

use a protocol (two doses of PGF2 $\alpha$ ) based on cost-effectiveness compared to the Ovsynch protocol (three doses of hormones).

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### **FIRST REPORT OF THE FUNGUS *FUSARIUM OXYSPORUM* F. SP. *RADICES LYCOPERSICI* IN THE COASTAL REGION OF SYRIA**

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**Abstract:** Eleven isolates of the fungus *Fusarium oxysporum* Schlecht. were obtained from cucumber and tomato plants showing symptoms of *Fusarium* wilt, and crown and root rot from several regions in the coastal region of Syria. The molecular diagnosis was based on PCR genotyping. Results obtained indicated that seven of the collected isolates belong to the specialized form *Fusarium oxysporum* f. sp. *radicis lycopersici*. This is the first record of this fungus in the coastal region of Syria.

**Keywords:** *Fusarium* crown and Root Rot, Tomato, FORL, Coastal Region, Syria

### Introduction

The fungus *Fusarium oxysporum* Schlecht (FO), (subordinate in the sexual phase of the family Nectriaceae from the order Hypocreales and the class Sordariomycetes in the phylum Ascomycota) is a serious pathogen to the cultivated crops, fruit trees and ornamental plants that belong to various plant families [1]. Due to the nutritionally and economically importance of tomato plant (*Solanum lycopersicum* L.) in both Syria and the world, it was necessary to pay attention to its safety from pathogens especially *F. oxysporum* that attacks tomato and causes two serious diseases. The first one, vascular wilt, result from the specialized form *Fusarium oxysporum* f.sp. *lycopersici* (Sacc) W.C Synder and H.N. Hans (FOL) which infects tomato only. The second one, the crown and root rot disease, is caused by the specialized form *Fusarium oxysporum* Schlecht f. sp. *radicis lycopersici* Jarvis and Shomaker (FORL) that infects many plant families. Previous researches confirmed that these two diseases are responsible for the loss of more than 80% of the yield in the severe infections. It is likely for these two diseases to exist together in the same tomato fields [2]. Due to the difficulty of differentiating between these two forms depending on morphological and colonies characteristics for the similarity of their characteristics, many researches were conducted in order to distinguish between them depending on biotechnologies. Distinctive genes were identified for each of them [5], and it is possible to distinguish between these two forms through the symptoms and the host range. The FOL causes symptoms of wilting on the infected tomato plant. In the cases of severe infections, a brown discoloration that extended to the top of the stem was observed, when making a longitudinal section [6]. And it is specialized in infecting tomato plants (Forero *et al.*, 2018). Regarding the fungus (FORL), It causes brown rot in the roots and the crown of the infected plants, and it is observed, when making a longitudinal section in the stem of the infected plant, that there is a brown discoloration dose not extend more than 25 - 30 Cm above the soil line [4]. The (FORL) is considered destructive to tomato plant all over the world. Its danger lies in the possibility of its entry into the plant through the aboveground vegetative portions, in addition to its wide host range [7]. This fungus was reported in many geographical regions around the world including a number of countries neighboring to Syria. Hence, that has prompted us to suspect its presence in Syria, especially after the visible signs of symptoms of root rot and the crown on tomato

plants, cucumber in fields. However, these symptoms were not sufficient alone to decide whether the FORL is the causative or another fungus. Therefore, this research aims at separating the isolates and identifying the causative factor of these symptoms using molecular markers.

### Results and Discussion:

It is worth noting that we obtained the fungus FORL from tomato plants with a brown discoloration extension of more than 50 cm above the soil line and that contradicts what was recorded in the researches about the brown discoloration in the stem of tomato plant infected with FORL that it doesn't exceed 25-30 cm above the soil line [6]. Table 1 shows plant characterization, the source of the isolates used in this research, the extent of the brown discoloration on the stems of the infected plants.

Sources of *F. oxysporum* isolates used in this study, the measurements of the plant height in which the fungus was isolated from and the extent of the brown discoloration within it table 1.

