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Comparative Study of Fungal Diversity in the Agricultural soil and Non-agricultural soil of Bhadravathi taluk, Shimoga district, Karnataka, India

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ABSTRACT:

Fungi play an important role in the maintenance and survival of tropical forests. In the present study, both agricultural soil and non-agricultural soil samples were studied for screening and detection of fungal diversity in these two samples.

Three different methods were subjected for the diversity analysis of fungi. Among all the methods serial dilution method is better compared to the baiting technique and war cup method. One gram of leaf litter soil sample was added into the 10 ml of sterile distilled water and mixed well. Then, PDA media was prepared and poured into sterile petriplates and allowed to solidify. The serial dilutions were prepared and 0.1 ml of each dilution were transferred to sterile plates containing PDA media.

In non-agricultural soil, four samples were screened for fungal diversity. A total of 14 fungal genera were recorded in all the four samples. In agricultural soil, four samples were screened for fungal diversity. A total of 12 fungal genera were recorded in all the four samples. Umblebylu sample shows more fugal diversity than Kuvempu University Campus, Lakkavalli and Back water of Bhadra reservoir. In agricultural soil sample, maize field shows more fungal diversity than groundnut field, paddy field and sugarcane field.

Keywords:
Agricultural soil, Non- agricultural soil (Leaf litter soil), Fungi.

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INTRODUCTION

Fungi play an important role in the maintenance and survival of tropical forests. In some cases, microbes may influence ecosystem process indirectly by altering the diversity of other microorganisms. In ecosystem compartment models, dead materials still attached to the living plants are distinguished from litter as 'standing dead' (Anu Kalia and R.P. Gupta, 2005). Litter decomposition is relevant to many aspects of ecology. Traditionally, ecologists have taught the concept of tropic levels and food chains from the plant-herbivore-carnivore-parasite sequence but a marked feature of the contemporary teaching is its increased awareness of the production of the primary resource that passes through the decomposer channel. As far as practical aspects are concerned, improvement in the farming practices and other operations have brought significant effects over the quality and quantity of the agricultural crop debris. (Gonzalez and Timothy, 2001). In traditional farming, virtually the whole of the plant production was returned to the soil. Loss of nitrogen by accelerated mineralization may be compensated by aircraft application of urea as is practiced in some commercial forests. Thus, production systems that sustain soil organic matter levels reduce the rate of organic matter oxidation by leaving crop residues on the soil surfaces, which help to maintain soil productivity **(**Ian and Colin, 2005). Crop residues, green manure crops and weeds are added to the arable soils by farmers each year in the season. These residues play an important role in maintaining soil fertility, affecting both the physical structure of the soil and its nutrient status. In addition, the study of crop residue and decomposition has been promising to the biocontrol of plant pathogens found on the crop debris and in the soil **(**Marie *et al*., 2000). The decomposition of plant litter can be described with a few equations, which indicate that organic matter is ultimately broken down to CO_2 and water. Different types of microorganisms are involved in the breakdown of farm crop litter. Majority of the fungal species that play a large part in the plant litter decomposition are saprophytic in nature. On litter derived directly or indirectly from plants, fungi are able to grow whenever they posses the necessary enzyme systems and environmental conditions (Christian *et al*., 2005; Sari Hill *et al*., 2006).

The main objective of the present work is to investigate Fungal diversity of Non- agricultural soil (leaf litter soil) in Bhadravathi taluk, Shimoga district; Karnataka. Fungi play a major role in fertility and promoting plant health. The present work was undertaken with the following objectives, Screening and detection of fungal diversity in the agricultural and non- agricultural soil samples in different regions and Comparison of the diversity of fungi from leaf litter soil and agricultural soil **(**Jonasson *et al*., 2005).

MATERIALS AND METHODS

Sample Collection

Leaf litter soil sample was collected from different forest regions of Bhadravathi taluk, Shimoga district, Karnataka. During the month of January and February2008-2010. Four forest leaf litter soil samples were collected from the different regions of Bhadravathi taluk, Shimoga district, Karnataka (**Table-1**) and another four samples were collected from agricultural soil (**Table-2**).

Screening and Detection of Fungi

For screening and detection of Fungi, three methods were used. They are Serial dilution method, Baiting technique, and Direct soil plating method / War cup soil plate method (Aneja, 2001).

