



Biodiversity of Mycoflora in Rhizosphere and Rhizoplane of Some Indian Herbs

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ABSTRACT: Rhizosphere and rhizoplane of most of the plants is always rich in various populations of microorganisms. The microorganisms, on a continuous scale forms parasitic to mutualistic association with plants. The present study deals with the investigation of fungal population in the roots vicinity of *Aloe vera*, *Argemone maxicana*, *Abutilon indicum*, *Amaranthus polygamus* and *Achyranthus aspera*. All these five species found to grow in wild and northern plains of India. A total number of 37 species of fungi were isolated and the number of fungi was found to be maximum in rhizosphere region than the non-rhizosphere region. Maximum number of fungal species were found in *Abutilon indicum* (11) followed by *Aloe vera* (9), *Achyranthus aspera* (9), *Amaranthus polygamus* (8) and *Argemone maxicana* (7). Though, some common genera were reported in both rhizosphere and rhizoplane region, yet a few forms like *Chaetomium spirale*, *C.globosum*, *Stachybotrys atra* and *Royella albida* were confined only to rhizoplane. Furthermore, *Glomus mosseae* and *Acaulospora laevis* were found dominant mycorrhizal species in the rhizospheric soil of all five medicinal plant species. The study confirmed that the biodiversity of mycoflora differs in rhizosphere and rhizoplane of selected medicinal herbs.

KEY WORDS: Medicinal plants, Rhizosphere, Rhizoplane, Mycoflora

INTRODUCTION

Herbal plants are of immense medicinal value for drugs and pharmaceutical industries. The growth of the herbal plants also depends on the population of soil microorganism present in their rhizosphere and rhizoplane area of plants as these microorganisms constitutes one of the important biotic and ecological factors responsible for plant growth. Hiltner (1904) introduced the term rhizosphere for the soil zone just adjacent to plant roots and Clark (1949) introduced the term rhizoplane to denote the external plant root surface and the closely adhering soil particles and debris. Fungal population in the rhizosphere and rhizoplane areas show a qualitative change with age of plants and also along with changing environment. Lugo *et al.* (2003), Moore *et al.* (2004) observed seasonal changes in the composition of AM fungi. The present paper includes the study of fungal biodiversity of rhizosphere and rhizoplane area of five wild medicinal plants, *Abutilon indicum*, *Aloe vera*, *Argemone maxicana*, *Amaranthus polygamus* and *Achyranthus aspera*. The leaves of *Abutilon indicum* are used against bronchitis, diarrhea and urethritis and roots are diuretic including pulmonary sedative in nature. *Aloe vera* leaves are antihelmintic, antidotal, anti inflammatory and also used for gonorrhoea, constipation, menstrual suppression, piles and jaundice. The juice of *Argemone*

mexicana are given for dropsy, rheumatic pains, scabies, warts, hepatic eruptions and asthma and whooping cough. *Amaranthus polygamus* is a small herbaceous annual herb. The decoction of leaves and roots are given in eczema, menorrhagia, leucorrhoea and colic pains where as *Achyranthus aspera* juice is used as laxative, stomachic, depurative, pectoral, astringent, hastens labour pains and cause abortion.

MATERIAL AND METHODS

Site description: The soil samples of five medicinal plants were collected from Rishinagar sewage disposal area of Hisar city. The study area is situated at 29°10' northern latitude and 75°46' eastern longitude on north-western region of Haryana. The climate of the area is continental type with very hot summers and relatively cool winter.

Soil and plant root sampling: Soil samples were collected from the root zone of five medicinal plant species up to a depth of 15-30 cm and were wet sieved for spore isolation using the technique of Gerdemann and Nicolson (1963). For cultural investigations of mycoflora of rhizosphere and rhizoplane, soil samples were taken and roots were removed from the plant. The isolation of mycoflora was done using the technique as suggested by Sullia (1966) and Martin (1950) medium.

Further, the isolation of soil fungi was done using serial plate dilution technique given by Warcup (1950).

Identification of Mycoflora: The identification of mycoflora were done by using keys of Walker (1983), Schenk and Perez (1990), Garrett (1956) and Mukerji (1996).

RESULTS AND DISCUSSION

The results obtained in the present study showed that on quantitative basis, the number of fungi was less in rhizoplane region than rhizospheric region. It was also found that as the age of the plants increased, the

number of fungal population also increased. The mycoflora of rhizosphere and rhizoplane also differ qualitatively but some genera like *Chaetomium spirale*, *C.globosum*, *Stachybotrys atra* and *Royella albida* were found to be present only in the rhizoplane. Out of all the five medicinal plants a total number of 37 species of fungi were isolated in both the rhizosphere and rhizoplane mycoflora but number of fungi was found maximum in the rhizosphere region as compared to rhizoplane region (Table 1).

