INVESTIGATION OF RHIZOSPHERE MYCOFLORA FROM SOME MEMBERS OF SOLANACEAE FAMILY

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ABSTRACT

Soil fungi play an important role as major decomposers in the soil ecosystem. The rhizosphere is an area of soil showing microbiological activity, which is slightly away from root system of the growing plants. The Rhizosphere soil is said to have a lower pH, lower water and oxygen pressure & high levels of carbon dioxide than the bulk soil. Rhizosphere mycoflora directly or indirectly inhibits the invasion of plant tissue by the pathogen, and synthesis of growth–controlling plant hormones such as Indole, 3-Acetic Acid and Giberellic acid. Considering these activities of rhizosphere mycoflora, present investigation is carried out with some members of family Solanaceae, like Capsicum annum, Lycopersicon esculentum and Solanum melongena cultivated in Gadchiroli district of Maharashtra state, India.

Keywords: Rhizosphere, mycoflora, Solanaceae, Soil fungi, Solanum melongena.

INTRODUCTION

Soil is a complex heterogeneous habitat for a wide variety of organisms including bacteria, fungi, protozoa, nematodes and earthworms in which organisms interact with each other and with their physical environment contributing to plant nutrition, soil structure, soil fertility, decomposition of organic matter, cycling of nutrients, suppression of soil born pathogens and removal of toxins (Prescott et al., 2005; Kirk et al., 2004; Kozdroj & Van Elsas, 2000; Dawar et al., 2014). Involvement of soil microorganisms are in a wide variety of metabolic and physiological activities that influence the microhabitat (Dawar et al., 2014). Soil fungi play an important role in nutrient cycling, plant health & development (Thorn, 1997; Dawar et al., 2014).

Soil fungi play an important role as major decomposers in the soil ecosystem. They also provide mankind with very useful pharmaceutical products, such as antibiotics & other valuable substances, including organic acids, enzymes, pigments and fermentation. In addition, many soil fungi are biological control agents for plant pathogens and insect pests. On other hand, some of them are very harmful causing food spoilage and diseases to plants, animals, and humans with significant economic losses and produce mycotoxins in certain products.

The term Rhizosphere was first proposed by Hiltner in 1904. And according to him, rhizosphere is a portion of the soil which is adjacent to the root system of a plant and is influenced by the root system of a plant. The rhizosphere is an area of soil showing microbiological activity, which is slightly away from root system of the growing plants. The width of this zone of soil varies with the type, age of plant & with soil environmental conditions. Rhizosphere microflora differs from plant to plant.

The Rhizosphere soil is said to have a lower pH, lower water, oxygen pressure & high levels of

carbon dioxide than the bulk soil (Suresh & Bagyaraj, 2002). A range of interaction area present in the rhizosphere from beneficial symbiotic relationships to detrimental pathogenic interactions (Sylvia et al., 2005). The Rhizosphere soil of mild plants supports an abundance of diverse saprophytic microorganisms. This could be due to high input of organic carbon compounds into soil through the process of rhizodeposition (Rovira, 1956; Merckx et al., 1987).

Rhizosphere fungal hyphae extend into the soil, penetrating into nutrient depletion zone and increases the effectiveness of immobile elements by as much as sixty times. Several pathogenic microorganisms have to pass through the Rhizosphere and infect root system. The Rhizosphere microbes show either beneficial or harmful effect on the development of plants. Fungi present in soil may be harmful and causing different plant diseases while some other fungi which antagonize plant pathogen, decompose plant residues and provide nutrients to which was helpful in plant growth. Rhizosphere environment play an important role in plants life cycle. Considering the above importance of rhizosphere mycoflora, the present investigation is carried out with some cultivated members of Solanaceae family, like *Capsicum annum, Lycopersicon esculentum* and *Solanum melongena* cultivated in Gadchiroli district of Maharashtra state, India.

MATERIAL AND METHOD

The plant family **Solanaceae** is found worldwide in distribution. The members of this family are economically important as food or medicinal plants. Among the most familiar to us are the vegetables: potato, eggplant, tomatoes, and the garden pepper etc.