Isolation of fungi by serial dilution method

One gram of leaf litter soil sample was added into the 10 ml of sterile distilled water and mixed well. Then, PDA media was prepared and

Table: 1 Non-agricultural soil sample collected during the year 2008-2010

Sl. No.	Non-agricultural soil	Places
1	Sample-1	Kuvempu University Campus
2	Sample-2	Umblebylu
3	Sample-3	Lakkavalli
4	Sample-4	Back water of Bhadra reservoir

Table: 2 Agricultural soil sample collected during the year 2008-2010

Sl. No.	Agricultural soil	Places
1	Ground nut field	Kuvempu University Campus
2	Maize field	Umblebylu
3	Paddy field	Lakkavalli
4	Sugarcane field	Back water of Bhadra reservoir

poured into sterile petriplates and allowed to solidify. The serial dilutions 10^{-2}, 10^{-4} and 10^{-6} were prepared, 0.1 ml of each dilution of 10^{-2}, 10^{-4} and 10^{-6} to sterile plate containing PDA media. Plates were incubated at 28°C for 5-7 days (Aneja, 2001).

Isolation of Fungi by Baiting technique

100 gm of litter soil was taken and placed in a petriplate. Soil was added with distilled water. The potato or carrot was cut into small pieces. Pieces of potato and carrot were surface sterilized by 0.1% sodium hypochloride. Sterilized potato pieces were placed on the petridish. Plates were incubated at 28ºC for 2 to 3 weeks (Aneja, 2001).

Isolation of Fungi by Direct soil plate method / War cup soil plate method

Leaf litter soil was collected in sterilized polythene bag. 0.15 g of soil was added to two sterile plates with the help of a sterilized cooled loop or transfer needle. 15-20 ml of melted, cooled (45°C) sabouraud agar media was added, supplemented with streptopenicillin and rose Bengal, to each soil inoculated petriplate. Dispense the soil particles through out the medium by gentle rotation of the petridishes and allowed the plates to solidify. Plates were incubated at 25°C in an inverted position for 15 days.

Fungal morphology was studied macroscopically by observing colony features (colour and surfaces) and microscopically by staining with lanctophenol cotton blue and observe under compound microscope for the conidia, conidiophores and arrangement of spores (Aneja, 2001; Barnett, 1975; Booth, 1971; Domsch and Games, 1980; Sigurd Fundar, 1961; Subramanian, 1983).

RESULTS

In non-agricultural soil (Leaf litter soil), four samples were screened the fungal diversity were detected. A total of 14 fungal genera were recorded in all the four samples. In Umblebylu sample (S_2) important fungal genera like *Mucor* sp., *Penicillium* sp., *Cladosporium* sp., *Alatospora* sp., *Aspergillus flavus, Aspergillus niger, Trichoderma* sp., *Chaetomium* sp. and *Fusarium* sp. were recorded. In Kuvempu University Campus sample (S_1) important fungal genera like *Mucor* sp., *Rhzopus* sp., *Gliocladium* sp., *Verticillium* sp., *Aspergillus flavus, Aspergillus niger, Trichoderma* sp., *Chaetomium* sp. and *Thamatephorus* sp. were recorded. In Lakkavalli sample (S_3) important fungal genera viz., *Mucor* sp., *Penicillium* sp., *Cladosporium* sp., *Rhizopus* sp., *Trichosporiella* sp., *Aspergillus flavus, Aspergillus niger, Trichoderma* sp., *Thamatephorus* sp., *Chaetomium* sp., *Verticillium* sp. and *Helminthosporium* sp. were recorded. In Back water of Bhadra reservoir sample (S_4) important fungal genera like *Mucor* sp., *Penicillium* sp., *Alatospora* sp., *Rhizopus* sp.,

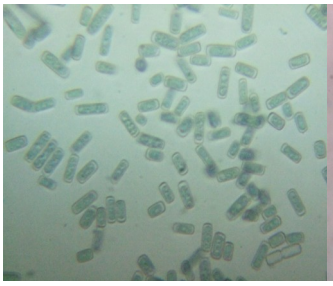
Table: 3 Fungal diversity in the non-agricultural soil samples (litter soil)

Sl. No.	Organisms	Serial dilution method				War cup method				Baiting technique method			
		S_1	S_2	S_3	S_4	S_1	S_2	S_3	S_4	S_1	S_2	S_3	S_4
1	*Mucor* sp.	+	+	+	+	-	-	-	-	-	-	-	-
2	*Penicillium* sp.	+	-	+	+	-	-	-	-	-	-	-	-
3	*Cladosporium* sp.	+	-	+	-	-	-	-	-	-	-	-	-
4	*Alatospora* sp.	+	-	-	+	-	-	-	-	-	-	-	-
5	*Rhzopus* sp.	-	+	+	+	+	+	+	+	+	+	+	+
6	*Trichosporiella* sp.	-	-	+	+	-	-	-	-	-	-	-	-
7	*Gliocladium* sp.	-	+	-	+	-	-	-	-	-	-	-	-
8	*Verticillium* sp.	-	+	-	+	-	-	-	-	-	-	-	-
9	*Aspergillus flavus*	+	+	+	+	-	-	-	-	-	-	-	-
10	*Aspergillus niger*	+	+	+	+	+	-	+	+	-	-	-	-
11	*Trichoderma* sp.	+	-	+	+	-	-	-	-	-	-	-	-
12	*Thanatephorus* sp.	-	-	+	-	-	-	-	-	-	-	-	-
13	*Chaetomium* sp.	+	-	+	-	-	-	-	-	-	-	-	-
14	*Fusarium* sp.	+	+	-	+	-	-	-	-	-	-	-	-
15	*Coccidioites immitis*	-	-	-	-	-	-	-	-	+	+	-	-
16	*Haplobasidium* sp.	-	-	-	-	+	-	-	-	-	-	-	-
17	*Helminthosporium* sp.	-	-	-	-	+	-	+	-	-	-	-	-

