Egypt. J. Appl. Agric. Res. (*NRC*), Vol. 1, No.2, pp.167-181 (2008)

Morphological, Physiological and Pathological Investigation on *Fusarium oxysporum* f.sp. *sesami*

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IN VITRO. morphological and physiological characters of *Fusarium oxysporum* f.sp. *sesami* i.e. linear growth, sporulation and pigmentation were studied on different media, different degrees of temperature , relative humidity (R.H.) and acidity values(pH). Also,pathological potential of fungal was studied on sesame plants in relation with fungal morphological and physiological characters. Potato dextrose agar (PDA) was the best medium for *F. oxysporum* f. sp. *sesami* linear growth, chlamydospores formation and pigment production, while yeast extract sucrose agar (YES) medium was the best medium for amount of growth, conidiospores and chlamydospores formation. Growth of *F. oxyspoum* f. sp. *sesami* increased as temperature degrees increased to give maximum linear growth at 30 ºC. Twenty five centigrade was the best temperature for mycelium weight, conidiospores and chlamydospores formation. Increasing relative humidity were increased fungal linear growth, chlamydospores formation and pigmentation till 100% (R.H). Meanwhile, 74% (R.H.) was the best for conidiospores production on Czapek's agar medium. Maximum fungal linear growth was found at acidity (pH 5.5), while, maximum of mycelium weight and sporulation recorded at (pH 5.2). Meanwhile chlamydospores formation highly production at (pH, 6.4).

No correlation between pathogenicity test of *F. oxysporum* f.sp. *sesami*, pigment production and amount of fungal growth was observed.

Keywords: Sesame, Wilt, *Fusarium oxysporum* f.sp. *sesame*, Temperature, Relative humidity and acidity.

Sesame plants are subject to attack by the wilt fungus *Fusarium oxysporum* f.sp. *sesami* . In USA (Armstrong & Armstrong, 1950, Castellani, 1950 and Rivers *et al.*, 1965) in India (Malaguti, 1961, Buldeo & Rane, 1978, Virk & Gemawat 1982 and Kavak & Boydak, 2006) in Iran (Banihashemi, 1982) in China (Lili, 1988) in Korea (Kang *et al.*, 1985, Shin *et al.*, 1987 and Paik *et al.*, 1988) in Egypt (Abd El-Ghany *et al.*, 1970, Seoud *et al.*, 1982 ; El-Deeb *et al.*, 1985, Zahra, 1990, Elewa *et al.*, 1994, Khalifa, 1997, Ziedan, 1998, Sahab *et al.*, 2001, Mostafa, *et al.*, 2003 and Abou Sereih *et al.*, 2007). *Fusarium oxysporum* f. *niveum* grew most rapidly on PDA media between 24°C and 24°C and 32°C, minimum temperature being above 8°C and its maximum temperature above 35°C. The fungus grew rapidly on a wide range of acid and alkaline media pH 3 to 8.4 (Porter, 1928 and Raghuwanshi & Deokar, 1993a,b). Formae specials of

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Fusarium oxysporum Schlect. Produce three types of a sexual spores, macroconidia are produced most often on branched conidiophores in sporodochia on the surface of infected plants parts or on artificial culture media especially when first isolated. *Fusarium oxysporum* f. *batatas* produced greater proportion of macroconidia on potato dextrose agar (PDA) under continuous fluorescent illumination than with diffuse light or darkness. *Fusarium* species *i.e F.subglutinans, F.anthophilum, F.globosum* and *F.thapisnum* were able formation microconidia on carnation leaf agar than synthetic low nutrient agar (Burgess *et al.*, 2003 and Hus & Lockwood, 1973) stated that chlamydospores of Fusarium are produced when environment is deficient .

