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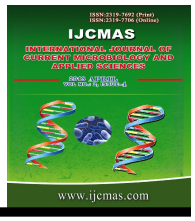

Original Research Article

Effect of No-tillage on the Biodiversity of Phytopathogenic Fungi in the Semi arid area (Case of Setif area)

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Keywords

Phytopathogenic fungi;
Soil;
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Rotation;
Algeria.

A B S T R A C T

The fungi from different soil samples conducted in direct seeding (no tillage) for four consecutive years were investigated in terms of quality and quantity, using the soil dilution plate. A total of nine opportunistic and fungal pathogens were identified. The most common genera are *Fusarium*, *Penicellium* and *Aspergillus*. We found that direct seeding promotes the growth of fungi particulary *Fusarium*. Furthermore, the choice of culture and its location in the rotation plays an important role in the distribution of the fungal. The plot conducted in monoculture for four years is the most infected compared to the other plots.

Introduction

Soils are excellent cultural media for the growth of many types of organisms. This includes bacteria, fungi, algae, protozoa and viruses. A spoonful of soil contains billions of general the majority of microbial population is found in the upper six to twelve inches of soil and the number decreases with depth. The number and kinds of organisms found in soil depend upon the nature of soil, depth, season of the year, state of the cultivation, reaction, organic matter, temperature, moisture and aeration (Mamatha *et al.*, 2006).

A change of the abundance and diversity of fungal communities in soils may therefore have huge impact on terrestrial ecosystems (Walker, 2008). One of the pest affecting the cultivate plants in Algeria is represented by the phytopathogenic fungi. Direct seeding requires the presence of the continuous covered plant residues (Bessam, and Mrabet, 2001) and provides an environment favorable to the growth of many types of organisms like the pathogenic fungi.

Through the analysis of the samples of soil from the plots conducted in direct seeding in Setif.

Materials and Methods

Sampling

The samples were collected from seven plots conducted under direct seeding for fourth consecutive years and cultivated with Chickpea, Durum wheat, Peas, Lens plant, Chemical fallow and Grazed fallow) (Table. 1) to identify soil microfungal flora. The plots are located in the Experimental Station of the Technical Institute of Field Crops (ITGC) belonging to Setif area (36 ° N and 5° 22 E). In each plot, we take six soil samples at two layers (Horizon). The first is at a depth and the second is at a depth of 7-15 cm. The sampling is made at 02/04/2011; it represents the stage of plant emergence. Sowing is carried out on 24/11/2010. The samples are collected in sterile polythene bags.

Methodology

Isolation of bacteria was performed by making serial dilution of the taken samples and the dilution used for studies were 10^{-2} and 10^{-4} (Rapilly, 1968). Isolation of Fungi was performed by making plate method using Dextrose Potato Agar medium (PDA) (Davet and Rouxel, 1997). Plates and media was weighed out and prepared according to the manufacture's specification, with respect to the given instructions and directions. The plates were incubated at 27^{o}C for 72 hrs to 144 hrs. Pure cultures were obtained and fungi are identified by morphological structures observed by lactophenol staining under 100x lens. The identification of fungal genera was performed according to the identification keys of Subramanian (1983), Lepoivre (2003) and Nasraoui (2006) based on the characteristics of the colonies, mycelium and the conidia.

Results and Discussion

Identification soil fungi

The soil samples were analyzed with respect to different types of fungi. We identified 9 genera of fungi. So, we have not able to determine the species belonging for each genus (Table. 2).

Abundance and diversity of soil fungi

The relative diversity and the abundance of the phytopathogenic fungi collected from the soil of different plots are given in the figure 2. The diversity relative and the abundance of phytopathogenic fungi at the two soil horizons (layers) from the 7 plots are reported in the figure 3. We noted that the type and the crop rotation have effect on the diversity and the abundance of phytopathogenic fungi. The genus *Fusarium* is the most present in almost plots. The abundance of *Fusarium* varies with the rotation and the type of crop. In the plot where wheat is grown for four consecutive years, *Fusarium* is the most abundant. We noted that *Fusarium* is more abundant in the superficial layer if the crop is the wheat and in the depth layer if the crop is wheat. The similar results were obtained by Colbach *et al*., (1996). We found that in the plot 7 grown with the lens plant and wheat alternately, *Fusarium* rate is very low and in the plot 5 where the crop wheat is introduced only once in the rotation, there is no *Fusarium*, which led us to conclude that the better rotation is also an important factor in the abundance of phytopathogenic and opportunistic fungi particularly *Fusarium* in the soil.

