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Effect of Biofertilizers, Resistance Inducers, Biological and Chemical Control in Controlling Root Rots of Paspalum Plants

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Some factors were evaluated for controlling the root rot of *Paspalum vaginatum*. Fungi belonging to 10 genera were isolated from diseased plants. The survey showed differences in the frequency of the isolated fungi. In general, *Fusarium semitectium, Helminthosporium tetrmera, Macrophomina phaseolina, Pythium splendens* and *Rhizoctonia solani* were found to be the most frequently isolated fungi. Percentages of post-emergence damping-off caused by the tested fungi were decreased in response to the effect of all tested treatments, *i.e.* biofertilizers, resistance inducers (chitosan and salycilic acid), biological control and chemical control, compared with check treatment.

Keywords: Biofertilizers, biocontrol, chemical control, chitosan, *Paspalum vaginatum*, root rot and salycilic acid.

Paspalum (*Paspalum vaginatum*) is an ornamental plant that acts as one of the most turfgrass plants allover the world. Nowadays, it is used mostly around airfields to reduce dust and thereby extend airplane engine life, thus increasing safety. Turfgrass is used widely to control water and wind erosion as a utilitarian cover around homes, businesses, parks, cemeteries, and other facilities. Paspalum suffer from different root rots fungal diseases such as *Fusarium* spp., *Rhizoctonia solani, Helminthosporium* spp., *Pythium* spp., *Macrophomina phaseolina*, Baldwin (1990), as well as bacterial diseases, nematodes and insects. In Egypt, it suffered from most of these diseases especially the fungal root rots. Systemic acquired resistance (SAR) and induced systemic resistance (ISR) are two forms of the induced resistance. In both SAR and ISR, plant defences are preconditioned by prior infection or treatment that results in resistance (or tolerance) against subsequent challenge by a pathogen. Great strides have been made over the past 20year in understanding the physiological and biochemical basis of SAR and ISR. Much of this knowledge is due to the identification of a number of chemical and biological elicitors; some of which are commercially available for use in conventional agriculture. Several investigators studied the effectiveness of these chemical inducers on root rot diseases. The induced systemic resistance (ISR) sensitizes the plant to respond rapidly after treatment. These responses include phytoalexin accumulation, phenol translocation, lignifications and activation of peroxidase, polyphenoloxidase and chitinase.

This work aimed to study the effect of some biofertilizers, resistance inducers, bio- and chemical controlling of root rots of paspalum.

Materials and Methods

1- Disease survey of plant root rots in different governorates:

Survey for root rot diseases were conducted during 2005, 2006 and 2007 seasons in several gardens of Alexandria, Giza and Sharm-Elsheikh Governorates on paspalum plants. Samples of the diseased plants were taken into the laboratory to isolate the causal pathogens. The average percentages of disease incidence were calculated as the number of rotted paspalum plants relative to the total number of examined plants.

2- Isolation and identification of the causal pathogens:

The infected roots were excised and carefully washed with tap water to remove any adhesive soil. Small segments of the infected roots were superficially sterilized in sodium hypochlorite 5% for 2 min. Then, the fragments were rinsed several times in sterilized distilled water, blotted to dry on sterilized filter papers then placed on PDA plates and incubated at 27°C for 7 days. The developed colonies were recorded as frequency percentages for each of the isolated fungi. The isolated fungi were purified using the single spore or the hyphal tip technique (Dhingra and Sinclair, 1985). Colony characteristics, spore morphology were described and identified, according to the description of Plates and Vandler (1981). The identification was confirmed by the Fungal Taxonomy Dept., Plant Pathol. Res. Inst., Agric. Res. Centre, Giza.

