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Corky Root Rot of Tomato in Jordan

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Abstract: Corky root rot symptoms caused by *Pyrenochaeta lycopersici* were observed on roots and stem bases of tomato plants under plastic houses in Jordan. Symptoms included chlorosis of foliage, stunting, root necrosis and poor fruit setting. The isolated fungus from diseased tomato plants formed a gray to dark green mycelium on PDA media with hyaline, uni-cellular cylindrical conidia. The main stem of diseased plants appeared to have cracked lesions along the length of the root with corky appearance. Based on the disease symptoms and morphological characteristics of the isolated fungus and pathogenicity test, *Pyrenochaeta lycopersici* was identified as the causal agent of the disease. This study seems to be the first study of corky root rot of tomato caused by *Pyrenochaeta lycopersici* in Jordan.

Key words: Tomato, *Pyrenochaeta lycopersici*, corky root rot, soil-borne fungus, stunting, Jordan

INTRODUCTION

Tomato (*Solanum lycopersicum*) is a member of the Solanaceae family that ranks as the leading fresh and processed vegetable crop in Jordan with a total area of about 124000 dunums comprising 30.1% of the area of vegetables and producing about 655000 metric ton. Corky root rot of tomato is a common disease of field-grown processing and fresh-market tomatoes in many countries of the world (Montealegre *et al*., 2005; Jones *et al*., 1989). It causes progressive deterioration of the entire root system, constricting uptake of water and nutrients (Last and Ebben, 1966; Pohronezny and Volin, 1991). It is a growing concern for tomato growers all over the world including major producers such as China, USA, Italy and Japan.

Yield loss up to 70-75% has been reported for certain years (Polley, 1985). However after the banning of soil fumigation with Methyl bromide due to global restrictions against the use of ozone-depleting substances, keeping corky root rot disease at bay has rapidly become a major problem (Campbell *et al*., 1982; Goodenough and Maw, 1973). No other efficient method to control the disease has been discovered so far (Campbell *et al*., 1982).

If infected soil is left untreated (that is not fumigated) an increasing infection pressure will build up and reach its maximum after 5-6 years, causing correspondingly increased root damage (Fiume and Fiume, 2003). *Pyrenochaeta lycopersici* is a soil-living filamentous fungus of the Ascomycete clade found in temperate zones worldwide (Hockey and Jeves, 1984; Hogenboom, 1970). The pathogen is a slow growing organism. It is an alternative biotroph that can grow saprophytically on artificial media but will spread on living host tissue in natural environment (Kim *et al*., 2003). *P. lycopersici* attacks tomato, melon, pepper, eggplant, spinach, cereals, nightshade and Jimson weed (Conn *et al*., 2010). It attacks the root system of infected plants and causes rotting of the smaller feeder roots, brown lesions on medium size roots and typical corky lesions on larger roots (Pohronezny and Volin, 1991). Without available living host tissue, the fungus can still survive as microsclerotia in the soil (White and Scott, 1973). These can stay inactive for very long periods of time, spores that have been dormant for up to 15 years were reported to be viable and infectious (Grove and Campbell, 1987). The fungus cannot grow on dead root material but could survive (Ball, 1979).

MATERIALS AND METHODS

Collection of isolates: Roots from symptomatic tomato plants (with chlorosis of foliage, lack of vigor, poor fruit setting and necrosis of tip branches) were collected from a single tomato field in Jerash (Northern area of Jordan) during the summer growing season of 2010. Roots were carefully washed under running tap water, root sections of about 1 cm long were taken from the corky lesions, washed and surface-disinfested for 30 sec in 0.5% sodium hypochloride (NaOCl) then rinsed with sterile distilled water, plated on PDA media and incubated at 22±2°C for 7 days. Three root sections were added to each plate.

Plant infection and pathogenicity tests: Conidial suspensions from 1 week old cultures grown on PDA were adjusted to 10^6 conidia mL^{-1} (Marlatt *et al*., 1996).

