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Fusarium Wilt of Sweet Potato Caused by *Fusarium oxysporum f. sp. batatas* in Egypt

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Fusarium wilt in sweet potato was first observed in Middle Egypt governorates, *i.e.,* Beni Sweif and Minia, between early April to September 2016. Disease symptoms started as a stunted growth, yellowing and wilting of the leaves, browning and discolouration of the xylem vessels. Koch's postulates were fulfilled and all *Fusarium oxysporum* isolates tested were able to infect sweet potato plants causing typical wilt symptoms. Prevalence, incidence and severity of sweet potato wilt (SPW) were varied with districts examined. Fungi belonging to five genera*e.g., Alternaria, Ceratocystis, Fusarium, Macrophomina* and *Rhizoctonia* were found to be associated with wilted sweet potato plants. *Fusarium* spp recorded the highest frequency (80.6%) and *Fusarium oxysporum* showed 51.5%. frequency. Sweet potato genotypes were varied in their response to infection by *Fusarium oxysporum* isolate F1. Genotypes Menoufia 6 and Menoufia 2 reacted as resistant, while Local A and Line 26 were highly susceptible. *Fusarium oxysporum* f.sp. *batatas* isolate F1 was infective to convolvulaceous plants such as Cairo morning glory and field bindweed but was not pathogenic to non convolvulaceous plants such as alfalfa, carrot, cotton, potato, sugar beet, sugarcane, turnip and wheat. Chlorophyll degradation was ralated to sweet potato genotypes reaction towards *Fusarium oxysporum* f.sp. *batatas* infection. Least degradation values were found in resistant genotypes and vice versa exhibited by susceptible genotypes. In contrast, phenols were enhanced when *Fusarium oxysporum* f.sp. *batatas* infected the resistant genotypes and decreased in the susceptible genotypes compared with uninfected.

Keywords: *Chlorophyll a; b, Fusarium oxysporum f.sp. batatas, host range, phenols, sweet potato genotypes, sweet potato wilt.*

Sweet potato, *Ipomoea batatas* L., family: Convolvulaceae is the world`s seventh most important food crop after wheat, rice, maize, potato, barley and cassava (Anon., 2008). The tuber is large, starchy, highly nutritious and widely consumed in human diet due to its good taste (Anon., 2009 and Nur Aida *et al*., 2017). It`s an important secondary crop that plays an important role in house hold food security in many countries (Muuura *et al*., 1992; Ray *et al*., 2010 and Tomlins *et al*., 2010).

Fusarium oxysporum is well represented among the communities of soil borne fungi, in every type of soil all over the world (Burgess, 1981). All strains of *F. oxysporum* are saprophytic and able to grow and survive for long periods on organic matter in soil and in the rhizosphere of many plant species (Garrett, 1970 and Fravel *et al*., 2003). In some cases, infected plants may survive and produce storage roots that are infected. If such tubers are used as seed tubers, they can transmit the fungus to the fresh sprouts which may will in plant beds. Sweet potato plants that show wilting, leaf yellowing and browning of vascular tissues in the lower stem are common in most production areas of Egypt. The disease is caused by *Fusarium oxysporum f. sp. batatas* (Holliday, 1970 and Hegda *et al*., 2012). The fungus produces a white aerial mycelium and purple pigment characteristic of the species. Erect, hyaline conidiophores are formed successively producing conidia which accumulate into groups. It produces microconidia, macroconidia and chalmydospores forming bud cells in liquid medium (Brayford, 1992 and Clerk and Moyer, 1988). Yield losses may be up to 50 percent and are more likely under warm weather and in dry soils. Plants normally die within a few days after visible symptoms appear on the plant (Gunua, 2010; Okungbowa and Shittu, 2012).

The present study aimed to 1) survey sweet potato wilt, 2) determine the frequency of microorganisums associated with wilted sweet potato, 3) test the pathogenicity of Fusarium isolates, 4) detect the host range of *Fusarium oxysporum* f. sp. *batatas* and 5) chemical analysis of chlorophyll a and b and phenols in infected sweet potato plants.

Materials and Methods

Survey of sweet potato wilt:

The disease survey, prevalence, incidence and severity were conducted on sweet potato plantations of 2 Middle Egypt governorates (Beni Sweif and Minia). Seventy two sweet potato fields (32 in 2016 and 40 in 2017) represnting the major production areas were sampled. Samples were collected during the period from April to September of 2016 and 2017 growing seasons.

