TANTA UNIVERSITY
FACULTY OF AGRICULTURE
KAFR EL-SHEIKH
Agricultural Botany Department

STUDIES ON SOME CAUSALS OF SUGAR BEET ROOT ROTS

By
MOUSTAFA IBRAHIM MOHAMED GOUDA
B. Sc. (Agric.), Tanta Univ., 1978.
M. Sc. (Agric.), Menufiya Univ., 1996.

Thesis

Submitted in Partial fulfillment of the requirements for the degree of

DOCTOR OF PHILOSOPHY

IN

PLANT PATHOLOGY

FACULTY OF AGRICULTURE,
KAFR EL-SHEIKH, TANTA UNIVERSITY

(2001)

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CONTENTS

INTRODUCTION

INTRODUCTION

Sugar beet (*Beta vulgaris* L.) is the second important sugar crop after sugar cane in terms of acreage, total production and cash value in Egypt. It is cultivated mainly for sugar on about 135,623 feddans in North and South of Egypt with over 21 tons/feddan (Agricultural Economy year book, Ministry of Agriculture, 2000). Sugar beet is still has good potential for higher yield in Egypt. This should be achieved to meet the increasing consumption of sugar.

One of the most important factors affecting the productivity of sugar beet is the attack of various diseases. The major diseases of this important crop in Egypt are root diseases at all stages of growth that affect directly sucrose production **(Abada, 1980 & 1994; Fahim *et al.*, 1981; El-Kholi, 1984; El-Kazzaz *et al.*, 1987 and 1999) .**

Great attention is made nowadays towards lessening fungicidal application to decrease the health hazards to humanity due to the environmental pollution caused by fungicides. Therefore, using some other means of disease control instead of fungicides is strongly encouraged.

This study was an attempt to control damping off and root rots of sugar beet by using some bioagents , certain plant extracts and essential oils. Survey of root diseases in certain Delta Governorates was also carried out to point out the most serious and dangerous diseases that affect the sugar beet roots.

REVIEW OF LITERATURE

REVIEW OF LITERATURE

Sugar beet (*Beta vulgaris* L.) is one of the important sugar crops in the world. Before 1982, sugar cane was only the main sugar producing crop in Egypt. However, since 1982 sugar beet has been introduced as a new crop to be cultivated espicially in northern delta (kafr El-shiekh Governorate) to face the increasing demand of sugars .

Sugar beet is known to be attacked by various diseases which affect its quantity and quality . Damping-off of seedlings and root rot diseases were considered among the most destructive diseases which are caused by many serious soil borne pathogens namely , *Sclerotium rolfsii* Sacc. (**El-Kholi , 1978 ; Singh, 1982 ; El-Zayat *et al.*, 1986 ; Ristaino *et al.* , 1991 ; El-Abyad *et al.* , 1992 ; Abada , 1994; Sharma and Pathak , 1994 ; Awad 1995 ; El-Kazzaz *et al.*, 1999 and Esh , 2000**) .*Rhizoctonia solani* Kuhn, (*Thanatephorus cucumeries*) Frank, (**El-Kholi , 1978 ; El-Zayat *et* al. , 1986 ; El-Abyad *et al.* , 1988 ; Abada , 1994 ; Awad , 1995 ; Mosa and El-Kholi , 1996 ; El-Kazzaz *et al.*, 1999&2000 and Esh , 2000**).Several species of *Fusarium* and *Pythium* were also recorded by many invistigators, i.e., *Fusarium oxysporum* Schlech, Synder and Hans., *F. solani* (Mart.), *F. semitictum* Berk and Rau., *F. moniliforme* and *Pythium debaryanum*, *P. ultimum*,

Hesse., *P. aphanidermatum*, Meurfd. **(El-Kholi , 1978 ; Hassan , 1981 ; Essa, 1993 ; Abada , 1994 ; Mansour *et al.* , 1995 ; Awad , 1995 and El-Kazzaz *et al.*, 1999 & 2000) .** *Phoma* (*Pleospora*) *betac*, (Berl) Nevodovsky **(Bugbee and Soine, 1974 and El-Kholi , 1978)** *Macrophemina phaseolina*, Tassi. **(El-Kholi , 1978 ; Fahim *et al.* , 1981 ; Abada , 1994 and Awad , 1995) .**

Cultivar resistance :

Cultivar resistance may be limited to specific pathogen or races and it is hard to incorporate resistance for more than one pathogen. Resistance based on plant diseases embraces a wide range of biological phenomena including true genetic resistance, tolerance and escape (**Maloy, 1993**). However, breeding for resistance to *Sclerotium* root rot was detected by many workers (**Waraitch 1985**). **Sharma and Pathak (1990)** tested 36 cultivars of sugar beet plants inoculated with *Sclerotium rolfsii*. They found that ten cultivars were resistant (Less than 10 % disease incidence) and found that cultivar Virtus was the most resistant one (4% infection).

Polygenic partialy dominant resistant to *R. solani* has been developed in germplasms in the USA (**Hecker and Ruppel , 1977 , 1988 & 1991**). Several commercial cultivars with moderate level of resistance have been developed by sugar

company breeders throughout the use of these germplasm (**Engelkes and Windels , 1994**).

Biological control :

In view of hazardous impact of pesticides and other agrochemicals on the ecosystem, the biocontrol of plant diseases as an alternate strategy has received increasing attention in recent years. Biocontrol agents have been found to be highly effective because of their broad-spectrum activity against several plant pathogens. A novel method of delivering these bioagents through seed treatment resulted in management of a large number of soil-borne diseases (**Papavizas, 1985 ; Backer, 1987; Campbell, 1989 and Mukhapadhyay , 1997**). About 35 genera of fungal and bacterial species have been used as a biocontrol agents against various plant pathogens (**Cooke and Baker , 1983**).

Numerous references covering the *in vitro* and *in vivo* antagonism of several fungal bacterial and actinomycetes genera to soil-borne pathogen were reported. (**Chet *et al.*, 1979 ; Elad *et al.*, 1980, 1981, 1984 and 1986; Abd El-Moity 1981, 1986 and Abd El-Moity *et al.*, 1990 ; Khalifa , 1987 and 1991 ; Khalifa *et al.*,1995 , Benhamou and Chet, 1993 and 1996; Ciccarese *et al.*,1991 and 1992; Lumsden 1993; El-Kazzaz *et al.*, 2000, Esh,2000 and Hamoud, 2000**).

Numerous fungi had been documented as effective antagonistis against several important soil-borne pathogens .*Trichoderma* spp.; *Gliocladium* spp.; *Penicilium* spp.; and *Cheatomium* spp. **(Dipietro *et al.*, 1992 and Amemiya *et al.* ,1994)** have been most studied in the biocontrol of root pathogens. Antagonistic *Trichoderma* spp. were regarded as being of special interest for use as biocontrol agents and succeeded to control soil-borne disease. (**Papavizas 1985; Lumsden *et al.* 1993; and Awad 1995**).

T. harzainum has been shown to suppress the growth of *S. rolfsii*, the causal agent of root and stem diseases of various crops (**Wells *et al.*, 1972; Abada , 1980**). *Macrophomina phaseolina* (**Elad *et al.* 1986 and Belal , 1996**) and *R. solani* (**Harder *et al.* , 1979 and Abd El-Moity , 1981**) .

Chet and Baker (1981) stated that an isolate of *T. hamatum* was effective in controlling *R. solani.* **Bicici *et al.*, (1991)** indicated that four *Trichoderma* spp. include *T. harzainum, T. hamatum, T. viride* and *T. pseudokoningii* were effective in controlling gummosis in lemon trees. They also, mentioned that *Trichoderma* was prepared by growing different isolates on a mixture of wheat brane saw dust and water (3:1:4 w/w/v).

Awad, (1995) found that an isolate of *Trichoderma harzainum* isolated from sugar beet rhizosphere was found to be antagonistic to all the tested pathogenic fungi. *T. harzainum* grew faster than the pathogens *in vitro*. *T. harzainum* over grew about two third of the medium when it was inoculated in paired culture with *S. rolfsii* or *R. solani*. He added that *F. oxysporum* was more inhibited *than S. rolfsii, R. solani* while *M. phaseolina* was the most affected pathogen by this biocontrol agent. He also reported that the application of *T. harzainum*, as wheat brane preparation reduced the incidence of sugar beet damping-off and root rot diseases incited by *S. rolfsii, R. solani, F. oxysporum* and *M. phaseolina* under greenhouse and field conditions. Also, increasing the amount of *T. harzainum* preparation led to decrease damping-off and root rot under greenhouse conditions.

Ushamalini *et al.*, (1997) studied the inhibitory effects of antagonists *T. viride, T. harzainum, T. hamatum* and *T. koningii* against *M. phaseolina* and *F. oxysporum in vitro*. They found that all the antagonists significantly inhibited the growth of *M. phaseolina*. *T. viride* and *T. harzainum* were the most effective but in case of *F. oxysporum, T. harzainum* was the most effective. *Gliocladium* is known to have a broad range of

hosts.In fact, **Papavizas(1985)**considered that *Gliocladium* species, have similar antagonistic effect as *Trichoderma* species.*G. virens* parasitized and decayed scleroltia of some fungi *i.e., S. rolfsii, Botrytis cinerea and M. phaseolina*.It was reported that *Trichoderma* spp. and *Gliocladium virens* showed strong antagonistic activity to *F. oxysporum* f.sp. *lycoepersici*; *S. rolfsii* and *R. solani* by mycoparasitism and over growth of the pathogens (**Collins and Papavizes , 1989, Ciccarese *et al.* , 1990, Lumsden , 1993, Abd El-Moneim , 1996,; El-Kazzaz *et al.*, 2000 and Hamoud , 2000**) .

Antibioses is potentially a principal component of mechanism of the biocontrol by *Trichoderma* spp. and *Gliocladium virens* which produced an array of metabolites were identified as antifungal and antibacterial compounds ,i.e.viridin, sesquiterfen, gliotxin, gliovirin, gliocladiacid. heptelidic acid (avocetin), viridiol and valinotricin.Gliotxin specifically has been inplicated in biocontrol mechanism, in addition to suzukacillin and alamicine were peptide antibiotics with antifungal and antibacterial properties. Dermandinis an unsaturated monobasic acid, active against gram negative and gram positive bacteria and a wide range of pathogenic fungi (**AbdEl-Moity,1981;Chisalberti and Sivasithamparam,1991**).However, strains of *Trichoderma*

spp. and *G. virens* have been used successfully to control *S. rolfsii* in field production of vegetable crop (**Lumsden,1993**).

Bacterial antagonists :

Antagonistic bacteria have been extensively studied as biocontrol agents effective against various soil-borne pathogens. Among 20 genera of bacteria, *Bacillus* spp. *Pseudomonas* spp. and *Actinomycetes* (*Streptomyces* spp.) are widely used for their abilities as biocontrol agents. Several *Bacillus* spp. including *B. subtilis* are antagonistic to plant pathogenic fungi and bacteria. *Bacillus* spp. produced at least 66 different antibiotic compounds (**Ferreira *et al.*,1991).** Subtilin, bacilin, bacillomycen, subtenolin ,mycosubtilin , toximycin and bacitracin are different names given to antibiotics produced by *B. subtilis* isolates (**Schobe, 1984 and Loeffler *et al.* , 1986**) . This antagonist has been identified for its ability to grow with the advancing root when applied to seeds since it inhibited germination of *Sclerotium cepivorum* sclerotia in soil and also gave fairly seasonal protection when introduced on the onion seeds (**Utkhede and Rahe , 1980) . Abd El-Moniem (1996)** found that, an isolate of *B. subtilis* has clear antagonistic effect against *S. rolfsii*, *in vitro* and *in vivo*.The culture filtrate of *B. subtilis* strains isolated from rhizosphere of *Cicer arietinum*

plants, reduced the mycelial growth of *R. solani*.**Loeffler *et al.*, (1986)** observed that , two antifungal antibiotics were prduced by *B. subtilis*.One of them was identified as dipeptide compound named bacilycin was demonsrtrated for all 12 wild- type isolate of *B. subtilis*, whereas the other was idintified as fengymycin (a complex of closely related lipopeptide components). They showed antibiotics activity to protect plants from the pathogenic action of soil borne fungi. **Wolk** and **Sorkar (1994)** tested the effect of *B. subtilis* against*R.solani* in presence of seeds of different crops. They found that the effect of some *B. subtilis* isolates against *R. solani* differed according to the crop. They concluded that this due to the antagonistic bacteria capacity to compete with other microorganisms establish in different rhizospheres.They also, found that the use of bacterial seed treatment (BSTS) in growth chamber and field trials for controlling damping-off and root rot of sugar beet caused by *R solani*(AG-2-2),reduced disease incidence and significantly increased root yield (**El-Kazzaz *et al.*, 1999 and Esh,2000**). **Saleh, (1997)** found that *B. subtilus* significantly decreased the incidence of root rot and wilt of groundnut caused by all of the tested fungi.The antagonist was more effective in decreasing root rot caused by *M. phaseolina* than that caused by *R. solani*.The addition of *B. subtilis* to soil infested with

one of the tested fungi appeared to hamper somewhat the growth of these fungi in the soil .**El-Kazzaz *et al.*, (2000)** used certain isolates of *T.harzainum,B.subtilis* and *Actinomycete isolate* against *R. solani* and *S. rolfsii* the causal pathogens of damping -off as well as crown and root rot diseases of sugar beet. *In vitro* studies they found that *B. subtilus* isolate (4) proved to have the highest effect against *R. solani* and *S. rolfsii* followed by the *Actinomycete* isolate (1).. *In vivo* studies they showed that each of *T. harzainum* (1), *B. subtilus* (4) and the *Actinomycete* isolate caused significant reduction of damping-off and root rot diseases caused by the tested pathogen. However, *T. harzainum* was the most effective followed by *B. subtilis*. They added that in field experiments *T. harzainum* proved to be the most effective biocontrol agent on seedling damping-off and root rot as well as disease severity followed by *B. subtilis in* comparison with the untreated control.

Gurusiddaiah *et al., (1986)* reported that, *Pseudomonas fluorescens* isolated from the root of wheat, produced an antibiotic highly effective against many several fungi including *Rhizoctonia solani*.

Esh, (2000) showed that a highly significant differences between pathogens. *In vitro* experiments *T. hamatum* showed

a highly significant activity in reducing the tested pathogenic fungal growth *in vitro* than *T. viride*. Also, *T. hamatum* showed a hyperparasitism in relation to the pathogenic fungi. On the other hand, *Bacillus* X isolate which was isolated from sugar beet roots was significantly much efficient in decreasing the linear growth of the tested pathogens *in vitro* than the identified isolate *Bacillus subtilis*. The *in vivo* studies showed that high significant differences between the bio agents in controlling damping off disease in the greenhouse. The highest effect in controlling damping off disease showed by the bioagent *T. hamatum*, which gave the highest means percentage of healthy survival plants, followed by *T. viride* and the lowest one was *B. subtilis*.

Plant extracts and oils :

In recent years, there is a world wide interest in identifying plants possessing antifungal properties for developing plant based fungicidal formulations. Plants and their constituents have shown values as potent, harmless and easily available fungitoxicants in contrast to synthetic chemicals, which often impose various undesirable side effects. With the increase of awareness on toxic hazards of chemicals to crops, consumers and environment due to their phytotoxic residual and pollution effects, the importance of indigenous products in plant disease control has been emphasized.Several higher plants have been

screened for their fungitoxicity against the fungi which causing severe damping-off disease of seedlings of various crops and some of them proved their successfulness. Efficiency of the higher plant extracts and oils against the mycelial growth and spore germination of different species of *Fusarium* was documented. Many workers have reported the antimicrobial activity of lupin seeds (**Dorozhkin *et al.*, 1985**); *Alnu acuminata* (**Gonzalez *et al.*,1988**); *Seseli indicam* (**Chaturvedi &Tripathi,1989**);*Euptorium anabinum* (**Kumar & Tripathi, 1991**) ; *Elaeis guineensis*, *Maize* seeds (**Huynh *et al.*, 1992**); *Inula viscasa* (**Yegen *et al.*, 1992**); *Citronella winterianus* (**Kole *et al.*, 1993**)); *Foeniculum vulgare*(**Dwivedi and Dubey 1993)** and *Mentha spicata* (**Jaspal *et al.*, 1994)** which completely inhibited the mycelial growth and spore germination of *F. oxysporum* the causal pathogen of some crops. **El-Shami *et al.*, 1985,** found that extracts of *Clematis gouriana* reduced sporulation of *F. oxysporium* and *F. solani* in chickpea. Effect of plant extracts on host-parasite interaction was reported when pea seeds were soaked in *Eupatorium cannabinum* for 6 h prior to planting, no seedling damping-off occurred, even after inoculation with *F. oxysporum*, and used of soybean-cacke in controlling *Fusarium* wilt of cotton.

Kishore *et al.*,(1982) noted that from 31 plant species leaves extracts tested for its fungitoxic activity against *R.solani*,

only leaf extract of *Allamanda cathartica* and *Artabatrys hexapetala* completely inhibited the growth of the tested fungus. **Dubey *et al.*, (1983)** revealed that leaves extract of *Chenopodium ambrosioides* exhibited strong fungitoxicity against the mycelial growth of *R. solani*, the essential oil was minimum inhibitory at 1000 ppm concentration.However they found that the essential oil did not show any phytotoxicity on germination and seedling of *Phaseolus aureus*. **Renu, (1983)** tested the leaf extract of 30 higher plant species against *R solani* and he noted that extracts of *Alegle marmelos* & *Cestrum diurnum* exhibited 100% fungitoxicity. This activity was unaffected by heating up to 100°C or autoclaving. **Dutta&Deb, (1986)**revealed that leaf extract of *Eupatorium adenophorum* suppressed mycelial growth and sclerotial germination of *S.rolfsii in vitro* The extract reduced the microbial population in soil and rhizosphere.On the other hand, it stimulated the antagonistic effect of *Trichoderma* spp in soybean seedlin **Sivakadadcham, (1988)** incorporated leaf extracts of *Adhatoda vasica, Azadirachta indica* and *Cullen corylifolium* into the PDA medium used for culturing some soil pathogens.He indicate that extract of *A.vasica* and *C.corylifolium* were suppressive *S.rolfsii* while different green manures could selectivel suppress or enhance microbial populations in the soil. **Dubey & Dwivedi, (1988)** indicated that the essential oil of

Ocimum canum inhibited the growth of *M. phaseolina* and it was more toxic than the aqueous extract of the plant.**Gonzalez *et al.*,(1988)** indicated that flavonoid glucoside from many compounds extracted from *Alnus acuminata* nodules inhibited the growth of *F. oxysporium*. **Khanna *et al.*, (1989)** identified 29 compounds of essential oil extracted from fresh carrot leaves. They stated that the major constituents were sabinene, linalool, linalyl acetate, carvone and carotol. They found that the oil inhibited the growth of *S. rolfsii* by 80%. **Thakur *et al.*, (1989)** studied the anti fungal activities of six essential oils namely, euganol, thymol, linalool, methyl chavical, citronellal and geraniol, which taken from four *Ocimum spp* (*O. gratissimum, O. viride, O. canum and O. basilicum*) against 3 pathogens i.e. *F. solani*, *S. rolfsii* and *R. solani*. They found that euganol oil at 0.1% inhibited the radial growth of *S. rolfsii* and *R solani* and thymol inhibited *R. solani* and *S. rolfsii*. Linalool checked the growth of *R.solani* while citronellal oil inhibited growth of *S rolfsii*. Radial growth of *S. rolfsii, R. solani*. and *F. solani* was completely checked by general oils. **Singh and Dwivedi (1990)** revealed that neem oil was the most effective of volatile and nonvolatile fractions tested against *S. rolfsii*. Viability of sclerotia was only 8% following treatment with neem oil and 20% with bluegum leaf distillate compared with 71% in the untreated control. **Manasi Mishra and Tewari,**

(1990) tested extracts from leaves of *Calotropis procera, Azadirachta indica* and *Datura stramonium* against *Piricullaria oryzae, R. solani, Curvularia lunata, F. moniliforme* and *A. niger*.They found that all the tested extracts possessed toxic substances against one or more of these pathogens.**Carlton *et al.*,(1991)** extracted kaempferol-3-(2,3-cliacetoxy-4-coumaragl) rhammnoside, a new flavonol glucoside from the leaves of bog myrtle (*Myrica gale*), which showed inhibitor activity against *F. sporotichioides*. **Bashar,(1991)** indicated that linear growth of *F. oxysporum* f. sp. *ciceris; F. solani; M. phaseolina* and *S. rolfsii* causing chickpea root rot was completely inhibited at 5, 2.5 and 100% concentrations, respectively, of the *clematis gouriana* filterating extract. Sporulation was reduced with increasing concentration of the extract. **Kumar and Tripathi, (1991)** screened leaf extracts of 18 higher plant species for the control of soil borne pathogens (*Pythium debaryanum, F. oxysporium, R. solani* and *S. rolfsii*). They found only extract of *Eupatorium comabinum* completely inhibited mycelial growth of all the tested pathogens at a min. dilution of 1:1. **Kishore and Mishra, (1991)** noted that from 20 tested plant essential oils, these of *Chenopodium ambrosioides, Lippia alba, Melaleuca teucadendron* and *Ocimum grattissimum* inhibited sclerotial germination of *Rhizoctonia solani* completely after 60 min. Oils of *Ageratum houstonianum*, *Eucalyptus citriodor* and

Nepta hindostana stopped sclerotial germination after 120 min. **Jiratko and Vesela, (1992)** tested the water and aceton-water extracts of 20 plant species for their effect on mycelial growth of *B. cinerea, F. solani, R. solani* and *Septoria nodorum*. They revealed that extracts of tomato tops and parsley seeds were the most effective, against the tested fungi. **Fewell *et al.*, (1994)** indicated that solamargine and solasonine, extracted from berries of *Solanum khasianum*, inhibited mycelium development in *R. solani*. This inhibition generally increased with increasing pH of extracts. **Reina *et al.*, (1995)** mentioned that out of many alkaloids which extracted from the aerial parts of *Heliotropium bovei*, the alkaloid European showed antifungal activity against *F. moniliforme*. **Sahu and Narain, (1995)** investigated the effects of seed, leaf, and stem extracts of groundnuts on *S. rolfsii*. they noted that the fungal growth was inhibited by each of seed coat leachate, root and stem extracts but not by root exudates or leaf and seed extracts . **Qasem and Abu-Blan, (1996)** noted that among aqueous extracts of 64 weed species, these of *Ranunculus asiaticous*: *Sonchus oleraceous* and *Mercurialis annua* were the most toxic to *R. solani*. **Eswaran *et al.*, (1997)** indicated that a field trial was carried out during the study to assess the effect of four plant extracts at 10% conc. on the sheath rot disease incidence. In all, the four treatments were found to reduce the percentage

of disease incidence when compared to the control. The chemical control hinosan got the maximum reduction of 71.08% over the control, while the plant extracts namely *Eucalyptus globulus*, *Ipomae carnea*, *Cocos nucifera* and *Adathoda vasica* gave a low level of disease incidence in ascending order over control. **Sivakumar and Sharma, (1997)** indicated that the efficacy of six plant oils viz., neem oil, Citronella oil, Eucalyptus oil, *Citrus sinensis* oil, Mahua oil and *Ocimum canum* oil on mycelial growth and sclerotial germination of *R. solani*. **El-Shoraky, (1998)** indicated that 9 aqueous plant extracts from 46 extracts tested against *S. rolfsii* gave 94.29% reduction percent of the fungal radial growth while anther 6 extracts gave over 90% reduction. On the other hand, extract of *E. globalus* completely inhibited the dry weight (100%) when 33 extracts gave more than 90% reduction. She added that the most effective one was *Agave sisalana* and *E. globolus* which had moderately effect against the radial growth of *M. phaseolina* . The extracts of *C. sinensis, C. aurnatium*, *O. basilicum* and *Cuminum cyminum* gave 96.0, 92.8, 92.0 and 90.0%, reduction in the dry weight of the fungal mycelium, respectively.She added that oil of *Jasminum sambac* reduced the fungal growth by 74.5% from control.

