BIRBAL SAHNI INSTITUTE OF PALAEOBOTONY
53, UNIVERSITY ROAD, LUCKNOW – 226 007, INDIA

PROFORMA FOR SCIENTIFIC STAFF FOR SUBMISSION OF RESUME AND WORK CARRIED OUT BY HIM/HER FOR CONSIDERATION OF HIS/HER CASE FOR ASSESSMENT FOR PROMOTION TO THE NEXT HIGHER GRADE
(This Proforma should be strictly followed)

1. Name of the Scientist (in Block Letters) : Dr. D.C. Saini

2. Date and place of Birth : 15-05-1955

3. Project/Section/Unit : Herbarium , 11.2

4. **Date of appointment/assessment** promotion to the present post : April 1988

5. Present grade pay : Rs.8700/

6. Academic Qualifications from Matriculation onwards:

Year	Examination passed	Name of Board/ University	Name of Institution where studied	Grade/ Division	Subjects
1969	High School	U.P. Board Allahabad	D.A.V. Inter College Gorakhpur	Ist	Hindi English Math Biology Science
1972	Intermediate	U.P. Board Allahabad	D.A.V. Inter College Gorakhpur	Do	Hindi English Biology Physics Chemistry

1974	B.Sc.	D.A.V. Degree College Gorakhpur	Gorakhpur University Gorakhpur	Do	Botany , Zoology Chemistry
1978	MSc.	D.A.V. Inter College Gorakhpur	Do	Do	Botany
1982	Ph.D.	Gorahpur University, gorakpur	Do		Botany (Taxonomy)

Ph D Thesis:

Thesis Title	Year of Award	University
FLOA OF BASTI District	1982	Gorakhpur University Gorakhpur

7. Details of Research/Professional/Teaching Employment before joining the Institute:

Name of the Organisation	Post held	Scale of Pay	Date		Nature of Duties
			From	To	
Gorakhpur University Gorakhpur	Research Scholar	UNPAID	1976	1980	Research work in floristic Diversity of Vegetation in
National	Junior Resear	Rs. 700-/	1980	1982	

Botanical Research Institute, Lucknow	ch Associate				Basti District
Birbal Sahni Institute of Palaeobotany	Research Associate	Rs.1100-/	1982	1988	Survey and identification of lactiferous plants for search of hydrocarbon -Do-

8. Details of research career in the Institute:

Post held	Scale of Pay	Date From To	Nature of Duties
Junior Scientific Officer	650-1200	1988 to 1966	Research in Taxonomy and Biodiversity
Senior Scientific Officer and Scientist "C"		1995 to 2001	Do
Scientist "D"		2001-2006	Do
Scientist "E"		2006 to contd.	Do

9. Type of work engaged in and extent of involvement since last appointment/assessment promotion:

(a) Planning and coordination **:** One Year

(b) Experimental work **:** One Year

(c) Results interpretation **:** Two Year

(d) Electronic Data Processing **:** One Year

(e) Other Scientific and Technical activities: Supervision of Staff and Maintenance of Herbarium & Garden

(**Give details)**

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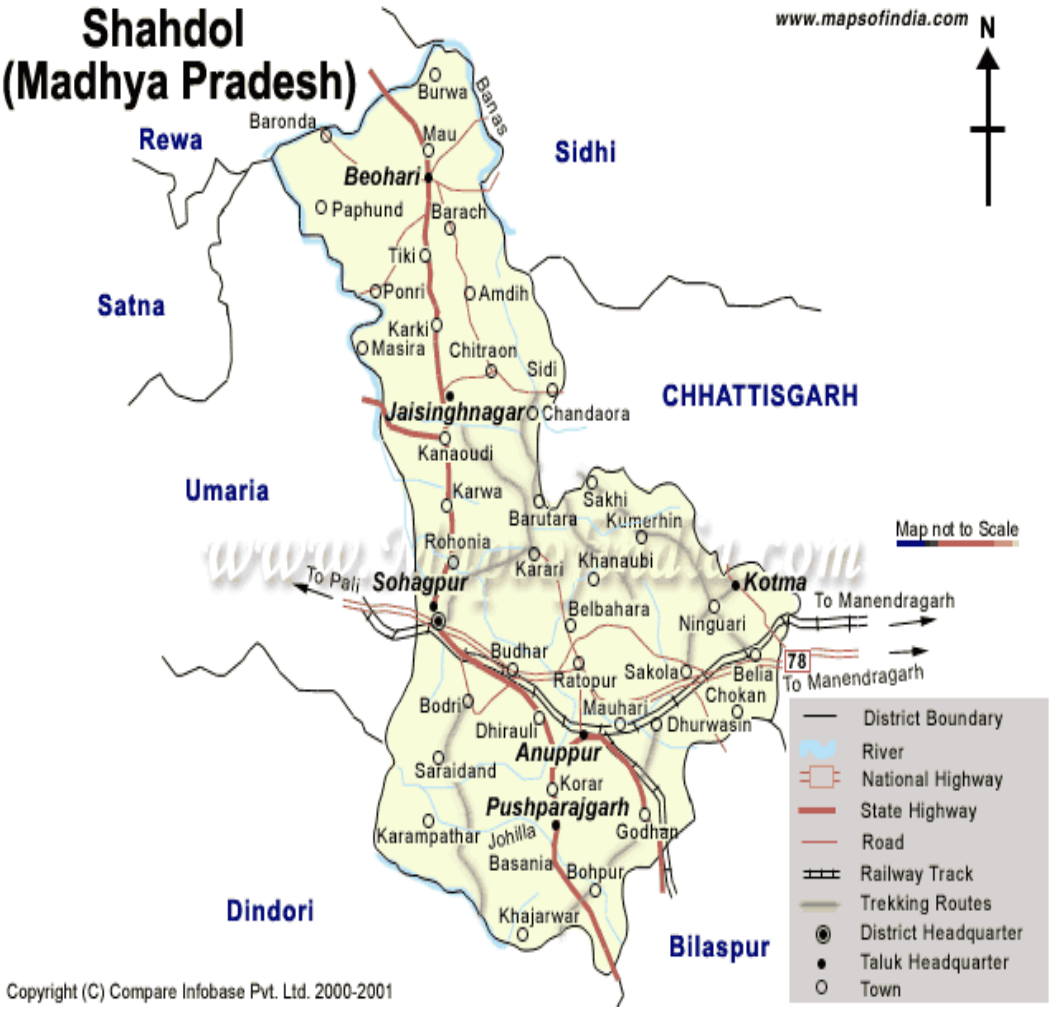
10. Details of research work carried-out and major achievements, if any, since last appointment / assessment promotion in the Institute, which in candidate's view justifies his/her assessment promotion to the next higher grade:

A detailed floristic survey of Shahdol district of Madhya Pradesh has been made and **1187 angiospermic plants species belonging to 643 genera and 188 familie**s have been collected from different habitats of entire district. An enumeration of plants has been made with botanical names and their basionym if any, synonyms, followed by a

short description ecological notes, flowering and fruiting times, place of collection and field number of specimen**.** Shahdol district is one of the districts of Madhya Pradesh, situated in North- Eastern part of the state. It lies between 23.28° North latitude and 81.35° East longitude. The total area of the district is about 5671 Sq. Km. The district is bounded by Rewa in the North, districts of Surguja in the West, district Bilaspur and Mandala in the South and Katani in East. Botanically the area is very interesting. The available botanical literature indicates that no systematic investigation of the district flora has been done. As it is well known that the alteration of local flora is a regular phenomenon, caused by introduction and migration of large number of exotic and indigenous species from one area to other area due to biotic and abiotic influences, it is suggested that flora of every region should be re-investigated after a period of every ten years. It is therefore, essential to make a detailed floristic survey of the entire district without any delay. Keeping the view in mind, the author has made a detailed floristic survey of the area.



LIMATE AND VEGETATION

The region enjoys monsoon type of climate. The climate is markedly periodic and is divided into three seasons i.e. rainy season, winter season and summer season. The monsoon rains commence during June (3rd week) and come to an end in September but may persist till October. From October to May there is the usually long dry weather with only scanty winter rains. The hot weather commences in March and lasts till the rains set in. The minimum temperature goes down to 3ºC in month of January and maximum rises up to 43ºC in the month of June.

The vegetation of any area comprises tree, shrubs and herbs along with fruit orchards. The trees, shrubs and woody climbers have long life. They survive for many years. Therefore, they may be called the peremanent vegetation.The general vegetation, other than forests in the area is mainlly charecterised by large number of herbaceous plants growing on variety of habitats with seattered occurance of many indigenous and exotic species of tree and shrubs in open areas or cultivated in public and private gardens and along road sides. Almost all the herbaceous plants are seasonal. Their life is for three or four months. They germinate in the begining of season as at the end of outgoing season died after completing their life cycle at the end of season. Every season has their own herbaceous vegetation along with some intermixing of plants of preceeding season which are bicnnials. Therefore, these vegetation may be described as seasonal vegetation.

Thus the vegetation of the district may be divided in two categories.

1. Permanent Vegetation.
2. Seasonal Vegetation.

PERMANENT VEGETATION

The general vegetation of the area is **Sub-tropical deciduous type**. However, some of the trees are evergreen and semi evergreen. The area is under the influence of human and their domestic animals. Thus, the vegetation of this area is being damaged by, cutting down of plants for fodder, fuel, grazing, fire and various developmental projects. The vegetation of these areas is mainly characterized by large number of herbaceous plants growing on variety of habitats along with scattered occurrence of many indigenous and exotic species of trees and shrubs in open areas or cultivated in gardens and along road sides. Orchards of mango and guava are common in the area.

The vegetation under this category is mainly represented by trees, shrubs and woody climbers. Though members of permanent vegetation are scattered on variey of habitats in the are, but to study the vegetation of this category, forests of the district have been taken into consideration, because forest are, such a place where we can find all members of permanent vetetation in their natural habitats along with their charecteristic associates.

FOREST TYPES AND VEGETATION

The temperature and rainfall data given above indicate that vegetation of the district cames under Sub-tropical deciduous type by mixture of trees particularly all of which

are deciduous during the dry season, usually for several months. Sal and miscellaneous forests are found in almost entire area. The Sal forests are in the climax stage of the plant succession. The miscellaneous forest is of preclimax stage. The medium quality bamboo forests are also found at several places. According to Champion and Seth (1968) the forests of the area can be classified as under:

SUB-TROPICAL DECIDUOUS FORESTS

A. CLIMATIC TYPE:

1. Moist Sub-tropical (Peninsular) Low level Sal forests
2. Dry Sub-tropical (Peninsular) Sal forests
3. West Gangetic Moist Mixed Deciduous Forests
4. Southern Dry Mixed Deciduous Foresrs
5. Northern Dry Mixed Deciduous Foresrs
6. Riverain or Reparian Fringing Forests

B. GENERAL EDAPHIC TYPE:

7. Salai (*Boswelia*) Foresrs
8. Butea forests
9. Khair (*Acacia categhu*) Forests
10. Bamboo forests

A. CLIMATIC TYPE

1. MOIST SUB-TROPICAL (PENINSULAR) LOW LEVEL SAL FORESTS

The better quality sal occur on well drainod and sandy loam soil along water courses and plain areas with moisture and deep soil and along lower hill slopes. The forests occur in these areas asre of two types, one with sal as dominant species and other with many dominant species intemately mixed with each other. Thus this type of forest is further subdivided into two types.

A large tract of the area having plains topography,where the moisture and soil conditions are fevourable, carry pure sal forest with profuse bamboo. Sal forests have dense top canopy. The chief associates of Shorea robusta forming top story are: *Lagerstroemia parviflora, Terminalia bellerica, Terminalia chebula, Diospros melanoxylon, Adina cordifolia, Sterospermum suavelolens, Pterocarpus marsupium , Schleichera oleosa, Ficus racemosa*. The middle storys have less canopy. A shrubby undergrowth is usual and mostly semievergreen, *Mallotus philippensis, Miliusa velutina, Pogostemon benghalensis, Murraya koenigii, Glycosmis mauritiana, Desmodium pulchellum* may occur gregariously. Heavey grass like *Themeda sp., Sacharum benghalensis, and Saccharum spontanaeum* are also seen in open areas on very stiff soils. Few large and common species of climbers are: *Bauhinia vahlii, Tiliacora acuminata.*

Mixed forests are also found in the area having medium and good height trees with many dominant species intimately mixed with many trees of middle story, forming upper canopy. No single species is dominant in this mixed type of forests. The chief associates forming top canopy are: *Diospyros melanoxylon, Terminalia chibula, Pterocarpus marsupium, Terminalia bellerica, Terminalia tomentosa, Boswellia serrata, Madhuca indica, Schleichera oleosa (Kusum), Lannea coromendelica (Gurja), Dalbergia paniculata (Dhobain), Adina cordifolia, Anogeissus latifolia, Emblica officinalis, Buchanania lanzan, Butea monosperma, Albizia procera, Semicarpus anacardium, Ficus racemosa, Mitragyna Parvifolia, Terminalia alata* etc.

