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Pathogenicity and Antimicrobial Activity of Seed-before *Fusarium solani* (Mart.) Appel and Wollenw. Emend. Snyd and Hans Strains

Shamim A. Qureshi, Rubina Riaz, Viqar Sultana, [1]Syed Ehteshamul-Haque and [2]Jehan Ara
Department of Biochemistry, [1]Department of Botany, [2]Department of Food Science and Technology
University of Karachi, Karachi-75270, Pakistan

Abstract: Eight strain/isolates of seed-borne *Fusarium solani* tested for pathogenicity on sunflower, sesame, tomato, wheat and millet showed variations in pathogenicity in *in vitro* on test host. Some strains were found pahtogen in their original host while some isolates showed pathogenicity on other host with out causing rot on roots of their original host. Culture filtrates of these eight strains of *F. solani* also showed variation in antimicrobial activity against *Bacillus subtilis*, *Staphylococcus aureus, Escherichia coli* and *Fusarium solani* (roots isolates).

Key words: *Fusarium solani*, pathogenicity, culture filtrates, antimicrobial activity

Introduction

The genus *Fusarium* occurs widely in nature as saprophytes in soil and decaying vegetables, some species are plant parasites, where specialized pathotypes may cause vascular wilt, stem rot, fruit rot, ear diseases and damping off (Booth, 1971; Domsch *et al*., 1980). The genus has also acquired notoriety because of the ability of serval species to produce toxic metabolites causing illness and even death in man and domesticated animals (Moss and Smith, 1984). Of the various species of *Fusarium*, F. *Solani* is one of the most ubiquitous soil fungus and a destructive plant pahtogen of hundreds of hosts, causing chiefly root and fruit rots (Booth, 1971; Domsch *et al*., 1980), readily isolated pathogenic fungus from seeds and considered as more serious threat to crops, due to its close proximity to growing roots (Neergaard, 1977).

Apart form destructive role, a number of naphthaquinone type pigments including fusarubin, anhydro-fusarubin, javanicin, methyl ether-fusarubin, marticin, isomarticin, lactone are ethyl ether-fusarubin, solaniol, nectriafusarubin and dihydro-fusarubin lactone are known to produce by *F. solani* (Kurobane *et al*., 1980; Baker *et al.,* 1981; James and Robert, 1983; Tatum *et al*., 1985). Some naphthaquinones have antimicrobial (Mokhtar *et al.,* 1979) and nematicidal properties (Hameed *et al.,* 2001). Fusarubin, a pigment isolated from *F. solani* showed antimicrobial, phytotoxic and antitumor properties (Arnstein *et al.,* 1946; Issaq, 1977). Although enormous literatures are available on the pathogenicity of seed-borne *F. solani* but no data is available on the antimicrobial activity of the same strains. This report describes the pahtogenicity of seed borne *F. solani* on their original and other hosts. Animicrobial activity of culture of *F. solani* strains was also examined.

Materials and Methods

Eight strains of Fusarium solani used in this study were isolated from seeds of different hosts viz., S-29 (*Sorghum bicolor*), B-17 (*Brassica compestris*), C-10 (*Capsiucm annuum*), SS (*Helianthus annuus*), TS (*Lycopersicon esculentum*) and L-25 (*Lens culinaris*).

Pathogenicity of *F. solani*: Seeds of test plants viz., (*Helinathus annuum)*, sesame (*Sesamum indicum*), tomato (*Lycopersicon esculentum*), Wheat (*Triticum aestivum*) and millet (*Pennisetum americanum*) were surface sterilized with $Ca(OH)_2$ and transferred on sterilized petri dishes having blotters paper. After coming out of the radical, seeds were transferred onto periphery petri dishes containing potato dextrose agar, in a position to ensure that The germinating radical face towards the center of the petri dishes. Test cultures of the *F. solani* placed in the center of petri dishes and incubated at 28°C for 3-5 days. The browning of the roots were recorded when test fungus touches the roots.

