

Prevalence and Possibility of Management of Grapevine Root-rot in Minia Governorate, Egypt

Shehata, A.M.; Hussein, N.A.; Abdou, EL-S. and Galal, A.A.

Plant Pathology Department, Faculty of Agriculture, Minia University, Minia, Egypt.

Grapevine root rot prevalence, incidence and severity were varied with plant age and grape variety. Young vineyards (1-3 years old) provided the highest values of prevalence, incidence and severity at Minia governorate, Egypt. Roomy grapevine variety recorded prevalence; incidence and severity values for root rot higher than Superior grapevine variety. Isolates of *Fusarium* sp. were the most frequent fungi associated with rotted grape roots followed by *Rhizoctonia solani* isolates, while other fungi, viz. *Alternaria* sp. *Aspergillus* sp. *Penicillium* sp. *Diplodia* sp. and *Nigrospora* sp. were the least frequent. Among 10 fungal isolates tested, *Fusarium* sp isolate G5 was the most infective followed by *R. solani* isolate G3 and *Fusarium* sp isolate G1. Identification of the most pathogenic isolates was confirmed as *F. solani* isolates G1 and G5 and *R. solani* isolate G3 that were used further.

Varietal response to root rotting fungi was varied with grapevine varieties and fungal isolates. Black desert grapevine variety exhibited resistance against *F. solani* and *R. solani* infection. Two grapevine varieties, Flame seedless and Early sweet reacted as moderately infected. The most susceptible variety was Superior followed by Roomy. A beneficial effect for potassium silicate against fungal growth and root rot infection was pronounced at 2mM.

Keywords: Grapevine, *Vitis vinifera*, Root-rot, *Fusarium solani*, *Rhizoctonia solani* and potassium silicate.

Grapevine (*Vitis vinifera* L.) is the most widely distributed fruit crop in the world. About 25 million feddan are cultivated at temperate to tropical regions for direct eating fresh, food industries for multi-use and medical purposes. In Egypt, grapes are situated in the second position, preceded only by citrus crops. Because of its high net return, its cultivated area increased rapidly and the fruiting area estimated by 1,686,706 hectar, produced 168, 670, 6 tons. Minia governorate occupied the second position after Behera governorate in grapevine cultivations and production with fruiting area of 24,085 feddan with total production of more than 211,719 tons of fruits, *i.e.* about 8.790ton/Feddan (Anonymous, 2015).

Foliar and root-rot diseases that attack grapevine have been studied for more than 170years till now world-wide including Egypt (Pearson and Goheen, 1994; Agrios, 2005; Diez *et al.*, 2008; Eichmann and Huckelhoven, 2008; and Hassan and Galal,

2012). Root-rot diseases of grape vine are continuing problems for growers worldwide and are common and destructive diseases in both nursery and field. Root-rot of grape vine caused by a wide range of pathogens, *Pythium ultimum* in Canada (Utkhede, 1992), *Phytophthora* spp. in Italy (Ciccarese *et al.*, 1992), in Mexico (Ramirez, 1994), and in Australia *Rhizoctonia solani* (Walker, 1994), and in Chile, (Latorre *et al.*, 1997). Grapevine root rots observed in New Zealand included black foot rot (caused by *Cylindrocarpon* spp.), Verticillium wilt (caused by *Verticillium dahlia*), Phytophthora root-rot (caused by various *Phytophthora* spp.) and Armillaria root rot (caused by *Armillaria novae-zelandiae* and *A. limonea*). In Egypt, root rot of grape vine caused by *Fusarium* spp., *Macrophomina phaseolina*, *Rhizoctonia solani*, *Pythium ultimum* and *Botryodiplodia theobromae* particularly in Gharbeia, and Behera governorates (Badaway, 1973; Mourad, 1983; Ziedan, 2003; Ziedan *et al.*, 2005 and Ziedan and EL-Mohamedy, 2008). Grapevine root diseases can cause whole plant loss in vineyards, resulting in additional costs of replacement vines and the management of mixed-age plantings (Jaspers, 2013).

The present study was planned to: 1) survey grapevine root rot in different vineyards of Minia governorate, 2) isolate and identify the microorganisms associated with rotted grapevine roots and calculating their frequencies, 3) run the pathogenicity of the most frequent fungi and 4) conduct management trials.