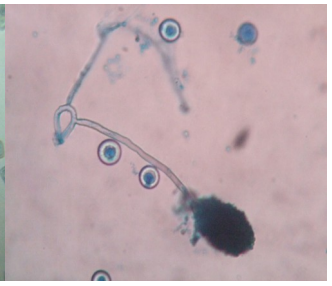
Trichosporiella sp., *Gliocladium* sp., *Verticillium* sp., *Aspergillus flavus, Aspergillus niger, Trichoderma* sp., *Fusarium* sp., *Rhizomucor* sp. and *Alternaria* sp. were recorded (**Table-3**).

In agricultural soil, four samples were screened and detected the fungal diversity. A total of 12 fungal genera were recorded in all the four samples. In groundnut field sample (S_1), important fungal genera like *Mucor* sp., *Helminthosporium* sp., *Aspergillus flavus, Aspergillus niger, Penicillium* sp., *Rhizopus* sp., *Trichoderma* sp. and *Fusarium* sp. were recorded. In maize field sample (S_2), important fungal genera viz., *Mucor* sp., *Dermatophora* sp., *Rhizomucor* sp., *Cryptococcus* sp., *Alternaria* sp., *Aspergillus niger, Verticillium* sp., *Rhizopus* sp. and *Fusarium* sp. were recorded (Shobha *et al.,* 1999). In paddy field sample (S_3), important fungal genera like *Mucor* sp., *Helminthosporium* sp., *Aspergillus flavus, Aspergillus niger, Verticillium* sp. and *Trichoderma* sp. were recorded. In sugarcane field sample (S_4), important fungal genera like *Mucor* sp., *Rhizomucor* sp., *Cryptococcus* sp., *Alternaria* sp., *Aspergillus flavus, Aspergillus niger, Verticillium* sp., *Penicillium* sp., *Rhizopus* sp., *Trichoderma* sp. and *Fusarium* sp. were recorded (**Table-4**).

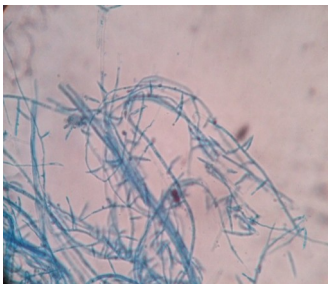
In the present study, both agricultural soil and non-agricultural soil (Leaf litter soil) samples were studied for screening and detection of fungal diversity in these two samples. More fungal diversity was found in non-agricultural soil than agricultural soil. Umblebylu sample shows more fungal diversity than Kuvempu University Campus, Lakkavalli and Back water of Bhadra reservoir. In agricultural soil sample, maize field shows more fungal diversity than groundnut field, paddy field and sugarcane field (Shobha *et al.,* 1999).



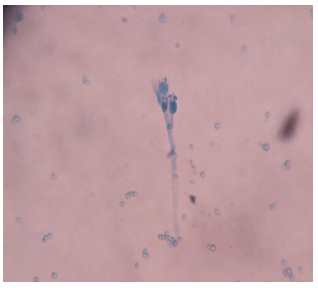
Coccidioides immitis



***Cryptococcus* sp.**



***Fusarium* sp.**



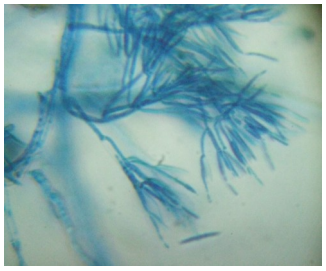
***Penicillium* sp.**

DISCUSSION

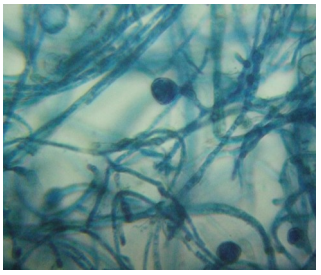
Fungi are the major decomposers present in

