

## AN ACCOUNT OF TOLERANT PLANT SPECIES GROWING ON COAL MINE WASTES OF TALCHER, ORISSA

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### ABSTRACT

The present study describes a specialized vegetation tolerant to nutrient-deficient and trace-metal-enriched soil of coal mine waste at Talcher, Orissa. A total of 105 species, belonging to 40 families, have been reported, and two species with morphological abnormalities have been detected. The importance of such floristic studies for revegetation of abandoned coal mine sites has been suggested.

### INTRODUCTION

THE impact of surface mining on soil, vegetation, water resource, and biota is well documented<sup>1</sup>. Thousands of hectares of unreclaimed land from opencast mines are prone to severe erosion and related environmental degradation.

Talcher, the largest depository of coal in the state of Orissa, has four underground mines and three opencast mines. The dumps of overburdens/mine wastes from opencast mines generated in the last 30 years have turned into large artificial hills. The abandoned mines have a low plant density due to the high sulphur content of the soil, nutrient

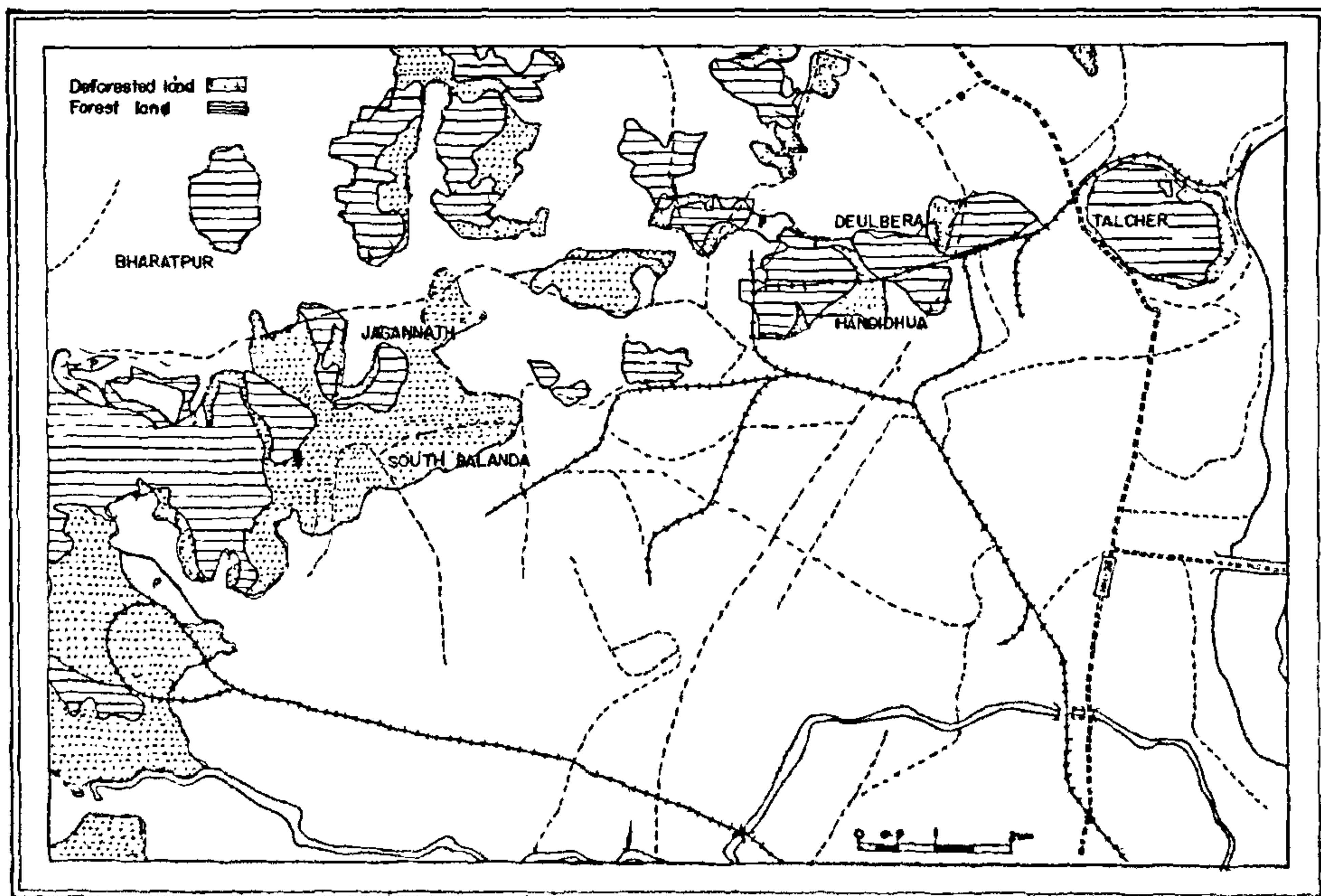


Figure 1. Deforestation around Talcher coal field from satellite data.

