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SOIL FUNGAL DIVERSITY IN SEETHALAYANAGIRI HILLS OF CHIKKAMAGALURU, KARNATAKA

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Abstract : Mountains are the hotspots of biodiversity with their isolated position and altitudinal belts. Their flora and fauna have been observed worldwide but the microbial groups have not attracted any attention as yet and focus on such ecosystem studies is urgently needed along altitudinal gradients because of limited information. Although many fungi were reported from Western Ghats but no significant studies on the role of environmental gradient on soil micro fungal diversity was carried out till date in Seethalayanagiri (1,524 m / 5,000 ft) hills is located at 13°23′26″N 75°43′18″E in the Chandra Dhrona Hill Ranges of Chikkamagaluru, Karnataka one of the biodiversity hot spot of Western Ghats. So in the present study, an attempt has been made to investigate soil micro fungal community to assess if altitude, temperature and soil physico-chemical factors have any impact on the diversity of fungi from Octo 2015 – Dec 2015. Six Soil samples were collected out at the depth of 0 – 15 cm by random sampling technique in each study sites. The soil fungi were enumerated by using serial dilution method on PDA and CZA medium supplemented with tetracycline/Streptomycin. A total of 19 genera and 42 species with classes Deuteromycetes (50%) with highest percentage followed by Ascomycetes (23.8%) and Zygomycotina (21.4%) were recorded in the study site. Our results indicates that altitudinal gradient ,soil temperature, soil pH , soil moisture , vegetation along with other physicochemical factors that influence the soil fungal assemblage in the study area.

Key words: Altitude, Latitude, Diversity, Soil fungi, Hills.

I. INTRODUCTION

Distribution and abundance of plants ,animals and microbes can be affected by altitude due to change in temperature, rainfall and composition of soil. Soil fungi performs various functions in the ecosystem that are very important in maintaining stability of the ecosystem. Limited references are available demonstrating the changes in fungal assemblages along altitudinal gradients (Raviraja *et.al.* 1998, Buckova *et.al.* 2000, Slavikova &Vadkertiova 2000) in different parts of the world. In India, studies on soil fungal diversity in relation to habitat, climate and altitudinal gradient is rare (Pandey *et al.* 2006, Satish *et al.* 2007). Although many fungi were reported from Western Ghats but no significant studies on the role of environmental gradient on soil micro fungal diversity was carried out till date in Seethalaiahnagiri hills of Chikkamagaluru one of the biodiversity hot spot of Western Ghats. So in the present study an attempt has been made to investigate soil micro fungal community to assess if altitude, temperature and soil physico-chemical factors has any impact on the diversity of fungi.

II. MATERIALS AND METHODS

2.1. Study area

Chikmagalur is one of the floristic areas with wide range of eco system and species diversity. The study area Seetalayyanagiri is a prominent peak situated nine km away from chikkamagaluru and is located at13^0 23'26"N and 75^0 43'18" E in the Chandra Dhrona Hill ranges of the Western Ghats of Chikkamagaluru with approximately a height of 1,524 m / 5,000 ft. The study site comprises of an area sprawling over 262,379 sq.km in NE India spread from 22~30° N and 89~97° E at altitude from 24 m above sea level to 2,000 m above sea level (Fig. 1).The temperature in Seetalayynagiri remains maximum 25^0c and reaches the minimum 12 - 14^0c , average rainfall is 650-800mm minimum and maximum 1800. Wind velocity is 4-5km/hr , atmosphere pressure is 1366.2-1432 mill bars and R^H is minimum of 50-60% and maximum of 70-80%.

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2.2. Collection of soil samples and isolation of fungi

Six soil samples were collected randomly from five different sampling sites were differed by a distance of about one km each other from 0-15cm depth after removing an inch of surface soil with a sterilized trowel and samples were collected in a sterilized glass jars. Soil samples were then brought to the laboratory for isolation of fungi and physicochemical analysis. Isolation of soil fungi were enumerated by serial dilution method (Waksman. 1944) on PDA and Czapek'sDox Agar medium within twenty four hour. The obtained fungal isolates were identified with the help of relevant literature (Nagamani *et.al.* 2006.) by observing

Cultural characteristics such as color, size, shape, spores etc. The obtained data was presented in terms of percent occurrence. Percentage of frequency (Subha. *et, al*, 2013).