MATERIALS & METHODS

MATERIALS AND METHODS

The present work was carried out during 1996-2000 in the laboratory and greenhouse of Agricultural Botany Department, Faculty of Agriculture, Kafr El-Sheikh, Tanta University and the field of Sakha Agricultural Research Station, Kafr El-Sheikh.

1. Survey, isolation and identification of the causal organisms:

1.1. Survey of seedling blight and root rot diseases of sugar beet in Northern and mid Delta of Egypt :

Several trips were done to sugar beet fields of four Governorates in Northern Egypt (Kafr El-Sheikh, Dakahliya, Gharbiya and Dameitta) during two successive growing seasons, *i.e.*, 1996 & 1997 to survey seedling blight and root diseases. Two to seven districts; 3 fields from each of the surveyed governorates were chosen for this work. Fields were inspected for diseases at different times covering different stages of plant growth (from seedling to mature plants). This work was designed to visit sugar beet grown fields in each of the three planting dates of the crop, namely: early date of planting (August,15), medium date of planting (September,15) & late date of planting (October,15). Affected materials were collected and transferred

to the Lab. for isolation and identification of the causal organisms.

1.2. Isolation of the causal organisms :

Sugar beet samples showing symptoms of seedling damping-off and root rots were washed with tap water to remove all soil-attached particles. Small pieces of the affected materials (about 0.5 cm long) were surface sterilized in 3% sodium hypochlorite solution for 3 minutes and rinsed in several changes of sterilized distilled water. Thereafter, samples were transferred to potato dextrose agar medium (PDA) containing streptomycin sulphate (40 ppm) to avoid bacterial growth and incubated at 28°C. The isolated fungi were purified by using hyphal-tip technique described by **Brown ,(1924)** and **Dhingra and Sinclair, (1995).** Isolated fungi were transferred to slants of PDA medium and incubated at 28°C for 7 days.

1.3. Identification :

The isolated fungi were identified at the Department of Agric. Botany, Faculty of Agriculture , Kafr El-sheikh as well as the Department of Mycology and Plant Diseases Survey, Plant Pathology Research Institute, Giza Egypt, according to **Gilman ,(1957); Barnett ,(1960) ; Booth, (1977)** and **Singh, (1982).** The identified fungi were kept at 5°C for further studies.

2. Pathogenicity tests :

Pathogenicity tests were done to the isolated fungi under greenhouse conditions. They were tested against the sensitive sugar beet cultivar, namely kawmera. Inoculum was prepared using corn meal medium as shown below :

Soil infestation technique: Glass bottles of 500 ml capacity containing 190 gm clean moistened sand and 10 gm corn meal were autoclaved for 30 minutes at 1.5 atm., then inoculated with the tested fungus and incubated at 28-30°C for 15 days. Sterilized-35cm diameter pots were used in this experiment. Pots were filled with sterilized sandy-loam soil (1:2 w/w). Potted soil was infested with the fungal inoculum at the rate of 2% of the soil weight. Infested soil was mixed thoroughly and moistened with water every other day for one week before planting to ensure the distribution and uniformity of the pathogen.

Sugar beet seeds of Kawmera cultivar were surface strelized by immersing in 3% sodium hypochlorite solution for 3 minutes, followed by ethanol 70% for 2 minutes, then rinsed in three changes of sterilized water. Fifteen seeds were planted in each pot. Three replicates were employed for each isolate.

Disease incidence was recorded as percentage of pre-emergence damping-off 15 days after sowing. Post-emergence

damping-off was calculated using the formula adopted by **Abd El-Moity (1986)** as well as blighted seedling and survived plants 45 days after sowing. Thereafter, plants were thinned to two plants per pot and left until maturity. Plants were uprooted and roots were checked for root-rotting after 150 days of sowing. The percentage of infected roots, disease severity and healthy plants were recorded. Disease severity index was estimated according to the 1-10 grades of Grainger Scal (**Grainger, 1949**) as illustrated in Fig. (1).

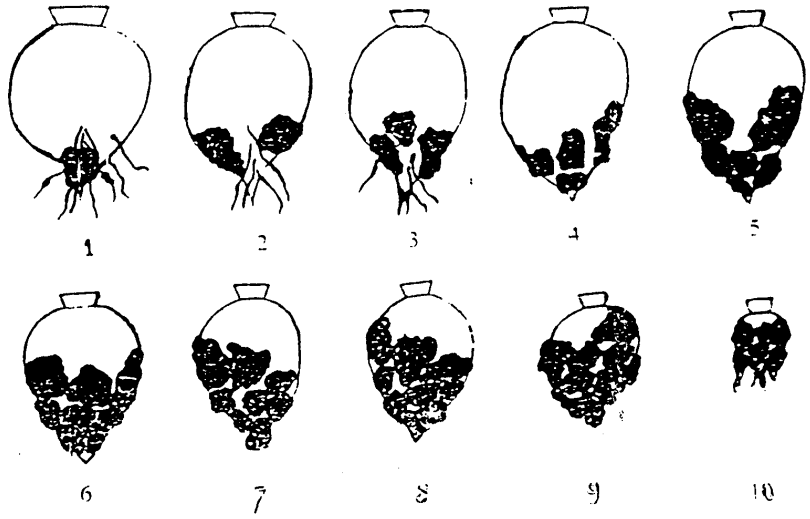

Fig. (1): Scale of Grainger (1949): "Standard area" diagram for estimating percentage (0-10 scale). Where, 0= healthy root and 10=complete damaged root.

3. Reaction of sugar beet cultivars to damping off and root rot infection :

A number of 15 sugar beet cultivars were screened for their susceptibility to infection with the major virulent root-infecting pathogens in a greenhouse and root rot disease in the field. These are Fareida, Pamela, Del 939, Top, Oscar poly, Plino, Rass poly, Lola, Kawmera, Hi- poly, Gitan, Delmon, Alexa, Del 936 and Gloria . Availabl sugar beet cultivars were obtaind from Delta Sugar Company at Giza , Egypt and Sugar Crops Research Institute (A.R.C) .

In the greenhouse, fungal inocula were prepared and used for infesting soil of no.35 pots and seeding was carried out as described before. Pre and post-emergence damping-off were recorded after 15 & 45 days of sowing respectively. Plants were then thinned to 2 plants / pot and root rot was estimated and recorded as percentage of infected roots and disease severity after 150 days of planting. Three replicate (pots) were used.

In the field experiment, beet cultivars were evaluated for their reaction to infection with root rot under natural infestation at farm of Agric.Res.Station of Sakha. The randomized complete blocks method in three replicate plots (1/400 feddan) was designed. Methods of sowing and cultural practices were carried out as usual. Disease readings were taker and recorded as

percentage of infection and disease index at harvest time, 200 days of planting.

4. Isolation of bioagents :

Isolation of bioagents used in the present study were carried out using rhizosphere soil samples collected from sugar beet producing areas of Egypt, namely Kafr El-Sheikh; Dakahliya; Gharbiya and Dameitta Governorates. Ten grams of soil were added to 90 ml sterilized distilled water in conical flask (250 ml) and thoroughly shaked for 10 min. dilution series up to (10^{-6} CFU/ml) was prepared. Portions of 0.1 ml from serial dilutions of the obtained suspensions were spread on the surface of Petri dishes containing media (Table 1) by the aid of sterilized glass triangle according to **Suslow and Schroth, (1982)**. Plates were incubated at 30°C for sufficient period and examined daily for the fungal , bacterial and actinomycetal growth.

Table 1: Dilutions and media used in isolating soil microorganisms.

Microorganisms	Dilutions	Media
Fungi	1:10000	Peptone Dextrose Agar plus rose Bengal and streptomycin (**Martin 1950, Johanson 1957**).
Bacteria	1:1000 000	Soil Extract agar (**Johanson *et al.*, 1960**). King's medium B agar, for *P. fluorescens* (**King *et al.*, 1959**)
Actinomycetes	1:100 000	Jensen's Agar Medium (**Jensen 1930**)

4.1. Identification of the bioagent isolates :

The selected isolated microorganisms were identified according to their cultural morphological and physiological characters (**Waksman and Henrici, 1943**). Key developed by **Rifai, (1969)** and **Bergey's Mannual of Determinative Bacteriology, (1984)**. Identification was confirmed through both the Department of Mycology and Plant Diseases Survey, and the Department of Bacterial diseases, Plant Pathology Research Institute, ARC, Giza. The total number of the isolated microorganism (fungi, bacteria and Actinomycetes) from soil were divided into groups or types according to shape, rate of growth ... etc. One isolate from each type was chosen for studying its antagonistic effect . Accordingly, 15 fungal isolates, 9 bacterial isolates and one Actinomycetal isolate were selected for further study.

5. Screening for antagonism and biological control:

5.1. *In vitro* experiment :

The selected isolated microorganisms were subjected to the test under laboratory conditions to evaluate their antagonistic effect against the root-infecting fungi. Petri-dishes (9.0 cm in diameter) contains 15 ml of gliotoxin fermentation medium (GFM) developed by **Brain and Hemming ,(1945)** were used to study antagonism between the isolated fungi and the pathogenic

fungi. The medium composed of: Dextrose 25.0 g; Ammonium tartarate 2.0 g; Mg $S0_4$ 1.0 g; KH_2 PO_4 2.0 g; Fe SO_4 0.01 g, agar 20.0 g and distilled water 1000.0 ml. To study the effect of either bacterial or Actinomycetal isolate on the pathogenic fungi, nutrient glucose agar composed of beef extract 3.0 g; peptone 5.0 g; glucose 10.0 g; agar 15.0 g and distilled water 1000 ml recommended by **Dowson, (1957)** was used.

Plates were inoculated with 3-7 days old culture discs (6 mm in diameter) of the phytopathogenic isolates at the peripheral of the plate surface. The antagonistic organism was inocualted (6 mm disc) at the opposite side of the pathogenic fungus and plates were incubated at 27°C and periodically examined at 24 h intervals. Three replicates were used. After complete growth of control plates, percentage of reduction in the mycelial growth was calcualted according to the following formula adopted by **Ferreira *el al.*, 1991** as follows :

$$R = \frac{A - B}{A} \times 100$$

where :

R= percentge of growth reduction

A=The distance of mycelial growth of the pathogenic fungus .

B= The distance of mycelial growth of the pathogenic fungus towards the anagonastic fungus .

Or **Bell *et al.*, 1982** .

Degree of antagonism was scored on a scale of 1-5 classes where :

Class 1: Antagonist completly over grow the pathogen and covered the entire medium surface .

Class 2 : Antagonist over grow at the least two-thirds of the medium surface

Class 3 : Antagonist and the pathogen each colonized approximately one-half of the medium surface (more than one-third and than two-thirds) and niether organism appeared to dominate the other .

Class 4 : The pathogen colonized at least two-thirds of the medium surface and appeard to with stand enceachment by the antagonist .

Class 5 : The pathogen completly over grow the antagonist and occupied the entire medium surface .

The relative power of antibiosis (RPA) of each isolate was estimated through the ratio as discribed by **Ibrahim *et. al.*, (1987) .**

Where:

$$R.P.A. = \frac{Z}{C}$$

Z = diameter of inhibation zone.
C = diameter of spotted antagonistic isolate .

5.2. Pot experiments :

Infested potted-soil prepared as mentioned before was used. Diluted suspension (10^6, 10^8, 10^7 from culture broth of fungi, bacteria and Actinomycete, respectively) were added to soil at the rate of 30, 20 ml/kg soil for *Trichoderma* & *Gliocladium* respectively. Whereas, bacteria and Actinomycete were added at the rate of 10 ml/kg soil. Liquid suspensions of the weighted soil were added at the same time of sowing. Fifteen seeds were planted in each no.35, cm diameter pots in three replicates. Pre and post emergence damping off was recorded after 15 & 45 days of planting respectively. Plants thereafter, were thinned to 2 plants per pot and root rot was estimated and recorded as infection percent and disease severity 150 days of sowing.

The fungicide, Rhizolex T50 was used as a reference for these treatments. Moreover, the commercial bioagents, Plantguard (0.4% dilution) and Rhizo-N were used as seed dressing. Chemical construction, recommended dose, and producing company of these chemicals are tabulated in Table (2).

Table (2) : Fungicides and Bioagents tested and there formula, chemical and bio-construction, recommended dose and producer.

Fungicide/ or Bioagents	Formula	Chemical and bio- constractions	Recomd. dose	Producer
Rhizolix T. 50	W. P.	20% O - 2 Dichloro – 4 - methylphenyl O - O dimethyl phosphoro thioate + 30% bis (dimethyl thio carbomyl)	3g/kg seeds	Sumitomo Chemical Compony
Plantgured	Suspention	***Trichoderma harzianum*** is suspended in water contaning 30x106 CUF/ Cm^3	4ml/L	El-Nasr Co., for Firtilizers & biological treatment
Rhizo-N	W.P.	***Bacillus subtilis*** is a powder contaninig 30x106 CUF/g	4g/L.	

6. Plant extracts and oils :

Six higher plant species belonging to 6 different plant families as shown in Table (3) were chosen for work in this study. These plants were identified according to the taxonomic characters described by **Tackholm ,(1974)** and **Chiej, (1988)** by the help of Dept.Weeds Res., Field Crops Res. Insitute, ARC, Giza, Egypt.

Table (3): Some higher plants have been screened for their fungitoxicity against the testing fungi.

Scientific name	**Common name**	**Arabic name**	**Part used**	Family
Trigonella foenum -graecum L.	Fenugreek	الحلبة	Seeds	Leguminaceae
Ammi visnaga L. (leaves and seeds)	Pick tooth	الخلة	Leaves	Umbelliferaceae
Glycyrrhiza glabra L.	Liquarice	عرقسوس	Roots	Leguminaceae
Eucalybtus globulus Labill.	Blue gume	الكافور	Leaves	Myrtaceae
Boughainvillae spectabilis Willd.	Boughainvilla	الجهنمية	Leaves	Nyctuginaceae
Salix purpurea L.	Purpurea willow	صفصاف عريض	Leaves	Salicaceae

The following essential oils used in this study are shown in Table (4). They were purchased from Gomhoriya Comp.for Medicine and Chemicals.

Table (4) : The commercial plant oils which were screened for their antifungal activity against the tested fungi.

Scientific name	Common name	Arabic name	Family
Mentha viridis L.	Mint	النعناع	Labiateae
Syzygium aromaticum L.	Clove	القرنفل	Myrtoeceae
Cuminum syminum L.	Cumin	الكمون	Umbelifereae
Ocimum basilicum L.	Basil	الريحان	Labiatae

Preparation of plant extracts :

According to **Mangamma and Srevamulu, (1991),** fresh plant materials were collected, washed with running tap water and then with distilled water and left in air to dry at room temperature.The dried plant materials were ground into fine powder. The powder was extracted using ethyl alcohol and acetone (1:1 v/v). One hundred grams from the finely powder of plant parts were soaked in 200 ml of the solvent and shaked for 48 h. then blended for 5 minutes and filtrated through anhydrous sodium sulfate by using Wattman No.1 filter papers. The solvent was evaporated under reduced pressure and the crude extract was stored in amber bottles and kept in refrigerator (5 ±1) until needed.

6-1. *In vitro* experiment :

6-1-1. Effect of plant extracts and oils on fungal linear growth and sporulation:

Plant extracts and essential oils were incorporated into melted PDA maedium just before solidification at the required concentrations and poured into Petri dishes (9 cm in diameter). Plates were inoculated at the center with 5 mm-culture discs of fungi under study and incubated at 28 °C. Radial growth of each fungus was determined daily by measuring colony diameter in each of four replicate plates. Percentage of reduction in colony diameter was calculated for each treatment.

Sporulations of *F.oxysporum & F.solani* were also determined after 15 days of incubation. Spores were collected from each dish by gentle brushing of the colony surface and collecting spores were suspended in 10 ml of sterilized distilled water. The collected spore suspension was then sieved through cheese cloth to remove the mycelial fragments. Spore suspensions were resuspended into sterile water to give a final volume of 100 ml. Spore concentration (No.of spores/ml) in each treatment was calculated by the aid of a haemocytometer **(Mandeel & Baker, 1991).**

6-2. Greenhouse experiments :

Plant extracts as well as the essential oils were evaluated for their efficiency against damping off and root-rot diseases caused by *S. rolfsii* under greenhouse conditions. Seeds were soaked into a concentration of 200 ppm of each of plant extracts as well as 100 ppm of oils under study for 8 hours before planting. Seeds were cultivated in *S.rolfsii*-infested soil (15 seeds/pot). Three replicate pots (No.35) were used and uninfested soil acted as control. Disease readings were taken 15, 45 & 150 days after planting for pre, post emergence damping off and root rot respectively. Root yield per plant and yield losses due to infection were also estimated at harvest time (150 days of planting). Yield component *i.e.*, total soluble solids (TSS) , sucrose percent and sugar purity were also estimated. TSS was estimated in fresh roots using the hand refractometer according to **Mc Ginnis, (1982).** Sucrose percent was estimated according to **(A. O. A. C. , 1990)** by adding 173 ml 3% lead acetate to 26 g from the sample representing the interior of the roots. After filteration, sucrose percent was measured by the aid of saccarometer. Purity percent was calculated by dividing the sucrose percent by TSS.

Also plant height, leaf area and leaf dry weight were estimated after 150 days of planting. Leaf area (mm2) was

determined using LI-3100 area meter according to **Aly *et.al.*,(1996).**

7. Chemical fractionation of seeds of *Ammi visnaga* :

To evaluate chemical extracts from *A.visnaga* seeds versus the major sugar beet root pathogens, the powdered of *A.visnaga* seeds were extracted in a soxhlet apparatus with diethyl-ether. The ether extract was concentrated and kept in a refrigerator for few days. The upper green oily layer was removed (fraction I) by filtration with suction. The fat was removed by dissolvindg in petroleum ether (fractions II). Methyl alcohol was used to solve the remaining solid product from the last step (fraction III). This extract contains the active substance within the seeds known as visnagin.The remaining purified crystals are the active ingredient known as khellin.

8. Field experiments:

Experiments were carried out to study the effect of the prepared formulae of some bioagents on seedling blight, root rots and root weight per plot. Effect of some plant extracts and oils on root rot incidence and yield per plot was also studied. These experiments were performed in the farm of Sakha in two successive seasons *i.e.* 1998-1999 and 1999-2000. Randomized complete blocks method with three replicate plots (1/400 feddan) was designed. Pre and post emergence damping off were taken

after 15 and 45 days of planting respectively. Root rots were estimated and recorded along with the yield per plot at harvest time (about 200 days of planting). Disease readings were taken and recorded as percentage of infection and disease severity at harvest

8.1. Formulae of the bio-control agents used in the field experiment:

An aqueous suspension at the concentrations of 10^6, 10^8&10^7/ ml were prepared from *T.hamatum, B. subtilis &* an *Actinomycete* isolate , respectively. The three antagonists were used in a field trial each in three different formulae, suspension, powder or granules.

The aqueous suspensions were dressed to seed at the rate of 20 ml/ kg. Powder form was prepared by mixing the suspension of each bioagent with talc powder (1:1 v/w) and left to dry. It was applied to soil at the rate of 150 kg/ feddan before sowing. The form of granules was prepared by thoroughly mixing 1 L of the aqueous suspension with 0.5 kg wheat bran and 7g sodium alginate. Calcium chloride (3%) was added drop by drop to the mixture until granule formation and left to dry. It was applied to soil at the rate of 150kg/feddan before sowing.

9-Statistical analysis :

Averages were compared to the least significant difference (LSD) and Duncan's multiple range test (DMRT). Analysis was performed by the software A micro computer programme for the design, Management and Analysis of Agronomic Research Experiments (Irristat Michigan state Univ., USA,1993).

EXPERIMENTAL RESULTS

EXPERIMENTAL RESULTS

1. Survey of seedling blight and root rot diseases of sugar beet:

Survey was conducted in sugar beet to determine the prevalence and distribution of seedling blight and root rot diseases in north and mid of delta Governorates at the early, medium and late crop seasons in 1996-1997.

Data presented in Table (5) and illustrated Fig. (2) indicate that the highest percentage of seedling blight (6.25) was recorded in fields of Kafr El-Sheikh followed by 5.33 and 4.59 in Gharbiya and Dameitta Governorates, respectively. The highest degree of infection was also found at the late crop season followed by the early and medium seasons (October,15, August,15& September,15 respectively). It was also observed that infection percent was always higher at the northern locations comparable to the southern locations of the same Governorate.