deficiency and steep slopes highly susceptible to wind and water erosion<sup>2</sup>. Soil polluted with heavy metals is toxic to the growth of vegetation, and as a consequence only metal-tolerant plants evolve and survive<sup>3</sup>. Relatively little effort has been made to study, document and report the vegetational status of abandoned mine sites<sup>4</sup>. The present communication is a preliminary report on the natural metal-tolerant plant species on the coal mine wastes at Talcher.

#### Site of study

Talcher coal mines are situated about 65 miles north-west of Cuttack in the valley of Brahmani river at 564 metres above MSL. It lies between 22°-55' N and 21°-00' N latitudes and 84°-15' E and 85°-10' E longitudes.

#### Methodology

Plant specimens were collected from overburden and adjoining areas of the opencast mines during several exploration trips in different seasons of the year. Collected plants were identified, documented and preserved in the herbaria of the Regional Plant Resource Centre. Correct names were ascertained in consultation with the International Code of Botanical Nomenclature. Families were arranged in accordance with the modified Bentham and Hooker's system of classification while the genera within a family, and species within a genus follow an alphabetical sequence.

### RESULTS AND DISCUSSION

One hundred and five species, belonging to 40 families, comprising herbs, shrubs, climbers and trees, have been observed on the mine wastes (table 1). A large number of herbs and undershrubs belonging to the families Fabaceae, Rubiaceae, Asteraceae, Apocynaceae, Euphorbiaceae, Cyperaceae and Poaceae occur predominantly throughout the undulating surfaces of the overburdens. These herbs and shrubs were associated with a few tree species like *Bombax ceiba*, *Ailanthus excelsa*, *Azadirachta indica*, *Adina cordifolia*, *Tamarindus indica*, *Acacia leucophlea*, *Morinda tinctoria*, *Diospyros melanoxylon*, *Alstonia scholaris*, *Ficus religiosa*, *Ficus benghalensis*, *Ziziphus mauritiana*, etc. The meagre occurrence of tree species indicates their gradual abolition in the last few decades due to mining activity. Remote sensing data reveal a depletion of 13.2 km<sup>2</sup> of forest over a