Soil and air temperature were directly effect on fungal growth and sporulation (Raghuwuanshi and Deokar, 1993a) found that a good growth and sporulation of *Fusarium oxysporum* f.sp. *sesami* at 27 C and pH 6.5-7.0. Cortes *et al.*, 2007 found that optimum soil temperature, maximum Fusarium wilt of chickpea developed by *F.oxysporum* f.sp. *cicers* races 0 and 5. Also, several studies confirmed that no correlation between pigmentation , morphological characters and pathogenicity test of *Fusarium oxysporum* f.sp. *pisidi* (Edward , 1960) *Fusarium oxysporum* f.sp. *sesami* (Raghuwanshi and Deokar, 1993a & b) *Fusarium oxysporum* f.sp. *cumini* (Champawat and Pathak, 1991). Meanwhile , (Ruppel, 1991) reported that isolates of *Fusarium oxysporum* from sugar beet were varied in growth , pigmentation and conidial production. Most pathogenic isolates were produced pigment very pale, salmon tinged or pinkish white on aerial growth and pale salmon to pale yellow under surface.(Ziedan, 1998) found that a virulent isolate of ***Fusarium oxysporum*** **f.sp. *sesami* had got a great ability for production chlamydospores on Richard's and conidiospore on (YES) media than less aggressive ones had'nt got it . Also , he found no correlation between pigment production on different media and pathogenic activity of *Fusarium oxysporum* f.sp. *sesami* isolates.**

This investigation aimed to study effect stress of different media, temperature, relative humidity and acidity on fungal morphology physiology and pathogenicity test.

Material and Methods

Fusarium oxysporum f.sp. sesami

Ten isolates of *Fusarium oxysporum* f.sp. *sesame* were obtained from Plant Pathology Dept. National Research Centre which previously isolated from El-Beheira, El-Sharkeia , Giza, Kafr El-Sheikh and El-Fayoum Governorates , Egypt in previous work (Ziedan , 1998).

Effect of different media

The effect of different media on growth of *Fusarium oxysporum* f. sp. *sesami* was studied on solid and liquid media, *i.e.*, Richard's, Czapek's, glucose peptone, yeast extract sucrose and potato dextrose agar (PDA).

Inoculum preparetion

Spore suspension ($1x10^5$ /ml) of *Fusarium oxysporum* f. sp.*sesami* was prepared and mixed with PDA agar medium at the rate of (1 ml/200 ml) and then poured in sterilized Petri-dishes. Plates were incubated at 27±2C for 5-7 days.

Growth on solid media

Equal amounts (10 ml) of tested media were poured in Petri-dishes (9 cm-diameter). After solidification, a disc (4 mm-diameter) from the fungal culture was set in the center part of each plate. Plates were then incubated at 27±2° C, Two colonies diameter of each dish was measured daily and the average diameters were calculated for each medium, A set of five dishes were used for each medium.

Amount of mycelia growth

One hundred ml of liquid sterilized medium were placed in every conical flask (250 ml). A set of 5 flasks were used for each particular treatment. All flasks were inoculated with discs (4 mm-diameter) of fungal growth and incubated at 27±2°C for 10 or 14 days. Fungal mats were collected on previously weighed filter papers, washed by distilled water, dried at 70°C for 24 hr and weighed.

Spore production

A disc (1 cm-diameter) of fungal growth on different media was taken 1 cm distance from the center of each plate, from 10 days old cultures each disc was put in 10 ml distilled water. The spores were smoothly removed and counted by the mean of conidial Hemacytometer. The average number was calculated per cm of fungal growth. Moreover, chlamydospores formation were determined on 20 days old cultures. The method described by (Ziedan, 1993 and Chopra & Curl, 1968). Chlamydospores were also counted in one cm distance from the central disc as follows : **** = very abundant , *** = abundant , ** = few and - = none.

Pigment production

A scale of pigmentation after (Ziedan, 1993) was used to describe the degree of pigmentation in 10 days old on solid culture. Pigmentation degree as follows: - = no pigment produced, + = pigment covered 25% of culture, ++ = pigment covered 50% of culture, +++ = Pigment covered 75% of culture and ++++ = Pigment covered 100% of culture.

Temperature

Czapek's liquid and solid media were used in this study. Petri-dishes (9 cm-diameter) containing Czapek's agar medium and conical flasks (250 ml) contained 100 ml of Czapek's liquid medium were inoculated with discs of *Fusarium oxysporum* f. sp. *sesami* as mentioned before and then incubated at 10, 15, 20, 25, 30, 35 and 40°C, The linear growth on solid medium and sporulation capacity were determined. A set of five replicates were used. Rate of

chlamydospore formation and degree of pigmentation were also determined. The liquid medium was used for determination of the weight of fungal growth .

