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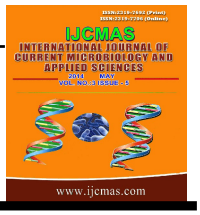

Original Research Article

Fungal Diversity of Rhizosphere Soils in Different Agricultural fields of Nanjangud Taluk of Mysore District, Karnataka, India

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A B S T R A C T

Soil microorganisms such as bacteria and fungi play an important role in soil fertility and promoting plant health. Soil harbors most of our planet's undiscovered biodiversity. Twenty soil samples of different agricultural crop fields in and around Nanjangud taluk were investigated for diversity among fungi. A total of 10 species belonging to 7 genera of fungi were isolated from agricultural fields at Nanjangud taluk. The mycoflora were isolated by using soil dilution technique or viable plate count method on Potato Dextrose agar and Czapek's Dox Agar medium supplemented with antibiotic Streptomycin. Identification and characterization of mycoflora were done with the help of manuals of fungi. The dominant genera in all the agricultural crop fields were *Aspergillus*, *Penicillium* and *Mucor species*.

Keywords

Diversity, Nanjangud Taluk, mycoflora, Agricultural fields

Introduction

Soil is the major component of earth's ecosystem which comprises of organic matter, minerals, gases and large numbers of macro and microorganisms. The soil ecosystem is supported by several interactions among its physical, chemical and biological components (Buscot 2005). Many biological processes take place in soil and determine functions that provide various services within ecosystems: turnover of organic matter, symbiotic and non symbiotic atmospheric nitrogen fixation, denitrification, aggregation etc. (Chenu and Stotzky, 2002). Rhizosphere is the narrow zone of soil surrounding the root where microbe populations are stimulated by root activities. Rhizosphere is known to be a hotspot of microbial activities. (Brimecomb *et al.*, 2007). Soil microflora plays a pivotal role in evaluation of soil conditions and in stimulating plant growth (Kiran Singh *et al.*, 1999). Microorganisms in the soil and rhizosphere are beneficial in increasing soil fertility and plant growth as they are involved in several biochemical transformations and mineralization activities in soils. Type of cultivation and crop management practices found to have greater influence on the activity of soil

microflora (Mc.Gill *et.al.,* 1980). Fungi are an important component of soil microbiota more in abundance than bacteria, depending on soil depth and nutrient conditions. Different soils have specific fungal flora, but the majority of species found in them are cosmopolitan (Ainsworth and Sussman, 1968).

Fungi are fundamental for soil ecosystem functioning (Warcup, 1951, especially in forest and agricultural soils, they play a key role in many essential processes such as organic matter decomposition and elemental release by mineralization (Christensen *et al*., 1989). It was estimated 1.5million fungal species are present in natural ecosystems, but only 5-10% has been described formally (Hawksworth 2001). The aim of the present investigation is to isolate mycoflora from different crop fields, to study fungal diversity and to observe percentage contribution of different fungal species. The study involves isolation, identification and enumeration of fungal species from different crop fields in and around Nanjangud taluk of Mysore district.

Materials and Methods

Study area

Nanjangud is one of the taluk in Mysore district of Karnataka which lies on the banks of river Kapila (Kabini). The study area lies on 15.12^{o}N latitude and 76.68^{o}E longitude which has an average elevation of 657 meters. The temperature ranges from 10^{o}C to 38^{o}C and the annual rainfall is 697mm. The types of soil found in this district are red sandy soil, red loamy soil, laterite soil and deep black soils. Paddy, Maize, Tobacco, Cotton, Groundnut, Banana, Ragi, Pulses, Vegetables and oil seeds are the crops cultivated.

Collection of Soil Samples

Soil and Rhizosphere soil samples were collected from the agricultural fields of Alaganchi, Alathur, Belale, Kempesiddanahundi, Gonahalli and Hadinaru at Nanjangud taluk (Table.1). In each locality 1 kg of soil sample was collected from the surface area reaching about 10-15 cm depth and near the rhizosphere region of plants. The collected soil samples were brought to the laboratory in sterile polythene bags and stored at 4^{o}C until further analysis.