Materials and Methods

1-Field surveys and fungal isolation:

To assess the severity and distribution of grapevine root rot of 3 various ages viz; 1-3, 4-10 and older than 10 years old, vineyards were surveyed throughout grape growing regions of all districts belong to Minia governorate, Egypt, Abo-Qurqas, Beni-Mazar, Deir-Mawas, El-Edwa, El-Minia, Maghagha, Mallawi, Mattay, Samalott, during 2016. At least 2 vineyards per plant age/district were surveyed. Five sampling sites were designated per vineyards (20 plants/site), one sample site from each corner and one at the center of each vineyard. Samples from the corners were at least five meters away from the edges (Úrbez-Torres *et al.*, 2014).

The disease incidence and severity for each sampling site were assessed (Ziedan, 2003).

2-Disease assessment:

Prevalence percentage of grapevine root rot (RRP) was monitored by using the following equation:

$$\text{Prevalence \%} = (\text{NIV}/\text{TNVV}) \times 100$$

Where NIV=number of infected vineyards, TNVV=total number of visited vineyards.

Root-rot disease incidence percentage (RRI) and disease severity (RRS) after 4 months from the formation of first leaf on plants were assessed (Ziedan, 2003) on shoot system as follows: 0= healthy, 1= yellowish +1/3 plant wilted, 2 =2/3 plant wilted, 3=whole plant wilted and 4=plants dead showed severe wilt.

$$\text{Disease incidence} = \frac{\text{No of inf. plants}}{\text{Total of plants}} \times 100$$

Disease severity was determined to the following equation:

$$\text{DSI} = \frac{\sum D}{D \text{ max} \times n} \times 100$$

Where D is the disease index on each plant, d max is the maximum disease index possible and n is the total number of plants examined in each replicate.

3- Isolation of associated fungi with rotted grapevine roots:

Different samples representing grape rotted roots were collected from only young plant, 1-3 years old of two varieties Roomy and Superior from different regions at Minia governorate. One hundred pieces of infected tissues of roots were first surface sterilized by submerging them in 0.5% sodium hypochlorite for 5 min and washed twice with sterile distilled water. After air-drying, sampled roots were inspected for presence of discolored or die back root (Walker, 1992). Fungi from roots were isolated as stated by Petit and Gubler, (2005). Small pieces (5mm) of symptomatic root tissues were incubated on potato dextrose agar (PDA) in plates at 20°C, for 5 to 7 days until fungal colonies were observed. Fungal colonies were individually transferred to fresh PDA. After wards, pure cultures were obtained by hypha tipping from colony margins and by placing them again on fresh PDA plates and incubated at 20°C.

4- Identification and frequency of microorganisms associated fungi with rotted grapevine roots:

Pure culture colonies were used to conduct a preliminary morphological identification of the different fungi isolated from symptomatic grapevine root tissues. The established fungal isolates were identified on the basis of culture morphology and microscopic characteristics according to Gilman, (1957); Barnett and Hunter, (1972); Nelson *et al.* (1983); Booth (1995) and frequency of fungi associated with rotted roots was detected as percentage.

5-Pathogenicity tests:

Unless otherwise stated, grapevine cuttings used throughout this study were taken from healthy apparent shoots for the previous growing season, uniformed length, thick and number of buds (5 buds/ each). Cuttings were upside down embedded in a moist soil for 40 days before planting. After that, cuttings with 2 buds were planted sub ground and those of transplanted 3 buds were up ground.

Ten fungal isolates were selected from the most frequent, i.e. *Fusarium* isolates; G1, G5, G6, G9 and G10, *Rhizoctonia* isolates; G3, G7 and G8, *Alternaria* isolate;

G2 and *Aspergillus* isolate; G4. The selected isolates were tested for their pathogenicity to grapevine Superior variety. The pot experiment was carried out at Plant Pathology Department, Faculty of Agriculture, Minia University, Egypt. Fungal inocula were prepared on sterilized sand barely medium (60 gm barley grains, 40 gm water washed sand and 50 ml distilled water). The inoculated media were left for 20 days at $25\pm 1^\circ\text{C}$. Plastic pots 25 cm-diameter containing sterilized soil were singly infested with each fungal inoculum at the rate of 2.5% (w/w). Five pots were used as replicate and 3 replicates for each isolate. Two grapevine cuttings of variety, Superior were planted in each pot (30 cuttings per treatment). All agriculture practices were conducted similarly as recommended to Ministry of Agriculture, Egypt: Either RRI and RRS caused by each tested isolate were recorded, four months after planting. Re-isolation was carried out from the artificially diseased plants to fulfill Koch's postulations and the developed fungi were confirmed with the original isolates.

