POPULATION STRUCTURE OF FUSARIUM OXYSPORUM IN CONVENTIONAL AND ORGANIC TOMATO PRODUCTION IN FLORIDA

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Fusarium wilt in tomatoes, caused by *Fusarium oxysporum* f. sp. *lycopersici* is currently managed through fumigation with methyl bromide. Nonpathogenic Fusaria have been demonstrated to reduce Fusarium wilt on several crops, including tomato (Larkin and Fravel, Plant Dis. 82:1022-1028; Phytopathology 89:1152-1161). Currently, the only way to distinguish pathogenic Fusaria from beneficial or saprophytic Fusaria is through a plant bioassay. This research was undertaken to determine the population structure of Fusaria in soil and on tomato roots, as well as to identify genetic markers for pathogenicity and biocontrol ability.

Roots and soil were collected from tomato plants at two sites in Osceola County, FL representing conventional and organic farming systems. Samples were dilution plated onto Komada's medium with each of the following plated separately: nonrhizosphere soil, soil in the root zone but not attached to roots, rhizosphere soil, fine roots, long lateral roots, and main roots. A total of 21,054 Fusaria were recovered, 26.6% of which were 5610 *F. oxysporum* (Table 1). Soil near tomato roots or rhizosphere soil had approximately 10-fold larger Fusarium population sizes than non-rhizosphere soil (Table 1). Fine roots (either attached to or not attached to the plant) had population sizes 2 to 7 fold greater than long lateral roots and main roots. This is likely associated with greater nutrient availability, as well as the volume:surface root surface ratio of fine vs larger roots. Soil amended with Telone alone had the largest fungal population of any site tested.

Pathogenicity assays using tomato cultivar Bonny Best were performed on all 406 *F. oxysporum* recovered (Table 2). Of these, 63 (15.5%) were pathogenic with 34 expressing symptoms as *F. o. lycopersici* and 29 as *F. o. radicis-lycopersici*. All pathogenic isolates were tested on differential tomato cultivars to determine race of the pathogen. All of the 34 pathogenic *F. o.. lycopersici* recovered were from the organic farm. Of these,15 were Race 1, 6 were Race 2 and 5 were Race 3. However, when samples were originally collected, no plants on the organic site showed symptoms, while several plants at the conventional site showed symptoms. Race 3 *F. o. lycopersici* was recovered from these plants from the conventional farm.

One hundred and twenty-nine *F. oxysporum* isolates were further characterized using ITS1-5.8S-ITS2 rDNA regions. Fungal mycelia were harvested from 5-day cultures in PDB and DNA were isolated from mycelia using a DNA isolation kit (Qiagen). ITS1-5.8S-ITS2 region was amplified using ITS4 and ITS5 primers on a thermalcycler, digested using *Msp*I restriction enzyme, and then separated on a agarose-gel Twin gel. At least 5 groups were identified based on polymorphism of the ITS1-5.8S-ITS2 rDNA regions. Group II, containing one *Msp*I cut site, was the largest containing 82 isolates, including almost all the pathogenic strains. Group III, with 2 cuts, contained 17 isolates; and Group V, with 3 cuts, had 4 isolates. Results indicated that nonpathogenic strains had higher diversity in the population.

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Table 1. Total Fusaria and *F. oxysporum* (*F.o.*) populations recovered from a conventional and an organic farm in Florida.

Sampling location	Total Fusaria [a]	*F.* o. (%)	Organic farm (CFU counted)				Conventional farm (CFU counted)			
			Solarized		Intercropped beans [b]		Telone+solarized		Telone alone	
			Total	*F.o.* (%)	Total	*F.o.* (%)	Total	*F.o.* (%)	Total	*F.o.* (%)
Non-rhiz. soil	955	408 (42.7)	100	8 (8.0)	160	7 (4.4)	90	10 (11.1)	389	331 (85.1)
Root-near soil	4482	1431 (31.9)	2303	178 (7.7)	633	553 (87.4)	108	15 (13.9)	810	540 (66.7)
Rhiz. soil	2893	921 (31.8)	591	170 (28.8)	1452	460 (31.7)	47	24 (51.1)	230	173 (75.2)
Root surface										
Fine root not attached	4730	978 (20.7)	2244	168 (7.5)	1581	436 (27.6)	97	6 (6.2)	336	285 (84.8)
Fine root attached	2219	308 (13.9)	1334	84 (6.3)	245	57 (23.3)	--	-- (--)	145	60 (41.4)
Long lateral root	3607	804 (22.3)	1477	94 (6.4)	940	399 (42.4)	434	225 (51.8)	120	40 (33.3)
Main root	2168	760 (35.1)	669	168 (25.1)	388	68 (17.5)	99	40 (40.4)	197	49 (24.9)

[a]Per g of soil or per g of root.
[b]Not solarized. Planted into bean stubble and intercropped with beans.

Table 2. Pathogenicity of *F. oxysporum* collected from organic and conventional tomato fields in Florida.

Farming system	No. of plants	Origin of *F. o.* isolate		Total *F. o.* isolated	Pathogenic (# of isolates)		Non-pathogenic (# of isolates)
		Root	Soil		*Fol* [a] (%)	*Forl* [b] (%)	
Organic	7	69	221	290	30 (52.6)	27 (47.4)	233
Conventional	3	16	100	116	4 (66.7)	2 (33.3)	110
Total	10	85	321	406	34 (54)	29 (46)	343

[a]*F. oxysporum* f. sp. *lycopersici.*
[b]*F. oxysporum* f. sp. *radicis-lycopersici*.