Antimicrobial activity of culture filtrates of *F. solani*: Fungi were grown on Czapeks Dox broth for 15 days at 28°Cl. After 15 days each strain was filtered over paper Whattman No 1. The culture filtrates obtained were used as such (1:0) or diluted as 1: 10 and 1:100. Sterlizied thick filter paper discs were impreganated with each dilution (20 µl $disc^{-1}$) and dried.

Antibacterial activity: Petri dishes containing Tripticase soya agar were seeded with test bacteria like *Staphylococcus aureus* Rosenbach, *Bacillus subtilis* Chon and *Escherichia coli* (Migula) Castellani and Chalmers with the help of a sterilized cotton swab. Discs of the culture filtrates and control were placed at different positions in the petri dishes. Discs impregnated with Czapex Dox broth served as control, while streptomycin served as+ve control @ 10 μg disc^{-1}. Each treatment was replicated 3 times and plates were incubated at 30°C. Observations were recorded daily. The zone appeared around the discs was considered as zones o inhibition.

Antifungal activity: In order to determine the antifungal activity of culture filtrates of *F. solani,* loaded discs with culture filtrates were placed at different places of petri dishes containing Czepak's's Dox agar (pH 7.2) with one control and one standard fungicide (Benlate) @ 10 μg disc^{-1}, served as positive control. A 5 mm disc of actively growing culture of *F. solani* (roots isolates), were inoculated in the center of the dish and incubated at 28°C. Each treatment was replicated 3 times and observations were recorded daily. Zone of inhibition produced were measured in mm and averaged.

Results

In pathogenicity test, *F. solani* strain T-9 isolated form tomato seed was found pathogenic on sunflower and millet, not on tomato. While other strain TS also isolated from tomato seed was found more pathogenic on millet and less on tomato seedling. *F. solani* strain S-29 (sorghum isolate) was pathogenic on sunflower, millet and tomato. Strain SS isolated from sunflower was more pathogenic on sunflower than millet (Table 1).

Table 1: Pathogenicity of *Fusarium solani* strains on seedlings of different plants

Strains of *F. solani*	Millet	Sunflower	sesame	tomato	Whezt
T-9	++	++	+++	+++	+++
TS	++	+++	+++	+++	+
L-25	+++	++	++	+++	+++
B-17	+++	+	+++	+	+++
W-5	+++	+++	+	+++	+++
C-10	+++	+	++	+++	++
SS	+	++	+++	+++	+++
S-29	++	++	+++	++	+++

\+ Root tips brown,
++ About half root brown
+++ Whole root brown

Table 2A: Growth inhinitions of *Staphylococcous aureus* by culture filtrates of deed-brone *F. solani* strains

Cluture filtrates of *F. solani* strains	Control	Streptomycin (10 μg disc^{-1})	Culture Filtrates 1:0	1:10	1:100
Zone if inhibitions					
T-9	0	15	10	7	0
TS	0	15	15	8	0
L-25	0	15	8	0	0
B-17	0	15	0	0	0
W-5	0	15	0	0	0
C-10	0	15	0	0	0
SS	0	15	0	0	0
S-29	0	15	10	7	0

Table 2B: Growth inhibitions *Esherichia coli* by culture filtrates fo seed-borne *F. solani* stranis

Cluture filtrates of *F. solani* strains	Control	Streptomycin (10 μg disc^{-1})	Culture Filtrates 1:0	1:10	1:100
Zone of inhibitions					
T-9	0	14	0	0	0
TS	0	14	10	7	0
L-25	0	14	7	0	0
B-17	0	14	8	6	0
W-5	0	14	11	8	0
C-10	0	14	12	8	0
SS	0	14	12	7	0
S-29	0	14	10	7	0

Table 2C: Growth inhibitions of *Bacillus subtilis* by culture filtrates of seed-brone *F. solani* strains

Cluture filtrates of *F. solani* strains	Control	Streptomycin (10 μg disc^{-1})	Culture Filtrates 1:0	1:10	1:100
Zone of inhibitions					
T-9	0	18	10	6	0
TS	0	18	9	6	0
L-25	0	18	8	0	0
B-17	0	18	9	6	0
W-5	0	18	12	7	0
C-10	0	18	10	7	0
SS	0	18	9	6	0
S-29	0	18	12	7	0

