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DIVERSITY OF SOIL FUNGI IN AND AROUND LONI, AHMEDNAGAR, MAHARASHTRA

A. J. Dhembare[1] Yogita S. Ghorpade[2], S. B. Parkhe[3] and S. L. Kakad[4]
[1,2,3]*Department of Zoology, P. V. P. College, Pravaranagar-413713, Ahmednagar, MS.*
[4]*Biotechnology, P. V. P. College, Pravaranagar-413713, Ahmednagar, MS.*

Abstract

The study was carried out to find out fungal presence and diversity in soil in and around Loni. Twelve different sites were selected for the study. The mean total fungal count (TFC) was 2.95x10^3 cfu/g and 2.70x10^6 cfu/g of soil from the dilution level F-10-2 and F-10-5 respectively. Twenty-five different species of fungi were isolated in the soil. All species were not noticed in all selected sites or none of single species reported in all sites. The results of this study showed that the soil of these selected locations has a large diversity but these finding cannot be considered as exhaustive because of the limited resources of the laboratory due to which there is a possibility of missing of certain species and other location of the same sites.

Keywords: Fungi, fungal diversity, soil, Loni village.

I. INTRODUCTION

Soil microbiology focuses on the soil viruses, bacteria, actinomycetes, fungi and protozoa. Soil microbiology commonly includes the soil animals such as nematodes, mites, and other micro arthropods. Modern soil microbiology represents an integration of microbiology with the concepts of soil science, chemistry and ecology to understand the functions of microorganisms in the soil environment. However, soil organisms interact within complex food webs, and therefore changes in diversity and functioning of another [1, 2].

Soil bacteria and fungi play essential roles in a variety of biogeochemical cycles (BGC) [2]. These are accountable for the cycling of organic compounds. Soil microorganisms as well control above ground ecosystems by providing nutrients to plant, plant physical condition [3], soil organization and soil productiveness. Our awareness of soil microbial diversity is limited because inability to study soil microorganisms. It is predicted that in 1 g of soil there are 4000 different bacteria [4]. So far about 5000 bacterial species have been estimated and described [5]. At the same time as many anthropogenic actions such as mining, urbanization, agriculture, pesticides utilize and pollution by industrialization can possibly affect soil microbial diversity. Our knowledge is limited to study the microbial diversity and changes in the below-ground and above-ground ecosystems.

Hence, it is important to know how changes in soil biodiversity and the simplification of the soil community composition influences ecosystem functioning. However, whether reductions of biodiversity in soil communities have consequences for the overall performance of an ecosystem remains unresolved. Moreover, recent studies show that above ground plant diversity influences multiple ecosystem functions. Hence present study was assigned to isolate fungal strains and diversity of an agriculture area of in and around Loni area. Although the study has been carried out within limited laboratory resources due to which many species might remain unexplored but still this study will provide an insight about the soil microbial diversity of the region.

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II. MATERIALS AND METHODS

Study area: The study has been carried out in the Loni rural region, Ahmednagar District, Maharashtra. Study area is located in 18^0 182' E longitudes to $74^0$36455' N latitude and 506 m. MSL altitude. It experiences an average rain fall 58 cm and mostly dry area. The soil is black cotton soil along with the Pravara river basin. Also canal and well water facilities are available. The twelve selected sites were coded as S-1(Loni-Sangamner road), S-2 (Loni-Kolhar road), S-3 (Loni canal side), S-4 (Loni-Pathare road), S-5 (Loni-Junior college), S-6 (Loni river opening), S-7 (Loni river muddle), S-8 (Loni river end), S-9 (Loni-Babhaleshwar road), S-10 (Loni-Nirmalpimpri road), S-11 (Loni-Lontek temple area) and S-12 (Loni-Sugar factory area).

Collection of sample: The soil samples were collected from twelve different selected sites of village Loni. The collection was made during dry monsoon. At each sites, soil samples was taken from different field survey number. The study sites was fixed, the digged at about 30 cm deep 'V' shaped pit and remove all soil after the samples were collected from margin of 'V' shaped pit with the help of large scalpel. The collected samples were made into four same sized parts and then removed two opposite parts. The process was repeated until the sample retains one half kg. Each of sample then were labeled, numbered with date of collection, survey number, name of village, type of field, etc [6].

Sterilization techniques: All the material used in this research work like jars, spatulas, beakers, test tubes, pipettes, distilled water (used for media preparation) and media were sterilized in autoclave at 121^0C for 25 min.

