

## STUDIES ON THE EFFECT OF *EUCALYPTUS* PLANT MATERIAL AMENDMENT ON THE POPULATION DYNAMICS OF SOIL MICROFUNGI

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In the present investigation population dynamics of soil microfungi in relation to ecological factors were studied after 10, 20 and 30 days of amendment. The *Eucalyptus* plant attached leaves (powdered) material was used to amend the cultivated agricultural soil in the concentration of 1.0, 1.5, 2.0, 5.0 and 10.0%. The mycoflora of amended soils were studied both qualitatively and quantitatively in relation to pH, temperature, moisture, nitrogen, organic carbon, organic matter, available phosphorous, exchangeable Na, Ca, K and soluble carbonate. Definite variation with amendments have been observed for soil fungi in cultivated soil. The soil mycoflora comprised of 36 fungal isolates, out of these 6 belonged to phycmycetes, 1 to ascomycetes, 24 to deuteromycetes and 5 to mycelia sterilia. The genera arranged in decreasing order of number of species were *Aspergillus*, *Fusarium*, *Penicillium*, *Mucor*, *Rhizopus*, *Chaetomium* and *Drechslera*.

**Keywords:** Amendment; Cultivated soil; Microfungi.

### Introduction

The soil microbial biomass is responsible for break down of the organic materials. The tissues of the plants are dumped or buried in the soils subsequently that undergoes biological decomposition. It is the microbes that make these changes. For improving the fertility of soil, application of organic manure, fertilizers and plant materials were used. These amendments may affect the soil ecosystem and physico-chemical characteristics of soil. The physico-chemical characteristics and soil microflora are of great significance in microbiology<sup>1-4</sup>. In the present study an attempt has been made to analyse the effect of *Eucalyptus* plant attached leaves enrichment on fungal population in soils at different time intervals.

### Material and Methods

The agricultural cultivated soil was collected from the farmer field. For amendments soil samples were collected aseptically, air dried, sieved and stored in screw capped bottles. To these soil samples 1.0, 1.5, 2.0, 5.0 and 10.0 percent solution (w/w) of attached leaves (powdered) was added. The soil fungi were isolated following soil plate method<sup>5</sup> using Martin rose Bengal medium<sup>6</sup>. Natural soil samples without any amendment to serve as control were also similarly maintained. The isolation were made on 10, 20 and 30 days after amendments. Physico-chemical characteristics of attached leaves amended soils were analysed as per the prescribed methods<sup>7,8</sup>.

### Result and Discussion

Soil mycoflora of amended soil at varying time intervals comprised of 36 fungal isolates (Table 1). Out of these, 6

species belonged to phycmycetes, 1 to ascomycetes, 24 to deuteromycetes and 5 to mycelia sterilia.

The generic wise representation was dominated by *Aspergillus* with 9 species, followed by *Fusarium* (3 species) while, *Mucor*, *Rhizopus*, *Penicillium* and *Trichoderma* were represented with 2 species each, and Mycelia sterilia were represented by 5 species. Moreover, single species were isolated for *Chaetomium*, *Acrophialophora*, *Memmoniella*, *Macrophomina*, *Myrothecium*, *Paecilomyces*, *Syncephalastrum* and *Cunninghamella*.

In the present study a higher fungal population was recorded in amended soils in comparison to unamended soil after 10 days of amendment. Many workers have reported the beneficial effect of amendments in increasing the fungal population and ascribed the higher nutrient supply as the reason for it<sup>3,9-18</sup>. It is also clear from the data (Table 2) that fungal population of amended soils decreased with the increase of incubation period. The reason for it may be the soil inhabitants, hence they increased in number as revealed after 10 days of amendment, but at later stages nutrient level decreases and consequently fungal counts get lowered.

