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ACTINOMYCETES POPULATION OF RUBBER GROWING SOILS AND ITS ANTAGONISTIC ACTIVITY AGAINST *PHYTOPHTHORA MEADII* (Mc RAE)

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The population of bacteria, fungi and actinomycetes in fifteen rubber growing soils was estimated. The occurrence of actinomycetes antagonistic to *Phytophthora meadii* (Mc Rae) and the extent of inhibitory activity were studied. In general, the population of bacteria was more than that of both fungi and actinomycetes and they varied widely in different soil samples. All soil samples, irrespective of the pH and microbial population, harboured actinomycetes antagonistic to *P. meadii* and majority of these isolates had inhibition zones upto 15 mm when tested by cross streak assay. Inspite of the presence of such large number of actinomycetes antagonistic to *P. meadii*, various diseases caused by this pathogen reoccurred every year.

Key words – Actinomycetes, Antagonism, *Phytophthora meadii*.

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INTRODUCTION

Soil is the treasure house of many useful micro-organisms and amongthem the actinomycetes are of particular importance, since they are capable of producing antibiotics. The richness of soil actinomycetes as a source of antagonistic micro-organisms, has been well understood (Waksman and Woodruff, 1940). About 20 per cent of the actinomycetes in soils exhibit antagonistic properties (Waksman and Woodruff, 1940; Waksman *et al.*, 1942) and they play an important role in the control of soil borne plant pathogens (Likais, 1952; Baker and Cook, 1974). Different species of *Phytophthora* cause diseases like abnormal leaf fall, fruit and shoot rots, patch canker and black stripe in *Hevea* (Radhakrishna Pillay *et al.*, 1980; Radhakrishna Pillay and George, 1980). The modern approach in the management of diseases caused by soil-borne plant pathogens is the use of bio-control agents and an understanding of the antagonistic actinomycetes in rubber growing soils may be of much use, when biological control measures are thought of. This study reports the presence of actinomycetes antagonistic to *P. meadii*.

MATERIALS AND METHODS

Surface, 0–15 cm depth, soil samples were collected from fifteen locations under different agroclimatic conditions and at various stages of growth of rubber plants. The populations of total bacteria, fungi and actinomycetes were estimated by serial dilution plate method of Timonin (1940) using soil extract agar, Martin's rose bengal agar

and Kenknight's agar, respectively. The actinomycete colonies were transferred to nutrient glucose agar slants after purification and tested for the inhibitory activity against *P. meadii* obtained from RRII culture collection using cross streak assay technique (Grove and Randall, 1955) employing potato dextrose agar medium. Actively growing cultures of actinomycetes were streaked at one end of the petridish and 5 mm size culture discs of *P. meadii* were placed in the opposite end and incubated at room temperature. After seven days the plates were examined for the inhibitory activity. The actinomycetes antagonistic to *P. meadii* were enumerated and the percentage of antagonism was calculated. The inhibitory zone of each isolate was also measured and the isolates showing inhibitions upto 3 mm, 3 to 15 mm and 15 to 25 mm were recorded and their percentage among the isolates of antagonistic actinomycetes was calculated. The pH of the soil was estimated using a pH meter.

RESULTS AND DISCUSSION

Observations on the microbial population in rubber growing soils are presented in Table 1. All the soils were of lateritic type and acidic, and differed widely in microbial population. Bacterial counts were more in all samples than were fungi and actinomycetes. As reported by Subba Rao (1977), cultivated soils are usually rich in bacterial flora. There was no relation between soil pH and different groups of microbial population or among different groups of microorganisms themselves. Kest and Tonkin (1983) also got similar results in soils of Western Australia. The per cent of actinomycetes inhibiting *P. meadii* in different soils range from 12.5 to 84.6 and twelve out of fifteen soils contained over 40 per cent actinomycetes which inhibited *P. meadii*.

