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تثبيط أمراض الذبول وعفن الجذور على نباتات الخيار باستخدام بعض عوامل التضاد الحيوى النشطة والكمبوست

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الملخص العربي :

أمراض الذبول وعفن الجذور من الأمراض الشائعة واسعة الإنتشار على نباتات الخيار فى كل من البيوت المحمية (الصوب) والحقول المفتوحة فى جميع أنحاء مصر . لذا فهى تُؤثر تأثيراً سلبياً على النبات حيث تُقلل من عدد النباتات السليمة وبالتالى تُقلل المحصول الناتج من الثمار . وفى هذه الدراسة أجريت تجارب بغرض تقليل تلك الأمراض باستخدام عوامل التضاد الحيوى والكمبوست وقد بدأت الدراسة بتجميع العينات النباتية المصابة من أماكن ومحافظات مختلفة فى أنحاء الجمهورية حيث تم عزل وتنقية وتعريف الفطريات المعزولة . وقد تم استخدام ثلاثة أنواع من كائنات التضاد الحيوى (الترايكودرما) حيث تم اختيار مقدرتها على تثبيط كلا الكائنين المسببين للذبول وعفن الجذور (فيوزاريوم أكسيسبوريم وفيوزاريوم سولانى فى المعمل والصوبة لدراسة تأثيرها المثبط وتأثيرها المعنوى . وكذلك تم استخدام أنواع مختلفة من الكمبوست مثل مخلفات الأبقار والخيول والدجاج وكذلك مجموعة من البقايا الثباتية واختبار مقدرتها على تقليل حدوث تلك الأمراض تحت ظروف الصوبة . وأعطت النتائج المتحصل عليها تأثيراً معنوياً على تقليل حدوث المرضين على نباتات الخيار . بالنسبة للذبول الفيوزاريومى كانت النتائج الأفضل فى التربة الطينية لترايكودرما هارزيانم (٧٣.٣٩%) وبقايا النباتات (٤٨.٥٠%) وأيضاً بالنسبة لعفن الجذور أظهرت ترايكودرما هاماتم فاعلية كبيرة (٥٠.١٣%) ومخلفات الأبقار (٣٤.٢٠%) أما فى التربة الرملية بالنسبة للذبول كانت ترايكودرما هارزيانم أيضاً أكثر فاعلية (٦٢.٠٧%) ومخلفات الأبقار (٤١.٠%) وبالنسبة لعفن الجذور أظهرت أيضاً ترايكودرما هارزيانم دور فعال فى تقليل الحدوث المرضى (٨٠.٢٧%) وكذلك بقايا النباتات (٥٥.١٠%) عند مقارنتها بباقى المعاملات .

وخلاصة هذه الدراسة أن كلا الطريقتين يُمكن استخدامهما بأمان وكفاءة عالية فى تقليل حدوث أمراض الذبول وأعفان الجذور على نباتات الخيار .

SUPPRESSION OF FUSARIUM WILT AND ROOT ROT

DISEASES OF CUCUMBER USING SOME ACTIVE BIOAGENTS AND COMPOSTS

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ABSTRACT: ***Wilt and root rot diseases are common and widespread on cucumber plants in both protected and open field cultivation all over the country. They reduce the number of plants in the fields, and greenhouses and consequently reduce the commercial yield of fruits. In the course of this study, cucumber infected samples were collected from different locations throughout the country. The causal organisms and the associated fungi were isolated, purified and identified. Three different Trichoderma spp. were tested against both Fusarium oxysporum f. sp. cucumerinum and F. solani (in vitro) to study their inhibitory effect which proved their significant effect against both pathogens. The same bioagents were also used against both diseases in pot experiment under greenhouse condition which reflected their active role in disease management. Also, different composts i.e. cow, horse, chicken manures and plant debris were tested against both diseases under greenhouse condition in loamy and sandy soils. The results obtained gave significant effect in reducing the incidence of both diseases. Wilt suppression was greater in loamy soil under the effect of Trichoderma harzianum (73.39%) and / or plant debris (48.50%) also, root rot suppression was high with T. hamatum (50.13%) and cow manure (34.20%). While in sandy soil wilt suppression was greater due to T. harzianum (62.07%) and cow manure (41.60%). Root rot was also reduced by T. harzianum (80.27%) and plant debris (55.10%) which were greater than the other treatments. Therefore, both methods can be used safely in wilt and root rot diseases management on cucumber plants.***