Physico-chemical properties of cultivated soil amended with different percentages (1.0, 1.5, 2.0, 5.0 and 10.0%) of attached leaves of *Eucalyptus* plant after an incubation of 10, 20 and 30 days have been presented in Table-3. After 10 days interval, soil temperature decreased from 37.3° C (1%) to 36.4 °C (10%) and an increase in soil moisture from 3.18%(1%) to 16.0%(10%). There was an all



**Table 2.** Total microbial counts of attached leaves (powdered) amended cultivated soil after 10 days (a), 20 days (b) and 30 days (c) of incubation. (Expressed in terms of mean log values log<sub>10</sub> colony forming unit (C.F.U.)/gram

S.N.			Cultivated soil				
			1%	1.5%	2%	5%	10%
1.	Fungal	a	4.598	4.684	4.713	4.482	4.487
2.	Bacterial	a	5.029	5.117	5.139	4.907	4.917
3.	Actinomycetes	a	4.828	4.919	4.951	4.716	4.724
4.	Fungal	b	4.496	4.616	4.681	4.421	4.487
5.	Bacterial	b	4.910	5.031	5.100	4.841	4.907
6.	Actinomycetes	b	4.699	4.824	4.892	4.637	4.699
7.	Fungal	c	4.362	4.447	4.616	4.404	4.467
8.	Bacterial	c	4.776	4.865	5.036	4.826	4.890
9.	Actinomycetes	c	4.564	4.656	4.828	4.616	4.684

**Table 3.** Physico-chemical characterization of cultivated soil with amendment of attached leaves (powdered) after 10 days(a), 20 days (b) and 30 days (c) interval.

S.N.	Physico-chemical characteristics		Cultivated soil				
			1%	1.5%	2%	5%	10%
1.	Soil Temperature	a	37.30	37.40	36.41	36.4	36.4
2.	Soil Moisture	a	3.18	4.01	5.12	10.99	16.00
3.	Soil pH	a	7.5	7.7	7.7	6.5	8.8
4.	Water Holding capacity	a	31.00	31.92	43.21	53.82	60.71
5.	Organic Carbon	a	0.67	0.75	0.45	0.75	0.95
6.	Total Nitrogen	a	0.057	0.064	0.038	0.065	0.083
7.	Organic Matter	a	1.155	1.296	0.78	1.293	1.655
8.	Available P (ppm)	a	2000	1500	1000	2500	3000
9.	Exchangeable Na	a	12.35	12.35	17.72	20.12	20.12
10.	Exchangeable Ca	a	1600	14.30	12.70	800	742
11.	Exchangeable K	a	10.32	10.32	11.50	1300	1400
12.	Soluble Carbonate	a	2800	3400	5200	6000	8000
1.	Soil Temperature	b	38.50	38.10	37.13	37.40	37.31
2.	Soil Moisture	b	2.33	3.66	4.99	10.00	15.6
3.	Soil pH	b	7.8	8.0	7.9	7.0	8.7
4.	Water Holding capacity	b	31.56	32.79	43.93	54.20	61.10
5.	Organic Carbon	b	0.66	0.74	0.44	0.76	0.94
6.	Total Nitrogen	b	0.056	0.063	0.038	0.065	0.081
7.	Organic Matter	b	1.137	1.279	0.761	1.310	1.620
8.	Available P (ppm)	b	21.11	14.80	10.50	2500	3100
9.	Exchangeable Na	b	12.22	12.00	17.11	2000	26.30
10.	Exchangeable Ca	b	15.90	14.00	12.00	7.50	7.00
11.	Exchangeable K	b	10.10	10.30	11.10	12.50	13.17
12.	Soluble Carbonate	b	27.89	33.40	51.30	59.40	79.20
1.	Soil Temperature	c	39.20	38.85	37.99	38.90	38.00
2.	Soil Moisture	c	1.46	2.78	4.01	9.09	14.72
3.	Soil pH	c	7.4	8.7	8.7	7.7	8.7
4.	Water Holding capacity	c	31.99	33.01	44.01	54.96	61.93
5.	Organic Carbon	c	0.66	0.73	0.43	0.78	0.45
6.	Total Nitrogen	c	0.056	0.063	0.037	0.067	0.081
7.	Organic Matter	c	1.137	1.262	0.743	1.344	1.637
8.	Available P (ppm)	c	22.00	16.00	11.00	25.50	31.70
9.	Exchangeable Na	c	11.98	11.90	16.91	19.40	25.70
10.	Exchangeable Ca	c	15.81	13.50	11.50	6.30	6.98
11.	Exchangeable K	c	10.00	10.00	10.90	11.00	13.00
12.	Soluble Carbonate	c	26.97	32.90	50.90	58.70	78.70

**Table 4.** Correlation coefficients 'r' and their calculated 't' values obtained between physico-chemical factors and microbial population of attached leaves amended cultivated soil.