Other trees, shrubs and woody climbes forming middle story are: *Kydia Calycina, Buchanauia lanzan, Careya arborea, Syzigium cerasoidium (Badam), Casearia graveolens, Milusa tomentosa, Eugenia heyneana, Cochlospermum religiosum, Bauchinia retusa, Holorrhena antidysenterica, Hymenodictyon excelsa, Aacacia catechu, Xeromphis spinosa, Embelica tsjaram-cottom, Woodfordia fruticosa, Dlabergia lanceolaria, Butea Manosperma, Soymida febrifuga, Semicarpus anacardium, Bauhinia racemosa, Mimosa himalayana, Millettia auriculata, Ziziphus mauritiana, Zizphus oenoplea, Carissa opaca, Indigofera cassioides, Phoenix acaulis, Moghania chappar, Helicters isara, Wendlandia heynei, Celastrus paniculatus, Vallaris solanacea.* The third story forming ground vegetation, composed of shrubs, herbs, grasses and climbers. The common species are:

Desmodium gangelicum, Asparagus racemosa, Calotropis gigantea, Flemingia chappar, Grewia hirsuta, Indigofera pulchella, Phyllanthus fraternus, Triumfetta pentandra, Caryretia trifolia, Woodfordia fruticosa, Carissa carandas, Tephrosia purpurea, Bidens biternata, Ampelocissus tomentosa, Indigofera echinata, Zizphus xylopyrus, Cassia tora, Tribulus terrestris, Euphorbia thymiflia, dioscorea bulbifera, Urena lobata, Adinalum lepulatum, Achyranthes aspera, Saccharum bengalensis, Rungea pectinata, Calotropis procera, Hekiotropium strigosum, Vernonia cinerea, Hetropogon contortus, Themeda triandra, Eragrostis tenella, Tridax promcubens, Dipteracanthus Sp., Sacharyn spontaneum, Imperata cyindriea, Bauhinia vahlli, Smilex zeylanica, Butea parviflora, Ziziphusoenoplea, Ventilago calyculata. The epiphytic plant and tesellata and dendrophthoea falcata are commonly seen on several tees and shrubs.

2. **DRY SUB-TROPICAL (PENISULAR)SAL FOREST**

The southern and western dry hill slopes are occupied by dry deciduous Sal, dry mixed forests and scrubby vegetation. The main components of vegetation forming top canopy present on dry hill slopes are: *Dillenia aurea, Cochlospermum religiosum, Nyctanthes arbor-tristis, Stereculia urens, Boswella serrata, Diospyros melanoxylon, Caryuga pinnata, Terminalia bellerica, Ficus tomentosa, Ougeinia ougeinensis, Wrightia tinctoria, Euphorbia nivulea, Gardenia latifolia, Zizyphus xylopyros, Lannea coromendelica, Emblica officinalis, Anogeissus latifolia, Lagerstroemia parviflora, along with some frequent species like Helicteres isora, Pavetta tomentosa, Bauhinia racemosa, Dndroealanus strictus, Flacourtia indica, Carissa opaca, Holarrhena antidysenterica, Phoenix acaulis*. The commonly occurring herbaceous and climbing plants are: *Heteropogon controtus, Capilipedium assimile, Rungea pectinata, Oldenlandia offinis, Crotalaria lmedicagenia, Crotaria mysorensis, Micromeria biflora, Calotropis procera, Ruellia tuberosa, Blumea oxyodonta, Crepis japonica, Vernonia cineria, Indigofera trifoliata, Phyllanthus maderaspatana, Phyllanthus debilis, Cleome monophylla, Indigofera hirsuta, Milletia auriculata, Vallaris*

solanacea, Ampelocissus latifolia, Cissus adnata, Smilex zeylanica, Vigna trilobata, vigna aconitifolia, teramnus labialis, Dioscorea pentaphylla, Dioscorea belophylla, Dioscorea bulbifera, Asparagus racemosus, Alylosia scaraboeoides, Hemidesmus indicus, Ichnocarpus frutescens, Abrus precatorious. Some epiphytic plants such as Vanda tesellata and Dendrophthoea falcata are also seen on varieties of trees and shrubs.

3. WEST GANGETIC MOIST MIXED DECIDUOUS FOREST

A large tract of the area in having plains topography,where the moisture and soil conditions are fevourable, carry pure sal forest with profuse bamboo. Sal forests have dense top canopy. The chief associates of Shorea robusta forming top story are: *Lagerstroemia parviflora, Terminalia bellerica, Terminalia chebula, Diospros melanoxylon, Adina cordifolia, Sterospermum suavelolens, Pterocarpus marsupium , Schleichera oleosa, Ficus racemosa.* The middle storys have less canopy. A shrubby undergrowth is usual and mostly semievergreen, *Mallotus philippensis, Miliusa velutina, Pogostemon benghalensis, Murraya koenigii, Glycosmis mauritiana, Desmodium pulchellum* may occur gregariously. Heavey grass like *Themeda sp., Sacharum benghalensis, and Saccharum spontanaeum* are also seen in open areas on very stiff soils. Few large and common species of climbers are: *Bauhinia vahlii, Tiliacora acuminata.*

This forest has also medium and good height trees with many dominant species intimately mixed with many trees of middle story, forming upper canopy. No single species is dominant in this mixed type of forests. The chief associates forming top canopy are: *Diospyros melanoxylon, Terminalia chibula, Pterocarpus marsupium, Terminalia bellerica, Terminalia tomentosa, Boswellia serrata, Madhuca indica, Schleichera oleosa (Kusum), Lannea coromendelica (Gurja), Dalbergia paniculata (Dhobain), Adina cordifolia, Anogeissus latifolia, Emblica officinalis, Buchanania lanzan, Butea monosperma, Albizia procera, Semicarpus anacardium, Ficus racemosa, Mitragyna Parvifolia, Terminalia alata* etc.

Other trees, shrubs and woody climbes forming middle story are: *Kydia Calycina, Buchanauia lanzan, Careya arborea, Syzigium cerasoidium (Badam), Casearia graveolens, Milusa tomentosa, Eugenia heyneana, Cochlospermum religiosum, Bauchinia retusa, Holorrhena antidysenterica, Hymenodictyon excelsa,*

Aacacia catechu, Xeromphis spinosa, Embelica tsjaram-cottom, Woodfordia fruticosa, Dlabergia lanceolaria, Butea Manosperma, Soymida febrifuga, Semicarpus anacardium, Bauhinia racemosa, Mimosa himalayana, Millettia auriculata, Ziziphus mauritiana, Zizphus oenoplea, Carissa opaca, Indigofera cassioides, Phoenix acaulis, Moghania chappar, Helicters isara, Wendlandia heynei, Celastrus paniculatus, Vallaris solanacea.

The third story forming ground vegetation, composed of shrubs, herbs, grasses and climbers. The common species are:

Desmodium gangelicum, Asparagus racemosa, Calotropis gigantea, Flemingia chappar, Grewia hirsuta, Indigofera pulchella, Phyllanthus fraternus, Triumfetta pentandra, Caryretia trifolia, Woodfordia fruticosa, Carissa carandas, Tephrosia purpurea, Bidens biternata, Ampelocissus tomentosa, Indigofera echinata, Zizphus xylopyrus,

Cassia tora, Tribulus terrestris, Euphorbia thymiflia, dioscorea bulbifera, Urena lobata, Adinalum lepulatum, Achyranthes aspera, Saccharum bengalensis, Rungea pectinata, Calotropis procera, Hekiotropium strigosum, Vernonia cinerea, Hetropogon contortus, Themeda triandra, Eragrostis tenella, Tridax promcubens, Dipteracanthus Sp., Sacharyn spontaneum, Imperata cyindriea, Bauhinia vahlli, Smilex zeylanica, Butea parviflora, Ziziphusoenoplea, Ventilago calyculata. The epiphytic plant and tesellata and dendrophthoea falcata are commonly seen on several tees and shrubs.

4. SOUTHERN DRY MIXED DECIDUOUS FOREST

This subgroup is differing from dry teak forest Mainly by presence of Boswellia serrata and increased proportion of theorny species. Bamboos are occasionally seen. Very few, woody climbers are present. This subgroup is prevalent in drier localisties and sites. The most charecteristic tree is *Anogeissus latifolia, whitst Terminalia tomentosa is very typical assoeiate. Diospyros tomentosa is also very common. Chloroxylon swietenia, Hardwickia binata, Boswellia serrata and Soymida febrifuga* are very widespread and useful indicators as they are absent from moist deciduous forests, but their occurence is rather sporadic. Acacia catechu is often present in thorn forest. The undergrowth is usually thin with fairly dense growth of grass during monsoon.

5. NORTHERN TROPICAL DRY MIXED DECIDUOUS FOREST

Sal is the most important and common species in the area. The pure crop of Sal occurs over extensive areas. Profuse and better type of sal forest occur on the Gondwana system and basal bed type of geological formation. Lower Vindhyan type of geological formation also contain Sal forest which are confined mostly to cool valley and along lower slopes of northern aspects. These are commonly met in churhat, Sidhi, Behara and part of Madwas ranges.The physical condition of the soil, its drainage capacity to hold moisture, along with the lunder lying rock formation excercise marked effect with regard to the distribution and growth of sal. Sal generally favoure acidic soil. The proportion of the sal in the area varies from 20 to 90%. Better quality sal is found along water courses and plain areas. Bamboo is generally absent in better quality areas. Regeneration of Sal is quite inadequate and nearly absent. The water courses normally have more percentage of natural sal trees. Sal favourers a sandstone, gneiss and lateritic soil in stages of decomposition. In schistic and calcareous soil on higher slopes. Sal crops is open, stunted and unhealthy with heavy infestation of Bandha (Dendrophthoe falcata) and heart rot. Sal generally avoid hard lateritic soil. Better quality sal occur in Mahadeva series of Gondawana system on well drained and sandy loam soil along water courses and plain areas with moisture and deep soil and along lower hill slopes. It progressively generates in quality and grow as it ascends the hills. Sal avoids the southern dry aspects in Lower Vindhyan system and is altogether absent in Upper Vindhyan system (Champion and Seth, 1968). The quality is generally poor but along water courses, better quality stands are also met within. Regeneration of *Diospyros melanoxylon, Pterocarpus marsapium, Terminelia tomentosa* is satisfactory. Regeneration of Ougeinia ougeinensis and Woodfordia fruticosa is profuse.The top canopy consist of *Anogeissus latifolia, Pterocarpus marsupium, Dalbergia latifolia, Dalbergia paniculata,*

diospyros melanoxylon, Boswellia serrata, garuga pinnata, Bauhinia variegata, Lagerstroemia parviflora, Lannea coromendalica, Schleichera oleosa, Adina crordifolia, Madhuca indica, Terminalea tomentosa, Shorea robusta, Millusa tomentosa, Terminalia bellirica, Mitragyna parvifolia, Kydia ealycina. The middle story comprises *Emblica officinalis, Acacia catechu, Careya arborea, Casearia tomentosa, Semicarpus anacardium, Terminalia chibula, Flacaurtia indica, Eugenia heyniana, Butea monsoperma, Aegle marmelos, Bauhinia retusa, Cassia fistula.* The shruby undergrowth are: *Woodfordia fruticosa, Nyctanthus arbor-tristis, Carissa opaca, Ziziphus xylopyrus, Helicteres isora.* The ground vegetation is characterized by herbaceous and grossy plants, growing in different seasons. On varieties of habitats. Some common representatives are mentioned here such as: *Cassia tora, Cassia occidentalis, Indigofera tinctoria, Indigofera hirsuta, Tephorsia purpurea, Blumea membranacea, Blumia oxyodonta, Sida cordata, Sida acuta, Sida rhomboidea, Sida cordifolia, Rungia pectinata, Tridax procumbens, Indigofera echinata, Leucas mollisima, Leucas aspera, Leucas cephalotes, Cleome gynandra, C. viscosa, Cleome monophilla, Tribulus terrestris, Adinatum lepulatum, Crotalaria medicagenia, Crotalaria mysoreusis, Crotalaria pallida, Crotalaria sericia, Crotalaria prostrata, Heteropogon contortus, Themeda triandra, Eragrostis tenella, Imperata cylindrica, Bothriocloa pertusa, Dichanthium annulatum, Chloris barbata, Cenchrus ciliaris, Sorghum halepans. The epiphytic plant, Dendrophthoe falcata is commonly seen on Madhuca indica, Shorea robusta, Mangifera indica, and albizia procera.* Thickets of Dendroealamus strictus are also seen scattered in the area. Chloroxylon sweitenia is found in patches on gravelled soil in Mahwas, Pahai and doari blocks and on Mara-Jir road in mixed forests. Some of the plains in Jhurhi on the Sarai road near Karwahi and Tansar along Mahan river comprise open scrabby or low forests. The soil in these region are hard and lateritic. Due to sparse ground vegetation, the erosion caused by rain and wind can be easily seen, especially in tansar area. The area is mainly abound by Acacia catechu in association with *Ziziphus sylopyrus, Soymida febrifuga, Aegle marmelos, Streblus asper, Butea monosperma, Lagerstroemia parviflora, Flacourtia indica, Bridelia retusa, Mallotus philippensis, Alangium salvifolium, Randia uliginosa.* The Son river basin near Jogdaha bride was previously good forested area but now a days it is cleared up and patches of *Lagerstroemia with Vitex negundo, Grewia hirsuta, Ziziphus xylopyrus are seen here and these. Zizyphus xyloprus are seen here and these. Zizphus nummularia, Zizphus rugosus* in association with *Woodfordia fruticosa, Ficus glomerata, Butea monosperma* are seen around Karwahi. The *Ziziphus oenoplea, Smilax zeylanica, Ichnocarpus frutescens, Ampelocissus latifolia, Dioscorea pentaphylla, Hemidesmus indica* are eommonoy seen climbing over trees and shrubs in these areas.