Media preparation: Potato Dextrose Agar (PDA) was used for the culture of fungus, was prepared by dissolving the media powder in sterilized distilled water according to the manufacturer instruction. PDA was added with streptomycin 30g/l to inhibit bacterial growth [7].

Microbial diversity: Microbial populations such as fungi were carried out for different soil and water samples following standard dilution plate technique [8]. In this method, 1mL water sample was taken and volume was made up 100 ml with sterile water which was further serially diluted to get 10-3 dilution.

From these diluted samples, 1 mL water sample was dispensed over each of three replicates and then media for growth of different microorganisms were added nutrient agar used for isolation of bacteria while potato dextrose agar and ammonium chloride-starch agar medium were used for fungi and actinomycetes respectively, the petriplates were incubated at 35^0C for 48 h for bacteria and 25^0C for 72 h for fungi. The microbial populations were enumerated as colony-forming units (CFU) from a serial dilution of soil suspensions.

The microbial colonies were counted in the three replica plates and the average values were calculated. The populations of microorganisms were considered from the number of microbes multiplied by the dilution factor for each sample.

Isolation of Fungal: The media used in this research was potato dextrose of agar medium. About 16 g of potato dextrosagar powder was weighed and dissolved in 500 ml and of distilled water. It was stirred vigorously and dissolved using hot plate after which was sterilized in autoclave for 15 minutes at 121^0C. It was then allowed to cool after which it was dispensed in Petri dishes and allowed to solidify. Portions of the suspension were inoculated on the nutrient agar by streaking and were incubated at 37^0C for 24hours.

Microbiological analyses: In the laboratory soil samples were mixed and the coarser particles removed, one gram of soil was suspended in 100 ml water and then serially diluted to five-fold that was used for the microbial analysis. This method is called pore-plate dilution method [9].

After solidification of media, they were incubated at 37^0C for 48 h for fungi, then colonies were counted and isolates were identified on the basis of cultural, microscopic and biochemical characteristics with reference to Bergey's manual of systematic for fungi [10].

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III. RESULTS AND DISCUSSION

Total fungal count (TFC): The fungi were isolated across the twelve sites (Table 1) mean total fungal count (TFC) was $2.95x10^3$ cfu/g and $2.70x10^6$ cfu/g of soil from the dilution level F-10-2 and F-10-5dilution level respectively. Total fungal count was highest as $4.1x10^3$ cfu/g and lowest as $1.5x10^3$ in soil of site S-6 and S-2 respectively in the dilution level F-10-2, while total fungal count was lowest as $0.7x10^6$ cfu/g and highest $8.1x10^6$ cfu/g from the soil site S-2 and S-5 respectively in the dilution level F-10-5. Twenty-five different species of fungi were noticed in the soil. All species not noticed in all selected sites or none of single species reported in all sites.

The knowledge of fungal diversity in soil is based on observations of fruiting bodies present in an environment, or from culture obtained soil isolation exercises. Both of these approaches have serious limitations for the detection of the diversity in any selected environment. An organism that exists only in mycelia form in soil is likely to be identified from direct observation if fruiting bodies not formed. Therefore, the observation through direct microscopy will give greatly reduced measures of the true diversity in the environment. Culturing fungal strains from soil isolates will only result in the detection of those propagates that are able to grow and sprouted on the isolate medium used. There are several techniques used for identification of fungal strains but do not distinguish between active and resting stages and in order to identify accurately some a prior knowledge of ecology and functions of organisms are required.

The microbial such as bacterial strains and fungal strains have some associations. The similar type of results gets reported in earlier [11,12]. Both the isolates throughout the in the regions were significant though some species were common to all sampling locations; this difference was due to the different agricultural practices [13]. Sometimes the dominant bacterial isolates were over fungal [14]. Both bacterial and fungal isolates were similar to those which were previously reported by other workers, but some bacterial isolates were newer to soil, these finding indicates that this region may harbor some distinct microbial diversity.

Fungal diversity: The study notice twenty-eight specie of fungi from the soil samples. The presence of species varies site to site. All the species not noticed in the all sites or single species not reported in all the sites. Fungal diversity increases soil fungistasis and resistance to microbial invasion by non-resident species. Loss of fungal microbial diversity may adversely affect ecosystem functionally.

