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PATHOGENIC EFFECTS AND TRANSMISSION STUDIES OF SEED-BORNE *FUSARIUM* SPECIES IN SUNFLOWER

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Abstract

Pathogenic effects of 6 *Fusarium* spp., *viz*., *F. equiseti*, *F. longipes*, *F. scirpi* (Section Gibbosum), *F. oxysporum* (Section Elegans), *F. pallidoroseum* (Section Arthrosporiella) and *F. solani* (Section Martiella) were studied on sunflower plants. Symptoms produced by *Fusarium* spp., were root-, collar-, stem- and seedling rots, damping-off, stunting, wilting, tip burning and reduction in growth. Wilting and seedling rot were found to be the most prominent symptoms produced by all *Fusarium* spp. Highest wilting was observed in plants inoculated by *F. equiseti*, *F. scirpi* and *F. solani*, whereas, highest seedling rot was observed by *F. solani*.

Introduction

Fusarium spp., are well known plant pathogens causing seed abortion, seed-, root-, stem- and seedling- rots, vascular wilt, damping-off, die back, stunting and reduction in growth in a variety of host plants. Seed-borne nature of *Fusarium* spp., in sunflower is well documented (Kaur *et al*., 1990; Dawar & Ghaffar, 1991; Ahmad *et al*., 1993; Ahmed *et al*., 1994; Sharfun-Nahar *et al*., 2005) but their association and pathogenicity in sunflower seedlings in connection to these *Fusarium* spp., is still lacking except that of *F. solani* (Dawar, 1994). In a previous study, pathogenic effects and transmission of *F. anthophilum*, *F. moniliforme*, *F. proliferatum*, *F. subglutinans*, *F. chlamydosporum* and *F. sporotrichioides* of sections Liseola and Sporotrichiella were tested on sunflower plants (Sharfun-Nahar & Mushtaq, 2006). In the present study experiments were carried out to observe the pathogenic nature and transmission of *Fusarium equiseti*, *F. longipes*, *F. scirpi* (Section Gibbosum), *F. oxysporum* (Section Elegans), *F. pallidoroseum* (Section Arthrosporiella) and *F. solani* (Section Martiella) in sunflower seedlings.

Materials and Methods

Conidial suspensions from 2-week-old cultures of *F. equiseti*, *F. longipes*, *F. scirpi* *F. oxysporum*, *F. pallidoroseum* and *F. solani* were adjusted to 50,000 conidia/ml in sterilized dist., water. This conidial suspension was mixed @ 1:20 v/w in sterilized moistened (20%) corn meal-sand medium and incubated at 25±1°C for 21 days (Hashmi, 1988). To detect threshold of pathogen at various inoculum levels, freshly prepared corn meal-sand inocula of *Fusarium* spp., were mixed with sterilized soil in 0.5, 1, 2, 5 and 10%. Soil used for artificial infestation was sandy loam (sand:silt:clay, 70:21:9) with pH range from 7.1-7.9 and 42% maximum moisture holding capacity (Keen & Raczkowski, 1921). The soil was moistened and sterilized at 15 psi for 1 hr before use. All

experiments along with control were carried out in triplicates. Component plating of healthy looking and affected sunflower seedlings was carried out on PDA (Baker & Cook, 1974) and infection and colonization percentages were calculated as follows:

$$\text{Infection \%} = \frac{\text{No. of plants affected by a pathogen}}{\text{Total no. of plants}} \text{ X } 100$$

$$\text{Colonization \%} = \frac{\text{No. of pieces infected by a pathogen}}{\text{Total no. of pieces tested}} \text{ X } 100$$

Results and Discussion

Pathogenicity of 6 *Fusarium* spp., *viz*., *F. equiseti*, *F. longipes*, *F. scirpi* (Section Gibbosum), *F. oxysporum* (Section Elegans), *F. pallidoroseum* (Section Arthrosporiella) and *F. solani* (Section Martiella) was tested on sunflower at 0.5, 1, 2, 5 and 10% inoculum levels. Symptoms produced by *Fusarium* spp., were observed as root-, collar-, stem- and seedling rots, damping-off, stunting, wilting, tip burning and reduction in growth (Table 1) and their colonization and transmission up to leaves were recorded and presented in Fig. 1a–f.

