



## SURVEY OF SOME FUNGAL DISEASES ON GARLIC PLANTS AT EAST DELTA GOVERNORATES OF EGYPT

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### ABSTRACT

A survey of pink root rot, *Stemphylium* blight and powdery mildew as new recording fungal diseases on garlic were conducted in 60 garlic fields at different localities of four governorates at East Delta region of Egypt, during 2013/2014 and 2014/ 2015 growing seasons. Pink root rot disease caused by *P. terrestris* was found on garlic Seds-40 cv., more than on Balady one. The disease was appeared 120- 130 days after planting in naturally infested soil. The occurrence of garlic pink root rot disease was widely prevalent in Ismailia Governorate, followed by Suez and North Sinai Governorates, meanwhile Sharkia Governorate showed the least percentage of infection. *Stemphylium* blight caused by *S. vesicarium* was appeared 50- 60 days after planting in naturally infected fields. The disease was widely prevalent in Ismailia Governorate followed by Sharkia and Suez Governorates while North Sinai showed the least infection. Powdery mildew disease was appeared 90- 100 days after planting in naturally infected fields. The occurrence of garlic powdery mildew caused by *L. taurica* was widely prevalent in North Sinai Governorate, followed by Ismailia and Suez Governorates, while Sharkia Governorate showed the least infection. Pathogenicity tests revealed that isolates caused pink root severity ranged between 23.31-70.20%, *Stemphylium* blight infection ranged between 53.76 - 68.22% and powdery mildew severity ranged between 47.70-59.80% on garlic Seds-40cv.

**Key words:** Fungal diseases, garlic, *L. taurica*, *P. terrestris*, *S. vesicarium*, survey.

### INTRODUCTION

Garlic (*Allium sativum* L.) is one of the most important vegetable crops of Egypt. Garlic plants are attacked by several diseases, which cause qualitative and quantitative losses. Pink root rot, *Stemphylium* blight and powdery mildew diseases are new recording fungal diseases on garlic in Egypt (Shalaby *et al.*, 2002 ; Shalaby, 2000 and 2003). Pink root rot disease caused by *Pyrenochaeta terrestris* has been reported as serious disease on Egyptian garlic (Shalaby *et al.*, 2002). Pink root rot pathogen is a soilborne fungus and remains viable in the soil for many years (Rengwalska and Simmon, 1986). Roots infected by *P. terrestris* turn pink initially and then become brittle and dies. Although the pathogen can be present in the root; it does not invade the basal plate or dwarf stem

bulb (Coleman and Ellerbrock, 1997). *Stemphylium* blight caused by *Stemphylium vesicarium* is an important disease on garlic, where it was recorded in Egypt by Shalaby (2000). Disease symptoms are elliptical, distinctly sunken, typically smaller (2- 4 mm long). The lesions eventually coalesced and killed the older leaves, closely resembling to those of blight symptoms. Powdery mildew caused by *Leveillula taurica* is an important disease on garlic, where it was recorded in Egypt by Shalaby (2003). Disease symptoms are light powdery colonies or lesions that are visible on lower leaf surface of the older leaves. The lesions are covered with a hyaline powdery growth of conidia and conidiophores of the pathogen. Severly infected leaves developed chlorotic and necrotic patches on lower or upper leaf surface perior leaf dried. The symptoms

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were produced mainly on older leaves, then the infection spread from the older leaves to the younger ones.

Few data are available on the survey of new recording fungal diseases on garlic. However, Shalaby (2001) indicated that *Stemphylium* blight disease was widely prevalent on garlic plants grown commercially in Egypt. Disease severity was increased gradually and then remained constant during February- March when temperature are optimum for the pathogen growth (18°C). Infection of garlic leaves by this disease increased at 22°C and after 24 hr., of leaf wetness. Powdery mildew disease was found on garlic during 2001/2002 growing season in Sharkia Governorate (Shalaby, 2003). The outbreak of this disease are sever on garlic Seds 40 cv. Shalaby *et al.* (2008) found that, the occurrence of garlic pink root rot disease was widely prevalent in Ismailia Governorate.

The objective of this study was to investigate the distribution and incidence of some fungal diseases on garlic at East Delta governorates of Egypt.