The most frequent and virulent isolates (2 *Fusarium* isolates G1 and G5 and one *Rhizoctonia* isolate G3) were further verified at Assiut University Mycological Center (AUMC) under code No. (13886 G1) and code No. (13888 G5) that was confirmed *Fusarium solani* while isolate code NO. (13887 G3) was *Rhizoctonia solani*.

6-Varietal response:

The response of 5 grapevine varieties; Black Desert, Early Sweet, Flame seedless, Roomy and Superior, were tested against the most virulent isolates of *Fusarium solani* (G1 and G5) and *Rhizoctonia solani* (G3). The experiment was conducted in pots during 2018 season. Inocula, inoculation, disease incidence and disease severity were conducted as described before.

7-Effect of potassium silicate on grapevine root-rot infection:

Pot experiment was carried out during 2018 season to test two concentrations of K_2SiO_3 (1.0 mM and 2.0 mM) on the incidence of grapevine root rot. Soil infestation by the individual tested fungal isolates, *F. solani* G1 and G5, and *R. solani* G3 and planting Superior grapevine cuttings were essentially conducted similarly as described under pathogenicity tests. One month later, pots of inoculated or non-inoculated cuttings were received the tested solution of K_2SiO_3 (0.0, 1.0 and 2.0mM concentrations singly). Three months after treatment RRI and RRS were estimated as described before.

8-Statistical analysis:

Statistical analyses of all the previously designed experiments were carried out according to (ANOVA) procedures reported by Gomez and Gomez (1994), treatment means were compared by the least significant difference test (LSD) at 5% level of probability.

Results

1-Field survey:

During 2016 season, survey data (Table1) show various grapevine root rot prevalence (RRP), incidence (RRI) and severity (RRS) depending on viticulture grapevine varieties and plant age. Grapevine Roomy variety Showed greater values of RRP (38.3%), RRI (12.6%) and RRS (8%) as compared to grapevine Superior variety, being RRP 21.6, RRI 8.3 and RRS 4.6%, respectively. Young plants (1-3 years old) recorded the highest values of all patho-metery characters, viz RRP 65, RRI 23 and RRS 9%, for Roomy var., while Superior variety gave RRP 45.8, RRI 15, and RRS 7%, respectively, followed by medium age plants (4-10 years old) of Roomy var, which provided RRP 32%, RRI 10% and RRS 4%, but in case of Superior var. these values were RRP 13.6, RRI7 and RRS 5%. The least values of disease prevalence were pronounced by older viticulture that gave RRP 18.1 %, RRI 5% and RRS 3%, in case of Roomy var. but in Superior var. these values were 7% for RRP, 3% for RRI and 2% for RRS on the average, respectively.

Table (1): Prevalence, disease incidence and disease severity of grapevine root rot in three different plant ages of two grapevine varieties (Superior and Roomy), grown in Minia governorate during 2016.

Plant age (years)	Varieties	No. of inspected vineyards	No. of Infected vineyards	Prevalence of root rot %	Root rot incidence %	Root rot severity %
Young (1-3)	Roomy	23	15	65.2	23	9
	Superior	24	11	45.8	15	7
Medium (4-10)	Roomy	25	8	32.0	10	4
	Superior	22	3	13.6	7	5
Old (>10)	Roomy	22	4	18.1	5	3
	Superior	28	2	7.3	3	2
Average	Roomy	23.3	9	38.3	12.6	8
	Superior	24.6	5.3	21.6	8.3	4.6

2-Frequency of fungi associated with rotted grapevine roots:

Seven fungal species, i.e. *Alternaria* sp, *Aspergillus* sp, *Penicillium* sp, *Diplodia* sp, *Fusarium* sp, *Nigrospora* sp and *Rhizoctonia solani*, were found to be associated with rotted grapevine roots of Roomy and Superior varieties. Frequency of identified fungi associated with rotted grapevine roots (Table 2) indicate that *Fusarium solani* isolates were the most dominant (51.1%) followed by *Rhizoctonia solani* (24%) while other fungi, viz *Alternaria* sp, *Aspergillus* sp, *Penicillium* sp, *Diplodia seriata*, and *Nigrospora* sp, gave low frequency, being 3.5, 6.0, 4.5, 5.0 and 5.5 %, respectively. Frequency of fungi associated with rotted grapevine Roomy var. roots was merely to Superior grapevine variety.

