Fusarium Wilt on Chickpea in Syria

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Introduction

Chickpea, (*Cicer arietinum* L.) is the second most important food legume crop in the world. Norther Syria and southeastern Turkey are being the origin of chickpea. In Syria, the cultivated area of chickpea is about 65,000 ha in 2019. In the world, chickpea is affected by at least 67 fungal pathogens, 3 bacterial pathogens, 22 viruses and 80 nematodes. Fusarium wilt (*Fusarium oxysporum* f.sp. *ciceris*) is one of the most important soil-borne fungal disease that affect chickpea causing about 10-15% annual yield loses. However, the damage can reach 100% when conditions are favorable in some cropping seasons for disease development.

The Causal Agent

Fusarium oxysporum f.sp. *ciceris* (Foc)

Foc is mainly a soil borne pathogen with high diversity. So far, eight races (0, 1A, 1B / C, 2, 3, 4, 5, 6) were reported in the world The two races 0, 1B/C, cause yellowing symptoms, and the others cause wilting symptoms**.** The known races are vary in virulence where race 0 is the least virulent, while race 5 is the most virulent.

Four races (0,1B / C, 5 and 6) were recorded in Syria. Interestingly, Fusarium wilt can be caused by *F. redolense* and this pathogen is reported in Tunisia, Spain and Turkey.

The Symptoms

Foc is a soil borne pathogen and it secretes enzymes that dissolve the cellular walls of the plant roots, and after entering the plant tissues, it a gelatinous material that block vessels, which leads to the appearance of yellowing or wilting symptoms (Figs. 1& 2) and later the plant died (Fig. 2& 8)

Fig 1: Yellowing symptoms

Fig 2: Symptoms of wilting

When making a longitudinal or cross-section in the stem and roots of infected plant, the veins are often dark brown (Fig 3) and can be used for diagnosis of the wilt disease in the field.

Fig 3: A longitudinal section of a stem of a plant showing fusarium wilt symptoms

Foc can infect chickpea at any growth stage (Fig. 4, 5), incidence and severity of the disease relates to cultivars, pathogen race, type of soil and the prevailing weather factors (Fig. 6- 8)**.**

Fig 4: Symptoms of partial yellowing in the pre-flowering stage

Fig 5: Symptoms of the disease appear at pod formation stage

Infestation is distributed in the field in the form of individual plants (Fig 1& 2) or spots (Fig 6& 7).

Fig 6: Severity of Fusarium wilt in winter planted chickpea, Syria

Fig 7: The incidence disease is 80% in Kafr Nouran - Aleppo governorate on 4/17/2011

Fig 8: The incidence disease is about 90% in Al Foah - Idlib governorate on 4/17/2011

Fungal Isolates

Foc is isolated from plants showing pathological symptoms on potato dextrose agar PDA medium from the base of the stem, and after incubation at 25 ± 2 ° c for 48 hours, mycelium growth is observed from the vasculature of the plant (Fig. 9)

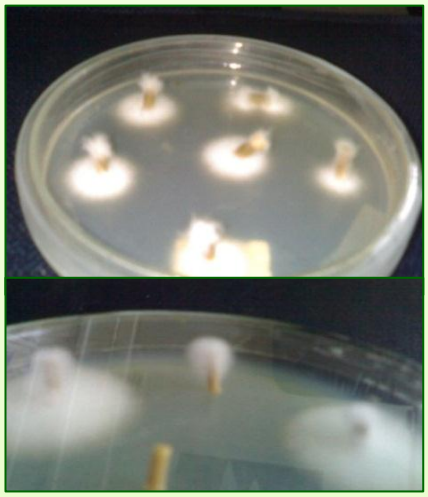

Fig 9: Mycelium growth from infected stem plated on PDA medium after 48 hours of incubation

Culture and Microscopic Characterization

Foc form strength cotton (Fig 10) or fluffy cotton (Fig 11) mycelium growth on PDA

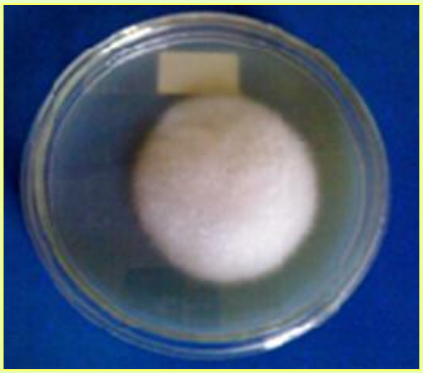

Fig 10: Foc mycelium on PDA like strength cotton

Fig 11: Foc mycelium on PDA like fluffy cotton

FOC forms microconidia (Fig 12), macroconidia (Fig 13), and chlamydospores (Fig 14). Chlamydiospores retain their aviability in the soil for up to 6 years.

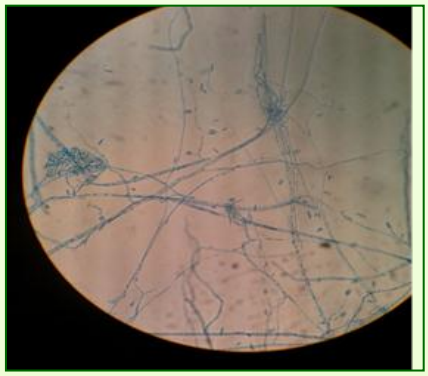

Fig 12: Mycelium and microconidia (X 40)

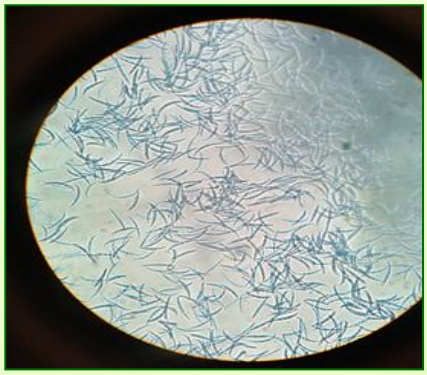

Fig 13: macroconidia (X 40)

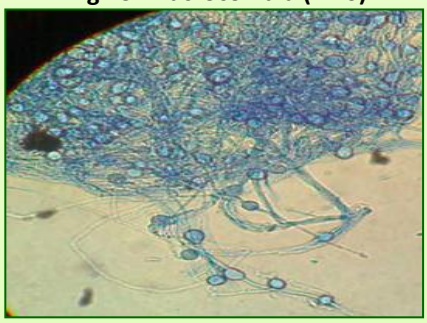

Fig 14: chlamydospores (x 40)

Control

Fusarium wilt disease were management by many ways, cultivation cycle, soil solarization, biological control and treatment of seeds with chemical pesticides before planting. All the previous methods are of limited effectiveness in controlling the disease, while the use of resistant varieties and planting dates are the most effective methods of managing Fusarium wilt, so agricultural scientific research centers as ICARDA work to develop resistant varieties

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