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Comparative Soil Nutrient Status and Microbiota Associated in the Rhizosphere of *Oroxylum indicum* growing in Different Natural Habitat in North East India

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A B S T R A C T

The rhizospheric soil samples were collected from five different sites of Northeast India where *Oroxylum indicum* was naturally growing in its ecological habitat and were analysed. A total of 25 fungal species and four bacterial isolates were found to be associated in the rhizosphere of *O.indicum*. The fungal microbiota comprised mainly of *Trichoderma harzianum*, *Penicillium* sp., *Aspergillus* sp., *Trichoderma viride*, *Fusarium* sp., *Penicillium funiculosum*, *Penicillium capsulatum*, *Penicillium citrinum*, *Pachybasium* sp**.,** *Trichoderma hamatum*, *Mucor* sp., *Verticillium* sp., *Curvularia* sp., *Rhizomucor* sp., *Pythium* sp., *Rhizoctonia* sp., *Colletrotrichum* sp. *etc.* While the bacterial isolates mainly comprised of Four bacterial isolates *Pseudomonas putida*, *Pseudomonas* sp., *Streptobacillus* sp., *Bacillus* sp. The overall analysis of soil nutrient status showed that pH status was higher in roadside and riverside, while mimum pH was found in forest fringe and hillslope. The % Organic Carbon was found to be highest in agricultural farmland and lowest in hillslope. Available Nitrogen was highest in agricultural farmland, while it was minimum in forest fringe. Available Phosphorus was again highest in agricultural farmland while it was lowest in riverside and forest fringe areas. Available Potassium was highest in hillslopes and agricultural farmland while it was lowest along riverside.

Introduction

The rhizosphere is a densely populated area in which the roots must compete with the invading root systems of neighboring plant species for space, water and mineral nutrients, and with soil-borne microorganisms, including bacteria, fungi, and insects feeding on an abundant source of organic material (Ryan and Delhaize 2001). Soil acts as a habitat for diverse group of microorganisms. Plant root exudates enrich rhizosphere region of the soil and attracts a variety of micro-organisms. Plant growth is influenced by the presence of bacteria and fungi and their interactions are common in the rhizospheres of plants with high relative densities of microbes (Berg and Smalla, 2009). Rhizosphere interactions are not solely driven by roots but are highly integrated with and influenced by residing organisms and local edaphic factors. Soil-inhabiting mutualists and parasites, both prokaryotic and eukaryotic, are actively involved in signaling

with a host plant. Microbial populations react to the exudates released by plant roots making the rhizosphere interactions very dynamic which are altered by addition or loss of any microbe (Badri *et al.,* 2009). A strong interaction prevails between the group of microorganisms colonising the rhizosphere region and plant roots. Microorganisms and their products also affect the roots in a variety of positive, negative and neutral ways (Broeckling *et al.,* 2008).

Plant growth-promoting bacteria occupy the rhizosphere of many plant species and have beneficial effects on the host plant. They may influence the plant in a direct or indirect manner. A direct mechanism would be to increase plant growth by supplying the plant with nutrients and hormones. The release of carbon compounds from plants into the rhizosphere increases microbial biomass and activity. *Pseudomonas* sp. comprises a genus of ubiquitous Gram-negative bacteria that can live in several environmental niches in the rhizosphere. Although, a few *Pseudomonas* spp. are studied for their role as plant pathogens i.e., *Pseudomonas syringae* but there are many species such as *P. fluorescens, P. putida, P. aeaureofasciens* and *P. chloraphis*, which may act as plant beneficial bacteria by antagonizing plant pathogens and through the production of traits that directly influence plant disease resistance and growth (Venturi 2006).

Plant Growth Promoting Rhizobacteria (PGPR≈PGPB) are natural rhizosphere-inhabiting bacteria, which belong to diverse genera such as *Pseudomonas* and *Bacillus* species. These microorganisms have been isolated from a wide variety of wild and cultivated plant species such as Arabidopsis, barley, rice, canola and bean (Persello-Cartieaux *et al.,* 2003). PGPR are used as inoculants for biofertilization, phytoestimulation and biocontrol. The general effect of PGPR is an increased growth and productivity of plants. Their contribution can be exerted through different mechanisms including root system architecture modulation and increased shoot growth by production of phytohormones such as auxins and cytokinins. Free-living microbes including filamentous fungi of the genus *Trichoderma* sp. and a variety of plant growth-promoting rhizobacteria (PGPR) are able to suppress soil-borne plant pathogens and to stimulate plant growth by different direct or indirect mechanisms, such as production of phytohormones, mycoparasitism and competence with plant pathogens, decomposition and mineralization of organic matter and enhancing the bioavailability of mineral nutrients such as phosphorus and iron (Valencia *et al.,*2007).