Table (2): Frequency of identified fungi associated with rotted roots of grapevine Roomy and Superior varieties grown under Minia conditions during 2016.

Fungi	Frequency to the grapevine varieties %		Mean
	Superior	Roomy	
<i>Alternaria</i> sp.	4	3	3.5
<i>Aspergillus</i> sp.	5	7	6.0
<i>Penicillium</i> sp.	5	4	4.5
<i>Diplodia</i> sp.	6	4	5.0
<i>Fusarium solani</i>	53	50	51.5
<i>Nigrospora</i> sp.	5	6	5.5
<i>Rhizoctonia solani</i>	22	26	24.0
Total	100	100	100

3- Pathogenicity tests:

Ten fungal isolates were tested for their capabilities to induce root rot to grapevine Superior variety (Table 3). *Fusarium solani* isolate G5 exhibited the highest 86.7% RRI and 45% RRS followed by *Rhizoctonia solani* isolate G3 that incited 66.7% RRI and 38% RRS and *Fusarium solani* isolate G1 that caused 43.3% RRI and 28.9% RRS. Other *F. solani* and *R. solani* isolates caused moderate RRI and RRS, being 29.6 - 40.4% RRI and 16.5 - 26.6% RRS. *Alternaria* sp. isolate G2 and *Aspergillus* sp. isolate G4 were weakly reacted to cause root rot, less than 5.0 % RRI and RRS.

Table (3): Root rot incidence (RRI) and root rot severity (RRS) of grapevine variety Superior caused by artificial inoculation with most frequent fungi.

Fungal Isolates	Pathogenicity test expressed as	
	Disease Incidence %	Disease Severity %
<i>Alternaria</i> sp G2	3.3	2.2
<i>Aspergillus niger</i> G4	3.9	2.5
<i>Fusarium solani</i> G1	43.3	28.91
<i>Fusarium solani</i> G5	86.7	45.0
<i>Fusarium solani</i> G6	38	24.5
<i>Fusarium solani</i> G9	35.4	26.6
<i>Fusarium solani</i> G10	29.6	16.5
<i>Rhizoctonia solani</i> G3	66.4	38.0
<i>Rhizoctonia solani</i> G7	38.8	24.7
<i>Rhizoctonia solani</i> G8	40.4	21.3
Control	0	0
L.S.D.at 0.05=	12.83	6.4

4- Varietal response:

Data summarized in Table (4) show significant variance of grapevine variety to infection by the tested fungi. Superior grapevine variety expressed the most susceptible, as RRI was 50.9% and RRS was 30.7%, followed by Roomy variety (23.5% and 14.9, RRI and RRS, respectively) Early sweet (17.8% RRI), Flame seedless RRI (16.8%), whereas Black desert grapevine variety exhibited the least mortal plants (11.9% and 8.2 for RRI and RRS, respectively). *Fusarium solani* isolate G5 incited the highest mortality to all grapevine varieties tested followed by *Rhizoctonia solani* isolate G3 and *Fusarium solani* isolate G1.

Table (4): Response of various grapevine varieties to infection by *Fusarium solani* isolates (G1 and G5) and *Rhizoctonia solani* isolate (G3).

Grapevine Varieties	Root rot Incidence (RRI) caused by					Root rot Severity (RRS) caused by				
	Control	<i>F. solani</i> G1	<i>R. solani</i> G3	<i>F. solani</i> G5	Mean	Control	<i>F. solani</i> G1	<i>R. solani</i> G3	<i>F. solani</i> G5	Mean
Black Desert	0	11.7	13.2	22.8	11.9	0.0	9.0	6.7	17.3	8.2
Early Sweet	0	22.2	26.4	22.6	17.8	0.0	13.3	23.4	16.7	13.3
Flame seedless	0	16.2	26.3	24.9	16.8	0.0	6.7	18.5	20.1	11.3
Roomy	0	25.2	32.2	36.7	23.5	0.0	10.0	26.6	23.3	14.9
Superior	0	44.4	75.6	83.9	50.9	0.0	36.7	38	48.3	30.7
Mean	0	23.9	34.7	38.1	24.1	0.0	15.1	22.5	25.1	15.6
L.S.D.at0.05 for:										
Fungi (A) =			2.8					2.52		
Varieties (B) =			2.12					1.89		
A×B =			8.48					7.55		

5- Effect of potassium silicate on grapevine root rot infection:

Potassium silicate amendment to soil at 0.2 mM significantly reduced grapevine root rot (Table 5). Using 2.0mM potassium silicate caused the highest reduction in the values of RRI and RRS. The highest protection was explored by 2Mm potassium silicate against *F. solani* isolate G5 (40.3%) followed by isolate G3 of *R. solani* (31.1%) and *F. solani* isolate G1 (27.2%), respectively.

