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GEO BOTANICAL STUDIES ON OBULAPURAM IRON MINE

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ABSTRACT

In this study Vegetation of Iron mine showed very sparce and comprises theory scrubs and very few tree species, with Semi-evergreen nature. Ninty four species belonging to 80 genera of 30 angiosperm families were recorded on Iron mine. Eight species showed the highest percentage of presence values on Iron mine Schouwia purpurea possessed the highest percentage of presence, density and higher abundance and higher levels on iron accumulation. As Schouja purpurea is the costant species, it may be considered as a local indicator plant for Iron.

Key words : *Iron mine, constant species, local indicator plant.*

INTRODUCTION

Plants growing on mines and mine relics have been found to accumulate and tolerate unusual concentration on metals. These metal to learnt species as indicator plants have attracted the attention for prospecting the mineral deposits. Individual species or vegetation types are known to act as indicators of are deposits in geobotanical prospecting.

Several investigators have recognized different plant associations on varying geologic substrates. Koch(1932) studied in detail the communities growing on zinc and copper contaminated soils. Similarly many geobotanists have reported on the exclusive occurrence of certain plant species and their associations on metal rich soils (Aery 1977; cole 1965; Nesvetayalova 1961; Tiagi & Singh 1973; Venkatesh 1964: Veeranjaneyulu & Dhanaraju

1990) Ernst (1966) has successfully classified plant communities on soils containing heavy metals according to Braun – Blanquet (1932) approach. The present paper deals with the vegetation on the metal rich soil of obulapuram Iron mine.

MATERIALS AND METHODS:

Study Area:

The Obulapuram iron mine is situated between the Latitude $15^0$05' and longitude $76^0$46' covering an area of about 6.38 sq.km at a distance of about 39 Km from Rayadurg of Anantapur district in Andhra Pradesh, India. The maximum elevation in the area is 976m which the plains having a reduced level of 579m.

Hematite is the only predominant iron mineral in this deposits. The area is combined to well-drained soils. The average maximum and minimum temperatures are 38.5^0c and 16.8^0c respectively and the average annual rainfall is 538 mm.

Methods:

The vegetation on iron ore deposits was studied by Belt transect method and the vegetation analysis was made according to the method of Braun-Blanquet (1951). Ten belts of 2m width were laid in the study area, and in each belt 10 quadrats of 2m x 2m were made at random. The plant species and number of individuals of each species were recorded in each quadrat. Similarly plant species were recorded on normal soil outside the mine. Percentage of presence was calculated by dividing the total number of stands in which the species was found by the total number of stands investigated (Braun-Blanquet 1951).

Density, abundance and percentage of frequency for individual species were calculated according to Raunkiaer (1934). The soil and plant samples were collected from the quadrats on iron mine and normal soil outside the iron mine. Plant samples were digested by dry ashing according to the method of Humphries (1956) and soil was digested in concentrated perchloric acid and iron was estimated by o-phenanturolene method as per Sandell(1950).

RESULTS AND DISCUSSION:

The vegetation is sparse and scrub species were appearing as patches, separated by barren land with few grass elements. A total number of 94 plant species belonging to 80 genera of 30 angiospermic families were recorded on iron ore deposits (Table-1). Among the families. Leguminosae showed the highest number of species with 8 genera. In monocots highest number of genera and species was observed in the family poaceae. These observations confirm the reports of Wild(1968). Veeranjaneyulu & Dhanaraju (1990) who were reported

that on copper bearing soils, the greatest number of tolerant species is found in leguminosae and poaceae.

A Total number of 31 species belonging to 29 genera of 16 families was observed on normal soil outside the iron mine. Among these, leguminosae in dicots and poaceae in monocots showed highest number of genera and species (Tables 1 & 2).

Table: 1 Family, density, abundance, frequency and percentage of plant species present on Iron ore deposits.