Key Words***: Cucumber, wilt, root rot, inhibition, suppression.***

INTRODUCTION

Cucumber wilt and root rot are considered the main diseases which reduce the number of plants under field conditions. These diseases annually occur in most fields and / or in the protected cultivation which finally make considerable losses in fruit yield (Reverchon *et al.,* 2000 and Punja and Parker, 2000).

Different methods of disease management are followed (Shusheng *et al.,* 2008). However, the biological methods of disease control are considered the most save which reduce the hazards of using fungicides or chemicals for disease control (Gurha, 2001 and Rose *et al.,* 2003).

The bioagents such as fungi or bacteria which act through antagonism, inhibition and / or hyperparasitism were recorded (Bernal *et al.,* 2001). Also composts i.e. cow, horse, chicken manures and plant debris could be used for controlling many soil borne pathogens (Spyridon *et al.,* 2008). These bioagents and composts could be successfully used in disease management under greenhouse and field conditions (Sliva and Menezes, 1997 and Zhou and Everts, 2004). Therefore, in the present study effective bioagents and composts were used to study their effect or role in cucumber wilt and root rot suppression under greenhouse condition.

MATERIALS AND METHODS

The work undertaken here delt with the suppression of wilt incidence caused by *Fusarium oxysporum* f. sp. *cucumerinum* to cucumber plants (*Cucumis sativus*). Also the effect against root rot of cucumber caused by *F. solani* was studied. The laboratory and greenhouse work was carried out at the Agriculture Botany Department, Faculty of Agriculture, Minufiya University.

Collection of infected materials:

Infected roots and crowns of cucumber plants showing typical symptoms of wilt and root rot were collected from different cucumber genotypes grown in different governorates in Egypt during 2007 growing season.

Isolation and purification of the causal organisms and the associated fungi:

Isolation of the pathogenic fungi and the associated fungi was done from roots and crowns of infected samples. The infected roots and stem bases (crowns) which showed vascular brown discoloration were cut into small pieces, washed thoroughly with running water to remove the adhering soil particles. They were surface sterilized by immersing them in 0.25% sodium hypochlorite solution for 4 minutes. The samples were washed several times in sterilized distilled water and blotted between sterilized filtered papers. The surface sterilized samples were transferred onto potato Dextrose Agar medium (PDA) containing penicillin (50 units / ml), 20 ppm terramycin and 40 ppm streptomycin sulphate to avoid the bacterial contamination. The inoculated plates were incubated at 25°C for 3 – 7 days and examined daily for the occurrence of fungal growth. The developed fungal colonies were isolated, microscopically examined and identified.

Purification and identification:

Two techniques i.e. the single spore technique and the hyphal tip technique were used (Barnett, 1960 and Domsch *et al.,* 1980). The isolated fungi were identified based on the cultural and microscopical features of the

different isolates according to Barnett (1960) and Both (1971). *Fusarium* spp. were identified according to Nelson *et al.* (1983). The characters of *Fusarium oxysporum* were studied for each monocondial culture of the different isolates at the Unit of Microorganisms and Plant Pathology Res. Inst., Agric., Res. Centre, Giza, Egypt according to their morphological characters according to Both (1971).

All isolates of the bioagents which were obtained from the rhizosphere of infected plants were also identified in the Agricultural Research Centre at the same department.