Sweet potato wilt assessment:

The disease assessment methods were chosen according to Nutter et al. (2006) and Madden *et al*. (2008). Disease prevalence, incidence and severity were used to determine disease distribution and disease intensity of sweet potato wilt. Disease prevalence (SPDP) is the percentage of the infected fields over the sampled (*Fig*. 1) fields. Disease incidence (SPDI) is the percentage of the symptomatic plants over assessed plants per field. The average SPDI was obtained by summing the SPDI values for each field divided by the number of fields surveyed expressed as a percentage. Disease severity (SPDS) is the level of disease per infected plant as determined using disease rating scales, divided by the number of plants sampled per field (Thompson *et al*., 2011). The average SPDS was obtained by summing the SPDS values for each field divided by the number of fields surveyed multiplied by the maximum disease index rating to convert ordinal class values to a percentage scale (Madden *et al*., 2008). Disease rating scale is summarized in Table 1 as described by Thompson *et al*. (2011).

Isolation and identification of sweet potato wilt associated fungi:

The study was conducted in the laboratories and greenhouse o Sids Agricultural Research Station. Sweet potato plants cv. Abees showing symptoms of wilt were selected from five different fields. The lower stem pieces showing vascular browning were surface sterilized for 5 min in 0.1% sodium hypochlorite, thoroughly washed by sterile distilled water and air dried in a laminar flow bench. A stem was aseptically split longitudinally, and four separate segments were put onto potato dextrose agar (PDA) in petri plates amended with 0.4% streptomycin asulfate. Fifty segments were made from fifty stem and or tuber pieces (1per stem piece). Plates were incubated at 25 ± 2°C for 7-10 days. A representative, single spore isolate was made from infected stems assessed from each field, using the method of Leslie and Summerell (2006). The fungal colonies were purified using single spore or hyphal tip techniques suggested by Booth (1985) and Dhingra and Sinclair (1985) and then identified according to their morphological and microscopical characters as described by Booth (1985) and Barnett and Hunter (1986). The obtained isolates were maintained on PDA slants and kept in refrigerator at 5°C for further study.

Table 1: Disease rating scales for sweet potato wilt

Disease scale	Stem/ tuber root symptoms	Leaf symptoms
0	-No discoloration present in lower stem	-No yellowing
1	-Reddish/dark brown stem discoloration present	-Yellowing of leaf with associated necrosis
2	-Stem decay present; plant stunted and slight browning.	-Leaf with severe necrotic areas
3	-Dead plant and dark browning of tuber root	-Dead leaf

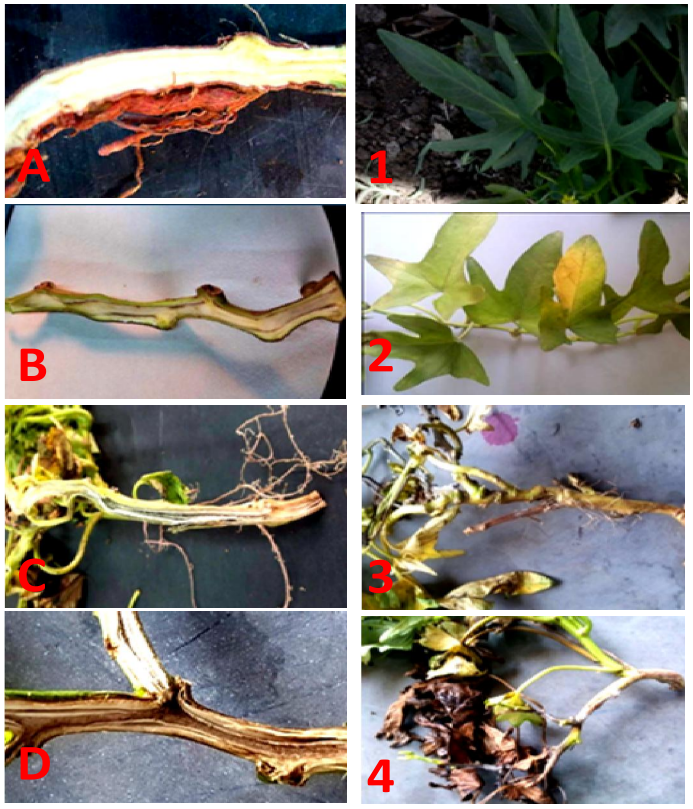

***Fig.* 1. (I): Scales of Stem Discoloration Index (SDI). A-no discoloration; B- a partial discoloration of stem vascular; C- a complete discoloration; and D- xylem completely discolored and the plant is dead. (II): Scales of Leaf Symptom Index (LSI). 1- no yellowing of leaves (plant appears healthy); 2- slight yellowing of lower leaves; 3- extensive yellowing on most or all of the leaves and 4- most of the leaves are dead.**

