Fusarium oxysporum* f. sp. *Melonis*



Fig.1 Effect of temperature on growth of *Fusarium oxysporum* f. sp. *melonis* Mysore isolate-II

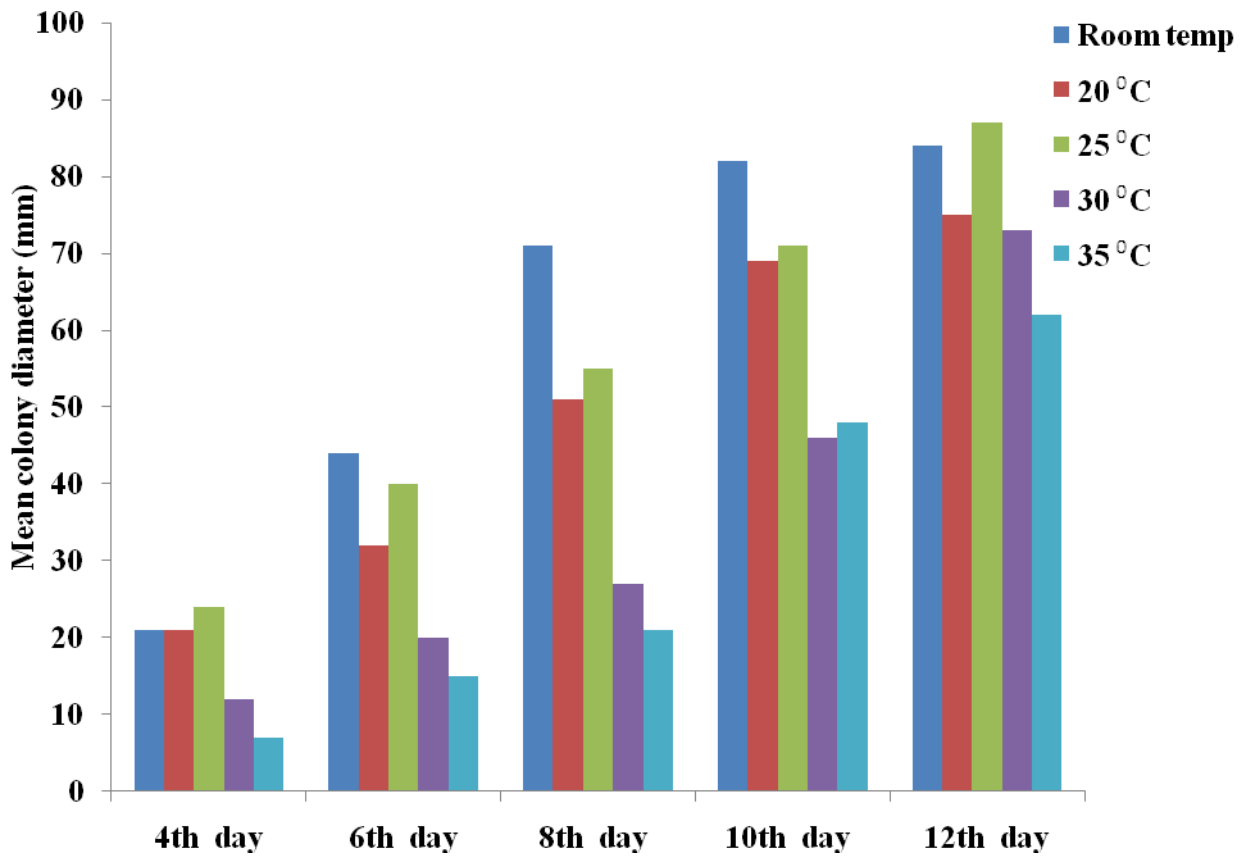


Fig.2 Effect of light and darkness on the growth of *Fusarium oxysporum* f. sp. *melonis* Mysore isolate-II