Disease suppression:

Bioagents:

Inocula of *Trichoderma harzianum, T. hamatum* (Marquez *et al.,* 2002) and *T. viride* (Gurha, 2001) were prepared on sterilized sand wheat bran medium. Also the inocula of the different isolates of the pathogens were prepared on the same medium. The pathogens were *F. oxysporum* and *F. solani*, two isolates for each. Field loamy and sandy soils were infested with the pathogen and / or the biocontrol agent one week before sowing at the rate of 1% (w/w). Infested soil with each isolate of *F. oxysporum* (Both, 1971) and *F. solani* (Barnett, 1960) was used as control. Plastic pots 50 cm in diameter were filled with the soil and watered when needed. Ten seeds of cucumber c.v. Beit Alpha were sown in each pot. Four replicates were used for each treatment. Disease incidence was recorded as disease index (DI) and disease severity (DS). Also, the disease inhibition was estimated. This experiment was designed in randomized split split block design.

Growth inhibition *in vitro* due to the effect of *Trichoderma* spp. in dual cultures:

The effect of *Trichoderma* spp. on fungal growth of both *Fusarium oxysporum* f. sp. *cucumerinum* and *F. solani* was studied in dual cultures in Petri dishes.

Composts:

To study the effect of different composts on wilt and root rot incidence, different types of compost were used. These composts were cow manure, hours manure, chicken manure and plant debris. The different composts were added separately to the two types of soil (loamy and sandy soils) at the rates of 3%. The soil and each compost was mixed and the inocula of each fungas were added after one week. Seeds of cv. Beit alpha (BA) were sown at the rate of 10 seeds for each pot one week after adding the compost. Disease incidence as disease severity (DS) and disease index (DI) were scored at 15,

30 and 75 days from sowing.

The experiment was carried out as split block design with six replicates while the total number of seeds were 60 seeds for each treatments. On the other hand, the control treatment was infested soil free from composts.

The effect of different types of compost on the suppression of wilt and root rot diseases caused by *Fusarium oxysporum* and *Fusarium solani*, respectively was studied in two types of soils (sandy and loamy). Disease incidence was determined as Disease severity and disease reduction (%) to show the effect of every type of compost i.e., cow manure, horse manure, chiken manure and plant debris.

Disease assessment:

Disease index = Disease severity × 100 (Rand and Stevenson, 1999).

Disease severity = $\frac{a \times b}{N \times K}$ (Soleman *et al.,* 1988) where: a: Number of infected plants, b: Grade of infection, N: Number of total plants and K: Maximum grade of infection

Infection Type (IT): 0 = no symptoms, 1 = few lesions (covering < 10% of root), secondary root rot slight; 2 = rot of secondary roots or lesions covering approximately 25% of the root; 3 = lesions covering at least 50% of the root and dead secondary roots; 4 = general root rot, most of the root affected, also including (pre and post emergence damping-off), (Aegerter *et al.,* 2000).

EXPERIMENTAL RESULTS

Isolation of the causal organisms:

***Fusarium oxysporum* f. sp. *cucumerinum* was the common fungus followed by *Fusarium solani* in all governorates. *Fusarium oxysporum* f. sp. *cucumerinum* ranged in the different seasons. It was recorded in all governorates with different frequencies ranged from very low in Ismailiya (2.16%) to high in most locations (19.27%) (Table 1).**

***Fusarium solani* was isolated from most locations (eleven governorates). It was not recorded in Beheira and Kafr El-Sheikh governorates. The frequencies were ranged from 21% (Minufiya) to 2.17% (Shark El-Owainat).**

***Fusarium chlamydosporum* was recorded in most governorates except Qalubiya, Qena, Minia and Faiyoum. The frequency ranged between 30% (Giza) to 2.07% (Sharkiya).**

***Fusarium avenaceum* was also isolated from most governorates with frequency ranged from 21.37% (Giza) to 3.02% (Faiyoum).**

***Fusarium moniliforme* was found in eight governorates i.e. Minufiya, Giza, Qalubiya, Sharkiya, Gharbiya, Kafr El-Sheikh, Dakahliya and Shark El-Owainat. The highest frequency was recorded in Shark El-Owainat (24.07%)**

and the lowest one was found in Qalubiya (2.07%).