Table.1 Type of the rotation plants during the fourth years by plots

	First year	**Second year**	**Third year**	**Fourth year**
Plot 1	Wheat durum	Wheat durum	Wheat durum	Wheat durum
Plot 2	Wheat durum	chemical fallow	Wheat durum	Wheat durum
Plot 3	Wheat durum	grazed fallow	Wheat durum	Chickpea
Plot 4	Lens plant	Wheat durum	Chemical fallow	Wheat durum
Plot 5	Lens plant	Wheat durum	Chemical fallow	Lens plant
Plot 6	Wheat durum	Peas	Wheat durum	Lens plant
Plot 7	Lens plant	Wheat durum	Lens plant	Wheat durum

Table.2 List of genera of f List of Fungi identified by horizon and plot

Plots	**Horizon**	**Genera**
Plot 1	H 1	*Fusarium, Penicillium, Alternaria, Aspergillus, Cladosporium, Erysiphe*
	H 2	*Fusarium, Penicillium,Alternaria ,Aspergillus, Bulmeria*
Plot 2	H 1	*Fusarium,Penicillium, Alternaria, Aspergillus, Cladosporium, Rhizopus*
	H 2	*Fusarium, Penicillium, Alternaria, Aspergillus, Cladosporium, Erysiphe, Rhizopus, Helminthosporium*
Plot 3	H 1	*Fusarium, Penicillium, Alternaria, Rhizopus, Aspergillus, Cladosporium, Helminthosporium*
	H 2	*Fusarium, Penicillium, Alternaria, Aspergillus, Helminthosporium*
Plot 4	H 1	*Fusarium, Penicillium, Alternaria, Rhizopus,Aspergillus, Helminthosporium*
	H 2	*Fusarium, Penicillium, Aspergillus, Helminthosporium*
Plot 5	H 1	*Fusarium, Penicillium*
	H 2	*Fusarium, Penicillium, Aspergillus*
Plot 6	H 1	*Fusarium, Penicillium, Alternaria, Aspergillus, Cladosporium, Rhizopus, Helminthosporium*
	H 2	*Fusarium, Alternaria, Aspergillus, Rhizopus, Helminthosporium*
Plot 7	H 1	*Fusarium, Aspergillus, Penicillium, Helminthosporium*
	H 2	*Fusarium, Aspergillus, Penicillium, Helminthosporium*

Table.3 Pathogenecity Scale of the identified fungi

Genera	Nature of pathogen	Scale
Penicellium, Aspergillus	Opportunistic	0
Alternaria, Rhizopus and Erysiphe	Weakly pathogenic	1
Fusarium and *Blumeria*	Moderately pathogenic	2
Helminthosporium and *Cladosporium*	Highly pathogenetic	3

Figure. 1 Relative abundance and diversity of phytopathogenic and opportunistic fungi from the soil of the 7 plots.