3- Pathogenicity test:

Pathogenicity test was carried out using the more frequent five isolated fungi, *i.e. Fusarium semitectium, Helminthosporium tetrmera, Macrophomina phaseolina, Pythium splendens* and *Rhizoctonia solani.*

This experiment was conducted in the greenhouse of Ornamental, Medicinal and Aromatic Plant Dis. Res. Dept., Plant Pathol. Res. Inst., Agric. Res. Centre. Pots (25-cm-diameter) were sterilized by immersing in 5% formalin for 15 minutes, then left to dry for 10 days. A mixture of clay soil and sand (1:1 w/w) was also sterilized with the same solution and covered with polyethylene sheets for 15 days then left uncovered to evaporate formalin for 10 days. The pots were filled with the sterilized soil (3kg/pot). Data were recorded as percentages of post emergence damping-off and survival plants.

4- Inoculation:

Inocula of the tested fungi were prepared by growing each fungus in 500-ml glass-bottle containing sterilized potato dextrose broth (PDB). The bottles were incubated for 15 days at 27°C. Soil infestation was achieved by mixing inoculums of each fungus with the upper layer of the soil at the rate of 3% of soil weight, seven days before planting. The infested soil was regularly irrigated to stimulate fungal growth to ensure its homogenous distribution in the soil. Control treatment was prepared using the same amount of sterilized PDB medium. Ten plants were sown in each pot and a set of three replicates were used for each particular treatment. The disease assessment was estimated.

5- In vivo effect of biofertilization on the disease incidence:

This experiment was carried out in summer of 2007 using three different types of biofertilizers as a substitution of chemical fertilization, namely; Microbin (containing, *Azotobacter* sp., *Pseudomonas* sp. and *Bacillus megaterium*), Potassiumag (containing *Bacillus verculanes*) and Phosphoren (containing *Bacillus megaterium* var. *phosphaticum* as phosphorus solubilising bacteria at 10^8cfu/g). These biofertilizers were obtained from the Biofertilization Centre, Agric. Res. Inst., Minst. Agric., Giza, as microorganisms in peatmoss carrier substrate. The sterilized pots used in this experiment were filled with the sterilized soil (clay and sand 1:1 v/v). The inocula of *F. semitectium, H. tetrmera, M. phaseolina, P. splendens* and *R. solani,* fungi were added at the rate of 3% of soil weight and mixed with the upper surface of the soil, irrigated and left 7 days for fungal growth, then the fresh preparation of each biofertilizer was mixed separately in the soil at the rates of 0 and 4g/pot. The plants of *Paspalum vaginatum* L. were prepared and immediately covered in the infested or non-infested soil with the tested fungi (10 plants / pot). Three pots were used for each treatment. Disease incidence was assessed as the percentages of diseased plants.

6- Effect of resistance inducers on paspalum root rots incidence under greenhouse conditions:

Each of the tested fungi was grown on PDB medium for two weeks at 27°C. The fungal propagules of each flask contains 200 ml, medium was blended then mixed with the upper soil surface of each pot (25-cm-diameter) containing 3kg soil in three replicates. Apparently healthy plants of paspalum were soaked for 20 min. in either chitosan or salicylic acid (at the rate of 15.0 and 0.9 g/l water, respectively), just before sowing. Treated plants were sown (10 plants/pot) in soil infested, or not, with any of the tested fungi.

7- Effect of bio-agents on paspalum root rot incidence under greenhouse conditions:

Three commercial bioproducts, *i.e.* Bio-Arc (*Bacillus megaterium* $25X10^6$ cfu/ml), Bio-Zeid (*Trichoderma album*, $10x10^6$ spores/ml) and Clean-Root, (*Bacillus subtilis*, $30X10^7$ cfu/ml) were used.

Bio-Arc, Bio-Zeid and Clean-Root were used to evaluate their efficiency on controlling *Paspalum vaginatum* root rots. Plants were dipped in Bio-Arc, Bio-Zeid (2.5g/l water) and Clean-Root (5.0 ml/l), for 2 hours before planting. Ten plants were planted in each pot contained infested soil. The control pots contained infested soil used without treated plants. Three pots for each treatment were used. All the pots were irrigated as usual. Percentages of post-emergence damping-off and survival plants were recorded 60 days after planting.