Pathogenicity test:

Seven fungal isolates of *Fusarium oxysporum* were selected and their identification was confirmed by Assiut University Mycological Centre (AUMC), Assiut University, Assiut, Egypt. The cultures were maintained on potato-dextrose agar (PDA) in an incubator at 24 °C and 12 hr of fluorescent light (500 ft-c) per day. The cultures were transferred frequently by the single spore technique. Conidial suspensions used for inoculum were obtained from 3- to 4- week–old cultures, filtrated through four sterile layers of cheese cloth and washed three times by centrifugation at ca. 3000 rpm per 5 min. The concentration of washed conidial suspensions was determined by hemocytometer count. Unless otherwise stated, the

inoculum conceration used was 2 x104 conidia/ml. Pots were infested by inocula at the rate 200 ml/pot, 3 kg soil (Abawi and Lorbeer, 1972; Alon *et al*., 1973).
Transplants of sweet potato cultivar Abees were transplanted in pots 25 cm diameter that previously infested with the fungal isolates as described before. Transplants were irrigated directly and subsequently when necessary as recommended. Five pots were used as replicates, 3 plant/pot for each treatment were used. Plants were observed daily and disease assessment was recorded through 2 months.

Host range of the pathogen:

Ten plant species *e.g.*, alfalfa, carrot, cotton, Cairo morning glory, field bindweed, potato, sugarbeet, sugarcane, turnip and wheat were tested. Seeds were surface sterilized and sown in artificially infested soil with sweet potato fungal isolate F1 that was the highest pathogenic to sweet potato in pathogenicity tests. Check treatments were used but without soil infestation. Plants were observed daily for development of disease symptoms. Data were recorded after 60 days of sowing.

Response of sweet potato genotypes to Fusarium oxysporum f.sp. batatas:

Transplants of nine sweet potato genotypes namely; Abees, Mabrouka, Menoufia 6, Line 28, Mabrouka 2, Menoufia 66, Line 26, Menoufia 2 and Local A were tested for their response to infection with the most pathogenic *Fusarium oxysporum* f.sp. *batatas* isolate F1 during 2016 and 2017 growing seasons, Inocula, Inoculation and disease assessment were conducted similarly as described before.

Determination of total chlorophylls:

Leaf samples were placed separately in 95 % methanol (10 ml per gram) and blended using Braun blender MR 404 for 1 minute. Chlorophyll a showed maximum absorbance at 662 nm, chlorophyll b at 645 nm (Association of official Agriculture chemists,1985). The amounts of these pigments were calculated according to the following formulas (Nagata and Yamashita, 1992 and Dinu *et al*., 2018).

Chlorophyll a = 9.784 E662 – 0.99 E645 = measured in Mg /L
Chlorophyll b = 21.426 E645 – 4.65 E662 = measured in Mg /L
Chlorophyll ab = Chlorophylls a + Chlorophylls b

Total phenols:

The total phenolic content of the extract was determined by the Folin–Ciocalteu method. Briefly, 200 ml of crude extract (1 mg/ml) were made up to 3 ml with distilled water, mixed thoroughly with 0.5 mL of Folin–Ciocalteu reagent for 3 min, followed by the addition of 2 ml of 20% (w/v) sodium carbonate. The mixture was allowed to stand for a further 60 min in the dark, and absorbance was measured at 650 nm. The total phenolic content was calculated from the calibration curve, and the results were expressed as mg of gallic acid equivalent per ram dry weight. (Swain and Hillis , 1959 and Baba and Malik, 2015).

Statistical analyses:

Data were subjected to the analysis of variance procedures and treatment means were compared using standard deviation (SD) and Least significant difference (LSD) described by Gomez and Gomez (1994).