Results of surveying sugar beet for percentage of infection with root rots and disease severity are presented in Table (6) and illustrated in Fig. (3&4). Data indicated that the highest percentage of root rot as well as disease severity were observed at Kafr El-Sheikh followed by Gharbiya, Dakahliya

Table 5: Occurrence of seedling blight of sugar beet at different locations during , 1996 season .

Governorate	Location	Seedling blight			
		Early	Medium	Late	Mean
Kafr El-Sheikh	1. Kafr El-Sheikh	5.00 a-d	2.67 ab	7.00 bcd	4.89 c
	2. Desouq	4.33 bcd	4.33 ab	6.33 ce	5.00 c
	3. El-Hamol	9.33 a	7.00 a	13.67 a	10.00 a
	4. Biala	3.33 cd	6.00 a	11.33 ab	6.89 bc
	5. Sidy-Salem	8.67 ab	6.00 a	10.67 abc	8.44 ab
	6. Qalen	1.33 d	0.67 b	3.33 d	1.78 d
	7. El-Ryad	7.00 abc	5.67 a	7.67 bcd	6.78 bc
Mean		**5.57**	**4.62**	**8.57**	**6.25**
Dakahliya	1. Belkass	8.00 a	3.33 a	7.67 a	6.33 a
	2. Sherbin	3.33 b	2.67 ab	5.67 b	3.89 b
	3. Temy El-Amdid	2.67 b	2.33 ab	5.33 b	3.44 b
Mean		**4.67**	**2.77**	**6.22**	**4.55**
Gharbiya	1. Qauttor	6.33 a	5.67 a	8.33 a	6.78 a
	2. El-Santa	3.67 b	2.33 b	5.67 b	3.89 b
Mean		**5.00**	**4.00**	**7.00**	**5.33**
Damietta	1. Kafr-Saad	6.67 abc	3.33 bcd	5..67 de	5.22 ab
	2. Faraskour	2.33 d	2.33 cd	4.67 de	3.11 bcd
Mean		**4.50**	**2.83**	**5.17**	**4.59**
Total Mean		**4.89**	**3.56**	**6.74**	**5.18**

Mean followed by the same letter are not significantly different at the 5% level by DMRT.

Table 6. Occurrence of root rots of sugar beet at different locations during , 1996 season.

Governorates	Location	Root rot				Disease severity			
		Early date	Medium date	Late date	Mean	Early date	Medium date	Late date	Mean
Kafr El-Sheikh	1. Kafr El-Sheikh	4.67 cd	3.67 cd	5.67 c	4.67	1.67 c	2.33 bc	3.00 cd	2.33
	2. Desouq	2.67 e	1.33 e	7.67 b	3.89	1.33 c	0.67 c	3.67 cd	1.89
	3. El-Hamol	7.33 b	6.67 ab	11.67 a	8.56	5.33 ab	5.67 a	7.67 a	6.22
	4. Biala	6.67 b	5.33 bc	9.00 b	7.00	3.67 b	2.67 b	2.33 cd	2.89
	5. Sidy-Salem	11.67 a	8.33 a	11.67 a	10.56	6.67 a	3.33 b	7.67 a	5.89
	6. Qalen	3.67 de	2.67 de	3.67 d	3.33	0.33 c	0.67 c	1.67 d	0.89
	7. El-Ryad	5.67 bc	4.33 cd	3.67 d	6.08	3.67 b	1.67 b	5.67 b	3.67
Mean		**6.05**	**4.62**	7.57	**6.08**	**3.24**	**2.43**	**4.52**	**3.40**
Dakahliya	1. Belkass	3.33 b	3.67 a	1.67 a	2.89	2.33 a	1.00 a	0.67 a	1.33
	2. Sherbin	4.33 b	3.33 a	2.67 a	3.44	1.33 a	0.67 a	0.67 a	0.89
	3. Temy El-Amdid	6.67 a	3.67 a	3.33 a	4.56	2.67 a	1.67 a	0.67 a	1.67
Mean		**4.78**	**3.56**	**2.56**	**3.63**	**2.11**	**1.11**	**0.67**	**1.30**
Gharbiya	1. Qauttor	6.33 a	5.67 a	8.33 a	6.78	2.33 a	1.67 a	3.67 b	2.56
	2. El-Santa	3.67 b	2.33 b	5.67 b	3.89	3.67 a	0.67 a	1.33 a	1.89
Mean		**3.33**	**3.00**	**3.83**	**3.39**	**3.00**	**1.17**	**2.50**	**2.22**
Damietta	1. Kafr-Saad	3.67 a	2.67 a	3.67 a	3.22	2.33 a	1.33 a	3.67 a	2.44
	2. Faraskour	2.33 a	1.67 a	2.67 a	2.33	1.67 ab	0.67 ab	2.33 ab	1.56
Mean		**3.17**	**2.00**	**3.17**	**2.77**	**2.00**	**1.00**	**3.00**	**2.0**
Total Mean		**4.33**	**3.32**	**4.28**	**3.96**	**2.58**	**1.63**	**2.67**	**2.23**

Mean followed by the same letter are not significantly different at the 5% level by DMRT.

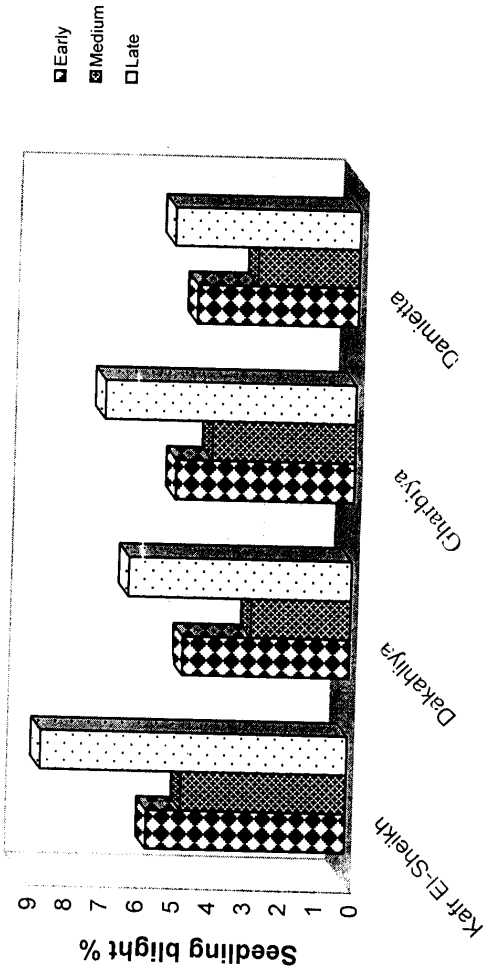

Fig. 2. Percentage of pre- and post-emergence damping-off disease occurrence in different sugar beet growing areas .

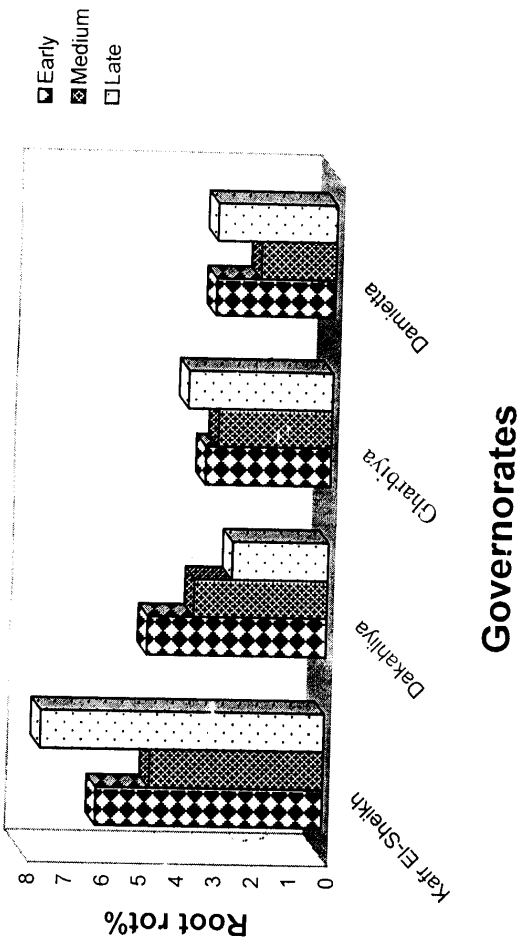

Fig. 3. Percentage of root rot diseases occurrence in different sugar beet growing areas

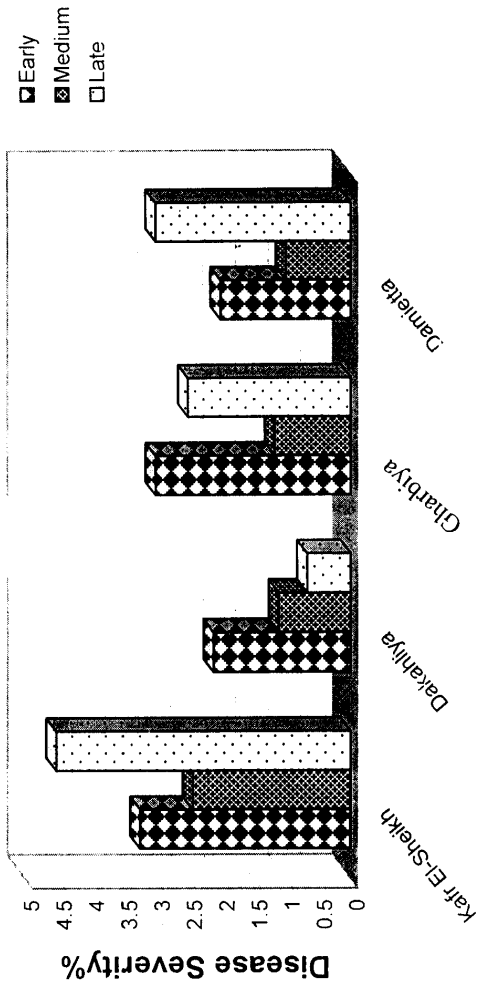

Fig. 4: Percentage of disease severity occurrence in different sugar beet growing areas.

and Damietta Governorates. On the other hand, the least disease incidence with the least disease severity was found in the medium planting date if compared with the early or late seasons, generally, at all surveyed Governorates. Also, northern districts showed the highest degrees of infection with root rots and disease severity comparable to the southern regions of the surveyed Governorates.

2. Isolation and identification of sugar beet root-rot fungi :

Diseased materials collected from sugar beet growing areas in Northern Region of the country were used to isolate the causals of common root- infecting fungi. The isolated fungi were identified and representatives of each isolate was stored on PDA slants at 5 °C until use. Results inTable (7) indicate that *Sclerotium rolfsii* followed by *Rhizoctonia solani* were the most prevalent fungi giving the highest frequencies from samples of Kafr El-Sheikh.Gv. Whereas, *R.solani* appeared in samples of Dakahliya in higher frequencies than *S.rolfsii*. *Fusarium* spp., could be detected from all samples of the four Governorates in high frequencies in almost the same rate of appearance. *Macrophomina phasiolina*, *Pythium debaryanum* and other unidentified fungi were isolated from most of infected root samples indicating the involving of all or some of these organisms in producing the root-rot complex disease of sugar beet in nature.

It could be concluded from data presented in Table (7) that *F.oxysporum & F.solani* were appeared in a higher frequencies than the other fungi in samples collected from Gharbiya Governorate.

Also, from data presented in Table (7) the isolated fungi could be ranked in a descending order for all Governorates as follows : *S. rolfsii (11.6%),R. solani (10.1%), F.oxysporum (9.67%) & F.solani (9.29%).* Some other isolated pathogens were predominant in certain Governorates and absent in others, e.g.,.*M. phaseolina, F. moniliforme & P.debaryanum.*

3. Pathogenicity tests :

Pathogenicity tests of five isolates of each of the isolated fungi ,i.e., *S. rolfsii, R. solani, F. oxysporum, F.solani & M. phaseolina.* representing the geographic locations throughout the 4 Governorates were done under greenhouse conditions. Results inTable (8) show that all the five isolates of *S. rolfsii* were highly pathogenic causing pre- and post-emergence damping off as well as root rot to sugar beet plants. Isolate no.21 (from Gharbiya) was the most virulent one in producing damping off and root rot as well, besides

Table 7. Isolation frequency of the different isolated soil-borne pathogens from infected sugar beet plants collected from different locations during the disease survey throughout, 1996season..

Governorates	Location	Isolation frequency %									
		No. of samples	*F. oxysporum*	*F. semitectum*	*F. solani*	*F. monilforme*	*R. solani*	*S. rolfsii*	*M. phaseolina*	*P. debaryanum*	Others
Kafr El-Sheikh	1. Kafr El-Sheikh	26	7.69	7.69	7.69	7.69	11.54	11.54	0.0	7.69	38.46
	2. Desouq	10	10.0	10.0	0.0	0.0	10.0	20.0	0.0	10.0	40.0
	3. El-Hamol	21	9.5	4.46	9.52	0.0	9.52	19.05	4.76	9.52	33.33
	4. Biala	17	23.52	5.88	11.76	17.65	0.0	0.0	0.0	11.76	29.41
	5. Sidy-Salem	18	5.52	0.0	11.11	0.0	5.55	38.89	0.0	11.11	27.78
	6. Qalen	7	0.0	14.29	0.0	0.	28.57	0.0	14.29	0.0	42.86
	7. El-Ryad	19	5.26	0.0	10.53	10.53	5.26	10.53	5.26	5.26	47.37
Mean			**8.79**	**6.05**	**7.23**	**5.12**	**10.06**	**14.29**	**3.47**	**7.29**	**37.03**
Dakahliya	1. Belkass	13	7.69	0.0	7.69	7.69	15.38	15.38	0.0	0.0	46.15
	2. Sherbin	6	0.0	16.67	0.0	16.67	16.67	0.0	16.67	0.0	33.33
Mean			**3.85**	**8.24**	**3.85**	**12.18**	**16.03**	**7.69**	**8.34**	**0.0**	**39.74**
Gharbiya	1. Qauttor	12	16.67	0.0	16.67	0.0	16.67	0.0	8.33	8.33	33.33
	2. El-Santa	9	11.11	0.0	11.11	0.0	0.0	22.22	0.0	0.0	44.44
Mean			**13.89**	**0.0**	**13.89**	**0.0**	**8.34**	**11.11**	**4.17**	**4.17**	**38.88**
Damietta	1. Kafr-Saad	13	7.69	7.69	7.69	7.69	0.0	23.07	0.0	7.69	38.88
	2. Faraskour	6	16.67	0.0	16.67	0.0	16.67	0.0	0.0	0.0	50.0
Mean			**12.18**	**3.85**	**12.18**	**3.85**	**8.34**	**11.53**	**0.0**	**3.85**	**44.23**
Total Mean			**9.67**	**4.56**	**9.29**	**6.57**	**10.10**	**11.16**	**3.99**	**5.40**	**39.97**

giving the highest rot disease severity to infected roots compared with the other isolates under study. Isolates no.78 & 142, on the other hand, caused the least degree of infection with both damping-off and root-rot to infected plants.

Data presented in Table (9) indicate that all *R.solani* isolates were very aggressive in producing pre- and post-damping off and crown rots to sugar beet plants, in general. Isolate no.1 (from Kafr El-Sheikh) caused the highest percentage of infection with pre-emergence damping off, whereas, it could not cause any sign of post emergence damping -off to sugar beet plants. Isolate no. 14 caused the highest degree of infection with crown rot, but gave the least disease severity and the least degree of damping off compared with the rest isolates.

All isolates of *M. phaseolina* (Table, 10) were pathogenic causing damping off and root rot to sugar beet plants. Isolate no.10 (from Kafr El-Sheikh) gave the highest infection percent of pre- emergence damping- off , but gave the least infection percent of root rot compared with isolate no.102 (from Dakahliya) which produced the least infection with damping off and moderate infection percent with root rot. Isolate no. 27 (from Kafr El-Sheikh), on the other

Table 8. Virulence of *Sclerotium rolfsii* isolates on sugar beet susceptible cultivar Kawmera in a greenhouse, during 1997season.

Governorate	Isolate no.	Damping-off		Surviving plants	Root rot		Healthy plants
		pre-emergence %	Post-emergence %		Disease incidence %	Disease severity	
Dakahliya	93	68.89 d	26.67 b	6.67 b	66.67 d	7.33 de	33.33 c
Kafr-El Sheikh.	78	37.78 b	48.89 e	13.33 c	55.55 b	5.67 bc	44.67 e
Gharbiya.	21	71.00 d	26.67 b	2.22 a	87.78 f	8.67 e	11.11 a
Kafr-El Sheikh.	60	53.11 c	35.55 d	11.11 c	77.78 e	6.33 cd	22.22 b
Damietta.	142	37.78 b	31.11 c	31.11 d	62.45 c	4.67 b	37.78 d
Control		0.00 a	0.00 a	100.0 e	0.00 a	0.00 a	100.00 f

Mean followed by the same letter are not significantly different at the 5% level by DMRT.

Table 9. Virulence of *Rhizoctonia solani* isolates on sugar beet susceptible cultivar Kawmera in a greenhouse, during 1997season.

Governorate	Isolate no.	Damping-off		Surviving plants	Root rot		Healthy plants
		pre-emergence %	Post-emergence %		Disease incidence %	Disease severity	
Kafr-El Sheikh.	1	93.33 d	0.00 a	6.67 a	84.45 c	2.67 c	15.55 c
Damietta.	3	40.00 b	33.33 c	26.67 c	66.67 b	2.33 c	33.22 d
Kafer-El Shaikh.	8	53.11 c	33.33 c	13.32 b	93.78 d	4.67 d	11.11 b
Gharbiya.	14	40.00 b	20.00 b	40.00 d	97.78 e	1.33 b	2.22 a
Dakhaliya	15	52.66 c	20.00 b	26.67 c	66.67 b	2.33 c	33.33 d
Control		0.01 a	0.00 a	100.00 e	0.00 a	0.00 a	100.00 e

Mean followed by the same letter are not significantly different at the 5% level by DMRT.

Table 10. Virulence of *M. phaseolina* isolates on sugar beet susceptible cultivar Kawmera in a greenhouse, during 1997season.

Governorate	Isolate no.	Damping-off		Surviving plants	Root rot		Healthy plants
		pre-emergence %	post-emergence %		Disease incidence %	Disease severity	
Kafr-El Sheikh.	10	17.78 d	13.33 c	68.89 b	33.33 b	2.67 b	40.00 a
Dakhaliya	102	6.67 b	4.45 b	88.89 d	37.78 c	2.33 b	62.22 b
Kafr-El Sheikh.	27	15.55 d	37.78 d	46.67 a	60.00 e	1.33 ab	66.67 b
Gharbiya.	18	11.11 c	15.55 c	80.00 c	55.55 d	4.33 c	44.45 a
Kafr-El Sheikh.	82	8.89 bc	13.33 c	82.22 c	33.33 b	1.67 b	66.67 b
Control		0.00 a	0.00 a	100.00 e	0.00 a	0.00 a	100.0 c

Mean followed by the same letter are not significantly different at the 5% level by DMRT.

hand,caused the highest degree of infection with root rot, but it gave the least disease severity to sugar beet plants if compared with the other isolates under study.

Fusarium oxysporum, as shown in Table (11) was also highly pathogenic to sugar beet plants, generally. Isolate no.26 (from Kafr El-Sheikh) was virulent in producing pre- and post- emergence damping-off to sugar beet plants and gave high degree in disease index comparable with the other isolates. Isolate no.42 (from Kafr El-Sheikh), on the other hand, showed the least effect in producing pre-emergence damping-off and root rot incidence and severity. Data in Table (11) also indicate that the highest level of infection with root rot was obtained by isolate no.19 (from Dameitta).

Results inTable (12) show that all isolates of *F.solani* under study were pathogenic to sugar beet plants causing pre and post damping-off and root rot disease as well. Isolate no.103 (from Kafr El-Sheikh) gave the highest degree of infection with pre- and post damping off and root rot incidence compared to the other isolates of the same species. Isolate no. 63 (from Dameitta) was the least one in producing pre- and post damping off to plants and isolate no. 37 (from Dakahliya) gave the least

Table 11. Virulence of *Fusarium oxysporum* isolates on sugar beet susceptible cultivar Kawmera in a greenhouse, during 1997season.

Governorate	Isolate no.	Damping-off		Surviving plants	Root rot		Healthy plants
		pre-emergence %	Post-emergence %		Disease incidence %	Disease severity	
Dakhaliya	79	31.11 c	17.78 c	51.11 b	53.33 cd	2.67 b	46.67 b
Damietta.	19	28.89 c	11.11 b	60.00 d	58.89 d	3.67 c	41.11 b
Gharbiya.	101	35.55 d	14.00 b	55.55 c	75.33 e	5.67 d	24.67 a
Kafr-El Sheikh.	26	46.67 e	22.22 d	31.11 a	48.89 c	4.33 c	51.11 c
Kafr-El Sheikh.	42	15.55 b	17.78 c	66.67 e	35.55 b	2.67 b	64.15 d
Control		0.00 a	0.00 a	100.00 f	0.00 a	0.00 a	100.0 e

Mean followed by the same letter are not significantly different at the 5% level by DMRT.

Table 12. Virulence of *Fusarium solani* isolates on sugar beet susceptible cultivar Kawmera in a greenhouse, during 1997season.

Governorate	Isolate no.	Damping-off		Surviving plants	Root rot		Healthy plants
		pre-emergence %	Post-emergence %		Disease incidence %	Disease severity	
Gharbiya.	83	17.78 b	6.67 b	75.55 b	35.55 d	2.33 b	64.45 b
Kafr-El Sheikh.	103	24.45 c	14.89 d	60.67 a	40.00 e	2.33 b	60.00 a
Kafr-El Sheikh.	45	20.00 b	11.11 c	68.89 a	31.11 c	3.67 c	68.89 bc
Damietta.	63	13.33 b	4.45 b	82.23 b	28.89 bc	2.33 b	71.11 cd
Dakhaliya	37	17.78 b	6.67 b	75.55 b	26.67 b	2.67 b	73.22 d
Control		0.00 a	0.00 a	100.00 c	0.00 a	0.00 a	100.0 e

Mean followed by the same letter are not significantly different at the 5% level by DMRT.

degree of infection with root rot compared with the other isolates under study.