8- In vivo effect of using fungicides on paspalum root rots incidence:

Different concentrations of five fungicides namely; Maxim (Fludioxonil, syngenta, Canda), MonCut (Flutolanil, Nibon Nohyaku, Japan), Rizolex-T (Tolclofos-methyl + Thiram, Sumitomo, Japan), Sanlit (simeconazole, Dupont, USA) and Uniform (Azoxystrobin + Mefenoxam, Syngenta, Canda) were tested against the aforementioned pathogenic fungi causing *Paspalum vaginatum*, root rots. These five fungicides were used in treating plants to evaluate their efficacy against

paspalum root rots under the greenhouse conditions. Plants were separately treated with each fungicide by soaking in a solution of the recommended dose of each tested fungicide for 2 hours. Ten treated plants were planted in the infested or non infested soil (control) in sterilized pots (25-cm-diameter). Non treated plants were used in the same way. Three replicates were used for each treatment. Disease readings were recorded 60 days after post planting as mentioned before.

9- Statistical analysis:

Data obtained were statistically analyzed when necessary using L.S.D. procedure outlined by Snedecor and Cochran, (1981).

Results and Discusion

1 Survey, isolation and identification:

Data in Table (1) reveal no great differences in the infection percentages during the three successive seasons in the inspected fields of the three governorates. The natural infection ranged from 9.0% at Sharm-Elsheikh to 21.5% at Giza Governorate. Naturally infected plants exhibited some variation in the symptoms according to the sample and/or governorate. The infection of adult plants showed wilt and dry off from plant top to down wards. Most of the infected plants were characterized by cankers and/or soft rot in the basal part of their stems at soil surface. The infected plants were usually easy to pull out the soil.

Table 1. Percentages of naturally infected *Paspalum vaginatum* plants in three Governorates

Governorate	Root rot incidence (%) during season;			Mean
	2005	2006	2007	
Alexandria	18.0	11.0	14.0	14.33
Giza	20.0	19.0	21.5	20.16
Sharm-Elsheikh	10.0	9.0	12.0	10.33
Mean	16.0	13.0	15.83	14.94

Generally, the average percentages of infection are varied from one season to another and from locality to other one. The percentage of naturally infected *Paspalum vaginatum* plants was higher in 2005 season followed by 2006 and 2007 seasons. Giza Governorate was the highest infected one followed by Alexandria and Sharm-Elsheikh Governorates. The corresponding values of the infection percentages were 20.16, 14.33 and 10.33%, respectively.

2- Frequency of fungi isolated from diseased plants:

Data in Table (2) indicate that the highest percentage of occurrence was recorded for *P. splendens* being 20.36%, followed by *R. solani* (19.29%), *H. tetrmera* (17.48%), *F. semitectium* (13.40%), while *M. phaseolina* was the last frequency,

Table 2. Occurrence and frequency of isolated fungi from naturally infected *Paspalum vaginatum* collected from three governorates in Egypt

Isolated fungi	Frequency (%)			Mean
	Alexandria	Giza	Sharm-Elshikh	
Alternaria tenius	6.0	9.0	5.0	6.66
Chaetomium globosum	0.0	4.0	0.4	1.46
Curvularia lunata	0.5	2.0	0.4	0.96
Fusarium moniliforme	1.0	2.0	2.0	1.66
Fusarium semitectium	20.0	10.1	10.1	13.40
Fusarium solani	0.2	1.2	9.0	3.46
Helminthosporium tetrmera	20.0	15.30	17.16	17.48
Macrophomina phaseolina	11.0	14.80	14.09	13.29
Nigrospora sp.	0.5	1.5	0.6	0.86
Pythium splendens	21.8	19.3	20.0	20.36
Rhizoctonia solani	19.0	18.80	20.09	19.29
Stemphylium botryosum	0.0	2.0	1.16	1.05
Mean	8.33	8.33	8.33	8.33

being (13.29) %. The average percentage of occurrence for other fungi was between (0.43) to (10.22) %. The isolated fungi were purified and identified and the most frequently isolated fungi, *i.e. F. semitectium* Berk & Rav, *H. tetrmera*, *M. phaseolina* (Tassi) Goid, *P. splendens* Braun and *R. solani* Khün, were used for further studies.