Results

Symptomatology:

The disease symptoms begin with yellowing in infected leaves, specially the initial symptoms on leaves and followed by complete yellowing of the lower, older leaves during the rapid growth stage. The following symptoms by leaves wilt later, stunting and eventually death of the plant. Necrosis of the stem vascular bundles occurs with brown to purple discoloration and this may be accompanied by rupturing of the cortex of the stem and mycelium appear on infected stem surface.(Fig. 2G,F) The vines may turn tan to light brown *(*Fig. 2B,E). Dead vines often have an extrametrical pinkish fungal growth with numerous macroconidia and microconidia of the pathogen.

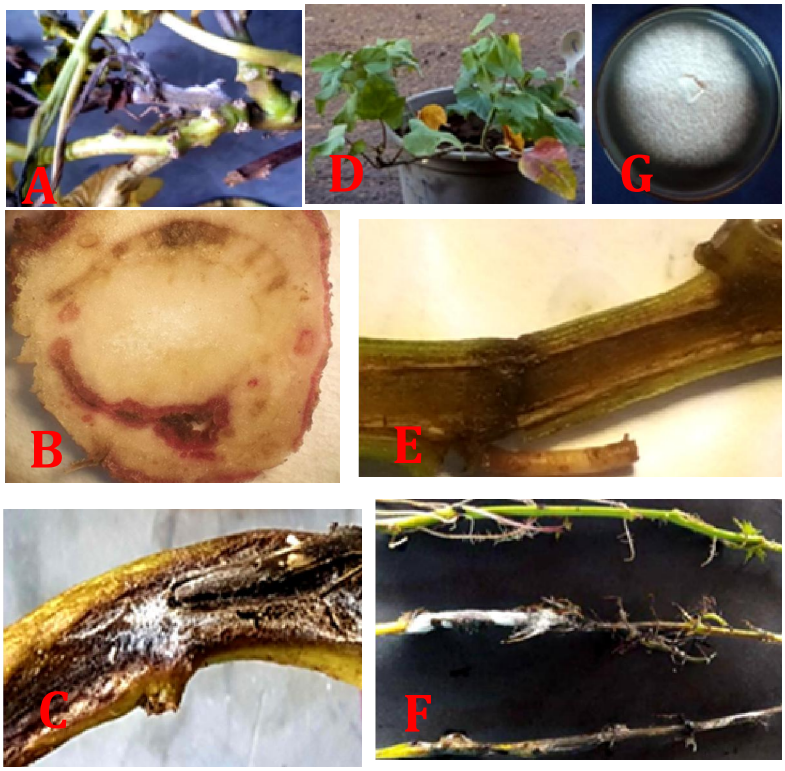

Fig. 2. Symptoms of fusarium wilt in sweet potato; A-defoliage and leaves death ; B- stem vascular coloured with brown to purple discoloration in the cross section; C- mycelium growth on stem rupturing.; D- Leaves yollowing; E- discoloration in length section of stem.; F- mycelial growth on sweet potato stem. And G- Fusarium growth on PDA medium.

1- Survey of sweet potato wilt:

Prevalence of sweet potato wilt was the highest in plantation of Beba county, being 28.57% in 2016, followed by Mallawi plantation (23.53%), while in 2017 Mallawi plantation showed the highest prevalence (50.00%) followed by Beba

(45.45%). The least prevalence was expressed by plantation of Nasser county (12.50%) in 2016 and (0.00%) in 2017. Sweet potato wilt was found in 7 of the 32 sampled fields, belonging to the two assessed counties (Table 2). Mallawi county had the highest disease incidence (10.93 %) and disease severity (6.97 %) in 2017, followed by Beba county (7.94 %) and disease severity (4.39 %) in 2017, while in Nasser county no infection was found. There is generally, a gradual increase in disease incidence in different locations from year 2016 to year 2017. In this respect, the highest mean percentage of infection in Minia governorate locations was observed in Mallawi, followed by Beni Sweif governorate in Beba county, whereas the lowest infection was recorded in Nasser county.

