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EFFECT OF SOME RESISTANCE INDUCING AGENTS ON THE GROWTH AND CONTROL OF *MACROPHOMINA PHASEOLINA* AND *FUSARIUM OXYSPORUM* THE CAUSAL AGENTS OF CHARCOAL ROT AND WILT OF SESAME

BY

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ABSRACT

Macrophomina phaseolina and *Fusarium oxysporum* were isolated from sesame seeds by using Agar plate and blotter methods. Pathogenicity test using sesame seeds cv Giza 32 illustrated that *M. phaseolina* and *F. oxysporum* are the causal agents of charcoal rot and wilt diseases. Laboratory experiments were carried out to study the effect of 7 chemical inducers on the linear growth (LG) of *M. phaseolina* and *F. oxysporum.* Studying the effect of different concentrations of some inducing resistance agents on the linear growth (mm) of 4 isolates representing each fungus showed that the linear growth of the tested isolates was significantly suppressed by all chemical inducers *i.e.*, Potassium Chloride, Hydrogen Peroxide, Acetic Acid, Butyric Acid, Tanic Acid, Salicylic Acid and Bion, respectively. Greenhouse experiments were carried out to study the effect of some resistance inducing agents *i.e.*, 7 chemical inducers on disease incidence.

The most effective agents and concentrations for controlling pre-emergence damping-off in soil infested with *M. phaseolina* were salicylic acid & bion at 4 mM, tanic acid at 8 mM, IBA at 400 ppm and H_2O_2 & KCl at 4%, respectively. The effect of the chemical inducing agents on controlling wilt disease caused by *F. oxysporum* indicated that IAA and SA were the most effective inducers for decreasing pre-emergence damping-off, respectively, followed by Bion, IBA, KCl and H_2O_2. However, the most effective concentrations for controlling pre-emergence damping-off were IAA at 400 ppm and SA at 8 mM. The highest increase in survived plants was recorded at IAA at 400 ppm and SA at 8 mM, respectively compared to control treatment. The least effective treatments were H_2O_2 at 0.5% and Tanic acid 1 mM.

Key words: Sesame, inducing resistance compounds, *M. phaseolina, F. oxysporum*

INTRODUCTION

Sesame (*Sesamum indicum* L.) is one of the oldest cultivated plants in the world. Sesame is attacked by some economic diseases *i.e.*, root rot, wilt and damping-off. Also, seed decay is caused by several pathogens among which *M. phaseolina* and *F. oxysporum* are of great importance.These diseases have been increased tremendously during the last years (El-Barougy 1990; Gupta & Cheema, 1990; Khalifa, 1997; El-Deeb *et al.*, 1998 and El-Fiki *et al.*,2004).

Inducing resistance agents of different concentrations were investigated for their effect on the fungal growth of different plant pathogens (Datar., 1999; Orober *et al.*, 1998).

The efficacy of different inducing resistance agents was studied by earlier investigators. Shalaby & Saeed, (2000) and Shalaby *et al.*, (2001) reported the efficacy of potassium salicylate, oxalic acid and salicylic acid in controlling *M.phaseolina* on sesame plants and sunflower in greenhouse.All treatments reduced the incidence of *M. phaseolina* and increased peroxidase activity and IAA content of sesame and sunflower plants.

Shalaby and Saeed (2000) investigated the biochemical defense mechanisms against wilt disease caused by *F. oxysporum* f. sp. *sesami* following treating sesame plants with flower extract of Helichrusum plants, amino butyric acid (ABA) and KCl. They suggested that the observed increases in activity of peroxidase, polyphenoloxidase and chitinase enzymes, IAA hormone and RNA content of sesame plants may be considered as biochemical mechanisms for inducing systemic resistance in sesame plant against wilt disease. Free phenols of sesame plants may not be involved in induced resistance mechanisms against wilt.

This study was conducted to investigate the efficacy of some chemical inducers on controlling sesame diseases caused by *M. phaseolina* and *F. oxysporum* under greenhouse conditions.

MATERIALS AND METHODS

Isolation and identification of sesame seed-borne fungi:

Isolation of the causal pathogenic fungi was carried out on PDA medium by agar plate and blotter methods in Seed Pathology Dept., Plant Pathology Research Institute, ARC, Giza, Egypt. Identification of the isolated fungi was verified according to their morphological features using the descriptions of Barnett and Hunter (1998).

The developed fungi were isolated, purified using the hyphal tip and/or the single spore techniques (Hildebrand, 1938). The pure cultures were also maintained on PDA slants kept at 5 °C for further studies.

Pathogenicity tests:-

Pathogenicity of isolates of *M. phaseolina* and *F. oxysporum*, isolated from sesame seeds was tested under greenhouse conditions using seeds of sesame cv. Giza-32 planted in soil infested with the desired fungal isolate.