Most of fungi were isolated with different frequencies from the infected roots and crowns of the plants collected from the inspected governorates. The isolated fungi were found to belonged to 10 genera, *i.e. Alternaria, Chaetomium, Curvularia, Fusarium, Helminthosporium, Macrophomina, Nigrospora, Pythium, Rhizoctonia* and *Stemphylium*.

The obtained data are in agreement with those recorded by Kim and Park (1999). The highest percentage of occurrence was noticed with *Pythium* spp., followed by *Rhizoctonia* sp., *Helminthosporium* sp., *Fusarium* sp. and *Macrophomina* sp., while the least occurrence was recorded for leaf spot and saprophytic fungi, *Alternaria* sp., *Chaetomium* sp., *Stemphylium* sp. and *Curvularia.*

3- Pathogenicity test:

The isolated fungi were screened for their capabilities to infect paspalum plants and the percentages of the disease incidence were recorded after 60 days. Data in Table (3) show a wide variation in the percentages of infection depending on the causal pathogenic agent and the source of isolate; *Fusarium semitectium; Helminthosporium tetrmera* and *Pythium splendens* isolated from Alexandria; *F. moniliforme* and *Macrophomina phaseolina* isolated from Giza and *Rhizoctonia solani* and *F. solani* from Sharm Elsheikh. *H. tetrmera* and *P. splendens* which caused the highest percentages of infection (56.67 %), followed by *R. solani* (53.3%), *M. phaseolina* (46.67%) and *F. semitectium* (43.33%), while the lowest percentage was recorded in case of *F. solani* and *F. moniliforme*. The corresponding values of infection percentages were 15.0 and 11.67%, respectively.

Table 3. Pathogenicity test of isolated fungi from damped seedlings of *Paspalum vaginatum* expressed as post-emergence damping-off and survivals

Tested isolate	Source of isolate	Post-emergence damping-off	Plant survival
Fusarium moniliforme	Giza	11.67	88.33
Fusarium solani	Sharm-Elsheikh	15.00	85.00
Fusarium semitectium	Alexandria	43.33	56.67
Helminthosporium tetrmera	Alexandria	56.67	43.33
Macrophomina phaseolina	Giza	46.67	53.33
Pythium splendens	Alexandria	56.67	43.33
Rhizoctonia solani	Sharm-Elsheikh	53.33	46.67
Control		0.00	100.00
Mean		35.41	64.59
L.S.D at 5% for fungi = 11.38			

Pythium splendens and *Helminthosporium tetrmera* (from Alexandria) as well as *R. solani* (from Sharm-Elsheikh) were the most aggressive fungi followed by *Macrophomina phaseolina* (from Giza) and *F. semitectium* (from Alexandria), respectively. The infection (%) significantly varied among the pathogens. The disease incidence of these fungi on the plants grown in the infested soil was also affected by the source of isolates. Isolates of Alexandria seemed to be more aggressive than the other ones. A similar trend was obtained by Weber (2004).

4- Effect of biofertilizers on the root rot disease incidence:

Data in Table (4) indicate that Microbin has significantly decreased disease incidence (2.1%), followed by Potassiumag (12.7%) and Phosphoren (17.4%) compared with the control (42.7%). The same results recorded that *P. splendens* was less affected with Phosphoren since it gave 30%. Disease symptoms caused by all the tested fungi were completely inhibited by using Microbin for all tested fungi (except *F. semitectium* and *H. tetrmera*) compared with 56.7% for *M. phaseolina*; 40.0% for *P. splendens* and 33.4% for *R. solani* in control treatment.