Oroxylum indicum is a medicinally important forest tree species. This species is categorized as vulnerable due to over exploitation of whole plant for medicinal uses (Ravikumar and Ved 2000; Saraf *et al.,* 2013). Das *et al.,* 2013 reported that *O. indicum* is categorized under endangered status in North east India. Very little information is available on the soil nutrient status and rhizospheric micro biota associated with this medicinal plant species. Quiang (2006) reported that *O. indicum* lives in relationship with the actinomycete-*Pseudonocardia oroxyli* present in the soil surrounding the roots. Rashidi and Deokule, (2013) isolated 14 fungal species in the rhizosphere of *O. indicum* which comprised mainly of *Fusarium solani, F. reticulatum, F. equiseti, F oxysporum, F. semitectum, F. acuminatum, Rhizopus oryzae, A. niger, A. parasiticus, Cunningamella elegans, Syncephalestrum racemosum, Chaetomium indicum, Trichoderma* sp. and *Papulaspora immerse*. In the present study the fungal as well as bacterial microbiota present in the rhizospheric soil sample of *O. indicum* was analysed with respect to the soil nutrient

status of the tree growing in different natural habitat in North East India. The determination of the soil fungal as well as bacterial community composition along with physico-chemical properties of soil is essential in order to evaluate above- and below-ground plant ecosystem health and functioning. It is also a prospective to exploit micro-biota for future conservation strategies.

Materials and Methods

Collection of the rhizospheric soil, root and plant samples

The rhizospheric soil and plant samples were collected from five different sites of Northeast India where *Oroxylum indicum* was naturally growing in its ecological habitat. The rhizospheric soil and root samples and pods were collected from Jorhat, Nalbari, Guwahati, Itanagar and North Lakhimpur. The samples of *O. indicum* were collected from trees showing fruiting from five different collection sites of a single eco-region (Brahmaputra Valley semi- evergreen forests), *i.e.* Jorhat, Nalbari, Guwahati, Itanagar and North Lakhimpur. Rhizospheric soil samples along with root segments were taken by digging out a small amount of soil (500g) close to the plant roots up to a depth 15-30 cm and these samples were kept in sterilized polythene bags for further processing in the laboratory for physicochemical analysis of soil, mycorrhizal colonization and spore quantification etc. Samples from the selected plant species were collected from the plant growing along riverside in Nalbari. From Guwahati, samples were collected from the tree growing in forest fringe area. Samples from hill slope were collected from Itanagar, while, sample from agricultural farmland were collected from North Lakhimpur. The samples were collected from healthy trees which overall represented the region.

Isolation of fungal isolates

The rhizospheric soil samples were collected from five different study sites in polyethene bags and was further analysed in the laboratory. Soil Dilution Plate Method (Waksman 1927) was used for the isolation of fungal species. Soil dilutions were made by suspending 1g of soil of each sample in 10ml of sterile distilled water. Dilutions of 10^{-2}, 10^{-3} and 10^{-4} were used to isolate fungi in order to avoid over-crowding of the fungal colonies. 1ml of the suspension of each concentration was added to sterile Petri dishes, in triplicates of each dilution, containing sterile Potato Dextrose Agar (PDA) medium. 1% streptomycin solution was added to the medium for preventing bacterial growth, before pouring into Petri plates. The plates were then incubated at 28±2^{o}C for 4-7 days. Fungi easily isolated because they formed surface colonies that were well dispersed particularly at higher dilutions. The pure colonies were preserved in PDA slants and stored at 3-4^{o}C for further analysis.

Identification of the soil fungi

Identification of the fungal species is based on morphological characteristics of the colony and microscopic examinations (Diba *et al.*, 2007). The fungi were identified by the help of various taxonomic keys available (Gilman 1957; Subramanian, 1971; Watanabe 1993; Domsch *et al.*, 2007; Singh *et al.*, 1991).

Isolation of bacterial isolates

The isolation of soil bacteria was done by using dilution plate technique as given by Johnson and Curl (1972) at 10^{6} dilutions on Nutrient Agar (NA). The NA plates were incubated at 30±1^{o}C for 48 hours. The pure cultures of bacteria were preserved at 4^{0}C in NA slants after observing the abundance of bacterial growth and colony morphology. The

isolated bacteria were preserved in 15% (v/v) glycerol in nutrient broth (NB) at -20^{o}C.

Identification of bacterial isolates

The identification of bacteria is based on external morphology as well as biochemical tests. The physiological and biochemical characteristics were examined according to Cappuccino and Sherman (2004) and Bergey's Manual of Systematic Bacteriology, 1934. In order to differentiate Gram-positive and Gram- negative strain of bacteria, a modified method of Gram staining (Cruickshank, 1965) was followed.

The soil samples were analysed in the laboratory of Rain Forest Research Institute, Jorhat following standard methods. Soil pH was determined by the help of standard pH meter. The soil Organic Carbon Estimation was done by Walkley-Black's method (1934). The estimation of Available Nitrogen in soil was done with the help of Kjeldahl (1883). The estimation of available Potassium in soil was done through Ammonium acetate extraction method by R.R. Simard (1993). Soil Available Phosphorus estimation was done according to Bray (1948).