Air relative humidity

Czapek' s agar medium was used for this study by using different volumes of sulfuric acid and distilled water according to the method devised by (Stevens, 1916). The approximate percentage humidity in each was as follows:

200 ml distilled water + 0 ml sulfuric acid = 100% humidity
180 ml distilled water + 20 ml sulfuric acid = 92.3% humidity
160 ml distilled water + 40 ml sulfuric acid = 74.6% humidity
140 ml distilled water + 60 ml sulfuric acid = 49.0% humidity
120 ml distilled water + 80 ml sulfuric acid = 27.0% humidity

Inoculated Petri-dishes 9 cm-diameter with discs of fungal growth of *F.oxysporum* f. sp *sesami* were turned up side down and ten ml of the prepared solution were poured in the lid of every dish and incubated at 27±2°C. Linear growth, spores production and pigmentation were estimated as mentioned before. Five replicates were used for each treatment.

Effect of acidity (pH values)

Czapek's broth and solid media were used for this study using the method described by (Sahab, 1970) . Medium was buffered by using 11.8g of succinic acid and 35.8 g of sodium monohydrogen phosphate ($Na_2HPO_4 12\ H_2O$) per one liter of medium. The medium was adjusted to different pH values by adding different amounts of (4N) hydrochloric acid or (4N) sodium hydroxide. A set of five conical flasks (250 ml) was prepared for each treatment. Four flasks of each set were inoculated and the fifth was used for determining the pH value by electric method. The rate of growth, conidiospores, chlamydospores and pigment production were measured on solid medium by methods described before. Amount of growth on liquid media was recorded after 15 days incubation at 27±2°C.

Pathogenicity test

Pathogenicity test has been carried out according to the slant board culture technique . Ten isolates of *Fusarium oxysporum* f.sp *sesami* were tested their pathogenic act activity on sesame seedling cultured in Hogland solution (Roberts and Kraft , 1971). Sesame seedlings 30 days old were aseptically placed for each tube at the rate of two sesame (Giza.25 Cv.) seedlings. Roots just immersed in the spore suspension and the remained in opening of tubes covered by a cotton plug. Tubes were placed on laboratory bench under fluorescent light as 15 hr/day for 4 days then transferred to bottles contained Hogland's solution. Wilt symptoms were estimated 30 days after inoculation. Disease severity was measured according to (Ziedan, 1993) on shoot system as follows :

0=healthy plant , 1=chlorosis only , 2= 1/3 plant wilted , 3=2/3 plant wilted , 4=whole plant wilted and 5=dead plant. Meanwhile, diseases severity on root system was measured as follows :

0=No color , 1=slight brown, 2=brown , 3=dark brown, 4=very dark brown.

Media used

1- Potato dextrose agar (PDA) (A.T.C.C., 1984) (g./L) potato peeled and diced 200.0 g. , D.glucose 20,
2- Czapek's (A.T.C.C., 1984) sucrose , 30 g. , sodium nitrate, 2.0 g. $MgSO_4$.$7H_2O$, 0.5 g. , KH_2PO_4 , 1.0 $FeSO_4$.$7H_2O$, 0.01g. and
3- *Yeast extract sucrose* (YES) Davis *et al* (1966) g./L yeast extract, 20.0g. sucrose 20.0 g.,
4- Richard's and A.T.C.C., 1984) sucrose 50.0 g KNO_3 , 10.0 , KH_2PO_4,15.0 , $MgSO_4$, 2.0 , ferric chloride 0.01 .
5- glucose peptone (Allen, 1961) glucose ,10.0 peptone , 5.0; K_2HPO_4 , 1.0, $MgSO_4$ $7H_2O$, 0.5 .

Statistical analysis

Data obtained were analyzied according to (Sendecor and Cochoran, 1980).

Results

Effect of different media

Fusarium oxysporum f.sp. *sesami* was grown on five different solid and broth media . Results were shown in Table 1. It is revealed that PDA medium followed by Czapek's and Richard's media increased fungal linear growth. However, fungal gave a maximum weight of mycelium growth on yeast extract sucrose broth (YES) followed by Richard's broth media. Also, the best medium for conidiospores and chlamydospores formation was (YES) followed by PDA media. Potato dextrose agar medium was also the best media for pigment production followed by Richard's medium.

TABLE 1. Effect of different media on growth of *F. oxysporum* f.sp. *sesami*.