Table 4. Effect of three biofertilizers on the disease incidence (%) of *Paspalum vaginatum* in soil infested with the tested fungi

Tested fungi	Disease incidence (%)							
	Control		Microbin		Phosphoren		Potassiumag	
	Post.*	Survival	Post.	Survival	Post.	Survival	Post.	Survival
F. semitectium	43.4	56.6	3.4	96.6	10.0	90.0	3.4	96.6
H. tetrmera	40.0	60.0	6.7	93.3	16.7	83.3	16.7	83.3
M. phaseolina	56.7	43.3	0.0	100.0	23.4	76.6	3.4	96.6
P. splendens	40.0	60.0	0.0	100.0	30.0	70.0	20.0	80.0
R. solani	33.4	66.6	0.0	100.0	6.7	93.3	20.0	80.0
Mean	42.7	57.3	2.1	97.9	17.4	82.6	12.7	87.3
L.S.D. at 5 % for: Fungi (F)= 2.578, Biofertilizers (B)= 3.64, FxB= 8.15								

* Post.= post-emergence damping-off.

Biofertilization was recently recommended to be an effective mean in controlling soil-borne fungal diseases on the ornamental plants as reported by Abo-El-Ela (2003) who mentioned that, the benefit of biofertilization might due to its cumulative effects such as supplying the plant with nitrogen in addition to growth promoting substances produced by microorganisms.

Also, data reveal that the biofertilizers reduced disease incidence caused by the tested fungi. Under greenhouse conditions, Microbin was more effective on *M. phaseolina, P. splendens* and *R. solani* where it prevented the infection of them and reduced it in both *F. semitectium* and *H. tetrmera.* In this respect, Hassouna *et al.*, (1998) stated that, *Azotobacter brasilensis* and *A. chrococcum* as well as Halex were very effective against the infestation with *R. solani* and *F. oxysporum.*

Phosphoren was effective than Microbin in reducing pod rot of peanut. This effect was attributed to the decrease of population density in the rhizosphere (Zeidan, 2000). The same trend was recorded by Emara (2005) using Rhizobacterin and Phosphoren.

Also Brown (1962) observed that *Azotobacter* besides the N-fixation were able to produce growth substances and fungal antibiotics, and the response of the crops to the inoculation could be attributed to the substances produced by the organisms. Also, Chung and Wu (2000) recorded the efficiency of *Bacillus megaterium* var. *phosphaticum* to control lily root rot caused by *R. solani* and the mycelial growth was generally reduced, where some isolates were able to cause a significant reduction in the damping-off of the plants. Also, Potassiumag containing *Bacillus verculanes* was suppressive compared with the control.

Also, the results are in agreement with the findings of Hilal *et al.* (2003). The same effect was found by Zeidan (2000) and Emara (2005). These findings could be interpreted in light that *Bacillus* and Rhizobia increase the plant P uptake, water status inside the plant tissues and hence increases the plant amino acids and activate its rates and enhance the action of succinic and lactic acids which induce the root growth.

5- Effect of resistance inducers on paspalum root rots incidence:

The efficacy of the elicitors (chitosan and salicylic acid) as soaking treatment in controlling damping-off was determined. Data in Table (5) indicate that all the tested elicitors significantly reduced post-emergence damping-off of paspalum plants compared with the control. On the other hand, increases in the survival plants resulted from both treatments. Chitosan was significantly superior in increasing healthy survivals than the other tested elicitor. The corresponding values of survived plants were 80.6 and 69.9%, respectively compared with the control (50.6%).

In this respect, two models have been proposed to explain the antifungal activity of chitosan first, the interaction with fungal DNA and RNA (Hadwiger and Loschke, 1981) and second, its ability to interfere with the plasma membrane function. The mechanisms of the natural elicitors, chitosan in controlling plant diseases based on the increase of lignin biosynthesis and plant cell wall lignifications as well as its

Table 5. Effect (chitosan and salycilic acid) on root rot disease incidence of paspalum plants under greenhouse conditions

Fungus	Control		Salicylic acid		Chitosan	
	Post.	Survival	Post.	Survival	Post.	Survival
F. semitectium	50.0	50.0	36.7	63.3	20.0	80.0
H. tetrmera	46.7	53.3	26.7	73.3	26.7	73.3
M. phaseolina	53.4	46.6	33.4	66.6	20.0	80.0
P. splendens	50.0	50.0	30.0	70.0	16.7	83.3
R. solani	46.7	53.3	23.4	76.6	13.4	86.6
Mean	49.4	50.6	30.1	69.9	19.4	80.6
L.S.D. at 5 % for:	Fungi (F)= 5.525,		Elicitors (E) = 5.875,		FxE= 13.14	