Plastic pots (25 cm diameter) were filled with formalin disinfested soil. Inocula were prepared by growing the desired isolate at 25°C. for two weeks on autoclaved sand sorghum medium. The prepared inoculum was added to the potted soil at the rate of 3.0% weight, mixed thoroughly with the soil, watered and left for a week. Pathogen-free sterilized sand sorghum was mixed at the same rate with the potted soil to serve as control treatment. Pots were planted with apparently healthy surface sterilized sesame seeds of cv. Giza-32 at the rate of ten seeds per pot. Three replicated pots were used for each particular treatment. Percentage of pre-emergence damping-off was calculated 15 days after sowing, while (%) post-emergence damping-off and (%) healthy survived seedlings were also determined after 45 days according to the following formula:

$$(\%)\ \text{Pre-emergence} = \frac{\textit{Total No. of ungerminated seeds}}{\textit{Total No. of planted seeds}} x 100$$

$$(\%)\ \text{Post-emergence} = \frac{\textit{Total No. of rotted seedlings}}{\textit{Total No. of planteed seeds}} x\ 100$$

$$(\%)\ \text{Survived seedlings} = \frac{\textit{Total No. of survived seedlings}}{\textit{Total No. of seeds}} x\ 100$$

90 days after sowing, percentages of healthy standing sesame plants were calculated

Effect of different inducing resistance compounds on the linear growth of *M. phaseolina* and *F. oxysporum in vitro*:

Potassium chloride (KCl) and Hydrogen Peroxide (H2O2) were tested at concentrations of 0.0, 0.25, 0.50, 1.0, 2.0, 4.0 and 8%. In addition, the Indol acetic acid (IAA) and Indol butyric acid (IBA) were tested at concentrations of 0.0, 0.25, 50.0, 100.0, 200.0, 400.0, 800.0 and 1600.0 ppm. Moreover Tanic acid (TA); Salicylic acid (SA) and Bion were tested at concentrations of 0.0, 0.25, 0.50, 1.0, 2.0, 4.0 and 8.0 mM. The amount required for obtaining a known concentration of the desired chemical was calculated and added aseptically to a known amount of sterilized PDA medium immediately before pouring in plates, then plates were inoculated with the desired isolate of *M. phaseolina* and *F. oxysporum* and/or incubated at 25 oC for 5 days. Three plates were used as replicates for each particular concentration. Diameter of the linear growth of each isolate was determined .

Greenhouse experiments

Effect of different concentrations of some resistance inducing agents on controlling seedling mortality and wilt disease of sesame.

Apparently healthy sesame seeds were surface sterilized by soaking in sterilized solution 2.5 % viable sodium hypochlorite for 5 min, then washed in sterilized water. The seeds were soaked for 2.5 hours in the tested concentration of any of the tested chemical inducers. The wetted seeds were spread out in a thin layer on filter paper and left about 24 hours, then they were planted in pathogen-infested potted soils at the r90 days after sowing, percentages of healthy standing sesame plants were calculated ate of 10 seed/pot. Seeds soaked in water were sown in control pots. Three pots were used for each treatment as replicates. Disease incidence was estimated as previously mentioned.

Statistical analysis

The experimental design(s) of the present study are completely randomized with three replicates, analysis of variance (ANOVA) of the data was performed with MSTAT-C statistical package (A). Microcomputer program was used for the disease management, and analysis of agronomic research experiments. Least significant difference (LSD) was used to compare treatment means (Gomez and Gomez, 1984).

RESULTS

Isolation and identification of sesame seed borne fungi

This study was conducted to reveal the best method of isolation of sesame seed-borne fungi, *i.e.* agar plate and blotter methods. The isolated fungi were identified as mentioned before. Data in Table (1) illustrate that the blotter method was the most convenient for isolation. *Alternaria sesami* recorded the highest incidence (4.5 & 19.0%) followed by *A. Alternata* (3.5&17.5%) from apparently healthy (AH) and infected seeds, respectively. Also, *Fusarium roseum* recorded (2.5 & 16.5%) for (AH) and infected sesame seeds, respectively. Isolation on PDA medium from sesame seeds yielded different fungal species *i.e., A. alternata, A. sesami, Aspergillus flavus. Drechslera sesame, F. solani, F. oxysporum* and *M. phaseolina* which resulted 14.5, 18.0, 11.0, 16.5, 12.0, 4.6 and 8.5% for infected sesame seeds, respectively. On the other hand, the (AH) sesame seeds yielded *A. alternata, A. sesami* and *A. flavus*, being (1.5, 2.5 and 5.0 %, respectively).

Table (1): Incidence of seed-borne fungi in samples, apparently healthy and infected sesame seeds cv. Giza – 32

Isolated fungi	Method of isolation			
	Blotter		PDA	
	*AH	**INF	AH	INF
Alternaria alternata	3.5	17.5	1.5	14.5
Alternaria sesami	4.5	19.0	2.5	18.0
Aspergillus flavus	0.0	14.5	5.0	11.0
Drechslera sesame	6.0	11.0	0.0	16.5
Fusarium oxysporum	0.0	13.5	0.0	4.6
Fusarium solani	0.0	0.0	0.0	12.0
Fusarium roseum	2.5	16.0	0.0	0.0
Macrophomina phaseolina	0.0	6.5	0.0	8.5
Mean	2.1	12.3	1.1	10.6

*AH % = apparently healthy sesame seeds.
**INF % = infected sesame seeds.