S. No	Plant Name	Family	Density	Abundance	Frequency	Percentage of Presence
(I)	(II)	(III)	(IV)	(V)	(VI)	(VII)
1	Abutilon indicum	Malvaceae	0.01	1.00	1.0	10
2	Acacia catechu	Leguminosae	0.01	1.00	4.0	40
3	Acacia latronum	Leguminosae	0.25	1.56	16.0	50
4	* Acgtrabtbes asoera	Amaranthaceae	0.92	4.18	22.0	40
5	* Aerva kabata hyss	Amaranthaceae	0.30	3.33	9.0	50
6	Aerva tomentosa	Amaranthaceae	1.12	8.00	14.0	40
7	Alternanthera pungens	Amaranthaceae	0.13	3.25	4.0	30
8	Andrographis echioides	Acanthaceae	0.4	2.00	2.0	20
9	Anisomeles malaoarica	Lamiaceae	0.01	1.00	1.0	10
10	* Apulda mutica	Poaceae	1.35	11.25	12.0	80
11	* Arustuda gtstrux	Poaceae	0.06	6.00	1.0	10
12	Barleria longiflora	Acanthaceae	0.12	2.40	5.0	30
13	* Cadaba indica	Capparidaceae	0.35	2.43	14.0	50
14	* Calotropis procera	Asclepiadaceae	0.20	1.33	15.0	50
15	Cantnium parviflorum	Rubiaceae	0.05	1.25	4.0	30
16	Capparis	Capparidaceae	0.02	2.00	1.0	50

	zeylanica					
17	*Carissa spinarum	Asclepiadaceae	0.01	1.00	1.0	10
18	*Carissa spinarum	Apocynaceae	0.30	1.43	21.0	30
19	*Cassia auriculata	Leguminosae	0.01	1.00	1.0	10
20	Cassia pumila	Leguminosae	0.02	2.00	1.0	10
21	*Cassia senna	Leguminosae	0.02	2.00	1.0	10
22	Celosia argentea	Amaranthaceae	0.05	1.67	3.0	30
23	*Cnrysopogon fulvus	Praceae	4.95	13.38	37.0	90
24	Corcnorus trilocularis	Tiliaceae	0.01	1.00	1.0	10
25	Crotalaria mucranata	Leguminosae	0.01	1.00	1.0	10
26	*Cymbopogon colouratus	Cyperaceae	4.26	8.52	50.0	90
27	Cynodon dactylon	Praceae	0.05	5.00	1.0	10
28	Diospyros melanoxylon	Ebenaceae	0.02	2.00	1.0	10
29	Diperacantnus petulus	Acanthaceae	0.01	1.00	1.0	10
30	Dodonaea viscose	Sapindaceae	0.25	4.17	6.0	20
31	Dolicnandron atrovirens	Bignoniaceae	0.01	1.00	1.0	10
32	Ecninoss ecninatue	Asteraceae	0.01	1.00	1.0	10
33	*Eragrostis viscose	Poaceae	2.16	10.29	21.0	90
34	Euphorbia antiquorum	Euphorbiaceae	0.33	1.18	28.0	40
35	Euphorbia caducifolla	Euphorbiaceae	0.06	1.00	6.0	30
36	*Euphorbia nitra	Euphorbiaceae	0.02	1.00	2.0	20
37	Euphorbia indica	Euphorbiaceae	0.01	1.00	1.0	10
38	Evolvalus alsinoides	Convolvulaceae	0.07	1.40	5.0	40