The great majority of the 80000+ fungal species so far named and described in soil environment. Those undergoing rapid warming that contain few species [17, 18]. Previous work reported Soil fungi have pivotal ecological roles as decomposers, pathogens and symbioses [15, 16]. Alterations to their diversity arising from climate change could have substantial effects on ecosystems; particularly that using pyrosequencing to assess fungal diversity in soils sampled from a climatic gradient through the maritime Antarctic, the most rapidly warming region in the Southern Hemisphere [19-21]. Using a space-for-time substitution approach, they showed that soil fungal diversity is higher in warmer habitats, with increases of fungal taxa per degree Celsius rise in surface temperature along the transect. Among the predictor variables, air temperature was the strongest and most consistent predictor of diversity. That the current rapid warming in the maritime Antarctic (0.34^0C per decade) will facilitate the colonization of soil by a wider diversity of fungi than at present, with data from regression models suggesting 20-27% increases in fungal species richness in the southernmost soils by 2100 [19, 20].

The results of this study shows that the soil of these selected locations has a large diversity which have similarities with that of other regions of the world but these finding cannot be considered as exhaustive because of the limited resources of the laboratory due to which there is a possibility of missing of certain species and other location of the same sites may have larger diversity than the sampling location. Some fungal isolates were newer; that indicates that there may be many species that

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are exclusive to this region but more research are needed in this regard, as this will open doors for new research.

The conclusion can be drawn that this study of fungal diversity of soil samples showed dissimilar values at different places. This can be due to the irregular distribution of different parameters present in soil. Such type of monitoring of soil samples is beneficial to know the concentrations of various parameters present in soil samples.

Table 1: Fungal isolates and their distribution in soil among selected sites.

Dilution Factor	Sampling sites											
	S-1	S-2	S-3	S-4	S-5	S-6	S-7	S-8	S-9	S-10	S-11	S-12
F-10-2	3.2×10^3	4.1×10^3	3.2×10^3	4.0×10^3	2.9×10^3	1.5×10^3	2.6×10^3	3.0×10^3	1.7×10^3	2.9×10^3	4.8×10^3	1.6×10^3
F-10-5	1.2×10^6	0.7×10^6	1.6×10^6	7.2×10^6	8.1×10^6	1.4×10^6	1.4×10^6	1.8×10^6	1.2×10^6	2.1×10^6	3.2×10^6	2.6×10^6

Table 2: Fungal diversity in soil among the selected sites.

Sr N0.	Fungi Species	Selected sites											
		S-1	S-2	S-3	S-4	S-5	S-6	S-7	S-8	S-9	S-10	S-11	S-12
1	*Chaetomium*	+	-	-	-	-	-	+	-	-	-	-	-
2	*Mucor*	+	+	-	-	-	-	+	+	+	-	+	+
3	*Rhizopus*	+	-	+	-	-	-	-	+	-	-	+	-
4	*Phoma*	-	-	+	+	-	+	-	-	+	+	-	-
5	*Fusarium solani*	-	-	+	-	-	-	+	-	-	-	-	+
6	*Monila*	+	-	-	+	+	+	-	+	+	+	-	-
7	*Trichoderma*	-	-	-	+	-	-	-	-	-	-	+	-
8	*Asprgillus*	-	+	-	-	+	+	-	-	-	-	+	-
9	*Gila monilia*	-	-	-	-	-	+	-	-	-	+	-	+
10	*Nigrospora*	+	-	+	-	-	+	-	-	-	-	+	-
11	*Fusarium*	-	+	-	-	-	-	+	+	+	+	-	-
12	*Aspergillus nigar*	-	-	-	-	+	-	+	-	+	+	-	+
13	*Phoma*	-	-	-	+	-	-	-	+	-	-	+	-
14	*Memnolelia*	+	-	-	-	-	-	-	-	-	+	-	-
15	*Cricinalis*	-	-	-	-	+	-	-	-	-	-	+	-
16	*Fusarium oxysporium*	-	+	-	-	-	-	-	-	+	-	+	-
17	*Penicillum chrysogenum*	-	-	-	-	-	-	+	-	-	+	+	-
18	*Penicillum*	-	-	-	+	-	-	-	+	-	-	-	+
19	*Chaetomium*	-	-	-	-	+	-	-	-	+	-	+	-
20	*Pythium*	-	+	-	-	-	-	-	-	-	-	-	-
21	*Rhizoptonia*	-	-	+	-	-	+	-	-	-	+	-	-
22	*Rhizopus*	+	-	-	-	+	-	-	-	-	-	-	+
23	*Fusarium chlamydospores*	-	-	-	-	-	-	+	-	+	-	-	-
24	*Verticillium*	-	-	+	-	-	-	-	-	+	-	-	-
25	*Absidas*	-	-	+	-	+	-	-	-	-	+	-	+

+ = Presence, - = Absent

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BIBLIOGRAPHY

[1] Hunt, H.W. and Wall, D.H. 2002. Modeling the effects of loss of soil biodiversity on ecosystem function. *Global Change Bio.,* 8(1), 33-50.