Pathogenicity tests:

Data in Table (2) indicate that all tested isolates of *M. phaseolina* recorded different percentages of pre-and post-infection at seedling stage. *M. phaseolina* (M_8) recorded the lowest percentage of pre-infection (6.6%), while (M_{10}) recorded 13.3% followed by (M_9) that recorded 20%. For survived plants, it is clear from the data that significant differences were recorded between the survival of sesame plants due to infection. The highest percentage of survived plants, being 80% was recorded with isolate (M_8), while the lowest percentage of survived plants was recorded with isolate M_1. At mature stage, isolate (M_1) showed the lowest infection with charcoal rot (16.6%) followed by isolate (M_9), being 20.0% without significant differences. The highest infection with charcoal rot was recorded when isolates M_5 and M_{10} were used. All the tested *F. oxysporum* isolates were differed in their reaction from one isolate to another Giza isolate showed the highest percentage of survived plants, whereas the lowest percentage of survived plants (36.4 %) was recorded in case of F_6 (BeniSweif isolate). The lowest percentage of wilted plants (13.4%) was recorded by isolate (F_{10}) and isolate F_9 (16.8%) without significant difference, while isolate F_3 recorded the highest percentage of healthy mature plants (43.4%).The lowest percentage of healthy mature plants (16.4%) was recorded with isolate F_6.

Table (2): Pathogencity of 5 isolates of *M. phaseolina* and 6 isolates of *F. oxysporum* on sesame cv. Giza 32 under greenhouse conditions

M. phaseolina isolates	Location	(%) Disease incidence				
		Seedling stage			Mature stage[E]	
		% pre[A]	% post[B]	% Survivals[C]	% mortality[D1]	Healthy
(M1)	Giza	26.6	20.0	53.4	16.6	36.8
(M5)	Ismailia	23.3	13.3	63.4	40.0	23.4
(M8)	Benisweif	6.6	13.4	80.0	30.0	50.0
(M9)	Sharkyia	20.0	20.0	60.0	20.0	40.0
(M10)	Sohag	13.3	10.7	76.0	40.0	36.0
Control		0.0	100.0	0.0	0.0	100.0
L.S.D		4.3	4.2	6.3	7.1	8.2
F. oxysporum isolates	Location	% Disease incidence				
		Seedling stage			Mature stage	
		%pre	%post	% Survival	% Wilted plants[D2]	% Healthy
(F3)	Giza	6.6	20.0	73.4	30.0	43.4
(F4)	Ismailia	10.0	30.0	60.0	20.0	40.0
(F6)	Benisweif	30.0	33.3	36.4	20.0	16.4
(F8)	Sharkyia	13.3	16.6	70.7	40.1	30.7
(F9)	Giza	26.6	26.6	46.8	16.8	30.0
(F10)	Sohag	16.6	40.0	43.4	13.4	30.0
L.S.D		5.8	4.2	5.1	5.4	7.2

A= pre-emergence damping-off, 15 days after planting.
B= post-emergence damping-off, 45 days after planting.
C= Survived plants 45 days after planting.
D1= plants showing charcoal rot symptoms.
D2= Wilted plants.
E= Mature stage 90 days after planting.

Effect of different concentrations of some resistance inducing agents on the linear growth in (mm) of 4 isolates of *M. phaseolina* and 4 isolates of *F. oxysporum*:

Effect on the linear growth of *M. phaseolina* isolates:

Data shown in Table (3a) demonstrate that the linear growth of the 4 tested isolates of *M. phaseolina* was significantly decreased due to the effect of all the tested chemicals. The highest decrease in linear growth was noticed with KCl at concentration 4.0 % for all isolates.

Table (3 a): Effect of KCl and H_2O_2 concentrations as resistance inducing chemicals inducers on the linear growth of four isolates of *M. phaseolina*.

Inducer	Isolate	Concentration (%)							Mean	Grand mean
		0.0	**0.25**	**0.50**	**1.0**	**2.0**	**4.0**	**8.0**		
KCl	**M1**	90.0	81.5	68.5	56.2	13.2	0.0	0.0	43.5	40.08
	M5	90.0	65.7	57.3	37.4	18.4	0.0	0.0	37.8	
	M8	90.0	74.8	61.6	42.3	12.8	0.0	0.0	39.5	
	M10	90.0	67.2	66.5	46.8	11.4	0.0	0.0	39.5	
H_2O_2	**M1**	90.0	75.4	72.8	56.6	17.7	5.9	0.0	44.7	41.78
	M5	90.0	66.7	56.3	46.8	24.5	10.4	0.0	41.4	
	M8	90.0	77.0	65.7	30.6	8.5	2.3	0.0	38.5	
	M10	90.0	80.2	73.9	34.5	18.7	5.4	0.0	42.5	

LSD. at 5% for:
Isolates (Iso) = n.s. Inducers (Ind) =1.23 Conc. (C) =1.23 Iso x Ind =2.33
Iso x C = n.s. Ind x C = 1.92 Iso x Ind x C = 3.90

Data in Table (3b) show that IAA caused a noticeable decrease in the linear growth (Ranged from 40.8 to 45.9 ppm) compared to control (90.0 ppm), while IBA caused a decrease in linear growth of the 4 tested isolates of *M. phaseolina*, ranged from 40.3 to 43.4 ppm.

Table (3 b): Effect of some growth regulators on the linear growth of four isolates of *M. phaseolina*.