## MATERIALS AND METHODS

### Survey

A survey of pink root rot disease caused by *Pyrenochaeta terrestris* (Hanson) Gorenz., Welker and Larson., *Stemphylium* blight disease caused by, *Stemphylium vesicarium* (Wallr) Simm and powdery mildew disease caused by *Leveillula taurica* (lev) Arnaud, as new recording fungal diseases on garlic plants in Egypt, were carried out at different localities of four governorates, *i.e.*, Sharkia (Abo Hammad), Ismailia (El - Kantra), Suez (Ganin) and Sinai (North Sinai). Sixty garlic fields scattered in an area of a bout 500 km<sup>2</sup> were randomly selected for this study. These fields were located a long of East Delta governorates. Survey was carried out from 1<sup>st</sup> of November to end of March, during two successive growing seasons, 2013 / 2014 and 2014/2015. The survey included garlic cultivars Balady and Seds- 40. Three sites were chosen at random in every naturally infected field and the average of pink root rot, *Stemphylium* blight and powdery mildew

infection were estimated in all inspected fields. Samples showing typical symptoms of all studied diseases were collected from all surveyed localities to identify the causal organism. Pink root infection (%) was determined, while *Stemphylium* blight and powdery mildew severity were determined using scal 0- 4 according to Kremer and Unterstanhofer (1967).

### Identification of the Causal Organisms

*P. terrestris* was purified using single spore technique (Dhingra and Sinclair, 1985), and identified according to Watson (1961). *S. vesicarium* was purified using single hyphal tipe technique and identified according to Simmons (1967), Ellis (1971) and Biotewx *et al.* (1994). *L. taurica* was identified according to morphological characteristics, *i.e.*, the presence of diomorphic conidia, branching of the conidiophores as well as size and shap of the conidia (Boesewinkel, 1980).

### Inocula

#### *P. terrestris*

The isolated fungus was grown on Czapek's liquid medium for 30 days , the mycelial and broth were blended for 30 sec. at low speed in a wiring blender, then 200 ml inoculum and 1.400 ml of distilled water were mixed with 23.5 kg of sterile soil (Rengwalska and Simmon, 1986), and used as inoculum

#### *S. vesicarium*

The isolated fungus was grown on autoclaved medium contained 100 ml tomato juce, 1.5 g CaCO<sub>3</sub>, 10 g agar and 400 ml distilled water (Reifschneider *et al.*, 1992). The techniques described by Ludwig *et al.* (1962) and Shahin and Shepard (1979), were employed to profuse sporulation. Conidial suspension was adjusted to 10<sup>5</sup> conidia per milliliter of the pathogen.

#### *L. taurica*

The inoculum was conducted by using naturally infected garlic showing evidence of infection and sporulation stored under cool condition (about 10°C). Garlic leaves were incubated for 24- 48 hr., about 20°C before using as an inoculum soruce.

## Pathogenicity Tests

The Pathogenicity studies of the isolated pathogens were conducted under greenhouse conditions at Onion, Garlic and Oil Crop Dis. Res. Dept., ARC, Giza. Plastic Pots (30 cm in diam.), filled with sterilized sand - clay soil. Inoculum potential of each pathogen, which obtained from surveyed localities were used as previously mentioned. Garlic cloves of Seds 40 cv. were sown on 27 Sept., at the rate of three cloves/ pot. The pots were divided into four groups:

- a- Group (1). The soil infested with *P. terrestris*.
- b- Group (2). The 30 days old plants inoculated by *S. vesicarium*.
- c- Group (3). The 30 days old plants inoculated by *L. taurica*.
- d. Group (4). The control (uninfested).

The experiment was designed in randomized complete block system with four replicates per each treatment. After 90 days from planting, percentages of pink root rot, disease severity of Stemphylium blight and powdery mildew were estimated.

The obtained data were statistically analyzed according to Snedecor and Cochran (1972).

## RESULTS AND DISCUSSION

### Pink Root Rot Disease

Data present in Table 1 show that, the highest average percentages of pink root rot disease were recorded on garlic Seds – 40 cv., in Ismailia Governorate during 2013/2014 – 2014/2015 growing seasons, being 37.98% and 39.59%, respectively followed by Suez Governorate being 35.14% and 34.59%, respectively and North Sinai Governorate being 25.20% and 26.93%, respectively. While the grown plants in Sharkia Governorate showed the least percentages of 14.14% and 13.67% respectively. The outbreak of pink root disease on garlic Seds - 40cv. increased gradually from February to the end of March. Pink root was recorded only on Seds – 40 cv.