Results of the various experiments were analyzed following appropriate statistical methods as per the procedure suggested by Panse and Sukhatme (1978). The results were further analysed using IBM SPSS Statistics 21. The ANOVA as well as DMRT was applied on the data sets.

Results and Discussion

The rhizospheric samples of *Oroxylum indicum* were collected from five different collection sites of a single eco-region of Northeast India (Brahmaputra Valley semi-evergreen forests), *i.e.* Jorhat, Nalbari, Guwahati, Itanagar and North Lakhimpur. In Jorhat the sampling was done along roadside, while, in Nalbari, the sampling was done along riverside. The samples were collected from forest fringe zone in Guwahati collection site, while, soil samples from hill slope were collected from Itanagar site. In North Lakhimpur site the soil samples were collected from agricultural farmland. The highest elevation was observed in Itanagar while lowest was found in Nalbari. Table 1 shows the pH and nutrient status of the soil under naturally growing *O. indicum* tree species. The organic carbon content %, available Nitrogen (kg/hac), available Potassium and available Phosphorus (P) in kg/ hac was determined. The nutrient status of soil varied along different collection sites. The soil status of the sample collected from Jorhat site has a pH value ranging between 5.89±0.11 to 6.2±0.03. The soil organic carbon percentage varied between 1.243±0.034 to 1.282±0.025, available Nitrogen (kg/hac) ranged between 242.69±0.001 to 301.27±0.001, and available Phosphorus (kg/hac) varied between 34.39±2.90 to 39±3.151, while available potassium (kg/hac) varied between 28.52±0.754 to 37.36±1.24. In Nalbari site the pH of the soil varied from 5.91±0.11 to 6.11±0.08. The organic carbon percentage was found to range between 1.320±0.033 to 1.397±0.034, the available nitrogen (kg/hac) varied between 326.37±0.002 to 359.85±0.002; available phosphorus (kg/hac) was between 40.78±3.15 to 43.61±0.81 and available potassium varied between 21.39±1.78 to 25.09±1.58. In Guwahati site the pH varied between 5.25±0.187 to 5.61±0.097, the organic carbon ranged between 1.760±0.050 to 1.808±0.033. The available nitrogen (kg/hac) varied between 175.74±0.0006 to 217.58±0.001; available phosphorus (kg/hac) was between 38.82±0.614 to 41.8±0.063 and available potassium varied between 29.37±1.24 to 36.22±1.02. The soil nutrient status of

Itanagar site shows that the pH varied between 5.17±0.323 to 5.47±0.279, The organic carbon percentage was found to be 1.081±0.078, the available nitrogen (kg/hac) varied between 472.82±0.001to 564.88±0.001, available phosphorus (kg/hac) was between 44.32±1.799 to 46.27±0.307 and available potassium varied between 42.49±1.50 to 45.34±1.48. In North Lakhimpur site the pH of the soil varied from 5.38±0.43 to 6.05±0.131. The organic carbon percentage was found to range between 1.808±0.033 to 1.865±0.049, the available nitrogen (kg/hac) varied between 594.17±0.003 to 648.56±0.004, available phosphorus (kg/hac) was between 48.22±0.639 to 50.17±0.639 and available potassium varied between 45.06 ± 1.99 to 49.34±1.50. The DMRT analysis of different parameters was done to segregate different parameters. The DMRT analysis of the pH status was higher in Jorhat and Nalbari, intermediate pH was found in North Lakhimpur site while mimum pH was found in Guwahati and Itanagar site. Overall, the pH of the soil under *O. indicum* is acidic. The % Organic Carbon was found to be highest in North Lakhimpur site while it was lowest in Itanagar site. Available Nitrogen was highest in NorthLakhimpur, while it was minimum in Guwahati. Available Phosphorus was again highest in North Lakhimpur site while it was lowest in Nalbari and Guwahati site. Available Potassium was highest in Itanagar and North Lakhimpur sites while it was lowest in Nalbari site. Soil borne microorganisms are beneficial for plant growth.

Rhizospheric mycoflora associated with the rhizospheric soil samples of *Oroxylum indicum* (L.) Benth. ex Kurz