6. RIVERAIN OR REPARIAN FRINGING FORESTS

The prevailing moist conditions in valley, ravines, riverain tracts and depressions scattered in the area very much responsible for grow of moist Sal forest. The water courses nromally have more percentage of natural sal trees The lower slopes in valleys, ravines and along rivers are inhabited by *Shorea robusta, Diospyros melanoxylon, Trena orientalis, Syzigium heyneanum, S. cumini, Emblica officinalis, Mallotus philippensis, Terminalia arjuna, Tamarix ericoides, Ixora arborea, Meliosma simplicifolia, Shorea robusta, Dendrocalamus strictus, Ficus semicordata, Bombax ceiba.* The shady habitats in the forests of Jir and Bhadaura are occupied by

Baliospermum montanum, Indigofera cassioides, Boehmeria platyphylla, Grewia rothii, Casearia graveolens, Perilepta auriculata, Colebrookia oppositifolia, Woodfordia fruticosa, Thyanolaena maxima, Saccharum spontaneum, Phragmitis Karka, Adenostema lavenia var. rugosa, Desmodium gangetieum, Reinwardtia indica, Chlorophytum tuberosum, Perilepta auriculata, Leucas biflora, Piper longum, Companula colorata, Cythocline purpurea, Glochidion lanceolarium, Gloechidion zeylanica, Apluda mutica. The common twiners and climbers growing at Mara are: Ampelocissus latifolia, Cryptostegia grandiflora, Dragea voluvilis, Ventilago madersapatana. Cissus adnata, Smilex zeylanica, Dioscorea puber, Dioscorea glabra, Dioscorea bulfifera, Combretum roxburghii, and *Schefflera stellata* is recorded at Jir.

B. GENERAL EDAPHIC TYPE

The forest types associated with definite site factors. Many of the tree species of the jmixed deciduous forests are capable of forming more or less pure consoeiations. Due to harsh environmental conditions, greater demands are made on the specific adaptability of constituent dlements leading to pure group and local dominance (Champion and Seth 1968). The following edaphic type of forests are recognised in the area.

7. SALAI FOREST (*Boswellia serrata*)

The forest of Boswellia serrata are found overlapping in Sal and Mixed forests. They cover 2% of total forest area. `Salai' forest generally tend to occupy high elevation on plateaus, ridged tops and slopes particularly on southern and south-western aspects of kaimur hills, where shallow and drier soils with lot of skeletal material is in existence as derived from porcellanite and Upper and Lower Vindhyan formations. These forest are generally open. Its common associates are *Diospyros melanoxylon, Anogeissus latifolia, Lagerstroemia parviflora, Sterculia urens, Lannea coromendalica, Emblica officinalis, Zizphus xyloprus, Acacia catechu, Holarrhena antidysenterica, Hardwickia binata* occurs on higher elevation in Jethula, Rani Satti, Harbaro and Tatpahar blocks of Sidhi ranges and in Kushanhiya. Scrubby vegetation comprises *Ziziphus xylopyrus, Carissa opaca, Flacourtia indica, Rosa involucrata, Mimosa himalayana, Woodfordia fruticosa, Nyctanthes arbor-tristis* are seen scattered here and these in hanumangarh block on Kaimur hills and near Churhat. Lagerstroemia parviflora and Madhuca indica are found with stunted growth. *Cassia tora , Occinum americanum, Themeda trianda, Heteropogon controtus, Imperata cytindrica* are the common herbaceus and grasses occur in this areas. *Ziziphus oenoplea, Vallaris heynii, Ventilago maderaspatana* are the climbers of the area.

8. **BUTEA FOREST** (Dhak forest).

On flat ground this type presents a savannah appearance with scattered stunted and very malformed trees are thickets standing over short grass or bare ground. On lower hill slopes almost pure consociations. The other associates occur along with Butea are: *Butea monosperma, Acacia leucophloea, Ziziphus mauritiana, Ziziphus numularia,*

Tephrosia purpurea, Mimosa rubicaulis, Indigofera cordifolia, Apluda mutica, Heteropogon contortus, Bolhriochloa pertusa.

9. **BAMBOO FOREST**

Bamboos do not form pure forest but occur as understory in the Sal and Mixed forests. They cover 0.97% of lthe total forest area. *Dendrocalamus strictus* is the only species occurring as representative of bamboo. According to Champion & Seth (1968) that Baboo has been rendered to a depleted condition during the last decade. What remains now are the scattered stunted, malformed and congested bamboo clumpos, occupying occasionally here and there. Illicite fellings, unsystematic and over exploitation recurring annual feres and heavy looping of bamboo clumps by grazing have caused a great damage to these forests.

Several other plants found scattered in the area an waste lands, road sides, railway tracks, along river banks, in and around the village sides in shrubberies, orchards and boardess hedges around crop fields are: *Mangifera indica, Azadirachta indica, Madhuca longiffolia, Ficus benghalensis, Tamarindus indica, Aegle marmelos, Lagerstroemia parviflora, Acacia nilotica ssp. indica, Diospyros melanosylon, Syzigium cumini, Morus alaba, Moringa oleifera, Lawsonia inermis, cordia dichotoma, Ficus lucescens, Holoptelia integrifolia, Albizia procera, Anogeissus pendula, Erythrina indica, Melia azedarach, Butea monosperma, Procopis juliflora, Acacia leucophloea, Bombax ceiba, Pterospermum acerifolium, Toona ciliata, Terma orientalis, Streblus asper, etc. Among shrubs Euphorbia nivulia, Euphorbia nerifolia, Euphorbia tirucalli, Nopalia codhinelliformis, cereus hexagonus, Cercus triangularis, Lawsonia inermis, Vitex negundo, Jatropha curcas, Jatropha gossypifolia, Adhatoda geylanica, Ipomoea fistulosa, Ricinus communis, Caesalpinia globulorum, Woodfordia fruticosa, comiphora mukul, Ziziphus mauritiana, Pandanus fruticosus* are commonly seen.

Achievements:-

1. Three new species described
2. Recorded four species new to india
3. Recorded hundred species new to Uppar Gangetic Plain

.Interdisciplinary/Inter-institutional/Collaborative research activities in which the candidate is participating since last appointment/assessment promotion in the Institute (Please mention all relevant details and extent of involvement along with others, if any in such activities)

N.A.

12. Details of field work undertaken since last appointment / assessment promotion in the Institute:

Conducted 9 Field Trips in different vegetation rich areas and tribal rich areas of shahdol district Amarkantak and Achanakmar since last assessment promotion in the Institute during five year (2006-2012) and recorded actual number of plant species for floristic studies and documented variety of traditional uses of plant species among tribal communities. Added 8000 plant specimens, 2000 samples of seed and fruit samples and 100 wood samples.

Total plant material added to Herbarium during (2006-2012)

1. FLORISTIC STUDY

Plant speimens----------8000
Fruits &Seeds---------- 2000
Woods----------100

1.ETHNOBOTANICAL STUDY

Food Plants----------400
Fiber Plants----------300
Fiber & Cordage Plants----------200
Medicinal Plants----------800

Spices & Condiments----------150
Gums & Resins----------70

13. Publications (in chronological order, please enclose reprints of five of your best papers published since last appointment / assessment promotion in the Institute and indicate the same in the list) :

a) Original Research Papers (Please mention Co-author (s), if any, title, journal, volume, year and page numbers):

(i) Upto (2006-2012) the last appointment/assessment promotion in the Institute:

Book Published----------2

Paper Published In SCI Journal----------12

Paper Pulished In Proceeing----------14

Paper published ----------1

Papr Pblished In News Letter----------1

1. **दिनेश चन्द्र सैनी, 2006.** पर्यावरण एवंस्वास्थ्य संरक्षाण में लवणोद्भिद (मैंग्रूव) वनो की उपयोगिता तथा योगदान, (रामअवतार, तथा एस.एम. बेदनायगम्) 69–73 आई.टी.आर.सी. लखनऊ।

2. **दिनेश चन्द्र सैनी, 2006.** अमरकंटक क्षेत्र की रोगनिवारक एवं स्वास्थ्यवर्घक वन औषधियॉ 115-121 आई.टी. आर.सी. लखनऊ।

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8. Saini, D.C. 2008. Observations of ethno-botanical studies in India. *The Palaeobotanist*57(1-2): 277-288.

9, Saini, D.C. 2008. Traditional uses of Pteridophytes among Baiga tribes of Amarkantak, Anuppur district, M.P. *Ethnobotany* 20 (1-2): 65 – 69.

10. Saini, D.C. 2009-Preliminary Investigation on Invasive Alien Species of Uttar Pradesh, in (Eds. Pawan Kumar, D.C.Saini, ShantanuChatterjee, MadhbiChakraborty and R.K.Dubey) *Invasive Alien Species.pp.21-32.* Published by U.P.State Biodiversity Board Lucknow (With ShantanuChatterjee, MadhabiChakarborty)

11. Saini, D.C. 2010. *Biodiversity of Aquatic and Semi aquatic plants of Eastern Uttar Pradesh*, Published by Uttar Pradesh State Biodiversity Board, Lucknow. (with S.K. Singh and Kamlesh Rai)

12. Saini, D.C.2010. Utilizaton of tradional plant diversity for poverty eradication in India.In (Eds. Pawan Kumar, H.B.Singh, D.P.Singh, R.K.Dubey and R.J.Srivastava) *Biodiversity,*

Development and Poverty Alleviation. pp. 137-144, Published by Uttar Prdesh Biodiversity Board, Lucknow.(with R.K.Dubey, Ram Jee Srivastava, Kaushal Kishor Singh and MadhabiChakraborty).

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26. **Mishra G. K. and Saini D.C. 2012.** Nitrogen Fixation and Distribution of Soil Lichens in a Boreal Forest fire of Himalayas. . In (Eds. S.D.Rajkumar & L.K. Lal & C.O. Samuel) *Proc. of National Conference on "Climate Change, Biodiversity & Conservation"* pp.272- 279.

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(ii) Since last appointment/assessment promotion in the Institute:

b) **Review Papers** (Please mention Co-author (s), if any, title, journal, volume, year and page numbers):

(i) Upto the last appointment/assessment promotion in the Institute:

(ii) Since last appointment/assessment promotion in the Institute:

c) **Books/ Monographs/ Catalogues (Please mention Co-author (s), if any, title, year, edition and name of the publisher:**

(i) Upto the last appointment/assessment promotion in the Institute:

(ii) Since last appointment/assessment promotion in the Institute:

1. **D.C.Saini 2006 ,** Medicinal Plants of BSIP campus, Published by Birbal Sahni Institute of Palaeobotany. Lucknow.

2. **D.C.Saini, S.K. Singh, and Kamlesh Rai,** 2010. Aquatic and Semi Aquatic Plants Divsersity of Uttar Pradesh. (With Special reference to Eastern Uttar Pradesh) published by UP State Biodiversity Board Lucknow

d) **Edited Volumes** (Please mention Co-author (s), if any, name of the book/journal, volume, year and name of the publisher):

(i) Upto the last appointment/assessment promotion in the Institute:

(ii) Since last appointment/assessment promotion in the Institute:

e) **Chapters contributed in Edited Books** (Please mention Co-author (s), if any, title of the Chapter, year, name of the book, editor (s), edition and name of the publisher :

(i) Upto the last appointment/assessment promotion in the Institute:

(ii) Since last appointment/assessment promotion in the Institute:

f) Popular Scientific Articles/Reports (Please mention Co-author (s), if any, title, name of the magazine/periodical, year and page numbers) :

(i) Upto the last appointment/assessment promotion in the Institute:

(ii) Since last appointment/assessment promotion in the Institute:

g) Book Reviews (Please mention Co-author (s), if any, title, name of the book reviewed, name of the journal, volume, year and page numbers) :

(i) Upto the last appointment/assessment promotion in the Institute:

(ii) Since last appointment/assessment promotion in the Institute:

h) Papers presented in National/International Conferences/ Seminars/ Symposia,

(i) Upto the last appointment/assessment promotion in the Institute:

(ii) Since last appointment/assessment promotion in the Institute:

14. Citation of research work since last appointment / assessment promotion in the Institute (Please mention names of the scientists who have cited your publication (s) along with all relevant details) **:**

15. Training undertaken /short term or refresher course since last appointment/assessment promotion in the Institute:

Name and type of training/short-term or refresher course	**Duration**	**Venue**	**Relevance to the candidate's research activities**

16. Lectures/Seminars delivered or Training imparted since last appointment/assessment promotion in the Institute:

Title	Date	Organization where Lecture/Seminar delivered or Training imparted (with the name (s) of trainee (s))

17. Theses supervised:

Degree	Name of student	Name of University	Title of Thesis	Year completed	Co-supervisor, if any

18. Sponsored projects completed/in progress since last appointment/assessment promotion in the Institute :

Project Title	Whether	Duration	Sponsing	Co-supervisor,

	completed or in progress	Amount of grant	agency	if any
Floristic Diversity and Antiquity of Vegetation in Lucknow and Adjoining Areas	Completed	One Year 12 Lakh	UP State Biodiversity Board, Lucknow	Dr. (Mrs.)Kamla Kulshrestha

19. Review/Research/Design/Feasibility Reports prepared since last appointment/assessment promotion in the Institute :

Title	No. of pages	Agency for which prepared	Co-author, if any

20. Consultancy/Contract Research/Contract Training Services rendered since last appointment/assessment promotion in the Institute :

Name of client	Type of service rendered	Period	Amount paid by the Client to the Institute

21. Conferences/ Symposia/ Seminars/Workshops attended since last appointment /assessment promotion in the Institute:

Conferences/Symposia/Seminars/Workshops	Duration	Venue
In India:		
Abroad		

22. Visits abroad, if any for availing Scholarship/Fellowship/Training or under any Exchange Programme since last appointment/assessment promotion in the Institute:

Name of Scholarship/ Fellowship/ Training/ Exchange Programme	Laboratories/ Countries visited	Duration

23. Examinerships, Memberships of Selection/Assessment Committees and other expertise, etc. render to other origination since last appointment/ assessment promotion in the Institute

Academic/Professional expertise	Name of the Organization	Year

24. Memberships/Fellowships of scientific/ professional bodies/ societies/ academies:

Scientific/professional Body/society/academy	Year of admission as Member/Fellow	whether the Membership/ Fellowship is continue
1. Society of Ethno botanists, Lucknow	F.E.S.	Life Member
2. The Palaeobotanical Society, Lucknow	F.Pb. S.	Life Member
3. The Botanical Society of India	2012-13	Annual Member

25. Prizes/Honours/Medals/Awards/Distinctions, if any, received in recognition of the research work:

Prizes/Honours/Medals/Awards/Distinctions	Year
Upto the last appointment/assessment promotion in the Institute	
Since last appointment/assessment promotion in the Institute	

26. Involvement in the administrative/organizational activities of the Institute since last appointment/assessment promotion in the Institute:

Garden Work:- Administration management and maintenance work.