Inducer	**Isolate**	**Concentration (ppm)**							**Mean**	**Grand mean**
		0	**25**	**50**	**100**	**200**	**400**	**800**		
IAA	**M1**	90.0	85.0	73.9	30.2	6.8	5.2	0.0	40.8	43.68
	M5	90.0	85.0	80.3	63.4	7.5	0.0	0.0	45.9	
	M8	90.0	85.0	65.7	39.2	16.3	9.5	0.0	42.9	
	M10	90.0	85.0	80.4	48.6	11.5	4.6	0.0	45.1	
IBA	**M1**	90.0	85.0	72.3	31.4	6.5	1.5	0.0	40.3	41.95
	M5	90.0	85.0	72.4	56.6	4.1	0.0	0.0	43.4	
	M8	90.0	85.0	81.9	46.8	3.8	0.0	0.0	43.2	
	M10	90.0	85.0	74.0	40.0	2.5	0.0	0.0	40.9	

LSD. at 5% for:
Isolates (Iso) = n.s. Inducers (Ind) =1.61 Conc. (C) =1.61 Iso x Ind =2.11
Iso x C = n.s. Ind x C = 2.13 Iso x Ind x C = 3.22

Data in Table (3c) show that tanic acid caused the highest decrease in the linear growth recorded with isolate M8 (being 37.1mm). Salicylic acid SA, and bion completely decreased the linear growth of the 4 tested isolates at 8.0 mM. Also, bion suppressed the linear growth for all *M. phaseolina* isolates at 8.0 mM.

Table (3 c): Effect of some resistance inducing chemicals on the linear growth of four isolates of *M. phaseolina.*

Inducer	Isolate	Concentration (mM)							Mean	Grand mean
		0.0	0.25	0.50	1.0	2.0	4.0	8.0		
Tanic acid	M1	90.0	82.9	76.8	22.7	6.3	0.0	0.0	39.2	39.85
	M5	90.0	76.5	66.3	36.5	8.3	0.0	0.0	38.9	
	M8	90.0	66.5	61.5	37.4	8.9	0.0	0.0	37.1	
	M10	90.0	80.4	73.9	56.2	11.2	2.5	0.0	44.2	
SA	M1	90.0	85.0	81.9	41.2	19.8	5.6	0.0	45.6	42.10
	M5	90.0	85.0	72.4	22.8	9.5	2.5	0.0	39.9	
	M8	90.0	85.0	74.3	37.8	11.3	4.2	0.0	42.5	
	M10	90.0	85.0	65.7	25.1	13.5	8.1	0.0	40.4	
Bion	M1	90.0	85.0	72.3	30.8	15.6	4.3	0.0	41.8	42.30
	M5	90.0	85.0	81.9	21.4	9.8	2.1	0.0	40.7	
	M8	90.0	85.0	75.4	67.5	12.4	3.2	0.0	46.9	
	M10	90.0	85.0	65.2	28.2	11.5	4.2	0.0	39.8	

LSD. at 5% for:
Isolates (Iso) = n.s. Inducers (Ind) =1.82 Conc. (C) =1.82 Iso x Ind =2.77
Iso x C = n.s. Ind x C = 2.60 Iso x Ind x C =3.11

Effect on the linear growth of *F.oxysporum* isolates:

Data in Table (4 a) illustrate that the linear growth of the 4 tested isolates of *F. oxysporum* was significantly decreased due to the tested resistance inducing chemicals. The linear growth was completely suppressed at conc. 2.0% with H_2O_2. Generally, the linear growth (mm) was decreased at conc. of 4.0% with KCl and H_2O_2.

Table (4 a): Effect of some KCl and H_2O_2 Concentrations on the linear growth of four isolates of *F. oxysporum.*

Inducer	Isolate	Concentration (%)							Mean	Grand mean
		0.0	0.25	0.50	1.0	2.0	4.0	8.0		
KCl	F6	90.0	85.0	68.3	37.3	0.0	0.0	0.0	39.4	40.1
	F8	90.0	85.0	57.2	56.3	0.0	0.0	0.0	40.5	
	F9	90.0	85.0	61.5	36.5	0.0	0.0	0.0	38.3	
	F10	90.0	85.0	76.8	48.2	0.0	0.0	0.0	42.2	
H_2O_2	F6	90.0	85.0	73.9	48.4	14.6	0.0	0.0	43.8	41.8
	F8	90.0	85.0	67.3	41.3	13.8	0.0	0.0	41.7	
	F9	90.0	85.0	65.8	22.8	13.8	0.0	0.0	38.8	
	F10	90.0	85.0	70.5	48.4	11.9	0.0	0.0	42.9	

LSD. at 5% for:
Isolates (Iso) = 1.50 Inducer (Ind) =1.60 Conc. (C) =1.60 Iso x Ind =2.41
Iso x C = 3.10 Ind x C = 2.60 Iso x Ind x C =3.90

Data in Table (4 b) show that IAA and IBA also decreased the linear growth for all the tested isolates, F10 isolate was the least affected by IAA and IBA and recorded 12.9 & 17.9 ppm, respectively at conc.800 ppm with IAA and IBA, respectively .

Table (4 b): Effect of some growth regulators on the linear growth of four isolates of *F. oxysporum*.