Field observations during the survey indicated that symptoms of pink root rot on garlic Seds- 40 cv., were appeared 120- 130

days after planting in naturally infested soil. Pink root rot disease symptoms were measured on the basis of root pinking as described by Nichols *et al.* (1965).

Pink root rot pathogen is a soilborne and remains viable in the soil for many years (Rengwalska and Simmon, 1986). Roots infected by *P. terrestris* turns pink initially and then becomes brittle and dies. Although the pathogen can be present in roots; it does not invade the basal plate or dwarf stem bulb (Coleman and Ellerbrock, 1997). The occurrence of garlic pink root rot disease was widely prevalent in sandy new reclaimed soil (Shalaby *et al.*, 2002). Shalaby *et al.* (2008) indicated that, pink root rot disease of garlic was found in all the major garlic growing area of Egypt, in addition to Allium genus, the pathogen infected six hosts, *i.e.* cucumber, pea, cantaloupe, tomato, papper and eggplant.

It is worth to mention that symptoms of pink root rot disease on garlic Seds -40 cv., were appeared 120 days after planting under field conditions. In this concern, Thornton and Mohan (1996) found that symptoms of pink root rot disease were not usually noticeable during early stage of onion growth when temperature is below optimum for the pathogen growth. They concluded that *P. terrestris* has been developed at the optimum temperature, (28°C). Also, field observation indicated that, there were great difference between the two investigated garlic cultivars in their susceptibility to the pink root rot disease. No appeared infection was noticed on Balady cv. The results obtained were in line with those of Shalaby *et al.* (2007) who cleared that Balady cv. was the most resistant for the pink root rot disease, while Chinase and Seds-40 garlic cultivars were the most susceptible. Pink root rot disease of garlic caused by *P.terrestris* was found on Seds – 40 garlic cv., in all the major garlic growing regions at the East Delta of Egypt during the growing seasons, 2013- 2015.

### Stemphylium Blight Disease

The severity of Stemphylium blight arising from naturally infection on garlic plants was most severe in Ismailia Governorate during both seasons, being 25.91% and 30.13%, respectively followed by Sharkyia Governorate, being 24.30% and 24.32%, respectively and Suez

**Table 1. The percentage of garlic pink root rot disease at East Delta governorates of Egypt during two successive growing seasons**

Governorate	Date	Disease incidence (%)			
		First season (2013-2014)		Second season (2014 - 2015)	
		Balady	Seds - 40	Balady	Seds -40
Sharkia	Nov.	00-00	00-00	00-00	00-00
	Dec.	00-00	00-00	00-00	00-00
	Jan.	00-00	00-00	00-00	00-00
	Feb.	00-00	13.18	00-00	13.22
	Mar.	00-00	15.10	00-00	14.11
Average		00-00	14.14	00-00	13.67
Ismailia	Nov.	00-00	00-00	00-00	00-00
	Dec.	00-00	00-00	00-00	00-00
	Jan.	00-00	00-00	00-00	00-00
	Feb.	00-00	35.77	00-00	35.17
	Mar.	00-00	40.18	00-00	44.01
Average		00-00	37.98	00-00	39.59
Suez	Nov.	00-00	00-00	00-00	00-00
	Dec.	00-00	00-00	00-00	00-00
	Jan.	00-00	00-00	00-00	00-00
	Feb.	00-00	32.12	00-00	33.17
	Mar.	00-00	38.15	00-00	36.01
Average		00-00	35.14	00-00	34.59
North Sinai	Nov.	00-00	00-00	00-00	00-00
	Dec.	00-00	00-00	00-00	00-00
	Jan.	00-00	00-00	00-00	00-00
	Feb.	00-00	00-00	00-00	25.11
	Mar.	00-00	25.20	00-00	28.77
Average		00-00	25.20	00-00	26.93

Governorate, being 20.72% and 23.15% respectively. Meanwhile North Sinai Governorate showed the least infection being 20.46% and 22.66%, respectively (Table2). Outbreak of Stemphylium blight is severe in Seds-40 cv., than on Balady one. Disease severity on both garlic cultivars was gradually increased and remained constant during February and March in the two successive growing seasons (2013/2014- 2014/2015).