[2] Syed Aftab Hussa in Shah and Khalil Ahmed. 2013. Microbial analysis of different top soil samples of selected sites in Gilgit, Gilgit-Baltistan, Pakistan. *Aca. J. Sci. Res*., 1 (1): 6-9.

[3] Wall, D.H. and Virginia, R.A. 1999. Controls on soil biodiversity: insights from extreme environments. *App. Soil Eco*., 13, 137-150.

[4] Smith, K.P. and Goodman, R.M. 1999. Host variation for interactions with beneficial plant-associated microbes. *Annu. Rev. Phytopathol.,* 37, 473-491.

[5] Torsvik, V., Goksoyr, J. and Daae, F.L. 1990. High diversity in DNA of soil bacteria. *App. Environ. Microbiol.*, 56, 782-787.

[6] Pace, N. R.1999. Microbial ecology and diversity. *ASM News*, 65, 328- 333.

[7] APHA. Standard methods for the examination of water and waste water, 21th Edition American Public Health Association, Washington.

[8] Iram, S., Ahmad, I., Javed, B., Yaqoob, S., Akhtar, K. M., Raza, M.K. and Zaman, B. 2009. Fungal tolerance to heavy metals. *Pak. J. Bot.,* 41(5), 2583-2594.

[9] Megharaj, M., Avudainayagam, S. and Naida, R. 2003. Toxicity of hexavalent chromium and its reduction by bacteria isolated from soil contaminated with tannery waste. *J. Cur. Microbio.,* 47, 51-54.

[10] Cappuccino, J.G. and Sherman, N. 2005. Microbiology: A Laboratory Manual. 7th Ed. Dorling and Kindersly (India) PVT. Ltd.

[11] Prescott, L.M., Harley, J.P. and Klein, D.A.2005. Microbiology Sixth edition, McGraw-Hill, New York.

[12] Ogunmwonyi, I. N., Igbinosa, O. E., Aiyegoro, O.A. and Odjadjare, E.E.2008. Microbial analysis of different top soil samples of selected site in Obafemi Awolowo University, Nigeria. *Sci. Res. Essay,* 3(3), 120-124.

[13] Ingham, E. R. and Horton, K. A. 1987. Bacterial, fungal and protozoan responses to chloroform fumigation in stored prairie soil. *Soil Bio. & Biochem.,* 19, 545-550.

[14] Torsvik, V. and Ovreas, L. 2002. Microbial diversity and function in soil: from genes to ecosystems. Elsevier Science Ltd. p: 240.

[15] Sessitsch, A., Weilharter, A., Erzabek, M. H., Kirchmann, H. and Kandeler, E. 2001. Microbial population structures in soil particle size fractions of a long term fertilizer field experiment. *Appl. Environ. Microbiol*., 67 (9), 4215-4224.

[16] Swift, M. J., Heal, O. W. and Anderson, J. M. 1979. Decomposition in Terrestrial Ecosystems, Blackwell Scientific Publications, John Wiley and Sons, Oxford.

[17] Tedersoo, L., Mohammad, B., Sergei, P., Urmas, K., Nourou, S. Y. and Ravi W. 2004. Global diversity and geography of soil fungi. *Science,* 346, 1078.

[18] Setala, H. and McLean, M. A. 2004. Decomposition rate of organic substrates in relation to the species diversity of soil saprophytic fungi. *Oecologia,* 139, 98-107.

[19] Tiunov, A. and Scheu, S. 2005. Facilitative interactions rather than resource partitioning drive diversity functioning relationships in laboratory fungal communities. *Eco. Lett.,* 8, 618-625.

[20] Adams, B., Bardgett, R.D., Ayres, E,, Wall, D. H., Aislabie, J., Bamforth, S., Bargagli, R., Cary, C., Cavacini, P., Connell, L., Convey, P., Fell, J., Frati, F., Hogg, I., Newsham, K.K., O'Donnell, A., Russell, N., Seppelt, R. and Stevens, M.I. 2006. Diversity and distribution of Victoria Land Biota. *Soil Bio. & Biochem.,* 38, 3003-3018.

[21] Turner, J., Lachlan-Cope, T.A., Colwell, S.R., Marshall, G. J. and Connolley, W. M. 2006. Significant warming of the Antarctic winter troposphere. *Science*, 311, 1914-1917.

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