The natural occurrence of the mycoflora associated in the rhizosphere of *O.indicum* was assessed in the laboratory of RFRI, Jorhat. The rhizospheric samples of *O. indicum* were collected from five different collection sites *i.e.* Jorhat, Nalbari, Guwahati, Itanagar and North Lakhimpur. 25 fungal species were isolated from the rhizosphere of *O. indicum* (Table 5). A total of 11 fungal species were isolated from the Jorhat collection site, which comprised mainly of *Trichoderma harzianum, Penicillium* sp., *Aspergillus* sp., *Trichoderma viride, Fusarium* sp., *Penicillium funiculosum, Penicillium capsulatum, Penicillium citrinum, Pachybasium* sp**.,** *Trichoderma hamatum, Mucor* sp. 12 fungal species were isolated from the rhizosphere of *O. indicum* from Nalbari collection site *i.e. Trichoderma harzianum, Penicillium* sp., *Aspergillus* sp., Verticillium sp., *Fusarium* sp., *Curvularia* sp., *Penicillium capsulatum, Rhizomucor* sp., *Pythium* sp., *Penicillium citrinum, Pachybasium* sp, *Penicillium* sp. The Guwahati collection site showed occurrence of 14 fungal isolates *i.e. Rhizoctonia* sp., *Trichoderma harzianum, Penicillium* sp., *Colletrotrichum* sp., *Geotrichum* sp., *Trichoderma viride, Trichoderma hamatum, Penicillium capsulatum, Cunnighamella* sp., *Pythium* sp., *Penicillium citrinum, Pachybasium* sp., *Mucor* sp., *Trichoderma* sp.

A total of 12 fungal species were isolated from the Itanagar collection site, which mainly comprised of *Rhizoctonia* sp., *Trichoderma harzianum, Trichoderma viride, Scelosporium* sp., *Absidia* sp., *Fusarium* sp., *Colletrotrichum* sp., *Curvularia* sp., *Mucor* sp., *Pythium* sp., *Pachybasium* sp. The North Lakhimpur collection site showed the occurrence of 15 fungal isolates which mainly comprised of *Rhizoctonia* sp., *Trichoderma harzianum, Aspergillus* sp., *Trichoderma viride, Absidia* sp., *Fusarium* sp., *Trichoderma hamatum, Gliocladium* sp., *Colletrotrichum* sp., *Rhizoctonia solani, Penicillium capsulatum, Rhizomucor* sp., *Pythium* sp., *Penicillium citrinum, Pachybasium* sp. only (Plate 1.1 and 1.2).

Table.1 Soil status of different collection sites of *Oroxylum indicum* (L.) Benth. ex Kurz

Sample	Habitat	pH	%OC	Available N (kg/hac)	Avl P (kg/hac)	Avl K (kg/hac)
JORHAT	Roadside	5.89±0.11	1.282±0.025	242.69±0.001	39±3.151	36.506±1.73
		6.2±0.03	1.243±0.034	251.05±0.002	34.39±2.90	28.52±0.754
		5.74±0.141	1.253±0.025	301.27±0.001	34.75±5.22	37.36±1.24
NALBARI	Riverside	6±0.173	1.339±0.025	330.56±0.001	40.78±3.15	21.39±1.78
		6.11±0.08	1.397±0.034	326.37±0.002	41.48±1.91	24.81±1.30
		5.91±0.11	1.320±0.033	359.85±0.002	43.61±0.81	25.09±1.58
GUWAHATI	Forest Fringe	5.4±0.221	1.760±0.050	209.21±0.008	41.8±0.063	36.22±1.02
		5.25±0.187	1.760±0.074	175.74±0.0006	39.71±0.987	29.37±1.24
		5.61±0.097	1.808±0.033	217.58±0.001	38.82±0.614	34.79±1.99
ITANAGAR	Hill Slope	5.41±0.270	1.081±0.050	472.82±0.001	45.92±0.639	43.92±1.73
		5.47±0.279	1.081±0.078	502.11±0.001	44.32±1.799	45.34±1.48
		5.17±0.323	1.081±0.058	564.88±0.001	46.27±0.307	42.49±1.50
NORTH LAKHIMPUR	Agricultural Farmland	5.65±0.174	1.808±0.033	594.17±0.003	48.22±0.639	49.34±1.50
		6.05±0.131	1.846±0.041	648.56±0.004	50.17±0.639	45.63±0.75
		5.38±0.43	1.865±0.049	623.46±0.001	48.58±0.639	45.06±1.99

Table.2 Bacteria in rhizosphere of *Oroxylum indicum* (L.) Benth. ex Kurz

Bacteria	Jorhat	Nalbari	Guwahati	Itanagar	N. Lakhimpur
Pseudomonas putida	+	+	+	-	+
Pseudomonas sp.	+	-	+	-	+
Streptobacillus sp.	-	+	+	+	-
Bacillus sp.	+	-	+	+	+

+ denotes present, - denotes absent.

Table.3 Classification of bacteria based on colony morphology

Sl.No.	Biochemical test	*Pseudomonas* species	*Bacillus* species
1	Gram stain	-	+
2	Shape	Rod	Rod
3	Agar plate character	White translucent (Kings B medium)	Dull white
4	Methyl red test	-	-
5	Catalase test	+	+
6	Oxidase test	+	+
7	Growth in NB	+	+
8	Glucose fermentation test	-	+
9	Nitrate reduction test	-	NA