Table 2: Disease prevalence (WDP), incidence (WDI) and severity (WDS) of sweet potato wilt at Beni Sweif and Minia governorates

Growing seasons	Inspected counties	Total fields sampled TFS	Total fields sampled with WD	WDP %	WDI %	WDS %
2016	Beba,	7.00	2.00	28.57	5.29	2.78
	Mallawi,	17.00	4.00	23.53	4.87	2.95
	Nasser,	8.00	1.00	12. 50	1.43	0.53
	Means	10.67	2.33	21.53	3.86	2.09
2017	Beba	11.00	5.00	45.45	7.94	4.39
	Mallawi	20.00	10.00	50.00	10.93	6.97
	Nasser	9.00	0.00	0.00	0.00	0.00
	Means	13.33	5.00	31.82	6.29	3.79
L.S.D at 5% for Counties (A): Growing seasons (B): A×B :					0.2 0.17 0.30	0.47 0.28 0.49

2- Frequency of fungi associated with wilted sweet potato plants:

Fungi belonging to five genotypes*e.g., Fusarium, Macrophomina, Alternaria, Ceratocystis* and *Rhizoctonia* were variously isolated from wilted sweet potato (Table 3). The results indicated that a total of seven fungi, *Fusarium oxysporum, F. solani, F. circinatum, Macrophomina phaseolina, Alternaria sp, Ceratocystis sp* and *Rhizoctonia solani* were found in Minia and Beni sweif; *Fusarium oxysporum* (46 % from root, 5.56% from leaves) and *Fusarium solani* (22.2 %) showed the highest frequency followed by Alternaria sp (6.94%), *Fusarium circinatum* (6.94%), *Ceratocystis sp* (5.56%), *Rhizoctonia solani* (4.17%) and *Macrophomina phaseolina* (2.8%) showed the least percentage frequency.

Table 3: Frequency of fungi associated with Fusarium wilt of sweet potato plants grown in Beni Sweif and Minia governorates

Fungi	Source of fungi	Number of Isolates	Frequency %
Alternaria sp	Foliar	5	6.94
Ceratocystis sp	Root	4	5.56
Fusarium circinatum	Root	5	6.94
Fusarium oxysporum	Foliar	4	5.56
	Root	33	45.83
Fusarium solani	Root	16	22.22
Macrophomina phaseolina	Root	2	2.78
Rhizoctonia solani	Root	3	4.17
Total		72	100

3- Pathogenicity test of Fusarium oxysporum:

Due to isolation *F. oxysporum* with high frequency from naturally infected sweet potato plants showing wilt symptoms, seven isolates of them were selected for pathogenicity test (Table 4). The tested isolates significantly varied in their ability to cause wilt symptoms as shown from the percentage of infection and disease severity. The highest percentage of Fusarium wilt was obtained by isolates F1, F2 (65.1%, 63.1%) followed by isolates F3 and F4 (60.7% and 47.5%). The least percentage was expersed by F7 (27.4 %), while F5 and F6 isolates showed moderate infection (30.7, 33.2%) respectively. Similarly, F1 gave the highest wilt severity (64.6%) followed by F2 (48.7%) and the least severity was pronounced by isolate F7 (11.4%). Finally, *F. oxysporum* was re-isolated only from artificially inoculated diseased plants. In contrast, noninoculated control plants remained symptomless and uncontaminated under the same experimental conditions.

Table 4: Ability of *Fusarium oxysporum* isolates to cause wilt of sweet potato *Ipomoea batatas* cv. Abees

Fusarium oxysporum isolates	Source of isolate, county	Disease incidence %	Disease severity %
F1	Beba	65.1± 1.7*	64.6± 1.9
F2	Beba	63.1± 2.7	48.7± 1.3
F3	Mallawi	60.7± 1.5	41.4±1.2
F4	Mallawi	47.5± 2.9	39.2± 2.7
F5	Mallawi	30.7± 2.3	29.0 ± 1.3
F6	Mallawi	33.2± 1.6	19.2± 2.7
F7	Nasser	27.4± 2.5	11.4± 1.0

* Data are means of 3 replicates ± standard deviation (SD)

4-Host Range:

Only convolvulacous plant species Cairo morning glory, field bindweed were infected by *Fusarium oxysporum* f.sp. *batatas* beside the main host (sweet potato). Other non convolvulaceae plant species such as Alfalfa, carrot, cotton, potato, sugar beet, sugar cane, turnip and wheat were not infected (Table 5).

Table 5. Response of various plant species to infection by *Fusarium oxysporum* f.sp. *batatas* isolate F1.