* Post.= post-emergence damping-off.

effect on enzyme biosynthesis associated with the development of resistance (Tiuterev *et al.*, 1996). Also, chitosan has also demonstrated the fungicidal activity against several fungi (Nawar, 2005). However, chitinase enzyme which is already present in plant as a defence mechanism is stimulated earlier than the normal cycle in plants growth therefore, providing protection at an earlier stage (Felicity *et al.*, 2007). Chitosan and salicylic acid play a very useful role as effective and safe means in controlling of root rots of *Paspalum vaginatum*. In this respect, similar results were found by Hilal and Zaky (2008). The majority of the tested treatments, grown in soil infested with any of the five tested fungi. Chitosan, however, was significantly the best treatment in improving plant growth of most cases than salicylic acid.

Chitosan and its oligosaccharide contributed to plant growth by acting as natural elicitor or catalyst inducing pathogenesis related proteins such as chitinase enzymes for young plants. Chitosan was more effective *in vivo* on the growth of plants.

6- Effect of bio-agents on paspalum root rot incidence:

Data presented in Table (6) reveal that the bioproducts (Bio-Arc; Bio-Zeid and Clean-root) treatments were effective in decreasing the percentage of disease incidence caused by the root rot pathogenic fungi. The percentage of disease incidence ranged between 9.67 and 40.0% compared with the control (49.33 to 53.33%).

Bio-Arc was the most effective which gave 19.27% of post emergence damping-off followed by Bio-Zeid which gave 29.27%, while Clean-root scored gave 29.87% compared to the control (49.86%).

Recently, chemical control is faced with many difficulties especially what concerned with their efficacy, selectivity, toxicity and general impact on the environment (Melaren, 1986). As well as the harmful side effects of the fungicides on human and environment led to searching new means or bioagents with low toxicity and side effects that can effectively replace the fungicides in controlling plant diseases. Therefore, Bio-Arc (*Bacillus megaterium*), Bio-Zeid (*Trichoderma album*) as biocides play a very useful role as effective and safe means in controlling

Table 6. Effect of bio-agents on the paspalum root rot incidence under greenhouse conditions

Fungus	Bio-agents								Mean
	Bio-Arc		Bio-Zeid		Clean-Root		Control		
	Post.*	Survival	Post.	Survival	Post.	Survival	Post.	Survival	
F. semitectium	19.33	80.67	29.33	70.67	19.33	80.67	49.33	50.67	100
H. tetrmera	9.67	90.33	29.67	70.33	39.67	60.33	50.00	50.00	100
M. phaseolina	29.67	70.33	39.67	60.33	19.67	80.33	49.33	50.67	100
P. splendens	10.00	90.00	9.67	90.33	40.0	60.00	53.33	46.67	100
R. solani	9.67	90.33	20.00	80.00	39.67	60.33	53.33	46.67	100
Mean	19.27	80.73	29.27	70.73	29.87	70.13	49.86	50.14	100
L.S.D at 5% for: Fungi (F)= 6.286, Bio-agents (B)= 4.846, FxB= 10.84									

* Post.= post-emergence damping-off.

root rots. In this respect, similar results were obtained by Chavan *et al.* (2004) on the positive efficacy of treating with bioagents, *i.e.* several strains of bacterial bioagents including *Bacillus megaterium* and also by *Trichoderma* spp., to control damping-off of safflower.

7- Effect of different fungicides on paspalum root rot disease incidence:

The effectiveness of Rizolex-T; Sanlit; MonCut; Maxim and Uniforme on post emergence damping-off were studied by sowing treated plants in the infested soil. Data in Table (7) show that plants treated with Uniform were the least in post-emergence damping-off (3.33%) in case of the inoculated soil with *F. semitectium* and *P. splendens* and 6.67 % with *H. tetrmera* and *M. phaseolina* and recorded 10.0 with *R. solani*. Maxim and Rizolex-T were also highly effective fungicides in managing the tested fungi where damping-off reached 11.33% followed by Sanlit and MonCut which gave 17.33%.