Isolation and Enumeration of Fungi from the soil samples

The soil micro fungi were enumerated by soil dilution plate method or viable plate count method (Waksman, 1922) on Potato Dextrose Agar and Czapek's Dox Agar. 1 gm of soil sample was suspended in 9 ml of 0.9% saline (Sodium chloride) to make microbial suspensions (10^{-1} to 10^{-4}). Dilution of 10^{-3} and 10^{-4} were used to isolate fungi. 1 ml of microbial suspension of each concentration was added to sterile Petri dishes (triplicate of each dilution) upon which sterile Potato Dextrose Agar and Czapek's Dox Agar is added by pour plate technique. One percent Streptomycin solution was added to the medium before pouring into petriplates for preventing bacterial growth. The petridishes were then incubated at 28^{o}C for 5-7 days. The plates were observed everyday up to 7 days. The colony forming units (CFU) of the fungal isolates were calculated. All the results were calculated and statistical analysis was performed.

Identification of Soil Fungi

Fungal morphology were studied macroscopically by observing colony

features (Texture and Color) and microscopically by staining with Lacto phenol cotton blue and observed under compound microscope for conidiophores, conidia and arrangement of spores (Aneja, 2001). The fungi were identified with the help of literature (Nagamani *et al.,* 2006).

Statistical analysis

The number of colonies per plate in 1 g of soil was calculated. The percent contribution of each isolate was calculated by using the following formula:

$$\% \text{ Contribution} = \frac{\text{Total No. of CFU of an individual species}}{\text{Total No. of CFU of all species}} \times 100$$

*CFU-Colony forming Unit

Results and Discussion

Diversity refers to the variability of life which can be among plants, animals and microorganisms. Fungi are important components of biodiversity which has major role in global ecological processes. In the present study 162 fungal colonies of 10 fungal species were isolated from different agricultural crops fields in Nanjangud taluk (Table 2). The maximum fungal species belonging to Deuteromycotina (135 colonies) and Zygomycotina (27 colonies) were observed. *Apergillus, Penicillium* and *Mucor species* were the dominant fungal species found among the isolates (Table 2). They are dependent on the nature of substrate and temporal region that favors the colonization, growth and substrate possession of the fungi (Rani *et al.,* 2010).

Soil microorganisms play an important role in biogeochemical processes which determine plant productivity successful functioning of introduced microbial inoculants and their influence of soil health. Exhaustive efforts have been made to explore soil microbial diversity of indigenous community, their distribution and behavior in soil habitats (Saravanakumar *et.al.,* 2010). The soil microflora in different crops fields like Paddy, Pulses, Ragi, Sugarcane, Vegetable and Banana were observed. The most common among them like *Curvularia lunata* (6.8%), *Alternaria alternata* (6.2%), *Penicillium fumiculosum* (13.6%), *Penicillium chrysogenum* (11.1%), *Fusarium solani* (8.1%), *Rhizopus stolonifer* (3.1%), *Mucor spp*. (13.6%), *Aspergillus flavus* (16.1%), *Aspergillus terreus* (8.7%) and *Aspergillus Niger* (13.1%) were isolated and characterized. Diversity was found to be higher in agricultural fields of vegetables, pulses and paddy as compared to other agricultural fields of ragi, sugarcane and banana where the mycorrhizal association was found to be predominant along with the soil particles. The percentage contribution of each fungal species in different fields was statistically analyzed (Table 3). *Aspergillus niger, Aspergillus flavus, Penicillium chrysogenum* and *Mucor species* were dominant in all agricultural fields, due to high sporulation capacity. The toxins produced by *Aspergillus species* and antibiotics produced by *Penicillium species* may be preventing the growth of other fungal species.

Table.1 Agricultural soil samples collected from different places of Nanjangud.