Table 3A: Antifungal activity of cultural filtrates of seed-brone *F. solani* strains against sunflower roots infecting *F. solani* isolate

Cluture filtrates of *F. solani* strains	Control	Streptomycin (10 μg disc^{-1})	Culture Filtrates 1:0	1:10	1:100
Zone of inhibitions					
T-9	0	17	18	0	0
TS	0	17	0	0	0
L-25	0	17	7	0	0
B-17	0	17	0	0	0
W-5	0	17	0	0	0
C-10	0	17	0	0	0
SS	0	17	0	0	0
S-29	0	17	8	0	0

Table 3B: Antifungal activity of culture of seed-borne *F. solani* strains against chilli's roots infecting *F. solani* isolate

Cluture filtrates of F. solani strains	Control	Streptomycin (10 μg disc^{-1})	Culture Filtrates 1:0	1:10	1:100
Zone of inhibitions					
T-9	0	15	13	5	0
TS	0	15	15	5	0
L-25	0	15	10	5	0
B-17	0	15	0	0	0
W-5	0	15	0	0	0
C-10	0	15	0	0	0
SS	0	15	8	0	0
S-29	0	15	0	0	0

Table 3C: Antifungal activity of culture of seed-borne *F. solani* strains against wheat's roots infecting *F. solani* isolate

Cluture filtrates of F. solani strains	Control	Streptomycin (10 µg disc^{-1})	Culture Filtrates 1:0	1:10	1:100
Zone of inhibitions					
T-9	0	19	16	5	0
TS	0	19	11	5	0
L-25	0	19	12	5	0
B-17	0	19	0	0	0
W-5	0	19	0	0	0
C-10	0	19	0	0	0
SS	0	19	0	0	0
S-29	0	19	0	0	0

Maximum growth inhibition of *Staphylococcus aureus* was found by strain TS followed by S-29. Maximum zone was produced by strain TS (15 mm) followed by SS (12 mm). All the test *F. solani* strains inhibited *B. subtilis*, with maximum zone was produced by S-29 (14 mm) followed by C-10 and T-9 (10 mm). Antibacterial activity of *F. solani* strains was reduced when diluted (Table 2A-2C).

Where inhibition potential of cultural filtrates of seed borne *F. solani* were tested against radial growth of *F. solani* isolated from sunflower root, culture filtrates of T-9, S-29 and L-25 inhibited the radial growth of *F. solani.* Whereas wheat's root and chilli's root isolates were inhibited by culture filtrates of T-9 and L-25 strains of *F. solani.* Diluting of culture filtrates either reduced or loss the antifungal activity (Table 3A-3C).

Discussion

Fusarium solani causes a variety of diseases in plants in plants such as wilt, blight root and stem rot (Janke, 1976) and was found associated with root rot of greenhouse tomato (Armstrong and Armstrong, 1978) and soybean seedlings (Grant, 1980). In Pakistan *F. solani* has been reported to cause root rot disease in a number of economic crops (Ehteshamul-Haque, 1994). In this study seed-brone *F. solani* strains showed tremendous variations in pathogenicity on various hosts. It is interesting to note that some strains were found non-or less pathogenic on their original host while found pathogenic on other host.

In this study, culture filtrates of *F. solani* strains showed antibacterial activity against *B. subtilus, E. Coli* and *S. Aureus* and antifungal activity against some roots isolates of *F. solani.* Many antibiotics and mycotoxins were produced by strains of *Fusarium* species (Burmesiter *et al*., 1974). There are reports on naphthazarin pigments fusarubin, anhydrofusarubin and javanicin isolated from culture filtrates of *F. solani* which were found to possess insecticidal activity on blowfly *Calliphora erythrocephala* (Claydon *et al*., 1977). Fusarubin has also been reported to have antimicrobial (Arnstein *et al*., 1946) activities. In this study *F. solani* strains showed tremendous variations in antimicrobial activity. Variation in their antimicrobial activity is presumably due to genetic makeup (Domsch *et al.,* 1980), a marked variations in *F. solani* isolates have been reported (Burnett, 1984). Strains of *F. solani* could be exploited for the isolation antimicrobial compounds.

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