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DISEASES OF *Nigella sativa* AND THEIR MANAGEMENT IN EGYPT

Baiuomy, M. A. M.[1] and I. A. Shalaby[2]

[1] **Plant Pathology Res. Inst. , Agriculture Research Center Giza Egypt**

[2] **Medicinal and Aromatic Plants Res. Sta., Hort. Res. Inst., Agric. Res. Center, Giza, Egypt**

ABSTRACT

Surveying the crop plantations (2003 & 2004) in the four governorates, showed that in Qalubia governorate diseases incidence percentage of *Nigella sativa* was higher than those in the other governorates.

Isolation trials from plants yielded *Fusarium oxysporum, F.moniliforme, F. semitectum, F. solani, Macrophomina phaseolina, Pythium.ultimum* and *Rhizoctonia.solani.* While, they yielded *Alternaria. alternata, Aspergillus flavus, F. oxysporum, F.moniliforme,F. semitectum ,F.solani* , *Mucor* sp..*Penicillium* sp., and *Rhizopus stolenifer* from the seeds

Pathogenicity test, indicated that *F. oxysporum* , *F. moniliforme M. phaseolina, P. ultimum* and *R.solani* were the most virulent fungi , while, *F. semitectum*, F. *solani* were the least ones. Also, *A. alternata* caused clearly pod blight under greenhouse conditions .

Three recommended chemical fungicides ,i.e. Rizolex T, Topsin M and Vitavax Thiram were compared with two biocides ,i.e. Plant Guard and Rhizo N; two biofertilizers ,i.e. Cerealin and Rizobacrtrein ;and four plant essential oils active ingredients (AI) ; i.e. Anisole, Citral, Menthol and Thymol (as seed dressing treatments) for control the causal pathogens of *Nigella sativa In Vitro* and *In Vivo*, except of biocides and biofertilizers were tested *in vivo* only .

In Vitro ,all treatments at 3000 ppm completely inhibited the mycelial growth of the six tested fungi .Also, Topsin M, Citral and Thymol at2000ppm completely inhibited the mycelial growth of *Fusarium oxysporum* and *F. moniliforme* .

In greenhouse Vitavax Thiram (3g/kg seeds) completely prevented damping - off diseases of *N. sativa* (100%) caused by all the tested fungi, except of *F. oxysporum* and *Macrophomina phaseolina*. Also, Rhizo N completely prevented damping – off disease caused by *P. ultimum*. While, Thymol (3000ppm) at the rate of 50ml/kg seeds gave the same results against *F. solani and P. ultimum*. On the contrast Cerealin at the rate 150g/kg seeds and Menthol (3000ppm) at the rate 50ml/kg seeds were the least efficient for controlling damping - off diseases of *N.sativa* .

Also, under field conditions experimental in naturally infested soil, and in the both seasons, Topsin M (3g/kg seeds) Rhizo N(4g/kg seeds); Rizobactrein (150 g/kg seeds); Anisole and Thymol (50ml/kg seeds) gave percentages of infection reductions by (93.33%- 92.56%) and (88.89%-91.19%) ; (80.0%-77.7%) and (80.53%-76.58%) ; (69.97%-62.84%) and (69.42%-64.86%) ; (89.97%-81.95%) and (88.89%-87.88%) and (86.67% - 77.50%) and (83.33% - 76.58%) after 30 and 60 days of sowing date and in the both experimental seasons, respectively .

Under field conditions, all treatments increased percentages of fresh and dry weight, number of pods, plant heigh, seed and oil yield compared with the control treatment. Fungicides followed by Rhizo N ,Anisole and Thymol were the best treatments for plant growth, while Cerealin and Menthol were the least active treatment in this respect.

INTRODUCTION

Nigella sativa L. is an annual herbaceous plant , growing in countries bording the Mediterranean .In Egypt the area cultivated of *N.sativa* was expanded during the last years , especially in the newly reclaimed areas. It used as spieces and medicinal herb. Part used is the dried ripe seeds ,known as (Habet El- Barka). It's constituents are volatile and fixed oils, saponin and glycosides (Mahran,1967 and Linskens and Jackson,1991). The seeds used as expectorant ,diuretic, carminative in asthma and coughs and as flavoring agent to bread. Also, the seeds are used in India to treat intestinal worms, and nerve defects, to reduce flatulence, induce sweating and stimulate milk flow (Wallis,1967; Chiej,1988;;Chevallier, 1996). Also, it is known to indigenous and grows well in different localities of Egypt (Soliman,1997).

Fungal diseases have been observed in *N. sativa* plantations which resulted in reduction in plant stand and vegetative growth , and consequent decreased of seed and oil yield .Root rot and wilt diseases are the most destructive diseases attack *N.sativa* plants(Naqvi and Gupta,1979; Qureshi *et. al.*, 1979; Srivastava and Chandra 1983; Hashmi, 1988; Hilal *et al.*, 1994; Dubey, 1995 and Sinha and Singh, 1995). These diseases caused by soilborne fungi and can be transmitted by seeds (El-Wakil and Ghoneem, 1999). Percentages of occurrence of these diseases always increased in the absence of control measurements in field ,and replanting the crop in the same area for many years .