Media	Colony	Dry Weight (mg)	Sporulation		Pigment produced on solid media
			Conidiospores (No x 10^5 /cm^2)	Chlamydospore	
PDA	84.0 a	270.0 d	22.8 b	***	+++
YES	68.4 c	1220.0a	32.6 a	***	+
Glucose-peptone	71.2 c	230.0 e	15.8 d	**	+
Czapek's	77.1 b	398.0 c	6.6 e	**	+
Richard's	75.6 b	573.0 b	19.4 c	**	++

-Each figure represent an average of 5 replicates at 27±2°C for 6 days (solid) or 10 days (liquid) media

-Pigmentation degree as follows: - = no pigment produced, + = pigment covered 25% of culture, ++ = pigment covered 50% of culture, +++ = Pigment covered 75% of culture and ++++ = Pigment covered 100% of culture.

-Chlamydospores were also counted in one cm distance from the central disc as follows : **** = very abundant , *** = abundant , ** = few and - = none

-In each column, values followed by the same letters do not differ significantly ($P \geq 0.05$) according to Duncan's multiple range test.

Effect of temperature degrees

Fusarium oxysporum f. sp. *sesami* was incubated at seven different degrees of temperatures, *i.e.*, 10, 15, 20, 25, 30, 35 and 40°C on solid and liquid Czapek's medium. Results in Table 2 reveal that growth of *F. oxysporum* significantly increased as temperature degree increased to give maximum linear growth at 30°C , for mycelium dry weight at 25°C. Raising the temperature to 35°C caused a decrease in linear growth and mycelium dry weight. Spore production followed the same trend as in dry weight as the maximum conidiospores was recorded at 25 C, while chlamydospores were produced at a range of temperature between 20 and 25°C. No growth or spore formation were detected on the culture media at degrees of 10 or 40°C. However, the fungal produced pigment at a wide range of temperatures (15 to 35°C) .

TABLE 2. Effect of different temperatures on *F. oxysporum* f. sp. *sesami*.

Temp ±1°C	Colony diameter (mm)	Dry weight (mg)	Sporulation		Pigment produced on solid medium
			Conidiospores (Nox $10^5/cm^2$)	Chlamydospores	
10	00.0 f	00.0 f	0.00 d	-	-
15	35.5 e	473 e	1.95 c	-	++++
20	62.2 d	603 c	2.60 bc	***	++++
25	75.3 c	750 a	7.26 a	***	++++
30	84.0 a	628 b	2.95 b	**	++++
35	77.6 b	570 d	1.82 c	*	++++
40	00.0 f	00.0 f	0.00 d	-	-

Each figure represented an average data of 5 replicates for 6 days on solid and 10 days on liquid Czapek' s medium

-Pigmentation degree as follows: - = no pigment produced, + = pigment covered 25% of culture, ++ = pigment covered 50% of culture, +++ = Pigment covered 75% of culture and ++++ = Pigment covered 100% of culture.

-Chlamydospores were also counted in one cm distance from the central disc as follows : **** = very abundant , *** = abundant , ** = few and - = none

-In each column, values followed by the same letters do not differ significantly ($P \geq 0.05$) according to Duncan's multiple range test

Effect of relative humidity

Data in Table 3 indicated that *F. oxysporum* f. sp. *sesami* grows at a wide range of air relative humidity (R.H.) .Growth was increased as the R.H. increased up to 100%. Conidiospores production reaching its maximum at 74% R.H, then decreased with significant differences between all treatments. However at 100% R.H, the fungus produced the highest amount of chlamydospores and decreased at humidity values less than 100% till 74%. No detection of chlamydospores was found at values of 49 and 27% R.H. Meanwhile, the high relative humidity was increased pigment production, by increased at maximum degrees between 92 and 100% R.H.

TABLE 3. Effect of relative humidity (RH) on the mycelial growth, sporulation and pigment production on media by *F.oxysporum* f. sp. *sesami*.