Table 1 List of plants growing on coal mine wastes of Talcher, Orissa

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Annonaceae: *Annona squamosa*; Brassicaceae: *Brassica campestris*; Capparaceae: *Cleome viscosa*; Violaceae: *Hybanthus enneasepermus*; Flacourtiaceae: *Casearia elliptica*, *Flacourtia indica*; Malvaceae: *Sida cordata*, *Urena lobata*; Bombacaceae: *Bombax ceiba*; Tiliaceae: *Triumfetta neglecta*; Simaroubaceae: *Ailanthus excelsa*; Meliaceae: *Azadirachta indica*; Rhamnaceae: *Ziziphus mauritiana*—var. *fruticosa*; Fabaceae: *Aeschynomene indica*, *Alysicarpus vaginalis*, *Atylosia scarabaeoides*, *Dalbergia sissoo*, *Desmodium triflorum*, *Indigofera linnaei*; Ceasalpineaceae: *Tamarindus indica*; Mimosaceae: *Acacia leucophloea*; Lythraceae: *Ammania baccifera*, *Rotala serpyllifolia*, *Woodfordia fruticosa*; Onagraceae: *Ludwigia perennis*; Rubiaceae: *Adina cordifolia*, *Borreria articularis*, *Borreria stricta*, *Dentela asiatica*, *Hedyotis erecta*, *Ixora arborea*, *Mitragyna parviflora*, *Morinda tomentosa*, *Oldenlandia corymbosa*; Asteraceae: *Acanthospermum hispidum*, *Ageratum conyzoides*, *Blumea amplexans*, *Blumea bialata*, *Eclipta alba*, *Tridax procumbens*, *Vernonia cineria*, *Vollutrella divaricata*; Campanulaceae: *Sphenoclea zeylanica*; Ebenaceae: *Diospyros chloroxylon*, *Diospyros melanoxylon*; Styracaceae: *Symplocos* sps; Apocynaceae: *Alstonia scholaris*, *Catharanthus roseus*, *Ichnocarpus frutescens*, *Hylarrhena antidysenterica*; Asclepiadaceae: *Gymnema sylvestris*, *Hemidesmus indicus*, *Leptadenia reticulata*; Loganiaceae: *Strychnos nux-vomica*; Gentianaceae: *Canscora diffusa*; Convolvulaceae: *Ipomoea carnea*; Solanaceae: *Solanum xanthocarpum*; Scrophulariaceae: *Adenosma indianum*, *Scoparia dulcis*; Acanthaceae: *Andrographis paniculata*, *Justicia diffusa*; Verbenaceae: *Lantana camara*; Lamiaceae: *Hyptis suaveolens*, *Leucas aspera*, *Leucas linifolia*, *Ocimum basilicum*; Amaranthaceae: *Alternanthera sessilis*, *Celosia argentea*, *Gomphrena celosioides*; Lauraceae: *Cassytha filiformis*; Euphorbiaceae: *Brynia rhamnoides*, *Croton bonplandianum*, *Euphorbia hirta*, *Euphorbia thymifolia*, *Phyllanthus niruri*, *Phyllanthus reticulatus*, *Phyllanthus simplex*, *Sebastiania chamelia*; Ulmaceae: *Tragia involucrata*; Moraceae: *Ficus benghalensis*, *Ficus religiosa*; Commelinaceae: *Commelina kurzii*, *Commelina benghalensis*; Typhaceae: *Typha angustata*; Cyperaceae: *Bulbostylis barbata*, *Cyperus iria*, *Cyperus castaneus*, *Fimbristylis acuminata*, *Fimbristylis aestivalis*, *Kyllinga triceps*, *Mariscus panicus*; Poaceae: *Aristida setacea*, *Chloris barbata*, *Dactyloctenium aegyptiacum*, *Digitaria ciliaris*, *Digitaria longifolia*, *Echinochloa colonum*, *Eleusine indica*, *Eragrostis ciliaris*, *Eragrostis gangetta*, *Eragrostis uniloides*, *Heteropogon contortus*, *Pennisetum pedicellatum*, *Saccharum spontaneum*.

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period of 15 years from 1972 to 1986 due to deforestation and mining activity in the region (figure 1).

Resistant ecotypes with morphological peculiarities were also detected. Interesting cases of polymorphism, in *Croton bonplandianum* with variegated leaves, and *Catharanthus roseus* with clustered leaves at the terminus and small-sized leaves and flowers, have been observed. In general the plants exhibit stunted growth, with an extremely thick and long tap root system.



**Table 2** Trace metal concentrations of overburden soil and non-mine soil of Talcher coal mine area

Trace elements	Concentration (ppm)	
	Overburden soil	Non-mine soil
B	10-15	4-11
Ba	120-350	55-130
Co	10-15	3-12
Cr	30-100	20-45
Cu	60-75	32-55
Ga	10-15	0-9
Ge	100-150	70-98
La	15-25	0-13
Mo	400-2000	100-750
Ni	50-150	30-110
Pb	10-20	5-15
Nb	15-20	7-12
Sr	50-100	10-62
V	50-150	0-98
Y	30-40	5-20
Zr	200-250	30-110

Occurrence of peculiar flora very much alien to the natural vegetation can be attributed to the presence of higher concentrations of a large number of trace metals in the overburden soil compared to the soil of the non-mine area (table 2). The present results suggest that the large number and variety of tolerant plant species, with occasional manifestation of morphological anomalies, found in such sites are

related to the overall environmental diversity created by surface mining. The vegetation described in this study (table 1) can provide guidelines for reforestation of derelict lands resulting from deforestation and mining activity and help environment managers to choose suitable species for reclamation and revegetation of abandoned mine lands.

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## ANNOUNCEMENT

### 11TH INTERNATIONAL CONGRESS OF IUSSI

The Eleventh Congress of the International Union for the Study of Social Insects (IUSSI) will be held in Bangalore from 5 to 11 August, 1990. The main theme of the Congress will be: Social Insects and Environment. Those interested in participating in

this Congress may write to: The Secretary, 11th International Congress, IUSSI-1990, Department of Entomology, University of Agricultural Sciences, GKVK Campus, Bangalore 560 065, India.