Participated in flower show and own many prizes and sealed Trophies.

Herbarium Work:- Administration management and maintenance work. Conducted several field trips and added the research plant material herbarium as follows.

a. Plant specimen: 10 thousands
b. Wood block: 150
c. Fruits and Seeds: 2500
d. Leaf venation mount: 50

27. Any other information which is relevant for considering the candidate's case for assessment promotion:

Besides assigned regular project I was involved in following scientific and technical work

1. Scientific work:

1. Completed to Sponsored Project of Uttar Pradesh State Biodiversity Board in which Biodiversity information system developed.

2. Plant identification work

2. Technical work :

1. Herbarium curatorial work and administration.
2. Garden work: Garden maintenance and administration.

I am satisfied with my performance during the period.

Date: 23-12-2013 Signature of Candidate

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Pteris multifida Poiret., a new record from eastern Uttar Pradesh, India

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Accepted for publication: 20 July 2013

ABSTRACT

Gond D. K., Kumar S., Samuel C. O., Abbasi P. & Saini D. C. 2013. *Pteris multifida* Poiret., a new record from eastern Uttar Pradesh, India. Geophytology 43(2): 167-169.

Pteris multifida Poiret is described and illustrated as a new record from eastern Uttar Pradesh, India.

Key-words: *Pteris multifida,* new record, eastern Uttar Pradesh, India.

INTRODUCTION

The genus *Pteris* (family Pteridaceae) is represented in India by 64 species. Of these, 18 species are simple pinnate types (Das 2007). Manickam and Irudayaraj (1991) reported 15 species of *Pteris* from the Western Ghats of South India. About 30 species have been reported from the peninsular India (Sreenivas & Madhusoodanan 2010). Only two species of *Pteris* have been recorded from Uttar Pradesh (U.P.), viz. *Pteris vittata* from eastern U.P. (Saini et al. 2010) and *Pteris multifida* from Moradabad in western U.P. (Singh 1989). So far, there is no record of *Pteris multifida* from eastern U.P. As Gorakhpur (eastern U.P.) is situated in Terai region, where moisture and humidity prevail almost throughout the year, *Pteris multifida* commonly grows here on moist places along the road side, on shady moist walls in villages and along the banks of river and other water channels. Previously, this species was collected from the cultivated areas, but now it is naturalized in these habitats. The eastern part of Uttar Pradesh lies between 23°56' and 28°54'N latitudes and 84°40' and 87°10'E longitudes and is bounded by Nepal in the north, Madhya Pradesh in the south, Bihar and Jharkhand in the east and districts of central U.P. in the west. During floristic survey of wetlands of eastern U.P., including Gorakhpur and adjoining areas, the authors collected some interesting pteridophytic plant specimens which were identified as *Pteris multifida* Poiret.

MATERIAL AND METHOD

The plant was collected from different localities of Gorakhpur, eastern Uttar Pradesh during July 2009-2010. Field notes were prepared during collection and samples were kept in separate polythene bags. The plant was properly processed, poisoned, mounted on sheet and deposited in the Herbarium of the Birbal Sahni Institute of

Text-figures 1-4. *Pteris multifida* Poiret. 1. Plant body. 2. A portion of pinna, enlarged. 3. Sporangium. 4. Spore, Bar a = 1 cm.

Palaeobotany, Lucknow for future reference. Detailed observation was made on its taxonomic characters and ecological and distributional patterns.

DESCRIPTION

***Pteris multifida* Poiret** in Lam. Encycl. Bot. 5: 714. 1804.

Text-figures 1-4

Description: Rhizome short, creeping, thick, scaly. Scales small up to 2.5 mm long, entire, apex acute. Fronds dimorphic, thin, fertile fronds 25-32 cm in height; sterile fronds 13-20 cm in height, green, ovate. Pinnae 2-3 pairs, opposite, lanceolate, green, terminal pinnae larger than lateral pinnae, terminal pinnae 15.0-16.0 cm long, and 0.6-0.8 cm broad; lateral pinnae 6.0-9.0 cm long and 0.4-0.5 cm broad; margin wavy, apex acute, serrate, glabrous, thin, papyraceous, pinna decurrent to form a winged rachis; lower pinnae multifid; venation free, forking, numerous. Sori brown along the margin. Indusium white. Sporangium globose, 220-240 µm long; stalk 250-300 µm, 2-celled. Annulus 17-18 celled, Spores brown, 40-45 µm, trilete-tetrahedron.

Material collected: *Pteris multifida* Poiret (Pteridaceae), Gorakhpur, U.P., India, 03.11.2010, collected by D. K. Gond, BSIP Herb. No. 0342.

Distribution: United States, Japan, Korea, China, Pakistan and India.

DISCUSSION

The serrated margin in young fronds of *Pteris multifida* indicates similarity with *Pteris cretica* L. However, serration disappears in the former at maturity. It also differs from *Pteris cretica* in having winged rachis. A careful study of collected specimens and thorough perusal of literature indicate that the plant was previously recorded only from Moradabad of western U.P. (Singh 1989, Saini et al. 2010). Hence the plant is treated as a new record for eastern Uttar Pradesh.

ACKNOWLEDGEMENT

The authors are thankful to the Director, Birbal Sahni Institute of Palaeobotany, Lucknow and to the Principal, St. Andrew's Post-Graduate College, Gorakhpur for providing necessary facilities.

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Singh S. 1989. *Pteris multifida* Poiret, a new record for India. Indian J. Forestry 12(1): 82.

Sreenivas V. K. & Madhusoodanan P. V. 2010. *Pteris multifida*, a new record from peninsular India. Acta Botanica Hung. 52(3-4): 425-427.

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SACRED GROVES AS EXCELLENT HABITATS FOR MACRO AND MICRO LICHENS

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ABSTRACT

The study dealt with lichen diversity in sacred groves of Uttar Pradesh, as these groves maintained the micro-climatic conditions and showed excellent habitat for lichens. The tradition of sacred groves could provide base line information of biodiversity conservation through community participation. In all the sacred groves, *Mangifera indica* trees were common and maximum crustose and folios lichen species were reported. Epiphytic (bork inhibiting) lichens were dominant in all sacred groves.

Figure :00 References : 19 Table : 00

KEY WORDS : Lichens, Sacred groves, Uttar Pradesh.

Introduction

Sacred groves are small or large patches of near natural vegetation preserved on the basis of religious and cultural beliefs and they often represent the climax vegetation of the region[8]. Sacred groves comprise patch of forest or natural vegetation from a few trees to forests of several acres that are usually dedicated to local folk deities or tree spirits. These forests are the relics and are left in small pockets untouched due to religious beliefs and myths[5]. There are different names of sacred groves in various parts of India such as *Orans* in Rajasthan, *Kavil Kadu* in Karnataka, *Dev Bhumi* in Uttarakhand, *Law Lyngdhoh* in Meghalaya and *Dev Asthan* in Uttar Pradesh etc. The sacred groves are important in taxonomical, ecological and anthropological studies. Uttar Pradesh is known for its ecologically distinct and rich biodiversity, having many rare, endemic flora and rich cultural and traditional diversity. In most of the sacred groves of India, the higher groups of plants are well known. However, such information regarding cryptogams of the sacred groves was by and large neglected. In the sacred grove of the Ugavai of Maharashtra 17 species of lichens were reported, in which endemic taxa *Thelotrema poeltii* were encountered[11]. Several studies have already discussed the need and problems associated with the conservation of the scared groves[4,6,14]. In Garhwal Himalaya Tarkeshwar sacred groves were reported while in Kumaun Himalaya, Thalkedar and Nakuleshwar sacred groves with respect to biodiversity conservation except lichens[7,13]. The importance of Haat Kali sacred groves of Central Himalaya with respect to biodiversity conservation including endemic moss and rare lichens was reported[1]. A study of the sacred groves and their significance in conserving biodiversity was carried out which reported six sacred groves in Uttar Pradesh[9]. A survey of sacred groves of Devipatan

ACKNOWLEDGEMENTS : We are thankful to the Director, Birbal Sahni Institute of Palaeobotany, Lucknow for providing necessary laboratory facilities to work. Authors are also grateful to the Uttar Pradesh Biodiversity Board and local people Dr. D.K. Upreti and Dr. Sanjeeva Nayaka, Lichenology lab, NBRI, for their cooperation and encouragement to complete this work.

region of U.P. was done[16]. Lichens are used in medicine, fodder, and spices[15] and their chemical substances also show activities against different microorganisms[17]. Due to the fast pace of urbanization and other human activities the sacred groves are facing threats of destruction and it is essential to document first and then conserve their biodiversity for ecological balance.

Study Area

Present study was based on the survey of lichens from Lucknow, Sitapur, Lakhimpur, Kanpur, Allahabad, Hardoi, Barabanki, Gonda, Gorakhpur, Bahraich, Shravasti, Varanasi, Balrampur districts sacred groves. In all the districts groves were dominant tree *Mangifera indica* forest especially open deciduous forest, and some time mixed with *Azadirachta indica, Phyllanthus emblica, Ficus benghalensis, Acacia arabica, Artocarpus heterophyllus* and *Nerium olender*. Shrub layers were showing dominance of *Lantana camera, Xanthium strumarium, Ocimum teniflorum* and *Parthenium* sp. etc.

Materials and Methods

The specimens were identified by studying their morphology, anatomy and chemistry following the literature[2,3]. The morphology of the taxa was studied under stereo-zoom binocular microscope. The details of thallus anatomy and fruiting bodies were studied by compound microscope. The colour spot tests were carried out on cortex and medulla with the usual chemical reagents such as aqueous potassium hydroxide, Steiner`s stable paraphenylenediamine and aqueous calcium hypochlorite. Thin layer chromatography was performed for authentic identification of the lichen substances in system (Toluene: 1-4 dioxane: Acetic acid)[19].

Results and Discussion

The rich diversity of lichens in the sacred groves clearly indicated that these habitats were treasure house of cryptograms and supported suitable niches not only for lichens but for the groups of plants. In all the groves crustose lichens were dominant followed by the foliose lichens. The microclimatic conditions provide optimum growth to lichens exhibit well developed growth of their fruiting bodies on various substrates. Further, studies of cryptogams are also important as lichens and bryophytes are well known for their sensitivity to atmospheric pollution and can be used as excellent indicators of pollution.

The common trees of *Azadirachta indica, Ficus benghalensis, Acacia arabica,* provide good substratum for their growth in the groves. Parmeloid lichens popularly known as 'Charila' or 'Jhula' in these areas are exploited for their ethnic and commercial uses and hence need to be conserved for the future. The observation of lichens from all the sacred groves surveyed showed dominance of foliose lichens which clearly indicated a pollution free environment of sacred grove. The leprose and crustose lichen such as *Bacidia, Graphis, Leconara* and *Chrysothrix* were the primary colonizers of ecosystem and indicated the presence of regenerated young forest trees in sacred grove.

The occurrence of two *Peltula* species (*Peltula obscurances* Nyl. Gyeln. and *Peltula patellata* Bagl. Swinscow & Krog) found growing wall of temple or rocky outcrop suggesting the excellent habitat of sacred grove in different districts for growth of some exclusive lichens taxa. The lichen family Physciaceae, grows luxuriantly on the moist and shady habitats. The abundance of foliose lichens (*Pyxine, Physcia, Phaeophyscia, Dirinaria*) in the sacred grove was more experienced in the open forest with sufficient penetration of sunlight. The localities which were near the cities, the micro lichens were dominant such as *Rinodina, Caloplaca, Bacidia and Arthopyrenia* because of heavy authropogenic activities

The sacred groves in Uttar Pradesh exhibit occurrence of crustose lichen species both on trees and rocky crop. The growth of *Lecanora* species is favored in well illuminated environmental conditions mostly in thinned forest with considerable exposure of light and wind.

Sacred groves are treasure of rare and endemic flora and showed occurrence of some rare lichens such as *Caloplaca subpoliotera* and *Heppia lutosa* (Ach.) Nyl. on the rocks, *Collema* sp. (on the bark)[10]. The most common lichen species among phorophyte were *Pyxine cocoes* (Sw.) Nyl. (on the bark of *Mangifera indica* and *Ficus benghalensis* trees) and *Rinodina sophodes* (Ach.) Massal. (on the bark of *Azadirachta indica* and *Acacia arabica* trees).

Climax vegetation in sacred groves was always very rich in their species composition. As such these sacred groves serve the vital function of preservation of plants which become very rare or extinct elsewhere[18]. The sacred groves exhibit rich

diversity of lichens as compared to their nearby city areas. Being protected areas, mostly the growth of thick phorophytes in the sacred groves formed a close canopy which provided moisture and shade at the forest floor. The moist, shady habitats provide suitable condition for many lichen taxa to colonize there. The species of *Bacidia, Chrysothrix* and *Pertusaria* prefered to grow on such habitats.

Ninety species belonging to 24 families and 33 genera of lichens were reported from Uttar Pradesh and the crustose lichens were dominant with 60 species followed by the 15 foliose lichens species[12].