Table (5): Effect of soil application with potassium silicate on root rot incidence and root rot severity in grapevine Superior variety grown in infested soil by the tested fungi.

Fungi	Disease Incidence				Disease Severity				Protection %
	0.0	1mM/L	2mM/L	Mean	0.0	1mM/L	2mM/L	Mean	
<i>F. solani</i> G1	40.5	26	20	28.8	25	17.5	12.3	18.2	27.2
<i>R. solani</i> G3	55	22.3	18.2	31.8	30.2	18.9	13.5	20.8	31.1
<i>F. solani</i> G5	83.3	33.3	23.3	46.8	55	27.8	15.8	32.8	40.3
Control	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Mean	59.6	27.2	20.5	35.8	36.7	21.4	13.8	23.9	
L.S.D.at 0.05 for:									
fungi (A) =				2.28					1.65
compounds (B) =				1.71					1.42
A×B =				6.84					4.68

Discussion

To achieve a successful integrated disease management program for any plant disease, several steps are needed. The first step began from the definition of the problematic diseases through making a survey for such diseases by monitoring their prevalence, disease incidence and severity (Abdou *et al.*, 2001, Hassan and Galal, 2012 and Abdullah *et al.*, 2015). The survey data indicated that areas cultivated with grapevine throughout Minia districts suffer from root rot diseases and root rot prevalence was varied with grape variety and age of plants. Young plants (1-3 years old) viticulture were the most affected than medium and older ones and Roomy var. grapes was the most affected than Superior var. As for root rot incidence and root rot severity, a survey, results of survey revealed the highest root rot incidence and root rot severity values were associated with young grape plants (1-3 years old vineyards) while, older plants showed lowest values. Due to the available literature, this study is the first report concerning Minia governorate, however, Hassan and Galal (2012) surveyed foliar and root rot diseases affecting vineyards growing in Minia governorate.

For integration survey studies, frequency of microorganisms associated with rotted grape roots was subsequently conducted. Seven fungal species, i.e. *Alternaria* sp, *Aspergillus* sp, *Penicillium* sp, *Diplodia* sp, *Fusarium* sp, *Nigrospora* sp and *Rhizoctonia solani*, were found to be associated with rotted grapevine roots of Roomy and Superior varieties. The present study provided that *Fusarium solani* isolates showed the highest frequency (51.15%) followed by *Rhizoctonia solani* (24%) while other fungal species were less than 5% for each. Data indicated that the

two pathogenic fungi, *Fusarium solani* and *Rhizoctonia solani* generally were associated with rotted roots of grapes, this was in accordance with Walker (1994) and Zidean *et al.*, 2011).

The ability of the isolated fungi to cause rot in grape roots revealed significant variation between fungal isolates tested. Isolates belong to *Fusarium solani* and *Rhizoctonia solani* showed a substantial RRI and RRS. Isolate G5 of *Fusarium solani* provided the highest RRI and RRS followed by isolate G3 *Rhizoctonia solani* and G1 of *F. solani*. Other *F. solani* and *R. solani* isolates expressed moderate infection effects. Otherwise, *Alternaria* sp. and *Aspergillus* sp. isolates tested reacted as weak pathogens that caused the lowest RRI and RRS which were not more than 5.0%. Data showed that virulence of fungal isolates varied according to the variety tested and its age (Henis, 1970; Bumbieris, 1972 and Walker, 1992).