Fusarium equesti was recorded in most governorates. The frequency ranged from 33.16% (Beheira) to 4.17% (Dakahliya).

Fusarium lateratum was isolated from cucumber plants in few locations i.e. Qalubiya, Kafr el-Sheikh and Shark El-Owainat (Table 1).

Table (1): Frequency of occurrence (%) of *Fusarium* spp. isolated from wilted and rot roots of cucumber plants collected from different governorates in Egypt (2007).

Governorate	Isolated *Fusarium* sp. / frequency of isolation (%)						
	F. oxysporum	*F. solani*	*F. chlomydosporum*	*F. avenaceum*	*F. moniliforme*	*F. equesti*	*F. lateratum*
Minufiya	19.27	21.00	19.50	19.66	20.00	12.80	0.00
Giza	15.21	19.73	30.00	21.37	15.60	0.00	0.00
Beheira	10.33	0.00	10.69	15.70	0.00	33.16	0.00
Qalubiya	9.57	3.17	0.00	20.32	2.07	4.81	22.70
Sharkiya	8.22	10.00	2.07	0.00	6.18	12.44	0.00
Gharbiya	7.11	4.31	11.50	4.17	4.11	10.70	0.00
Qena	5.02	11.55	0.00	12.60	0.00	11.56	0.00
Minia	7.51	5.50	0.00	0.00	0.00	0.00	0.00
Kafr El-Sheikh	4.38	0.00	2.17	0.00	15.37	0.00	69.43
Dakahliya	3.00	4.63	4.00	3.16	12.60	4.17	0.00
Ismailiya	2.16	7.69	12.00	0.00	0.00	0.00	0.00
Faiyoum	6.00	10.25	0.00	3.02	0.00	10.36	0.00
Shark El-Owainat	2.22	2.17	8.07	0.00	24.07	0.00	7.87

The results illustrated in Table (2) showed that *Trichoderma* spp. showed inhibition effect against both pathogens (Table 2). The percentage of inhibition reached 80.0% with *T. hamatum* followed by the effect of *T. harzianum* and *T. viride* which gave 80.0, 76.6 and 64.0%, respectively, comprised with the control treatment.

The results shown in Table (2) showed that the percentage of inhibition reached 68.2% with *T. harzianum* followed by the effect of *T. viride* and *T. hamatum*, they gave 60.8 and 56.0%, respectively, comprised with the control treatment.

Table (2): Growth inhibition of *Fusarium oxysporum* f. sp. *cucumerinium* and *Fusarium solani* due to the effect of *Trichoderma* spp. in dual cultures.

Treatment	*Fusarium oxysporum* f. sp. *cucumerinium*		*Fusarium solani*	
	Growth diameter (mm)	Inhibition (%)	Growth diameter (mm)	Inhibition (%)
T. harzianum	19	76.6	22.0	68.2
T. hamatum	30	80.0	17.0	56.0
T. viride	25	64.0	20.0	60.8
Control(pathogen only)	90	0.00	90.0	0.0
L.S.D. at 5%	0.87		0.81	

Percentage of inhibition of the fugal growth = $\frac{C-T}{C}$ × 100 (Fokkema, 1973 and Zhou & Reeleder, 1990)

where: T = Fungal growth. C = Diameter of fungal growth of the control (each isolate of the pathogen individual).

Disease suppression in greenhouse experiment:

1. The use of bioagents:

The effect of *Trichoderma* spp. on cucumber wilt and root rot incidence was studied in terms of disease index and percentage of disease suppression, as follow:

a) Loamy soil:

* Wilt:

Three *Tridhoerma* spp. i.e. *T. harzianum, T. hamatum* and *T. viride* were used in arterially infested loamy soil against *Fusarium oxysporum* under greenhouse condition. The results obtained and given in Table (3) revealed that disease incidence was suppressed by all isolates used. Disease severity values were 0.23, 0.33 and 0.41% for *T. harzianum, T. hamatum* and *T. viride*, respectively. Disease suppression was greater with *T. harzianum* (73.39%) followed by *T. hamatum* (50.05%) and *T. viride* (41.40%), in descending order, in comparison with the control treatment (infested soil and free from *Trichoderma* spp.).