The Naimisharanya (Neemsaar) scared grove in Sitapur, situated near Gomati river exhibited occurrence of crustose species of lichens. Similarly, many species of lichens such as *Lecanora, Pyxine, Pertusaria* and *Peltula* were reported only from localities within the sacred groves and exhibited their absence even in protected areas of the district.

Together with the plant resources, the scared groves are also the excellent habitats of other natural resources (water, fodder, fuel and other commercial uses) and thus experience heavy anthropogenic. The devotees, celebration of rituals ceremonies, over-grazing, and water from their resources were the various human activities responsible for loss of diversity of these areas. Under the broad umbrella of protected area a scared grove conservation programme could be initiated keeping the traditional administrative bodies at centre stage. The degraded sacred groves should be immediately restored or regenerated using appropriate technology. Steps must be taken to raise awareness among the concerned villagers regarding importance of sacred grove conservation.

It is clear from the above observations that the sacred groves of Uttar Pradesh exhibited occurrence of some exclusive lichen taxa together with different groups of lichen which indicated different characteristic features of the sacred groves. The diverse microclimatic conditions provide opportunity for many groups of cryptogams and phanerogams to colonize in these excellent micro-habitats of sacred groves. The present number and diversity of lichen species will act as a base line data to carry out biomonitoring studies in the area in future.

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Traditional use of Pteridophytes as medicine among Tharu of Duduhwa National Park in Lakhimpur-Kheri district, U. P., India

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ABSTRACT

The present study is an attempt to enumerate the phyto-remedial pteridophytes of the terai region of India, exclusively in use by the natives in and around the Dudhwa National Park specially the Tharu. It has been observed that nearly 14 species of pteridophytes belonging to 10 genera and 9 families are used as medicine in treatment of different diseases like bleeding, leprosy and as blood purifier etc. The plants were collected and brought to the laboratory for correct identification and its preservation as permanent voucher specimens. The enumeration comprises alphabetical list of correct botanical name of species followed by family under parenthesis, basionyms, synonyms, vernacular names, and methodology of preparation of medicine along with mode of administration.

Keywords: Dudhwa National Park, Medicine, Pteridophytes, Tharu

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1. INTRODUCTION

Owing to the wide range of climate, topology and environments India is one of the richest countries in the world in terms of biological diversity and holds a respectable position among the world's 12 mega biodiversity centers. It harbors about 18000 flowering plant species and nearly 1000 species of pteridophytes along with millions of other organisms, which account for 6 percent of the total plant species in the world (Dixit, 1984; Bir, 1992**;** Anonymous, 2009).The forest cover in India as per 2005 report is 20.6% and the tree cover is 2.8% of the total geographical area of India**.** This forests area is home to tribal populations ever since the decent of man on earth. Living in close association with nature and natural resources these primitive people by virtue of their own distinct culture, believes, taboos, totems, religious rites, traditional food habit and medicines are a storehouse of enormous knowledge about sustainable use of plant species available to them in their native home land.

Experience gained over the generations by trial and error method has been passed on as traditional knowledge through verbally from generation to generation since dawn of civilization. Over 9500 wild plant species in use by Indian tribes for various needs have been recorded so far. Out of 7500 wild plant species used by the tribes for medicinal purposes, about 950 species have been found to be new claims and worthy of scientific investigations. Several of the medicinal plants find wide acceptance and honorable place in traditional as well as in modern medicine. Although traditional medicine flourished in India for quite a long time yet for a while it was subdued under the impact of miraculous and quick effect of modern medicine. Nevertheless, due to the fear of side effects of modern synthetic drugs, traditional herbal medicine has once again started gaining popularity throughout the world (Sullivan and Shealy, 1997; Singh 2002). Scrutiny of ethnobotanical literatures, published by earlier workers from Uttar Pradesh (Maheshwari et al. 1980 & 1981; Saxena and Vyas 1981; Singh and Maheshwari, 1983a,b; Dixit, 1984; Maheshwari et al 1986; Singh et al 1987; Singh, 1988; Singh, 2002) reveals that in spite of being the second largest group of vascular plants after Angiosperms (Benjamina and Manicum, 2007), pteridophytes have got very little attention as far as its medicinal use is concerned (Singh et al. 1989) from the state. Considering the above facts, the Dudhwa National Park is selected for ethnopteridological study.

2. STUDY AREA

Dudhwa National Park comprises of the Dudhwa Tiger Reserve The Park is located on the Indo-Nepal border in Nighasen Tehsil of Lakhimpur-kheri district near the foot hills of the Himalayas' Between the Bhabar and the Gangetic plain in marshy undulating alluvial lands and, with fine selection of terai ecosystem. The area lies between 28°, 18' N and 28°, 42' N latitudes

Figure 1

Bharra (Traditional doctor of tharu tribal's) of Dudhwa National Park

and 80°, 28' E and 80°, 57' E longitudes. The total area of the park is 49029.10 ha. Reserved forest area of 12401.39 ha. Serves as its North buffer and an area of 6602.32 ha. Serves as its southern buffer. The areas which constitute the DNP and its buffer were once part of the North Kheri forest division. The climate of Dudhwa National Park is like the rest of north India, summers are hot with the temperature rising up to 40 °C. During winters, the temperature hovers between 20 and 30 °C. The average annual rainfall is 1,600 mm. The Park is mosaic of Tropical semi ever green, Tropical moist deciduous, dry deciduous and Swamp forest. This part is also known for one of the important Tiger Reserves of India. Large number of Tharu people, an ethnic group indigenous to the Terai forest is living in this area for quite long time. This has provided ample opportunities of interaction between the vegetation and primitive societies.

3. THE THARUS

Tharu is considered as one of the biggest primitive tribes in Uttar Pradesh who have lived in the swampy Terai region for centuries and have developed an innate resistance to malaria that is most likely based on an unidentified genetic factor (Kumar, 1968). The Tharus have small populated villages and generally scattered and are often located at a miner distance. The culture of Tharu tribe is really Eco-friendly and represents a good social life system (Srivastav, 1958). This tribe has mongoloid affinity. They practice monogamy and role of women is dominant. They usually work as farmers or peddlers. The economy of Tharu community is based on Agriculture and forestry (Pradhan, 1937). They has deep affinity with forests and rivers. Contrast in colour predominate their attire as well as decorative wall paintings on houses. They grow barley, wheat, maize, and rice, as well as raise animals such as chickens, ducks, pigs, and goats. Although physically the Tharu are similar to other peoples in the area, they speak their own language that has its origins in Sanskrit and is now officially recognized.

4. METHODOLOGY

Several field trips were conducted between the year 2009 and 2011, with a view of collecting information on medicinal uses of ferns by Tharu tribe and other rural people in the studied area for treatment of various diseases. All information presented in this communication is based on first hand on the field observations and interviews with knowledgeable men and women of the tribal community. To confirm the validity of recorded medicinal uses of ferns, they were verified by repeated quarries from the various informants in the same and other localities of far and distant. As far as possible the medicinal sample and their voucher plant specimens were collected in the guidance of Traditional medical practitioners. The collected plant specimens have been processed and pressed in the field and identified in the Herbarium, Birbal Sahni Institute of Palaeobotany, Lucknow, with the help of available literature on pteridophytes (Tiwari, 1964; Panigrahi & Dixit, 1966; Bir & Vasudeva, 1973; Beddome, 1883; Dixit, 1984).

5. RESULT & DISCUSSION

About 14 species of pteridophytes belonging to 10 genera & 9 families were found to be in use by the Tharu tribe for medicinal purposes. The voucher herbarium specimens are deposited in Herbarium, Birbal Sahni Institute of Palaeobotany, Lucknow, India. Tharu tribes use many of the pteridophytic plants species in and around the vicinity in various therapeutic uses including treatment of common skin ailments like wounds, eczema as well as gastro-intestinal problems such as diarrhea, dysentery, and snake bite, fracture of bone, speematorrhoea, blood dysentery etc. Most common mode of usage is as a tonic in different forms such as juice, extract, paste, infusion, powder etc. Tharu community is not untouched by the winds of change and as modern ideas and scientific know how makes its presence felt in the area, traditional customs and practices are losing ground especially among the younger generation. However, traditional systems of medicine are still patronized by a few elders of the community and they get their medicinal samples or Jadi-buti (medicinal plant products) on the recommendation of 'Bharra', who is traditional doctor of these tharu tribal's (Figure 1). The 'ferns and ferns allies' species have been found to be of great medicinal values. Instead of exploiting the 'ferns and ferns allies' for their economic value and ornamental beauty, care should be take for their conservation (Benjamina and Manickum, 2007). The result of this study may help to the scientists of pharmaceutical laboratories in identification of reliable source of medicine and as a connecting link between traditional knowledge and modern biotechnogical tools of genetic engineering to get new sources of medicine.

5.1. Adiantaceae

***Adiantum capillus-veneris* Linn. f.** / 'Ratanjot'

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The decoction of about 50 fresh fronds is taken in dose of one teaspoonful twice a day for 7 days in Menorrhagea to promote menstruation or regulate the menstrual periods. It is also used to check cancerous growth. Externally, it is used as a poultice on snake bites and bee stings. A paste made from the fronds is used to relieve headaches.

***Adiantum incisum* Forsk.** / *Syn.: A. caudatum* Linn. /'Lotan-Hansraj'

Aqueous extract of about five leaves is given thrice a day for fifteen days to treat Jaundice. Decoction of rhizomes is used in dose of one teaspoonful thrice a day for seven days to promote bronchial secretion and its removal during cold and cough. It is also used to promote sexual desire in men when taken with milk once a day for one week.

***Adiantum philippense* Linn**. */Syn.: A. lanulatum* Burm. *f.*/'Hansraj'/

An aqueous extract of about fifteen fronds is taken orally in dose of two teaspoonful thrice a day for a week to treat blood dysentery which is an infectious disease having ulceration of the lower part of the bowels, characterized by acute diarrhoea accompanied by griping pain, and passage of mucus and blood in stool. It is also taken in dose of half cup twice a day for one month or more to treat Leprosy which is a serious and progressively destructive form of disease caused by bacteria that attacks the skin, nerves and mucous membranes**,** creating lumps in the skin, thickening of skin and nerves, numbness and paralysis. The more serious case shows deformity and considerable disfigurement and sometimes blindness.

5.2. Ceratopteriaceae

***Ceratopteris siliquosa* (Linn) Copel.** / *Syn.: C. thalictroides* (Linn.) Brougn. 'Panighas'.

The extract of fresh leaves is taken thrice a day for three days to treat stomach disorder including indigestion and acidity. The paste of plant is applied on cuts and wounds to check bleeding.

5.3. Equisetaceae

***Equisetum arvense* Linn**. Harjor

The one cup aqueous extract of fresh plant is taken thrice a day for fifteen days to treat liver disease, and to increase appetite. Decoction of fresh plant is taken in dose of two teaspoonfuls thrice a day for ten days to treat burning sensation in urine.

5.4. Marsileaceae

***Marsilea minuta* Linn.** Susnari

Vegetable of plant is taken for treatment of various eye diseases and to increase Eye sight. The powdered mixture of this plant and turmeric is used as tooth powder to get rid of toothache and to treat caries characterized by gradual decay and disintegration of soft or bony tissue or of a tooth.

5.5. Ophioglossaceae

***Ophioglossum reticulatum* Linn.** Ekpatia

The paste of about 10 to 50 plant is taken with water thrice a day for three days to treat stomach disorder and used to neutralize acidity, especially in the stomach and duodenum. The fronds are used as tonic. The paste of fresh fronds is used to check bleeding from cuts and early healing.

***Helminthostachys zeylanica* (Linn.) Hook. f.** Kamraj

The gargle with decoction of fronds is helpful in treatment of the sore throat. This decoction is also taken in dose of two teaspoonfuls thrice a day for seven days to treat constipation. The powdered mixture of rhizomes of this plant and 'bach' (*Acorus calamus* Linn.) is taken once a day with milk to treat impotency. Rhizome is used in dose of one teaspoonful twice a day for seven days to treat cough, acute diarrhoea and dysentery.

5.6. Pteriadaceae

***Pteris longifolia* Linn**. Tatkhar

Paste of plant is used to treat ulcer marked by an open sore or lesion of the skin or mucous membrane accompanied by sloughing of inflamed necrotic tissue. If the sore becomes infected, pus is formed.

***Pteris multifida* Piroet.**

The extract or paste of rhizome is applied to treat scrofula characterized by swelling and enlargement of gland below the lower jaw of the young's, marked by want of resisting powers, making the patient susceptible to tuberculosis, especially of the glands, bones and joints. An extract of leaves is taken in dose of one teaspoonful thrice a day for seven days to treat acute diarrhoea and blood dysentery.

***Pteris vitta* L.**

Fresh leaves are crushed and applied to stop bleeding and healing of wounds. Plant extract is used as demulcent, hypertensive tonic.

5.7. Salviniaceae

***Salvinia natans* (Linn.) All.** Jalmaganiya

The paste made by about fifty fresh plants is applied for a week to treat ringworm and eczema. An extract of fresh plant is taken in dose of one teaspoonful thrice a day for two days to get relief from acidity.

5.8. Schizaeaceae

***Lygodium flexuosum* (Linn.) Sw.** Kali jar.

Decoction of leaves is used in dose of one teaspoonful thrice a day for five days to treat acute diarrhea and dysentery. Paste of leaves is used to treat skin diseases and applied on the piles. Extract of stem and rhizome is taken orally twice a day for a week for sexual diseases like speematoeeh.

5.9. Thelypteridaceae

***Ampelopteris prolifera* (Retz.) Copel.** / *Syn.: Hemionitis sprolifera* Retz. / 'Bhuisag'

About fifty leaves are boiled with coconut oil and applied to cure various skin diseases. Paste of root is used to cure eczema. Aqueous extract of about fifty leaves are used in a dose of one teaspoonful once a day at night for seven days to kill intestinal worm; it is also taken thrice a day for one month as blood purifier.