Relative humidity %	Colony diameter (mm)	Sporulation		Pigment produced on solid medium
		Conidiospores (Nox 10^5 /cm2)	Chlamydospores	
100	75.1 a	7.86 d	***	++++
92	66.2 b	11.90 b	**	++++
74	59.3 c	17.90 a	*	+++
49	50. 0 d	9.45 c	-	++
27	33.0 e	3.39 e	-	+

- Each figure represented an average data of 5 replicates on solid Czapek' s medium incubated at 27±2°C for 10 days.
- Pigmentation degree as follows: - = no pigment produced, + = pigment covered 25% of culture, ++ = pigment covered 50% of culture, +++ = Pigment covered 75% of culture and ++++ = Pigment covered 100% of culture.
- Chlamydospores were also counted in one cm distance from the central disc as follows : **** = very abundant , *** = abundant , ** = few and - = none
- In each column, values followed by the same letters do not differ significantly ($P \geq 0.05$) according to Duncan's multiple range test.

Effect of acidity (pH values)

Buffered Czapek's medium was used in this study. A wide range of pH values from 4.2 to 8.2 were tried. Data in Table 4 *F. oxysporum* f. sp. *sesami* grows at a wide pH range from 4.2 to 8.2 with an optimum at 5.5 then the growth rate was decreased in more alkaline or more acidic media. However, the fungus gave its maximum dry weight of mycelium on liquid media at pH 5.2 and decreased in more alkaline or more acidic media. Maximum average of conidiospores was obtained at 5.2 pH, whereas chlamydospores formation was remarkedly increased at 6.4. under study *F.oxysporum* f. sp. *sesami* isolate tested was produced pigments at a wide range of pH from 4.2 to 8.2.

Pathological test of F.oxysporum f. sp. Sesame isolates

Data in Table 5 indicate that tested isolates of *F.oxysporum* f. sp. *sesami* varied for induce wilt diseases of sesame plants . Isolates (No. 4 & No. 9) were recorded highly amount of fungal mycelia dry weight meanwhile No. 4 isolate was failur to produce pigmentation but isolate (No.9) produced pigment at moderate rate. On the other hand isolates (No.1 and 7) showed highly produce pigment and moderatly value of fungal dry weight. Furthermore , isolates (No. 2, 5 and 6) moderately produced pigment and dry weight. No correlation was found between pathogenic activity of *Fusarium oxysporum* f. sp. *sesami* isolates, amount of growth and pigment production.

TABLE 4. Effect of different acidity (pH) values on *F. oxysporum* f.sp. *Sesami.*

PH Values	Colony diameter (mm)	Dry weight (m/g)	Sporulation		Pigment produced on solid medium
			Conidiospores (Noxl0^5 /cm^2)	Chlamydo-spores	
4.2	52.0 i	640 f	8.22 ed	*	+
4.5	61.0 g	790 d	8.91 ed	**	+++
4.8	G5.0 e	940 bc	14.7 b	**	+++
5.2	63.0 f	1100 a	33.2 a	**	+++
5,5	73.0 b	1000 b	12.0 c	**	++
6.0	71.0 c	880 c	9.6 d	**	++
6.4	67.0 d	770 d	8.5 ed	****	+
6.7	57. 0 h	680 ef	7.4 e	**	-
7.5	45. 0 j	450 g	5.2 f	*	+
8.2	25.0 k	240 h	5.0 f	-	+

-Each figure represents average of 5 replicates incubated at 27± 2°C for 6 days (solid) or 14 days (liquid) Czapek's medium

-Pigmentation degree as follows: - = no pigment produced, + = pigment covered 25% of culture, ++ = pigment covered 50% of culture, +++ = Pigment covered 75% of culture and ++++ = Pigment covered 100% of culture.

-Chlamydospores were also counted in one cm distance from the central disc as follows : **** = very abundant , *** = abundant , ** = few and - = none

-In each column, values followed by the same letters do not differ significantly ($P \geq 0.05$) according to Duncan's multiple range test.

TABLE 5. Wilt disease incidence of sesame and relation with morphological and physiological of *Fusarium oxysporum* f. sp. *sesami* isolates.

Isolates of *F. oxysporum* f. sp. *sesami*	Pigmentation degree on PDA medium **	Dry weight (nig)	Disease severity	
			Shoot	Root *
El-Behira (1)	++++	460	0.8	0.6
El-Behira (2)	+++	435	1.2	1.2
El-Behira (3)	+	440	1.0	0.8
El-Sharkeia (4)	-	650	0.6	0.7
El-Sharkeia (5)	+++	485	2.3	2.1
El-Giza (6)	+++	485	1 .0	0.5
Kafr El-Sheikh (7)	++++	445	1 .1	1.3
Kafr El-Sheikh (8)	+	210	0.3	0.3
El-Fayoum (9)	++	620	0.8	1.5
El-Fayoum (10)	++	450	0.1	1.2

In Each figure, five replicates were used. Dry weight determined after 15 days on potato dextrose liquid medium incubated at 27±2°C

* The intensity of root browning was graded as follows;

0 = No color. 1 = Slight brown, 2 = Brown.