Plants inoculated with *F. equiseti* showed root rot in 1, 5 and 10% inoculum levels in 20 days old seedlings, whereas, highest wilting was found at 1% inoculum level. Stunting was found in 0.5, 5 and 10% inocula. Highest stunting and reduction in growth were observed in 10% treatment in 60 days old plants. Maximum colonization and transmission of pathogen were observed at 10% inoculm (Fig. 1a).

Plants inoculated with *F. longipes* showed symptoms of root rot, seedling rot, damping-off, stunting, wilting, tip burning and reduction in growth. Prominent tip burning was found in 5% inoculum in 2 weeks old seedlings. Reduction in growth of test plants was evident in almost all plants after 60 days where maximum reduction was observed at 5% inoculum (Table 1). Transmission of *F. longipes* up to leaves was observed in 2, 5 and 10% inocula (Fig. 1b).

Plants tested with *F. scirpi* showed seedling rot, stunting, wilting, tip burning and reduction in growth. Tip burning was observed at 0.5 and 2%, whereas, wilting was recorded in all inoculum levels and was maximum at 10% (Table 1). In 20 days old seedlings rotting was found at 0.5 and 10% and reduction in growth was found at 1 and 10% inoculum levels. Stunting was observed in 2% inoculum level in 60 days. Pathogen reached up to leaves in all inoculum levels (Fig. 1c).

Seedling rot was found as the major symptom in 3 weeks old plants inoculated with *Fusarium oxysporum* in all inoculum levels, where maximum infection was observed at 1%. Stunting and collar rot were also recorded at 2 and 5% inocula respectively (Table 1). Most of the plants remained healthy-looking and colonization of the pathogen was recorded in low percentages in all plant parts and pathogen was transmitted up to leaves in all inoculum levels (Fig. 1d).

During pathogenicity test of *F. pallidoroseum*, sunflower plants showed symptoms of root-, collar-, stem- and seedling rots, stunting and wilting. Seedlings grown in 1 and 2% inoculum levels showed root rot within 20 days, whereas, collar- and stem rots were recorded in 30 days. Seedling rot occurred at 0.5 and 10% inoculum level and wilting was also observed in 1, 5 and 10% inoculum levels. The highest pathogenic level was 10% where maximum root colonization and transmission up to true leaves was observed (Fig. 1 e).