39	Ficus hispida	Moraceae	0.03	1.00	3.0	20
40	Flueggea leucopyrus	Euphorbiaceae	0.24	12.00	2.0	10
41	Flaverla australasica	Asteraceae	3.76	10.16	37.0	50
42	Grewla damine	Tilliaceae	0.05	2.50	2.0	20
43	Grewla villosa	Tiliaceae	0.03	1.50	2.0	20
44	Gynandropsis pentaphylla	Capparidaceae	0.01	1.00	1.0	10
45	Hardwickia binata	Leguminosae	0.06	1.20	5.0	40
46	Hibiscus ovalifolius	Malvaceae	0.41	1.71	24.0	50
47	Heylandia latebrosa	Leguminosae	0.01	1.00	1.0	10
48	*Indigofera trita	Leguminosae	0.11	2.20	5.0	30
49	Impomaea obscura	Convolvulaceae	0.03	3.00	1.0	20
50	*Iseilema anthephoroides	Poaceae	2.67	11.61	23.0	90
51	Jatropha glandulifera	Euphorbiaceae	0.49	4.90	10.0	40
52	Justicia prostrate	Acanthaceae	0.18	4.50	4.0	40
53	Leucas stricta	Lamiaceae	0.26	4.33	6.0	30
54	*Lepidagathis cristata	Acanthaceae	0.35	3.18	11.0	50
55	Maerua arenaria	Capparidaceae	0.08	1.33	6.0	40
56	Maytenus emarginata	Celastraceae	0.13	1.18	11.0	30
57	*Melanocenchris jacquemontii	Poaceae	2.47	12.35	20.0	90
58	Merremia tridentate	Convolvulaceae	0.66	9.43	7.0	20
59	Mollugo cerviana	Aizoaeceae	0.17	2.43	7.0	40
60	Mollugo nudicaulis	Aizoaeceae	0.35	3.50	10.0	30
61	Mollugo oppositifolia	Aizoaeceae	0.15	3.75	4.0	10
62	Ocimum	Lamiaceae	0.02	1.00	2.0	20

	sanctum					
63	Opuntia dillenii	Cactaceae	0.02	1.00	2.0	20
64	*Panicum repens	Poaceae	2.52	12.00	21.0	90
65	Passiflora foetida	Cucurbitaceae	0.02	2.00	1.0	10
66	Phyllanthus maderaspatensis	Euphorbiaceae	0.04	4.00	1.0	10
67	Phyllanthus niruri	Euphorbiaceae	0.01	1.00	1.0	10
68	Polycarpaea aurea	Caryophyllacea e	0.01	1.00	1.0	10
69	Polygonum plebejum	Polygonaceae	0.01	1.00	1.0	10
70	*Prosopis juliflora	Leguminosae	0.06	1.00	6.0	40
71	Pupalia atropurpurea	Amaranthaceae	0.06	6.00	1.0	10
72	Pualia lappacea	Amaranthaceae	0.01	1.00	1.0	10
73	Rhus mysorensis	Sapindaceae	0.15	1.88	8.0	40
74	Rhynchelytrun repens	Poaceae	0.97	10.78	9.0	70
75	Sapindus emarginatus	Sapindaceae	0.06	6.00	1.0	10
76	Sarcostemma acidum	Asclepiadaceae	0.04	2.00	2.0	10
77	Schowia purpurea	Cruciferae	4.44	14.80	30.0	90
78	Setaria pumila	Poaceae	1.78	11.13	16.0	80
79	Solanum nigrum	Solanaceae	0.01	1.00	1.0	10
80	Sonchus olaraceus	Solanaceae	0.03	1.50	2.0	20
81	Tephrosia procembens	Asteraceae	0.89	3.87	23.0	50
82	Tephrosia procumbens	Leguminosae	0.03	3.00	1.0	10
83	*Tephrosia purpurea	Leguminosae	0.01	1.00	1.0	10
84	Tragus roxburghii	Poaceae	3.97	14.18	28.0	90
85	Trianthema	Aizoaceae	0.08	4.00	2.0	20

	decandra					
86	Tribulus terristris	Zygophyllaceae	0.09	3.00	3.0	20
87	Trichodesma indicum	Boraginaceae	0.02	1.00	2.0	20
88	*Tridax procombens	Asteracea	1.53	5.10	30.0	80
89	Vernonia cinerea	Asteracea	0.26	3.25	8.0	50
90	Vicoa indica	Asteracea	0.14	2.33	6.0	40
91	Volunterella divaricata	Asteracea	0.23	2.56	9.0	50
92	Wrightia tinctoria	Apocynaceae	0.04	1.33	3.0	30
93	*Xeromphis spinosa	Rubiaceae	0.25	1.67	15.0	40
94	*Zizyphus mauritiana	Rhmnaceae	0.01	1.00	1.0	10

* Indicates the presence on the normal soil outside the mined area.

Table:2 : Plant species present on normal soil outside the Iron Mine not encountered / found on Iron rich soils.