The purposes of this study were to investigate the occurrence and distribution of these diseases and identify their causal pathogens,to estimate diseases losses ,and to develop different controlling means for control these diseases. Because most of synthetic fungicides used to control such pathogens are hazardus for the environment, beside having long residual effects, therefore the present study were undertaken to evaluate some alternative means (biocides, biofertilizers,and plant essential oils active ingredients) comparison with three recommended fungicides against the causal pathogens of *N.sativa InVitro* ,and *In Vivo* ,also on plant growth parameters and seed and oil yield .

MATERIALS AND METHODS

I. Diseases survey :

Diseases survey in some plantations of four governorates, i.e. Beni-suef, Fayoum; Giza and Qalubia was carried out during season (2003-2004).Plants showing disease symptoms i.e. yellowing ,stunting and dried shoots were recorded and the percentages of infection were calculated .

II.Isolation, purification and identification the causal pathogens:

The samples of the infected plant parts were thoroughly washed with tap water, cut into small pieces and surface sterilized with Sodium hypochlorite (1%) for 3 min. washed several times with sterilized distilled water and dried between sterilized filter paper. The sterilized pieces were aseptically transferred to Petri dishes of Potato Dextrose Agar medium and incubated at

25°C for 7 days. The growing fungi were purified using single spore or hyphal tip techniques However, detection of seedborne fungi was carried out following the procedures published by International Seed Testing Association (ISTA,1999). The purified fungi were identified according to (Barnett ,1960, Booth,1971 and Domasch *et. al.*, 1980 and Plaats-Niterink and VanDer, 1981). Also, the identification was kindly confirmed by Mycol. Res. Dis . and Survey Dep. Pl. Path. Res. Inst. ARC. Giza Egypt.

III.Pathogenicity test :

Fungi grown on Potato Dextrose liquid media (200g. potatoes and 20g. dextrose per liter of medium) in 500 ml glass bottles. Inoculation was carried out with 5mm fungal discs taken from the margins of 10- days old cultures of the isolated fungi .i.e. *A. alternate*, *A. flavus* , *F. oxysporum* , *F. moniliforme* , *F. solani* , *F. semitectum*, *M. phaseolina*, *Mucor* sp., *P. ultimum*, *Penicillium* sp., *R. solani and R stolonifer.* The inoculated bottles were incubated at 25°C ± 1 for 15 days . The Formalin sterilized potted soil (50 % sand + 50 % clay w/w) was infested with each fungus at the rate 1% (w/w) . Five pots (25cm in diam .) used for each treatment , and each pot was considered as one replicate . Commercial variety of *N. sativa* seeds were obtained from The Horticulture Department, Sids Research Station Beni-Suef governorate ,and surface sterilized using Sodium hypochlorite (1 %) solution for 3 min.and sown at the rate 15 seeds/ pot. Pre and post – emergence damping off percentages were recorded 30and 60 days after sowing date ,respectively. Reisolation was conducted from infected plants and compared with the original culture for each isolated fungus . On the other hand , *N. sativa* plants (3 month –old) were sprayed with spore suspention (5x 10^6 spores /ml water) of *A.alternata* , then covered with polyethylene bags for 48 hrs. and left for 21 days under greenhouse conditions before evaluating infection of pod blight .

IV. Controlling of *N.sativa* fungal diseases :

Seven different treatments were tested as controlling agents against *N.sativa* fungal diseases *In vitro* ,also eleven treatments were tested *In vivo*(Table,1). The biocides and the biofertilizers were evaluated in greenhouse and fields experiments only.All essential oils active ingredents (AI) were emulsified by adding few drops of Triton X363 to it before adding to sterile distilled water to used them as seed dressing treatment or PDA medium to evaluate their activity against the tested pathogenic fungi in all expermints . Also, the same amount of Triton X 363 was added in the control treatment of (AI).

1. *In Vitro* expermint :

Effect of fungicides and (AI) on fungal linear growth :

(Linskens and Jackson ,1991):

Three concentrations (1000,2000 and 3000 ppm) of each tested fungicide or (AI) were mixed with autoclaved PDA medium before solidification. Five plates containing the poisoned PDA medium were inoculated with a disc (5mm- in diam.) of mycelial growth of each fungus

,whileTriton X 363 only for (Al) check treatment. Linear growth was measured and the percentages of the toxicity was calculated according to the formula suggested by (Topps and Wain ,1957) as follows :

$$\% \text{ Toxicity} = \frac{(A-B)}{A} \times 100$$

Where: A = Diameter of untreated fungus (Control).
B = Diameter of treated fungus.