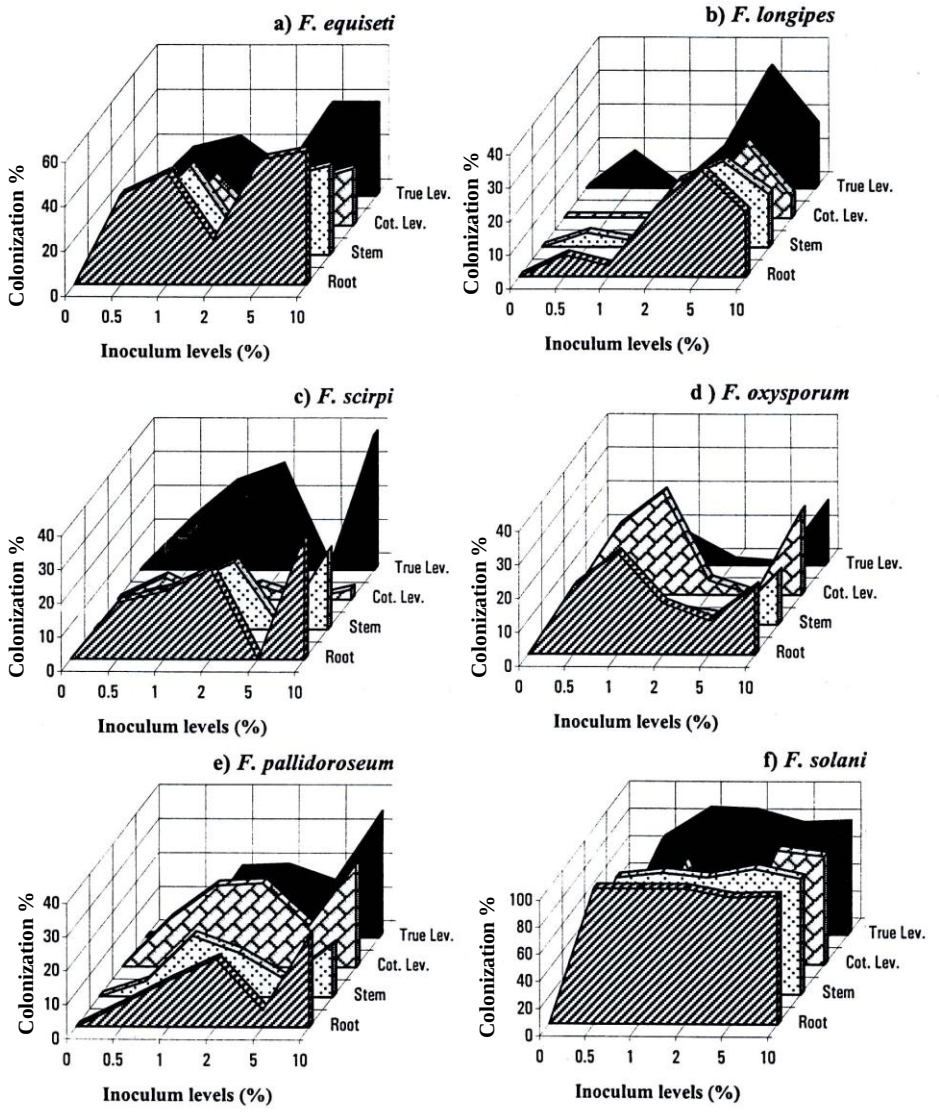

Fig. 1. a-f Percent colonization of *Fusarium* spp., in different parts of sunflower (*Helianthus annuus*) at different inoculum levels as compared to control (0).

Fusarium solani caused collar and seedling rots, wilting and tip burning in sunflower plants. Seedling rot appeared as a major symptom in 0.5, 1, 2 and 10% in 15 to 20 days old seedlings. Collar rot was observed at 0.5, 1 and 10%, whereas, wilting was recorded at 2 to 10% inoculum levels in 45 days old plants. Tip burning was observed only at 0.5% inoculum level. Most pathogenic levels were 0.5 and 10% but plants at 0.5% quickly showed maximum seedling rot (Table 1). Dawar (1994) also studied the pathogenic nature of *Fusarium solani* in sunflower. Hundred percent root colonization was observed

in all inoculum levels. The pathogen transmitted to seed coat and embryo in 3 months old plants (Fig. 1 f).

In pathogenicity experiments, *Fusarium* spp., prominently produced wilting, seedling rot and stunting in sunflower plants (Table 1). Highest wilting was caused by *F. equiseti* and highest seedling rot by *F. solani*. Mushtaq & Hashmi (1997) reported severe wilt in young seedlings of capsicum caused by *F. equiseti*. It is interesting to note that *F. equiseti*, *F. longipes*, *F. oxysporum*, *F. pallidoroseum* and *F. scirpi* which are not reported as pathogens of sunflower (Ahmed *et al*., 1994; Dawar, 1994) caused significant diseases including wilting, root-, seedling-, collar- and stem rots, damping off, stunting, tip burning and also reduced the growth of plants. The results are comparable to the findings of Shamim *et al*., (2003), where some strains of *Fusarium solani* showed pathogenicity on their original as well as other hosts.

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