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Effect of chromium sulphate amendment on soil mycobiota

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Abstract

Effect of chromium sulphate solution of different concentrations (0.25%, 1.0%, 1.5%, 2.0% and 3.0%) on soil mycobiota was studied. Up to a certain 1evel; the fungal diversity improved as a result of amendment with chromium sulphate solution. However, higher concentration (3%) led to marked decrease in the number of isolates. *Aspergillus flavus, A. niger, A. terreus. A. fumigatus, A. luchuuensis, Fusarium* spp., *Periconia byssoides* and a species of *Penicillium* could be isolated from soil treated with 3% chromium sulphate solution. Out of these, *A. fumigatus* and *Fusarium* spp. together accounted for more than 94% of isolates and may be tried for removal of chromium from industrial effluents.

Keywords:- *Tannery effluents, Chromium sulphate, Bioremediation*

Introduction

Indiscriminate disposal of industrial effluent leads to undesirable effects on the environment including the soil microbiota as well as growth, yield and chemical composition of various crops (Sharma and Habib, 1995). Effluents of leather tanneries are no exception (lyer *et al*., 1952; Padmani, 1976). More and more tanneries are now shifting to chrome tanning resulting in increased quantities of chromium sulphate in the effluents. Hence, the effect of chromium sulphate on the soil mycobiota needs to be studied not only to get better understanding of the impact of effluents emanating from chrome-tanning units on the environment, but also to search those fungal strains, which can tolerate and remove chromium from tannery waste water (Raman *et al*., 2002). The present study was undertaken to study the effect of chromium sulphate amendment on soil mycobiota.

Materials and Method

Approximately 75 gm of air-dried, sieved soil was taken in each of 48 disposal plastic pots with a small hole at the bottom of each, 8 pots were kept saturated with 0.25%, 1.0 %, 1.5%, 2%.and 3% solutions of chromium sulphate. The pots treated with distilled water served as control. After 20 days, 4 pots were randomly picked from control sets as well as each of the treatment sets. The soil from all the four pots taken from a given set was mixed thoroughly aseptically in a fresh polythene bag. In this way, 6 composite samples were prepared, which were analyzed for fungal mycobiota. Dilution plate method as followed earlier by Singh and Charaya (1975) was adopted in present study. Twenty grams of soil from each sample were suspended in sterilized water to give a dilution of 1: 10. From this, further dilutions of 1: 100, 1: 1000 and 1: 10000 were prepared. One-ml. aliquots of each of last of the 3 dilutions were added aseptically to four Petridishes each. Sterile and cooled Czapek's agar medium was added to the plates, which were incubated at 25±2 °C for 5-8 days for identification. For the purpose of calculation of frequencies of fungi, each petri dish was treated as a quadrat. The frequency class was expressed as mention by Saksena (1955).

Results and Discussion

In all, 28 species of fungi were isolated from the

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Table-1: Frequency (F), total number of isolate (T I) and percentage isolates (P I) of fungi colonizing soil amended with chromium sulphate solution of different concentrations (Values are means of three replicate of each treatments)