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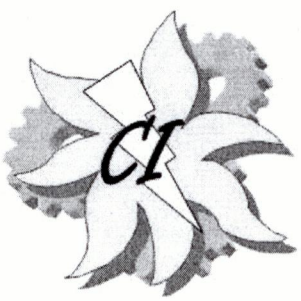

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Impact of Metal Concentration and Pollen Preservation in Copper and Manganese Ore Rich Soil from Balaghat District, Madhya Pradesh: Mineral Indicator Plants and Fungal Remains

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Abstract: The essential micronutrients viz., Fe, Cu, Zn, Mo, Mn and Phosphorus are readily taken up by the plants as required for their proper growth. The availability of mineral nutrients in the root environment influences the metal content of a plant. With the increase in concentration of an element, the normal functioning of a plant is hampered and plants may develop symptoms of toxicity such as dwarfism, chlorosis and necrosis. In extreme cases (lethal levels of concentration) a plant may restrict inflow of toxic metals through its roots or may simply fail to grow due to the death of the root. With the above objective we analyzed 10 mineral rich subsurface soil samples procured from undisturbed hillock close to Copper and Manganese mineral exploration areas of Malanjkhand (Lat. 22°00'05" : Long. 80°42'33") and Ukwa (Lat. 21°59' : Long. 80°21') mines of Balaghat District, Madhya Pradesh in order to assess impact of metal on land flora and pollen preservation. The information of ore body and the country rocks in both the mine areas belong to the Archaean age. The tropical deciduous forest elements are sparsely distributed in vast hillock in vicinity of mine areas. Preliminary geobotanical and biogeochemical studies considered three plant taxa, i.e., Borreria pusilla (Wall.) DC., Hyptis suaveolens (L.) Poit. (S Am.) and Cassia tora Linn., belong to the family Rubiaceae, Lamiaceae and Caesalpiniaceae respectively as local indicators of Copper and Manganese in Central India. Though the palynological studies from ore rich soil reflects paucity of pollen and spores, the occurrence of higher frequency of fungal spores, hyphae, fruiting body of Microthyriaceae and other hyaline ascospores along with degraded pollen/spores is indicative of biodegradation and destruction of microbiota in mineralized condition which is unconducive for pollen preservation too. Examination of underlying soil has also been made to understand the concentration pattern of six important elements like Fe, Mn, Zn, Cu, Pb Cd., in the plant parts. The possible reasons related to impact of metal on land flora and scarcity of pollen frequency in ore rich areas have also been discussed.

Keywords: *Metal concentration; pollen preservation; Balaghat District; Madhya Pradesh.*

Introduction:

In brief the use of vegetation as a guide to mineralization is a subject which primarily combines the Geobotany which involves identification of indicator plants by visual observation, aerial photography of satellite imagery of the vegetation cover, whereas, Biogeochemistry deals with gathering evidence of mineralization through chemical analysis of the plant cover and its underlying soil (Brooks, 1972). The use of indicator plants or plant communities in search of water or minerals has been known since long. In ancient times the Indian sages had fairly good ideas about the plant cover as an indicator of water or minerals. The total estimated Copper ore reserve is 237 million tones in Malanjkhand (open cast) and about 11 million tones Manganese ore reserve in Ukwa (underground method). Two mines are of Archaean in age and situated in a hilly terrain (625-650 m asl). In the present communication some mineralized sub surface soil sediments were examined with a view to understand the status of pollen preservation and pollen/vegetation relationship in and around Malanjkhand and

Ukwa ore rich area of Balaghat District, Madhya Pradesh (Fig. 1), from where already three plant taxa were discovered as Cu and Mn indicator plants (Guleria et al. 1990). The object of pollen analytical study on mineralized soil is to understand the pattern of pollen distribution and deposition which will in turn help in assessing accurate pollen/vegetation relationship in and around mining areas where vegetation status is under threat. The concentration pattern of six important elements like Fe, Mn, Zn, Cu, Pb Cd. in the plant parts is given in Table 1 and 2. The tropical deciduous forest elements are sparsely distributed in vast hillock area adjacent to Malanjkhand mine. Tree taxa are dominated by Terminalia arjuna, Anogeissus latifolia, Buchanania lanzan, Butea monosperma, Holarrhena anti-dysenterica, Diospyros exculpta, Syzygium cumini, Boswellia serrata, Lagerstroemia parviflora, Pongamia pinnata, Tectona grandis and Mitragyna parvifolia, etc. Shrubby taxa are represented by Ziziphus mauritiana, Pogostemon benghalensis, Lantana camara, Urena lobata, Ligustrum compactum and Melastoma malabathricum. The major herbs are represented by Hyptis suaveolens, Borreria pusilla, Cassia absus, C. tora, Triumfetta rhomboidea, Tephrosia senticosa, Crotalaria prostrata, Indigofera linifolia, Bidens biternata, Phyllanthus simplex, etc. The Ukwa mine region reflects almost same vegetation complex besides a few herb elements like Ageratum conyzoides, Crepis japonica, Oldenlandia corymbosa, Cyanotis cristata, Rungia pectinata and Borreria articularis, etc.

Geology and Climate:

The Malanjkhand and Ukwa area is basically confined to sheared quartz, veins/reef. The reef is having an average width of 65 m, which shares highly fractured and fissured planes with granitoids. This highly fractured and sheared geology appears responsible for hydrothermal gnesis of sulphidic ore are seritization, saucerization, chloritization, potassium alteration and silicification. Among these alterations the mineralized granitoids are characterized by potassic alternation, which are most conspicuous and widespread. The primary ore in both areas are chalcopyrite, pyrite, molybdenite, magnetite and sphalerite and the secondary ore are chalcosite, bornite and covallite. The oxidized ore are malachite, azurite, cuprite and native copper. The most prominent ore minerals are chalcopyrite. chalcocite and the oxidized ore mineral are confined to the upper part of the deposit. The District has a subtropical climate. Like most of north India it has a hot dry summer (April-June) followed by monsoon rains (July-September) and a cool and relatively dry winter. Average annual rainfall is 1,183 mm. Minimum temperature during winter is 4 to 6° Celsius while maximum temperature during summer is 38 to 42° Celsius.

Material and Methods:

Chemical analysis of different parts of plants and underlying soils were carried out on dry weight basis for six elements by Varian Techron AAS. Plant and soil samples were powdered and dried at 80 degree C for 48 hours. One gram of dried material was digested with ternary acid (10:4:1 namely HNO_3, $HCLO_3$ and $H2SO_4$) and made up to suitable volume (1000 ml) and analyzed by AAS (Tiagy and Aery, 1981). The iron, manganese, zinc, copper, lead and cadmium concentration (ppm) in some of the plant species and the underlying soil are shown in Table 1 and Table 2. The pollen analysis of 10 surface soil five each from Cu and Mn mineralized areas was carried out using a standard acetolysis method (Erdtman, 1954). Pollen count per samples was made up to 100 to 150 due to low concentration of palynomorphs in mineralized sediment. The photo documentation of palynomorphs was done by using Olympus BX-50 Microscope (Fig. 4).

Modern Pollen/Vegetation Relationship:

The overall palynological studies of 10 ore rich soil do not cohere with the surrounding vegetation set up in both copper and manganese mineralized areas. In Cu mineralized area, pollen spectra of five soil samples is dominated by arboreal taxa like Terminalia, Salmalia, Acacia, Myrtaceae, Sapotaceae and Oleaceae recorded with in the average value of 8%. The grasses and

herbs are recorded under 12% of which Borreria (Cu indicating plant) ranges from 0.5–1% and Hyptis up to 1-2%. The fern allies are encountered within the value of 10% of which trilete fern spore 3%, monolete fern spore 2%. Betula, Alnus and Pinus, etc., are recorded as only highland exotic taxa within 14%. The degraded elements are recorded within 8%. Fungal remains show the higher value reaching upto 48% incorporating Microthyriaceae, Nigrospora, Diplodia, Xylaria, Alternaria, Cookeina, etc (Fig. 2). The elemental study shows maximum of Cu concentration is in soil of Borreria growing zone (1392 ppm) in contrast to the leaves (460 ppm) and in Hyptis growing soil it is 1463 ppm and 240 ppm in soil and leaves respectively. On the other hand pollen concentration in Manganese bound soil where, Mn concentration is higher in underlying soil (22.88%) than leaves (8.37%) is found very poor in term of the growth of ore indicated (Cassia tora) as well as other herbs. Pollen analytical data of five samples shows scarcity of tree pollen frequency at the value of 4% among which Myrtaceae, Madhuca and Lagerstroemia found dominated. However, grasses and herbaceous taxa include Celosia, Artemisia, Convolvulaceae and Malvaceae in moderate values (10%). Among fern allies (15%) Pteris was dominated at the value of 12% as compared to the Cu dominated soil. Fungal remains were predominated within the value of 54% including Microthyriaceae, Nigrospora, Cookeina, Diplodia, Tetraploa, Xylaria and Glomus as the major taxa. Most interestingly the assemblage of Botryococcus, Xylaria, Pleospora and Nigrospora in high value signifies the extreme moist depositional environment. Degraded elements combined with both crumbled and corroded have been recorded within the value of 13% which is higher than copper mineralized soil. The poor concentration of palynomorphs causing anomalies in actual pollen/vegetation relationship along with adequate number of fungal remains (mostly of grass pathogen) with degraded pollen and spores are indicative of biodegradation of microbiota in mineralized sediments under moist condition as evidenced by the adequate frequency of Microthyriaceous fruiting body. The actual role of different elements (Fe, Mn, Zn, Cu, Pb and Cd) in pollen preservation though is not known, the permutation and combination of the generated geochemical and palynological data in more samples will be helpful to understand the interplay between pollen and vegetation in mining areas.

Conclusions:

On the basis of preliminary studies it was concluded that the numerical abundance coupled with stunted growth of Borreria pusilla (Rubiaceae) and Hyptis suaveolens (Lamiaceae) together indicate a Copper rich substratum. Likewise the abundance and stunted growth of Cassia tora also gave clue about Manganese rich area (Fig. 5). In working with fossil pollen it is important to consider the sediments from which they come. Different sedimentary sites, primary and secondary changes in the parent material and differences in the chemical composition all influence the particular fossil pollen assemblage present. A whole series of factors effect buried pollen and spores before and during their conversion to fossils. Each factor in turn affects the state of preservation of the fossil pollen and in turn their ultimate fate. To understand the status of pollen/spores preservation in different ecological condition a number of factors controlling the process are to be studied of which most important factors are pH, concentration of minerals, hydrological status and both biotic/abiotic factors related to the whole process. Besides, based on the geology and the water chemistry it can be seen that Acid Mine drainage (AMD) at the present site is principally caused by the oxidation of pyrite and pyrrhotite and the subsequent ferric iron induced dissolution of chalocopyrites, etc. The oxidation rate is depending on many factors, which define the environment within the waste-rock pile, including pH, temperature, oxygen concentration, chemical composition of the contacting water, and also the microbial population. The overall oxidations are causing the ultimate drainage water with high levels of major ions, and trace

elements but with near-neutral pH values. Extensive damage to the flora and fauna is visible in the receiving waters. The extent of damages to the overall environment is so high that it can be termed as criminal negligence on the part of the concerned (Pandey et al. 2007). Degradation and destruction of pollen and spores by chemical and biochemical action may be attributed due to most destructive agents and account for most of the corrosion in pollen and spores. In terrestrial soils pH may be one of the most important factors in pollen preservation, pH greater than 7.0 (alkaline) the preservation of pollen was not sufficient to warrant the time needed to conduct an analysis. However, from the present study major inferences which could be drawn from both Cu and Mn bound soil are as follows, 1) Decreasing trend of deteriorated pollen and fungal remains with mineral percentage up to pH 7. 2) A reverse scenario is observed at pH 7 and onward i.e., increasing trend of deteriorated pollen with decreasing mineral percentage and fungal remains. However, in Mn bound soil the frequency of both deteriorated pollen and fungal remains is relatively higher than that of Cu bound soil (Fig. 3 a and b). As of now, the exact role of microbiota (host-parasite relationship at species level) in mineralized soil for pollen preservation is not clear, which need further investigation. However, in non mineralized soil definitely presence of microbiota play role in pollen preservation (Bera et al. 2008). Furthermore, a systematic study involving the development and origin of fungal elements as causal agent in destructing certain palynomorphs in mineralized soil should be made. It may be noted that inspite of healthy vegetative growth of indicator plants, short flowering period may not fulfill the reproductive phases (as observed in the field excursion) for which pollen production is hampered ultimately failing to pollen preservation in sediment. However, the detail study must be undertaken to find the exact reason for this hampered reproductive phase inspite of healthy vegetative phase. In most cases, the lower the ratio of sporopollenin in the total mass of the pollen wall, the lower the stability of that grain to preserve in geological sediments. The differences in oxidation rates of pollen walls closely parallels the ratio of sporopollenin to cellulose in the pollen wall. The lower the ratio of sporopollenin, the higher and faster the oxidation rate. Thus, the oxidation rate varies inversely with the percentage of sporopollenin. Moreover, psilate exines are somewhat less resistant to oxidation than grains with ornamented exines in some types of environments of deposition such as peaty or humic deposits. No data on the environmental deterioration due to copper and Manganese mining in Malanjkhand and Ukwa at Central-East India is available although geological aspects are well studied. Biomonitoring of more sediment from other mining areas may be undertaken to compare the data in relation to the study of pollen preservation status from mineralized soil which in turn may prove a very significant impact on the environmental health. It is well established that modern pollen/vegetation relationship of a particular area is prerequisite for deciphering past vegetation and climate of that area (Bradley, 1985) and also that the mineralized area of MP is devastating at a faster rate that in near future almost all flora of the area will be vanished and therefore the data generated from our study provides a background information for the future palaeoecologists.

