

Rhizosphere and Non-Rhizosphere Mycoflora of Som (*Persea bombycina* Kost.) with Physico-Chemical Properties of Soil from Goalpara District of Assam, India

Manjit Kumar Ray¹, Piyush Kumar Mishra² and Pradip Kumar Baruah³

¹SRF, DBT-Biotech Hub, BN College, Dhubri, Assam & PhD scholar,
University of Science & Technology, Meghalaya-793101

²Assistant Professor, Dept. of Botany, BN College, Dhubri, Assam-783324

³HOD & Assoc. Prof., Dept. Of Botany, University of Science & Technology, Meghalaya-793101

*Corresponding Author E-mail: manjit_ray2002@yahoo.com

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ABSTRACT

Muga Silkworm (Antheraea assamensis Helfer) that produces the golden silk primarily feed on two host plant namely Som (Persea bombycina Kost. Family-Lauraceae) and Soalu (Listea polyantha Juzz.). Goalpara district of Assam, India has given Geographical identification mark as its climate is suitable for silkworm rearing. As food plants play an important role for the growth and development of silkworm, hence a mycological study was conducted in rhizosphere and nonrhizosphere soil of Som in Goalpara district of Assam, India by using serial dilution and agar plating method. A total of 13 fungal species have been isolated from non rhizosphere soil while a total of 21 fungal species were identified from the rhizosphere soil. Rhizopus stolonifer, Aspergillus flavus and Penicillium chrysogenum were the dominant mycoflora during the study period. Rhizopus stolonifer were dominant in spring (25.5%), autumn (16.0%) and winter season (32.0%) while Aspergillus flavus were dominant myflora in summer season (20.5%). During Spring Rhizopus stolonifer (22.5%), Aspergillus flavus in summer (16.5%) and autumn (13.0%) and during winter Penicillium chrysogenum (13.0%) were the dominant fungal species of the rhizosphere soil. The physico-chemical properties such as P^H, Organic Carbon, available Nitrogen, available Phosphorus, available Potassium, water holding capacity and moisture of the soil samples from 4 different places depending upon direction of the district were evaluated with its textures by standard sampling procedures. Seasonal variations of the fungal occurrence is observed for both the nonrhizosphere and rhizosphere soil samples as well.

Key words: Rhizosphere, non rhizosphere, mycoflora, physico-chemical properties, Goalpara

INTRODUCTION

Fungi plays major important role in the soil ecosystem, which functions as the main decomposers of forest as well as involve in nutrient cycling, while few other species form

mycorrhizal associations and can also act as harmful agents as plant pathogens. Plants root system is associated with various organic and inorganic substances with microbial communities.

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The plant types, age of the plant and the soil influences the nature and number of mycoflora. Foster and Marks¹⁶ observed the soil root interface through TEM and reported relationship that occurred among microorganisms, soil and roots. Bowen and Theodoros⁹ reported that the surface of the 90 days old plant root contains more microorganisms (37%) than three weeks old plant root (10%). Soil pH, moisture content, Organic carbon, total nitrogen concentration, available K and topography also influences the fungal diversity^{7,32}.

Persea bombycina Kost. Commonly known as “Som” is the primary food plant of golden silk producing Muga silkworm (*Antheraea assamensis* Helfer.), which is endemic to Northeast India. Sericulture in Goalpara district of Assam, India existed almost as a practice among the people since a long time. The district is situated at a distance of 146 km from Guwahati, the capital city of Assam. The district covers an area of 1,824 sq. km and is located between latitudes 25.53 degree and 26.30 degree North and longitudes 90.07 degree and 91.05 degree east. The district has been given the geographical identification mark because its climate is suitable for silkworm rearing. The present study deals with the rhizosphere and non-rhizosphere mycoflora of som from Goalpara district of Assam during February, 2014 to January, 2015 with various physicochemical properties of different soil samples.

MATERIALS AND METHOD

The pH of the soil sample was determined in distilled water and 1N KCl solution taking soil solution ratio of 1:1 using Systronics digital PH meter. The organic carbon percentage was determined by titration method as described by Walkley and Black³⁴. Available Nitrogen was determined by Kjeldahl distillation method by Jackson¹⁹. Available phosphorus was determined by Bray's No.1 method¹⁰. Available potassium was determined by Toth and Prince³³ method. Water holding capacity

was determined by using Lal²² method. The moisture content was determined by gravimetric method³⁵. The texture of the soil is determined by International pipette method by Black⁸.

