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Soil mycofloral communities across different land-use types

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Abstract

A total of 36 fungal species were isolated during the study. The soil mycoflora was cultured using serial dilution and plate count method on PDA and Malt Extract Agar supplemented with streptomycin. The fungal density was recorded maximum during summers followed by spring and winter.

In summers the fungal density was recorded highest in descending order: Mixed wood forest of pine and oak (12.4×10^4cfu g^{-1}), land put to non-agriculture use (11.8×10^4 cfu g^{-1}), Silvo-pasture (8.2×10^4cfu g^{-1}), agricultural field (8.0×10^4cfu g^{-1}), floating garden (7.8×10^4cfu g^{-1}). In spring the density remained more or less same in sites 1, 3, 6 and 7. In winters sampling could only be carried out in only three sites, density in these sites decreased appreciably due to drop in temperature.

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Introduction

Soil is a complex and dynamic media in which biological activity is majorly governed by microorganisms (Nannipieri and Badalucco, 2003; Liang and Balser, 2010). The favourable effects of soil microfauna are manifold and range from nitrogen fixation and organic matter decomposition to breakdown of metabolic by-products and agrochemical, enhancing the bioavailability of nitrates, sulphates, phosphates and essential metals (Bridge and Spooner, 2001). Fungi are an important component of the soil microbiota typically constituting more of the soil biomass than bacteria, depending on soil depth and nutrient conditions (Ainsworth andBisby, 1995) The role of fungi in the soil is an extremely complex one and is fundamental to the soil ecosystem.The fungal diversity in any given soil type, besides being determined by the soil environment, is dependent on the culture techniques adopted, as a complex interaction which exists between the microbes and soil can't be replicated in the laboratory conditions. The goal of this study is to utilize classical technique to estimate the density of culturable fungi in terms of Colony Forming Units per gram in different soil types categorized on the basis of land-use pattern.

Methodology

Preliminary investigation was carried out in different ecosystem types from August, 2013 to July, 2014. These study sites were categorized on the basis of land-use pattern (table 1).

Table 1: Sampling areas based on land-use pattern

Ecosystem type	Land use	Site Code
Agriculture	Permanent crop land	01
	Land put to non-agricultural use	02
Garden	Garden	03
	Floating garden	04
Forest	Pure vegetation	05
	Mixed wood	06
	Silvo-pasture	07

Composite soil samples were collected in sterile containers from the selected study sites. A total of 25 soil samples were analysed. During the study it was found that the desirable depth for getting a better colony count is upto5-10 cm(table 2).Spread plate technique and pour plate method were used for isolation of fungal community.

Sr. No.	Depth	CFU g^{-1}
1.	Surface-5cm	7.6×10^4
2.	5-10 cm	8.0×10^4
3.	10-20 cm	4.4×10^4
4.	20-30 cm	2.3×10^4
5.	30-35 cm	2.5×10^4
6.	35-40 cm	2.2×10^4
7.	40-50 cm	1.1×10^4
8.	50-60 cm	1.4×10^4
9.	>60cm	1.0×10^4

Table 2: Determination of desirable soil depth for recording appropriate fungal density

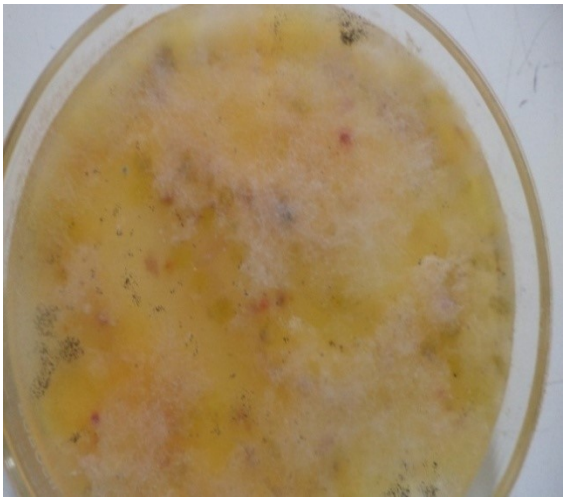
Results and discussion

All fungi require several specific elements for growth and reproduction. In order to determine a better media for growth of soil fungi, different types of media were utilized namely Potato Dextrose Agar, Malt Extract Agar, Rose Bengal Agar and Corn Meal Agar. PDA promoted excessive and invasive sort of mycelia growth at the expense of sporulation. Moreover, the excessive growth of one species hampered the growth of other less opportunistic fungal colonies. On the other hand a comparatively weak media like Malt Extract Agar was found to be an all-purpose media that yielded a better diversity of culturable soil fungi (table 2). Dilution of 10^{-3} is found appropriate for determining the density of different soil fungi. 250µl or 1000 µl of this suspension is transferred to the petri plates and spreaded evenly with the help of 3mm sterilized spreader. The plates are then incubated for 3-6 days at 25-30°C. The colonies obtained are then counted and the average number of colonies per dish is multiplied by the dilution factor to obtain the density of fungi per gram of soil.