* Root rot:

The same species of Trichdoerma were also studied. The results given in Table (3) revealed that disease incidence was suppressed by all isolates used. Disease severity values were was 0.31, 0.25 and 0.43% for *T. harzianum, T. hamatum* and *T. viride*, respectively. Disease suppression was greater with *T. hamatum* (50.13%) followed by *T. harzianum* (42.27%) and *T. viride* (28.91%), in descending order, in comparison with the control treatment (infested soil and free from the bioagents.

Table (3): Suppression of wilt and root rot of cucumber cv. Beit Alpha under the effect of *Trichoderma* spp.-plants grown in loamy soil artificially

infested with the causal organisms.

Treatment	Pathogen / disease severity and reduction (%)			
	Fusarium oxysporum		*Fusarium solani*	
	Disease severity (D.S)	Reduction (%)	Disease severity (D.S)	Reduction (%)
T. harzianum	0.23	73.39	0.31	42.27
T. hamatum	0.33	50.05	0.25	50.13
T. viride	0.41	41.40	0.43	28.91
Trichoderma free (pathogen only)	0.88	0.00	0.81	0.00
L.S.D. at 5%	0.09		0.01	

Disease severity = $\frac{a \times b}{N \times K}$ (Soleman *et al.,* 1988) where: a: Number of infected plants, b: Grade of infection, N: Number of total plants and K: Maximum grade of infection.
Disease reduction represents the percent of disease reduction relative to the control (pathogen only).

b- Sandy soil:

The effect of *Trichoderma* spp. on cucumber wilt and root rot incidence was studied in terms suppression in sandy soil.

* Wilt:

A dominant isolate of each of *T. harzianum, T. hamatum* and *T. viride* were used in infested sandy soil against *Fusarium oxysporum* f. sp. and *F. solani* under greenhouse condition.

Data obtained in Table (4) revealed that disease incidence was suppressed by all isolates used. Disease severity was 0.18, 0.32 and 0.26 under the effect of *T. harzianum, T. hamatum* and *T. viride*, respectively. Disease suppression was greater with *T. harzianum* (80.22%) followed by *T. viride* (71.43%) and *T. hamatum* (64.83%), in descending order, in comparison with the control treatment (infested soil and free from *Trichoderma* spp.).

* Root rot:

Also, three *Trichoderma* spp. were used against *Fusarium solani*. The results obtained in Table (4) showed high degree of disease suppression with low level of disease severity or disease index. Disease severity was 0.33, 0.24 and 0.40% under the effect of *T. harzianum, T. hamatum* and *T. viride*, respectively. Disease suppression was greater with *T. hamatum* (72.41%) followed by *T. harzianum* (62.07%) and *T. viride* (54.02%) in descending order in comprised with the control treatment.

Table (4): Suppression of wilt and root rot of cucumber cv. Beit Alpha under the effect of *Trichoderma* spp.-plants grown in sandy soil artificially

infested with the causal organisms.

Treatment	Pathogen / disease severity and inhibition (%)			
	Fusarium oxysporum		*F. solani*	
	Disease severity (D.S)	Reduction (%)	Disease severity (D.S)	Reduction (%)
T. harzianum	0.18	80.22	0.33	62.07
T. hamatum	0.32	64.83	0.24	72.41
T. viride	0.26	71.43	0.40	54.02
Trichoderma free (control) pathogen only	0.91	0.00	0.87	0.00
L.S.D. at 5%	0.03		0.04	

Disease severity = $\frac{a \times b}{N \times K}$ (Soleman *et al.,* 1988) where: a: Number of infected plants, b: Grade of infection, N: Number of total plants and K: Maximum grade of infection.
Disease reduction represents the percent of disease reduction relative to the control (pathogen only).