Extraction *N.sativa* seed oil :

The *N.sativa* seed oils ,used in this investigation were obtained by extraction crushed seeds with n-Hexane organic solvent at 40°C for 6 hours. Oil samples were determination by Soxhlet apparatus using n-Hexane at 40 - 60°C as solvent according to A.O.A.C. (1973). Oil samples were dried by heating on 60 °C for changeless the weight samples then filtered through oridinary filter paper . The obtained oil samples were kept in washed cleaned and dried brown glass bottles and were completely filled by the oil. The bottles were stopped carefully and stored at 5± 2 °C in order to preserve the physiochemical properties . Oil exraction proses were done in Medicinal & Aromatic Plants Res. Sta., Hort. Res. Inst., Agric. Res. Center, Giza,

2. Greenhouse Experiment :

Effect the tested fungicides ,biocides ,biofertilizers and(Al) on *N.sativa* plants damping -off :

For controlling wilt and root rot diseases of *N. sativa* the experiment was conducted under greenhouse conditions . Seeds were dressed with each of controlling means (Table,1), exept of Plant Guard was applied as dipping treatment for 10 min..The chek treatment of (Al) was dressed with Ttriton X363 M + sterile distelled water only ,before sowing. The treated seeds were sowing in infested soil with each of *N. sativa* pathogenic fungus .Disease incidence was recorded as mentioned before in pathogenicity test.

3. Field Experiment :

Effect of the tested fungicides, biocides,biofertilizers and (Al) on percentages of infection and plant growth of *N.sativa* under field conditions :

The field experiment was carried out at private field in Qualubia governorate. The selected field for these test ,was known to be naturally and highly infested with soilborne pathogens as evidenced by a high incidence of *N.sativa* plant diseases.Treatments were arranged in acomplete randomized block design with 4 replicates .The field plot was 16 m (4 X 4m) with 4 rows, each replicate consisted of 40 plants. All cultural practices were as recommended. The treatments were applied as mentioned before in Greenhouse expermint. Mean percentages of infection were recorded 30 and 60 days after sowing , ,also, dry weigh,number of branches ,plant high ,seed and oil yield were recorded in the end of the growing seasons (2004- 2005) and (2005- 2006).

Table (1) : The fungicides,biocides, biofertilizers and active ingredients of essential oils (AI) used in this study.

Commercial names	Composition	Rate
Fungicides:		
RizolexT50% WP	20% Tolclofos methyl (0,2, 6- dichloro 4 – methyl – phenl-0,0-diethyl nphosphorothioate) and 30% Thira (tetrathioate) thiuram disulfide)	3g/kg seeds
TopsinM70% WP	1,2-bis (3- methoxycarbonyl-2-2 thiouredio) benzene (T P M).	3g/kg seeds
Vitavax/thiram 75%WP	(37.5%(5,6-dihydro-2 methyl - 1-1,4- oxathin-3-carboxanilide)+37.5%Thiram(tetramethyl thiuram disulfide).	3g/kg seeds
Biocides :		
Plant Guard	(*Trichoderma harzianium* $3x10^7$ cfu/ml)	4ml/ kg seeds
Rhizo N*	(*Bacillus subtilis* $3x10^7$ cfu/g)	4g/ kg seeds
Biofertilizers:		
Cerealin	(*Azospirillium brasitense* at $3x10^{10}$cfu/g)	150g /kg seeds
Rhizobactrein**	(*Azotobacter chroococcum* at $3x10^{10}$ cfu/g)	150g/ kg seeds
AI (3000ppm):		
Anisole 98.5%	Extracted from essential oil of anse	50ml/kg seeds
Citral 95%	Extracted from essential oil of lemongrass	50ml/kg seeds
Menthol 95%	Extracted from essential oil of mint	50ml/kg seeds
Thymol 95%	Extracted from essential oil of thyme	50ml/kg seeds

***Produced by the General Orgonization for Agric. Equalization ,ARC with Arbic gum solution(5%) .**
****(AI) products were purchased from Sigma Aldrich Co.**

RESULTS AND DISCUTION

1- Diseases survey:

Symptoms of root-rot ,wilt and pods blight diseases under field conditions were stunting,, root rot , yellowing ,,wilt and blight of pods (Fig. 1,2 3&4).In the surveyed fields,wilt symptoms usually develop on plants showing symptoms of root –rot ,therefore ,incidence of both diseases was expressed as total natural infection percentages .While, pods blight disease showed in Qualubia governorate only, and the percentages of infection was (11.8%) .

Results (Table,2) indicate that infection percentages varied in the different governorats depending on the environmental conditions. as well as plant age. They ranged from 27.3% to 100%. In Qualubia governorate diseases incidence was higher than those in the other governoraes .While, in Fayoum governorate showed the least disease incidence percentages of the other governorates.Mositure weather might be favorable for infection and development of these diseases . In many countries have described similar diseases symptoms on various spices plants (Misra, 1981; Sharma, 1981; Vaidehi,1984;Champawat and Pathak,1994 ;Dange *et al* ., 1994 and Koike and Gordan, 2005) .

Fig.(1): Natural infection in the field showing symptoms of yellowing,and wilting on the foliar growth.

Fig.(2): Withered plants from the field , showing root rot and wilt symptoms.