Identification of the most pathogenic 3 isolates was confirmed as *F. solani* isolates (G1 and G5) and *R. solani* (isolate G3). Thus these pathogenic isolates were only used further. *Fusarium solani* was reported as rot causal fungus to grape root (Zidean, 2005 and Zidean and EL-Mohamedy, 2008). The same assume was assured with *R. solani* (Walker, 1992; Walker, 1994 and Sandres *et al.*, 1978). The present work explored that response of grapevine plants to root rot pathogens was significantly varied with isolates of fungi and varieties of grapevine tested. It's very important to choose cultivars with multiple pathogen resistance whenever possible, practical control of many diseases of plants (*Fusarium* wilt, *Verticillium* wilt, and gray leaf spot for tomato). Superior grapevine variety reacted as the most susceptible variety to all pathogenic isolates tested followed by Roomy variety, whereas Black Desert grapevine variety reacted as a resistant variety to all tested root rotting isolates, However, such resistant variety could be recommended to use as rootstock Flame and Early sweet were moderately infected. Data indicated that virulence of root rotting fungi varied depending on varietal response These results are in agreements with those reported by several investigators (Baumgartner and Rizzo, 2001; Baumgartner and Rizzo, 2002 and Baumgartner and Rizzo, 2006).

Silicon (Si) is a bioactive element associated with beneficial effects on mechanical and physiological properties of plants. Several studies have suggested that Si activates plant defense mechanisms, yet the exact nature of the interaction between the element and biochemical pathways leading to resistance remains unclear. It can act as a modulator influencing the timing and extent of plant defense responses in a manner reminiscent of the role of secondary messengers in induced systemic resistance; it can also bind to hydroxyl groups of proteins strategically involved in signal transduction; or it can interfere with cationic co-factors of enzymes influencing pathogenesis-related events. (Belanger *et al.*, 2003; Rodrigues *et al.*, 2003; Fauteux *et al.*, 2005 and Cruz *et al.*, 2013). The current study expressed a beneficial effect for potassium silicate against the infectivity of grapevine root rot pathogens. Soil amendment with potassium silicate caused the highest protection (40.3%) against *F. solani* isolate G5 followed by *R. solani* isolate G3 (31.1%) and *F.*

Egypt. J. Phytopathol., Vol. 47, No. 1 (2019)

solani isolate G1 (27.2%). Data are consistent with the effect of potassium silicate on several plant pathogens interactions (Cai *et al.*, 2008; Dallagno *et al.*, 2009; Epstein, 2009 and Guntzer *et al.*, 2012).

References

- Abdou, EL-S.; Abd-Alla, H.M.; and Galal, A.A. 2001. Survey of sesame root rot/wilt disease in Minia and their possible control by ascorpic and salicylic acids. *Assiut J. Agricultural Sci.*, **32**(3):135-152.
- Abdullah, S.K.; AL-Samarraie, M.Q. and AL-Assie, A.H. 2015. Fungi associated with grapevine (*Vitis vinifera* L) decline in middle of Iraq. *Egypt. Acad. J. Biol. Sci.*, **7**(1):53-59.
- Agrios, G.N. 2005. Plant Pathology. 5th Ed., Elsevier Academic Press, Pp1451.
- Anonymous, 2015. Annual Reports of Statistical Institute and Agriculture Economies Research in A.R.E. Agric. and Land Reclamation Ministry (2015).
- Badaway, M.F. 1973. Studies on the decayed grape cutting in nursery in Egypt .M.Sc. Thesis Fac. Agric, AL-Azhar. Univ. Egypt, pp 180.
- Barnett, H.L. and Hunter, B.B. 1972. Illustrated Genera of Imperfect Fungi. 3rd Edition, Burgess Publishing Co., Minneapolis, Pp 1-241.
- Baumgartner, K. and Rizzo, D.M. 2001. Ecology of *Armillaria* species in mixed-hardwood forests of California. *Plant Disease*, **85**:947-951.
- Baumgartner, K. and Rizzo, D.M. 2002. Spread of *Armillaria* root disease in California vineyards. *Am. J. Vitic.*, **53**:197-203.
- Baumgartner, K. and Rizzo, D.M. 2006. Relative resistance of grapevine rootstocks to *Armillaria* root disease. *Am. J. Enol. Vitic.*, **57**: 408-414.
- Belanger, R.R.; Benhamou, N. and Menzies, J.G. 2003. Cytological evidence of an active role of silicon in wheat resistance to powdery mildew (*Blumeria graminis* fsp. *tritici*). *Phytopathology*, **93**:402-412.
- Booth, C., 1995. Fusarium: Laboratory Guide to the Identification of the Major Species. The Common Wealth Mycological Institute, Kew, Pp1-237.
- Bumbieris, M. 1972. Observations on some pythiaceous fungi associated with grapevine decline in South Australia. *Australian J. Agric. Res.*, **23**: 651-657.
- Cai, K.Z.; Gao, D.; Luo, S.M.; Zeng, R.S.; Yang, J.Y. and Zhu, X.Y. 2008. Cytological mechanisms of silicon-induced resistance in rice against blast disease. *Physiol. Plant.* **134**: 324-333.
- Ciccarese, F.; Frisullo, S. and Amenduni, M. 1992. Observations of foot rots of Actinidia in southern Italy. *Informatore Fitopatologico*, **42**(2):57-58.
- Cruz, M.F.; Rodrigues, F.A.; Diniz, A.P.C.; Moreira, M.A. and Barros, E.G. 2013. Potassium silicate and calcium silicate on the resistance of soybean to *Phakopsora pachyrhizi* infection. *Bragantia Campinas*, **4**: 373-377.
- Egypt. J. Phytopathol.*, Vol. **47**, No. 1 (2019)