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Table 1: *Analysis of Ukwa Manganese Mine Plants*

Name of plant	Sample No.	Fe (%)	Mn (%)	Zn (ppm)	Cu (ppm)	Pb (ppm)	Cd (ppm)
Cassia tora Linn.	1 (R)	0.08	0.14	26	9	1	NT
	2 (St)	0.09	0.18	27	14	4	NT
	3 (L)	2.77	8.37	42	32	21	1
	5 (So)	6.6	22.88	128	108	73	5
Borreria articularis (L. f.)	33 (L)	0.31	1.06	73	12	2	0.25
F. N. Will.	34 (Se)	0.18	0.5	41	10	1.5	NT
	35 (So)	7.6	31.81	80	108	72.5	7.5
Pogostemon benghalensis Kuntze	83 (L)	0.1	0.11	22	14	7.75	0.5
	85 (So)	5.44	36.59	65	78	72.5	7.5
Abbreviations: NT-non-traceable; R-root; St-stem; L-leaf; Se-seed; So-soil							

Table 2: *Analysis of Malanjkhand Copper Mine Plants*

Name of Plant	Sample No.	Fe (%)	Mn (%)	Zn (ppm)	Cu (ppm)	Pb (ppm)	Cd (ppm)
Hyptis suaveolens (L.) Poit. (S Am.)	111 (R)	0.25	0.26	9	74	1.5	0.25
	111 (B)	0.11	0.0097	16	69	6	0.25
	112 (St)	0.07	0.09	12	24	4	0.25
	112 (B)	0.01	0.0188	25	19	NT	NT
	113 (L)	1.59	0.02	29	240	9.5	0.75
	113 (B)	0.09	0.0106	88	119	10	0.75
	115 (So)	7.03	0.0278	30	1463	48	2.5
	115 (B)	5.35	0.1223	95	1223	70	5
Tephrosia senticosa Pers.	232 (St)	0.02	0.02	33	20	8	0.25
	233 (L)	0.04	0.03	43	30	2.25	0.5
	234 (FL/Se)	0.05	0.01	26	19	2.25	0.5
	235 (So)	8.56	0.06	28	1412	37.5	2.5
Borreria pusilla (Wall.) DC.	131 (B)	0.2925	0.005	20	18	14	NT
	132 (St)	0.18	0.04	23	42	4.75	0.5
	132 (B)	0.148	0.0034	38	13	9	NT
	133 (L)	3.14	0.05	34	460	15	1.25
	133 (B)	2.14	0.0352	40	51	11	NT
	134 (FI/Fr)	0.82	3.17	60	40	13.5	0.75
	134 (B)	1.44	0.0172	36	30	11	NT
	134 (SO)	8.44	0.08	35	1392	47.5	2.5
	135 (B)	12.25	0.2055	142	295	68	NT

Abbreviations: NT-non traceable; R-root; St-stem; L-leaf; Se-seed; Fl/Fr/-flower/fruit; So-soil; B-background.

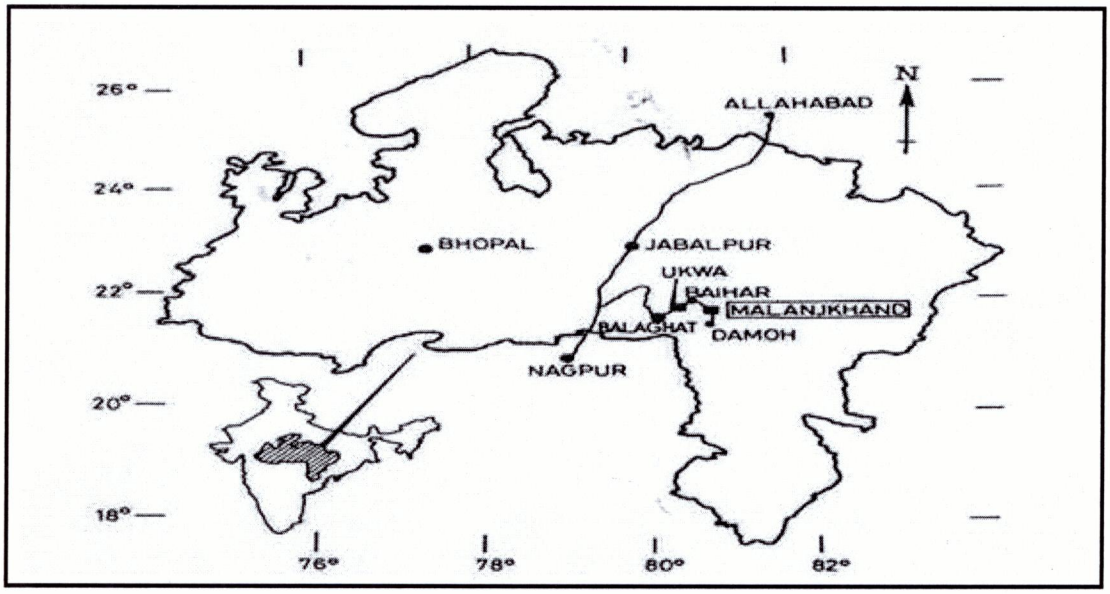

Figure 1: *Map Showing Sites of Sampling.*

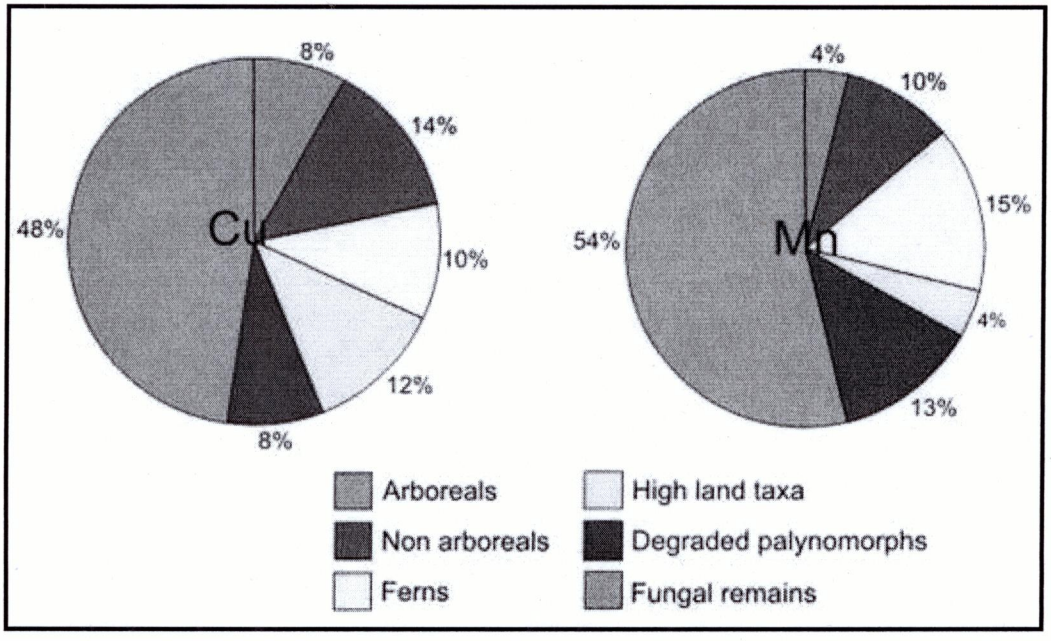

Figure 2: *Pollen Rain in and around Copper and Manganese Ore, Balaghat District, Madhya Pradesh.*

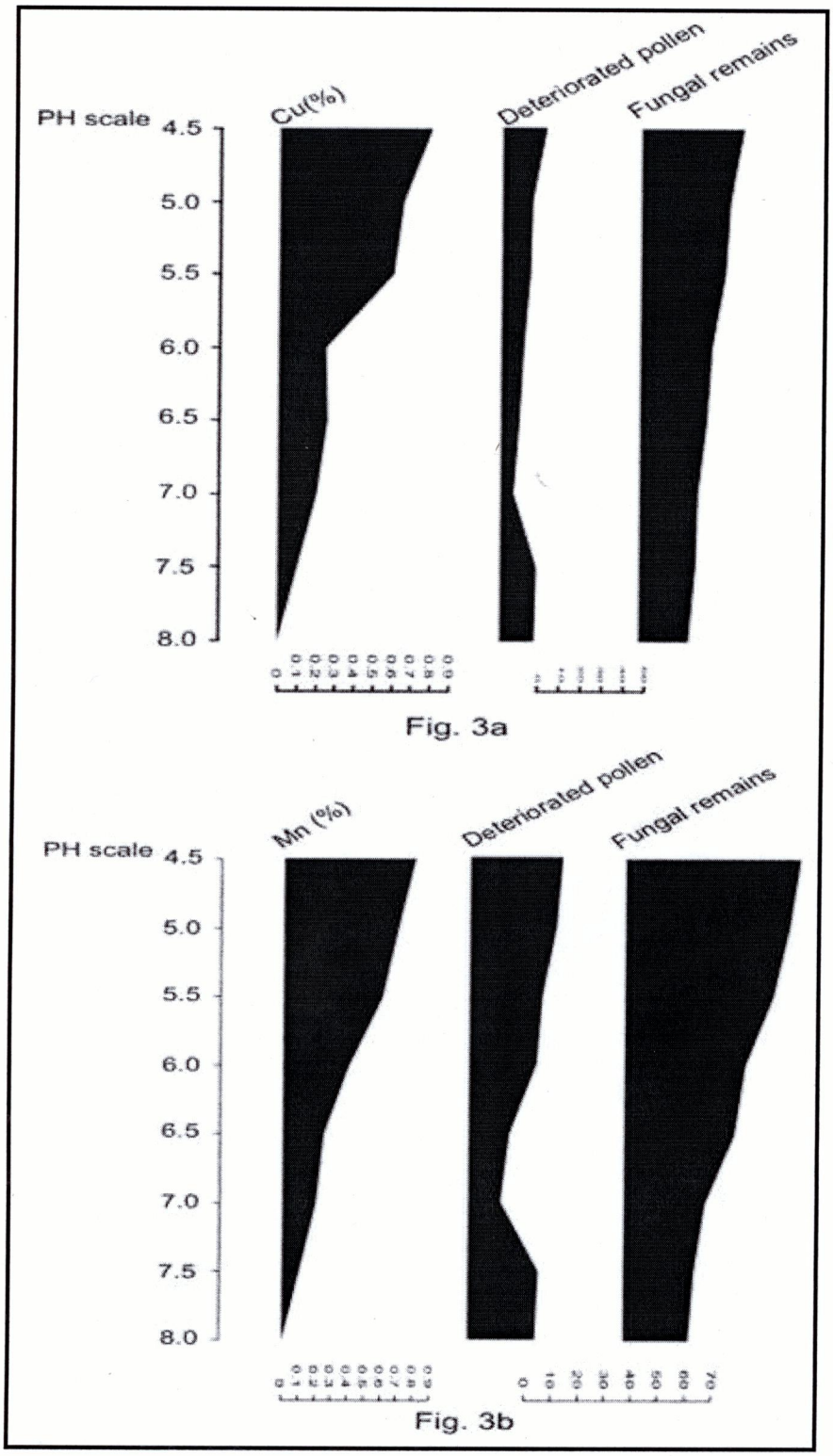

Figure3: a & b: *An Interaction among pH, Mineral Percentage (Cu & Mn), Deteriorated Pollen and Fungal Remains.*

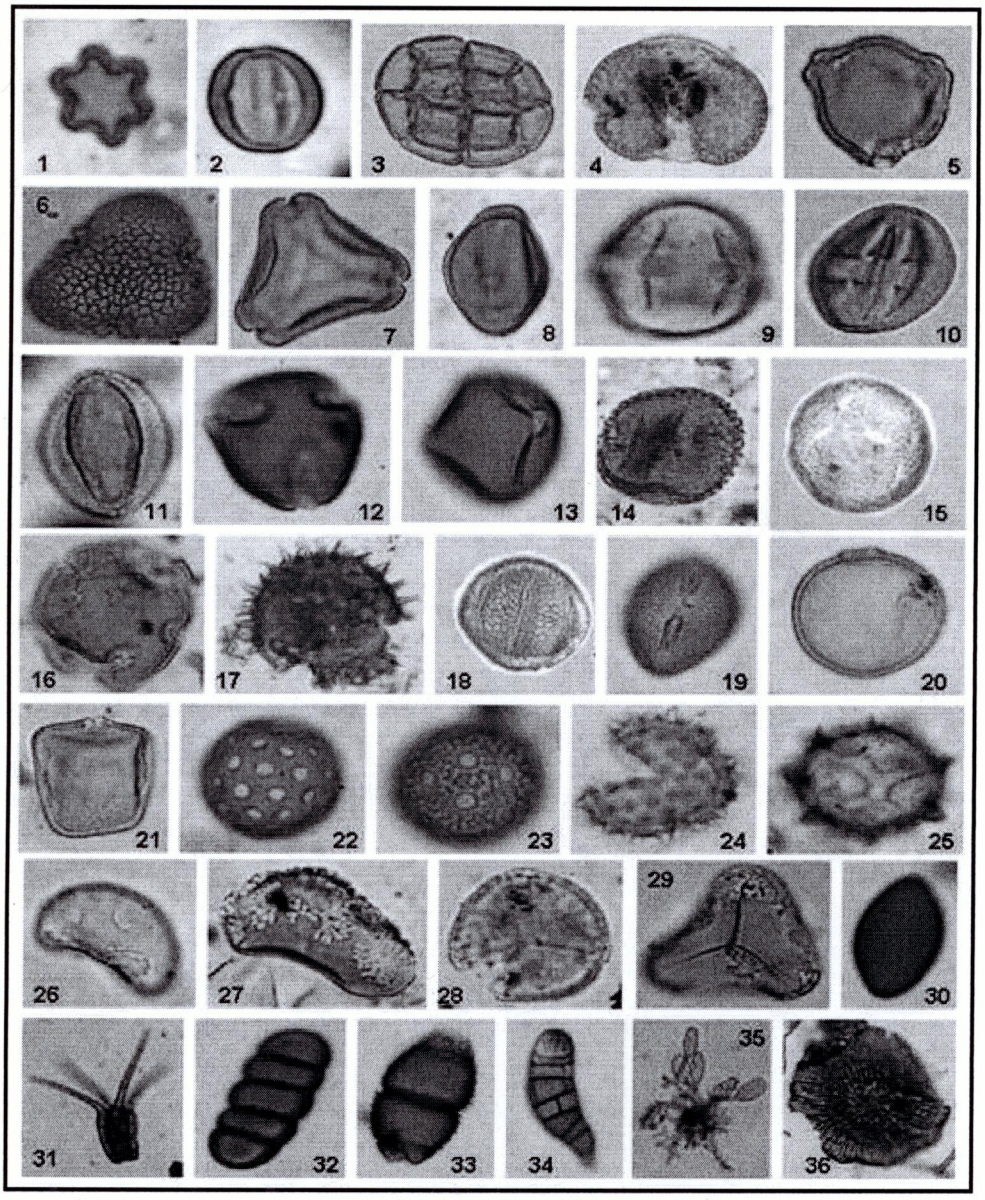

Figure 4: *Palynoassemblage Recovered from Cu and Mn Rich Sediments from Balaghat District, Madhya Pradesh.*