Table.4 Biochemical test of bacteria

Species	Colony morphology	Gram's reaction	Cell shape
***Streptobacillus* sp.**	Pleomorphic, Fusiform; develop characteristic lateral bulbar swellings, filamentous rod	Gram -ve	Rods
Pseudomonas putida	Round, Translucent whitish, Bright, Button shaped Colonies	Gram -ve	Rods
***Bacillus* sp. 1**	Punctiform, Irregular, Opaque, Whitish, Raised	Gram +ve	Rods
***Pseudomonas* sp.**	Irregular, whitish, raised colonies	Gram -ve	Rods

Table.5 Rhizospheric mycoflora associated with *Oroxylum indicum* (L.) Benth. ex Kurz

Sl. No.	Fungal Species	Family	Jorhat	Nalbari	Guwahati	Itanagar	N. Lakhimpur
1.	*Absidia* sp.	Cunnighamellaceae	-	-	-	+	+
2.	*Aspergillus* sp.	Trichocomaceae	+	+	-	+	+
3.	*Colletrotrichum* sp.	Glomerellaceae	-	-	+	+	+
4.	*Cunnighamella* sp.	Cunnighamellaceae	-		+	-	-
5.	*Curvularia* sp.	Pleosporaceae	-	+	-	+	-
6.	*Fusarium* sp.	Nectriaceae	+	+	-	+	+
7.	*Geotrichum* sp.	Endomycetaceae	-	-	+	-	-
8.	*Gliocladium* sp.	Hypocreaceae	-	-	-	-	+
9.	*Mucor* sp.	Mucoraceae	+	-	+	+	-
10.	*Pachybasium* sp.	Hypocreaceae	+	+	+	+	+
11.	*Penicillium capsulatum* Raper and Fennell	Trichocomaceae	+	+	+	-	+
12.	*Penicillium citrinum* Thom	Trichocomaceae	+	+	+	-	-
13.	*Penicillium funiculosum* Thom	Trichocomaceae	+	-	-	-	-
14.	*Penicillium* sp. 1	Trichocomaceae	+	+	+	-	+
15.	*Penicillium* sp. 2	Trichocomaceae	-	+	-	-	-
16.	*Pythium* sp.	Pythiaceae	-	+	+	+	+
17.	*Rhizoctonia solani* Kuhn.	Ceratobasidiaceae	-	-	-	-	+
18.	*Rhizoctonia* sp.	Ceratobasidiaceae	-		+	+	+
19.	*Rhizomucor* sp.	Mucoraceae	-	+	-	-	+
20.	*Scedosporium* sp.	Microascaceae	-	-	--	+	-
21.	*Trichoderma hamatum* (*Bonord.*)	Hypocreaceae	+	-	+	-	+
22.	*Trichoderma harzianum* Pers.	Hypocreaceae	+	+	+	+	+
23.	*Trichoderma* sp.	Hypocreaceae	-	-	+	-	-
24.	*Trichoderma viridae* Pers.	Hypocreaceae	+	-	+	+	+
25.	*Verticillium* sp.(Nees)	Plectospharellaceae	-	+	-	-	-

+ denotes present, - denotes absent

Plate.1 A. *Aspergillus ruber* B. *Trichoderma harzianum* C. *Penicillium citrinum* D. *Aspergillus* sp. E. *Absidia* sp. F. *Penicillium funniculosum* G. *Rhizoctonia solanii* H. *Penicillium capsulatum* I. *Aspergillus* sp. J.*Cunnighamella* sp. K. *Mucor* sp. L. *Aspergillus* sp.