Fig.(3): Pod blight on *N.sativa* immature plant caused by *Alternari alternate*, showing black and dry of the infected pods.

Fig.(4): Interior infection of mature pod showing brown colour of the blight pod (right,A), white color of the interior healthy pod(A),no seeds with the infected pod (right,A).While,there.are many seeds in healthy pod (left,A).

Table(2): Perecentages of natural infection on *Nigella sativa* plants grown in four governorates during (2003 & 2004)

Governorate	season (2003-2004) 4% infection on plants of:	
	*2month	4months
Beni-suef	30.7	44.3
Fayoum	27.3	40.1
Giza	28.5	41.2
Qalubia	62.7	100.0

*Two months after sowing .

II. **Fungi associated with diseased plants and seeds :**

Four genera of fungi (Table,3) were found to be associated with rotted roots and wilted plants . *Pythium .ultimum* (13.7 %), *F.moniliforme* (14.1%), *Rhizoctonia solani* (15.0%), *Macrophomina phaseolina* (18.3%) and *Fusarium oxysporum* (23.5%) were the most common fungi isolated from diseased plants.

Table (3) : Frequency of the isolated fungi from diseased *N.sativa* plants and Seeds.

Fungi	Plants	Seeds
Alternaria alternata	00.00	11.7
Aspergillus flavus	00.00	17.7
Fusarium oxysporum	23.50	15.7
F. moniliforme	14.10	09.2
F.semitectum	05.40	17.2
F.solani	10.00	03.6
Macrophomina phaseolina	18.30	00.0
Mucor sp	00.00	06.2
Penicilium sp.	00.00	13.2
Pythium .ultimum	13.70	00.0
Rhizoctonia solani	15.00	00.0
Rhizopus stolenifer	00.00	05.5
Total	100.0	100.0

The other fungi occurred, however, in less frequencies. Qureshi *et.al.*, 1979 isolated *R.solani* from many seedlings of *N.sativa* in India, Naqvi and Gupta, 1979 stated that *Sclerotinia sclerotiorum* caused wilt and root rot of *N. sativa*.Also, Sinha and Singh, 1995 isolated *M. phaseolina* from *N. sativa* plants. On the other hand, *F.solani* (3.6%), *R. stolenifer* (5.5%), *Mucor sp.* (6.2%) *F. moniliforme* (9.2%) *Altmaria alternate* (11.7%), *Penicillium sp.* (13.2%), *F. oxysporum* (15.7%), *F. semitectum* (17.2%) *and A. flavus* (17.7%) were isolated from *N. sativa* seeds collected from the four surveyed govemorates. *F. semitectum,* and *A. flavus* were, however. the most predominant fungi ,whereas *F. solani* and *R. stolenifer* were the least in this respect. Many investigators dealt with seed infecting fungi in *N. sativa ;A. niger , A. flavus , R. stolonifer , Penicillium sp., Chaetomium sp Fusarium sp.,Curvularia sp., and Mucer sp.*,were frequently isolated from *N. sativa* seeds(Srivastava and Chandra,1983 , Hashmi ,1988 and El-Wakel and Ghoneem,1999) .

III. Pathogenicity studies :

Data in Table (4) (Fig.5,6) indicate that the tested fungi varied in their pathogenic capabilities causing pre- and post emergence damping -off at range of (00.00% to 54.66%) and (00.00% to 62.66%), respectively. *Fusarium oxysporum*(25.33% - 62.66%), *R.solani* (54.66% - 24.00%), *F. moniliforme* (38.66% - 18.66%), *M phasaeolina* (17.33% - 42.66%), *P. ultimum* (30.66% - 18.66%) and *F.solani* (14.66% - 21.33%), caused the highest percentages of pre- and post emergence damping –off ,respectively .

Table (4): Percentages of pre- and post emergence damping –off caused by the isolated fungi 30 and 60 days after sowing, respectively .

Fungi	% Pre-emergence	% Post-emergence	% Survivals
Alternaria alternate	00.00	00.00	100.0
Aspergillus flavus	00.00	00.00	100.0
Fusarium oxysporum	25.33	62.66	12.01
F.moniliforme	38.66	18.66	42.68
F.semitectum	08.00	10.66	81.34
F.solani	14.66	21.33	64.01
Macrophomina phaseolina	17.33	42.66	40.01
Mucor sp.	00.00	00.00	100.0
Penicillium sp.	00.00	00.00	100.0
Pythium .ultimum	30.66	18.66	50.68
Rhizoctonia solani	54.66	24.00	21.34
Rhizopus stolenifer	00.00	00.00	100.0
Control (without fungus)	00.00	00.00	100.0
L.S.D.at 5% :	7.3	4.9	-