- Dallagnol, L.J.; Rodrigues, F.A.; Mielli, M.V.B.; Ma, J.F. and Datnoff, L.E. 2009. Defective active silicon uptake affects some components of rice resistance to brown spot. *Phytopathology*, **99**: 116-21.
- Diez, N.A.M.; Wiedemann, M.S.; Greif, C. and Merdinoglu, D. 2008. Non host versus host resistance to the grapevine downy mildew, *Plasmopara viticola*, studied at tissue level. *Phytopathology*, **98**: 776-780.
- Eichmann, R. and Huckelhoven, R. 2008. Accommodation of powdery mildew fungi in intact plant cells. *J. Plant Physiol.*, **165**: 5-18.
- Epstein, E. 2009. Silicon its manifold roles in plants. *Ann. Appl. Biol.*, **155**: 155-160.
- Fauteux, F.; Remus-Borel, W.; Menzies, J.G. and Belanger, R.R. 2005. Silicon and plant disease resistance against pathogenic fungi. *FEMS Microbiology letters*, **249**:1-6.
- Gilman, J.C. 1957. A Manual of Soil Fungi (2nd ed.) The Iowa State Univ. Press. Ames, Iowa, Pp1-450.
- Gomez, K.A. and Gomez, A.A. 1994. Statistical Procedures in Agricultural Research, by New York, Chichester, etc.: Willy, 2nd ed., Paperback, PP. 1-680.
- Guntzer, F.; Keller, C. and Meunier, J.D. 2012. Benefits of plant silicon for crops, *Agron. Sustain. Dev.*, **32**: 201-213.
- Hassan, H.M.M. and Galal A.A. 2012. Diseases affecting foliars and fruits of grapevine under filed conditions of Minia governorate. *Minia J. Agric. Res. & Develop.*, **32**(1): 65-82.
- Henis, Y. 1970. Significance of population level of *Rhizoctonia solani* in soil. In Root Diseases and Soil Borne Pathogens. (EdsT. A. Toussoun, R.V. Bega and P.E. Nelson), pp.34-36.
- Jaspers, M.V. 2013. Black foot in vineyards. New Zealand Wine growers Fact Sheet N ZTD 102. <http://www.nzwine.com/assets/sm/upload/zp/51/nm/g8/NZTD10>.
- Latorre, B.A.; Wicox, W.F. and Banados, M.P. 1997. Crown and root-rot of table grapes caused by *Phytophthora* spp. in Chile. *Vitis.*, **36** :195-197.
- Mourad, M.Y. 1983. Studies on root-rot disease of grape in Egypt and its control. Ph.D. Thesis, Fac. Agric., Cairo Univ., Egypt, Pp162.
- Nelson, P.E.; Toussun, T.A. and Marasas, W.F.O. 1983. *Fusarium* spp. An Illustrated Manual for Identification. Univ. Park: The Pennsylvania State Univ. Press. Pp 1-189.
- Pearson ,C.R. and Goheen, A.C. 1994. Compendium of grape diseases. APS Press. Pp94.
- Petit, E. and Gubler, W.D. 2005. Characterization of *Cylindrocarpon* species, the cause of black foot disease of grapevines in California. *Plant Disease*, **89**: 1051-1059.