III. RESULTS AND DISCUSSION

During our investigation period we could able to isolate 286 colonies from six soil samples belonging to 19 genera and 42 species. Among these ten sp. belongs to class *Ascomycetes*, Nine *Zygomucetes*, 21 *Deuteromycetes*, which includes six sps of *Aspergillus*, followed by eight sp. of *Penecillium*, three sp. of *Absidia*, eight sp. of *Chaetomium*, two sp. of *Phoma*, two sp. of *Cladosporium*, *one sp. of Gongronella*, *Cylindrocladim*, two sp. of *Cunninghamella*, one sp. of *Fusarium*, *Macrophomina*, *Mucor*, *Nectria*, *Nectriopsis*, *Rhizopus*, *Syncephalastrum*, *Trichoderma*, *Geosmithia*, *Allomyces*. The propagules of *Absidia glauca* was most abundant, followed by *Gongronella butlari*, *Cladosporium cladosporioides*, *Asprgillus flavus and Pencillum aurantiogriseum*. *Absidia* was the dominant genus and repeatedly isolated from all soil samples. In the present study the sp. of *Absidia* and *Gongronella* are not only dominant but also common in all soil samples.

Soil analysis results based on the physicochemical characters such as pH, moisture, content and micro and micronutrients showed variation In the present study the pH value was acidic in all the samples ranging from 5 to 5.5. The organic carbon content of the soil found to be 3 to 3.53%, hold high water holding capacity and moisture content ranging from 30-38(ppm) favoured the growth of fungi (Table 1.).

We used two types of media for the isolation of fungi and maximum fugal diversity was recorded in PDA than Czapek'sDox Agar media. Fungal incidence was more on PDA than on CZA and RBA (Bhattacharyya and Jha, 2011**).** CZA supported fewer fungal species and suggest the use of more than one culture media for fungal isolation (Tejesvi *et al.*, 2005, Oyeyiola, 2009).

The percent occurrence of individual species to the total fungal population showed variation. The Maximum percent occurrence showed by *Absidia glauca* 13.98% followed by *Gongronella butleri* 10.83%, *Cladosporiumcladosporioides*10.13%, *and minimum showed by Chaetomium torolosum, Phoma/Phaeosporia oryzae, Penicillium sps, Cladosporium oxisporum, Aspergillus sps* and *Aspergillus japanicus* 0.69%. (Table.2).

Maximum fungal diversity at medium elevation was also reported in different parts of the world (Devi *et al.* 2012, Sharma *et.al.* 2015). More severe competition at lower elevations in less stressful environments and more severe environmental stresses at higher elevations lead to higher microfungal species present at intermediate elevations under moderate environmental conditions (Osono and Hirose 2009; Jackson *et al.* 1991; Raviraja *et al.* 1998). Devi *et al.* (2012) also reported maximum fungal diversity at intermediate elevations. pH and soil organic carbon do not appear to exert conclusive effects on fungal distribution since alterations in pH and soil carbon in several cases has insignificant effects on fungal dominance (Strickland and Rousk *et al.*, 2010). Plant materials that are used by fungi constitute an important and decisive resource for the life of the different species (Zhang 2010). Fungal flora may be vary depends on its native soils (Shi.*et.al* 2002). Complex vegetation provides various kinds of substrata, thereby allowing different fungal species to coexist (Christensen 1984; Wicklow and Whittingham 1974).Higher fungal diversity in sub-tropical and tropical forest soil with maximum intra-specific variation and showed similarities in abundance and distribution of fungi (Sharma *et.al.* 2015).