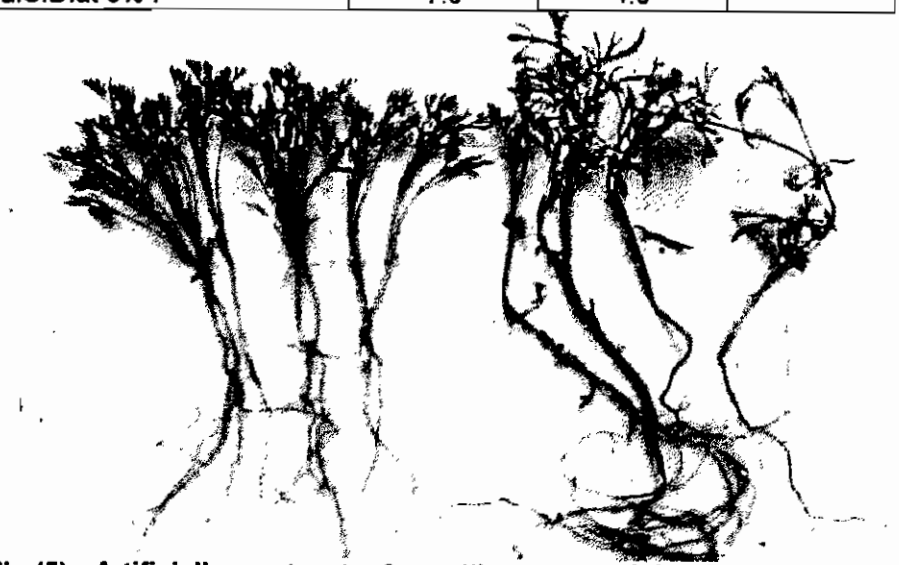

Fig.(5): Artificially root rot of seedlings caused by *R. solani*(right) Healthy roots (left).

Fig.(6): Artificially wilted seedlings casued by *F. Oxysporum* (right), healthy seedlings (left).

On the other hand, *F.semitectum* (8.00% -10.66%), was the least destructive fungs in this respect .While, the other fungi were not pathogenic to *N.sativa* plants .*Rhizoctona solani* has been reported parsitizing *N.sativa* abroad (Qureshi *et . al.*, 1979). *F. oxysporum* produced atrue wilt syndrome , thus confirming it,s pathogenicity to *N.sativa* (Hashmi ,1988).El Wakel and Ghoneem,1999) , detected some of the tested fungi as seed – borne fungi of *N.sativa* in Pakistan .Also, *M. phaseolina* was reported to be a pathogenic fungus to *N. sativa* (Sinha and Singh, 1995). While, *Sclerotinia sclertiorum* which was reported on *N.sativa* by Naqvi and Gupta 1979, in India was not recorded in this study .

IV.Controlling *N.sativa* fungal diseases :

1. *In Vitro* Experiment :

Effect of fungicides,plant essential oils active ingredients (AI) on fungal linear growth :

Data in (Table,5) indicate that the inhibition activity of the seven treatments used was more evident when their concentrations increased Moreover, complete inhibition was showed at concentration 3000ppm for all treatments and against the six tested fungi. Citral,Thymol and Topsin M were the best treatments against mycelial growth, wherease, out of the six tested fungi mycelial growth of five , four and three tested fungi ,completely inhibited, respectively .

On the other hand, Menthol was the least effective in this respect .The different responses of each fungus to different treatments tested indicated different antifungal specifity as reported by Champwat and Pathak ,1994 and Dang *et.al.*, 1994. Also, these results are in agreement with Agrawal and Mathela ,1979, they found that the essential oil of thyme was

highly active against six *Aspergilli* species .Also, Linskens and Jackson ,1991 stated that many terpenoids of essential oils , inhibited mycelial growth of some plant pathogenic fungi and they added that the antifungal activity increase with increasing their concentrations .

Table (5): Efficacy of three fungicides , and active ingredients of four essential Oils on fungal linear growth *in vitro*.

Treatment	Conc. ppm	%Toxicity of :					
		F. oxysporum	*F. moniliforme*	*F. solani*	*M. Phaseolina*	*R. solani*	*P. ultimum*
Fungicide:							
Rizolex T 50%wp	1000	50.60	66.30	71.10	61.50	90.00	20.10
	2000	70.00	80.00	90.00	75.30	100.0	73.30
	3000	100.0	100.0	100.0	100.0	100.0	100.0
Topsin M 70%wp	1000	79.30	70.00	75.30	39.30	68.30	76.30
	2000	100.0	100.0	100.0	91.70	76.50	90.20
	3000	100.0	100.0	100.0	100.0	100.0	100.0
Vitavax / thiram 75%wp	1000	60.10	77.10	73.50	40.30	62.10	62.20
	2000	78.20	90.00	88.20	79.60	83.70	88.10
	3000	100.0	100.0	100.0	100.0	100.0	100.0
(AI):							
Anisole 98.5%	1000	50.40	61.40	50.40	25.30	66.20	75.00
	2000	90.30	100.0	74.10	58.60	90.00	100.0
	3000	100.0	100.0	100.0	100.0	100.0	100.0
Citral 95%	1000	46.40	51.60	58.60	23.30	74.40	100.0
	2000	100.0	100.0	100.0	59.90	100.0	100.0
	3000	100.0	100.0	100.0	100.0	100.0	100.0
Menthol 95%	1000	20.10	39.60	75.00	20.50	68.30	76.70
	2000	75.00	70.10	100.0	70.70	91.80	100.0
	3000	100.0	100.0	100.0	100.0	100.0	100.0
Thymol 95%	1000	66.70	52.80	60.30	28.30	70.70	90.10
	2000	100.0	100.0	77.30	61.20	100.0	100.0
	3000	100.0	100.0	100.0	100.0	100.0	100.0
Control	0	00.00	00.00	00.00	00.00	00.00	00.00