Sample No	Sampling Location	Types of Crops
1	Alaganchi	Paddy
2	Alathur	Pulses
3	Belale	Ragi
4	Kempesiddanahundi	Sugarcane
5	Gonahalli	Vegetables
6	Hadinaru	Banana

Table 2: Frequency of mycoflora in different crop fields at Nanjangud taluk

Sl No	Crops	Average no of total colonies	Average number of individual colonies									
			Curvularia	Alternaria	Penicillium		Fusarium	Rhizopus	Mucor spp.	Aspergillus		
			Clu	Alal	Pfu	Pch	Fs	Rso	Mu	Afl	At	An
1	Paddy	28	4	3	6	4	2	-	2	3	2	2
2	Pulses	30	-	2	4	2	3	2	5	4	4	4
3	Ragi	22	1	-	1	5	3	-	4	3	3	2
4	Sugarcane	24	1	1	3	-	2	-	4	5	2	6
5	Vegetables	36	3	2	5	4	1	2	4	7	3	5
6	Banana	22	2	2	3	3	2	1	3	4	-	2
Total		162	11	10	22	18	13	5	22	26	14	21
% Contribution			6.8	6.2	13.6	11.1	8.1	3.1	13.6	16.1	8.7	13.1

Table.3 Percent contribution of fungal species in different crop fields of Nanjangud taluk

Sl No	Fungal Species obtained	% Contribution					
		Paddy	Pulses	Ragi	Sugarcane	Vegetables	Banana
1	*Curvularia lunata*	14.28	-	4.54	4.54	8.33	9.09
2	*Alternaria alternata*	10.71	6.67	-	4.54	5.55	9.09
3	*Penicillium fumiculosum*	21.43	13.33	4.54	12.5	13.90	13.64
4	*Penicillium chrysogenum*	14.28	6.67	22.72	-	11.11	13.64
5	*Fusarium solani*	7.14	10.00	13.63	8.33	2.77	9.09
6	*Rhizopus stolonifer*	-	6.67	-	-	5.55	4.54
7	*Mucor spp.*	7.14	16.67	18.18	16.67	11.11	13.64
8	*Aspergillus flavus*	10.71	13.33	13.63	20.83	19.44	18.18
9	*Aspergillus terreus*	7.14	13.33	13.63	8.33	8.33	-
10	*Aspergillus niger*	7.14	13.33	9.09	25.00	13.90	9.09

Fig.I Fungal colonies obtained on PDA.