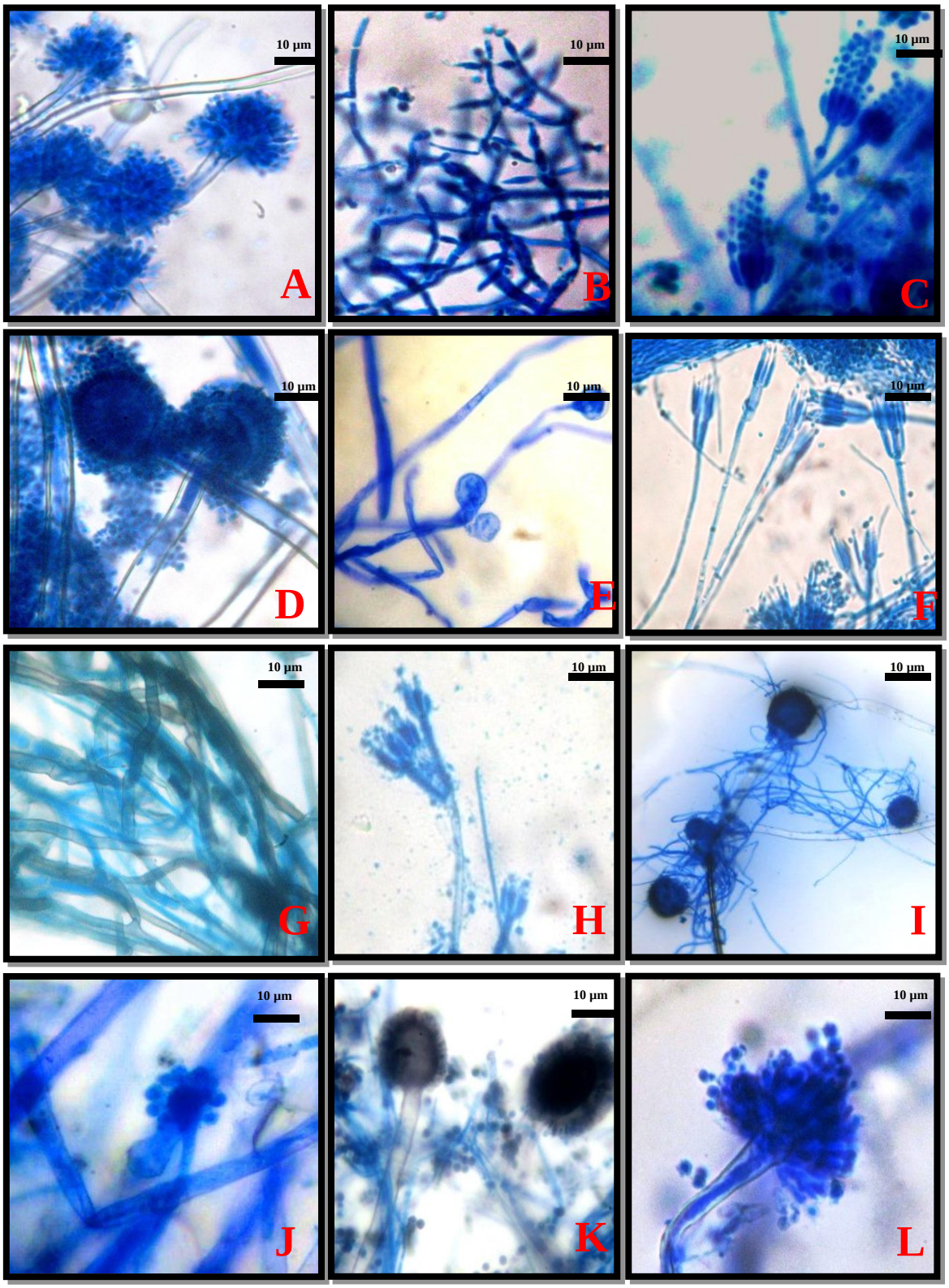


Plate.2 Isolation of fungal species from rhizospheric soil samples A. Jorhat site B. and C. Nalbari site D. Guwahati site E. Itanagar site F. and G. North Lakhimpur site H., I., J. and K. Isolation of fungal species at different dilutions L. Pure culture of *Trichoderma harzianum*