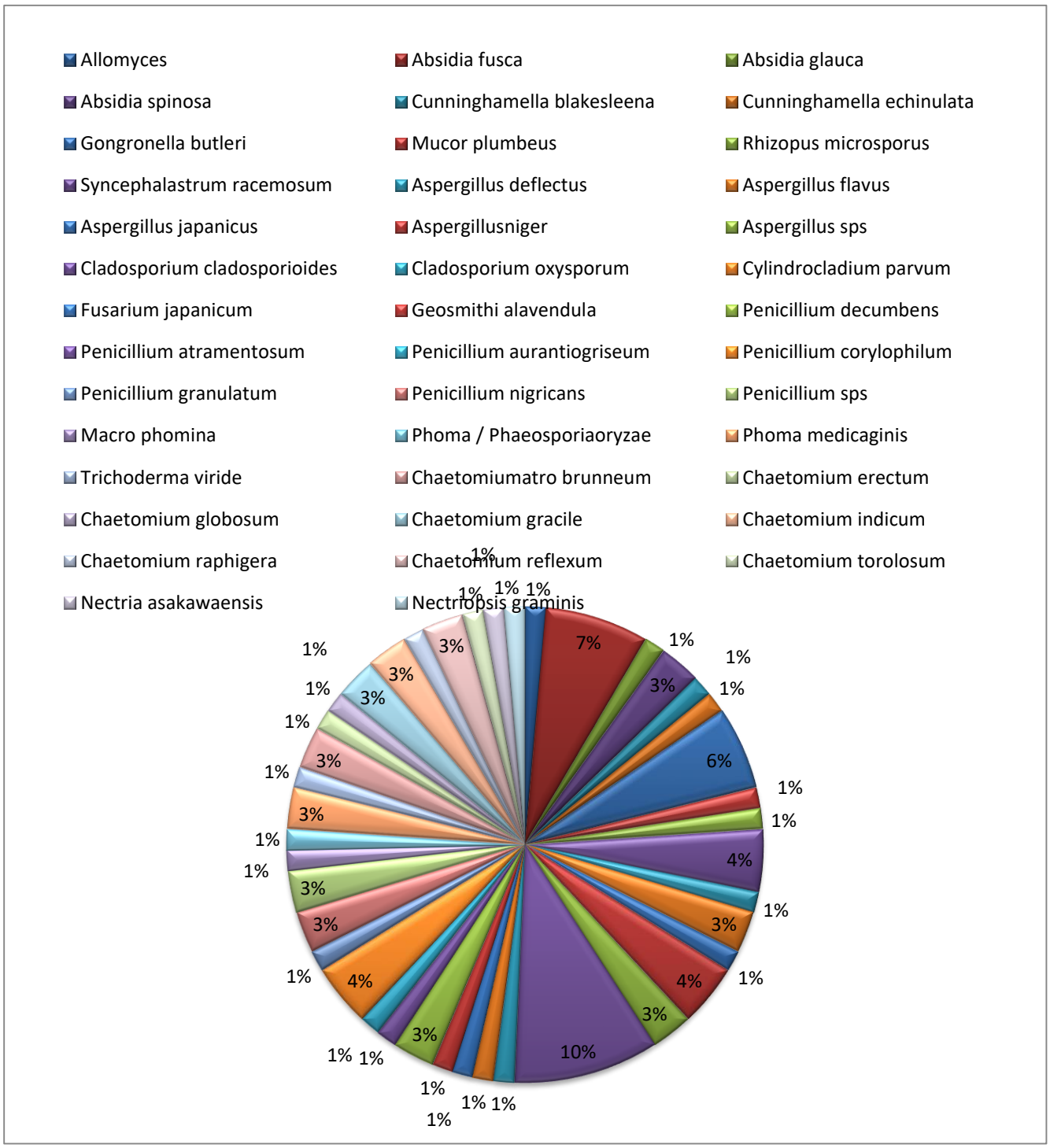
Table.!.Soil physicochemical parameter of study area