However, results shown in Tables No.6-10 indicate that *S. rolfsii* followed by *R. solani* were the most virulent and superior in causing damping off and root rots to sugar beet plants in the greenhouse, in general. Whereas, *M. phaseolina*, showed the least effective on sugar beet plants and *Fusarium. spp.*was moderate in this respect. Therefore, further studies were carried out throughout the present work using *S. rolfsii & R. solani.*

4-Varietal reaction toward infection with *S. rolfsii* or *R. solani:*

A number of 15 cultivated varieties were tested for their susceptibility to infection with *S.rolfsii* and/or *R.solani.* This experiment was carried out in potted infested soil. Data presented in Table (13) indicate that all tested cultivars were susceptible or highly susceptible to infection with damping-off and root rot caused by *S.rolfsii.* Percentage of survived plants after 30 days of planting ranged between 2.22 % in Pamela & Del 939 (highly susceptible to damping off) and 26.67 % in

Oscarpoly & Gloria (susceptible to damping off). The rest cultivars distributed between these two extremes in this respect. Kawmera cultivar was highly susceptible to infection with root rot (88,89%) showing the highest disease severity (7.33 % D.I.) whereas, Pleno cultivar showed the least level of infection with root rot (33.33 %) showing the least severity of the disease (1.33 % D.I.). The rest cultivars distributed between these two cultivars.

Screening for the resistance to infection with *R.solani* in Table (14) showed that all the cultivars under study were susceptible to infection with damping off and root rot diseases. Percentage of survived plants taken after 30 days of planting ranged between 6.67 & 8.89 % in Del 936 & Kawmera respectively (insignificant difference) and 60.0% in Pleno cultivar. Four out of the 15 evaluated cultivars showed to have the highest ability to infection with root rot. These are Kawmera with 4.67 % D.I., Del 936 with 3.33 % D.I., Pamela with 2.67 % D.I. and Rass poly with 2.33 % D.I. Whereas, Fareida, Top, and Lola, on the other hand were the least susceptible cultivars to infection with root rot symptoms.

Table 13. Reaction of some sugar beet cultivars to damping-off and root rot diseases caused by *S.rolfsii,* in a greenhouse, during1998 season .

No.	cultivar	Damping-off		Surviving plants	Root rot		Healthy plants
		pre-emergence%	Post-emergence%		Disease incidence %	Disease severity	
1.	Fareida	73.56 e	15.55 bc	8.89 b	66.67 c	2.33 ab	33.33 c
2.	Pamela	82.22 f	15.55 bc	2.22 a	77.78 d	5.17 e	22.22 d
3.	Del 939	71.11 de	26.67 fgh	2.22 a	77.78 d	4.67 cde	22.22 d
4.	Top	64.44 c	26.67 fgh	17.78 c	44.44 b	3.67 bcd	55.44 b
5.	Oscar poly	66.89 cd	15.55 bc	26.67 d	66.67 c	2.50 ab	33.33 c
6.	Pleno	51.11 ab	22.33 def	6.67 ab	33.33 a	1.33 a	66.67 a
7.	Rass poly	64.45 c	28.89 hg	6.67 ab	77.78 d	4.33 cde	22.22 d
8.	Lola	55.55 b	24.45 efg	20.07 c	66.67 c	3.33 bc	33.33 c
9.	Kawmera	86.67 f	8.89 a	4.45 ab	88.89 e	7.33 f	11.11 e
10.	Hi-poly	64.45 c	17.78 bcd	17.78 c	33.33 a	3.67 bcd	66.67 a
11.	Gitan	66.89 cd	31.11 h	6.67 ab	44.44 b	4.67 cde	55.56 b
12.	Delmon	75.55 e	20.00 cde	4.45 ab	66.67 c	5.00 de	34.22 c
13.	Alexa	71.11 de	20.00 cde	8.89 ab	72.67 cd	1.33 a	33.22 c
14.	Del 936	86.67 f	13.33 b	6.67 ab	77.78 d	6.67 f	22.22 d
15.	Gloria	48.89 a	24.45 efg	26.67 d	44.44 b	3.33 bc	55.56 b

Mean followed by the same letter are not significantly different at the 5% level by DMRT.

Table 14. Reaction of some sugar beet cultivars to damping-off and root rot diseases caused by *R..solani* in a greenhouse during, 1998 season .

No.	cultivar	Damping-off		Surviving plants	Root rot		Healthy plants
		pre-emergence%	Post-emergence%		Disease incidence%	Disease severity	
1.	Fareida	42.22 c	17.78 bc	40.0 g	33.33 a	2.33 abc	66.67 d
2.	Pamela	60.00 e	17.78 bc	22.22 d	66.67 d	2.67 bcd	33.33 a
3.	Del 939	62.22 e	20.00 cd	17.78 bc	62.22 cd	3.67 d	37.78 b
4.	Top	31.11 b	13.33 a	55.55 h	33.33 a	1.67 ab	66.67 d
5.	Oscar poly	48.89 d	17.89 bc	33.33 f	44.44 b	2.33 abc	55.56 c
6.	Pleno	24.45 a	15.55 ab	60.00 i	44.44 b	1.33 a	55.56 c
7.	Rass poly	68.89 f	15.55 ab	15.55 b	66.67 d	2.33 abc	33.33 a
8.	Lola	48.67 d	22.22 d	37.78 g	33.33 a	1.67 ab	66.67 d
9.	Kawmera	73.33 f	17.78 bc	8.89 a	66.67 d	4.67 e	33.44 a
10.	Hi-poly	51.11 d	15.55 ab	33.33 f	55.56 c	2.33 abc	44.44 b
11.	Gitan	46.67 cd	13.33 a	40.00 g	58.89 cd	3.33 cd	41.11 b
12.	Delmon	57.78 e	20.00 cd	22.22 d	44.44 b	3.67 d	55.56 c
13.	Alexa	51.11 d	20.00 cd	28.89 e	44.44 b	2.33 abc	55.56 c
14.	Del 936	71.11 f	22.22 d	6.67 a	66.67 d	3.33 cd	33.33 a
15.	Gloria	57.78 e	22.22 d	20.00 cd	55.67 c	2.67 bcd	44.44 b

Mean followed by the same letter are not significantly different at the 5% level by DMRT.

5-Biological control of sugar beet root pathogens:

5-1- *In vitro* experiments:

Experiments were conducted to test the effect of certain fungal, bacterial and Actinomycetal antagonists isolated from rhizosphere of healthy sugar beet plants against some serious isolated pathogens of sugar beet. A number of 15 fungal isolates belonging to *Trichoderma hamatum, T.harzianum, T.viride, T.pseudokoningii,& Gliocladium virens* were screened in this respect. In addition to 8 bacterial isolates identified as *Bacillus subtilis, Pseudomonas fluorescense* and one *Actinomyces sp.*were also used in this evaluation.

Results shown in Table (15 &16) and illustrated by Figs (5&6) inicated that the majority of these bioagent have antagonistic effect against the phytopathogenic fungi under study. In general. *Trichoderma spp.*(Table 15) were found to be the most bioagent that could affect drastically the growth of all sugar beet pathogens followed by some isolates of *Bacillus subtilis &Pseudomonas fluorescens* Table (16) . While, *G.virens* Table (15) showed the least effect against all tested pathogens. Data in Table (15) indicate that *S.rolfsii* was obviously affected by 4 isolates of *Trichoderma spp., i.e.,T.hamatum* no.30 ,*T.* no. 12 *T.harzianum* No. 25 and

Table 15. Effect of the antagonistic fungal isolates against the tested phytopathogenic fungi .

	Antagonists	*S. rolfsii*		*R. solani*		*M. phaseolina*		*F. oxysporum*	
		H.	R.	H.	R.	H.	R.	H.	R.
1	*T. harzainum* 1	3 c	57.32 cd	4 d	32.73 o	2 b	59.28 l	4 c	30.42 m
2	*T. harzainum* 3	2 b	59.28 cd	3 c	51.28 k	2 b	62.90 g	4 c	33.91 l
3	*T. harzainum* 5	2 b	60.78 cd	2 b	78.43 l	3 c	56.86 k	3 b	44.39 g
4	*T. harzainum* 9	1 a	67.42 a-d	3 c	54.30 g	2 b	64.44 f	3 b	43.85 h
5	*T. harzainum* 14	3 c	55.80 cd	2 b	69.83 d	2 b	65.91 e	4 c	39.89 k
6	*T. harzainum* 19	2 b	64.40 bcd	3 c	52.79 j	2 b	58.82 j	4 c	41.87 l
7	*T. harzainum* 25	1 a	72.24 abc	2 b	73.45 c	2 b	59.28 l	3 b	48.37 e
8	*T. harzainum* 26	2 b	67.42 a-d	4 d	42.23 m	2 b	61.84 h	4 c	39.86 k
9	*T. hamatum* 12	1 a	80.03 ab	1 a	75.57 b	1 a	75.87 b	3 b	46.37 f
10	*T. hamatum* 17	1 a	73.91 abc	2 b	60.33 e	2 b	67.87 d	4 c	40.95 j
11	*T. hamatum* 30	1 a	82.59 a	1 a	52.79 a	1 a	78.88 a	2 a	65.30 a
12	*T. Viride* 1	3 c	49.32 d	2 b	56.86 f	2 b	58.82 j	3 b	49.88 c
13	*T. Viride* 28	2 b	59.88 cd	3 c	53.24 h	3 c	51.73 l	3 b	48.43 d
14	*T. Pseudokoningii* 29	1 a	70.89 d	4 d	45.25 l	1 a	71.34 c	3 b	51.37 b
15	*G. Virens* 1	4 d	33.18 e	4 d	40.72 n	4 d	45.25 m	4 c	24.45 n
16	Control	-	0.00	-	0.00	-	0.00	-	0.00

H.= Hyperparasitism . R. = % reduction in colony diameter.

Table 16. Relative power of antibiosis (R.P.A.) by bacterial and actinomycetal antagonistes against the tested phytopathogenic fungi .

Antagonists		*S. rolfsii*		*R. solani*		*M. phaseolina*		*F. oxysporum*	
		RPA	R.	RPA	R.	RPA	R.	RPA	R.
1	*B. subtilis* 8	2.55 c	62.29 a	0.80 f	47.81 f	1.35 e	50.83 f	0.70 g	21.07 g
2	*B. subtilis* 23	2.85 a	62.89 a	2.40 b	58.82 b	2.55 a	67.89 a	1.30 bc	42.35 b
3	*B. subtilis* 15	1.65 f	37.25 c	1.45 d	41.78 I	1.60 d	47.78 h	0.50 h	14.45 h
4	*B. subtilis* 33	0.80 h	48.72 b	1.05 e	48.27 e	1.05 g	49.32 g	1.10 de	27.83 e
5	*P. fluorcenes* 3	2.35 d	55.81 ab	1.75 c	57.76 c	1.95 c	54.30 d	1.20 cd	39.70 c
6	*P. fluorcenes* 27	1.55 g	36.65 c	1.08 e	43.74 h	1.20 f	47.21 I	0.90 f	25.05 f
7	*P. fluorcenes* 22	2.75 b	62.29 a	2.75 a	70.89 a	2.65 a	62.29 b	1.40 ab	48.31 a
8	*P. fluorcenes* 52	2.20 e	50.21 b	1.40 d	51.13 d	2.35 b	57.32 c	1.00 ef	30.41 d
9	*Actinomycetes* 1	2.50 c	51.28 a	1.10 e	46.76 g	2.10 b	51.73 e	1.50 a	42.35 b
10	Control	-	0.00	-	0.00	-	0.00	-	0.00

R.P.A. = Relative power of antibiosis R. = % reduction in colony diameter.

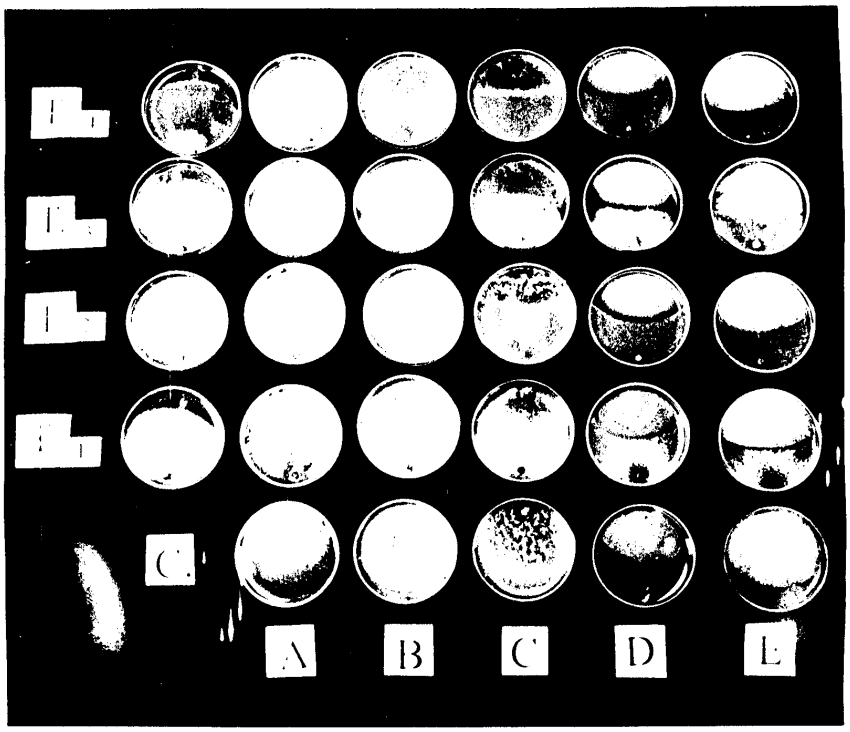

Fig. 5. Antagonism of *Trichoderma* spp, against :
S. *rolfsii* (A) , *R. solani* (B) , *M. phaseolina* (C) , *F. oxysporum* (D) , *F. solani* (E) .
T.1 = *T .harzainum*, T.2 = *T. hamatum*, T.3 = *T. viride*, T.4 =*T. pseudokoningii*

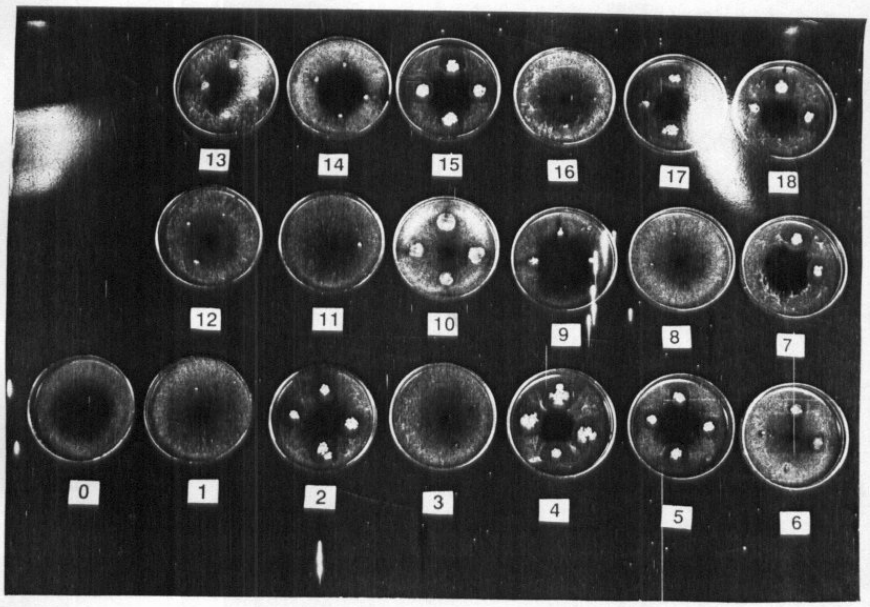

Fig. 6. Inhibition zone of *M. phaseolina* surrounding by some antagonistic bacterial isolate .

0 = control. , 1 = isolate no.B.2, 2 = isolate no. B.23 , 3 = isolate no. B.24 ,4 = isolate no.B.8, 5 = isolate no.P.15 , 6 = isolate no. P.22 , 7 = isolate no. P.13 , 8 = isolate no. B.30 , 9 = isolate P.27 ,10 = isolate no. B.28 ,11 = isolate no. B.1 , 12 = isolate no. B.26 , 13 = isolate no. P.10 , 14 = isolate no. P.29

T. pseudokoningii no.29. Whereas, *R.solani* was affected *by* 3 isolates of *Trichoderma.* Its growth was retarded significantly by the antagonism with isolates no.12 &25 as *S. rolfsii. Trichoderma hamatum* No.12 was as effective on the growth of *M.phaseolina* as on the two mentioned pathogens. *B. subtilis* no.23 & no.8 as well as *P.fluorescense* no.22 & no.3. affected significantly the radial growth of *S. rolfsii, R. solani & M. phaseolina.* It was observed from the results in Table (15) that *F.oxysporum* was slightly affected by all antagonists, but *T.hamatum* no.30 was the most effective one in inhibting the radial growth of *F. oxysporum* comparable to the other antagonests .

5-2-Pot experiment:

An experiment was designed to evaluate a number of 10 out of the 24 bio agents (Table 17) against pre-and post- emergence damping- off and root rot caused by *S.rolfsii* in a greenhouse . This experiment was carried out in 1998-1999 and 1999-2000 growing seasons. *S. rolfsii*-infested potted-soil prepared as mentioned under Materials and Methods was used. Bio

agents were added to soil before sowing as mentioned and disease readings were taken and recorded as infection percent and efficiency of treatments. To compare the efficacy of the bio agents with the recommended fungicide, Rhizolex T.50 was used as seed dresser. *S.rolfsii*-free soil served as control.

Data presented in Table (18) reveal that most of screened bioagents were effective in reducing damping- off of sugar beet expressed as the survived seedlings after 30 days of planting. Came after the effect of the fungicidal treatment on pre- and post-emergence damping- off , *T.hamatum* No.30 followed by *T.harzianum* no.25 and *B.subtilis* no.23 which were highly effective in controlling the disease compared with the untreated control. Concerning root rot caused by *S.rolfsii*, the majority of bio agents successfully reduced the disease incidence and disease severity. The most efficient agents on root rot after Rhizolex T 50 were *P.fluorescense* no.3, *T.hamatum* no.30, *B.subtilis* no.23. This is true over the two seasons of experimentation, *i.e.*,1998-1999 & 1999-2000 .

Table 17.Effect of some bioagents on damping-off and root rot diseases caused by *S. rolfsii* in a, greenhouse, during 1998-1999 season.

No.	Bioagent	Damping-off		Surviving plants	Root rot		Healthy plants
		pre-emergence %	Post-emergence %		Disease incidence %	Disease severity	
1.	*T. harzianum* 25	22.22 bc	8.89 abc	68.87 de	33.33 cd	2.33 cde	66.67 cd
2.	*T. harzianum* 9	28.00 cd	11.11 abc	60.00 bc	33.33 cd	2.83 e	66.67 cd
3.	*T. hamatum* 30	20.00 b	6.78 ab	73.33 e	22.22 b	1.67 bcd	81.11 ef
4.	*T. hamatum* 12	31.11 d	11.11 abc	60.00 bc	33.33 cd	3.33 e	66.67 cd
5.	*G. virens* 1	28.89 cd	13.33 bc	55.55 b	41.11 de	5.00 f	55.55 c
6.	*Actinomycetes* 1	28.89 cd	11.43 abc	60.00 bc	32.33 cd	1.33 abc	67.67 de
7.	*B. subtilis* 23	26.67 bcd	8.89 abc	66.67 cde	31.33 c	1.00 ab	66.67 cd
8.	*B. subtilis* 15	24.45 bcd	13.33 bc	60.00 bc	44.44 e	3.33 e	55.56 c
9.	*P. fluorcenes* 3	26.67 bcd	11.11 abc	62.22 bcd	21.22 b	2.67 de	78.78 def
10.	*P. fluorcenes* 22	28.89 cd	15.55 c	55.56 b	66.67 f	4.33 f	33.33 b
11.	Rhizolex T. 50	0.00 a	4.45 a	95.55 f	11.11 a	0.33 a	88.89 f
12.	Control	62.22 e	16.67 c	11.11 a	88.89 g	9.10 g	11.11 a

Mean followed by the same letter are not significantly different at the 5% level by DMRT.

Table 18. Effect of some bioagents on damping-off and root rot diseases caused by *S. rolfsii* in a greenhouse, during 1998-1999 season.

No.	Bioagent	Damping-off		Surviving plants	Root rot		Healthy plants
		pre-emergence %	Post-emergence %		Disease incidence %	Disease severity	
1.	*T. harzianum* 25	22.00 bc	6.67 bc	71.22 gh	22.22 c	3.00 c	77.78 f
2.	*T. harzianum* 9	26.67 cde	8.89 cd	64.44 ef	55.56 f	3.17 c	44.44 b
3.	*T. hamatum* 30	19.78 b	4.45 ab	75.55 h	11.11 b	1.67 b	88.89 f
4.	*T. hamatum* 12	26.34 cde	8.89 cd	64.45 ef	21.22 c	2.23 bc	78.78 e
5.	*G. virens* 1	28.89 de	15.55 fg	55.55 bc	55.56 f	4.50 d	44.44 b
6.	*Actinomycetes* 1	26.67 cde	11.11 de	62.22 de	44.44 e	5.33 d	55.56 c
7.	*B. subtilis* 23	24.44 bcd	8.89 cd	68.89 fg	33.33 d	2.33 bc	66.67 d
8.	*B. subtilis* 15	28.78 de	11.11 de	60.00 cde	55.56 f	5.33 d	44.44 b
9.	*P. fluorcenes* 3	28.89 de	13.33 ef	57.78 cd	11.44 b	2.00 bc	88.89 f
10.	*P. fluorcenes* 22	31.11 e	17.78 g	51.11 b	55.56 f	6.67 e	44.44 b
11.	Rhizolex T. 50	0.00 a	1.89 a	97.78 I	0.00 a	0.00 a	100.00 g
12.	Control	66.67 f	28.89 h	4.45 a	100.0 g	0.00 a	0.00 a

Mean followed by the same letter are not significantly different at the 5% level by DMRT.