Data of wilt disease caused by *Fusarium oxysporum* f. sp. *cucumerinium* was given in Tables(5,6). The plant debris showed the lowest disease severity and highest disease reduction in loamy and sandy soils, compared to the other manures. In the loamy soil, the disease severity was 0.47 with 48.5% disease reduction compared to (0.41) disease severity and 55.1% disease reduction in sandy soil. While chicken manure showed the highest disease severity and lowest disease reduction in loamy and sandy soils, respectively. In the loamy soil, the disease severity was 0.63 with 30.8% disease reduction compared to 0.61 disease severity and 33.1% disease reduction.

On the other hand, cow manure gave 0.45 disease severity with 50.6% disease reduction in sandy soil while it gave 0.55 disease severity with 40.0% disease reduction in loamy soil. The horse manure showed 0.51% disease severity with 44.1% disease reduction in sandy soil while it gave 0.60 disease severity with 34.1% disease reduction in loamy soil. On the other hand, the control (compost only) and control (compost free) gave the highest level of disease index.

Root rot disease caused by *Fusarium solani* under the effect of horse manure showed the highest disease index and lowest disease reduction in loamy soil. It gave 64.9 disease index with 23.5% disease reduction. While chicken manure showed the highest disease index 56.9 with 32.9% disease reduction in sandy soil than other manures. On the other hand, plant debris gave high disease index in both sandy and clay soils 54.9 and 58.8%, respectively. With lowest disease reduction (35.2 and 30.7%) while cow manure gave the lowest disease index (50.0 and 55.8%) in sandy and loamy soil, respectively with disease reduction (41.0 and 34.2%) compared to the control.

Table (5): Effect of different composts on the incidence of wilt and root rot of cucumber cv. Beit Alpha grown in artificially infested loamy soil-in pot experiment.

Compost	Disease / disease severity and disease reduction (%)			
	Wilt		Root rot	
	Disease severity (D.S)	Disease reduction (%)	Disease severity (D.S)	Disease reduction (%)
Cow manure	0.55	40.0	0.56	34.2
Horse manure	0.60	34.1	0.65	23.5
Chicken manure	0.63	30.8	0.60	29.2
Plant debris	0.47	48.5	0.59	30.7
Control (P)	0.87		0.85	
Control (C)	0.67		0.69	
Control free	0.75		0.77	
L.S.D. at 5%	0.03		0.04	

Disease severity = $\frac{a \times b}{N \times K}$ (Soleman *et al.,* 1988) where: a: Number of infected plants, b: Grade of infection, N: Number of total plants and K: Maximum grade of infection.
Disease reduction represents the percent of disease reduction relative to the control (pathogen only).
P: pathogen only C: Compost only

Table (6): Effect of different composts on the incidence of wilt and root rot of cucumber cv. Beit Alpha grown in artificially infested sandy soil-in pot experiment.

Compost	Disease / disease severity and disease reduction (%)			
	Wilt		Root rot	
	Disease severity (D.S)	Disease reduction (%)	Disease severity (D.S)	Disease reduction (%)
Cow manure	0.45	50.6	0.50	41.0
Horse manure	0.51	44.1	0.53	37.7
Chicken manure	0.61	33.1	0.57	32.9
Plant debris	0.41	55.1	0.55	35.2
Control (P)	0.91		0.85	
Control (C)	0.64		0.68	
Control free	0.72		0.74	
L.S.D. at 5%	0.03		0.03	

Disease severity = $\frac{a \times b}{N \times K}$ (Soleman *et al.,* 1988) where: a: Number of infected plants, b: Grade of infection, N: Number of total plants and K: Maximum grade of infection.
Disease reduction represents the percent of disease reduction relative to the control (pathogen only).
P: pathogen only C: Compost only

DISCUSSION

Fusarium wilt caused by *Fusarium oxysporum* f. sp. *cucumerinum* and root rot caused by *F. solani* are common diseases on cucumber plants in Egypt. The causal organisms were isolated from greenhouse and commercial fields in most locations in Egypt. Both pathogens were isolated at different levels of isolation depends on the location as shown in results of the present study.