L.S.D. at 5% for:

Fungi (F)	**=0.34**
Concentration (C)	**=0.30**
Tretment (T)	**=0.70**
TxC	**=0.60**
FxTxC	**=2.90**

2.Effect of the tested treatments on *N.sativa* damping -off diseases under greenhouse conditions :

Concerning the greenhouse control study , the percentages of pre and post emergence damping- off diseases were estimated for various treatments applied (Table, 6).Generally , all the treatments gave some degree of controlling activity. The magnitude of such control varied with the treatment used and also, with the fungus under considerations . Vitavax Thiram as chemical fungicide,Rhizo N as biocide,Rhizobacrtrein as biofertilizer and Citral and Thymol as (Al) were the most effective treatments against the tested fungi compared with the other treatments. Furthermore, Vitavax Thiram completely prevented damping- off diseases of *N.sativa* (100%) caused by all the tested fungi except of *F. oxysporum* and *M.phaseolina*. Also, Thymol gave the same result against *F.solani* and *P.ultimum*

Table (6): Effect of the tested fungicides ,biocides , biofertilizers and essential oils active ingredients (AI) as seed treatment on *N. sativa* plants damping –off and survivals in greenhouse .

Treatment	Rate g/kg ml/kg	Effect of pathogenic fungi on percentages of pre and post emergence damping off:																	
		F. oxysporum			*F. moniliforme*			*F. solani*			*M. phaseolina*			*R. solani*			*P. ultimum*		
		*	**	***	*	**	***	*	**	***	*	**	***	*	**	***	*	**	***
Fungicides:																			
Rizolex T	3g/kg	06.67	20.00	73.33	08.00	00.00	92.00	00.00	00.00	100.0	08.00	17.33	74.67	00.00	00.00	100.0	00.00	00.00	100.0
Topsin M	3g/kg	06.67	13.33	80.00	04.00	00.00	96.00	00.00	00.00	100.0	04.00	14.00	82.00	04.00	00.00	96.00	00.00	00.00	100.0
Vitavax / thiram	3g/kg	00.00	06.67	93.33	00.00	00.00	100.0	00.00	00.00	100.0	05.33	22.66	72.01	00.00	00.00	100.0	00.00	00.00	100.0
Biocides ;																			
Plant Guard	4ml/kg	13.33	20.00	66.67	12.00	09.33	78.67	04.00	01.33	94.67	12.00	29.33	58.67	08.00	01.33	90.67	09.33	04.00	86.67
Rhizo N	4g/kg	06.67	13.33	80.00	09.33	06.67	84.00	01.33	00.00	98.67	10.67	25.33	64.00	07.00	00.00	93.00	00.00	00.00	100.0
Biofertilizers:																			
Cerealin	150g/kg	26.67	40.00	33.33	21.33	14.67	64.00	12.00	09.33	78.67	14.67	30.67	54.66	18.67	14.67	70.66	25.33	18.67	56.00
Rizobactrin	150g/kg	13.33	20.00	66.67	16.00	16.66	73.34	09.00	04.00	86.67	12.00	25.33	65.34	13.33	06.67	80.00	12.00	00.00	88.00
AI) 3000ppm																			
Anisole95.5%	50ml/kg	06.67	13.33	80.00	08.00	06.67	85.33	02.67	05.33	92.00	09.33	25.33	65.34	13.33	04.00	82.67	18.67	10.66	70.67
Citral 95%	50ml/kg	13.33	13.33	73.34	13.33	06.67	80.00	05.33	08.00	86.67	09.33	22.66	68.01	17.33	06.67	76.00	00.00	00.00	100.0
Monthol 95%	50ml/kg	26.67	33.33	40.00	17.33	14.67	68.00	10.67	08.00	81.33	13.33	28.67	30.00	29.33	13.33	57.34	12.00	08.00	80.00
Thymol 95%	50ml/kg	06.67	20.00	73.33	06.67	00.00	93.33	00.00	00.00	100.0	04.00	17.33	78.67	08.00	00.00	92.00	00.00	00.00	100.0
Control	0	29.30	66.67	4.00	37.33	17.33	42.67	17.33	21.33	61.34	16.00	45.33	38.67	56.00	25.33	18.67	34.67	21.33	44.00
L.S.D.at 5%		4.8	6.3		3.4	2.1	-	2.5	1.4	-	2.1	2.8	-	3.9	1.7	-	2.4	3.8	-

* pre –emergence ** post – emergence *** survivalsz

On the other hand , the biofertilizer Cerealin and Menthol as (Al) were the least efficient against all the tested fungi . Similar results were obtained by other workers (Linskens and Jackson ,1991; Reddy *et.al.,* 1991 ; Gowily *et. al.,* 1993 ; Champawat and Pathak 1994 ; Dange *et. al.,* 1994 and Harender *et. al.,* 1995). The variation response of the pathogen to the controlling means in terms of diseases level ,may be attributed to one or more resons , such as differences in fungitoxicity , solubility and stability of each treatment.