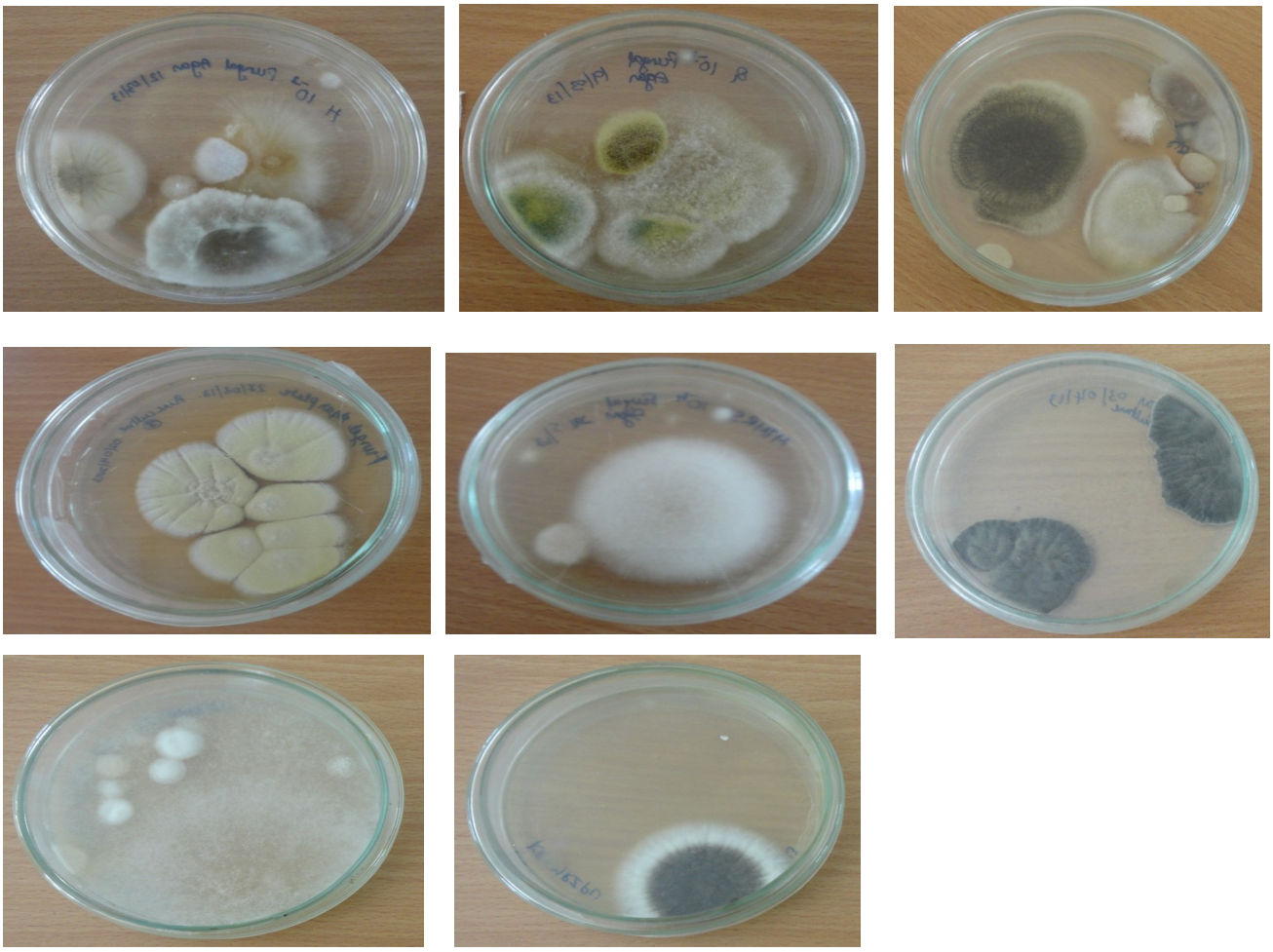


Fig.II Frequency of mycoflora in different crop fields at Nanjangud taluk

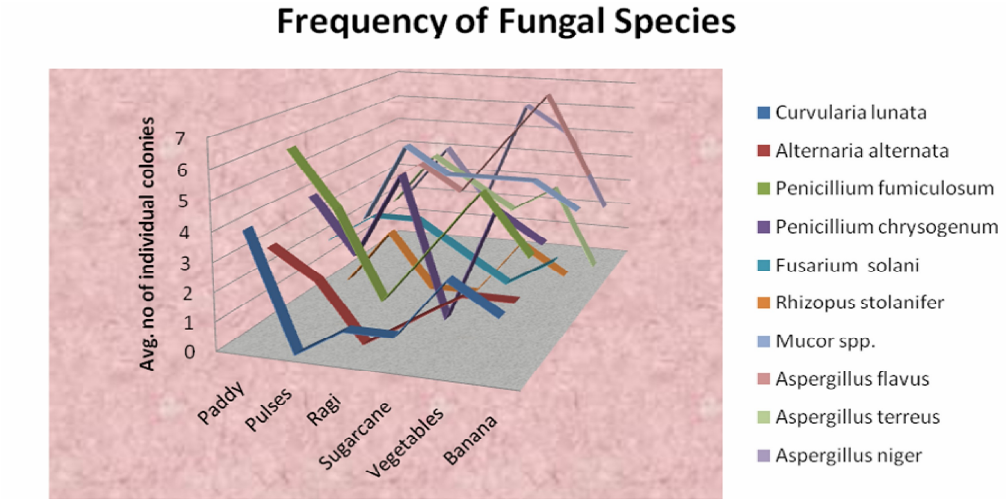


Fig.III Percent contribution of fungal species in Paddy field of Nanjangud taluk

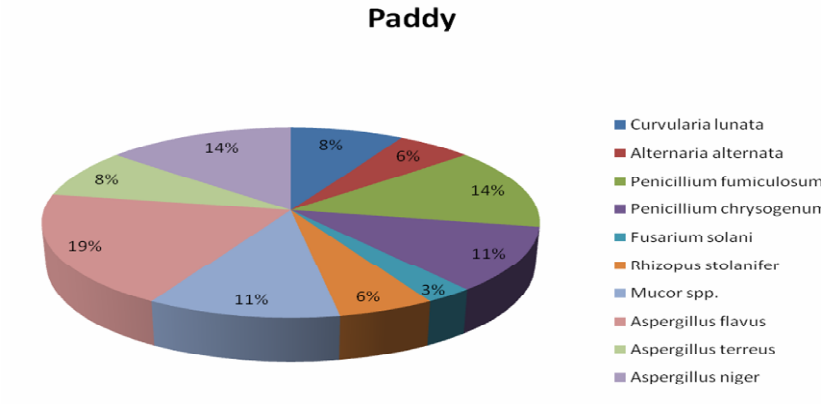