Inducer	Isolate	Concentration (ppm)							Mean	Grand mean
		0	25	50	100	200	400	800		
IAA	F6	90.0	81.6	66.7	40.0	23.5	12.8	6.8	45.2	48.3
	F8	90.0	85.0	80.3	56.6	24.2	12.4	7.9	50.2	
	F9	90.0	65.7	65.7	46.8	40.8	20.2	11.6	47.9	
	F10	90.0	85.0	85.0	37.8	22.6	21.7	12.9	50.0	
IBA	F6	90.0	74.9	73.9	30.6	19.4	17.7	7.5	44.5	45.3
	F8	90.0	73.9	65.8	36.0	24.1	12.8	6.9	43.6	
	F9	90.0	66.6	73.9	34.6	27.2	20.1	16.3	46.4	
	F10	90.0	75.4	66.6	31.4	27.5	23.0	17.9	46.7	

LSD. at 5% for:
Isolates (Iso) = 1.50 Inducer (Ind) =1.90 Conc. (C) = 1.93 Iso x Ind =3.10
Iso x C = 4.29 Ind x C = 2.90 Iso x Ind x C = 4.81

Data in Table (4 c) show that tanic acid caused a noticeable reduction in the linear growth (mM) for all the tested isolates by using the aforementioned resistance inducing chemicals. Isolate F9 recorded the least reduction, being 53.8mm on the average. Whereas, the highest inhibition was recorded with isolate F6 (44.3 mM). As for SA, all the tested concentrations caused a reduction in the linear growth at 4.0 mM for all the tested isolates. Regarding bion, the reduction was noticed at 8.0 mM for all the tested isolates, whereas, the highest inhibition was recorded with isolate F8 (43.9 mM) and the least was recorded with isolate F9 (60.6 mM).

Table (4 c): Effect of some resistance inducing chemicals on the linear growth of four isolates of *F. oxysporum*.

Inducer	Isolate	Concentration (mM)							Mean	Grand mean
		0.0	0.25	0.50	1.0	2.0	4.0	8.0		
Tanic acid	F6	90.0	85.0	73.9	30.2	16.2	12.4	7.3	44.3	49.7
	F8	90.0	85.0	70.7	48.6	43.5	17.8	11.6	51.7	
	F9	90.0	85.0	73.9	47.1	43.2	24.5	17.5	53.8	
	F10	90.0	85.0	75.4	39.2	17.2	27.0	13.0	48.8	
SA	F6	90.0	85.0	74.3	70.1	42.0	0.0	0.0	50.9	51.8
	F8	90.0	85.0	73.9	72.4	70.8	0.0	0.0	55.4	
	F9	90.0	85.0	72.3	63.4	59.8	0.0	0.0	52.21	
	F10	90.0	85.0	85.0	58.6	28.2	0.0	0.0	48.8	
Bion	F6	90.0	85.0	81.9	48.3	23.2	14.2	0.0	48.3	49.[illegible]
	F8	90.0	85.0	72.4	25.3	21.4	18.7	0.0	43.9	
	F9	90.0	85.0	85.0	79.3	67.5	22.4	0.0	60.6	
	F10	90.0	85.0	74.3	31.3	27.2	23.8	0.0	46.7	

LSD. at 5% for:
Isolates (Iso) = 1.50 Inducer (Ind) =2.11 Conc. (C) = 2.13 Iso x Ind =3.59
Iso x C = 1.90 Ind x C = 3.10 Iso x Ind x C = 4.65

Effect of soaking sesame seeds in the solution of inducing resistance agents on controlling seedling diseases caused by *M. phaseolina:*

Data shown in Table (5a) indicate that potassium chloride (KCl) was the most effective treatment for decreasing pre-emergence damping-of, being 9.6 %. Whereas, the least effective inducer was hydrogen peroxide H_2O_2 (13.1%). The most effective concentrations for controlling pre-emergence damping-off were H_2O_2 and KCl at 4% which gave 4.6 and 6.5%, respectively compared to control treatment (29.5%). The highest decrease in post-emergence damping-off was noticed with KCl and H_2O_2 at 4%, being 3.5& 4.3%, respectively. Concerning the survived plants, data also show that high percentage of survived plants was recorded by H_2O_2 (91.1%) and KCl (90.0%) compared to control treatment.

Table (5 a): **Effect of some resistance inducing chemicals as seed soaking on the incidence of pre- and post - emergence damping-off caused by *M. phaseolina* under greenhouse conditions.**

Disease incidence %	Inducers	Different concentrations				Mean
		Conc.1	Conc.2	Conc.3	Conc.4	
pre-emergence	KCl	12.5	10.5	8.9	6.5	**9.6**
	H_2O_2	20.7	16.4	10.5	4.6	**13.1**
	Control	29.5	29.5	29.5	29.5	**29.5**
Post-emergence	KCl	8.6	7.8	5.6	3.5	**6.4**
	H_2O_2	13.4	12.2	7.8	4.3	**9.4**
	Control	22.5	22.5	22.5	22.5	**22.5**
Survived Plants	KCl	78.9	81.7	85.5	90.0	**84.2**
	H_2O_2	65.9	71.4	81.7	91.1	**77.5**
	Control	48.0	84.0	84.0	84.0	**48.0**

LSD at 5% for:	Pre-	Post-	Survivals
Inducer (I) =	1.12	3.11	3.82
Concentration (c)	1.30	2.33	3.21
IxC=	2.09	4.21	4.01

Data shown in Table (5 b) indicate that the most effective treatments for decreasing pre-emergence damping-off were indole acetic acid (IAA) and indole butyric acid (IBA) which recorded 7.4 & 9.6 %, respectively. For the post-emergence damping-off, the obtained data show that IAA and IBA caused a reduction in post-emergence at 400 ppm, being 0.0 & 2.5 %, respectively. Concerning the survived plants, data also show that IAA gave 96.8 % followed by IBA 91.9 %, compared to control treatment (48.0 %).