Soil Parameter	Sample 1	Sample 2	Sample 3	Sample 4	Sample 5	Sample 6
pH	5-5.1	4.9-5.0	5.0	5.1	5.2	5.0-5.1
Electrical conductivity ds/m	0	0.02	0.05	0.03	0.05	0.05
copper(ppm)	1.0	1.25	1.12	1.01	1.26	1.22
Phosphorous	34.32-35.00	35.33-36.88	31.00-34.56	36.68-37.90	39.21-40.00	38.00-39.12
Potassium(ppm)	88.62-89.22	90.60-90.66	91.33-96.87	102.34-111.2	130.00-139.49	94.84-110.2
Iron(ppm)	32.62	32.26	41.00	43.34	44.23	41.97
Manganese C.Mol/kg	4.0	3.97	4.23	4.76	4.68	4.11
Sulphur (ppm)	37.00	36.87	37.99	38.32	36.23	35.22
Texture	Silt,powdery	Silt,powdery	powdery	Powdery	Powdery	powdery
Moisture content	7.2	6.10	5.15	6.8	7.0	6.5

Table.2.Diversity of soil fungi in terms of Percent occurrence and Percentage of frequency.

Name of the fungus	Total number of colonies	Percent occurence	Percentage of Frequency
Chytridomycotes			
Allomyces sp.	1	0.34	5.55
Zygomucetes			
Absidia fusca	10	3.49	27.77
Absidia glauca	40	13..98	5.55
Absidia spinosa	18	6.3	11.11
Cunninghamella blakesleena	3	1.04	5.55
Cunninghamella echinulata	4	1.39	5.55
Gongronella butleri	31	10.83	22.22
Mucor plumbeus	1	0.34	5.55
Rhizopus microsporus	3	1.04	5.55
Syncephalastrum racemosum	6	2.09	16.66
Deuteromycetes			
Aspergillus deflectus	6	2.09	5.55
Aspergillus flavus	13	4.54	11.11
Aspergillus japanicus	2	0.69	5.55
Aspergillus niger	5	1.74	16.66
Aspergillus sps	2	0.69	11.11
Cladosporium cladosporioides	29	10.13	38.88
Cladosporium oxysporum	2	0.69	5.55
Cylindrocladium parvum	3	1.04	5.55
Fusarium japanicum	1	0.34	5.55
Geosmithi alavendula	1	0.34	5.55
Penicillium decumbens	7	2.44	11.11
Penicillium atramentosum	3	1.04	5.55
Penicillium aurantiogriseum	12	4.19	5.55
Penicillium corylophilum	19	3.49	16.66
Penicillium granulatum	1	0.34	5.55
Penicillium nigricans	4	1.39	11.11
Penicillium sps	2	0.69	11.11
Macro phomina	1	0.34	5.55
Phoma / Phaeosporia oryzae	2	0.69	5.55
Phoma medicaginis	3	1.04	11.11
Trichoderma viride	6	2.09	5.55
Ascomycetes			
Chaetomium atrobrunneum	6	2.09	11.11
Chaetomium erectum	1	0.34	5.55
Chaetomium globosum	1	0.34	5.55
Chaetomium gracile	10	3.49	11.11
Chaetomium indicum	5	1.74	11.11
Chaetomium raphigera	6	2.09	5.55
Chaetomium reflexum	4	1.39	11.11
Chaetomium torolosum	2	0.69	5.55
Nectria asakawaensis	7	2.44	5.55
Nectriopsis graminis	3	1.04	5.55

Fig.1. Distribution of fungal colonies recorded in terms of percentage of frequency in the study area.



IV.CONCLUSION

The study area Seethalayanagiri hill associated with activity of large number of microbes. It can be concluded from the results that Altitude, latitude, temperature, pH and vegetation type are the most important factors that influence the soil fungal assemblage. Diversity pattern in the study area indicates that fungal heterogeneity was highest in the forest region with the lowest tree diversity because of favorable pH, micro and macro nutrient status of the soil. These factors are essential to maintain a productive environment to enhance microbial growth.

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