1 & 2. *Terminalia arjuna,* ***3.*** *Acacia nilotica.,* ***4.*** *Pinus sp.,* ***5.*** *Degraded pollen of Betula sp. with perforations near aperture and sporoderm.,* ***6.*** *Salmalia malabaricum,* ***7.*** *Syzygium cumini,* ***8.*** *Lagerstroemia parviflora,* ***9.*** *Madhuca indica,* ***10.*** *Semecarpus anacardium,* ***11.*** *Tectona grandis,* ***12&13.*** *Cassia tora,* ***14.*** *Ligustrum compactum,* ***15.*** *Borreria pussila,* ***16.*** *Degraded pollen of Juglandaceae,* ***17.*** *Partly degraded pollen of Malvaceae,* ***18.*** *Hyptis suaveolens,* ***19.*** *Tephrosia senticosa,* ***20.*** *Poaceae,* ***21.*** *Cyperaceae,* ***22.*** *Amaranthaceae,* ***23.*** *Celosia argentea,* ***24.*** *Degraded pollen of Tubuliflorae,* ***25.*** *Liguliflorae sp.,* ***26.*** *Monolete spore with perforations in spore body,* ***27.*** *Branched rosette shaped perforations degrading nearly whole monolete spore,* ***28.*** *Trilete spore of Trismeria trifoliata with degradation in one lete part,* ***29.*** *Trilete spore of Cyathea sp. with degradation near lete and sporoderm,* ***30.*** *Xylaria sp.,* ***31.*** *Tetraploa sp.,* ***32.*** *Meliola sp.* ***33.*** *Diplodia type,* ***34.*** *Alternaria sp.,* ***35.*** *Group of Glomus sp.,* ***36.*** *Microthyriaceae.*

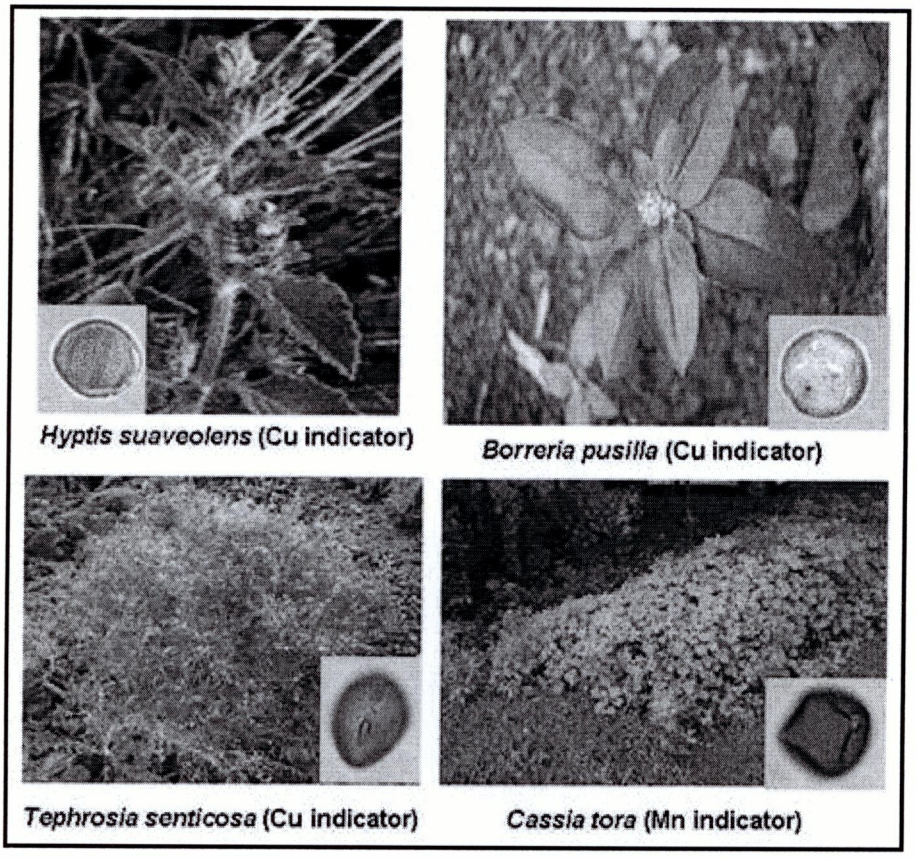

Figure 5: *Some Important Cu and Mn Indicator Plants with their Pollen from Malanjkhand and Ukwa Mine Area, Balaghat District, M. P.*

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Diversity of Pteridophytes in Wetlands of Gorakhpur and Adjacent Districts (Uttar Pradesh) India

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ABSTRACT

Wetlands are the sites of natural succession and therefore contain all the groups of plant kingdom in a single place. The present paper encompasses the floristic account of Pteridophytes occur in wetland of Gorakhpur and adjacent districts of Uttar Pradesh. In this region, varies wetlands like Ramgarh Tal, Tura Nala, Salona Tal, Narya Tal, and Ratoi Tal and varies small water bodies. A total of 20 Pteridophytes species were recorded from the wetland.

Introduction

India is one of the richest countries in the world in terms of biological diversity and holds a respectable position among the world's 12 mega biodiversity centers. It harbors about 18000 flowering plant species and nearly 1000 species of pteridophytes along with millions of other organisms, which account for 6 percent of the total plant species in the world (Bir, 1992, Dixit, 1984). Wetlands are described as those areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support (and under normal circumstances do support) a prevalence of vegetation typically adapted for life in wet or saturated soil conditions. An area is classified or determined to be a wetland when the three key parameters of hydrophytic vegetation, hydric soils, and wetland hydrology occur together on a site under normal circumstances and of sufficient duration just from looking at a wetland, it can be hard to imagine what kind of important value or use it might provide. But we have found that these 'wetland worlds' house many of our biological wonders and serve various important functions that make them of increasing value in their natural state.

Fresh water wetlands are the unique ecosystems having very specific vegetation. These are the sites of natural succession and therefore contain all the groups of plant kingdom in a single place. Water is the prime requisite of the vegetation of the wetland and any alteration in the availability of water affects their presence as well as distribution. Wetlands have often been described as the kidneys of the landscape because of the role they play filter out sediment and pollution from surrounding environment. Some plant species of ecotone zones, which grow in moist habitats, need well aerated soils. Wetland of India was explored by (Fassett, 2000; Cook, 1996; Subramanyam, 1962; Biswas & Calder, 1937). An account of Uttar Pradesh was given by (Saini, et. al., 2010; Srivastava, 2004; Srivastava et.al., 1987; Sen, 1959,). Scrutiny of pteridophytes literatures, published by earlier workers from Uttar Pradesh (Singh, 2011; Saini, et. al., 2010; Subhash, 2008; Srivastava 2008; Khare, et. al., 2005; Srivastava , 2002; Dixit, 1992; Singh, 1989; Singh, et. al. 1989; Chawdhury, 1973; Panigrahi and Dixith, 1969; Roy & Kumar 1966; Dixit and Tripathi, 1956; Hope 1899). The study area has been surveyed and a brief account of wetland vegetation is enumerated with their diversity.

Study Area

The extreme variations in climatic condition of Gorakhpur and adjacent district, especially in rainfall, naturally result in a wide range of vegetation patterns in wetland. North eastern Himalaya consists of a Terai belt which experiences humid subtropical climate. The annual means temperature is 24.45□C, the mean maximum temperature is 39.4□C, and the minimum temperature is 18.4□C. Soil of area is related to the new alluvium or khaddar, which covers the low lands. Particularly in flood plains of the rivers that are replenished every years. It contains a large percentage of humus and can grow crops without irrigation. This soil is very fertile and very much suitable for the cultivation of crops. The Gorakhpur and adjacent districts constitutes a major part of this densely vegetated Terai region. This area being situated on the foothills of great Himalaya. The district lies between 260 42' and 270 25' N Latitude and 830 13' and 830 52' E Longitude. The present study was conducted in highly degraded and fragmented wetlands of Gorakhpur and adjacent districts.

Materials And Methods

Several field trips were conducted during 2010 - 2012, with a view to collect information on wetland Pteridophytic diversity. The information recorded during this study was through direct observation. The survey was a random opportunistic visiting different wetland locality in Gorakhpur and Adjacent Districts. The collected plant specimens have been processed and pressed

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and identified with the help of available literature on pteridophytes (Beddome, 1883; Tiwari, 1964; Panigrahi & Dixit, 1969; Dixit, 1984). Properly authenticated specimens have been incorporated in the Herbarium of Birbal Sahni Institute of Palaeobotany, Lucknow, as reference specimens for future work.

Result and discation:

Freshwater ecosystems provide vital resources for humans and are the sole habitat for an extraordinarily rich, endemic, and sensitive biota. Human demands on freshwater ecosystems have risen steeply over the past century, leading to large and growing threats to biodiversity around the world (Dudgeon *et al.,* 2006). Most of the area of the wetland has been converted to agriculture fields and residential colonies. A total of 20 Pteridophytes belongs to 13 families and 13 genus were recorded from the wetland. The most species rich families in descending order are Ophioglossaceae (4 species), Adntiaceae (3species), Lygodiaceae and Salvinaceae (2species) and Cratopteridaceae, Dryopteridaceae, Equisetaceae, Pterdiaceae, Selagenaceae (1species). *Pteris multfida, Helmitosacthyes zeylanica, Ophioglossum nudicauli, Lygodium microphyllum, and Isoets coromandelina* are rare in wetland. *Selaginella bryopteris* and *Ophioglossum gramineum* are uncommon species in wetlands. Due to high anthropogenic disturbance in the wetlands of Gorakhpur and adjacent districts as well as pteridophytes both are needed to conservation.

"In the end we will conserve only what we love; we will love only what we understand; and we will understand only what we have been taught." – aba Dioum, 1968 International Union for Conservation of Nature

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Table: Wetland Pteridophytes of Gorakhpur

No.	Family	Botanical Name	Habit	Habitat	Abundance
1.	Adiantaceae	*Adiantum capillus- veneris* Linn.	T	1, 2	A
2.		*Adiantum philippense* Linn.	T	1, 3	C
3.		*Adiantum incisum* Linn.	T	1, 2	L
4.	Cratopteridaceae	*Certopteris thalictroides* (L.) Brongn.	A	2, 3	A
5.	Dryopteridaceae	*Dryopteris auriculata* (L.) Kuntze	S	2, 3	C
6.	Equisetaceae	*Equisetum diffusum* D. Don	S	2, 3	C
7.	Isoetaceae	*Isoetes coromandelina* L.	A	2, 3	R
8.	Lygodiaceae	*Lygodium flexuosum* (L.) Sw.	S	1, 3	L
9.		*Lygodium microphyllum* (Cav.) R. Br.	S	1, 3	R
10	Ophioglossaceae	*Ophioglossum gramineum* Wild.	S	3, 2	UC
11.		*Ophioglossum nudicaule* Linn.	S	3, 2	R
12.		*Ophioglossum reticulatum* Linn.	S	3, 2	C
13.		*Ophioglossum vulgatum* Linn.	S	3, 2	A
14.		*Helminthostachys zeylanica* (L.) Hook.	S	3, 2	R
15.	Pteridaceae	*Pteris multifida* Poir.	S	1, 2	R
16.		*Pteris vittata* L.	S	1, 2	A
17.	Selaginellaceae	*Selaginella bryopteris* Baker	S	3	UC
18.	Saliviniaceae	*Azolla pinnata* R. Br.	A	1, 2	A
19.		*Salvinia natans* All.	A	1, 2	A
20.	Thelypteridaceae	Ampelopteris prolifera (Retz.) Copel.	S	2, 3	C

Appendix 1. Wetland Pteridophytes of Gorakhpur and Adjacent Districts

Habit: A = aquatic herb, S = semi aquatic herb, T = terrestrial herb

Habitat: 1 = shady place, 2 = along river banks, 3 = lowland,

Abundance: A = abundant, C = common, L = locally abundant, R = rarely found, UC = Uncommon.

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