Conidia were counted using a hemacytometer. Pathogenicity tests were performed by sub-emerging roots of 2 weeks old tomato seedlings in the conidial suspension of the fungus for 5 min then transplanting the seedlings in pots of sterilized soil (peat moss and perlite mixture 1:1 v/v) amended with nitrogen, phosphorous and potassium (NPK 18:6:6) and trace elements, transplants were grown under greenhouse conditions, controls were dipped in tap water and PDA only (Marlatt *et al*., 1996; Mes *et al*., 1999).

Disease symptoms were assessed 8 weeks after inoculation where the inoculated plants were left to continue their growth for 3 months.

RESULTS AND DISCUSSION

Isolation and identification of the fungus: *Pyrenochaeta lycopersici* was isolated on Potato Dextrose Agar media (PDA) from roots of symptomatic tomato plants. The fungal growth on the media was very slow with a growth rate of about 2 mm day^{-1}. The fungus formed a gray to dark-green color mycelium (Fig. 1a) and a un-icellular hyaline cylindrical shaped conidia (Fig. 1b).

Plant infection and pathogenicity tests: Inoculated tomato plants appeared to show poor vegetative growth compared with the control (Fig. 2) with crown and basal corky lesions along the basal part of the stem (Fig. 3a). Discoloration of the pith and vascular system appeared when longitudinal sections were made in the stem of inoculated plants after 8 weeks of infection with brown lesions on the fine roots (Fig. 3b). The main roots appeared to have cracked corky lesions in the later stages of infection (8 weeks after inoculation) (Fig. 3c). None of the inoculated plants died during 3 months after inoculation.

Corky root rot is a serious disease of tomato under green house conditions. In Jordan about 30% of tomato plants are grown under plastic houses in Jordan Valley and high lands. Symptomatic plants were collected from a single tomato field in Jerash (Northern area of Jordan) in Summer season, 2009 and the causal agent was isolated and studied on PDA media. In Summer, 2010 disease symptoms appeared on tomato plants grown in the same plastic house and the causal agent was the same in both seasons. This observation was confirmed by White and Scott (1973), who pointed that the fungus can survive as icrosclerotia in the absence of living host tissue. *P. lycopersici* growth rate on PDA media was found to be about 2 mm day^{-1} and this was agreement with Golzar (2009). In the early stages of infection, infected

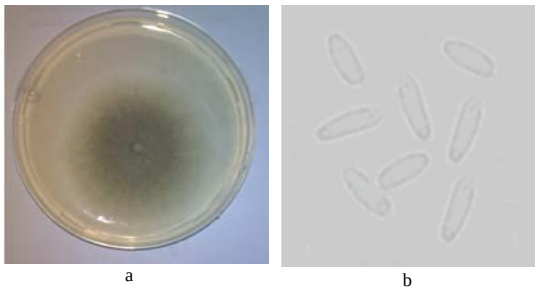

Fig. 1: *Pyrenochaeta lycopersici* growth on a) PDA medium and b) conidia

Fig. 2: Symptomatic tomato plant infected with the corky root fungus *Pyrenochaeta lycopersici* (a), compared with healthy plant in the same plastic house (b)

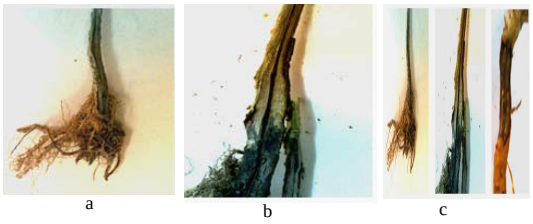

Fig. 3: Symptoms of corky rot caused by *P. lycopersici* appearing as: a) basal rot; b) root, root rot and pith discoloration and c) lesions on the main root

roots developed necrotic lesions that spread along the roots where in the late stages the main roots of infected plants became swollen with corky lesions but the infected plants did not die due to infection during the 1st 3 months after inoculation, this was in agreement with Ekengren.

CONCLUSION

The results indicates the ability of *Pyrenochaeta lycopersici* to keep viable in the soil with the absence of

host plant for about 1 year, colony morphology and micro-morphological characteristics of the isolated fungus were similar to those described by Schneider and Gerlach. Koch's postulates were fulfilled by re-isolation of the fungus *P. lycopersici*.

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