S.No.	Factor	Fungi	Bacteria	Actinomycetes
1.	Soil Temperature	r=-0.22232 t=0.84326	r=-0.24408 t=0.93579	r=-0.27139 t=1.05631
2.	Soil Moisture	r=-0.31426 t=1.19354	r=-0.29194 t=1.10054	r=-0.26457 t=0.98196
3.	Soil pH	r=0.06118 t=0.22099	r=0.04133 t=0.14915	r=0.04133 t=0.14915
4.	Water Holding capacity	r=-0.32027 t=1.21896	r=-0.30363 t=1.14899	r=-0.28021 t=1.05247
5.	Organic Carbon	r=-0.56205 t=2.45011*	r=-0.52346 t=2.2150*	r=0.223768 t=4.3041**
6.	Total Nitrogen	r=-0.49174 t=2.03618	r=-0.49174 t=2.03618	r=-0.24403 t=0.90729
7.	Organic Matter	r=-0.55975 t=2.43550*	r=-0.53796 t=2.30096*	r=0.50662 t=2.11866
8.	Available P (ppm)	r=-0.72520 t=3.79748**	r=-0.70542 t=3.58837**	r=0.15164 t=0.55314
9.	Exchangeable Na	r=-0.22093 t=0.81675	r=-0.22093 t=0.81675	r=-0.1963 t=0.72181
10.	Exchangeable Ca	r=0.33209 t=1.26941	r=-0.12977 t=0.47188	r=-0.63904 t=2.99554*
11.	Exchangeable K	r=-0.20954 t=0.77266	r=0.901287 t=0.04640	r=0.870646 t=6.38156**
12.	Soluble Carbonate	r=-0.17223 t=0.63040	r=0.501617 t=2.09066	r=-0.92212 t=8.59312**

\* Significant at 5% level of significance

\*\* Significant at 1% level of significance

round increase in pH values. In attached leaves amended cultivated soil the values of water holding capacity were 31.0% in (1%) soil and 43.21%, 53.82% in (2%) and 5% soil respectively. Exchangeable Na, K values increased with the increase of amendment. Similar condition was also seen in soluble carbonate content. After an incubation of 20 and 30 days increased values of soil temperature and water holding capacity was recorded with the increase in amendment. The total nitrogen percentage was slightly lesser than 10 days of attached leaves amended soil. Exchangeable Na, Ca and K values were lesser in comparison to 10 and 20 days of amendment.

The distribution of microbial count was surely affected by edaphic factors and for this detailed analyses of various physico-chemical characteristics of cultivated soil amended with *Eucalyptus* plant attached leaves (powdered) material was done. The correlation coefficients 'r' and their calculated 't' values were obtained between physico-chemical characteristics and microbial population in respective amendment (Table 4).

In case of attached leaves amended soils, no

significant correlation was observed between temperature and microbial population. Tresner *et al*<sup>19</sup> and England and Rice<sup>20</sup> are of the opinion that temperature affects fungal counts/ population. Many workers<sup>5,21,22</sup> are of the opinion that soil microorganisms are greatly influenced by differences in soil reaction (pH) and thrive in both acidic and alkaline soils. In present study significant correlation has been observed between microbial population and pH of the soil. Cobb<sup>23</sup>, Eggleton<sup>21</sup> and Manoharachary<sup>25</sup> have failed to observe positive correlation with fungal, bacterial and actinomycetes numbers. Organic carbon displays significant correlation with fungal, bacterial and actinomycetes numbers.

The most significant correlation was established in *Eucalyptus* attached leaves amended soil and organic matter. Number of workers<sup>22,26,27</sup> have observed positive effect of phosphorus on fungal numbers. Whereas inverse correlation with fungal population and available phosphorus has been established by Agarwal<sup>28</sup> and Ramarao<sup>29</sup>. Present study also showed negative correlation with available phosphorus. Kadrekar and Kibe<sup>30</sup> observed

a relationship between soil texture and potassium content of the soil. Agrawal<sup>28</sup> established positive correlation between fungal population and exchangeable potassium in wasteland soil and no clear correlation in agriculture and forest land. In the present investigation also cultivated soil amended with attached leaves show no clear correlation. Ramakrishnan<sup>27</sup> also observed no positive correlation with fungi and exchangeable potassium content of the soil.

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