For microbiological studies, soil samples from various som plantation area were collected following standard sampling method. A total of 4 sites were selected depending upon the direction namely Budlung pahar on north, Lengopara on the south, Dorapara Agia on the east and Bhalukdubi on the west respectively for collecting the samples during the summer, Autumn and Winter seasons. For collection of rhizosphere soil sample each Som plantlet was carefully uprooted and the soil adhering to the roots was gently shaken into a sterile polythene bag; the bag was tied and labelled. The non rhizosphere soil samples were collected by digging a few centimeters deep into the field with a sterile hand trowel; the soil collected was then tied and labelled. Isolation and evaluation of microfungi from soil and rhizosphere will be done by serial dilution agar plating method⁴. The petridishes were inoculated at 26° C for 5 days and then the plates are examined for the development of fungal colonies. The isolated fungi were identified. The mycelia and spore characters of fungi were studied under microscope (Labomed, Germany) using Lactophenol cotton blue staining and with the help of “A manual of soil fungi by Gilman¹⁸ and Illustrated genera of imperfect fungi by Baranatt⁵.”

Physicochemical properties of soil samples with its texture is tabulated in Table 1. Observation of fungal isolates from Non-rhizosphere and rhizosphere of Som are presented in Table .2 & Table.3 respectively. Fig.1 represents the map of the study site, i.e the Goalpara district, Assam, India.

Fig.2 and Fig.2 represents statistical analysis of occurrence of both the non-rhizosphere and rhizosphere mycoflora in soil in four different seasons from Goalpara district of Assam, India.



Fig. 1: Map of Goalpara district, Assam, India

Table1. Physico chemical properties of Soil of Goalpara district, Assam during Summer and winter season

Season	pH	O.C (%)	Av. N ₂ (Kg/ha)	Av. P ₂ O ₅ (kg/ha)	Av. K ₂ O (kg/ha)	Water Holding Capacity (%)	Moisture (%)
Summer	6.13±5	2.194	730.18	39.23	325.92	38.34	35.46
Winter	4.74±5	2.438	811.20	21.798	483.16	46.42	12.28

Texture:

Season	Sand %	Silt %	Clay %	Texture
Summer	9.51	54.21	36.27	Silty clay loam
Winter	10.63	55.25	34.10	Silty clay loam

Table 2. Frequency of Occurrence (%) of fungal isolates in the Non-rhizosphere soil of Som

S.No.	Fungal isolates	% of occurrence of fungal isolates			
		Monsoon (Feb-Mar-Apr)	Summer (May-June-Jul)	Autumn (Aug-Sep-Oct)	Winter (Nov-Dec-Jan)
1	<i>Aspergillus fumigatus</i>	0.0	20.0	12.50	12.0
2	<i>Trichoderma viridae</i>	8.50	10.0	6.5	0.0
3	<i>Rhizopus stolonifer</i>	25.50	15.0	16.0	32.0
4	<i>Penicillium chrysogenum</i>	10.50	8.0	10.0	15.0
5	<i>Saccharomyces cerevisiae</i>	5.50	0.0	4.0	0.0
6	<i>Aspergillus clavatus</i>	0.0	5.50	0.0	0.0
7	<i>Aspergillus niger</i>	24.0	15.0	15.0	10.5
8	<i>Mucor hiemalis</i>	10.50	0.0	0.0	3.5
9	<i>Mycelia sterile (white)</i>	15.50	0.0	5.5	0.0
10	<i>Rhodotorula glutinis</i>	0.0	5.50	3.5	0.0
11	<i>Aspergillus flavus</i>	0.0	20.50	15.5	12.5
12	<i>Pestalotiopsis disseminata</i>	0.0	0.0	3.0	0.0
13	<i>Cladosporium cladosporioides</i>	0.0	0.0	8.5	15.0

Table 3. Frequency of Occurrence (%) of fungal isolates in the Rhizosphere soil of Som