- Ramirez, J.A. 1994. Diseases caused by fungi on fruit trees in the Hermosillo Coast, Mexico. *Revista-Mexicana-disease Fitopatologia*, **12**: 183-188.
- Rodrigues, F.A.; Benhamou, N.; Datnoff, L.E.; Jones, J.B. and Belanger, R.R. 2003. Ultrastructural and cytochemical aspects of silicon-mediated rice blast resistance. *Phytopathology*, **93**: 535-546.
- Sanders, P.L.; Burpee, L.L. and Cole, H. 1978. Preliminary studies on binucleate turf grass pathogens that resemble *Rhizoctonia solani*. *Phytopathology*, **68**: 145-148.
- Úrbez-Torres, J.R.; Haag, P.; Bowen, P. and O’Gorman, D.T. 2014. Grapevine trunk diseases in British Columbia: Incidence and characterization of the fungal pathogens associated with black foot disease of grapevine. *Plant Disease*, **98**: 456-468.
- Utkhede, R.S. 1992. Biological control of soil-borne pathogenic of fruit trees and grapevines. *Can. J. Plant Pathol.*, **14**(1): 100-105.
- Walker, G.E. 1992. Root rot of grapevine root lings in South Australia caused by *Rhizoctonia solani*. South Australian Department of Agriculture, Loxton, South Australia 5333. *Australasian Plant Pathology*, **21**: 58-60.
- Walker, G.E.; 1994. Growth of grapevine rootling in soil from a field nursery naturally infested with *Meloidogyne incognita* and *Rhizoctonia solani*. *South African J. Ecology and Viticulture*, **15**(2): 26-32.
- Ziedan, E.H.; Embaby, E.M. and Farrag, E.S. 2011. First record of Fusarium vascular wilt on grapevine in Egypt. *Archives of Phytopathology and Plant Protection*, **44**: 1719-1727.
- Ziedan, E.H. 2003. Root-rot diseases of grapevine in Egypt. *J. Agric. Sci. Mansoura Univ.*, **28**(2): 147-1481.
- Ziedan, E.H. and EL-Mohamedy, R.S. 2008. Application of *Pseudomonas fluorescens* for controlling root-rot disease of grapevine. *Res. J. Agric. and Biol. Sci.*, **4**(5): 346-353.
- Ziedan, E.H.; Saad, M.M. and Farrag E.S., 2005. Biological control of grapevine root-rot by antagonistic microorganisms. *African Mycology and Biotech.*, **13**(3): 19-36.

Corresponding author: Galal, A.A.

E-mail: anwar_galal@yahoo.com

(Received 07/04/2019;
in revised form 21/04/2019)

تواجد وإمكانية مكافحة أمراض عفن جذور العنب بمحافظة المنيا – مصر

أسماء محمد شحاته، ونور الهدى أحمد حسين، والسيد عبده السيد، و
انور عبد العزيز جلال

قسم أمراض النبات، كلية الزراعة، جامعة المنيا، المنيا، مصر

اختلفت نسب تواجد أمراض عفن جذور العنب في محافظة المنيا – مصر باختلاف عمر النبات والصنف المختبر. سجلت زراعات العنب الصغيرة (عمر ١-٣ سنوات) أعلى نسب تواجد ونسب إصابة وشدة إصابة كما أظهر صنف العنب الرومي أعلى قيم تواجد وإصابة وشدة إصابة مقارنة بصنف العنب السويبيور. تبين أن عزلات *Fusarium sp* أعلى نسب تكرار (٥١%) تلاها عزلات *Rhizoctonia solani* (٢٤%) وتوجد عزلات أخرى تابعة لخمسة أجناس *Alternaria sp*, *Aspergillus sp*, *Penicillium sp*, *Diplodia sp* and *Nigrospor sp*. ولكن نسب تكرارها أقل من ٥% كما أظهرت عزلات فطر *Fusarium sp* عزلة ١ و ٥ والعزلة الثالثة من فطر *Rhizoctonia solani* أكثر قدرة مرضية. كما اختلفت أصناف العنب في الإصابة بعفن الجذور ولأن صنف العنب بلاك ديزيرت مقاوم للإصابة بالعزلات الممرضة السابق ذكرها وصنفي الفيليم وإيرلي سويت كانتا درجة متوسطة القابلية للإصابة بالعزلات، أما صنف السويبيور أظهر أعلى قابلية للإصابة و بينت المعاملة بسليكات البوتاسيوم تركيز ٢ mm تأثير فعال في خفض الإصابة بمرض عفن جذور العنب.