3. Effect of the tested treatments on *N.sativa* diseases infection under field conditions:

Data in Tables (7) demonstrated that all treatments tested as seed dressers significantly decreased percentages of infection compared with the control treatment after 30 and 60 days of sowing date, and in the both experimental seasons.In general, the chemical followed by biocides treatments were the superior as controlling agents. Topsin M (93.33%- 92.56%) and(88.89% - 91.19%), followed by Rhizo N (80.0% -77.7%) and(80.83% - 76.58 %) and Anisole (89.97% - 81.95%) and(88.89% - 87.88%) showed the highest reduction percentages of diseases infection . On the contrast, Cerealin and Menthol proved to be the least effective treatment in this respect.These results are in harmony with those obtained by Gowily *et al.*, 1993 ; Champawat and Pathak 1994 ; Danage *et al.*, 1994 and Harendr *et al.*, 1995.

3. Effect of the tested treatments on *N.sativa* plant growth and oil and oil yield under field conditions:

Data in Table (8,9& 10) reveal that different treatments used varied in their effects on growth of *N.sativa* plants under field conditions .In general all treatments tested were nontoxic and increased plant height, number of branches, dry weight , seed yield and oil yield percentages over the control treatment in the both experimental seasons. All chemical fungicides followed by Rhizo N as biocide ,Rizobactrin as biofertlizer and Anisole and Thymol as (Al) were the most effective treatments in this respect.While,Cerealin and Menthol were the least effective treatments in this respect. (Reddy *et al.*, 1991 and Soliman 1997).

Table (10) : Effect of different treatments as seed treatment on *N.sativa* oil yield, under field conditions ,(2004-2005 & 2005-2006).

Treatment (T)	Rate	Season (2004- 2005)				Season (2005-2006)			
		Fixed Oil/ plot (g)	% * increase	Essential oil / plot (g)	% * increase	Fixed Oil/ plot (g)	% * increase	Essential oil / plot (g)	% * increase
Fungicide :									
Rizolex T	3g/kg	196.2670	85.59	1.3200	275.00	188.3630	100.6994	0.9430	346.7077
Topsin M	3g/kg	155.2000	107.39	0.7300	107.39	151.6111	61.5405	0.6330	199.8579
Vitavax / Thiram	3g/kg	178.6000	68.89	0.9650	174.150	175.0000	86.4612	0.8553	305.1634
Biocide :									
Plant Guard	4ml/kg	130.0000	22.93	0.4960	40.910	126.1500	34.4119	0.3762	78.2094
Rhizo N	4gl/kg	153.7000	45.34	0.6990	98.580	148.3621	58.0787	0.5330	152.4870
Biofertilizer :									
Cerealin	150g/kg	124.7680	17.98	0.3770	07.100	119.9632	27.8199	0.2773	31.3604
Rizobactrin	150g/kg	171.1450	61.84	0.8550	142.900	167.2433	78.1965	0.8440	29.8105
(AI)3000ppm:									
Anisole 98.5%	50ml/kg	130.0000	22.93	0.4330	23.010	125.3500	33.5595	0.3662	73.47.23
Citral 95%	50ml/kg	134.3680	27.06	0.6530	85.510	130.7200	39.2811	0.4320	104.6423
Menthol 95%	50ml/kg	130.7000	23.59	0.5330	51.420	126.6600	34.9553	0.2870	35.9545
Thymol 95%	50ml/kg	160.3320	51.61	0.7740	119.890	195.9870	70.4650	0.8770	315.4430
Control	0	105.7510	-------	0.3520	-------	93.8533	-------	0.2111	-------
L.S.D.at5% :		16.6420	----	0.1650	---	14.20	-----	0.2090	---

*Relative to the control treatment .

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أمراض حبة البركة وطرق مقاومتها فى مصر

محمد احمد محمد بيومى[1] وإبراهيم احمد محمد شلبى[2]
١- قسم بحوث أمراض نباتات الزينة والطبية والعطرية – معهد بحوث أمراض النباتات – مركز البحوث الزراعية – الجيزة- مصر
٢-قسم بحوث النباتات الطبية والعطرية - معهد بحوث البساتين - مركز البحوث الزراعية - الجيزة

يعتبر حبة البركة من النباتات الطبية الهامة التى تزرع فى مصر ، ولقد ازدادت المساحة المنزرعة بهذا النبات فى السنوات الأخيرة وذلك بغرض تلبية متطلبات التصدير بالإضافة إلى الاستهلاك المحلى. تم حصر الأمراض التى تصيب نبات حبة البركة فى خمسة محافظات، ووجد أن اعلى نسبة إصابة كانت فى محافظة القليوبية.