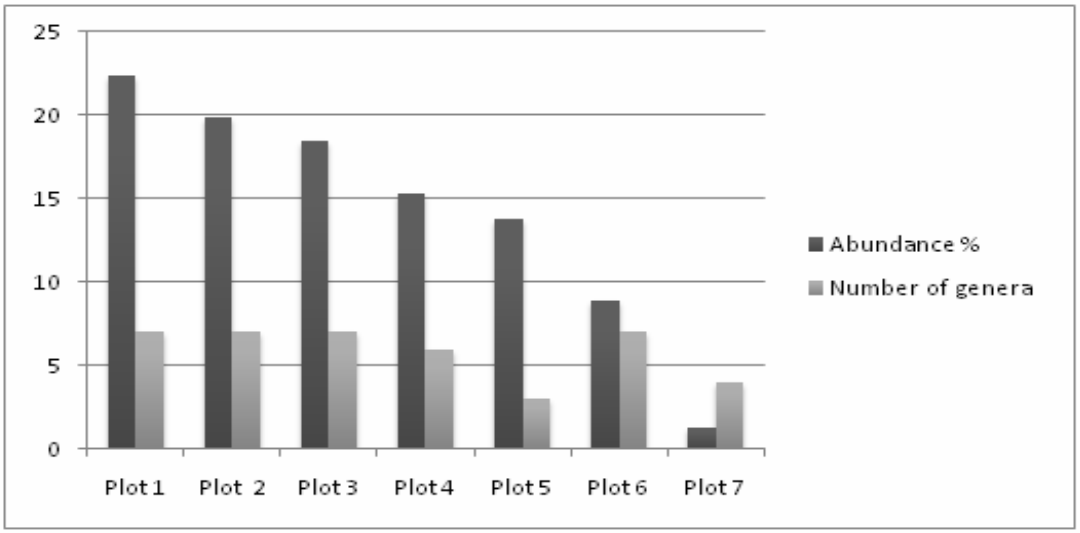
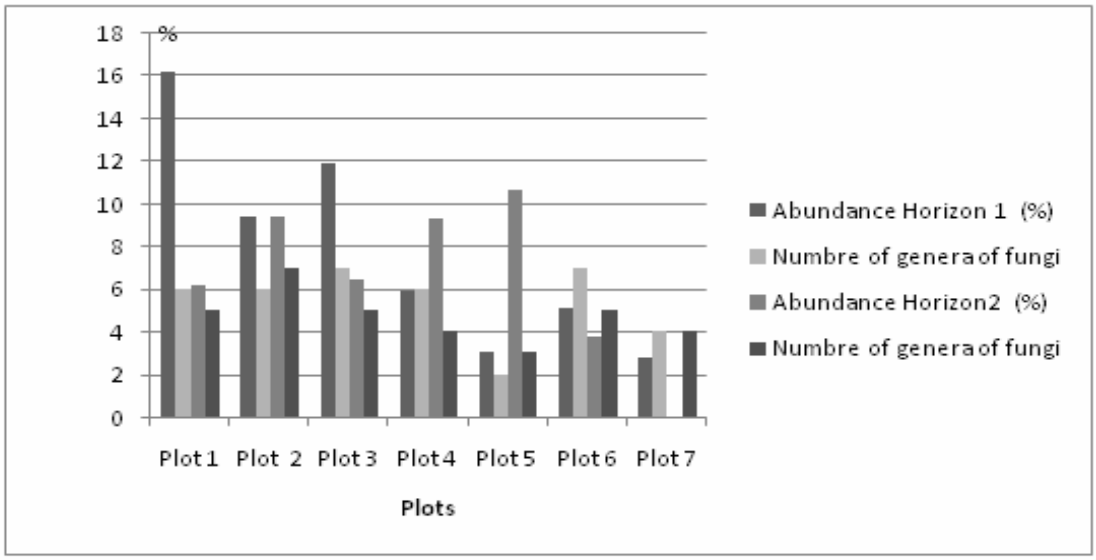


Figure 2. Relative abundance and the diversity of phytopathogenic and opportunist fungi from the soil by horizon in the 7 plots.



Pathogenicity of fungal inventoried in soil

Pathogenicity of fungi varies from one species to another (Table. 3). The results showed that *Fusarium* is the most present in all plots. According Segey *et al*., (2009), that the only disadvantage of this technique (no-tillage) is on increased of This type of fungus in the soil which harms the crops. The rotations of the crops in the same station (plot) affect the diversity, distribution and the abundance of the phytopathogenic fungi soil. However, the incidence of fungal diseases is greatly reduced in soils with the organic amendments.

In these work 9 genera of phytopathogenic and opportunistic fungi were identified. *Fusarium* is the most present in all plots. The plot conducted with the monoculture is the most infected. The crop type, crop rotation and the horizon of soil, have an important role in the biodiversity and the abundance of phytopathogenic fungi. The choice of the better crop rotation associated with a fungal treatment can resolved this problem. The no tillage is a technique that it can be applied in many countries with arid or semi-arid climate.

Direct seeding can reduce erosion, improve and protect the water quality, enhance the biodiversity, biological activity, reducing the greenhouse effect, enrich the soil with organic matter and improving the soil structure. However, the downside of this technique is the proliferation of phytopathogenic fungi in the soil, especially when the crop rotation is not better and the no using the chemical control. All these drawbacks limit the use of this technique in many countries.

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