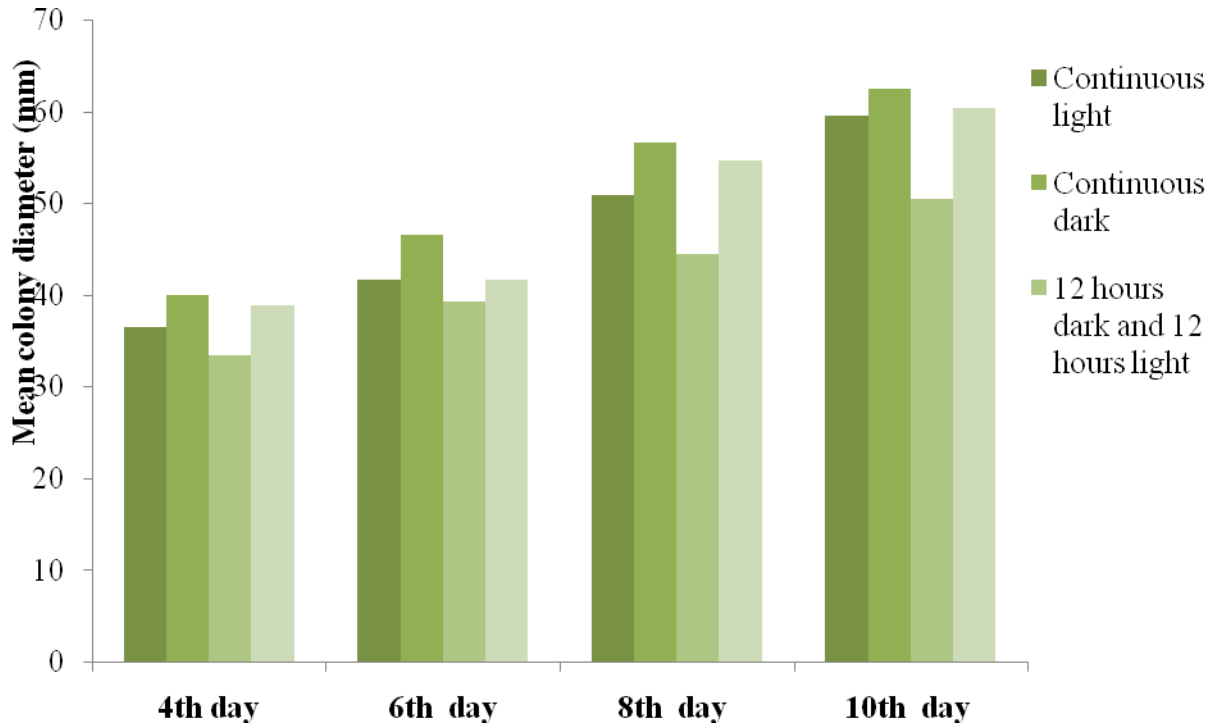
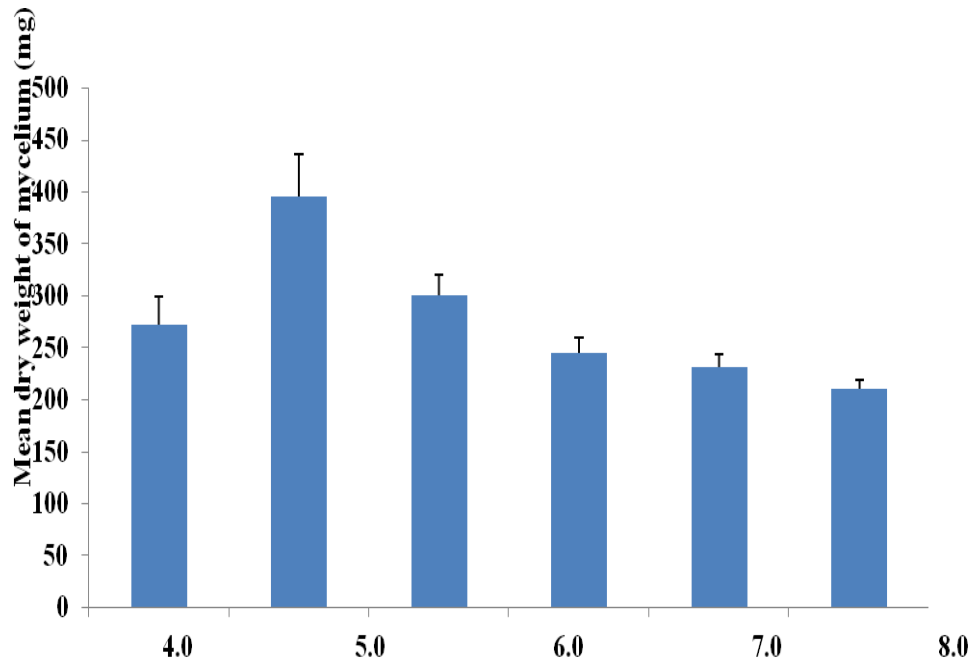


Fig.3 Dry weight of *Fusarium oxysporum* f. sp. *Melonis* Mysore isolate-II at different pH levels in potato dextrose broth



Effect of hydrogen ion concentration (pH) on the growth and sporulation of *Fusarium oxysporum* f. sp. *melonis* isolate Mysore-II

An experiment was conducted to find out the effect of different levels of pH on the growth of *Fusarium oxysporum* f. sp. *melonis*. Isolate of *Fusarium oxysporum* f. sp. *melonis* was incubated at 26±1°C for 10 days maintained at different pH of 4.0, 5.0, 6.0, 7.0, 8.0 and 9.0. The results revealed that maximum dry weight of mycelium was recorded in pH 5.0 (395.50 mg) followed by pH 6.0 (300.33 mg), 4.0 (271.80 mg) and minimum dry weight of mycelium was recorded in pH 9.0 (209.50 mg). The mycelial dry weight was recorded and presented in Table 3, Figure 3 and Plate 3.

The fungi generally utilize substrates in the form of solution only if the reaction of solution is conducive to fungal growth and metabolism. This shows importance of hydrogen ion concentration for the better fungal growth. The isolates of *Fusarium oxysporum* f. sp. *melonis* could grow under a wide range of hydrogen ion concentrations from 4.0 to 9.0. The present findings are in agreement with the respect of Anusuya and Ananthan (2016) reported that the fungus *Fusarium oxysporum* f. sp. *phaseoli* grow well at a pH of 4.0 and 5.0.

The optimum pH level for growth and sporulation of the fungus *Fusarium oxysporum* f. sp. *ciceri* was maximum at pH 6.0. Nath *et al.*, (2017). Naik *et al.*, (2010) observed that the most suitable pH for growth of *F. oxysporum* f. sp. *vanillae* was 5.0 and 6.0. pH of 6.0 was found optimum for growth and sporulation of *Fusarium oxysporum* f. sp. *lentis*. Sporulation of chlamydospore formation was found best in the pH level of 4.0. Further increases in the pH level show retarding effect on growth and sporulation (Jaruhar and Prasad, 2011). Farooq *et al.*, (2005) reported that maximum growth of

Fusarium oxysporum f. sp. *ciceri* was at pH 7. The dry mycelial weight was recorded at 5.0 pH followed by 6.0 and 4.0.

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