Field observations during the survey indicate that, symptoms of Stemphylium blight of garlic cvs., were appeared 50- 60 days after planting. Stemphylium blight was found on garlic during 1998/ 1999 growing season in Egypt (Shalaby, 2000). According to Shalaby (2001) the disease caused by *S. vesicarium* is appeared 30-40 days after inoculation with the pathogen under greenhouse conditions and 50 - 60 days after planting under field conditions. Stemphylium blight severe on Seds - 40 cv., than on Balady one. Disease severity was gradually increased and remained constant during February and March. In this respect, Shalaby (2001) indicated that, the optimum temperature for Stemphylium growth (18°C) and infection of garlic leaves by this disease increased at 22°C and after 24 hr., of leaf wetness. Shalaby (2003) evaluated some garlic cvs., to Stemphylium blight under greenhouse and field conditions and found that, garlic Balady and Spanish cvs., were least severe of infection, while Seds- 40 and Chinese cvs were of severe infection.

It is worthy to mention that, survey of garlic Stemphylium blight caused by *S.vesicarium* indicated that the disease was widely prevalent in Ismaelia Governorate, followed by Sharkia and Suez Governorates, meanwhile North Sinai Governorate showed the least infection.

### Powdery Mildew Disease

During 2013/ 2014 and 2014/ 2015 growing seasons a severe outbreak of powdery mildew disease occurred in commercial fields of garlic Seds – 40 cv. in Egypt, (Table 3). Disease survey in 60 fields of garlic indicated that, garlic Seds – 40 cv., was affected by powdery mildew than Balady one. Severity of powdery mildew arising from naturally infection on garlic plants was most severed in North Sinai Governorate, being 18.31% and 17.51%, respectively

followed by Ismailia Governorate, being 13.81%, and 13.75%, respectively and Suez Governorate, being 11.40% and 12.75%, respectively. While Sharkia showed the least infection of 2.52% and 3.61%, respectively.

Field observations during the survey was indicated that, symptoms of powdery mildew disease on garlic Seds - 40 cv., was appeared 90-100 days after planting in naturally infected fields. Disease severity on garlic Seds-40 cv., was increased gradually from January to the end of March. The infection appears on the lower surface of the older leaves and spread to the young ones.

Hirata (1968) reported that *L. taurica* was found on 710 host species from 59 plant families.

Additional reports indicated that, the host range of *L. taurica* includes a minimum of 750 plant species including 27 economically important crop hosts (Palti, 1974). Most of powdery mildew disease reports have been obtained from warm arid to semiarid climatic zones in Asia, the Mediterranean and Africa (Palti, 1971). *L. taurica* has been reported on several economically important crops including tomato (Kontaxis and Van Maren, 1978) pepper (Thomson and Jones, 1981; El-Kafrawy, 1997; Mc Grath and Shishkoff, 2001), guar (Mihail and Alcorn, 1984), onion (Laemmlen and Endo, 1985), cotton (Correll, 1986) and calla lily (Konike and Beckman, 2002). Powdery mildew disease was found only on Seds - 40 garlic cv., during 2001- 2003 growing seasons in Egypt (Shalaby, 2003).

The survey confirmed that garlic Seds - 40 cv. was affected by powdery mildew disease. The disease was widely prevalent in North Sinai, followed by Ismailia and Suez, while Sharkia showed the least infection.

It is worthy to mentioned that, outbreake of pink root, Stemphylium blight and powdery mildew on garlic are severe on Seds - 40 cv. than on Balady one under field conditions at the inspected governorates of Egypt.

### Pathogenicity Tests

Results in Table 4 indicate that all tested fungi were able to infect garlic Seds – 40 cv., with significant different in between. Ismailia Governorate isolate caused the highest pink root

**Table 2. Disease severity of garlic Stemphylium blight disease at East Delta governorates of Egypt during two successive growing seasons**