Data shown in Table (5c) indicate that salycilic acid and bion were the most effective treatments for decreasing pre-emergence damping-off (4.9 & 3.6 % on the average, respectively). The most effective concentration for controlling pre-emergence damping-off was salicylič acid at 8 mM and bion at 8 mM, tanic acid at 8 mM. For the post-emergence damping-off, the obtained data show that bion gave the highest significant decrease in post-emergence damping-off at all concs., followed by tanic acid 4.2%. Tanic aicd, SA and bion completely prevented the post-emergence damping-off at 8mM.Concerning the survived plants, data also show that tanic acid, SA and bion caused the highest increase in the average of survived plants (100.0%), compared to control treatment (48.0%).

Table (5 b): Effect of some growth regulators on the incidence of pre- and post - emergence damping-off caused by *M. phaseolina* as well as healthy survived plants under greenhouse conditions.

Disease incidence %	Inducers	Different concentrations				Mean
		Conc.1	Conc.2	Conc.3	Conc.4	
Pre-emergence	IAA	10.0	9.8	6.5	3.2	**7.4**
	IBA	13.5	11.5	7.6	5.6	**9.6**
	Control	29.5	29.5	29.5	29.5	**29.5**
Post-emergence	IAA	7.4	5.7	0.0	0.0	**3.3**
	IBA	11.4	8.9	6.7	2.5	**7.4**
	Control	22.5	22.5	22.5	22.5	**22.5**
Survived Plants	IAA	82.6	84.5	93.5	96.8	**89.3**
	IBA	75.1	79.6	85.7	91.9	**83.1**
	Control	48.0	48.0	48.0	48.0	**48.0**

LSD at 5% for:	Pre-	Post-	Survival
Inducer (I) =	2.15	2.20	4.09
Concentration (c)=	2.90	2.11	3.45
I x C =	3.11	3.91	5.36

Table (5 c): Effect of some resistance inducing chemicals on the incidence of pre- and post - emergence damping-off caused by *M. phaseolina* as well as healthy survived plants under greenhouse conditions.

Disease incidence %	Inducers	Different concentrations				Mean
		Conc.1	Conc.2	Conc.3	Conc.4	
Pre-emergence	Tanic acid	14.7	10.6	5.8	0.0	**7.7**
	SA	11.5	8.4	0.0	0.0	**4.9**
	Bion	8.9	5.7	0.0	0.0	**3.6**
	Control	29.5	29.5	29.5	29.5	**29.5**
Post-emergence	Tanic acid	9.8	6.8	0.0	0.0	**4.2**
	SA	6.5	0.0	0.0	0.0	**1.6**
	Bion	0.0	0.0	0.0	0.0	**0.0**
	Control	22.5	22.5	22.5	22.5	**22.5**
Survived Plants	Tanic acid	75.5	82.6	94.2	100.0	**88.2**
	SA	82.0	91.6	100.0	100.0	**93.4**
	Bion	91.1	94.3	100.0	100.0	**96.4**
	Control	48.0	84.0	84.0	84.0	**48.0**

LSD at 5% for:	Pre-	Post-	Survival
Inducer (I) =	2.15	2.17	4.56
Concentration (c)	3.89	2.04	3.38
IxC=	4.23	3.64	6.26

Effect of soaking sesame seeds in the solutions of some resistance inducing agents on controlling wilt disease caused by *F. oxysporum:*

Data in Table (6 a) show that KCl and H_2O_2 were the most effective inducers for decreasing pre-emergence damping-off (8.4, 9.6 respectively). As for the post-emergence damping-off, data indicate that H_2O_2 recorded the least effect (8.9%). However, the low percentage of survived plants was recorded 70.9% with H_2O_2 at (0.5%) compared to the control.

Table (6 a): Effect of some resistance inducing chemicals on the incidence of pre- and post - emergence damping-off caused by *F. oxysporum* as well as healthy survived plants under greenhouse conditions.

Disease incidence %	Inducers	Different concentrations				Mean
		Conc.1	Conc.2	Conc.3	Conc.4	
pre-emergence	KCl	13.4	11.8	8.5	4.5	**9.6**
	H_2O_2	15.6	12.4	7.3	5.2	**10.1**
	Control	27.5	27.5	27.5	27.5	**27.5**
Post-emergence	KCl	10.5	8.7	5.4	0.0	**6.2**
	H_2O_2	13.5	11.2	8.5	2.5	**8.9**
	Control	22.5	22.5	22.5	22.5	**22.5**
Survived Plants	KCl	76.1	79.5	86.1	95.5	**84.3**
	H_2O_2	70.9	76.4	84.2	92.3	**80.9**
	Control	50.0	50.0	50.0	50.0	**50.0**

LSD at 5% for:	Pre-	Post-	Survival
Inducer (I) =	1.19	3.60	5.56
Concentration (c)	2.20	2.13	3.38
IxC=	4.35	6.14	7.26

Data in Table (6 b) show that IAA was the most effective inducers for decreasing pre-emergence damping-off, being 3.6, followed by IBA (8.4) compared to control treatment (27.5%). As for the post-emergence damping-off, data indicate that IAA and IBA caused the highest decrease in post-emergence damping-off, being 1.6 & 4.4% on the average, respectively. With regard to the survived plants, IAA & IBA caused the highest percentage of survived plants, being 94.8 and 87.2%, compared to the control.