Table 1: Occurrence of Mycoflora in Vicinity of Five Medicinal Plant Species.

Sr.No	Name of fungal species	<i>Abutilon indicum</i>	<i>Aloe vera</i>	<i>Argemone maxicana</i>	<i>Amaranthus polygamus</i>	<i>Achyranthus aspera</i>
1.	<i>Aspergillus flavus</i>	-	X	+	-	X
2.	<i>A.niger</i>	+	+	+	+	+
3.	<i>A.terreus</i>	X	-	-	+	-
4.	<i>Acaulospora laevis</i>	X	-	X	-	+
5.	<i>Alternaria alternate</i>	+	X	-	-	-
6.	<i>A.humicola</i>	X	-	-	X	X
7.	<i>Acrotherium robustum</i>	-	-	-	+	-
8.	<i>Choanephora cucurbitarum</i>	-	+	-	-	-
9.	<i>Chaetomium spiralis</i>	X	X	-	-	-
10.	<i>C.globosum</i>	-	-	-	X	X
11.	<i>Cephalosporium sp.</i>	+	+	X	-	-
12.	<i>Cladosporium herbarum</i>	-	X	-	-	+
13.	<i>C.epiphyllum</i>	X	-	-	X	-
14.	<i>C.lignorum</i>	-	X	-	-	+
15.	<i>Curvularia lunata</i>	+	-	X	-	X
16.	<i>C.pallenscens</i>	X	-	-	-	X
17.	<i>Fusarium solani</i>	+	+	+	+	+
18.	<i>F.culmorum</i>	-	X	-	-	-
19.	<i>Epicocum nigrum</i>	-	+	-	X	X
20.	<i>Glomus mosseae</i>	+	X	X	-	-
21.	<i>Humicola brevis</i>	+	+	+	+	+
22.	<i>Helminthosporium sp.</i>	+	-	X	-	-
23.	<i>Myrothecium sp.</i>	X	-	-	+	-
24.	<i>Mucor luteus</i>	X	-	-	-	-
25.	<i>M.racemosus</i>	+	+	+	+	+
26.	<i>Neocosmospora sp.</i>	X	-	-	-	X
27.	<i>Phoma glomerata</i>	-	-	X	-	+
28.	<i>P.humicola</i>	-	X	-	-	-
29.	<i>Penicillium terrestre</i>	X	+	-	X	-
30.	<i>P. humicola</i>	-	-	+	-	-
31.	<i>Rhizopus arrhizus</i>	-	-	-	-	-
32.	<i>R.nigricans</i>	+	+	+	+	+
33.	<i>Royella albida</i>	-	X	-	-	-
34.	<i>Stachybotrys atra</i>	-	-	X	-	-
35.	<i>Scutellospora sp.</i>	-	-	X	-	-
36.	<i>Trichoderma lignorum</i>	-	-	-	-	X
37.	<i>T. viride</i>	+	-	-	X	-

Rhizosphere = +, Rhizoplane =X

Maximum number of fungal species were found in *Abutilon indicum* (11) followed by *Aloe vera* (9), *Achyranthus aspera* (9), *Amaranthus polygamus* (8) and *Argemone maxicana* (7) in the rhizosphere region. Shaikh and Nadaf (2013) also screened various rhizospheric fungal isolates from different soil samples of rice and found that hyphomycetes were predominant in most of the tested rice varieties. The rhizoplane mycoflora has ten fungal species in case of *Abutilon indicum* followed by *Aloe vera* (9), *Achyranthus aspera* (8), *Argemone maxicana* (8) and *Amaranthus polygamus* (6) respectively. The above results showed that Mucorales and Fusari remained dominating and constant in rhizosphere region.

Similarly *Aspergillus flavus* and *A. niger* were also dominates in the rhizosphere region. Gadgil (1965) also observed the colonization of hypomycetes fungi in the root region. Similarly, fungal diversity in rhizosphere soil of several crops has also been well documented by Gopal and Kurein (2013). The results in the present investigation are also in conformity with the work of Sule and Oyeyiola (2012) who observed different fungal isolates in the rhizosphere and rhizoplane of cassava cultivar. It was observed that physio-chemical characters of the soil such as pH, water retention capacity and soil structure had improved as a result of cassava cultivation and more fungi were stimulated on the rhizoplane than in the rhizosphere. Association of arbuscular mycorrhizal fungi with the roots of medicinal and aromatic plants have also been observed Gupta *et al.* (2009).

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