6-Control of sugar beet root rot caused by *S. rolfsii* & *R.solani* by certain plant extracts and oils:

***6-1- In vi ro* experiments:**

Extracts of plants prepared as mentioned under Mater als & Methods were examined for their effect on the linear growth of *S. rolfsii, R. solani, M. phaseolina, F. oxysporum & F. solani* in Petri dishes.

Results shown in Tables (19&20) and illustrated by Figs.(7&8) indicate that all experimented materials were positively effective in reducing the linear growth *S. rolfsii & R. solani* , generally. The effect was obviously increased by increasing the concentration of plant extracts from 1000 to 2000 ppm. The obtained data show that the extracts from seeds of *Ammi visnaga* (pick tooth) was the most effective one in retarding the linear growth of the two pathogens after the fungicide, Rhizolex T. 50. On the contrary, extract of *Salix purpurea* (purpurea willow) leaves and *Eucalyptus globulus* (blue gum) leaves, showed the least effective on both pathogens.

In terms of the effect of the plant extracts on the growth of *M. phaseolina, F. oxysporum,& F. solani,* various degrees of slight effect were observed as

Table 19. Effect of certain plant extracts on linear growth (cm) of *S. rolfsii*.

Plant extracts	Concentrations						Mean	
	1000 ppm		1500 ppm		2000 ppm			
	L.G.	R.	L.G.	R.	L.G.	R.	L.G.	R.
1- *Trigonella foenum-graecum* L.	7.67 b	14.78	6.25 c	30.56	5.33 c	40.78	6.42	28.67
2- *Ammi visnaga* L . (Leaves)	7.12 d	20.89	5.90 e	34.33	4.10 e	54.44	5.71	36.56
3- *Glycyrrhiza glabra* L.	6.85 e	23.89	5.53 f	38.56	2.87 f	68.11	5.08	43.56
4- *Eucalyptus globulus* labill.	7.08 d	21.33	6.15 d	31.67	5.33 c	40.78	6.19	31.22
5- *Boughoinvillae spectabilis* willd.	6.43 f	28.56	5.97 e	33.67	4.77 d	47.00	5.72	36.44
6- *Ammi visnaga* L. (Seeds)	1.37 g	84.78	0.78 9	91.33	0.50 h	93.33	0.88	62.48
7- *Salix purpurae* L.	7.30 c	18.89	6.85 b	23.89	5.65 b	37.22	6.60	26.67
8- Rhizolex T-50.	0.60 h	93.33	0.60 h	93.33	0.60 g	93.33	0.60	93.33
9- Control	9.00 a	0.00	9.00 a	0.00	9.00 a	0.00	9.00	0.00
Mean	5.94		5.23		4.24		5.13	

Means followed by the same letter are not significantly different at 5% level by DMRT.
L.G. = fungal linear growth (cm).
R. = % reduction in colony diameter.

Fig.7. Effect of the tested Plant extracts on linear growth of *S. rolfsii* in PDA-plates at the concentration of 1000 (A), 1500 (B) 2000 ppm. (C) .1- *T. foenum-greacum*. 2- *A. visnaga* (leaves). 3- *G. glabra* 4- *E. globulus*. 5- *B. spectabilis*. 6- *A. visnaga*. 7- *S. purpura*.

Table 20. Effect of certain plant extracts on linear growth (cm) of *R. solani* .

Plant extracts	Concentrations						Mean	
	1000 ppm		1500 ppm		2000 ppm			
	L.G.	R.	L.G.	R.	L.G.	R.	L.G.	R.
1- *Trigonella foenum-graecum* L.	8.92 b	0.87	8.85 b	1.67	8.47 c	5.89	8.74	8.75
2- *Ammi visnaga* L. (leaves) .	7.68 d	14.67	6.45 c	28.33	5.65 d	37.22	6.59	26.74
3- *Glycyrrhiza glabra* L.	6.62 e	26.44	6.13 d	31.89	5.43 e	39.67	6.06	32.66
4- *Eucalyptus globulus* labill.	9.00 a	0.00	9.00 a	0.00	8.97 a	0.33	8.99	0.11
5- *Boughoinvillae spectabilis* willd.	8.77 c	2.55	6.03 e	33.00	4.65 f	48.33	6.48	27.96
6- *Ammi visnaga* L. (seede) .	5.62 f	37.55	3.48 f	61.33	2.95 g	67.22	4.02	61.18
7- *Salix purpurae* L.	9.00 a	0.00	8.82 b	1.89	8.63 b	4.11	8.82	2.00
8- Rhizolex T-50.	0.60 g	93.33	0.60 g	93.33	0.60 h	93.33	90.60	93.33
9- Control	9.00 a	0.00	9.00 a	0.00	9.00 a	0.00	9.00	0.00
Mean	7.24		6.49		6.04		6.59	

Means followed by the same letter are not significantly different at 5% level by DMRT.
L.G.= Fungal linear growth (cm).
R. = % reduction in colony diameter.

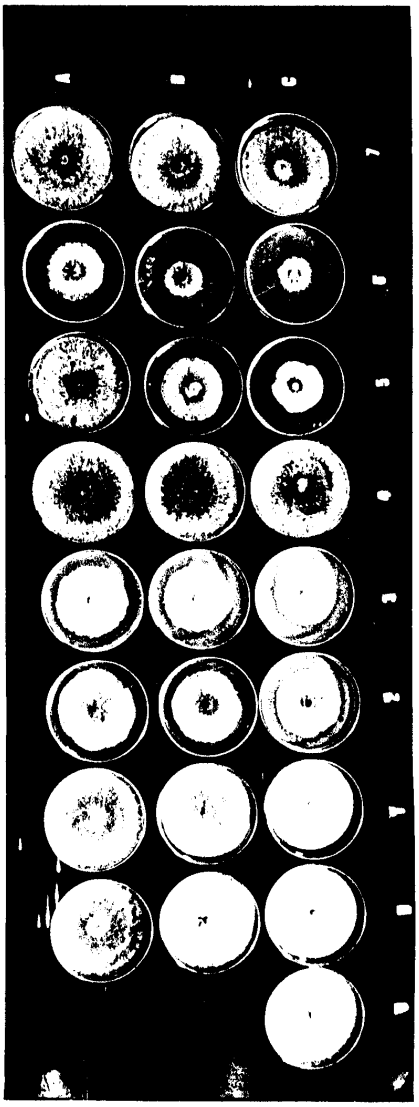

Fig. 8. Effect of the tested Plant extracts on linear growth of *R. solani* in PDA-plates at the concentrations of 1000 (A), 1500 (B) 2000 ppm. (C) .1- *T. foenum-greacum*. 2- *A. visnaga* (leaves). 3- *G. glabra* 4- *E. globulus*. 5- *B. spectabilis*. 6- *A. visnaga*. 7- *S. purpura*.

shown in Tables (21,22 & 23) and Figs.(9 & 10& 11). *Ammi visnaga* seed extract proved to be the promising material in reducing the linear growth of these pathogens as it gave the best effect on the fungal growth after Rhizolex T.50.

As regard to the effect of plant extracts on sporulation of *F. oxysporum* & *F.solani*, it was found (Tables 24& 25) that these extracts have either positive or negative effect on sporulation of both pathogens. Effect on sporulation was increased by increasing the concentration of extracts in the poisoned PDA. *E.globulus* stimulated the sporulation compared with the untreated control. Extracts of *A.visnaga* seeds followed by *Boughoinvillae spectabilis* (boughoinvilla) leaves and *A.visnaga* leaves gave the highest effect in decreasing the fungal sporulation and came after the fungicide, Rhizolex T. 50.

Concerning the effect of some essential oils on linear growth of the five aforementioned sugar beet pathogens, data presented in Table (26) and illustrated in Fig. (12) that oils of each of *Syzygium aromaticum* (clove), *Cuminum cyminum* (cumin), *Ocimum basilicum* (basil) & *Mentha viridis*

Table 21. Effect of certain plant extracts on linear growth (cm) of *M. phaseolina*.

Plant extracts	Concentrations						Mean	
	1000 ppm		1500 ppm		2000 ppm			
	L.G.	R.	L.G.	R.	L.G.	R.	L.G.	R.
1- *Trigonella foenum-graecum* L.	8.88 bc	1.33	9.00 a	0.00	9.00 a	0.00	8.96	0.44
2- *Ammi visnaga* L. (leaves).	8.93 ab	0.78	8.28 c	8.00	7.55 d	16.11	8.26	24.37
3- *Glycyrrhiza glabra* L.	7.35 f	18.33	5.83 f	35.22	4.75 f	47.22	5.98	22.59
4- *Eucalyptus globulus* labill.	8.83 cd	1.90	8.55 b	5.00	8.12 b	9.78	8.50	5.56
5- *Boughoinvillae spectabilis* willd.	8.78 d	2.44	8.12 d	9.78	7.85 c	12.78	8.25	8.11
6- *Ammi visnaga* L. (seeds) .	7.20 9	20.00	5.95 e	33.89	3.85 g	57.44	5.67	37.11
7- *Salix purpura*eL.	8.68 e	3.56	8.05 d	10.55	6.50 e	27.78	7.74	13.96
8- Rhizolex T-50.	0.60 h	93.33	0.60 g	93.33	0.60 h	93.33	0.60	93.33
9- Control	9.00	0.00	9.00 a	0.00	9.00 a	0.00	9.00	0.00
Mean	7.59		7.04		6.36		7.00	

Means followed by the same letter are not significantly different at 5% level by DMRT.
L.G. = Fungal linear growth (cm).
R. = % reduction in colony diameter .

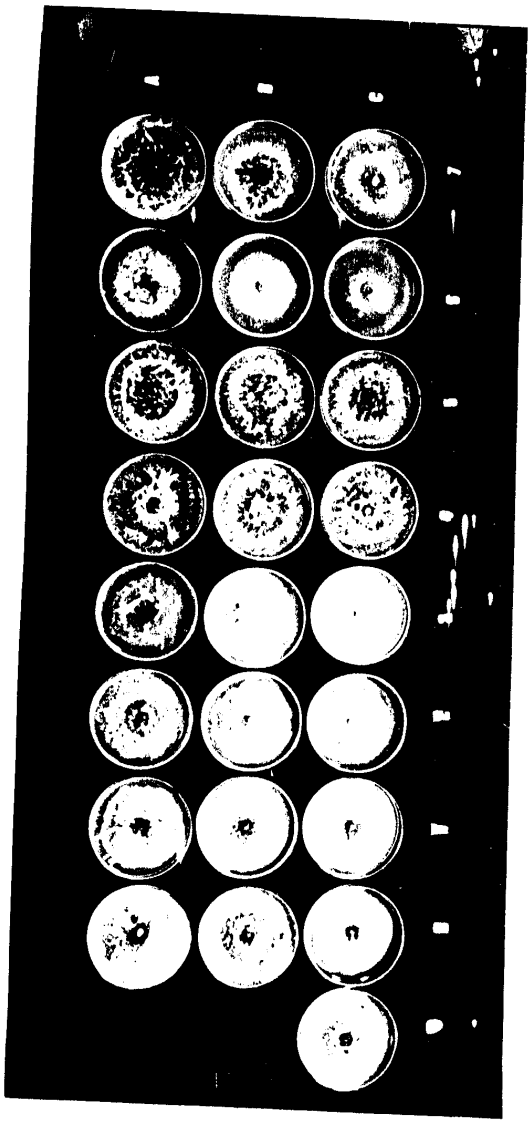

Fig. 9. Effect of the tested Plant extracts on linear growth of *M. phaseolina* in PDA-plates at the concentrations of 1000 (A), 1500 (B) 2000 ppm. (C) .1- *T. foenum-graecum*. 2- *A. visnaga* (leaves). 3- *G. glabra* 4- *E. globulus*. 5- *B. spectabilis*. 6- *A. visnaga*. 7- *S. purpura*.

Table 22. Effect of certain plant extracts on linear growth (cm) of *F. oxysporum*.

Plant extracts	Concentrations						Mean	
	1000 ppm		1500 ppm		2000 ppm			
	L.G.	R	L.G.	R	L.G.	R	L.G.	R.
1- *Trigonella foenum-graecum* L.	6.27 b	28.34	5.62 b	35.77	5.20 c	40.57	5.69	34.97
2- *Ammi visnaga* L. (leaves) .	5.23 g	39.09	4.98 e	43.09	4.65 f	46.86	4.99	43.01
3- *Glycyrrhiza glabra* L..	5.48 e	37.37	4.90 e	44.00	3.77 g	56.91	4.72	46.09
4- *Eucalyptus globulus* labill.	5.85 d	33.14	5.45 c	37.71	5.03 d	42.51	5.44	37.79
5- *Boughoinvillae spectabilis* willd.	5.45 ef	37.71	5.10 d	41.71	4.77 e	45.49	5.11	41.64
6- *Ammi visnaga* L.. (seeds) .	5.37 fg	38.63	3.98 f	54.51	3.73 g	57.37	4.36	50.17
7- *Salix purpurae* L.	6.00 c	31.14	5.55bc	36.57	5.42 b	38.06	5.66	35.38
8- Rhizolex T-50.	2.45 h	72.00	1.10 g	87.43	0.60 h	93.14	1.38	84.19
9- Control	8.75 a	0.00	8.75 a	0.00	8.75 a	0.00	8.75	0.00
Mean	5.66		5.05		4.66		5.12	

Means followed by the same letter are not significantly different at 5% level by DMRT.
L.G. = Fungal linear growth (cm).
R. = the fungal mycelial inhibition comparing the control treatment in present.

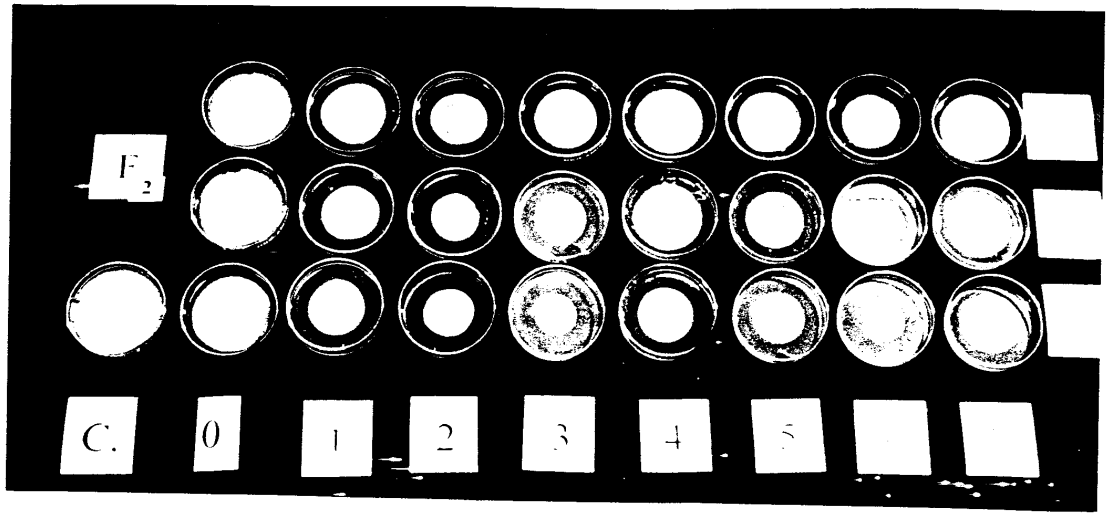

Fig. 1o. Effect of the tested Plant extracts on linear growth of *F. oxysporum* in PDA-plates at the concentrations of 1000 (A), 1500 (B) 2000 ppm. (C) .1- *T. foenum-greacum*. 2- *A. visnaga* (leaves). 3- *G. glabra* 4- *E. globulus*. 5- *B. spectabilis*. 6- *A. visnaga*. 7- *S. purpura*.

Table 23. Effect of certain plant extracts at different concentrations on linear growth (in cm) of *Fusarium solani*.

Plant extracts	Concentrations						Mean	
	1000 ppm		1500 ppm		2000 ppm			
	L.G.	R.%	L.G.	R.%	L.G.	R.%	L.G.	R%.
1- *Trigonella foenum-graecum* L.	7.22 bc	18.41	6.13 e	30.73	5.12 e	42.15	6.16	30.43
2- *Ammi visnaga* L. (leaves) .	6.15 f	30.51	5.07 f	42.71	4.73 f	46.59	5.32	39.92
3- *Glycyrrhiza glabra* L.	6.42 e	27.45	4.98 f	43.73	4.15 g	53.11	5.18	41.45
4- *Eucalyptus globulus* labill.	7.32 b	17.29	6.62 c	25.20	6.08 c	31.13	6.67	24.54
5- *Boughoinvillae spectabilis* willd.	7.18 c	18.87	6.40 d	27.68	5.77 d	34.80	6.45	27.12
6- *Ammi visnaga* L. (seeds) .	4.12 g	53.49	3.67 g	58.53	3.07 h	65.31	3.62	59.10
7- *Salix purpurae* L.	7.07 d	20.11	6.88 b	22.26	6.72 b	24.07	6.89	22.15
8- Rhizolex T-50.	2.72 h	69.27	1.85 h	79.10	8.98 i	88.93	1.85	79.10
9- Control	8.85 a	0.00	8.85 a	0.00	8.85 a	0.00	8.85	0.00
Mean	6.34		5.61		5.05		5.66	

Means followed by a common letter are not significantly different at 5% level by DMRT.
L.G. = The fungal linear growth in cm and this values are average of four replicates.
R. = % reduction in colony diameter.

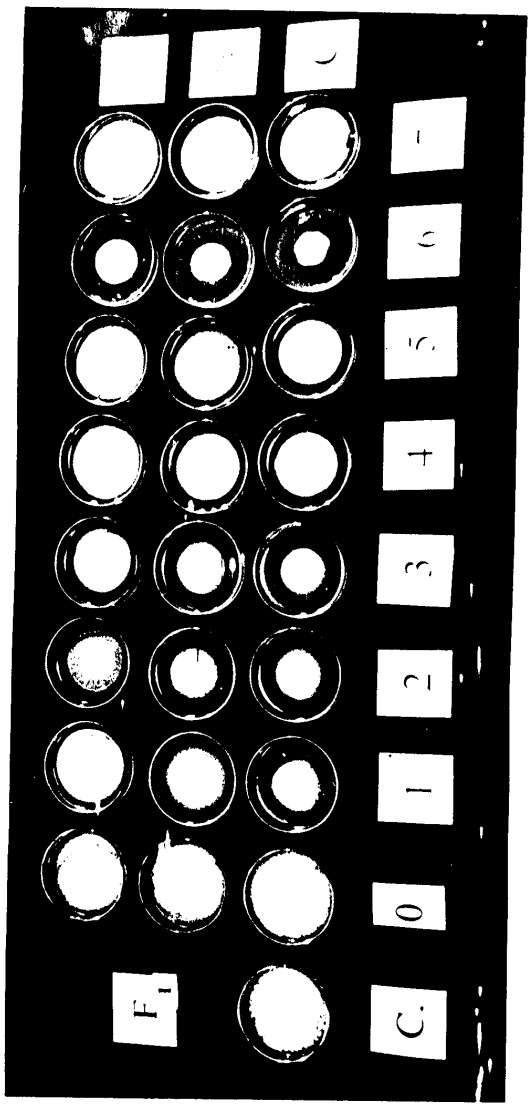

Fig. 11. Effect of the tested Plant extracts on linear growth of *F. solani* in PDA-plates at the concentrations of 1000 (A), 1500 (B) 2000 ppm. (C) .1- *T. foenum-graecum*. 2- *A. visnaga* (leaves). 3- *G. glabra* 4- *E. globulus*. 5- *B. spectabilis*. 6- *A. visnaga*. 7- *S. purpura*.

Table 24. Effect of certain plant extracts on a sporulation of *F.oxysporum*.

Plant extracts	Concentrations						Mean	
	1000 ppm		1500 ppm		2000 ppm			
	No. of sp.	R.	No. of sp.	R.	No. of sp.	R.	No. of sp.	R.
1- *Trigonella foenum-graecum* L.	228.0ab	1.29	227.0 b	1.73	175.0 c	24.24	216.7	6.06
2- *Ammi visnaga* L. (leaves) .	189.0 c	18.18	117.0 d	49.35	81.0 e	64.95	129.0	44.15
3- *Glycyrrhiza glabra* L.	202.0 bc	12.55	174.0 c	24.67	121.0 d	47.61	165.7	28.14
4- *Eucalyptus globulus* labill.	245.0 a	+3.89	300.0 a	+29.87	337.0 a	+45.88	294.0	+27.27
5- *Boughoinvillae spectabilis* willd.	140.0 d	39.39	102.0 d	55.84	64.0 e	72.29	102.0	55.84
6- *Ammi visnaga* L. (seeds) .	198.0 bc	14.28	114.0 d	50.64	48.0 e	97.22	120.0	48.05
7- *Salix purpurae* L.	227.0 ab	1.73	209.0 b	9.52	182.0 c	21.21	206.0	10.82
8- Rhizolex T-50.	23.0 e	90.04	12.0 e	94.81	6.0 f	97.40	13.7	93.94
9- Control	231.0 ab	0.00	231.0 b	0.00	231.0 b	0.00	231.0	
Mean	189.2		166.2		138.3		164.6	

Means followed by the same letter are not significantly different at 5% level by DMRT.
No. of sp. = Number of spores in one square of Hemocetometer slide
R.= % reduction in number of spores.

Table 25. Effect of certain plant extracts on a sporulation of *F. solani*.