Different methods of disease management were applied to control both diseases. These methods were carried out by using the application of different bioagents (Paultiz *et al.,* 1987; Larkin *et al.,* 1993; Karunanithi and Usman, 1999 and Marquez *et al.,* 2002).

Also the addition of some composts were used by different manures and plant debris (Weller and Cook, 1983 and Pavlou and Vakalounakis, 2005).

The results obtained revealed a significant suppression of both diseases of cucumber either by the bioagents or by composts and plant debris.

The bioagents i.e. *Trichoderma harzianum, T. hamatum* and *T. viride* were tested against the most common isolates of the causal organisms. *In vitro* the results showed that *Trichoderma* spp. inhibited the growth of both pathogens. The percentage reduction of *Fusarium oxysporum* reached 80.0% with *T. hamatum* followed by the effect of *T. harzianum* and *T. viride* which gave 76.6 and 64.0%, respectively, in comparison with the control treatment.

The obtained results were similar to those obtained by Bernal *et al.,* (2001), who found that antagonistic effect between *Trichoderma* spp. and *Fusarium oxysporum* f. sp. *cubense*, in dual cultures on potato dextrose agar medium. The comparative capacity and reduction of radial growth of *F. oxysporum* due to *Trichoderma* spp. were evaluated.

On the other hand, *F. solani* revealed that the percentage of reduction reached 68.2% with *T. harzianum* followed by the effect of *T. viride* and *T. hamatum*, which gave 60.8 and 50.0%, respectively, in comparison with the control treatment.

In pot experiment, the inhibition of both pathogens by *Trichoderma* spp. was studied under greenhouse condition in loamy and sandy soils. These studies were carried out highly disease pressure by inoculating the soil with high concentration (3%) of disease inocula of the different pathogens to emphasize the effectiveness of the different bioagents in disease control.

In loamy soil, the wilt and root rot suppression were measured by disease severity and disease reduction. The results obtained on wilt showed that the disease incidence was suppressed by all isolates of the bioagents. *T. harzianum* was most effective (73.0%) in comparison with the others *Trichoderma* spp. and the control treatment. On the other hand, root rot was suppressed by *T. hamatum* which gave the lowest disease severity (0.25)

with 50.13% reduction in comparison with the other bioagents and control treatment.

In sandy soil, the results obtained showed that wilt disease was suppressed by *T. harzianum* with 0.18 disease severity and 80.22% disease reduction compared with the other bioagents and control treatment. On the other hand, the results obtained revealed that root rot was suppressed by *T. hamatum* with 0.24 disease severity and 72.41% disease reduction in comparison with the other control treatments similar results were obtained by Niknejed *et al.* (2000), Tian *et al.* (2001) and Rose *et al.* (2003).

The effect of different composts on wilt and root rot incidence was studied. These composts were cow manure, chicken manure, horse manure and plant debris. The experiment was carried out in split block design in pot experiment under greenhouse condition in loamy and sandy soils.

In loamy soil, the results of wilt disease caused by *Fusarium oxysporum* f. sp. *cucumerinum* showed that the plant debris gave the lowest disease severity (0.47) and highest disease reduction (48.5%). While chicken manure showed the highest disease severity (0.63) and lowest disease reduction (30.8%). Cow manure gave 0.55 disease severity with 40.0% Disease reduction. The horse manure showed 0.60 D.S. with 34.1% disease reduction compared to the control (only compost) and the control (compost free) gave the highest level of disease severity.