Table 1. Microbial population in rubber growing soils (10^4/g on dry weight basis)

Sl. No.	Location		District	Soil pH	Population		
					Bacteria	Fungi	Actinomycetes
1	Allamachalai	D	Kanyakumari*	5.5	118.61	2.38	8.13
2	Manalodi	D	Kanyakumari*	5.2	117.98	3.65	6.21
3	Keeripparai	D	Kanyakumari*	6.5	185.23	4.08	1.85
4	Kulasekharam	D	Kanyakumari*	5.3	73.63	2.58	4.02
5	Chethackal	B	Pathanamthitta +	5.2	112.81	4.09	10.82
6	Kaliyar	D	Idukki +	5.2	98.20	4.03	14.85
7	Lahai	D	Pathanamthitta +	5.3	35.65	1.69	4.07
8	Chethalvetty	B	Quilon +	5.4	161.05	3.04	6.63
9	Iritty	D	Cannanore +	5.7	109.77	3.78	6.57
10	Pullengode	C	Malappuram +	5.8	109.70	3.53	6.40
11	Karikkattoor	A	Kottayam +	5.8	45.24	4.32	2.60
12	Mundakayam	D	Idukki +	6.1	86.84	1.94	7.74
13	Thirumbady	B	Calicut +	6.2	71.03	0.90	3.03
14	Kinaloor	C	Calicut +	6.4	51.86	4.46	8.51
15	Vellanikkara	B	Trichur +	6.4	41.36	2.41	9.73

* Tamil Nadu State

\+ Kerala State

A Nursery
B Young new planted rubber
C Young replanted rubber
D Mature rubber

As seen from Table 2 most of the antagonistic actinomycetes had an inhibitory zone upto 15 mm and only in seven soils they showed inhibition zones over 15 mm and the per cent was also very small. The occurrence of fairly large number of antagonistic actinomycetes in acidic laterite soils is not uncommon. Rangaswami and Obliswami (1967) reported the presence of more actinomycetes having inhibitory activity in Pollibetta laterite soil which contains more organic carbon and soil moisture.

Table 2. Inhibition of *Phytophthora meadii* by antagonistic actinomycetes

Sl. No.	Location	Number of isolates examined	Percentage of actinomycetes inhibitting *P. meadii*	Percentage of antagonistic actinomycetes possessing different levels of inhibition		
				Upto 3 mm	3 to 15 mm	15 to 25 mm
1	Allamchalai	41	46.30	13	87	—
2	Manalodi	22	50.00	50	50	—
3	Keeripparai	32	45.45	20	80	—
4	Kulasekharam	42	66.67	38	50	12
5	Chethackal	45	40.00	32	68	—
6	Kaliyar	46	29.80	37	63	—
7	Lahai	26	84.60	68	27	5
8	Chethalvetty	24	12.50	67	33	—
9	Iritty	38	47.35	41	26	33
10	Pullengode	34	47.05	13	87	—
11	Karikkattoor	26	42.30	28	63	9
12	Mundakayam	50	48.50	57	43	—
13	Thirumbady	28	35.70	51	29	20
14	Kinaloor	23	60.90	70	15	15
15	Vellanikkara	26	65.40	58	35	7

In spite of the presence of such large numbers of actinomycetes antagonistic to *P. meadii*, the various diseases of rubber caused by this pathogen appear every year when the environmental conditions like rainfall, humidity and temperature are favourable. The results of the present study are in conformity with that of Kest and Tonkin (1983) who observed die back of Jarrah and other understorey species caused by *P. cinnamomi*, inspite of enhanced population of antagonistic actinomycetes. This may probably be due to (1) the development of resistance to many antibiotics produced by actinomycetes, (2) production of very low concentration of the chemicals which are ineffective, (3) though they exhibit antagonism *in vitro* they may not produce any antibiotics *in vivo*, (4) even if antibiotics are produced in the soil, they might have been adsorbed over soil particles and (5) detoxification by several micro-organisms in

soil and one or several of these factors might be responsible for the failure of actinomycetes in checking the pathogen (Campbell, 1983).

The other major source of inoculum of *P. meadii* is infected and dried plant materials of the previous season (Mc Rae, 1919) which might be responsible for the perpetuation of this disease. Detailed investigations on the exploitation of the actinomycetes in the bio-control of rubber diseases caused by *P. meadii* are needed.

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