NOTES ON NATURAL HISTORY

Ecological Factors Dependent Soil Fungi Diversity from an Industrial Area of Raipur Chhattisgarh, India

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Study Area: Siltara Industrial Area, Raipur

Coordination: 21.37°40'02"N; 81.66°70'79"

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Introduction:

To sustain soil ecosystem soil microorganisms play a crucial role. Soil fungi play an important role in decomposition of complex substances and help in nutrient cycling. So the fungal wealth must be explored. Soil helps to clean our water, with the help of microorganisms, recycles nutrients, provides substrate for plants to grow and also provides gases to our atmosphere. Microorganisms such as bacteria, viruses, fungi, actinomycetes, protozoa and algae live in soil. The diversity of microorganism is more in soil than in any other environment. More number of genera and species of fungi occur in soil than in any other environment (Nagmani *et al.*, 2006). Most of the soil biomass is constituted by fungi than bacteria, depending upon soil depth and nutrient conditions. The largest proportion of fungal species in soil is represented by saprophytic fungi. They perform a crucial role in the decomposition of substances, such as, cellulose, hemicelluloses, and lignin, thus contributing to the maintenance of global carbon cycle (Durowade *et al.*, 2008). Many useful fungi for their biological potential are originally isolated from soil (Alexopoulos *et al.*, 1996). The fungi are also studied for bioremediation of pollutants such as persistent pesticides, benzene, toluene, xylenes and others.

Oureffort:

Soil fungi were tried to identify from the soil samples of "Siltara" industrial area of Raipur, Chhattisgarh, India, covering nearly 5 to 7 Km. Soil samples were collected at depth of about 10 cm once in a month in sterilized conditions in summer and rainy season from Mar. 2017 to Oct. 2017. Fungi were isolated by serial dilution method from collected soil samples once in a month (Harley & Prescott, 2002; Aneja, 2003). Morphological identification of fungi is done by microscopic observation and through available literatures (Barnett & Hunter, 1998; Nagmani *et al.*, 2006). Pure cultures were sent to NFCCI, Pune, India for proper identification.

Concentrations of heavy metal (Cu, Fe, Pb, Mn and Zn) existed in the soil collected samples were also analysed and the existing metal traces were found to be within permissible limits (Table-1).

Our findings:

A total of 662 fungal colonies belonging to 17 genera and 35 species were identified. In summer, 225 fungal colonies were seen belonging to 10 fungal genera and 20 fungal species whereas in rainy season 437 fungal colonies belonging to 15 fungal genera and 31 fungal species have been observed. Dry versus wet season wise percent contribution of isolated fungal species has been presented in the fig.-1.

Table - I: Concentration of heavy metals (mg/kg) in soil samples of Siltara industrial area (March – Oct 2017)

Metal	Dry season	Wet season	Limits (WHO st.)
Cu	23.07	26.66	100
Fe	30749.18	67247.31	50000
Pb	6.14	15.66	100
Mn	1024.60	639.23	2000
Zn	63.28	68.68	300

Figure-1: Comparative percentage contribution of the fungal species isolated during dry (Mar-Jun) & wet (Jul-Oct) seasons.

1-Acrophialophora fuscispora; 2-Aspergillus candidus; 3-A. flavipes; 4-A.flavus; 5-A.glaucus; 6-A. niger; 7-A.nidulans; 8-A.ochraceus; 9-A.restrictus; 10-Aspergillus sp.; 11-A.terreus; 12-A.versicolor; 13-Blastomyces sp.; 14-Cladosporium cladosporioides; 14-C.orchidis; 16-Curvularia lunata; 17-Fusarium pallidoroseum; 18-Fusarium sp.; 19-Humicola fuscoatra; 20-Lichtheimia corymbifera; 21-Mucor; 22-Paecilomyces sp.; 23-P.variotii; 24-Paramyothecium roridum; 25-Penicillium chrysogenum; 26-P.citrinum; 27-P.expansum; 28-Proseopurpureum; 29-Penicillium sp.01; 30-Penicillium sp05; 31-Phialophora cinerescens; 32-Phoma sp.; 33-Pleurophragmium sp.; 34-Purpureocillium lilacinum; 35-Yeast

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Aspergillus terreus, *Aspergillus versicolor*, *Penicillium chrysogenum*, *Aspergillus niger* were frequently occurred throughout the dry and wet seasons. The concurrent appearance of these species indicates their suitable adaptability in the soil of targeted industrial area. But, *Aspergillus restrictus*, *Aspergillus* sp., *Curvularia lunata*, *Fusarium* sp., *Humicola* sp., *Penicillium roseopurpureum*, *Penicillium* sp-1 and Yeast were found a rare occurrence.

Figure-2: Towards dry to wet season: monthwise fluctuation in colonies, genera and species of fungi

The area under study is an industrial area so the soil shows the presence of heavy metals. In present investigation *Aspergillus terreus* and *Penicillium chrysogenum* were observed as dominant fungi that show their better adaptability in such soil conditions. Earlier *Penicillium chrysogenum* was reported as dominating species from garbage waste soil (Kumar *et al.*, 2013) and agricultural soil (Chandrashekhar *et al.*, 2014). *Aspergillus terreus* was found as the dominant one in paddy field soil by Ramkumar *et al.* (2017). *A. terreus* and *P. chrysogenum* have already been studied for bioremediation of heavy metals by Joshi *et al.* (2011) and Xu *et al.* (2015). Fungi adapt themselves to heavy metals in long exposure so they can grow at higher metal concentration also. Fungi are known to tolerate and detoxify metals by several mechanisms. The present study depicts significant number of fungi in the industrial area. Heavy metals were revealed within permissible limits in the soil samples of our studied and perhaps it does not exert any apparent effect on the diversity of the fungi.

The isolated fungi may be degrading various contaminants present in the soil of the studied Industrial area and converting them into harmless compounds using natural biological activity of well-adapted fungi (Bhalerao, 2012). Our works explore the possibility to study these fungi for heavy metal absorption and bioremediation at low cost and in an eco-friendly way.

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