

## ANTAGONISTIC ACTIVITY OF ACTINOMYCETES IN SALINE SOILS OF SANGLI DISTRICT

V. V. Chougule, A. R. Jadhav\* and A. M. Deshmukh\*\*

Department of Microbiology, Miraj Mahavidyalaya, Miraj-416 410, Maharashtra

\*Department of Microbiology, KRP Kanya Mahavidyalaya, Islampur-415 409, Maharashtra

\*\*P.G. Department of Microbiology, Dr. B. A. Marathwada University, Sub-centre, Osmanabad-413 501, Maharashtra

### ABSTRACT

One hundred and ninety five actinomycetes were isolated from partial saline soils and 124 actinomycetes from deep saline soils of Sangli district in Maharashtra. All the actinomycetes were tested for antifungal activity against *Candida albicans*, *Aspergillus niger*, *Trichoderma viridae* and *Verticillium lecanii* by agar overlay method. It was found that out of 195 and out of 124 actinomycetes, isolated from partial saline and deep saline soils of Sangli, showed 12.30%, 23.07%, 35.38% and 38.46%, and 4.83%, 33.87%, 38.70% and 50.80% antagonistic activity against *Candida albicans*, *Aspergillus niger*, *Trichoderma viridae* and *Verticillium lecanii* respectively.

### INTRODUCTION

Actinomycetes have been described as the greatest source of antibiotics since Waksman introduced *Streptomyces* into his systematic screening program for new antibiotics in the early 1940. Actinomycetes have provided about two-thirds (more than 4000) of the naturally occurring antibiotics discovered, including many of those important in medicine, such as aminoglycosides, amtheracyclines, chloramphenicol,  $\beta$ -lactams, macrolides and tetracyclines. Antagonistic activity of actinomycetes has already been studied but antagonistic activity of actinomycetes in saline soils has not been studied much.

Waksman & Woodruff (1942) concluded that antagonistic actinomycetes against bacteria and fungi are widely distributed in nature, mainly in soil and compost. They further reported antagonistic activity in 106 cultures (43.4%) out of 244 cultures isolated from soils, and 49 (20%) were found highly antagonistic. Saline soils of Sangli district is catagorised in partial and deep saline soils. A detailed investigation on the antagonistic activity of actinomycetes against fungi in partial saline and deep saline soils was undertaken and results are presented in this paper.

### MATERIALS AND METHODS

The antimicrobial activity of the isolates was tested using four-test microorganisms by agar overlay technique (Locci 1989). Following four fungal cultures were used as test microorganism representing plant pathogens and common pest control microorganisms. *Candida albicans*, *Aspergillus niger*, *Trichoderma viridae* and *Verticillium lecaniae*. Previously isolated and identified cultures were selected for the study

The isolates were spot inoculated on nutrient agar plates and the plates were incubated at 30°C for 5 days. The 5-day old actinomycete colonies on agar were killed by inverting the plates with 1.5 mL chloroform for 40 min on nutrient agar plates. After removal of excess of chloroform vapors, the

plates were overlaid with 5 mL sloppy agar (0.7% w/v Sabouraud's agar) inoculated with a test microorganism. 0.2 mL suspension of test microorganism containing  $10^{10}$  cells per mL was used. The plates were allowed to solidify and incubated at 30°C for 24 hrs. The zones of inhibition around the colonies were recorded.

The antimicrobial activity was designated as per Casida (1984) as:

- A. - = No inhibition  
 B. + = < 10mm zone of inhibition  
 C. ++ = 10-20 mm zone of inhibition  
 D. +++ = > 20 mm zone of inhibition

## RESULTS AND DISCUSSION

It is observed from the Tables 1 and 2, and Figs. 1 and 2 that out of 195 actinomycetes, isolated from partial saline soils and out of 124 from deep saline soils of Sangli, 12.30%, 23.07%, 35.38% and 38.46%, and 4.83%, 33.87%, 38.70% and 50.80% showed antagonistic activity against *Candida albicans*, *Aspergillus niger*, *Trichoderma viridae* and *Verticillium lecanii* respectively.

It is also observed from the Table 1 that the percentage of isolates out of total isolates from partial saline soils, showing good (>20) inhibitory activity against *Candida albicans*, *Aspergillus niger*, *Trichoderma viridae* and *Verticillium lecanii* were 0, 1.53, 4.61 and 9.23 respectively.

It is also observed from the Table 2 that the percentage of isolates out of total isolates from deep saline soils, showing good (>20) inhibitory activity against *Candida albicans*, *Aspergillus niger*, *Trichoderma viridae* and *Verticillium lecanii*, were 0.0, 9.67, 4.83 and 2.41 respectively. It is also observed that partial saline and deep saline soil actinomycete isolates are most active against *Verticillium lecanii*.

Table 1: Percentage of antagonistic activity of actinomycetes against fungi in partial saline soil.