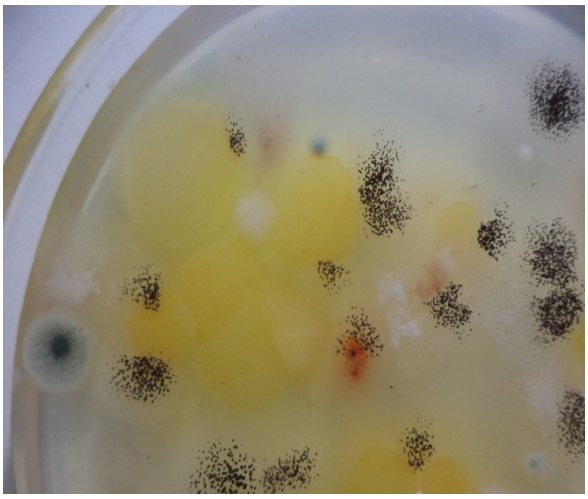
Table 2: Growth media for culturing soil fungi

S.No.	Media	CFU g^{-1}	Colony types
1.	Malt extract agar	7.1× 10^4	11
2.	Rose Bengal Agar	2.1 × 10^4	4
3.	Corn Meal Agar	5.2 × 10^4	6
4.	Potato Dextrose Agar	5.0 × 10^4	3

Fig 1: Petri dishes with dilution 10^{-3} (left) and 10^{-1} (right). Fungi enumeration not possible in the later plate



During the study 36 fungal species had been isolated. The



density of soil fungi in terms of colony forming units per gram was recorded maximum in summer followed spring and winter (fig. 2). In terms of total density maximum value was recorded in summers followed by spring and winter in all the study sites except for garden soil in which case maximum densitywas observed in spring.In terms of total density maximum density was recorded in summers in all the study sites except for garden soils. However, during winters sampling was done as the grounds were covered with snow.

In summers the fungal density was recorded highest in descending order: Mixed wood forest of pine and oak (12.4×10^4cfu g^{-1}), land put to non-agriculture use (11.8×10^4 cfu g^{-1}), silvo-pasture (8.2×10^4cfu g^{-1}), agricultural field (8.0×10^4cfu g^{-1}), floating garden (7.8×10^4cfu g^{-1}). In spring the density remained more or less same in sites 1, 3, 6 and 7. In winters sampling could only be carried out in sites 1,2 and 3. The

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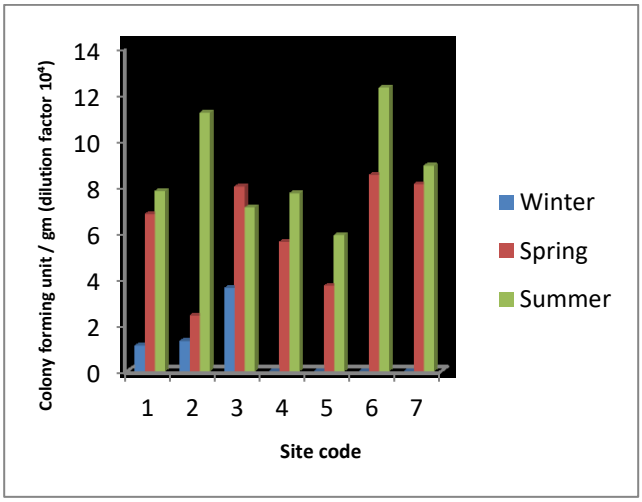

Fig. 2 Colony forming units (per gm dry wt. of soil) for different sites

Conclusion

In the present study soil samples were collected from seven sites differentiated on the basis of land use pattern. Malt Extract Agar was found to be a better growth media to assess the fungal diversity. The soil samples were processed and evaluated for identification and isolation of soil mycoflora, it was observed that the mixed wood forest of pine and oak were richest in total density throughout the year and the density was lowest in pure wood forest. The seasonal mycofloral diversity was found to be maximum for summers followed by spring and winter.

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