Hosts	Disease incidence %		Disease severity %	
	2016	2017	2016	2017
Sweet potato (Local A)	82.90	87.60	64.43	67.60
Alfalfa	0.0	0.0	0.0	0.0
Carrot	0.0	0.0	0.0	0.0
Cotton	0.0	0.0	0.0	0.0
Cairo morning glory	64.9 ± 0.1*	75.5 ± 1.6	44.9 ± 0.6	65.9 ±1.5
Field bindweed	63.4 ± 1.4	70.7 ± 0.8	40.9 ± 0.5	50.4 ±0.8
Potato	0.0	0.0	0.0	0.0
Sugar beet	0.0	0.0	0.0	0.0
Sugar cane	0.0	0.0	0.0	0.0
Turnip	0.0	0.0	0.0	0.0
Wheat	0.0	0.0	0.0	0.0

Data are means of 3 replicates ± standard deviation (SD**)**

5- Response of sweet potato genotypes to Fusarium oxysporum f.sp. batatas:

Under greenhouse conditions, symptoms of wilt appeared nearly 30 days after planting. Data showed a significant variation in response of nine sweet potato genotypes to wilt caused *Fusarium oxysporum* f.sp *batatas* isolate F1, Two sweet potato genotypes showed highly susceptible reaction, (HS) *i.e.,* Local A (85.2% DI and 66% DS) and Line 26 (80.7% DI and 63% DS), Two genotypes showed the reaction resistant (R) *i.e.,* Menuofia 6 (27.3 % DI and 14.8% DS) and Menoufia 2 (34.1 % DI and 16.7% DS). Genotypes Abees, Mabrouka, Menoufia 66 were moderate resistant (MR), while other genotypes Line 28 and Mabrouka Improved (2) were susceptible (S) to *Fusarium oxysporum* f.sp. *batatas* isolate F1 (Table 6).

Table 6. Wilt incidence (%) and severity (%) on various sweet potato genotypes caused by *Fusarium oxysporum* f.sp. *batatas*

Genotypes	SPWI %			SPWS %			Disease rating DR
	2016	2017	Mean	2016	2017	Mean	
Abees	50.03	63.90	56.96	35.37	30.90	33.13	M
Line 26	78.13	83.33	80.73	61.70	64.33	63.01	HS
Line 28	73.33	75.70	74.51	51.47	42.27	46.87	S
Local A	82.90	87.60	85.25	64.43	67.60	66.01	HS
Mabrouka	30.70	57.70	44.20	32.27	28.37	30.32	M
Mabrouka (2)	77.10	77.63	77.36	55.47	47.63	51.55	S
Menoufia 2	29.13	39.03	34.08	16.73	16.77	16.75	R
Menoufia 6	22.70	32.00	27.35	14.30	15.23	14.76	R
Menoufia 66	63.80	72.67	68.23	40.27	40.33	40.30	M
Means	56.43	65.51	60.97	41.37	39.27	40.30	M
L.S.D at 5% for Genotypes (A) :		3.30			2.07		
Growing seasons (B):		1.43			1.34		
A×B :		4.29			4.03		

6- Chlorophyll content:

Both chlorophyll a and b were reduced in sweet potato genotypes infected by *Fusarium oxysporum* f.sp. *batatas* isolate F1 (Table 7). The highest chlorophyll content a and b were recorded in Menoufia 6 and Menoufia 2 in noninfected plants and the least reduction was in infected plants, once in Menoufia 6 total chlorophyll was 70 µg and in infected 64 µg (less than 10% reduction). High reduction in chlorophyll contents is expressed in infected susceptible and highly susceptible genotypes.

Table 7. Chlorophyll a and b contents in various infected sweet potato genotypes infected by *Fusarium oxysporum* f.sp *batatas* (isolate F1)

Genotypes, Disease rating	Chlorophyll (A)µg		Chlorophyll (B)µg		Chlorophyll(A+B) µg	
	Control	Infected	Control	Infected	Control	Infected
Abees, MR	0.25	0.16	0.37	0.28	0.55	0.44
Line 26, HS	0.20	0.19	0.33	0.29	0.53	0.48
Line 28 , S	0.26	0.24	0.44	0.40	0.70	0.64
Local A, HS	0.21	0.13	0.31	0.20	0.45	0.33
Mabrouka, MR	0.18	0.10	0.24	0.15	0.35	0.25
Mabrouka 2,S	0.24	0.15	0.35	0.25	0.52	0.40
Menoufia 2, S	0.23	0.21	0.42	0.37	0.65	0.58
Menoufia 6, S	0.16	0.07	0.23	0.13	0.32	0.20
Menoufia66, MR	0.15	0.05	0.21	0.10	0.29	0.15