Chilli (*Capsicum annuum)* is native to Central and South America and cultivated extensively throughout tropical Asia and the equatorial regions of the developed world for their edible, pungent fruits. Red or green mild bell, rich in vitamins A and C, are used in seasoning and as a vegetable food. The pungency of hot peppers (chilli) comes from the compound capsaicin in the internal partitions of the fruit.

Tomato (*Lycopersicon esculentum)* is generally multi-branched and has hairy, strongly odiferous, feathery leaves. The drooping, clustered, yellow flowers are followed by red, scarlet, or yellow fruits, which hang from the many branches of one stem. The tomato fruit varies in shape from spherical to elongate and in size from 0.6 inches across to more than 3 inches across. Tomatoes are used raw or cooked as a vegetable or puree, and pickled, canned or sun- dried.

Eggplant (*Solanum melongena)* is a tender plant that requires a warm climate and is grown extensively in eastern and southern Asia (where it is native) and in the U.S. It is usually grown as an annual for its fleshy fruit. It has an erect, bushy stem; large ovate, slightly lobed leaves; and pendulous, violet, solitary flowers. The fruit is a large, glossy, egg-shaped berry, varying in colour from dark purple to red, yellowish, or white, and sometimes striped.

Collection of Plants

For the present study, samples were collected in the month of the January to March. The temperature during these month ranges from 22-30^{0}C. The sampling was done during morning at 7am-10am. The samples of fresh and healthy plants were collected in well sterilized polythene bags. The roots of vegetable like, Brinjal (*Solanum melongena*) and Chilli (*Capsicum annum*) and Tomato (*Lycopersicum esculantum*) etc. were collected from deferent fields of Gadchiroli district. Samples were kept until isolation and identification were made.

The roots of collected samples were inoculated directly on potato dextrose agar media (PDA) for germination of fungal spores. PAD was prepared by following method-

Preparation of fungal media

Potato - 250gm
Dextrose - 20gm

Agar Agar - 20gm
Distil water - 1000ml

After germination of spores, fungal identification is carried out based largely on the morphological character of spores and spore bearing structure by using direct microscopy and again by colour, size and shape of fugal colonies. Standard cotton blue was used for slide preparation. Microphotography of identified fungi was done by Zeiss Axio Star Plus Trinocular Microscope using Canon Power Shot G12 digital Camera.

For the present study three plants were selected and their rhizosperic mycoflora were isolated from different sites of Gadchiroli district. Total 19 different species were isolated from all the three plant samples. The genera of fungi isolated are: *Alternaria, Aspergillus, Chaetomium, Cunninghamella, Curvularia, Penicillium, Phoma, Rhizopus, Syncephalastrum, Trichoderma* etc. Apart from these some unknown fungal species are also reported. The reported fungi sp. are arranged in table.

RESULT AND DISCUSSION

Observation Table-1: Showing sample wise reported fungi

Sr.No.	Plant sample / Reported Fungi	Brinjal (*Solanum melongena*)	Chilli (*Capsicum annum*)	Tomato (*Lycopersicon esculentum*)
1.	*Alterneria solanii*	+	+	+
2.	*Aspergillus niger*	+	+	+
3.	*Aspergillus fumigatus*	+	+	+
4.	*Aspergillus flavus*	+	+	+
5.	*Aspergillus* sp. 1	-	-	+
6.	*Aspergillus* sp. 2	+	-	-
7.	*Aspergillus* sp. 3	+	+	-
8.	*Aspergillus* sp. 4	-	+	-
9.	*Chaetomium* sp.	+	-	+
10.	*Cunninghamella* sp.	+	-	-
11.	*Curvularia* sp.	+	+	+
12.	*Fusarium* sp.	+	+	+
13.	*Penicillium* sp.	+	+	+
14.	*Phoma* sp.	+	+	+
15.	*Rhizopus* sp.	+	+	+
16.	*Syncephalastrum* sp.	-	-	+
17.	*Trichoderma* sp.	+	+	+
18.	Unknown – sp. 1	+	+	-
19.	Unknown – sp. 2	+	-	+

(+) - Present, (-) - Absent

From the above observation, the rhizosphere mycoflora study in all samples, the *Solanum melongena* show highest numbers of species as compared to other two samples. In this sample 16 species are recorded. Followed by *Solanum melongena*, *Lycopersicon esculentum* is second highest sample, which carries total 14 species. *Capsicum annum* pusses quite less number of fungal species as compared to other two samples. The number of species recorded in this sample are 13.