Plant extracts	Concentrations						Mean	
	1000 ppm		1500 ppm		2000 ppm			
	No. of sp.	R.	No. of sp.	R	No. of sp.	R.	No. of sp.	R.
1- *Trigonella foenum-graecum* L.	226.0 c	22.30	161.0cd	43.90	154.0 c	46.83	179.3	37.63
2- *Ammi visnaga* L.	150.0 d	47.74	131.0cd	54.35	66.0 e	77.00	115.7	59.58
3- *Glycyrrhiza glabra* L.	252.0abc	12.20	175.0 c	39.02	133.0cd	53.65	186.0	34.84
4- *Eucalyptus globulus* labill.	290.0a	11.15	309.0 a	+7.66	396.0 a	+37.97	320.0	+11.49
5- *Boughoinvillae spectabilis* willd.	223.0 c	+1.05	159.0cd	44.59	113.0 d	60.63	166.0	42.16
6- *Ammi visnaga* L.	141.0 d	50.90	109.0 d	62.02	49.0 e	82.93	146.3	49.13
7- *Salix purpurae* L.	278.0 ab	3.14	213.0 b	25.78	161.0 c	43.90	217.3	24.39
8- Rhizolex T-50.	53.0 e	81.53	36.0 e	87.46	11.0 f	96.16	33.3	88.50
9- Control	287.0 a	0.00	287.0 a	0.00	287.0 b	0.00	287.0	0.00
Mean	223.3		175.6		152.0		183.5	

Means followed by the same letter are not significantly different at 5% level by DMRT.
No. of sp. = Number of spores in one square of Hemocetometer slide.
R= % reduction in number of spores.

Table 26. Effect of some essential oils on linear growth (cm) of *S. rolfsii*.

Essential oils	Concentrations								Mean	
	500ppm		1000ppm		1500ppm		2000ppm			
	L.G.	R.	L.G.	R.	L.G.	R.	L.G.	R.	L.G.	R.
1- *Mentha viridis* L	7.30 b	18.89	5.05 b	43.89	1.80 b	80.0	0.60 b	93.33	2.48	72.44
2- *Syzygium aromaticum*.	1.10 d	87.78	0.60 c	93.33	0.60 c	93.33	0.60 b	93.33	0.60	93.33
3- *Cuminum cyminum* L.	3.10 c	65.56	0.63 c	93.00	0.60 c	93.33	0.60 b	93.33	0.61	93.33
4- *Ocimum basilicum*	2.00 c	77.78	0.60 c	93.33	0.60 c	93.33	0.60 b	93.33	0.60	93.33
5- Rhizolex T-50.	0.60*d	93.33	0.60 c	93.33	0.60 c	93.33	0.60 b	93.33	0.60	93.33
9- Control	9.00 a	0.00	9.00 a	0.00	9.00 a	0.00	9.00 a	0.00	9.00	0.00
Mean	2.82		2.75		2.20		2.00		2.32	

Means followed by the same letter are not significantly different at 5% level by DMRT.
L.G. = Fungal linear growth (cm).
R. = % reduction in colony diameter.

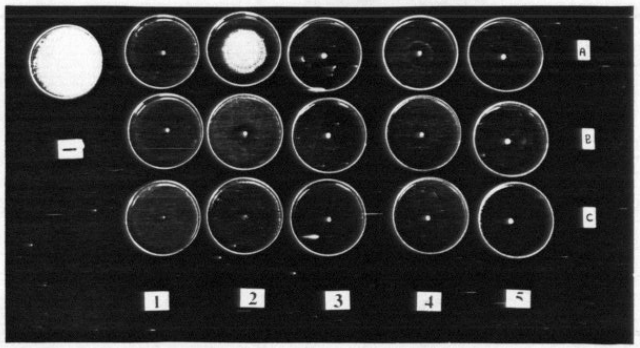

Fig. 12. Effect of the tested essential oils on linear growth of *R. solani* in PDA-plates at the concentrations of 1000 (A), 1500 (B) 2000 ppm. (C) . 1- *Rhizolex T.50*. 2- *M. virids*. 3- *S. aromaticum*. 4- *C. cyminum*. 5- *O. basilicum*. – *Control* .

(mint) were effective as inhibitors to growth of *S.rolfsii*. All of these oils except the mint oil inhibited the growth of this fungus at the concentration of 1000 ppm.

All oils under study significantly retarded the linear growth of *R. solani, M. Phaseolina,* on PDA at 1500 ppm however, oil of cumin was superior to the other oils in this respect Tables (27&28) and Figs.(13&14).

Oils under study, on the other hand, affected slightly the linear growth of both *F. Oxysporum & F. solani* at the concentration of 2000 ppm. Tables (29&30) and Figs (15 &16). Oil of *Syzygium aromaticum* however, was the most effective inhibitor to growth of all the tested pathogens with significant or insignificant difference between its effect and the effect of the fungicide, Rhizolex T50.

Concerning the effect of the tested oils on sporulation of *F.oxysporum & F.solani,* it is clear from Tables (31 and 32) that all the tested oils significantly reduced number of forming spores of both fungi. However, *S.aromaticum* was the most effective in this respect after Rhizolex T. 50.

Table 27.Effect of some essential oils on linear growth (cm) of *R. solani*.

Essential oils	Concentrations						Mean	
	1000 ppm		1500 ppm		2000 ppm			
	L.G.	R.	L.G.	R.	L.G.	R.	L.G.	R.
1- *Mentha viridis* L	5.65 b	37.22	0.60 b	93.33	0.60 b	93.33	2.28	74.67
2- *Syzygium aromaticum*.	2.38 c	73.56	1.08 b	88.00	0.60 b	93.33	1.35	85.00
3- *Cuminum cyminum* L.	1.25 ed	86.11	0.60 b	93.33	0.60 b	93.33	0.82	90.89
4- *Ocimum basilicum*	5.70 b	36.67	0.60 b	93.33	0.60 b	93.33	2.30	74.49
5- Rhizolex T-50.	0.60* d	93.33	0.60 b	93.33	0.60 b	93.33	0.60	93.33
9- Control	9.00 a	0.00	9.00 a	0.00	9.00 a	0.00	9.00	0.00
Mean	4.10		2.08		2.00		2.50	

Means followed by the same letter are not significantly different at 5% level by DMRT.
L.G. = Fungal linear growth in (cm) .
R. = % reduction in colony diameter.

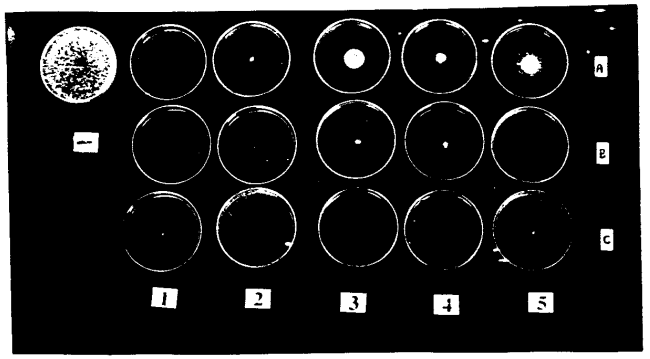

Fig. 13. Effect of the tested essential oils on linear growth of *R. solani* in PDA-plates at the concentrations of 1000 (A), 1500 (B) 2000 ppm. (C) . 1- *Rhizolex T.50*. 2- *M. virids*. 3- *S. aromaticum*. 4- *C. cyminum*. 5- *O. basilicum*. – *Control* .

Table 28. Effect of essential oils on linear growth (cm) of *Macrophomina phaseolina*.

Essential oil	Concentrations						Mean	
	1000 ppm		1500 ppm		2000 ppm			
	L.G.	R.	L.G.	R.	L.G.	R.	L.G.	R.
1- *Mentha viridis* L	4.83 b	46.33	0.60 c	93.33	0.60 b	93.33	2.01	76.67
2- *Syzygium aromaticum*.	0.77 e	91.44	0.60 c	93.33	0.60 b	93.33	0.66	92.67
3- *Cuminum cyminum* L.	3.18 d	64.67	2.30 b	74.44	0.60 b	93.33	2.03	77.44
4- *Ocimum basilicum*	3.53 c	60.78	0.60 c	93.33	0.60 b	93.33	1.58	82.44
5- Rhizolex T-50.	0.60 f	93.33	0.60 c	93.33	0.60 b	93.33	0.60	93.33
9- Control	9.00 a	0.00	9.00 a	0.00	9.00 a	0.00	9.00	0.00
Mean	3.65		2.28		2.00		2.64	

Means followed by the same letter are not significantly different at 5% level by DMRT.
L.G. = Fungal linear growth in (cm) .
R. = % reduction in colony diameter.

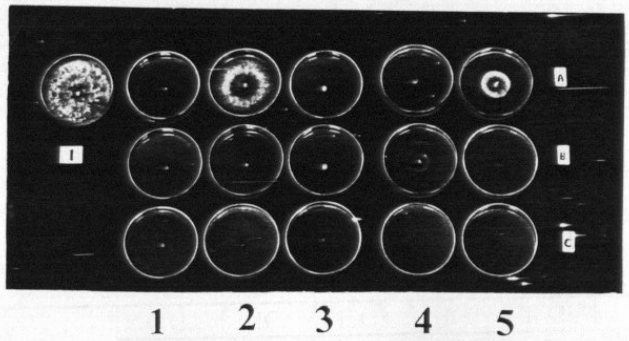

Fig. 14. Effect of the tested essential oils on linear growth of *M. phaseolina* in PDA-plates at the concentrations of 1000 (A), 1500 (B) 2000 ppm. (C) 1- *Rhizolex T.50*. 2- *M. virids*. 3- *S. aromaticum*. 4- *C. cyminum*. 5- *O. basilicum*. – *Control*.

Table 29. Effect of essential oils on linear growth (cm) of *F.oxysporum*.

The essential oils	Concentrations						Mean	
	1000 ppm		1500 ppm		2000 ppm			
	L.G.	R.	L.G.	R.	L.G.	R.	L.G.	R.
1- *Mentha viridis* L	7.25 b	19.44	6.23 b	30.78	5.25 b	41.67	6.24	30.67
2- *Syzygium aromaticum*.	3.80 e	57.78	3.65 d	59.44	0.60 e	93.33	2.68	70.22
3- *Cuminum cyminum* L.	5.25 d	41.67	4.80 c	46.67	2.10 d	76.67	4.05	55.00
4- *Ocimum basilicum*	6.15 c	31.67	6.15 b	31.67	3.77 c	58.11	5.36	40.44
5- Rhizolex T-50.	2.45 f	72.78	1.10 e	87.78	0.60 e	93.33	1.38	84.67
9- Control	8.75 a	0.00	8.75 a	0.00	8.75 a	0.00	8.75	0.00
Mean	5.68		5.11		3.51		8.75	

Means followed by the same letter are not significantly different at 5% level by DMRT.
L.G. = Fungal linear growth in (cm) .
R. = % reduction in colony diameter.

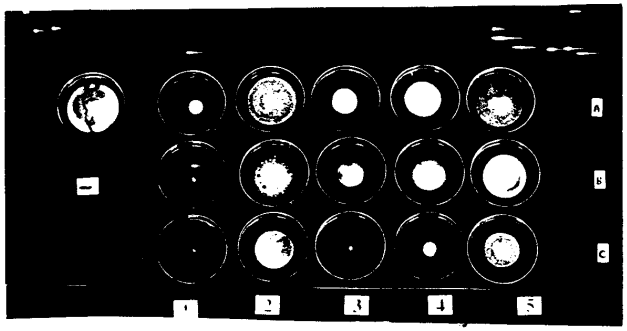

Fig. 15. Effect of the tested essential oils on linear growth of *F. oxysporum* in PDA-plates at the concentrations of 1000 (A), 1500 (B) 2000 ppm. (C) . 1- *Rhizolex T.50*. 2- *M. virids*. 3- *S. aromaticum*. 4- *C. cyminum*. 5- *O. basilicum*. – *Control*.

Table 30. Effect of some essential oils on linear growth (cm) of *F. solani*.

Essential oils	Concentrations						Mean	
	1000 ppm		1500 ppm		2000 ppm			
	L.G.	R.	L.G.	R.	L.G.	R.	L.G.	R
1- *Mentha viridis* L	5.45 d	38.63	2.68 d	69.62	0.88 e	90.09	3.00	66.11
2- *Syzygium aromaticum*.	3.83 e	56.87	3.00 c	66.22	0.60 f	93.24	2.48	72.11
3- *Cuminum cyminum* L.	5.70 c	35.81	3.80 b	57.20	1.85 b	79.17	3.78	57.39
4- *Ocimum basilicum*	6.88 b	22.52	3.80 b	57.20	1.63 c	81.64	4.10	53.79
5- Rhizolex T-50.	2.70 f	69.59	1.88 e	78.83	1.00 d	88.74	1.86	79.05
9- Control	8.88 a	0.00	8.88 a	0.00	8.88 a	0.00	8.88	0.00
Mean	5.57		4.00		2.47		4.02	

Means followed by the same letter are not significantly different at 5% level by DMRT.
L.G. = Fungal linear growth in (cm) .
R. = % reduction in colony diameter.

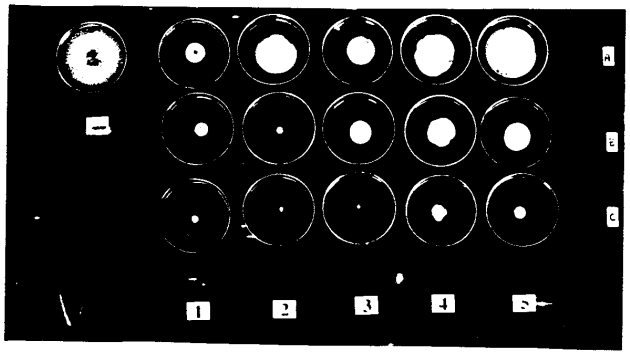

Fig. 16. Effect of the tested essential oils on linear growth of *F. solani* in PDA-plates at the concentrations of 1000 (A), 1500 (B) 2000 ppm. (C) . 1- *Rhizolex T.50*. 2- *M. virids*. 3- *S. aromaticum*. 4- *C. cyminum*. 5- *O. basilicum*. – *Control* .

Table 31. Effect of some essential oils on sporulation of *F.oxysporum*.

Essential oils	Concentrations						Mean	
	1000 ppm		1500 ppm		2000 ppm			
	No. of sp.	R.	No. of sp.	R.	No. of sp.	R.	No. of sp.	R.
1- *Mentha viridis* L.	84.0 b	63.46	63.0 c	72.73	47.0 b	79.65	64.7 c	71.99
2- *Syzygium aromaticum*.	36.0 cd	84.42	20.0 d	91.34	10.0 c	95.67	22.0 e	90.48
3- *Cuminum cyminum* L.	48.0 c	79.22	44.0 e	80.95	15.0 c	93.51	35.7 d	84.55
4- *Ocimum basilicum*	103.0 b	55.41	89.0 b	61.47	65.0 b	71.86	85.7 b	62.90
5- Rhizolex T-50.	23.0 d	90.04	12.0 d	94.81	6.0 c	97.40	13.7 e	94.00
9- Control	231.0	0.00	231.0 a	0.00	231.0 a	0.00	231.0 a	0.00
Mean	87.5		78.2		62.3		76.0	

Means followed by the same letter are not significantly different at 5% level by DMRT.
No. of sp. =Number of spores in one square of Hemocetometer slide.
R= % reduction in number of spores.

Table 32. Effect of some essential oils on sporulation of *F. solani*.

Essential oils	Concentrations						Mean	
	1000 ppm		1500 ppm		2000 ppm			
	No. of sp.	R.	No. of sp.	R.	No. of sp.	R.	No. of sp.	R..
1- *Mentha viridis* L	91.0 d	68.29	87.0 b	69.69	15.0 b	94.77	94.3	77.60
2- *Syzygium aromaticum*.	101.0 cd	64.81	84.0 b	70.73	11.0 b	96.17	65.3	77.25
3- *Cuminum cyminum* L.	115.0 bc	59.93	74.0 b	74.22	29.0 b	89.89	72.7	74.67
4- *Ocimum basilicum*	137.0 b	52.26	73.0 b	74.56	21.0 b	92.68	77.0	73.17
5- Rhizolex T-50.	53.0 e	81.53	36.0 c	87.46	11.0 b	96.17	33.3	88.50
9- Control	287.0 a	0.00	287.0 a	0.00	28.7 a	0.00	287.0	0.00
Mean	130.7		96.8		62.3		96.6	

Means followed by the same letter are not significantly different at 5% level by DMRT.
No. of sp. =Number of spores in one square of Hemocetometer slide.
R= % reduction in number of spores.

6-2- Pot experiments:

Greenhouse experiments were carried out in order to screen out the effect of plant extracts as well as essential oils on the disease incidence of sugar beet damping-off and root rot caused by *S. rolfsii*. Weight of roots as well as the yield components expressed as percentage of the total soluble solids (TSS)& sucrose, purity degree of sucrose and sugar losses due to the effect of root infection was studied. *S. rolfsii* infested potted soil was used in three replicates as mentioned under Materials and Methods. Un-infested soil and seeds treated with Rhizolex T 50 served as control. Disease readings were recorded as percentage of infection after 30 days of planting for damping- off and 150 days for root rot. This experiment was done in two seasons,*i.e.* 1998-1999 and 1999-2000.

Data presented in Table (33&34) illustrated by Fig.(16) show that all tested plant extracts and essential oils have significant effect in improving the number of survived seedlings due to controlling the pre-& post- damping off. Extracts and oils of *Ammi visnaga (seeds)*followed by *Boughoinvillae spectabilis & Glycyrrhiza glabra* ,*Cuminum cyminum* , *A.visnaga* (leaves) and *Syzygium aromaticum* were highly effective in reducing damping-off and root rot as well as the severity of rot diseases of sugar beet. The rest

Table 33. Effect of extracts and oils used for soaking seeds on the incidence of sugar beet damping-off, root rot and disease severity caused by *S.rolfsii.* greenhouse, during 1998-1999 season.

Treatment	Damping-off		Surviving plants	Root rot		Healthy plants
	pre-emergence %	Post-emergence %		Disease incidence %	Disease severity	
Plant extracts:						
1- *Trigonella foenum-graecum* L.	51.85 e	0.00 a	48.15 c	44.44 e	6.33 f	55.56 d
2- *Ammi visnaga* L.	22.22 c	11.11 c	66.68 de	0.00 a	0.00 a	100.00 h
3- *Glycyrrhiza glabra* L.	14.81 b	11.11 c	74.08 ef	33.33 d	3.33 c	66.68 e
4- *Eucalyptus globulus* labill.	48.15 e	3.70 ab	48.15 c	55.56 f	8.50 g	44.44 c
5- *Boughoinvillae spectabilis* willd.	11.11 b	11.11 c	77.79 f	22.22 c	2.00 b	77.78 f
6- *Ammi visnaga* L.	0.00 a	7.41 bc	92.59 gh	0.00 a	0.00 a	100.00 h
7- *Salix purpura* L.	59.26 f	11.11 c	29.63 b	84.45 g	5.67 ef	22.22 b
Oils:						
8- *Mentha viridis* L	25.92 c	11.11 c	62.97 d	54.44 f	5.17 de	55.56 d
9- *Syzygium aromaticum.*	0.00 a	33.33 e	66.66 de	11.11 b	0.67 a	88.89 g
10- *Cuminum cyminum* L.	0.00 a	25.92 d	74.08 ef	0.00 a	0.00 a	100.00 h
11- *Ocimum basilicum*	37.03 d	25.92 d	37.03 b	44.44 e	4.67 d	55.56 d
12- Rhizolex T-50.	0.00 a	7.41 bc	92.59 gh	0.00 a	0.00 a	100.00 h
13- Control : Infested	96.30 g	0.00 a	3.70 a	100.00 h	9.17 g	0.00 a
14- Control : Acetone	11.11 b	0.00 a	88.89 g	0.00 a	0.00 a	100.00 h
15- Control : Uninfested	0.00 a	0.00 a	100.00 h	0.00 a	0.00 a	100.00 h

Mean followed by the same letter are not significantly different at the 5% level by DMRT.

Table 34. Effect of plant extracts and oils used for soaking seeds on the incidence of sugar beet damping-of, root rot and disease severity caused by *S.rolfsii*, in a greenhous .during 1999-2000 season.

Treatment	Damping-off		Surviving plants	Root rot		Healthy plants
	% pre-emergence	% Post-emergence		Disease % incidence	Disease severity	
Plant extracts :						
1- *Trigonella foenum-graecum* L.	59.26 g	0.00 a	40.50 c	55.56 f	4.67 c	18.52 b
2- *Ammi visnaga* L.	37.03 de	11.11 d	51.85 d	11.11 b	0.33 ab	82.22 h
3- *Glycyrrhiza glabra* L.	33.35 d	3.70 b	55.57 d	22.22 c	1.00 b	77.78 g
4- *Eucalyptus globulus* labill.	40.74 e	0.00 a	59.26 de	66.68 g	7.50 e	33.35 d
5- *Boughoinvillae spectabilis* willd.	25.92 c	22.22 g	51.85 d	11.11 b	1.00 b	88.89 i
6- *Ammi visnaga* L.	22.22 c	11.11 d	66.68 ef	0.00 a	0.00 a	100.00 j
7- *Salix purpura* L.	62.97 g	7.41 c	29.63 b	77.78 h	7.50 e	22.22 c
Oils :						
8- *Mentha viridis* L	48.15 f	18.52 f	33.33 bc	33.33 d	6.33 d	66.68 f
9- *Syzygium aromaticum.*	0.00 a	29.63 h	70.37 f	11.11 b	0.67 ab	88.89 i
10- *Cuminum cyminum* L.	7.41 b	33.33 i	70.37 f	0.00 a	0.00 a	100.00 j
11- *Ocimum basilicum*	48.15 f	18.52 f	37.03 bc	44.44 e	4.83 c	55.56 e
12- Rhizolex T-50.	0.00 a	14.81 e	85.52 g	0.00 a	0.00 a	100.00 j
13- Control : Infested	77.79 h	14.81 e	7.41 a	82.22 i	8.5 f	11.11 a
14- Control : Acetone	11.18 b	0.00 a	88.89 g	0.01 a	0.00 a	100.00 j
15- Control : Uninfested	0.00 a	0.00 a	100.00 h	0.01 a	0.00 a	100.00 j

Mean followed by the same letter are not significantly different at the 5% level by DMRT.

materials and oils were less effective in decreasing the disease incidence, generally. Similar results were obtained from both seasons of experimentation.