3 =: Dark brown 4 = Very dark brown.

Discussion

In Egypt sesame plant is suffering from many pathogenic agents, among very serious diseases, sesame wilt caused by *Fusarium oxysporum* f. sp. *sesami* (Abd El-Ghany *et al.*, 1970, El-Deeb *et al.*, 1985, Zahra , 1990, Elewa *et al.*, 1994, Ziedan, 1998, Sahab *et al.*, 2001, Mostafa *et al.*, 2003 and Abou Sereih *et al.*, 2007).

The effect of some physiological factors on fungal growth, sporulation , and pigment production were studied. The best linear growth occurred on Potato dextrose agar (PDA) followed by Czapek's media. However, yeast extract sucrose (YES) gave the best amount of growth and best sporulation capacity. Meanwhile, chlamydospore formation was frequently observed on PDA and YES media after 20 days from incubation. This later result indicates that starvation of the fungal may not be the only factor of chlamydospore formation (Hus & Lockwood, 1973 and Hibar *et al.*, 2006). In addition (Ziedan , 1998) found that pathogenic isolates of *Fusarium oxysporum* f.sp. *sesami* were able to produce chlamydospores on Richard's medium, meanwhile a virulent isolates failed to produce it chlamydospores results may explain the surviving of pathogenic isolates of *Fusarium oxysporum* in soil for very long time.

Soil and air temperature plays an important role in diseases incidence of plants . sesame plants were found in the field, infection mostly during warm period of the growth stages (Kang, *et al.*,1985) . In this respect (Raghuwanshi and Deokar , 1993a) found that *Fusarium oxysporum* f.sp. *sesami* had shown luxuriant radial growth and maximum conidio sporulation at 27°C, meanwhile 40°C unfavorable for growth and sporulation. Study of temperature effect showed that the optimum range for fungal growth ranged between 25-30°C. The same trend of results was obtained by (Buldeo and Rane 1978). Sporulation of the fungus was abundant at 25°C, obviously maximum chlamydospore formation was obtained at 20 and 25°C. However, the higher and the lower temperature degrees had a bad effect on this type of spores. These results are in harmony with those obtained by (Neal, 1972) of *F.oxysporum* f.sp. *cicers* on chickpea (Landa *et al.*, 2006 and Cortes *et al.*, 2007) and *F.oxysporum* f.sp. *radicis-lycopersici* on tomato (Hibar *et al.*, 2006).

The wilt disease index reached its peak on plants cultivated in the disease incidence was highly detected on plants sown at the dates of 15 May and 1st of June and decreased after those dates. In this respect, Zahra (1990) reported that sowing sesame at 15 April or 1s May caused high wilt disease incidence. While, sowing plant at 15 May or 1s June reduced the disease incidence. In Korea,

Kang *et al.* (1985) studied the incidence of Fusarium wilt of sesame in relation to air temperature. They concluded that air temperature during sesame growth is one of the most important factor affecting the incidence of Fusarium wilt This suggested that sesame crop, which is of tropical origin, has been predisposed to Fusarium wilt, when the plants were exposed to low temperature of 16 to 20°C. These results was similar to result of chickpea cultivars by *F.oxysporum* f.sp. *cicers* races 0 and 5 (Cortes *et al.*, 2007) Mositure stress and high temperature favorus development of charcoal stalk rot in grain sorghum and pathogen (*Macrophomina phaseolina*) survives sclerotia in soil and crop residues (Edmunds, 1994).

In this study of the optimum (R.H). for mycelial growth of *Fusarium oxysporum* f. sp. *sesami* was found at 100% meanwhile, conidial formation was abundant at 75% (R.H). Chlamydospores formation decreased by decreasing (R.H). Similar result was found with *F. oxysporum* f. sp. *vasinfectum* on fungal growth, conidial production and chlamydospores formation. (Mostafa & Naim, 1952 and Sahab, 1970).