S.No.	Fungal isolates	% of occurrence of fungal isolates			
		Monsoon (Feb-Mar-Apr)	Summer (May-June-Jul)	Autumn (Aug-Sep-Oct)	Winter (Nov-Dec-Jan)
1	<i>Rhizopus stolonifer</i>	22.5	8.0	5.5	8.5
2	<i>Mycelia sterile (white)</i>	7.0	5.0	0.0	2.0
3	<i>Aspergillus flavus</i>	0.0	16.5	13.0	7.5
4	<i>Aspergillus niger</i>	13.5	15.0	10.0	12.0
5	<i>Curvularia lunata</i>	3.5	5.0	9.5	2.0
6	<i>Fusarium oxysporum</i>	9.5	3.0	0.0	0.0
7	<i>Mucor hiemalis</i>	18.0	0.0	0.0	3.5
8	<i>Trichoderma viridae</i>	5.0	10.5	7.0	4.5
9	<i>Verticillium sp.</i>	2.0	0.0	0.0	0.0
10	<i>Penicillium chrysogenum</i>	5.0	8.0	12.0	13.0
11	<i>Aspergillus fumigatus</i>	0.0	8.0	11.5	6.0
12	<i>Aspergillus clavatus</i>	0.0	4.0	0.0	5.0
13	<i>Saccharomyces cerevisiae</i>	4.0	3.0	3.5	0.0
14	<i>Geotrichum candidum</i>	2.0	0.0	0.0	0.0
15	<i>Rhodotorula glutinis</i>	3.5	7.0	0.0	2.5
16	<i>Alternaria 171ternate</i>	4.5	10.0	12.5	0.0
17	<i>Cladosporium cladosporioides</i>	0.0	0.0	8.0	12.5
18	<i>Rhizoctonia solani</i>	0.0	0.0	4.5	10.5
19	<i>Pestalotiopsis disseminata</i>	0.0	0.0	0.0	5.0
20	<i>Trichothecium sp.</i>	0.0	0.0	0.0	5.5
21	<i>Mycelia sterila (grey)</i>	0.0	0.0	3.0	0.0