Fig.IV Percent contribution of fungal species in Pulses field of Nanjangud taluk

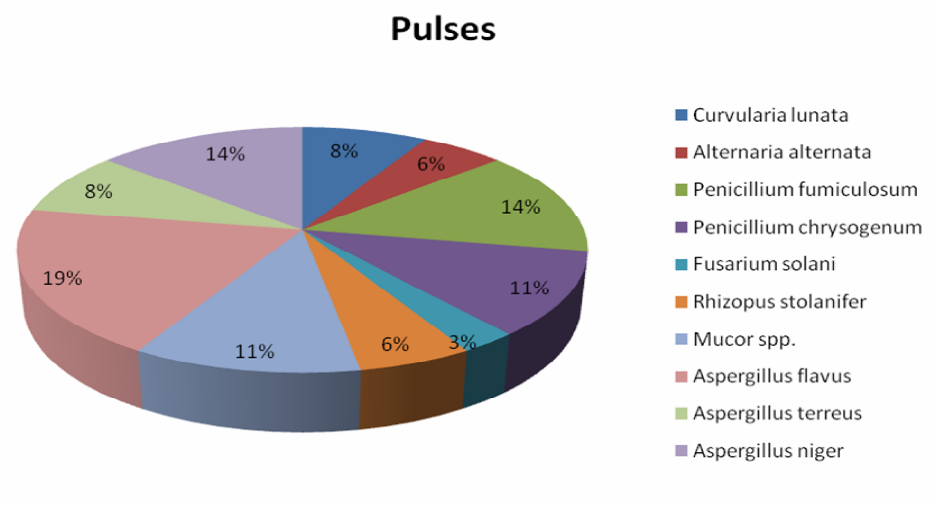


Fig.V Percent contribution of fungal species in Ragi field of Nanjangud taluk

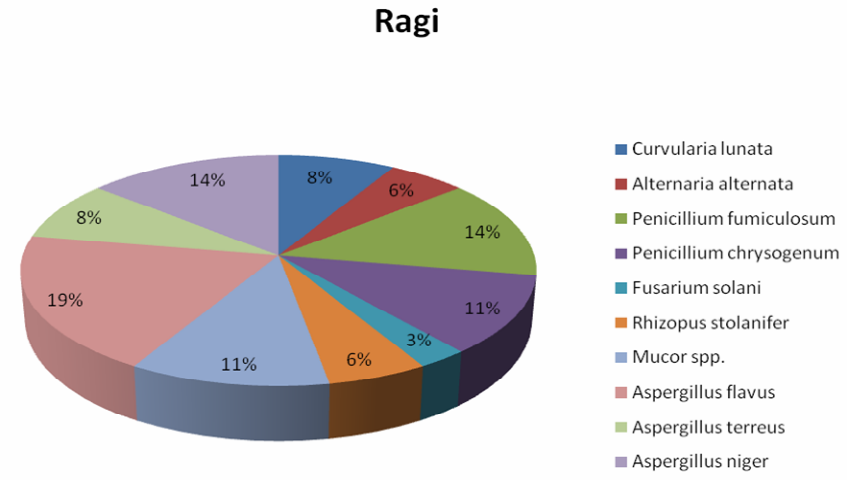


Fig.VI Percent contribution of fungal species in Sugarcane field of Nanjangud taluk