Parameters of plant growth were studied in the same two growing seasons and data are shown in Table (35). Results indicate that all plant extracts and oils improved plant growth expressed as plant height, leaf area, and leaf dry weight. However, *Ammi visnaga and B.spectabilis,* in particular were as effective as Rhizolex T in enhancing the plant growth comparable to the other materials. This is correct in both seasons of experimentation.

Root fresh weight was found to be increased by decreasing the disease incidence of root rot incited by *S. rolfsii* due to treating beet seeds with any of plant extracts or oils (Tables, 36&37). *Ammi visnaga* seed or leaf extracts and *Cuminum cyminum* and *Syzygium aromaticum* oils, however, caused the highest degree of increasing leaf dry weight, total soluble sugars (TSS), sucrose percent in roots and sugar purity. While, S *purpurea* & *T. foenum-graecum* Which showed the highest degree of infection to roots and disease severity were the least effective in this respect.

Table 35. Effect of plant extracts and oils on parameters of plant growth of sugar beet plants, in a greenhous, during 1998-1999 and 1999-2000 seasons .

Treatment	1998-1999 season			1999-2000 seasons		
	Plant height (cm)	Leaf area (cm^2)	Dry weight (g)	Plant height (cm)	Leaf area (cm^2)	Dry weight (g)
Plant extracts:						
1 - *Trigonella foenum-graecum* L.	37.67 de	894.10 e	10.47 e	36.00 f	799.63 j	8.73 h
2- *Ammi visnaga* L.	70.00 a	1434.62 a	13.90 a	69.67 a	1197.37 b	12.73 a
3- *Glycyrrhiza glabra* L.	42.33 d	1155.57 c	12.87 b	42.33 ef	1081.11 d	9.47 g
4- *Eucalyptus globulus* labill.	55.67 c	1090.22 c	11.87 d	53.00 c	998.17 f	10.60 e
5- *Boughoinvillae spectabilis* willd.	61.67 b	1347.16 b	13.73 a	60.33 b	1186.27 b	11.83 bc
6- *Ammi visnaga* L.	64.00 b	1136.30 c	12.27 bcd	67.67 a	1239.27 a	12.73 a
7- *Salix purpura* L.	36.00 ef	804.54 f	8.87 f	41.00 ef	914.97 h	8.50 h
Oils:						
8- *Mentha viridis* L.	42.00 d	977.09 d	10.73 e	45.00 de	986.86 fg	10.13 ef
9- *Syzygium aromaticum.*	51.33 c	1303.19 b	12.63 bc	51.00 cd	1108.58 c	11.63 cd
10- *Cuminum cyminum* L.	39.67 de	1081.68 c	9.37 f	48.00 cde	1061.97 e	8.77 h
11- *Ocimum basilicum*	37.67 de	818.63 f	11.07 e	36.67 f	977.71 g	10.03 f
12- Rhizolex T-50.	64.67 b	1128.11 c	12.07 cd	54.67 bc	1098.30 c	11.23 d
13- Control : Infested	25.00 g	655.13 g	7.07 g	22.33 g	554.05 k	6.30 i
14- Control : Uninfested	32.67 f	812.30 f	8.77 f	35.00 f	841.53 i	8.97 gh

Mean followed by the same letter are not significantly different at the 5% level by DMRT.

Table 36. Effect of plant extracts and oils on disease incidence, disease severity, root weight/plant, percentage of total soluble solids (TSS), percentage of sucrose, purity and losses (%) in yield and sucrose of sugar beet root rot under artificial infestation with *S. rolfsii*, in a greenhous during 1998-1999 season .

Treatment	Disease incidence	Disease severity	Root weight/plant		TSS		Sucrose %		Purity %		Losses %	
			Infected	Helthy	Infected	Helthy	Infected	Helthy	Infected	Helthy	Yield	Sucrose
Plant extracts :												
1- *Trigonella foenum-graecum* L.	44.44 e	6.33 f	0.366 L	0.618 j	8.53 i	19.00 cd	5.07 L	16.00 ab	59.43	84.21	40.77	68.31
2- *Ammi visnaga* L.	0.00 a	0.00 a	1.255 d	1.230 c	18.13 c	18.22 rf	14.00 c	16.40 a	77.22	89.47	2.03	14.63
3- *Glycyrrhiza glabra* L.	33.33 d	3.33 c	0.985 e	1.182 e	15.40 f	19.00 cd	12.33 f	15.73 b	80.06	82.78	34.87	21.61
4- *Eucalyptus globulus* labill.	55.56 f	8.50 g	0.730 h	0.920 h	11.93 g	18.73 de	8.13 i	14.00 b	68.15	74.75	20.65	41.9
5- *Bougboinvillae spectabilis* willd.	22.22 c	2.00 b	0.623 i	1.028 g	17.00 e	19.40 c	13.40 d	15.73 b	78.82	81.08	39.40	14.81
6- *Ammi visnaga* L.	0.00 a	0.00 a	1.345 c	1.353 b	19.27 b	19.60 b	16.07 a	16.73 a	83.39	85.35	0.60	2.33
7- *Salix purpura* L.	84.45 g	5.67 ef	0.318 m	0.610 j	9.87 h	17.53 g	5.47 j	12.00 f	55.42	68.45	47.86	54.41
Oils :												
8- *Mentha viridis* L.	54.44 f	5.17 de	0.487 k	0.809 i	12.07 g	18.07 f	10.73 g	14.40 d	59.30	80.20	39.80	25.48
9- *Syzygium aromaticum*.	11.11 b	0.67 a	0.929 f	1.115 f	16.27 de	17.87 fg	13.00 e	15.60 b	79.90	87.30	16.68	16.1
10- *Cuminum cyminum* L.	0.00 a	0.00 a	0.890 g	0.927 h	17.73 d	19.27 e	11.40 f	14.20 de	64.30	73.69	3.99	19.7
11- *Ocimum basilicum* L.	44.44 e	4.67 d	0.597 j	1.095 d	12.27 g	18.33 ef	9.47 h	14.80 c	77.18	80.74	45.47	36.01
12- Rhizolex T-50.	0.00 a	0.00 a	1.380 a	1.412 a	20.00 a	20.72 ef	15.00 b	15.60 b	75.00	75.25	2.27	3.61
13- Control : Infested	100.00 h	9.17 g	0.237 n	1.355 b	6.40 j	19.40 b	3.53 k	15.40 b	55.15	79.38	82.50	77.0
14- Control : Uninfested	0.00 a	0.00 a	1.355 b	1.355 b	19.60 b	19.60 b	15.40 b	15.40 b	78.57	78.57	0.00	0.00

Mean followed by the same letter are not significantly different at the 5% level by DMRT.

Table 37. Effect of plant extracts and oils on disease incidence, disease severity, root weight/plant, percentage of total soluble solids (TSS), percentage of sucrose, purity and losses (%) in yield and sucrose of sugar beet root rot under artificial infestation with *S. rolfsii*, in a greenhouse during .1999-2000 .

Treatment	Disease incidence	Disease severity	Root weight/plant		TSS		Sucrose %		Purity %		Losses %	
			Infected	Helthy	Infected	Helthy	Infected	Helthy	Infected	Helthy	Yield	Sucros
Plant extracts :												
1- *Trigonella foenum-graecum* L.	55.56 f	4.67 c	0.570 h	0.888 k	7.43 h	18.60 e	5.53 j	14.07 g	74.42	75.64	35.81	60.76
2- *Ammi visnaga* L.	11.11 b	0.33 ab	1.110 d	1.284 d	17.00 c	17.93 f	14.47 f	15.33 f	80.70	85.49	13.55	5.61
3- *Glycyrrhiza glabra* L.	22.22 c	1.00 b	0.730 f	1.088 f	13.53 f	19.93 b	8.77 h	17.47 c	64.82	87.65	34.09	49.79
4- *Eucalyptus globulus* labill.	66.68 g	7.50 e	0.560 h	1.050 h	10.67 g	17.07 g	6.33 i	14.00 g	59.33	82.01	50.22	54.78
5- *Boughoinvillae spectabilis* willd.	11.11 b	1.00 h	0.670 g	1.125 e	14.53 e	19.40 bcd	10.47 g	17.33 c	72.05	89.33	40.44	39.58
6- *Ammi visnaga* L.	0.00 a	0.00 a	1.450 b	1.463 b	19.20 b	19.87 bc	15.37 c	16.90 d	80.05	85.05	0.89	14.30
7- *Salix purpura* L.	77.78 h	7.50 e	0.390 j	0.619 L	5.47 i	16.83 g	3.47 k	12.83 i	63.44	76.23	36.99	72.95
Oils :												
8- *Mentha viridis* L.	33.33 d	6.33 d	0.570 h	0.911 j	10.73 g	18.07 f	6.73 i	16.03 e	62.72	88.71	37.43	58.01
9- *Syzygium aromaticum*.	11.11 b	0.67 ab	0.830 e	1.071 g	15.20 d	19.33 cd	13.20 e	18.67 a	86.84	96.58	22.50	29.29
10- *Cuminum cyminum* L.	0.00 a	0.00 a	0.820 e	0.939 i	16.67 c	17.75 f	12.60 f	13.40 h	75.58	75.57	12.67	5.97
11- *Ocimum basilicum* L.	44.44 e	4.83 c	0.440 i	1.102 e	10.67 g	19.00 de	8.33 h	16.20 d	78.06	88.42	60.07	50.42
12- Rhizolex T-50.	0.00 a	0.00 a	1.475 a	1.484 a	20.60 a	20.17 a	17.47 a	17.93 b	84.81	85.91	0.61	2.57
13- Control : Infested	82.22 i	8.5 f	0.190 k	1.240 e	4.47 j	19.27 de	2.40 L	16.60 d	53.69	86.14	84.67	85.50
14- Control : Uninfested	0.00 a	0.00 a	1.240 c	1.240 e	19.27 b	19.27 de	16.60 b	16.60 d	26.14	86.14	0.00	0.00

Mean followed by the same letter are not significantly different at the 5% level by DMRT.

Fig. 17. Effect of plant extract and oils on sugar beet root rot caused by *S. rolfsii* in greenhouse. 1- *T. foenum-greacum*, 2- *A. visnaga* (leaves), 3-*G. glabra*, 4-*E. globulus* 5- *B. spectabilis*, 6-- *A. visnaga*. 7- *S. purpura*, 8- *M virids*, 9- *S. aromaticum*, 10- *C. cyminum*, 11- *O. basilicum*, 12 -Rhizolex T. 50 , 13- control (infested) . 14- Control uninfested

7- Study the effect of chemical fractions of *A. visnaga* seeds on the growth of major root- infecting fungi of sugar beet:

This study was carried out to find out the chemical fraction of seeds of *A. visnaga* responsible for its effectiveness on the disease . Major chemical components of seeds of *A. visnaga* were fractionated into three fractions by three solvents as described under Material & Methods . Fraction No.IV containing khellin was not evaluated because of the tiny amount that could be obtained throughout the extraction process .Hence, commercial khellin (Sigma) was experimented as a refernce to the extracted fractions for their effectiveness in retarding the growth of fungi under study . Prepared extracts and khellin substance were added to the melted PDA medium to give the required concentrations before pouring into Petri dishes (9 cm) . This experiment was triaplicated and un-treated PDA act as control . Plates were incubated at 28° C for 4 days for *S. rolfsii* ; *R. solani* and *M. phaseolina* and for 7 days for *F. oxysporum* .

Data presented in Table (38) indicated that neither diethyl-ether nor potroleum-ether extract affected the growth of fungi under study at any of the concentrations

used . Methyl alcohol fraction, however effectively inhibited growth of *S. rolfsii* at all concentration (efficiency from 65.6 to 70 %) . This extract was less effective on the growth of *R. solani* and *M. phaseolina* , however ,effectivness has sligtly increased by increasing the concentration from 1000 up to 2000 ppm, generally. While it has no effect on the growth of *F. oxysporum* at any of concentrations used . Results also show that the commercial khellin was highly active in reducing the linear growth of all pathogens except *M. phaseolina* . Its effect has been increased gradually by increasing the concentration in PDA from 1000 to 2000 ppm .

8-Field experiments:

8-1- Varietal resistance of sugar beet root rot:

An experiment was designed to evaluate 15 cultivars of distributed sugar beet against root rot under natural infection at Sakha Agricultural Experimental Station in 1998-1999 and 1999-2000 seasons . Eleven multi germ and 4 mono germ varieties of sugar beet were screened.

Results in Table (39) indicate that some of the tested cultivars were susceptible to infection with root rot. They are Pamela, Ras poly, Kawmera, Delmon and Del 936. However, Kawmera proved to be the most susceptible

Table 38. Effect of chemical fractions of *A. visnaga* seed, on linear growth of some sugar beet root- infecting fungi.

Chemical fraction (concentrations ppm)		*S. rolfsii*		*R. solani*		*M. phaseolina*		*F. oxysporum*	
		L.G	E.	L.G	E.	L.G	E.	L.G	E.
Di ethyl-ether	1000	9.00 a	0.00	9.00 a	0.00	9.00 a	0.00	9.00 a	0.00
	1500	9.00 a	0.00	9.00 a	0.00	9.00 a	0.00	9.00 a	0.00
	2000	9.00 a	0.00	9.00 a	0.00	9.00 a	0.00	9.00 a	0.00
Potroleum- ether	1000	9.00 a	0.00	9.00 a	0.00	9.00 a	0.00	9.00 a	0.00
	1500	9.00 a	0.00	9.00 a	0.00	9.00 a	0.00	9.00 a	0.00
	2000	9.00 a	0.00	9.00 a	0.00	9.00 a	0.00	9.00 a	0.00
Methyl alochol	1000	3.10 b	65.56	7.80 b	13.33	8.90 ab	1.11	9.00 a	0.00
	1500	2.80 c	68.89	7.50 c	17.78	8.80 b	2.22	9.00 a	0.00
	2000	2.60 d	70.00	7.10 d	21.11	7.80 c	13.33	9.00 a	0.00
Khellin *	1000	1.60 b	82.22	6.00 b	33.33	8.70 b	3.33	5.60 b	37.78
	1500	1.30 c	85.56	3.40 c	62.22	8.30 c	7.78	4.70 c	50.00
	2000	0.80 d	91.00	2.50 d	72.22	7.80 d	13.33	3.70 d	57.78
Control		9.00 a		9.00 a		9.00 a		9.00 a	

Means followde by the same letter are not significantly different at the 5% level by DMRT.
L.G= Fungal linear growth (Cm). E= % efficiency in reducing colony dimeter. * Commercial

Table 39. Evaluation of some sugar-beet cultivars to root rot disease incidence, disease severity and yield/plot grown in the field at Sakha during 1998-1999 and 1999-2000 seasons .

No.	cultivar	1998-1999 season			1999-2000 season		
		Root rot		Yield/plot (kg)	Root rot		Yield/plot (kg)
		Disease incidence %	Disease severity		Disease incidence %	Disease severity	
1.	Fareida	4.67 c	2.67 c	57.67 f	3.67 a	2.67 fg	51.67 d
2.	Pamela	8.33 f	2.67 c	34.33 i	8.33 e	2.00 de	57.83 bc
3.	Del 939	10.00 g	3.33 d	60.33 e	9.33 e	1.33 bc	33.33 f
4.	Top	4.67 c	0.83 a	60.33 e	6.33 d	0.67 a	54.17 cd
5.	Oscar poly	5.33 d	1.33 ab	63.33 d	3.67 a	1.67 cd	59.00 b
6.	Pleno	3.67 b	1.33 ab	76.00 a	3.67 a	0.83 ab	65.00 a
7.	Rass poly	12.33 j	2.67 c	40.00 h	13.33 g	3.00 g	33.50 f
8.	Lola	5.33 d	1.50 b	72.67 b	5.33 bcd	2.33 ef	54.17 cd
9.	Kowmera	12.67 j	4.33 e	33.17 i	14.67 h	4.00 h	31.67 f
10.	Hi-poly	4.33 c	1.33 ab	66.33 c	4.33 ab	0.50 a	57.67 bc
11.	Gitan	2.67 a	0.83 a	63.33 d	3.67 a	0.67 a	55.33 bc
12.	Delmon	11.00 h	3.67 d	33.17 i	5.00 bc	2.33 ef	34.67 f
13.	Alexa	5.33 d	1.67 b	71.00 b	3.67 a	1.33 bc	40.50 e
14.	Del 936	11.67 i	4.33 e	45.33 g	12.00 f	4.67 i	39.50 e
15.	Gloria	6.00 e	1.33 ab	67.83 c	6.00 cd	0.83 ab	50.83 d

Mean followed by the same letter are not significantly different at the 5% level by DMRT.

cultivar comparable to the other ones. The trend in disease severity and yield per plot were also observed to be consistent with infection percent for each cultivar.

8-2-Control of seedling blight and root rot by different formulae of bio control agents:

This experiment was performed at Sakha Farm in two successive seasons i e., 1998-1999 and 1999-2000. . Results in Table (40) show that all bio agents used have the efficacy to control the diseases in any of the experimented formulae when compared with the un treated control. It was found that although Rhizolex T 50 was superior in controlling the diseases, Rhizo N (commercial) followed by *B.subtilis* (suspension) , *Trichoderma hamatum* & the *Actinomycte* (powder) gave good results in reducing the seedling blight compared with the un treated control. Granules of the *Actinomyces, Bacillus & Trichoderma* and the commercial substance,plant guard, on the other hand gave the least effect on seedling blight.

As regards to root rot and disease severity, *Trichoderma* powder followed by each of Rhizo N and the *Actinomyces* (powder) gave the best effect all over the experimented materials.This is correct over the two seasons of experimentation. These treatments caused also clear increase

Table 40. Biological control of seedling blight and root rot of sugar beet by seed dressing with different bioagents formulae compared to the recommended biocides in the field at Sakha during , 1998-1999 and 1999-2000 seasons .

Treatment	Formulae	1998-1999 season				1999-2000 seasons			
		Seeding blight	Root rot	Disease severity	Yield/plot (kg)	Seeding blight	Root rot	Disease severity	Yield/plot (kg)
1- *Trichoderma hamatum*	Suspension	8.00 cd	6.67 cde	2.33 bc	56.40 c	3.67 cd	3.67 ef	1.17 ab	56.67 c
	Powder	6.33 bc	3.67 b	1.33 ab	68.33 a	2.00 b	1.00 a	1.33 ab	71.17 a
	Granules	9.00 d	5.67 bc	1.67 b	62.83 ab	5.67 f	3.00 cde	1.33 ab	60.83 bc
2- *Bacillus subtilis*	Suspension	5.33 b	9.67 f	2.67 bc	43.83 d	4.33 de	4.33 fg	1.83 bcd	42.00 d
	Powder	9.33 d	6.33 cd	1.33 ab	59.83 bc	5.33 ef	2.33 bc	1.33 ab	67.33 ab
	Granules	11.67 e	8.33 def	2.33 bc	45.17 d	7.00 g	3.33 de	1.67 bc	42.77 d
3- *Actinomycetes* spp.	Suspension	8.33 b	7.33 cde	2.33 bc	49.17 d	6.67 g	4.67 g	1.67 bc	55.17 c
	Powder	6.33 bc	5.33 bc	2.67 bc	62.33abc	4.67 def	2.00 b	1.33 ab	63.07 abc
	Granules	12.33 e	8.67 ef	3.33 c	43.50 d	7.67 g	5.00 g	2.33 bcd	95.27 d
4- Plantgard	Suspension	12.67 e	13.67 g	3.33 c	45.17 d	6.67 g	8.33 h	3.00 d	40.67 d
5- Rhizo-in	Powder	5.00 b	5.33 bc	1.67 b	65.00 ab	2.83 bc	2.67 bcd	2.00 bcd	66.00 ab
6- Rhizolex T.	Powder	0.67 a	1.33 a	0.33 a	66.83 a	0.01 a	0.67 a	0.33 a	66.93 ab
7- Control		19.33 f	23.33 h	4.67 d	43.00 e	15.33 h	10.33 i	2.67 cd	40.83 d

Mean followed by the same letter are not significantly different at the 5% level by DMRT.

in yield per plot compared with the control.The yield per plot,however,was significantly affected by the powder natures of these materials more than the other formulae, in general.The same trend was obtained in both seasons concerning the effect of bio agents on the disease and yield of roots.

8-3-Effect of plant extracts and oils on sugar beet root rot incidence :

Different plant extracts and essential oils were studied for their effect on root rot of sugar beet under natural infection at the Farm of Sakha in 1998-1999 and 1999-2000 seasons .

Data presented in Table (41) reveal that plant extracts of *A.visnaga* & *B.spectabilis* and oils of *S.aromaticum* & *C.cyminum* were superior than the other materials in reducing the root rot of sugar beet as well as the disease severity in both seasons of experimentation. The yield per plot was found also to be increased due to treatment with these materials. *G.glabra,* was found to be effective in decreasing the disease incidence, but caused an increase in the disease severity. Rhizolex T 50 caused the least level of infection and disease severity if compared with the other treatments. The yield per plot in *A.visnaga* treatment exceeded the yield obtained from the Rhizolex T plots in 1999-2000 seasons .

Table 41. Effect of plant extracts and oils on root rot disease under field conditions, Sakha,1998-1999 and 1999-2000 seasons.