Table 7. Effect of different fungicides on post-emergence damping-off and survival plants of *Paspalum vaginatum* (pot-experiment)

Fungus	Tested fungicide											
	Rizolex-T		Sanlit		MonCut		Maxim		Uniform		Control	
	Post*.	Surv.	Post.	Surv.	Post.	Surv.	Post.	Surv.	Post	Surv.	Post.	Surv.
F. semitectium	6.67	93.33	20.0	80.0	20.0	80.0	20.0	80.0	3.33	96.67	46.67	53.33
H. tetrmera	13.33	86.67	16.67	83.33	23.33	76.67	10.0	90.0	6.67	93.33	50.0	50.0
M. phaseolina	13.33	86.67	13.33	86.67	6.67	93.33	13.33	86.67	6.67	93.33	43.33	56.67
P. splendens	3.33	96.67	23.33	76.67	20.0	80.0	6.67	93.33	3.33	96.67	53.33	46.67
R. solani	20.0	80.0	13.33	86.67	16.67	83.33	6.67	93.33	10.0	90.0	53.33	46.67
Mean	11.33	88.67	17.33	82.67	17.33	82.67	11.33	88.67	6.0	94.0	49.33	50.67
L.S.D at 5% for: Fungi (F)= 3.29, Fungicides (Fu)= 4.25, FxFu= 9.50												

* Post.= post-emergence damping-off.

Treating the paspalum plants with each one of the five tested fungicides, *i.e.* Maxim, MonCut, Rizolex-T, Sanlit and Uniform before sowing reduced greatly the post emergence damping-off of the five tested fungi. Uniform was the best fungicide

against all tested fungi, where it gave 6.0% of post-emergence damping-off whereas, the other fungicides were less effective where they gave a post-emergence damping-off ranging between 11.33 and 17.33% compared with Uniform and the control. These results could be attributed to that the fungicides act as a disinfectant around treated plant roots. The systemic properties of the tested fungicides permit the germinating plants the ability to absorb the giving fungicides to protect roots of plants against penetration and invasion by fungi. in addition to, the direct effect of the fungicide on the mycelia in the soil around plant. The reduction in the disease incidence using such fungicides might be attributed to less permeability of pathogen cells membrane and to the metabolization of other compounds into toxic products.

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تاثير التسميد الحيوى ، المستحثات ، المقاومة الحيوية والمقاومة الكيماوية على مقاومة أعفان جذور نبات البازبالم

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تعتبر المسطحات الخضراء من اهم نباتات الزينة فى التنسيق الحدائقى ومن اهم هذة النباتات نبات البازبالم الذى انتشر فى الفترة الاخيرة فى جميع انحاء العالم وهذا النبات يصاب بعديد من الامراض من اهمها اعفان الجذور.

تم عزل عشرة اجناس من الفطريات المختلفة من العينات النباتية المصابة و قد اظهرت نتائج العزل من ثلاث محافظات مختلفة هى الاسكندرية والجيزة وشرم الشيخ اختلافات واضحة فى تكرارات الفطريات المعزولة وبوجة عام كان كلا من فيوزاريوم سميتكتم , هيلمينثوزبوريوم تترامير ا , ماكروفومينا فاصيولينا , بيثيوم سبلندنس و ريزوكتونيا سولانى هى اكثر الفطريات تكرارا.

وقد استطاعت كل المعاملات المختبرة وهى: التسميد الحيوى باستخدام (الميكروبين – الفوسفورين – البوتاسيوماج) المستحثات مثل الكيتوزان والسالسليك اسيد , المقاومة الحيوية باستخدام (بيوارك – بيوزيد – كلين رووت) والمقاومة الكيماوية باستخدام ٥ مبيدات هى (ريزولكس-ت , سانليت , مون-كت , ماكسيم , يونيفورم) من تخفيض النسبة المئوية للاصابة باعفان الجذور مقارنة بمعاملة الكنترول.