Data in Table (6 c) show that SA was the most effective resistance inducing agent for decreasing pre-emergence damping-off (3.8%), followed by bion (7.9 %) compared to control treatment (27.5%). As for the post-emergence damping-off, data indicate that SA caused the highest decrease in post-emergence damping-off (2.2) followed by Tanic acid at 8 mM (8.6%). However, the highest increase in survived plants was reported at 8 mM, for SA (100.0%) compared to control treatment (50.0%), while the least effective treatment was recorded with tanic acid at 1mM (71.0%), compared to the control.

Table (6 b): Effect of some resistance inducing chemicals on the incidence of pre- and post-emergence damping-off caused by *F. oxysporum* as well as healthy survived plants under greenhouse conditions.

Disease incidence %	Inducers	different concentrations				Mean
		Conc.1	Conc.2	Conc.3	Conc.4	
Pre-emergence	IAA	8.7	5.6	0.0	0.0	3.6
	IBA	11.8	9.5	7.6	4.8	8.4
	Control	27.5	27.5	27.5	27.5	27.5
Post-emergence	IAA	6.5	0.0	0.0	0.0	1.6
	IBA	8.4	5.7	3.5	0.0	4.4
	Control	22.5	22.5	22.5	22.5	22.5
Survived Plants	IAA	84.8	94.4	100.0	100.0	94.8
	IBA	79.8	84.8	88.9	95.2	87.2
	Control	50.0	50.0	50.0	50.0	50.0

LSD at 5% for:	Pre-	Post-	Survival
Inducer (I) =	2.61	3.26	5.46
Concentration (c)	3.51	2.42	3.65
IxC=	3.36	5.11	7.25

Table (6 c): Effect of some resistance inducing chemicals on the incidence of pre- and post-emergence damping-off caused by *F. oxysporum* as well as healthy survived plants under greenhouse conditions.

Disease incidence %	**Inducers**	**different concentrations**				**Mean**
		Conc.1	**Conc.2**	**Conc.3**	**Conc.4**	
Pre-emergence	Tanic acid	16.3	10.3	8.3	3.5	9.6
	SA	10.5	4.7	0.0	0.0	3.8
	Bion	12.4	9.4	6.5	3.5	7.9
	Control	27.5	27.5	27.5	27.5	27.5
Post-emergence	Tanic acid	12.7	10.4	6.7	4.5	8.6
	SA	5.4	3.5	0.0	0.0	2.2
	Bion	10.2	8.4	6.5	0.0	6.3
	Control	22.5	22.5	22.5	22.5	22.5
Survived Plants	Tanic acid	71.0	78.9	85.0	92.0	81.7
	SA	84.1	91.8	100.0	100.0	94.0
	Bion	77.4	82.2	87.0	96.5	85.7
	Control	50.0	50.0	50.0	50.0	50.0

LSD at 5% for:	Pre-	Post-	Survival
Inducer (I) =	3.02	4.60	6.03
Concentration (c)	4.61	4.42	4.22
IxC=	3.89	3.61	7.13

DISCUSSION

Using different methods for isolation from sesame seeds, different numbers of fungi from both infected seed samples and apparantly healthy ones were isolated. Blotter method proved to be the most favorable for fungal isolation from both apparantly healthy and infected sesame seeds, followed by PDA medium.

Pathogenicity tests were conducted on sesame cv. Giza 32 using 5 isolates of *M. phaseolina* and another 6 isolates of *F. oxysporum*, revealed that these isolates varied in their pathogenicity on sesame plants.

M. phaseolina isolates *i.e.*, M1, M5, M8 and M10 which were isolated from different locations expressed different levels of infection. These results are in agreement with those reported by Pereira *et al.* (1995) and Zhang *et al.* (2001) who attributed the root-rot and wilt diseases of sesame to *M. phaseolina* and *F. oxysporum* and several species of *Fusarium, R. solani, S. rolfsii,* and *Pythium* spp.

Studying the effect of different concentrations of some reducing agents on the linear growth of 4 isolates of *M. phaseolina* showed that the linear growth of the tested isolates (M1, M5, M8 and M10) was significantly suppressed by all resistance inducing chemicals *i.e.*, KCl, H_2O_2, IAA, TBA, tanic acid and Bion, respectively. The highest decrease was induced by KCl at con. 4.0 % for all isolates . All chemical inducess showed noticeable decrease at 4.0% in the linear growth of *F. oxysporum* isolates. IBA suppressed the linear growth of *f. oxysporum* at con. 800 ppm. Also, IAA and IBA decreased the linear growth.

Using the chemical inducing systemic resistance compounds in controlling seedling and wilt diseases of sesame plants sown in soil artificially infested with *M. phaseolina,* sesame seeds were soaked in the solutions of different resistance inducing chemicals that were studied during this investigation. The highest percentage of survived plants was recorded with using KCl, H_2O_2, at cons. 0.5, 1, 2, 4 %; IAA, IBA at 50, 100, 200, 400 ppm.; Tanic acid, SA and bion at 2, 4 and 8 mM concentrations.