Data on root rot disease caused by *Fusarium solani* under the effect of horse manure shown in Table (5) revealed the highest disease severity (0.65) and lowest disease reduction (23.5%).

Chicken manure showed also high disease severity (0.60) with 29.2% disease reduction plant debris gave 0.59 D.S. with 30.7% disease reduction while cow manure showed the lowest D.S. (0.56) with 34.2%) disease reduction compared to the control.

On the other hand, in sandy soil, chicken manure showed the highest effect and suppression. It gave 0.61 D.S. with 33.1% disease reduction while the horse manure gave 0.51 D.S. with 44.1% disease reduction cow manure gave 0.45 D.S. with 50.6% disease reduction. Also, plant debris showed the lowest D.S. (0.41) with 55.1% disease reduction compared to the different control treatments.

In root rot, chicken manure gave the highest D.S. (0.57) with 32.9% Disease reduction. while cow manure gave the lowest D.S. (0.50) with 41.0% disease reduction Other manures i.e., horse manure and plant debris gave 0.53 and 0.55 D.S. with 3.7 and 35.2% disease reduction respectively, compared to the different controls.

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تثبيط أمراض الذبول وعفن الجذور على نباتات الخيار باستخدام بعض عوامل التضاد الحيوى النشطة والكمبوست

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الملخص العربي :

أمراض الذبول وعفن الجذور من الأمراض الشائعة واسعة الإنتشار على نباتات الخيار فى كل من البيوت المحمية (الصوب) والحقول المفتوحة فى جميع أنحاء مصر . لذا فهى تُؤثر تأثيراً سلبياً على النبات حيث تُقلل من عدد النباتات السليمة وبالتالى تُقلل المحصول الناتج من الثمار . وفى هذه الدراسة أجريت تجارب بغرض تقليل تلك الأمراض باستخدام عوامل التضاد الحيوى والكمبوست وقد بدأت الدراسة بتجميع العينات النباتية المصابة من أماكن ومحافظات مختلفة فى أنحاء الجمهورية حيث تم عزل وتنقية وتعريف الفطريات المعزولة . وقد تم استخدام ثلاثة أنواع من كائنات التضاد الحيوى (الترايكودرما) حيث تم اختيار مقدرتها على تثبيط كلا الكائنين المسببين للذبول وعفن الجذور (فيوزاريوم أكسيسبوريم وفيوزاريوم سولانى فى المعمل والصوبة لدراسة تأثيرها المثبط وتأثيرها المعنوى . وكذلك تم استخدام أنواع مختلفة من الكمبوست مثل مخلفات الأبقار والخيول والدجاج وكذلك مجموعة من البقايا الثباتية واختبار مقدرتها على تقليل حدوث تلك الأمراض تحت ظروف الصوبة . وأعطت النتائج المتحصل عليها تأثيراً معنوياً على تقليل حدوث المرضين على نباتات الخيار . بالنسبة للذبول الفيوزاريومى كانت النتائج الأفضل فى التربة الطينية لترايكودرما هارزيانم (٧٣.٣٩%) وبقايا النباتات (٤٨.٥٠%) وأيضاً بالنسبة لعفن الجذور أظهرت ترايكودرما هاماتم فاعلية كبيرة (٥٠.١٣%) ومخلفات الأبقار (٣٤.٢٠%) أما فى التربة الرملية بالنسبة للذبول كانت ترايكودرما هارزيانم أيضاً أكثر فاعلية (٦٢.٠٧%) ومخلفات الأبقار (٤١.٠%) وبالنسبة لعفن الجذور أظهرت أيضاً ترايكودرما هارزيانم دور فعال فى تقليل الحدوث المرضى (٨٠.٢٧%) وكذلك بقايا النباتات (٥٥.١٠%) عند مقارنتها بباقى المعاملات .

وخلاصة هذه الدراسة أن كلا الطريقتين يُمكن استخدامهما بأمان وكفاءة عالية فى تقليل حدوث أمراض الذبول وأعفان الجذور على نباتات الخيار .