

# **Preliminary Investigations into VAM Colonization of Plant Species found growing in Abandoned Tailing Pond of Iron Ore Mines in Goa.**

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## **ABSTRACT**

Mycorrhizal infection was assessed in 20 plant species belonging to 20 genera and distributed among 15 families found growing in abandoned tailing pond of iron ore mines in Goa.

All the plant species showed mycorrhizal infection that ranged from 5% to 99%. *Alternanthera sessilis* (Amaranthaceae) showed least mycorrhizal infection (5%), while maximum mycorrhizal infection (99%) was recorded in *Blumea wightiana* (Asteraceae). Plants exhibiting mycorrhizal infection had typical vesicular or arbuscular and inter-and intra-cellular hyphal infection.

## **Introduction**

Goa has been a prime exporter of iron ore. Since 1950, as much as 300 million tonnes of iron ore has been exported. Present production of iron ore is of the order of 15 million tonnes per year which constitutes 40% of the total iron ore production in the country and 50% of its export. The estimated reserve of iron ore is around 400 million tonnes and is expected to last for another 25-30 years at the present rate of mining.

The mining operation is such that, two classes of waste are produced viz., piles of surface overburden waste rock and lean ore, which constitutes the reject dumps, and a fine grained waste resulting from the ore beneficiation process and deposited in large man made basins called tailing ponds. The later kind of waste materials are termed as tailings.

VAM fungi are ubiquitous in distribution. They hold tremendous potential for use in the reclamation industry. In many instances they should improve plant growth and establishment on disturbed lands and speed processes of ecosystem recovery (Wood, 1982).

The present study was undertaken to find out whether the VA mycorrhizal fungi could colonize and infect plant species growing in abandoned tailing pond of iron ore mines in Goa.

## Materials And Methods

Root samples were collected from plant species growing in abandoned tailing pond at Sanquelim iron ore mines of M/S Sesa Goa Limited. The roots were freed from adhering soil, gently washed and cut into 1cm segments. The degree of colonization was calculated by using the slide method (Giovannetti & Mosse, 1980). Colonization of the roots was determined after clearing the roots with 10% KOH and staining with trypan blue (Philips & Hayman 1970).

The soil pH was measured in 0.01 M CaCl<sub>2</sub>. Electrical conductivity and cation exchange concentrations were determined in 1:1 water : waste extracts. Cation concentrations were measured by Atomic absorption spectrophotometry. Mineral (available) nitrogen was determined after extraction in 2M KCl (Bremner, 1965a) and total nitrogen determined after acid-Kjeldahl digestion (Bremner 1965b). Phosphorus was determined by using Olsen and Dean's (1965) method. Total water soluble sulphate sulphur was measured turbidimetrically (ADAS, 1981). All analyses were carried out on air-dried material but results are expressed on an oven-dry (105°C) weight basis after correction for moisture content.

## Results And Discussion

The pH of the tailings was found to be 6.48 (0.07) with an electrical conductivity (Ec) value of 0.065 (0.018) (ms cm<sup>-1</sup>). All the plant macro- and micro-nutrients analyzed were in very low levels (Table 1)

Table 1. Some properties of iron ore mine tailings.

Properties	Mean (S.D.)
pH	6.48 (0.07)
EC (ms cm <sup>-1</sup> )	0.065 (0.018)
Total N	60.3* (NA)
Available N	1.7* (NA)
P	1.9* (NA)
SO <sub>4</sub> -S	<0.1 (NA)
Ca	2.34 (0.57)
Mg	0.75 (0.17)
K	0.71 (0.30)
Na	4.85 (2.94)
Cu	<0.05 (NA)
Fe	<0.1 (NA)

Concentrations in µg.g<sup>-1</sup> oven-dry spoil.

NA = Not applicable

EC = Electrical conductivity

\* = Mean of two replicates taken from bulked sample.

Vesicular-arbuscular mycorrhizal association was observed in all the plant species investigated. Very heavy infection was recorded in *Blumea wightiana* (99%) and *Vandellia*

crustacea (98%). Rest of the species showed moderate infection ranging from 75% in *Ludwigia parviflora* to 25% in *Ficus glomerata*. Low infection was recorded in *Cassia tora* (11%) and *Alternanthera sessilis* (5%) (Table 2.) Plants exhibiting mycorrhizal infection had typical vesicular or arbuscular and inter- and intra-cellular hyphal infection. The vesicles showed variation in size and shape in the different species and also with the same species.

Daft and Hacskaylo (1976) recorded extensive infection of VAM fungi in plants colonizing the coal waste. They hypothesized that application of VAM fungi may ensure successful reclamation of coal mine areas.

**Table 2 : Degree of root colonization in plant species growing in abandoned tailing pond of iron ore mines.**

Sr. No	Plant species	Habit	Family	Degree of root colonization	Type of infection
1	<i>Psidium guajava</i> L.	Tree	Myrtaceae	64	H A V
2	<i>Leucaena glauca</i> Benth.	Tree	Mimosaceae	50	H V
3	<i>Crotalaria filipes</i> Benth.	Herb	Fabaceae	56	H A V
4	<i>Desmodium triflorum</i> (L.) DC.	Herb	Fabaceae	46	H A V
5	<i>Cassia tora</i> L.	Herb	Caesapiiniaceae	11	H A
6	<i>Melochia corchorifolia</i> L.	Herb	Sterculiaceae	48	H V
7	<i>Ludwigia parviflora</i> Roxb.	Herb	Onagraceae	75	H A
8	<i>Hydrocotyle asiatica</i> L.	Herb	Apiaceae	54	H A
9	<i>Oldenlandia corymbosa</i> L.	Herb	Rubiaceae	45	H A
10	<i>Blumea wightiana</i> DC.	Herb	Asteraceae	99	H A V
11	<i>Eupatorium odoratum</i> L.	Herb	Asteraceae	57	H A V
12	<i>Canscora diffusa</i> (Vahl.) R. Br.	Herb	Gentianaceae	58	H A
13	<i>Physalis minima</i> L.	Herb	Solanaceae	60	H A V
14	<i>Vandellia crustacea</i> (L.) Benth.	Herb	Scrophulariaceae	98	H A V
15	<i>Alternanthera sessilis</i> Br.	Herb	Amaranthaceae	5	H A
16	<i>Phyllanthus maderaspatensis</i> L.	Herb	Euphorbiaceae	40	H A V
17	<i>Ficus glomerata</i> Roxb	Tree	Moraceae	25	H A
18	<i>Dimeria woodrowii</i> Stapf.	Herb	Poaceae	50	H A
19	<i>Isachne elegans</i> Dalz. ex Hook.	Herb	Poaceae	31	H V
20	<i>Ischaemum semisagittatum</i> Roxb.	Herb	Poaceae	42	H A V

Legend: H=Hyphal; A=Arbuscular; V=Vesicular.

## Conclusions

VA mycorrhizal association was observed in all the 20 plants species growing in the mine tailings. Although ecosystems are self-sustaining and have capacity to develop, the process of natural succession on degraded areas like mine wastelands would be much slow. This could lead to further degradation of the already degraded land and can have serious effect on the surrounding land. Hence, identification of VAM species already thriving on the fairly established land and their application would help the reclamation of iron ore mine wastelands.

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