Treatments	1998-1999 season			1999-2000 season		
	Root rot		Yield/plot (kg)	Root rot		Yield/plot (kg)
	Disease incidence %	Disease severity		Disease incidence %	Disease severity	
Plant extracts :						
1- *Trigonella foenum-graecum* L.	4.68 g	2.33 d	42.00 d	2.63 d	2.00 e	50.00 de
2- *Ammi visnaga* L.	1.24 c	1.67 c	52.00 c	0.57 b	0.67 bcd	56.00 cd
3- *Glycyrrhiza glabra* L.	0.63 b	3.67 e	52.02 c	0.01 a	0.33 ab	46.00 ef
4- *Eucalyptus globulus* labill.	1.32 c	3.33 e	60.00 ab	1.49 c	1.00 d	48.00 d
5- *Boughoinvillaea spectablis* willd.	0.58 b	1.67 c	44.00 bc	0.00 a	0.01 a	60.00 bc
6- *Ammi visragu* L.	0.00 a	0.01 a	64.00 a	0.01 a	0.01 a	70.00 a
7- *Salix purpura* L.	3.19 f	2.50 d	40.00 de	3.61 d	2.67 f	42.00 f
Oils :						
8- *Mentha viridis* L	1.84 d	0.83 b	42.00 d	1.31 c	0.83 cd	46.00 ef
9- *Syzygium aromaticum*. L	0.54 b	0.33 a	54.00 c	0.66 b	0.33 ab	56.00 cd
10- *Cuminum cyminum* L.	0.65 b	0.33 a	52.00 c	0.57 b	0.33 ab	46.00 ef
11- *Ocimum basilicum L.*	2.33 e	1.33 c	52.00 c	1.24 c	0.67 bcd	54.00 cd
12- Rhizolex T-50 *	0.63 b	0.20 a	64.00 a	0.65 b	0.50 bc	64.02 ab
13- Control	8.05 h	3.67 e	36.00 e	9.32 e	3.67 g	26.00 g

Mean followed by the same letter are not significantly different at the 5% level by DMRT . *fungicidal seed dressing control

DISCUSSION

DISCUSSION

Survey of the sugar beet root diseases throughout this investigation revealed that seedling blight as well as root rot were prevalent in most sugar beet fields of the surveyed Governorates of Northern & mid Nile Delta. The highest percentage of infection was observed in the late growing season (mid Oct.) followed by the early and medium seasons (mid Aug.& mid September respectively), in general. Also, these diseases were found in high rates in the fields of Kafr El-Sheikh as was found in survey done by **El-Kazzaz *et al.*,1999.** It is known that Kafr El-Sheikh ranks the first in terms of acreage and productivity of sugar beet allover the beet growing locations of the country (according to the Statistical data of Sugar Experts Association, December 2000). This show how this type of diseases may affect dramatically the production of sugar beet crop as well as sugar production. As sugar beet seedlings could be infected either before or after emergence by one or more of several soil-borne fungi, frequencies and effect of this type of root diseases on the crop was studied. Effect of these pathogens on young seedlings are so similar and can be identified as damping off **(El-Kholi,2000)**. Root rots, in particular is the most destructive disease that badly affects the crop productivity and sugar quality. **Mukhopadhyay,(1971)** and **Tewari, (1971)** reported that root rot incited by *Sclerotium*

rolfsii causes extensive losses in the warmer regions. *Sclerotium rolfsii* and *Rhizoctonia solani* were recovered in high frequencies from the affected roots collected during the survey of sugar beet fields. They were recorded by previous investigators as the most prevalent and destructive pathogens responsible for root rots of sugar beet as they infect plants at different stages of development **(Fahim *et al.*,1981; Sharma and Pathak, 1994; El-Kazzaz *et.al.*,1999 and Esh, 2000)**. *Marcrophomina phasiolina, Pythium debaryanum, Fusarium oxysporum,F.solani* and other unidentified fungi were also isolated in low frequencies comparable to *S.rolfsii & R.solani* indicating that they may play an important role in root rotting of sugar beet. These fungi were identified by other investigators as components of root rot complex disease of sugar beet **(El-Kazazz *et al.*,1999 and El- kholi, 2000).**

Five isolates from each of *S. rolfsii, R. solani, M.phaseolina, F.oxysporum & F.solani* were found to be pathogenic to the susceptible cultivar (Kawmera) in the greenhouse. However, *S. rolfsii & R. solani* gave the highest degree of infection to sugar beet seedlings and adult roots. Whereas, *M.phaseolina* was the least pathogen in producing seedling damping off and root rot. These results are in agreement with those obtained by **Abada, (1980) Fahim *et al.*, (1981), El-Abyad *et al.*, (1992)** and **Awad, (1995)** who stated

that *S. rolfsii & R. solani,* but not *M. phaseolina* are the most common and destructive pathogens to roots of sugar beet seedlings and adult plants.

As *S. rolfsii* and *R. solani* are considered the most important and destructive components of sugar beet blight and root rot **(Abada, 1980; Fahim *et al.*,1981; Al-Abyad, 1992; Awad ,1995)**, distributed cultivars were evaluated for their susceptibility to infection with these two pathogens under greenhouse conditions. The same screened cultivars were also tested for their susceptibility to infection with root rots under field conditions. In a greenhouse, all evaluated cultivars were susceptible or highly susceptible to the two pathogens under study, in general. Cultivars of Kawmera Del 936, Rass poly, Del 939 & Pamela were the most sensitive ones to infection. In the field, some of cultivars were susceptible to infection with root rots. Kawmera proved to have the ability to be infected in a higher level of percentage comparable to the other cultivars. Generally, previous investigators stated that the majority of cultivars were recorded as susceptible to infection with these diseases **(El-Kholi, 1984; Waraitch,1985; El-Abyad *et al.*, 1992; El-Kazzaz *et al.*, 1999)**. **Sharma and Pathak, (1990)** in India reported that one out of 36 beet cultivars was the only resistant to hosts which harden the breeding for resistance.

As expected, root yield per plot was also found to be drastically affected by infection with root rots. Root yield has been affected by root infection as this study has proved.These results coincided with those obtained by previous investigators who stated that root yields were negatively affected by root rotting of sugar beet. **Sharma and Pathak (1994)** found that the increase in the root rot disease incidence caused a corresponding decrease in root yield. **Mukhopadhyay (1971)** found that root yield losses due to root rot ranged between 14 and 59 % according to the varieties. Under artificially infestation, **Tewari (1971)** recorded almost from 30 to 40 % reduction in root yield.

Some fungal, bacterial bioagents as well as an Actinomycete were screened for their antagonistic effects against *S.rolfsii, R.solani, M.phaseolina, F.oxysporum & F.solani in vitro. Trichoderma hamatum, T.harzianum, T.pseudokningii,* certain isolates of *Bacillus subtilis* and one isolate of *Pseudomonas fluorescense* were the most effective bioagents in suppressing the radial growth of the four pathogens, in general. Yet, they were less effective in retarding growth of *Fusarium spp.*as compared with the other pathogens under study. The obtained results are consistent to a great extent with the findings of **El-Kazzaz *et al.*,(2000)** who stated that an isolate of *B.subtilis* followed by an *Actinomycete* and

T.harzianum isolate could inhibit the growth of both of *R.solani* and *S.rolfsii in vitro*. *T.harzianum* is known to have the ability to produce some extracellular lytic enzymes that are involved in the process of antagonism against a variety of pathogenic organisms **(El-Assiuty *et al.*,1986; Upadhyay & Mukhopadhyay,1986; Benhamou & Chet, 1993 and Esh, 2000)** reported that *T. hamatum* was very effective in retarding the growth of *S. rolfsii* & *R. solani* in Petri dishes and explained the positive effect of this fungus against the tested fungi by the hyperparasitism. Also, **Asaka and Shoda, (1998)** suggested that the antagonistic activity of *B. subtilis* against several host fungi *in vitro* may be referred to the production of the antibiotics such as iturinA and surfactin. It was reported also by **Gurusiddaiah *et al.*, (1986)** that *P. fluorescens* produces phenazine-1-carboxilic acid (a product of the shikimic acid pathway) which is one of the most thoroughly studied biocontrol antibiotic. This product has an activity against a broad spectrum of fungal pathogens including *R.solani* **(Gurusiddaiah *et al.*, 1986)**. Suppressive effect of this antibiotic against sugar beet root rot fungi is suggested.

Studying biological control showed the possibility of controlling sugar beet damping-off and root rot by certain bioagents as *T. hamatum*, *T. harzianum*, *Pseudomonas fluorescens* & *B. subtilis* under greenhouse (*S. rolfsii*-infested

soil) and field (natural infection) conditions. These treatments also caused an increase in the root yield per plot comparable to the untreated control. These results are consistent with those obtained by other investigators.**(Ruppel *et al.*, 1983 and El-Kazzaz *et al.*, 2000)** got significant results in reducing the seedling damping off as well as the root rots of sugar beet by *T.harzianum* & *B.subtilis* in the greenhouse and field. Similar effects of these bioagents were obtained by many other investigators **(Khalifa, 1987 ; 1991 and Khalifa *et al.*,1995 ; Ciccarese *et al.*,1991 ; Asaka & Shoda,1998)**. Three mechanisms in controlling soil-borne pathogens biologically are proposed: **a**-minimize the population of the pathogen in the soil by direct antagonism, **b**-prevent the pathogen to infect the host by several possibilities such as competing in space or on nourishment and **c**-limiting disease development, if succeeded to penetrate the root by altering the defense mechanisms in the host tissues.

Trials were conducted to study the possibility of controlling sugar beet damping-off and root rots by extracts from some medicinal and aromatic plant parts and essential oils as well. PDA treated with plant extracts or oils inhibited growth of the fungal isolates under study. Extracts and oils could successfully reduce damping off and root rots of sugar beet in the greenhouse and field. Yield per plot was also

significantly increased due to these applications. Seed extract from *Ammi visnaga* (tooth pick plant) was shown to be superior to all materials in suppressing damping off and root rots in greenhouse and field. Its positive effect against sugar beet root diseases reflects, in turn on the root yield, whereas, it improved the yield potentiality comparable to the untreated control. Parameters of plant growth were enhanced due to these treatments. Increasing in total soluble sugars (TSS) and sugar purity in roots due to these applications were found . This result causes, in turn an improve to the sugar quality within the roots. These results are consistent with those obtained by other investigators who found an antimicrobial activity of some oils and plant extracts against many of pathogens *in vitro* **(Rathee *et al.*, 1982; Dey and Choudhuri, 1984; Garg and Dengre, 1988; Farag *et al.*,1989; Saiato *et al.*,1991 ; Mabrouk and El-Shayeb, 1992; Garg and Siddiqui, 1992 ; Deans *et al.*, 1992 ; Singh *et al*, 1992 ; Mc Cutcheon *et al.*, 1994 ; Ouf *et al.*, 1994 ; Navarro *et al.*,1996)** . Some essential oils and higher plant extracts have an allelopathic effect on some diseases on other plant hosts as previous investigators have reported **(Salama *et al.*, 1988; Jain, *et al.*, 1992; Zedan,1993; Paran *et al.*,1996; El-Shaer,1998 and Fahmy & Mahmoud,2001). Purnima *et al.*,(1989)** found that treated tomato fruits with ethanol extracts

from *Mentha arvensis & Ocimum sanctum* protected fruits from infection with *Aspergillus niger*. **Madhukor and Reddy, (1989)** reviewed that dipping in eucalptus and clove oils completely checked rotting of guva fruits.

Based on the obtained resultus, extracts from seeds of tooth picks (*Ammi visnaga*) is recommended to use in controlling the major pathogens of the root rots of sugar.This extract offer an excellent sourse of biologically active natural product through its allelopathic effect . Allelopathy , as defined by **Rice, (1984)** is any direct or indirect benficial or harmful effect of one organism (including plant or microorganism) on other through release of chemicals into the environment. English name of this medicinal plant is Pick-tooth, Tooth-pick and Bishop`s weed. It is grown mainly in the Nile region and in some regional and global countries. Seeds of this medicinal plant are available and cheap in local market. Active constituents that have the allelopathic effect of *A.visnaga* seeds according to **Batanouny, *et al.* , (1999)** are the furanochromones comprising 0.3-1.2 % khellin, 0.05-0.3 % visnagin. In addition to some flavonoides and fixed and volatile oils such as camphor. Present study showed the highly activity of methyl extract (containing the visnagin fraction) as well as the commercial substance of khellin in retarding the radial growth of root pathogens. This confirms and explains

the active role of visnagin and khellin in reducing the seedling blight and root rots of sugar beet. Positive effect of the toxic substances in extracts of seeds of *A.visnaga* (and other higher plant extracts used in this study) may be attributed to the known and unknown chemical compounds having synergistic effect on the pathogen. Besides, they may affect the populations of soil microflora around the host roots which may cause, in turn a rise of antagonistic and biological agents. Therefore, the author highly recommends, in the time being to soak seed of sugar beet with extract of *A.visnaga* for 8 h before planting (need further study for reasonable means of application). It is worth mentioning that using other means of disease control rather than fungicides is strongly encouraged by the government to decrease environmental pollution caused by fungicides.

SUMMARY

Major root-infecting diseases, namely damping off and root rots of sugar beet (*Beta vulgaris L.*) were studied during the period from 1996 to 2001. The main objective was to find out reasonable means of controlling this type of diseases other than fungicides.

Results obtained throughout this investigation can be summarized as follows:

1. Survey of root diseases was carried out to sugar beet fields in four Governorats of northern and mid Nile Delta. This survey revealed the widespread of seedling blight and root rots. Diseases were dominat in all surveyed Govs. With various degrees of infecation. Kafr El-sheikh Gov. represented the first rank in this respect.

2. *Sclerotium rolfsii* followed by *Rhizoctonia solani* and *Fusarium oxysporum* were the most frequently isolated fungi from diseased materials collected during such survey. *Macrophomina phaseolina*, on the other hand, was less frequent in isolation. *Fusarium oxysporum*, *F.solani*, *F.moliniforme* and some other unidentified fungi were also recovered from infected roots.

3. Studying pathogenicity revealed that *S.rolfsii* followed by *R.solani* were the most destructive pathogens to the tested

susceptible cultivar,c.v Kawmera under artificial infection. *Macrophomina phaseolina*, on the contrary, had the least capability to infect beet plants.

4. Studying the varietal resistance to infection with damping off and root rots caused by *S.rolfsii & R.solani* indicated that all the tested cultivars under study were susceptible with various degrees to infection with these pathogens under greenhouse conditions. But, under natural infection, some of them were susceptible to infection (giving more than 8% infection) , while the majority exhibited the moderate resistance response to infection (giving less than 8% infection). Clear negative correlation was found between infection percent and the root yield per plot.

5. studying the effect of some isolated bioagents for rhizospher of the healthy plants, on the growth of major sugar beet root pathogens, some isolates of *Trichoderma spp., Bacillus subtilis, Pseudomonas fluorescens & Actinomycetes* showed to be effective in reducing fungal radial growth.

6. Controling damping-off and root rots of sugar beet in a greenhouse and field by means of the tested bioagents namely : *Trichoderma hamatum, B.subtilis, & P.fluorescens* gave promising results in this respect.

7. Extracts prepared from some higher plants as well as essential oils could suppress fungal growth of major pathogens grown on PDA. They were more effective on *S.rolfsii&R.solani* compared to the other pathogens. These extracts and oils could significantly reduce infection with damping off and root rots, caused by *S.rolfsii* in a greenhouse under natural infection in the field. Extract of seeds of *Ammi visnaga* (Tooth picks) as well as oil of *Syzygium aromaticum* and *Cuminum cyminum* were shown to be superior to all of the other plant extracts and oils in controlling sugar beet root diseases in pot and field experiments.

8.Chemical components within seeds of *A.visnaga* were fractionated into three fractions by using the solvents; diethyl ether (fraction I) , petroleum ether (fraction II)and methyl alcohol (fraction III) . These fractions in addition to the commercial substance of khellin (active component in seeds) were evaluated for their efficacy in retarding the linear growth of major fungi under study in Petri dishes. Results showed that fractions III & khellin were the only ones which have the capability to check the fungal growth of most pathogens. This show that visnagin and khellin are the chemical compounds responsible for the inhibitory effect of seeds of *A.visnagin* against sugar beet root-infecting fungi.

Results of the present study provide sufficient evidence to recommend the use of antifungal isolates:

1. *Tricoderma* sp., *B. Subtilis* and *Actinomycetes* sp. as successful biocontrol agents against soil borne fungal disease of sugar beet plants.
2. The various plant aqueous extracts and plant essential oils acted by using of the rate 1000 ppm conc. as a seeddresers for control damping-off and root rot diseases.
3. It is clear from the previous results that the various plant extracts and essential oils acted by different rates on a same fungus. In Addition, the same aqueous extract and the same essential oil acted by different rates on the various fungi for controlling of certain of plant diseases. Thereafter, plant extracts and oils can be used instead of fungicides controlling plant disease. Fungicides, which increase the awareness of toxic hazards of chemical to crops, consumers and environment due to their phytotoxic residual and pollution effects.

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الملخص العربى

دراسات على بعض مسببات أعفان الجذور فى بنجر السكر

يعتبر الهدف الرئيسى من هذه الدراسة هو ايجاد وسائل بديلة للمبيدات لمقاومة الأمراض الرئيسية التى تصيب جذور بنجر السكر مثل موت البادرات وأعفان الجذور حيث تمت هذه الدراسة خلال الفترة من ١٩٩٦-٢٠٠١م.

ويمكن تلخيص النتائج المتحصل عليها فيما يلى:

١- أظهرت نتائج الحصر التى تمت لحقول بنجر السكر المنزرعة فى أربع محافظات من شمال ووسط الدلتا ، انتشار الإصابة بلفحة البادرات واعفان الجذور وكانت الاصابة فى المحافظات تحت الدراسة توضح انتشار المرض بدرجات متفاوتة.

٢- اظهرت النتائج ان الفطريات سكليروشيم رولفزياى وريزوكتونيا سولانى والفيوزاريم أوكسيسبورم كانت أكثر تكرارا اثناء العزل من العينات التى جمعت فى الحصرمن جميع المحافظات بينما ظهر الفطر ماكروفومينا فاسيولينا أقل تكرارا فى العزل بالاضافة إلى بعض الفطريات الغير معرفة.

٣- أظهرت نتائج القدرة المرضية أن الفطر سكليروشيم رولفزياى يليه الفطر ريزوكتونيا سولانى كانت أكثر الفطريات المختبرة شراسة على الصنف القابل للإصابة كاوميرا. وعلى العكس من ذلك أظهر الفطر ماكروفومينا فاسيولينا أقل قدرة على الاصابة لنباتات البنجر وذلك تحت ظروف العدوى الصناعية.

٤- أوضحت النتائج أن كل أصناف البنجر المختبرة كانت قابلة للاصابة بموت البادرات وأعفان الجذور المتسببة عن فطر ***S. rolfsii*** ، ***R. solani*** وأيضاً

تراوحت القابلية للإصابة للأصناف المختبرة من قابل للإصابة إلى شديد القابلية للإصـــابة وذلك تحت ظروف العدوى الصناعية ، بينما تحت ظروف العدوى الطبيعية أظهرت بعض الأصناف قابليتها للإصابة (أكثر من ٨%) بينما كانت الأغلـــبية متوسطة المقاومة ضد الإصابة بالمرض (أقل من ٨%) وكان هناك ارتباط سالب بين نسبة الإصابة والمحصول الناتج من كل معاملة.

٥- فى تجـــارب المقاومة البيولوجية أظهرت دراسة تأثير بعض الكائنات المضادة عـــلى الـــنمو لمسببات أمراض جذور بنجر السكر ان بعض العزلات من الـــ ***Trichoderma*** والـــ ***Bacillus subtilis*** والـــ ***Pseudomonas flurescense*** والـــ ***Actinomycetes*** ذات كفاءة عالية لتقليل النمو الفطرى فى المعمل.

٦- أظهـــرت تجـــارب الصـــوبة والحقل لمقاومة مرض موت البادرات وأعفان الجـــذور أن الكائـــنات المضـــادة ***Trichoderma*** ، ***Bacillus subtilis*** ، ***Pseudomonas flurescense*** ذات نتائج مبشرة فى هذا المجال.

٧- أظهـــرت تجـــارب اســـتخدام المستخلصات النباتية من بعض النباتات وكذلك الـــزيوت الطيارة تثبيطاً للنمو الفطرى للمسببات الرئيسية على بيئة الـــ P D A وذلـــك فى المعمـــل ، وكانت أكثر كفاءة على فطر ***S. rolfsii*** ، ***R. solani*** بالمقارنة بالمسببات المرضية الأخرى وكان اكثرها فاعلية مستخلص بذور نبات الخلة وزيت القرنفل والكمون.

٨- تـــم اســـتخدام بعض المذيبات مثل داى إيثايل إيثر ، بترواليم إيثر وميثايل إيثر وذلـــك لاســـتخلاص المكونـــات الكيماويـــة داخل بذور الخلة البلدى ***Ammi visnaga*** إلى ثلاث مكونات. وقد تم تقييم كل مكون من هذه المكونات ومادة الخلـــلين الـــتجارى (المركب الفعال فى البذور) لمدى كفاءتها فى تثبيط النمو لـــلفطر سكليروشيم رولفزياى فى المعمل ، وأظهرت النتائج أن المكون رقم ٣

(الفســناجين) ومادة الخللين هى المسئولة عن التأثيرالمثبط للاصابة الفطرية لجذور البنجر.

ومن خلال النتائج المتحصل عليها فى هذه الدراسة يمكننا التوصية بالآتى:

١-اســتخدام عزلات الكائنات المضادة *Trichoderma spp.* ، *Bacillus spp.*، *Pseudomonas* ، *Actinomycetes* فى صورة مسحوق لتحقيق مقاومة حيوية ناجحة ضد أمراض أعفان جذور بنجر السكر.

٢-اســتخدام مســتخلص بذور الخلة والعرقسوس والجهنمية وأحد الزيوت النباتية (قــرنفل- كمــون - نعناع - ريحان) كمعاملة نقع للبذور قبل الزراعة بثمانية ســاعات بتركيز واحد فى الألف لمقاومة مرض موت البادرات وأعفان جذور بنجر السكروتعتبرتلك النتائج جديدة ولم يسبق بحثها على نباتات بنجر السكر.

٣-اســتخدام مادة الخللين والفسناجين (المركب الفعال لبذور الخلة) كمعاملة بذرة لــبذور بــنجر الســكر بتركيز ٢ فى الألف لمقاومة أمراض عفن جذور بنجر السكر.

وفى الــنهاية من الناحية التطبيقية تؤثر المستخلصات والزيوت النباتية التى اســتعملت بدرجات مختلفة على الفطريات المختلفة لمقاومة الأمراض النباتية بدلا من استخدام المبيدات الفطرية حيث انها تضر بصحة الانسان كما انها تلوث البيئة.

To

My Family,

my perants,

my Wife

and

my Childerns Mohamed, Aya

and Mahmoud

بسم الله الرحمن الرحيم

يرفع الله الذين آمنوا منكم

والذين أوتوا العلم

درجات

صدق الله العظيم

دراسات على بعض مسببات أعفان الجذور في بنجر السكر

رسالة مقدمه من

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