Table: 4 Fungal diversity in the Agricultural soil samples

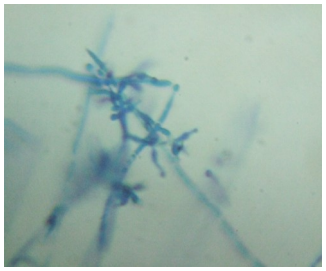
Sl. No.	Organisms	Serial dilution method				War cup method				Baiting technique method			
		S_1	S_2	S_3	S_4	S_1	S_2	S_3	S_4	S_1	S_2	S_3	S_4
1	*Mucor* sp.	+	+	+	+	+	+	+	+	-	-	-	-
2	*Dermatophora* sp.	-	+	-	-	-	-	-	-	-	-	-	-
3	*Rhizomucor* sp.	-	+	-	+	-	-	-	-	-	-	-	-
4	*Helminthosporium* sp.	+	-	+	-	-	-	-	-	-	-	-	-
5	*Cryptococcus* sp.	-	+	-	+	-	-	-	-	-	-	-	-
6	*Alternaria* sp.	-	+	-	+	-	-	-	-	+	+	-	+
7	*Aspergillus flavus*	+	-	+	+	-	-	-	-	-	-	-	-
8	*Aspergillus niger*	+	+	+	+	-	-	-	-	-	-	-	-
9	*Verticillium* sp.	-	+	+	+	-	-	-	-	-	-	-	-
10	*Rhizopus* sp.	+	+	-	+	+	+	+	+	+	+	+	+
11	*Penicillium* sp.	+	-	+	+	+	-	+	-	-	-	-	-
12	*Trichoderma* sp.	+	-	+	+	-	+	-	-	-	-	-	-
13	*Fusarium* sp.	+	+	-	+	-	-	-	-	-	+	+	-



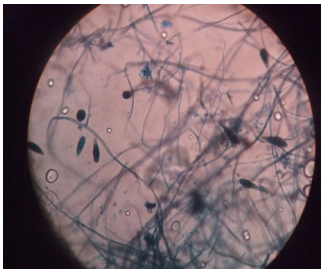
***Gliocladium* sp.**



***Trichosporiella* sp.**



***Trichoderma* sp.**



***Alternaria* sp.**

the Leaf litter soil and Agricultural soil. They secrete the extracellular enzymes, which break down potential food sources. Soil microorganisms such as bacteria and fungi, play major role in soil fertility and promoting health (Gonzalez and Timothy, 2001; Lizhang, 2006). They have examined and compared the various methods used to study the fungal diversity in soil. Three different methods subjected for fungi. Among all the methods serial dilution method is better compared to the baiting technique and war cup method **(**Jennifer *et al*., 2004). In the present study, comparison of diversity of fungi from leaf litter soil and agricultural soil were carried out. More Fungal diversity was found in non-agricultural soil (Leaf litter Soil) than agricultural soil. Umblebylu sample shows more fungal diversity than Kuvempu University Campus, Lakkavalli and Back water of Bhadra reservoir. Umblebyle region shows more fungal diversity because; this region is very thick forest and highly rich nutrients. In this site, litter decomposition is very rich and more humus formation. In other regions like, Kuvempu University Campus, Lakkavalli and Back water of Bhadra reservoir is a thin forest and very little amount of litter decomposition. An increase in organic matter of the soil through addition of leaf litter and other plant parts. Litter decomposition and soil fertility, the rate of decomposition of organic matter influences the rate of nutrients (Das *et al*., 2007).

In agricultural soil sample, maize field shows more fungal diversity than groundnut field, paddy field and sugarcane field. The maize field shows more Fungal diversity because, the soil fertility is very rich in maize field. In maize crops, the deposition of waste is very rich than compared to groundnut field, paddy field and sugarcane field. In this study, impact of maize litter amendment on the functional diversity of fungal communities of agricultural soils from a Bhadravathi taluk was studied. The soils amended with maize litter, either placed on soil surface or mixed into the soil (Shobha *et al*., 1999).

CONCLUSION

Fungal conservation has become essential as some of them have become extinct and many are facing threats. Fungal conservation involves the conservation of site, ecological niches and habitat. Fungi play significant role in the daily life of human beings besides their utilization in industry, agriculture, medicine, food industry, natural cycling and many other ways. Fungal biotechnology has become an integral part of the human welfare. In this study, non-agricultural soil has more fungal diversity than agricultural soil. Biodiversity of fungi is an important aspect to be deal with most scientific accuracy and accountability. One third of fungal diversity of the globe exists in India. Out of 1.5 million of fungi only 5% are identified and remaining 95% need to be identified.

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