عزلت فطريات الجنس فيوزاريوم اكسيسبورم، فيوزاريوم مونيليفورم، فيوزاريوم سيميتكتم، فيوزاريوم سولانى، ماكروفومينا فاصولينا، بيثيم التيمم وريزوكتونيا سولانى من النباتات المصابة. وكذلك عزلت الفطريات السابقة من البذور ما عدا ماكروفومينا فاصولينا، ريزوكتونيا سولانى، بثيوم التيمم بالاضافة الى فطريات الترناريا الترناتا، اسبرجلس فلافس، جنس الميوكر، وريزوبس ستولنيفر.

تبين من اختبارات العدوى الصناعية ان فطريات فيوزاريوم اكسيسبورم، فيوزاريوم مونيليفورم، ريزوكتونيا سولانى، ماكروفومينا فاصولينا، وبيثيم التيمم، هى اكثر الفطريات ضراوة فى احداث المرض بينما كان الفطرين فيوزاريوم سولانى وفيوزاريوم سيميتكتم اقلها. كذلك ثبت قدرة اللطر الترناريا الترناتا على إحداث عفن للقرون مماثل لما هو موجود فى الاصابة الطبيعية.

تم مقارنة كفاءة ثلاثة من المبيدات الكيماوية مع خمسة من المواد الفعالة لبعض الزيوت الطيارة وذلك تحت ظروف المعمل وفى اطباق ، واتضح ان توبسن م والسترال والثيمول وذلك بتركيز ٢٠٠٠ جزء فى المليون قد ثبطت تماما النمو الميسليومى لفطريات الفيوزاريوم اكسيسبورم والفيوزاريوم مونيليفورم والفيوزاريوم سولانى.

جميع المعاملات قد ثبطت النمو الميسليومى لجميع الفطريات تحت الدراسة وذلك عند تركيز ٣٠٠٠ جزء فى المليون. كذلك تم اختبار كفاءة ثلاث مبيدات كيماوية ، مبيدين حيويين ، ثلاث من الاسمدة الحيوية خمسة من المواد الفعالة لخمسة من الزيوت الطيارة وذلك تحت ظروف الصوبة فى أصص معدية بالفطريات الممرضة أو تحت ظروف الحقل فى ارض معدية طبيعيا، وذلك كمعاملات للبذور قبل الزراعة. وقد ثبت الأتى:

أولا: تحت ظروف الصوبة:

كان المبيد الفطرى فيتافاكس ثيرام (٣جم /كجم بذرة)اكثر المعاملات فعالية حيث منع تماما سقوط البادرات المتسبب عن الفطريين فيوزاريوم اكسيسبورم وماكروفومينا فاصولينا . كذلك اظهرت المادة الفعالة لزيت الزعتر (الثيمول) نفس التأثير ولكن ضد فطريات الفيوزاريوم سولانى والبثيم التيمم. على العكس من ذلك أظهر السماد الحيوى سيريالين (١٥٠ جم / كجم بذرة) أو المانثول (٥٠ مل / كجم بذرة) (وهى المادة الفعالة فى الزيت الطيار للنعناع) اقل المعاملات كفاءة فى مقاومة امراض سقوط البادرات لحبة البركة.

ثانيًا: تحت ظروف الحقل:

تحت ظروف الحقل اظهر المبد الكيماوى توبسن م (٣جم / كجم بذرة) والمبيد الحيوى ريزو ن (٤جم / كجم بذرة) والسماد الحيوى ريزوباكترين (١٥٠ج/كجم بذرة) اعلى قدرة على مقاومة امراض حبة البركة بالمقارنة بمعاملة الكونترول.

اختلفت المعاملات المختبرة فى تأثيرها على نمو النباتات وذلك تحت ظروف الحقل ولكن على العموم لم يكن لها أى تأثير سام على النباتات ولكنها أدت الى زيادة ملموسة فى الوزن الجاف، كذلك زيادة فى اطوال النباتات وعدد الأفرع وزيادة فى محصول البذور الناتج وذلك بالمقارنة بمعاملة الكونترول. كانت افضل المعاملات على النمو النباتى هى المبيدات الفطرية يليها المبيد الحيوى ريزو ن ثم السماد الحيوى ريزوباكترين ثم الانيثول والثيمول وهى المواد الفعالة فى الزيت الطيار للينسون والزعتر على التوالى. بينما كان السماد الحيوى سريالين والمركب الفعال لزيت النعناع الطيار منثول اقل المعاملات إيجابيًا على نمو نبات حبة البركة بالمقارنة بباقى المعاملات كذلك أدت المعاملات السابقة إلى زيادة فى محصول الزيت الثابت والطيار وذلك بالمقارنة بمعاملة المقارنة.