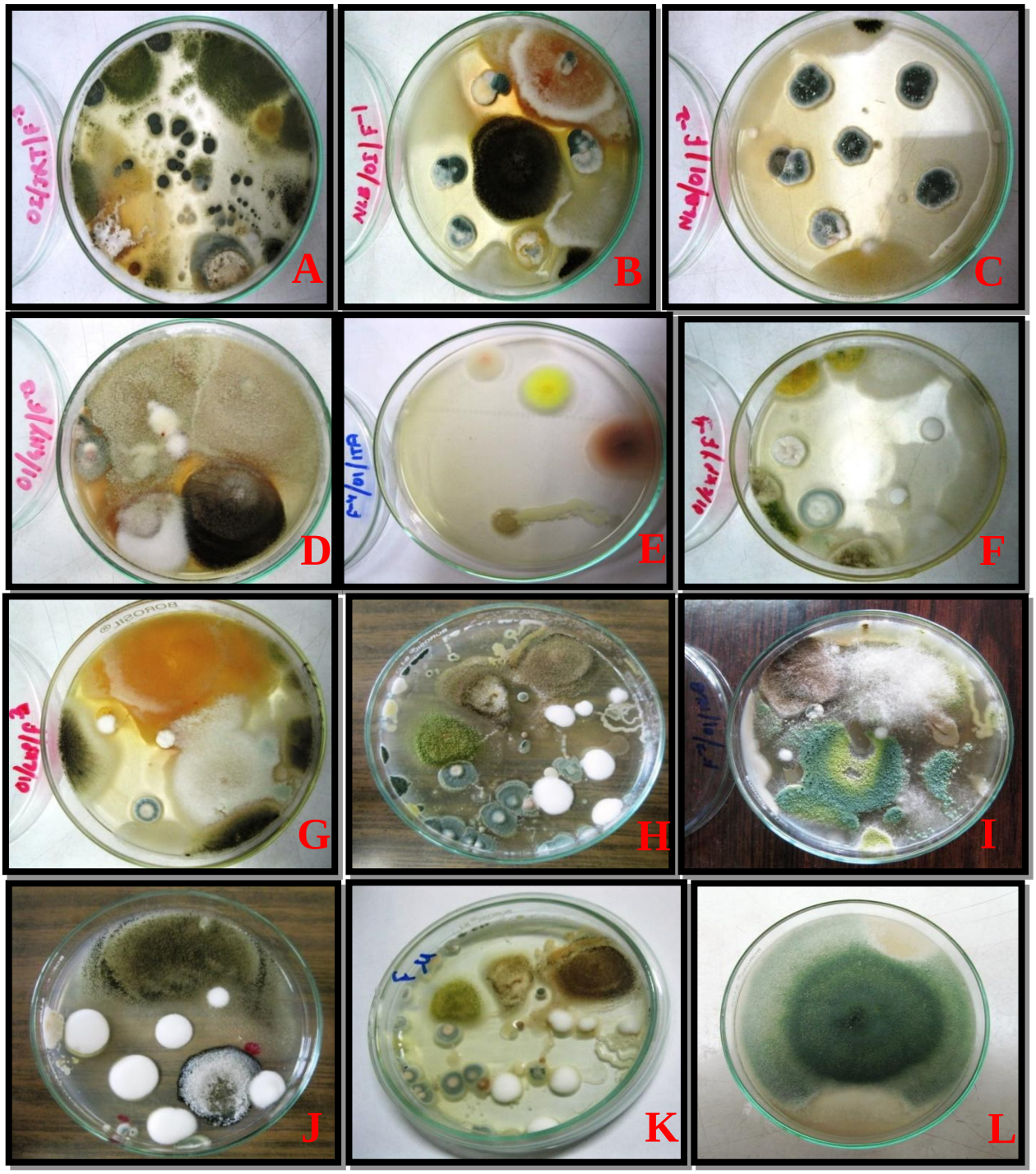
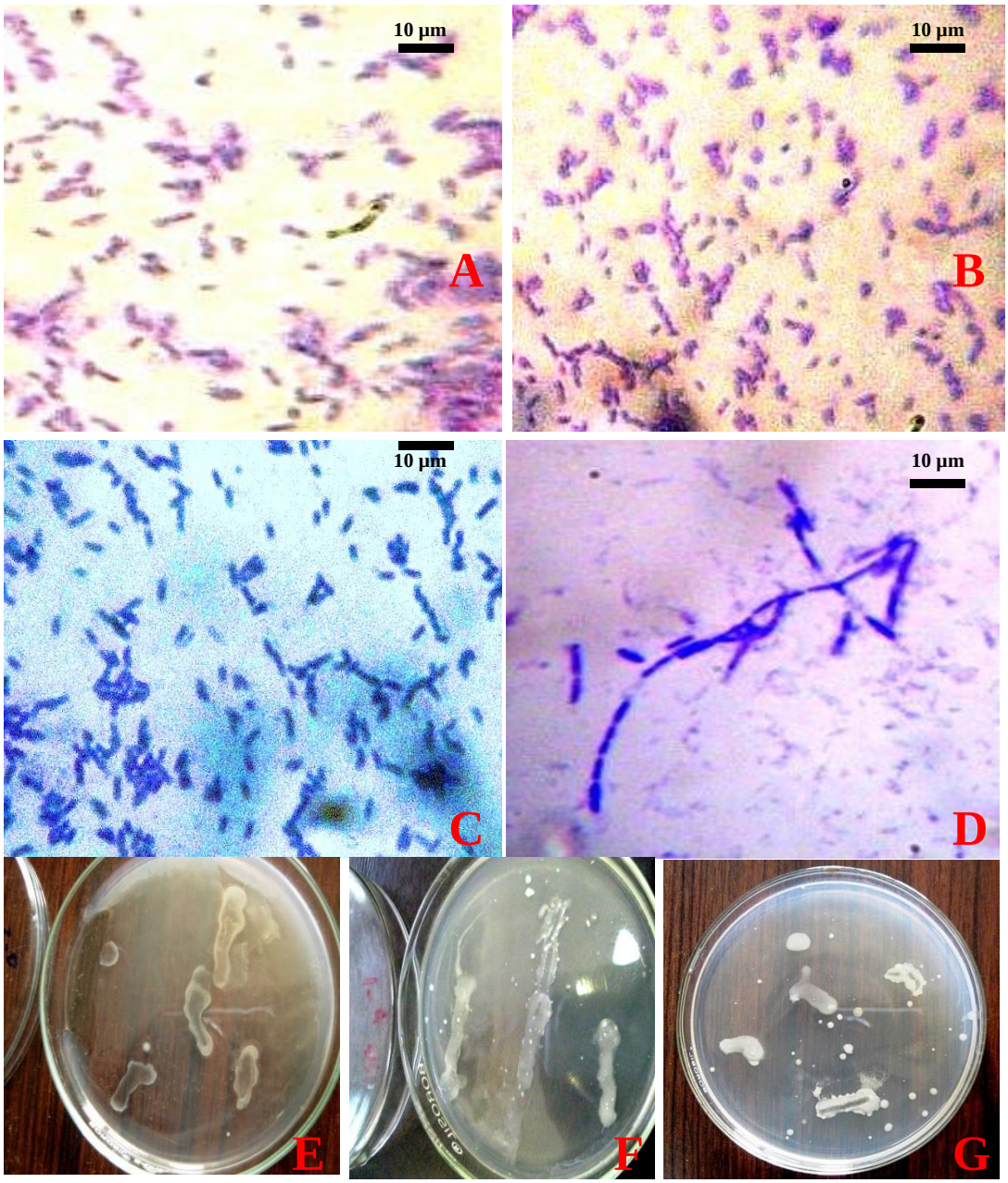