CONCLUSION

A total of 12 genera and 19 species of rhizophere fungi isolated from different members of solanaceae. Some fungi appeared in all 3 members, but some appeared in only a few members or in as little as one. *Syncephalastrum* sp. are recorded in only one member i.e. *Lycopersicon esculentum*.

Rhizosphere fungal hyphae extend into the soil, penetrating into nutrient depletion zone and increases the effectiveness of immobile elements by as much as sixty times. Rhizosphere soil is an imperative one, to assess the Arbuscular Mycorhizal Fungal (AMF) diversity in the roots of host plant and also associated with a great variety of plants of different taxonomic groups. The rhizosphere is highly dynamic, plant driven micro environment, which is characterized by interaction between plant root processes, soil characteristics and associated microbial population (Wenzel et al., 1999).

The intensive root colonization of host resulted in the better plant growth of in term of dry matter. It was also observed that colonization and spore population vary with time and increases with advancing growth stages of the plant. Rhizosphere mycoflora association is known to help in the growth of various crops including horticultural plants like brinjal, chilli and tomato. Nineteen mycorrhizal fungi are reported in the rhizosphere soil of three Solanaceous members namely, tomato (*Lycopersicon esculentum*), Chilli (*Capsicum annum*) and brinjal (*Solanum melongena*) collected from different locations of Gadchiroli.

REFERENCES

[1] Dawar S, Batool M, Tariq M, Zaki MJ. 2014. Mycoflora in the rhizosphere of some wild plants around Karachi University Campus *Pak. J. Bot.* 46(1): 369-373.

[2] Kirk JL, Beaudette LA, Hart M, Moutoglis P, Klironomos JN, Lee H, Trevors JT. 2004. Methods of studying soil microbial diversity. *Journal of Microbiological Methods* 58: 169-188.

[3] Kozdroj J, Van Elsas JD. 2000. Application of polymerase chain reaction denaturing gradient gel electrophoresis for comparison of direct and indirect extraction methods of soil DNA used for microbial community finger-printing. *Biology and Fertility of Soils* 31: 372-378.

[4] Merckx R, Dijkstra A, Hartog Den A, Van Veen JA. 1987. Production of root derived material and associated microbial growth in soil at different nutrient levels. *Biology and Fertility of Soils* 5: 126-13.

[5] Prescott LM, Harley JP, Klein DA. 2005. The epidemiology of infectious disease. *In: Microbiology*. 821-843.

[6] Rovira AD. 1956. Interactions between plant roots and soil micro-organisms. *Annual Review of Microbiology* 19: 241-266.

[7] Suresh CK, Bagyaraj DJ. 2002. Mycorrhiza-microbe interaction*:* Effect on rhizosphere. *In: Arbuscular Mycorrhizae: Interactions in plants, Rhizosphere and soils.* Science Publishers Inc., Hampshire, 7-28.

[8] Sylvia D, Fuhrmann J, Hartel P, Zuberer D. 2005. *Principles and Applications of soil Microbiology.* Pearson Education Inc, New Jersey.

[9] Thorn G. 1997. The fungi in soil. *In Modern Soil Microbiology.* New York, Marcel Dekker, 63-127.

[10] Wenzel, W.W., Lombi, E. and Anriano, C.C. (1999). Biogeochemical processes in the rhizosphere- role of phytoremediation of metal polluted sites. In: Heavy metal stress in plants-From molecules to ecosystems. M.N.V. Prasadand J. Hagemeyer (eds.) Springer Verlag, Heidelberg, Berlin, New York.