Sr.No.	Test fungi	Total No.		Zone of inhibition							
		A+B+C		>20mm (A)		10-20mm(B)		<10mm(C)		Absence of zone	
		No.	%	No.	%	No.	%	No.	%	No.	%
1	<i>Candida albicans</i>	24	12.30	0	0	6	3.07	18	9.23	171	87.69
2	<i>Aspergillus niger</i>	45	23.07	3	1.53	15	7.69	27	13.84	150	76.92
3	<i>Trichoderma viridae</i>	69	35.38	9	4.61	30	15.38	30	15.38	126	64.61
4	<i>Verticillium lecanii</i>	75	38.46	18	9.23	24	12.30	33	16.92	120	61.53

Table 2: Percentage of deep saline soil actinomycetes showing antagonistic activity against different test microorganisms.

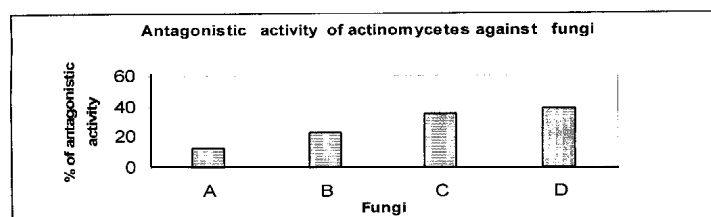
Sr.	Test microorganism	Total No.		Zone of inhibition							
		A+B+C		>20mm (A)		10-20mm(B)		<10mm(C)			
		No.	%	No.	%	No.	%	No.	%		
1	<i>Candida albicans</i>	6	4.83	-	-	-	-	-	-	6	4.83
2	<i>Aspergillus niger</i>	42	33.87	12	9.67	6	4.83	24	19.35	24	19.35
3	<i>Trichoderma viridae</i>	48	38.70	6	4.83	12	9.67	30	24.19	30	24.19
4	<i>Verticillium</i>	63	50.80	3	2.41	9	7.25	51	41.12	51	41.12

Antagonistic activity of actinomycetes against fungi is reported by Tims (1932), McCormack (1935), Mukherjee & Nandi (1955), Krassiinikov (1959), Gushcherov & Ginchera (1962), Ghule (1968), Reddi & Rad (1971), Antoun et al. (1978), Sharma et al. (1980), Tulemisova & Chormonova (1989), Chaphalkar (1993), Shejul (1998), Kulkarni (1999), Frandberg et al. (2000), Lee & Hwang (2002) and Jadhav & Deshmukh (2003).

Generic distribution of antagonistic actinomycetes against fungi is given in Table 3. It is seen that the member of the genera *Streptomyces*, *Micromonospora* and *Nocardiosis* isolated from partial

Table 3: Generic distribution of actinomycetes antagonistic to various groups of microorganisms.

Sr. No.	Actinomycete	No. tested	Active against fungi in PSS	Active against fungi in DSS
1	<i>Streptomyces</i>	91	21	20
2	<i>Streptovorticillium</i>	34	1	0
3	<i>Micromonospora</i>	19	10	6
4	<i>Nocardiosis</i>	12	9	9
5	<i>Dactylosporangium</i>	9	-	-
6	<i>Streptosporangium</i>	8	-	-
7	<i>Nocardia</i>	6	-	-
8	<i>Nocardioides</i>	4	-	-
9	<i>Actinoplanes</i>	3	-	-
10	<i>Thermoactinomycetes</i>	3	-	-
11	<i>Thermomonospora</i>	2	-	-
12	<i>Actinopolyspora</i>	2	-	-
13	<i>Saccharopolyspora</i>	2	-	-
	<b>Total</b>	<b>195</b>	<b>41</b>	<b>35</b>



A. *Candida albicans*, B. *Aspergillus niger*, C. *Trichoderma viridae*, D. *Verticillium lecanii*.

Fig.1: Antagonistic activity of actinomycetes against fungi in partial saline soils.

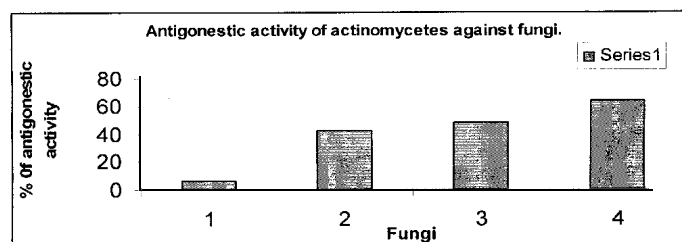


Fig.2: Antagonistic activity of actinomycetes against fungi in deep saline soils.

and deep saline soils were possessing antagonistic activity against fungi *Candida albicans*, *Aspergillus niger*, *Trichoderma viridae* and *Verticillium lecanii*. The members of *Streptovercillium*, isolated from partial saline soils, show their antagonistic activity only against *Verticillium lecanii*. Other isolates are not active against the fungi tested.

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