* Data are means of 3 replicates ± standard deviation (SD)

7- Phenols:

Phenols were varied with sweet potato genotypes and infection with *Fusarium oxysporum* f.sp *batatas* isolate F1 (Table 8). As for resistant genotypes, phenols were mustered significantly in infected than in non-infected plants of Menoufia 6 and Menoufia 2 in contect. In highly susceptible and susceptible plants of sweet potato genotypes, phenols in infected were lowered as compared to noninfected plants.

Table 8: Effect of infection by *Fusarium oxysporum* f.sp *batatas* (isolate F1) on total phenol contents in sweet potato genotypes

Genotypes and disease rating	Total phenols (mg)	
	Control	Infection
Abees, MR	99.7	148.6
Line 26, HS	103.2	84.4
Line 28, S	122.3	92.7
Local A, HS	151.9	133.4
Mabrouka, MR	107.1	182.2
Mabrouka 2, S	158.9	82.2
Menoufia 2, R	115.3	225.8
Menoufia 6, R	91.7	259.7
Menoufia 66, MR	129	107.7

D i s c u s s i o n

This is the first report of F. oxysporum f. sp.batatas occurring in Egypt. Sweet potato wilt (SPW) spread was widely in Middle Egypt governorates Beni Sweif and Minia. It had measurable prevalence, incidence and severity in all districts tested (Mallawi - Minia, Beba- Beni Sweif and Nasser counties). Prevalence highest percentage, 50% was recorded in Mallawi county during 2017 growing season followed by Beba county, 28.57% during 2016 growning season while Nasser county provided the least prevalence values of SPWD, 12.50% and 0.0 % during 2016 and 2017 growing season, respectively. Incidence and severity of SPWD were also varied with plantations examined and the highest incidence, 10.93% and severity 6.97% were expressed in Mallawi county followed by Beba (7.94% DI and 4.39% DS) and in Nasser county (1.43% DI and 0.53% DS). The present study indicated that 5 genera, *i.e., Fusarium, Macrophomina, Alternaria, Ceratocystis* and *Rhizoctonia* were associated with SPWD. Fusarium isolates showed the highest frequency, being 80.6; 51.5% for *Fusarium oxysporum*, 22.2% for *Fusarium solani* and 6.9% for *Fusarium circinatum*. Each of *Alternaria* sp and *Ceratocystis* sp recorded 5.5%, *Rhizoctonia solani* 4.2% and *Macrophomina phaseolina* 2.8%. Data are in line with those reported by Madden *et al*. (2008). However, in Egypt, it was reported that *Sclerotium bataticola* Taub causes charcoal

rot disease (Attia, 1966), *Diplodia tubericola* causes Jawa black rot of sweet potato (Youssef, 1964).

Results showed that all *Fusarium oxysporum* isolates tested for pathogenicity were able to infect sweet potato cv. Abees. However the infectivity was varied with isolates F1 and F2 that were highly pathogenic followed by F3 and F4 while F5 and F6 were moderate and F7 was the weakest. Data are in accordance with those obtained by fungi belonging to Holliday, (1970). Data confirmed that all *Fusarium oxysporum* isolates caused Fusarium wilt. Subsequently, sweet potato genotypes were used to test their reactions toward *Fusarium oxysporum* isolate F1 infection. Recent data provided various reactions in sweet potato genotypes. Out of 10 genotype, only 2, *i.e.,* Menoufia 6 and Menoufia 2 reacted as resistant against *Fusarium oxysporum* isolate F1 where they expressed the lowest DI(27.53, 34.97%) and DS (14.76, 16.75%). Two genotypes, *i.e.,* Local A and Line 26 were highly susceptible DI(85.25%, 80.73%) and DS(66.01%, 63.01%), Mabrouka 2 and Line 28 were susceptible, DI (77.36, 74.51%) and DS (51.55, 46.87%) and 3 reacted as moderately susceptible, Abees, Mabrouka and Monufia. As for host range, data pointed out that *Fusarium oxysporum* isolate F1 had ability to infect only convolvulaceous plants (Cairo morning glory and field bindweed) beside sweet potato, but was not able to infect other plant species of non convolvulaceous plants confirming that the pathogen is *Fusarium oxysporum* f.sp. *batatas*. Data are in line with those reported by Boix-Ruiz *et al*. (2015). As the authors are for aware, Fusarium wilt is recorded hereiu on sweet potato for the first time in Egypt.