Governorate	Date	Disease severity (%)					
		First season (2013/2014)			Second season (2014 /2015)		
		Balady	Seds- 40	Average	Balady	Seds - 40	Average
Sharkia	Nov.	8.13	18.33	13.23	11.11	15.77	13.44
	Dec.	10.01	22.11	16.06	13.15	21.07	17.11
	Jan.	15.15	35.01	25.08	15.20	33.27	24.24
	Feb.	27.11	40.02	33.57	28.02	38.80	33.41
	Mar.	27.11	40.02	33.57	28.02	38.80	33.41
Average		17.50	31.10	24.30	19.10	29.54	24.32
Ismailia	Nov.	6.22	20.02	13.12	10.15	25.02	17.59
	Dec.	10.15	28.81	19.48	16.22	33.13	24.68
	Jan.	15.13	37.50	26.32	23.22	38.50	30.86
	Feb.	22.22	48.40	35.31	30.02	47.50	38.76
	Mar.	22.22	48.40	35.31	30.02	47.50	38.67
Average		15.19	36.63	25.91	21.93	38.33	30.13
Suez	Nov.	1.11	15.02	8.07	1.15	81.01	9.58
	Dec.	2.61	25.13	13.87	3.31	30.30	16.81
	Jan.	13.11	30.22	21.67	15.10	33.03	24.06
	Feb.	19.77	40.22	29.99	25.30	40.01	32.66
	Mar.	19.77	40.22	29.99	25.30	40.01	32.66
Average		11.27	30.16	20.72	13.64	31.67	23.15
NorthSinai	Nov.	5.05	15.03	10.04	2.20	18.01	10.11
	Dec.	10.01	18.77	14.39	7.01	27.01	17.01
	Jan.	17.22	27.30	22.26	12.01	33.33	22.67
	Feb.	20.31	35.30	27.81	23.50	40.01	31.76
	Mar.	20.31	35.30	27.81	23.50	40.01	31.67
Average		14.58	26.34	20.46	13.64	31.67	22.66
LSD 5%		2.55	4.01	3.07	3.02	2.03	3.02

Table 3. Disease severity of garlic powdery mildew disease at East Delta governorates of Egypt during two successive grown seasons

Governorate	Date	Disease severity (%)			
		First season (2013/2014)		Second season (2014 /2015)	
		Balady	Seds - 40	Balady	Seds -40
Sharkia	Nov.	00.00	00.00	00.00	00.00
	Dec.	00.00	00.00	00.00	00.00
	Jan.	00.00	00.00	00.00	00.00
	Feb.	00.00	2.01	00.00	2.11
	Mar.	00.00	3.03	00.00	5.11
Average		00.00	2.52	00.00	3.61
Ismailia	Nov.	00.00	00.00	00.00	00.00
	Dec.	00.00	00.00	00.00	00.00
	Jan.	00.00	7.13	00.00	5.77
	Feb.	00.00	12.11	00.00	12.77
	Mar.	00.00	22.20	00.00	22.70
Average		00.00	13.81	00.00	13.75
Suez	Nov.	00.00	00.00	00.00	00.00
	Dec.	00.00	00.00	00.00	00.00
	Jan.	00.00	5.12	00.00	6.01
	Feb.	00.00	12.01	00.00	13.01
	Mar.	00.00	17.07	00.00	19.22
Average		00.00	11.40	00.00	12.75
North Sinai	Nov.	00.00	00.00	00.00	00.00
	Dec.	00.00	00.00	00.00	00.00
	Jan.	00.00	12.12	00.00	12.12
	Feb.	00.00	19.80	00.00	18.20
	Mar.	00.00	23.01	00.00	22.20
Average		00.00	18.31	00.00	17.51

**Table 4. Pathogenicity of *P. terrestris*, *S. vesicarium* and *L. taurica* on garlic Seds-40 cv., 90 days after planting**

Isolate source	Pink root infection (%)	Stemphylium blight severity (%)	Powdery mildew severity (%)
Sharkia	23.31	63.11	47.70
Ismailia	70.20	68.22	54.70
Suez	63.51	60.12	50.20
North Sinai	43.80	53.76	59.80
LSD 5%	5.81	2.01	2.33

rot infection, followed by Suez and North Sinai governorates isolates, while those from Sharkia Governorate were the least pathogenic, 90 days after planting under greenhouse conditions. In addition, Ismailia isolate caused the highest Stemphylium blight infection, followed by Sharkia and Suez isolates, while those from North Sinai were the least pathogenic. However, North Sinai isolate caused the highest powdery mildew infection, followed by Ismailia and Suez isolates, while those from Sharkia were the least pathogenic.