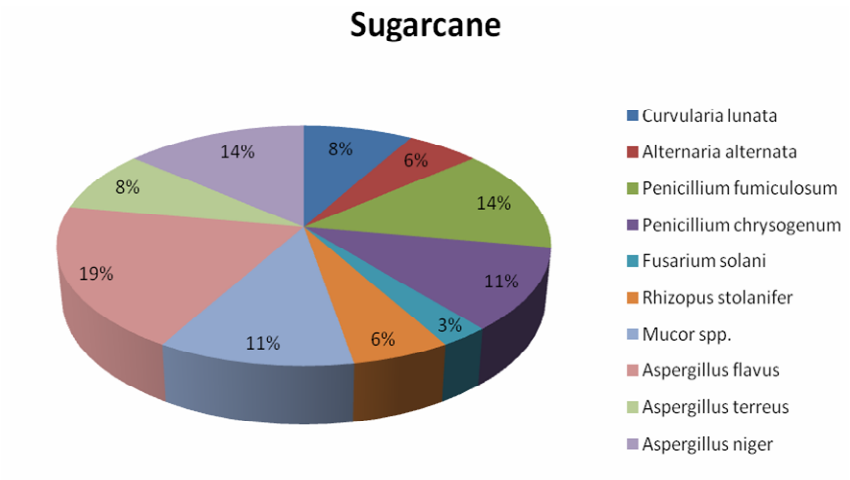


Fig.VII Percent contribution of fungal species in Vegetables field of Nanjangud taluk

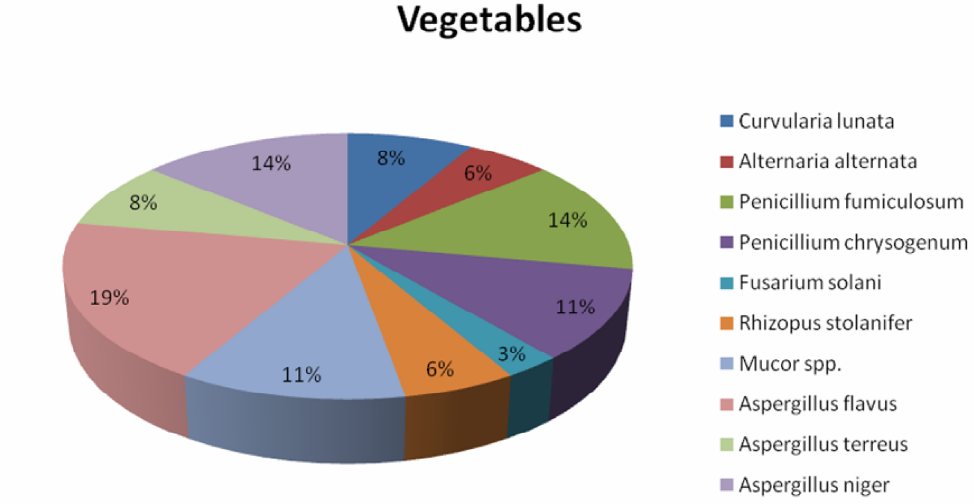
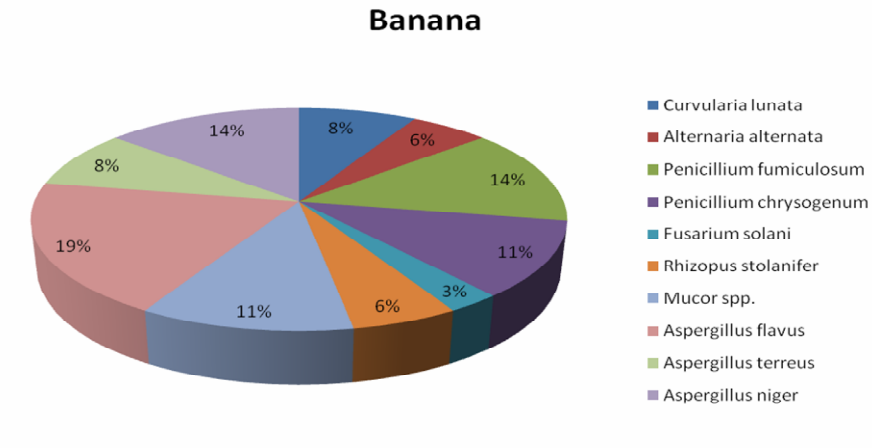


Fig.VIII Percent contribution of fungal species in Banana field of Nanjangud taluk



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