S.No	**Plant Name**	**Family**
1	Apluda mutica	Poaceae
2	Asparagus racemosus	Lilliaceae
3	Azadirachta indica	Meliaceae
4	Croton bonplandianum	Euphorbiaceae
5	Hyptis suaveolens	Lamiaceae
6	Prosopis spicigera	Leguminosae
7	Randia candolleana	Rubiaceae
8	Vitex negundo	Verbinaceae

Of the 31 species found on normal soils, 24 species were also observed on the iron ore deposits. These observations confirm the studies of Brandshaw (1971) and Tiagi & Aery (1982), who have also reported that the species that are found growing on metal contaminated soil are also seen on ordinary soil.

The data in Table 1 show also density, abundance, percentage of frequency and percentage of presence for plant species on iron ore deposit. Eight species Chrysopogon fulvus, Cymbopogon coloratus, Eragrostis viscose, iseilema anthephoroides, Melanocenchris jaequemontii,
Panicum repens, Schouwia purpurea and Tragus roxburghii have the highest percentage of presence values on iron ore deposits. High percentage of presence appears to be due to the narrowly specialized adaptation of these species to high metal content of the habitat. Obviously, they are the constant species of the community on the iron ore deposits. They are the constant species from Phytosociological view point.

Data in Table 3 show iron levels in different parts of some dominant plant species present on iron ore deposits and on normal soil outside the mine. Of the eight species, which had the highest percentage of presence, Schouwia purpurea showed higher levels of iron accumulation. Similarly, Calotropis procera and Flaveria australasica which were observed growing on mine soil and on normal soil accumulated high iron content.

Table: 3: Iron content in different parts of the plant species present on Iron ore deposits (IOD) and / or on Normal Soil (NS) outside the mined area (mg g^{-1} dry weight)

Plant Name		**Leaf**	**Stem**	**Root**
Aerua tomentosa	IOD	2944.44	1098.24	1183.92
	NS	470.18	133.33	63.16
Apluda mutica	IOD	2643.28	1222.22	-
Cadaba indica	IOD	4364.04	2540.93	-
Calotropis procera	IOD	5013.16	1671.05	159047.62
	NS	110.53	112.87	-
Capparis zeylanica	IOD	2600.88	527.05	-
Flaveria australasica	IOD	131666.76	4485.38	2669.59
	NS	426.61	788.01	1494.15

Lepidagathis cristata	IOD	2811.39	1307.02	215.12
Schouwia purpurea	IOD	1703.22	835.53	67619.05
Sonchus olaraceous	IOD	2461.26	640.95	2972.22

The constant species Schouwia purpurea, which showed highest percentage of presence, density and frequency on iron mine and higher levels of iron accumulation (Table 3) was not found on the normal soils outside the iron mine.

Schouwia purpurea, thus was observed on metal rich soil, with highest density and percentage of frequency and higher abundance, and was not observed in the region in wild state outside the iron mine on normal soil. Hence it may be considered as a local indicator plant for iron in this region and thus may deserve the rank of a local indicator for iron. Similarly Flavaria australasica and Calotropis procera may be considered as iron accumulated species of Obulapuram iron ore deposits and these species may be useful for geobotanical prospecting for iron.

Therefore, in geobotanical classification, Schouwia purpurea may fall into the category of local indicator of Malyuga (1964) and a local metallophyte of Lambinon & Auquier (1964). According to the classification of metallicolous plants of Duvignaud & Denaeyeo – De Smet (1960), all the species recorded on the iron mines of obulapuram area metalloresistant as these species can occur on non-metalliferous sites also.

Regarding the specific occurrence of these plant species on the metalliferrous soils, it may be stated that these species may be the product of parallel evolution on different mines from relative in the neighboring background areas. This process has been experimentally shown to be operative in grasses (Jowet 1958, 1964; snaydon 1970). Nearly 50% species found on metal rich soils are also seen on non-metalliferous soils. They may obtain the status of ecotypes differing in certain physiological characteristics. It needs of course to be experimentally established whether these plant species may be neo-endemics (Stebbins 1942) which might have evolved recently.

Another probable explanation regarding the presence of these species on metalliferrous soils has been given by Antonovics et al (1971). Since the metal rich soils commonly associated with man's activities, the presence of these plants on metal rich soils may simply indicate the efficiency of anthropochory, a phenomenon known as ' transport endemism'.

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