It is worthy to mention that, symptoms of pink root on garlic Seds 40 cv., were started to appear 65 days after planting, under greenhouse conditions. In this concern, Thornton and Mohan (1996) found that symptoms of pink root were not usually noticeable during early stage of onion growth when temperature is below optimum for the pathogen growth. These results are confirmed by Shalaby *et al.* (2002). They indicated that *P. terrestris* pink root has been developed under the optimum temperature, 28°C. However, Shalaby (2000) found that, Stemphylium blight severity on garlic Seds-40 cv. leaves was 60.7% and incidence was 37.3%, 80 days after planting. The disease was appeared 40 days after inoculation with the pathogen, under greenhouse conditions. Meanwhile, the disease severity of powdery mildew on garlic Seds-40 cv., was 51.07% and incidence was 60%, 80 days after planting, in field conditions (Shalaby, 2003).

Pathogenicity tests revealed that, isolates caused pink root rot infection on garlic ranged between 23.31- 70.20%, Stemphylium blight severity ranged between 53.76 – 68.22% and powdery mildew severity ranged between 47.70 – 59.80%.

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## حصر لبعض الأمراض الفطرية على نباتات الثوم في محافظات شرق الدلتا بمصر

شَلبي إبراهيم محمد شَلبي - سمير شَلبي - محسن محمدي أمين

معهد بحوث أمراض النباتات - مركز البحوث الزراعية بالجيزة - مصر

أجري هذا البحث بغرض حصر ومعرفة انتشار الأمراض الفطرية المسجلة حديثاً على نباتات الثوم (مرض الجذر القرنفلي ولفحة الاستمفيليوم والبياض الدقيقي) بمحافظات شرق الدلتا في مصر خلال موسمي الزراعة ٢٠١٣/٢٠١٤ و ٢٠١٤ / ٢٠١٥م، وتم إجراء الحصر في ٦٠ حقلاً منزرعة بالثوم وموزعة في ٥٠٠ كم<sup>٢</sup> بمحافظات الشرقية، والإسماعيلية، والسويس، وشمال سيناء، وأوضحت نتائج الحصر أن مرض الجذر القرنفلي المتسبب عن الفطر بيرنيوكيتا ترسترس واسع الانتشار بصنف الثوم سدس ٤٠ بالمقارنة بالصنف البلدي، وأن أعراض المرض تظهر بعد ١٢٠ - ١٣٠ يوماً من الزراعة تحت ظروف الحقل، والمرض واسع الانتشار بمحافظة الإسماعيلية يليها محافظة السويس ثم محافظة شمال سيناء بينما كان المرض أقل إنتشاراً بمحافظة الشرقية، وتبين من نتائج الحصر أن مرض لفة الإستفيليوم المتسببة عن الفطر ستيمفيليوم فيزيكورم تظهر أعراضه المرضية بنسب متباينة علي كلا صنفي الثوم سدس ٤٠، والبلدي، وكان الصنف البلدي أقل إصابة بالمرض بالمقارنة بالصنف سدس ٤٠، وتظهر أعراض المرض بعد ٥٠- ٦٠ يوم من الزراعة علي الأوراق المسنة تحت ظروف الحقل، وأن المرض واسع الانتشار بمحافظات شرق الدلتا حيث كانت محافظة الإسماعيلية أكثر المحافظات انتشاراً للمرض يليها محافظة الشرقية ثم محافظة السويس بينما كان المرض أقل انتشاراً بمحافظة شمال سيناء وأثبتت نتائج الحصر أن مرض البياض الدقيقي المتسبب عن الفطر لافليولا تايوركا واسع الانتشار بصنف الثوم سدس ٤٠ بالمقارنة بالصنف البلدي، وتظهر أعراض المرض بعد ٩٠-١٠٠ يوماً من الزراعة تحت ظروف الحقل، وكان المرض واسع الانتشار بمحافظة شمال سيناء يليها محافظة الإسماعيلية ثم محافظة السويس بينما كان المرض أقل انتشاراً بمحافظة الشرقية، أحدثت كل الفطريات المختبرة إصابات بنباتات الثوم وتراوحت نسبة الإصابة بالجذر القرنفلي ما بين ٢٣,٣١ - ٧٠,٠٢%، ولفحة الاستمفيليوم ما بين ٥٣,٧٦ - ٦٨,٢٢% والبياض الدقيقي ما بين ٤٧,٧٠ - ٥٩,٨٠%.

### المحكمون :

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