Plate.3 A: *Pseudomonas* sp., B: *Pseudomonas putida* C: *Bacillus* sp. D: *Streptobacillus* sp. E-G: Culturing and subculturing of the bacterial species



Four bacterial isolates *Pseudomonas putida*, *Pseudomonas* sp., *Streptobacillus* sp., *Bacillus* sp. were found to be associated in the rhizosphere of *O. indicum*. Table 2, 3 and 4 shows the bacterial species associated in the rhizospheric soil samples of *O. indicum*, classification and biochemical test performed.

Four bacterial isolates *Pseudomonas putida*, *Pseudomonas* sp., *Streptobacillus* sp., *Bacillus* sp. were found to be associated in the rhizosphere of *O. indicum* (Plate 1.3). Soil microbes act as essential component of plant community variety and productivity (Wardle 2004). The environmental factors such as the

soil pH, moisture, temperature, organic carbon and nitrogen play an important role in the distribution of microorganisms (Gaddeyya, 2012). These are the main factors affecting the microbial population and diversity.

The role of fungi in soil is extremely complex and is fundamental to the soil ecosystem (Bridge and Spooner, 2001). Soil fungi play an important role in nutrient cycling, and plant health and development (Bridge and Spooner, 2001; Thorn, 1997; Martin *et al.*, 2001). Some fungi cause a range of plant diseases (Jarosz and Davelos, 1995; Thorn, 1997), while others antagonize plant pathogens, decompose plant residues, provide nutrients to plants, and stimulate plant growth (Raaijmakers *et al.,* 2009). Information on the knowledge of the diversity and structure of fungal communities in bulk and rhizosphere soils help in better understanding of their roles in soil ecosystem and in improving plant health. The activity and effects of beneficial rhizospheric myco-biota on plant growth and health are well documented for fungi under Deuteromycetes *e.g. Trichoderma*, *Gliocladium* and non-pathogenic *Fusarium* species (Raaijmakers *et al.,* 2009).

Direct rhizospheric bio-control effects on soil-borne plant pathogens can result from hyperparasitism as is documented for *Trichoderma* and *Gliocladium* and it affects various fungal pathogens such as *Rhizoctonia*, *Sclerotinia*, *Verticillium* and *Gaeumannomyces* (Harman *et al.,* 2004). Thus, determination of the microbiota along with physico-chemical properties of soil associated with rhizosphere of *O. indicum* is essential in order to evaluate above- and below-ground plant ecosystem health and functioning. It is also a prospective to exploit myco-biota for future conservation strategies. Rashidi and Deokule (2013) isolated 14 fungal species in the rhizosphere of *O. indicum* which comprised mainly of *Fusarium solani, F. reticulatum, F. equiseti, F. oxysporum, F. semitectum, F. acuminatum, Rhizopus oryzae, A. niger, A. parasiticus, Cunningamella elegans, Syncephalestrum racemosum, Chaetomium indicum, Trichoderma* sp. and *Papulaspora immerse.*

In the present study 25 fungal species were isolated from the rhizosphere of *O. indicum*. growing under different natural habitat which comprised of *Trichoderma* sp., *Fusarium* sp., *Cunningamella* sp., *Aspergillus* sp., *Penicillium funiculosum, Penicillium capsulatum, Penicillium citrinum, Pachybasium* sp**.,** *Trichoderma hamatum, Mucor* sp., *Pythium* sp., *Penicillium citrinum* etc. *Curvularia* sp. was isolated from the seeds of *O. indicum* which might be the causative agent for fungal decay of seeds. Pande and Gupta (2011) also reported the presence of *Curvularia lunata* as seed mycoflora of *O. indicum.*

The study of rhizosphere bacteria from the important medicinal plants is very crucial, as they are known to have impact on plant growth and also produce industrially important metabolites and improve quality of medicinal product (Bafana and Lohiya, 2013). The rhizospheric soil samples of this plant species mainly comprised of *Pseudomonas putida, Pseudomonas* sp. and *Bacillus* sp and *Streptobacillus* sp. A significant number of bacteria produce the phytotherapeutic compounds (Koeberl *et al.,* 2013) and increase the growth of the medicinal plants when they are associated with rhizosphere of plants.

The study revealed that rhizospheric soil of *Oroxylum* reflects the presence of diverse fungi and bacteria. Concerned study are to be taken up to conserve the target plant species by modern biotechnological eco-friendly methods and to produce healthy and quality stock of superior germplasm.

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