*Table 1*

Number of Fusarium Isolate	Plant or tomato cultivar	Collecting site	Plant age and time of collecting (months)	Plant height above the soil surface (cm)	height of brown discoloration above the soil surface within the stem (cm)	Percentage of the brown discoloration on the stem (%)
F1	Domna	Mehwarty	5	190	65	34.2
F2	Picked fruits (from Mandaloon)	Dair Albeshl (Harf bnamra)	6	160	60	37.5
F8	Picked fruits (from Mandaloo)	Dair Albesh (Harf bnamra)	6	160	40	25
F9	Domna	Mehwarty	5	195	70	35.9
F13	Bastoona	Mehwarty	8	220	20	9.1
F15	Bastoona	Mehwarty	8	200	brown discoloration didn't extend, but there is an external black crown rot	0
F16	Majdolina + grafted top of the Mandoloon tree	Al-zallo crossroad	7	150	50	33.3

F18	Cucumber plant	Sahl Miaar (Samkah)	2	-	-	-
F22	<b>Antalia</b>	<b>Al-blatah Tartous northern border</b>	1.5	60	<b>26</b>	43.3
F28	Bastoona	Next to the cement factory (Tartous)	4	<b>160</b>	<b>100 &lt;</b>	62.5 <
F30	Bastella	Next to Al-hal Market (Tartous)	4	100	60	60

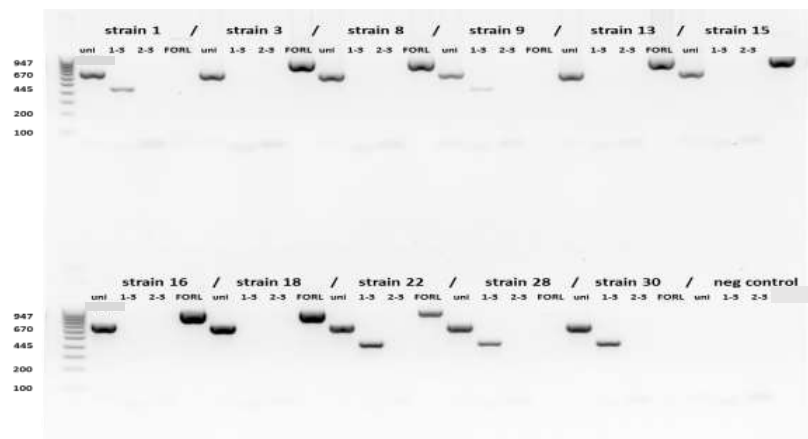
Results of the PCR test for the fungal isolates described in Table 2 show that isolates 3 ,8 ,13 , 15, 16, 18 belong to the specialized form FORL, while the isolates 1, 9, 28, 30 belong to the strain 1 of the specialized form FOL. Regarding the isolate 22, results showed that it belongs to both of the specialized forms which indicates that there are two diseases in the plant in which the isolate was isolated. This is consistent with previous results mentioning the existence of both fungi, together, in the same tomato fields [2].

PCR results using four primer pairs specialized in detecting *Fusarium oxysporum* fungal isolates table 2.

table 2

isolate	uni	Sp13	Sp23	Sp1l	Genotype
F1	+	+	-	-	FOL race1
F3	+	-	-	+	FORL
F8	+	-	-	+	FORL
F9	+	+	-	-	FOL race 1
F13	+	-	-	+	FORL
F15	+	-	-	+	FORL
F16	+	-	-	+	FORL
F18	+	-	-	+	FORL
F22	+	+	-	+	FOL-1+ FORL
F28	+	+	-	-	FOL race 1
F30	+	+	-	-	FOL race 1
control	-	-	-	-	-

Uni= pair of primers specialized in detecting *Fusarium oxysporum* , sp13= pair of primers specialized in detecting the strains 1 and 2 of the specialized form *Fusarium oxysporum* f. sp. *lycopersici*, sp1l= pair of primers specialized in detecting *Fusarium oxysporum* f. sp. *radicis lycopersici*.



**Figure 1:** represents the result of PCR on Agarose gel by electrophoresis using 4 pairs of primers specialized in detecting the fungal isolates that belong to *Fusarium oxysporum*. Uni: A pair of primers specialized in detecting *Fusarium oxysporum*, 2-3: strains 2 and 3 for the specialized form *Fusarium oxysporum* f. sp. *lycopersici*, FORL: The specialized form *Fusarium oxysporum* f. sp. *radicis lycopersic*.

It was found that seven of these isolates belong to the specialized form FORL, making this the first report of the fungus FORL in the coastal region of Syria.

### Conclusions:

We conclude that the Fungus *Fusarium oxysporum* f. sp. *radicis lycopersici* that causes the root rot and Fusarium crown diseases is widespread in the study region in the Syrian coast. It infects the plants of both tomato and cucumber in the greenhouses in this region. Therefore, we recommend to continue the researches on these isolates in terms of their morphological and vital characteristics in various conditions until finding an effective method to limit the dangers of this fungus and its negative impact on tomato cultivation in the Syrian coast.

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