Fungal species	Control			Soil amended with Chromium sulphate solution														
				0.25 %			1.00 %			1.50 %			2.00 %			3.00 %		
	F	T1	P1	F	T1	P1	F	T1	P1	F	T1	P1	F	T1	P1	F	T1	P1
A. flavus	I	1	0.46	II	2	0.75	II	2	0.62	II	6	1.50	II	5	2.22	I	1	0.71
A. humicola	-	-	-	-	-	-	-	-	-	I	2	0.50	-	-	-	-	-	-
A. niger	IV	29	13.3	II	3	1.13	IV	29	9.03	III	16	4.01	III	5	2.23	II	6	4.31
A. terreus	II	3	1.38	-	-	-	III	8	2.49	II	7	1.75	II	3	1.33	I	1	0.71
A. fumigatus	III	8	3.66	III	10	3.76	III	22	6.85	IV	68	17.04	V	59	26.2	V	62	44.6
A. luchuensis	II	2	0.92	-	-	-	II	4	1.25	II	4	1.00	I	3	1.33	I	1	0.71
A. funiculosus	-	-	-	I	7	2.63	-	-	-	I	3	0.75	-	-	-	-	-	-
A. versicolor	I	1	0.46	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
A. flavus sclerotial	V	-	-	-	-	-	II	8	2.49	-	-	-	-	-	-	-	-	-
Alternaria citri	-	-	-	-	-	-	I	1	0.31	-	-	-	-	-	-	-	-	-
Fusarium sp.1	I	168	77.1	V	238	89.5	V	217	67.6	V	265	66.42	IV	130	57.8	IV	56	40.29
Fusarium sp.2	-	1	0.46	-	-	-	I	1	0.31	I	1	0.25	-	-	-	-	-	-
Fusarium sp.3	I	-	-	I	2	0.75	-	-	-	-	-	-	-	-	-	-	-	-
Fusarium sp.4	-	1	0.46	-	-	-	I	1	0.31	-	-	-	-	-	-	-	-	-
Emericella rugulosa	-	-	-	I	1	0.38	-	-	-	II	2	0.50	-	-	-	-	-	-
Papulospora sp.	I	-	-	-	-	-	I	1	0.31	II	6	1.50	II	3	1.33	-	-	-
Pycnidial sp. uniden	I	1	0.46	-	-	-	II	2	0.63	-	-	-	-	-	-	-	-	-
Periconia byssoides	I	1	0.46	I	1	1	-	-	-	-	-	-	I	4	1.78	II	7	5.03
Penicillium sp.1	-	-	-	-	-	-	III	15	4.67	II	15	3.75	II	7	3.11	II	2	1.43
Penicillium sp.2	-	-	-	-	-	-	I	4	1.25	_	-	-	-	-	-	-	-	-
Penicillium sp.3	-	-	-	-	-	-	II	2	0.62	-	-	-	-	-	-	-	-	-
Penicillium sp.4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Penicillium sp.5	-	-	-	-	-	-	-	-	-	II	2	0.50	-	-	-	-	-	-
Myrothecium sp	-	-	-	-	-	-	-	-	-	II	2	0.50	-	-	-	-	-	-
Cladosporium sp	-	-	-	II	2	0.75	I	1	0.31	-	-	-	-	-	-	-	-	-
Verticillium sp	-	-	-	-	-	-	II	2	0.62	-	-	-	II	2	0.89	-	-	-
S. communis	-	-	-	-	-	-	I	1	0.31	-	-	-	-	-	-	-	-	-
Sporotrichum sp.	-	-	-	-	-	-	-	-	-	-	-	-	I	4	1.78	II	3	2.15
Total	216			266			321			399			225			139		

control soil samples as well as from those treated with chromium sulphate solution of different concentrations (Table-1). The number of species isolated from treated with 0.25%, 1.0 % and 1.5 % chromium sulphate solution were higher than that isolated from control soil. The numbers of species isolated from the soil treated with 2% chromium sulphate solution were equal to these isolated from control. However, the number of species decreased in the soils treated with 3% chromium sulphate solution. Thus, in general, an increase in the concentration of chromium sulphate solution resulted in increase in the fungal diversity up to 2% concentration. In the soil treated with 0.25% concentration solution, of course, lesser number of species was isolated. However, at this stage there was preponderance of *Fusaria*. This is in contrast with observations of Rai *et al.* (1995) that the treatment with chromium chloride, up to 200 ppm, *in-vitro*, markedly inhibited the growth of *Fusarium*. In the present study, the population of *Fusarium* sp-L, exhibited increasing trend with increase in the concentration of chromium sulphate solution up to 1.5% concentration. *A. flavus, A. niger, A. terreus, A. fumigatus, A.luchuensis, Fusarium* sp.l, *Periconia byssoides* Sporotrichum sp, and species of *Penicillium* could be isolated from soil treated with 3% chromium sulphate solution. Out of these, *A. fumigatus* and *Fusarium* sp.l together accounted for more than 94% of the isolates reflecting their tolerance to chromium. In their studies with chromium chloride, Rai *et al.* (1995) found that *Penicillium rugulosum* and *Fusarium oxysporum* are least affected by low concentration of chromium. It appears that these fungi has the ability to detoxify chromium.

Raman *et al.* (2002) have found that the fungi *Laccaria laccata* and *Suillos bouinus* show increased protein content when exposed to high doses of chromium, they believed that there was increased production of phosphatase enzyme to overcome stress. Stress alleviation through metal accumulation in polyphosphate granules in the hyphae of *Pisolithus tinctorius* have been found copper and zinc (Tam, 1995). It would be worthwhile to find out whether this happened with chromium sulphate also. In any case, the present investigation has revealed that *Fusarium* species are also highly tolerant to chromium sulphate through slightly lesser than *A. fumigatus*. *A. fumigatus* is already grown on chrome waste to leach out chromium (Kamtni *et al.,* 1999). It would beworthwhile to try *Fusarium* species or a combination of both of them for the same purpose.

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