Soil acidity (pH) plays an important role for incidence wilt disease of sesame and its development (Raghuwanshi and Deokar, 1993b) they found that *Fusarium oxysporum* f.sp. *sesami* well grow well between (pH) 6.5-7.5 and higher growth and sporulation was observed at (pH) 6.0 and 7.0 followed by 7.5 and 8.0 respectively. Meanwhile (Buldeo & Rane, 1978 and Virk & Gemawat, 1982) reported that *Fusarium oxysporum* f.sp. *sesami* grow well and sporulation between (pH) 5.5-8.5 and 6.5-7.0 respectively. Data also indicated that the fungal was grow well on media at (pH values) ranged from 4.5 to 6.7. Maximal spore production was at pH 5.2. Such results are in agreement with (Naim and Abd El-Salam, 1966) on *Fusarium oxysporum* f. sp. *vasinfectum* and *F. oxysporum* f.*fabae* (Sahab, 1970). On the other hand, chlamydospore formation was highly increased at pH 6.4, whereas the alkaline medium (pH 8.2) completely suppressed this type of spore production. Such effect was also clear on mycelial linear growth.

Pathogenicity test of different isolates of *F. oxyspoum* f. sp. *sesami* was carried out by liquid culture method (Ruppel, 1991). No correlation was found between pathogenicity test of fungal isolates on sesame seedlings and pigment production or fungal growth on nutrition media. These results are in agreement with the results obtained by (Edward, 1960) on Fusarium wilt of guava, (Virk and Gemawat, 1982) on Fusarium wilt of sesame and (Champawat and Pathak, 1991) on Fusarium wilt of *cumini.*

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(*Received* 23/4/2008;
accepted 31/ 8/2008)

دراسات مورفولوجية وفسيولوجية ومرضية على الفطر *Fusarium oxysporum* f.sp. *sesami* المسبب لمرض ذبول السمسم

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فى ضوء الاهتمامات الدولية بدراسة التغيرات المناخية وعلاقتها بالبيئة والانسان هدفت الدراسة الى دراسة تأثير درجات الحرارة والرطوبة والحموضة على خصائص الفطر المسبب لمرض ذبول السمسم المورفولوجية والفسيولوجية والمرضية من خلال بعض الدراسات المعملية ولقد تبين :

١- بيئة البطاطس دكستروز الآجار هى البيئة المفضلة لنمو الفطر *Fusarium oxysporum* f.sp. *sesami* وأكثرها تنشيطا لتكوين الجراثيم الكلاميدية وأفضلها وسطا لانتاج الصبغات- فى حين كانت بيئة مستخلص الخميرة والسكروز (YES) هى الافضل لتقدير كمية النمو وانتاج الجراثيم الكلاميدية و الكونيدية على البيئة الصلبة.

٢- ازداد نمو الفطر بزيادة درجة الحراره لتبلغ أقصاها عند ٣٠° م فى حين ٢٥°م هى أفضل لتكوين الجراثيم الكونيدية و الكلاميدية على بيئة تشابيك وأيضا عند نمو الفطر على البيئة السائلة فى حين لم يعطى الفطر أى مظاهر للنمو على البيئات الصلبة والسائلة عند درجات الحرارة ١٠، ٤٠° م ولم يكن لهما تأثير على انتاج الصبغة .

٣- تؤدى زيادة الرطوبة الى زيادة نمو الفطر وانتاج الصبغات وتكوين الجراثيم الكلاميدية على بيئة تشابك الصلبة وتبلغ أقصاها عند ١٠٠٪ رطوبة على حين كانت ٧٤٪ رطوبة هى الافضل لتكوين الجراثيم الكونيدية.

٤- تبين أن أفضل درجات الحموضة لنمو الفطر هى ٥,٥ pH بينما كانت ٥,٢ هى الافضل لتكوين الجراثيم الكونيدية على البيئة تشابك الصلبه وكذا كمية النمو على البيئة السائلة فى حين سجلت أفضل درجات لتكوين الجراثيم الكلاميدية عند رقم حموضة ٦,٤ على بيئة تشابك الصلبة.

٥- لا توجد علاقة واضحه بين الخصائص الفسيولوجية والمورفولوجية تحت الدراسة للفطر المسبب لمرض ذبول السمسم وقدرته على إحداث مرض الذبول.