The results indicated that chlorophyll degradation was occurred by *Fusarium oxysporum* f.sp. *batatas* infection and it was related to sweet potato genotypes reaction. Generelly, all infected genotypes expressed chlorophyll degradation, but resistant genotypes proved the lowest reduction in chlorophyll than the highly suscepitable sweet potato genotypes as explored before by (Nagata and Yamashita, 1992 and Dinu *et al*., 2018).

On the other hand, phenols were enhanced in the resistant sweet potato genotypes under *Fusarium oxysporum* f.sp. *batatas* infection as compared to noninfected. These results are in agreement with those obtained by Swain and Hillis (1959) and Baba and Malik (2015).

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مرض الذبول الفيوزرايومى على البطاطا والذي يسببه الفطر فيوزاريوم اوكسسبورم باتاتس فى مصر

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لوحظ مرض ذبول الفيوزاريوم بالبطاطا لأول فى مصر في الفترة ما بين أوائل أبريل وحتى سبتمبر من عام ٢٠١٦. بدأت أعراض المرض في صورة إصفرار وذبول الأوراق و نمو النباتات بصورة متقزمة، وتغير لون الحزم الوعائية باللون البني. تواجد مرض الذبول الفيوزاريومى في البطاطا بصورة متباينة بمحافظتى بنى سويف والمنيا بمنطقة مصر الوسطى، حيث اختلف معدل انتشار ونسبة وشدة الإصابة باختلاف المناطق المختبرة. امكن عزل فطريات تابعة لخمسة أجناس فطرية مرافقة للمسبب المرضى وهى ***Alternaria*, *Ceratocystis*, *Fusarium*, *Macrophomina*, *Rhizoctonia*** من عينات البطاطا التي اظهرت أعراض الاصابة بالذبول. وسجلت الفطريات التابعة للجنس فيوزاريوم أعلى نسبه تكرار(٨٠.٦%). اظهر الفطر فيوزاريوم أوكسسبوريوم اعلى تكرار (٥١.٥%) واظهرت جميع العزلات التابعة للفطر فيوزاريوم أوكسسبوريوم المختبرة اصابة للبطاطا صنف أبيس حيث احدثت أعراض نموذجية للذبول . اختلفت شدة الإصابة باحتلاف الطرز الوراثية للبطاطا المختبرة حيث اظهرت تباين في استجابتها للعدوى بالفطر فيوزاريوم أوكسسبوريوم عزلة واحد ، حيث تبين أن أثنان من الطرز الوراثيه منوفيه٦ ومنوفيه ٢ اظهرا تفاعل المقاومة في حين ان محلي أ وسلالة ٢٦ كانتا ذات قابلية للاصابة بالفيوزاريوم . باختبار المجال العوائلى اتضح أن الفطر فيوزاريوم أوكسسبوريوم ذات قدرة مرضة للنباتات العائلة العلاقية (ست الحسن والعليق) بينما لم يحدث الفطر اي اصابه للنباتات الغير تابعة للعائلة العلاقية (البرسيم والبطاطس وبنجرالسكر والجزر وقصب السكر والقطن والقمح واللفت). اظهر تحليل الكلوروفيل أن الإصابه بالفطر فيوزاريوم أوكسبوريوم قد ادى إلي تدهور في محتوي الأوراق من الكلوروفيل واظهرت الطرز الوراثية المقاومة أقل تدهور في محتوي الأوراق من الكلوروفيل بينما الاصناف ذات القابلية للاصابة اظهرت تدهور عال للكلورفيل. أما الفينولات فالنتيجة كانت عكسية حيث ان اصابة البطاطا بالفطر فيوزاريوم أوكسسبوريوم أدى الي زياده محتوى الفينولات للطرز الوراثية المقاومة وانخفضت في الطرز الوراثية ذات القابليه للاصابة. وبناء على المراجع المتاحة فان هذا البحث يتميز بتسجيل مرض الذبول الفيوزاريومى على البطاطا فى مصر لاول مرة و الذى يسببه الفطر *Fusarium oxysporum* f.sp. *batatas*.