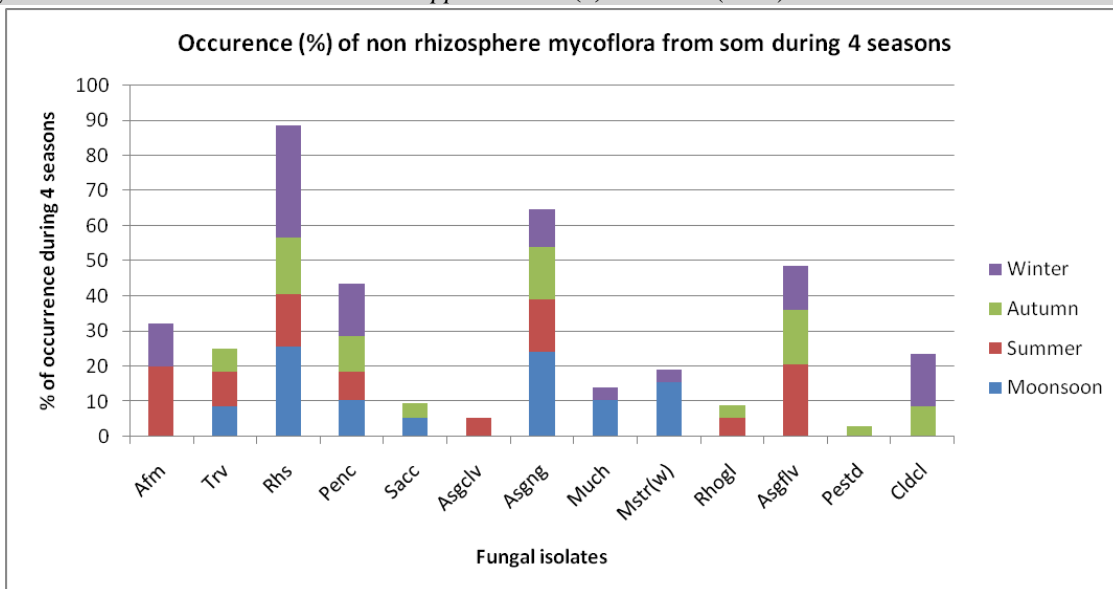


Fig.2: Occurrence of fungal species from non-rhizosphere soil

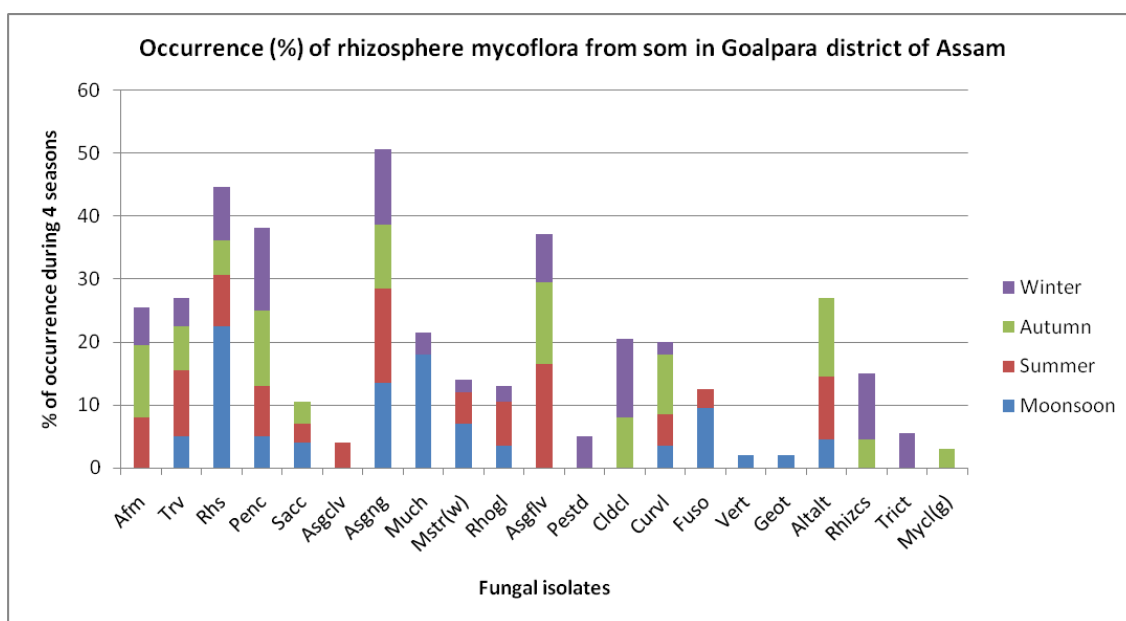


Fig.3: Occurrence of fungal species from rhizosphere soil

Note: Afm- *A.fumigatus*, Trv- *T. viridae*, Rhs- *R. stolonifer*, Penc- *P. chrysogenum*, Sacc- *S. cerevisiae*, Asgclv- *A.clavatus*, Much- *M. hiemalis*, Mstr(w)- *M. sterila* (white), Rhogl- *R. glutinis*, Asgflv- *A.flavus*, Pestd- *P.disseminata*, Cldcl – *C. cladosporioides*, Curvl- *C.lunata*, Fuso- *F.oxysporum*, Vert- *Verticillium sp.*, Geot- *G. candidum*, Altalt- *A.alternata*, Rhizcs- *R. solani*, Trict- *Trichothecium sp.*, Mycl(g)- *M. sterila* (grey)

RESULT AND DISCUSSIONS

During the study period, from the non rhizosphere soil of som plantation areas of Goalpara district of Assam, India, a total of 13 fungal species were isolated & identified based on colony morphology, spore structure &

mycelia structure. *Rhizopus stolonifer* were the dominant mycoflora during monsoon (25.5%), autumn (16.0%) and winter season (32.0%). While during summer season occurrence of *Aspergillus flavus* were the highest (20.5%). Again from the Rhizosphere soil a total of 21

fungal species were isolated & identified based on colony morphology, mycelia structure. During monsoon season the dominant rhizosphere mycoflora were *Rhizopus stolonifer* (22.5%), while percentage of occurrence of *Aspergillus flavus* were dominant among other fungal group during summer (16.5 %) and autumn (13.0%). Again in winter season *Penicillium chrysogenum* (13.0 %) were the dominant rhizosphere mycoflora in the study area. Various factors of the soil such as PH, organic content, water and moisture, topography greatly influences the fungal population and diversity^{13,21,29,32,36,37}. It has been reported that the density of fungal population occurred during monsoon season when the soil moisture was significantly high. Few works have been carried forward by various workers on soil fungi in crop/agricultural fields and enlightened the importance of soil mycoflora^{6,17,25,28,31}. Johri et al.²⁰ reported that several fungal species such as *Aspergillus sp.* can efficiently solubilise Phosphorus. Soil microorganisms are known to be effective in releasing phosphorous from inorganic complexes through solubilisation²⁶. Dutta¹⁵ reported that *Trichoderma viridae* and *Penicillium chrysogenum* controlled the growth of *Verticillium* wilt in tomato plant. Hence *T.viridae* can be used as antagonist. Similar studies in soil mycoflora by Dalal¹¹ showed that *Aspergillus sp.*, *Rhizopus sp.* and *Penicillium sp.* were more prevalent in soil than other genera.

Microorganisms growing on the plant roots can influence plant growth positively or negatively²⁴. The influence of exudates upon rhizosphere microorganisms varies with plant age^{2,27} reported *Rhizopus stolonifer*, *A.niger* and *A.clavatus* were predominant in rhizosphere soil while *Penicillium oxalicum* and *Alternaria herbarum* were predominant in non rhizosphere soil only. On the other hand in our present study it were observed that *R.stolonifer*, *A.niger* & *Penicillium chrysogenum* were the dominant fungi in nonrhizosphere soil and *R.stolonifer*, *A.niger*, *Curvularia lunata*, *Trichoderma viridae* & *Penicillim chrysogenum* were the dominant

fungal species in the rhizosphere soil. The seasonal variation of fungi is clearly observed during the study period.

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