The efficacy of different resistance inducing compounds was investigated by earlier investigators (Shalaby & Saeed, 2000). and Shalaby *et al.* (2001) They reported the efficacy of potasium salicylate (PS), oxalic acid and salicylic acid (SA) in controlling *M. phaseolina* on sesame plants and sunflower in greenhouse. All treatments reduced the incidence of *M. phaseolina* and increased peroxidase activity and IAA content of sesame and sunflower plants. These compounds also effectively controlled *M. phaseolina* and increased seed yield of sesame under field conditions. They observed an increase in the activity of peroxidase, polyphenoloxidase and chitinase enzymes, IAA hormone of sesame plants. Also, they found that KCl may be considered as a biochemical mechanism for inducing systemic resistance against wilt disease, on the same time free phenols of sesame plants may not be involved in induced systemic resistance mechanisms against wilt or mortality diseases of sesame. Also, Abdou *et al.*(2001) reported that soaking sesame seeds in SA at 5 mM for 2 hr before sowing and then treated with ascorbic acid 15 days after sowing resulted in the best control against *F. oxysporum* f.sp. *sesami* in comparison the with control (untreated sesame seeds).

Results obtained during the present investigation came to the previously mentioned findings that SA & Bion proved to be the more effective resistance inducing compounds in decreasing the investigated disease; seedling and wilt diseases of sesame.

As for diseases caused by *F. oxysporum,* the third concentration (400 ppm) of IAA and SA was more effective in decreasing disease incidence incited by *F. oxysporum*. IAA gave the highest percentage of healthy plants followed by IBA, compared to control. The promising effects of these resistance inducing chemicals could be attributed partially to their fungicidal properties. Most of these chemicals significantly decreased the linear growth of the tested isolates of *M. phaseolina* and/or *F. oxysporum.* Similar findings were recorded by Salama *et al.* (1985).

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تأثير بعض المواد المحثة للمقاومة في تثبيط نمو و مقاومة الفطرين ماكروفومينا فاسيوليناوفيوزاريم أوكسيسبورم المسببة للعفن الفحمي والذبول لنباتات السمسم تحت ظروف المعمل والصوبة

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تم عزل عدد من الفطريات من بذور السمسم بطريقتي(plate agar) و(blotter) شملت الفطريات الماكروفومينا فاسيولينا والفيوزاريم أوكسيسبورم التى تم دراسة قدرتها الامراضية على السمسم صنف جيزة ٣٢ وكانت هى المسببات الرئيسية لأهم أمراض السمسم وهى العفن الفحمي والذبول على التوالى. ولقد أجريت هذه الدراسة لاختبار تأثير بعض المواد المحثة للمقاومة وتأثيرها على النمو الطولى بالملى متر لأربع عزلات من الماكروفومينا فاسيولينا وأربعة عزلات من الفيوزاريم أوكسيسبورم تحت ظروف المعمل.

وأظهرت النتائج أن النمو الطولى للعزلات المختبرة أمكن تثبيطه بجميع المواد المختبرة ومنها كلوريد البوتاسيوم ، فوق أكسيد الأيدروجين ، والإندول أسيتك أسيد ، والإندول بيوترك أسيد، والتانيك أسيد على التوالى . و بدراسة تأثير إضافة أى من كلوريد البوتاسيوم ، فوق أكسيد الهيدروجين ، الأندول أسيتك أسيد ، ساليسيلك أسيد ، أندول بيوتريك آسيد ، تانيك آسيد ، والبيون لمعرفة أفضل التركيزات المناسبة لمقاومة مرض موت البادرات فى التربة الملوثه بالماكروفومينا فاصولينا قبل الإنبات،أظهرت النتائج أن كل من حامض التانيك ، حامض الساليسلك ، البيون أدى الى خفض النسبة المئوية للإصابه على التوالى، على حين سجلت أعلى نسبة مئوية فى خفض المرض مع البيون بينما كانت أقلها مع استخدام فوق أكسيد الهيدروجين.

من ناحية أخرى أنخفضت النسبه المئويه لموت البادرات بعد الإنبات تماماً مع البيون وكان أقلها نسبه خفض استخدام فوق أكسيد الهيدروجين. و فيما يختص بالنسبه المئويه للنباتات الباقية كانت أعلى نسبه مئوية للنباتات الباقيه مع البيون ثم السالسلك آسيد على التوالى.

بدراسة تأثير نقع بذور السمسم فى المواد الكيماويه السابقة الذكر لمقاومة مرض الذبول الناجم عن الفطر الفيوزاريم أكسيسبوريم، أشارت النتائج أن أعلى نسبة لخفض المرض كانت نتيجة استخدام الأندول أسيتك أسيد قبل الانبات، على حين كانت أقل نسبة مع استخدام المعاملة بفوق أكسيد الهيدروجين، وفيما يختص بموت البادرات بعد الإنبات فقد سجلت أعلى نسبه لمقاومة المرض مع المعاملة بالإندول أسيتك آسيد وأقلها كانت مع استخدام فوق أكسيد الهيدروجين، كما سجلت أعلى نسبه للنباتات الباقية مع المعاملة بالإندول آسيتك آسيد و أقلها مع المعاملة بفوق أكسيد الهيدروجين