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Tolerance of Certain Pesticides by Two Nitrogen Fixing Anoxygenic Phototrophic Bacteria

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ABSTRACT

The tolerance of some pesticides by two anoxygenic phototrophic bacteria, isolated from leather industry effluents, was investigated. *Rhodobacterium capsulatus* was found to be more resistant than *Rhodopseudomonas acidophila* to the pesticides tried in the present investigation. The pattern of inhibition of growth for both the organisms show that chlorpyrifos was most potent followed by methyl parathion, endosulfan, rogor and kitazin in a descending order.

INTRODUCTION

Pesticides reaching the soil affect non-target organisms and their activities. They adversely affect plant growth and crop production. Anoxygenic phototrophic bacteria are one of the major groups of microorganisms existing in high numbers in paddy soils and contributing significantly to soil fertility (Hable & Alexander 1980). Carbendazim was shown to be photoassimilated by *Rps. palustris* strain as sole carbon and nitrogen source (Rajkumar & Lalitha Kumari 1992). Chalam et al. (1992) have reported the effect of pesticides on diazotrophic growth and nitrogenase activity of some anoxygenic phototrophic bacteria isolated from paddy soils. *Rhodoferax* species was reported to degrade phenoxy herbicides (Ehrig et al. 1997). Berne et al. (2005) have reported tributyl phosphate (TBP) degradation by *Rps. palustris* and other photosynthetic bacteria. In this study, tolerance of some pesticides Kitazin (S-benzyle 0,0-di-isopropyl phosphrothioate); Rogor(0,0-dimethyl S-methyl-carbamoyl methyl phosphorodithioate); Methyl parathion (0,0 dimethyl 0-4-nitrophenyl phosphorothioate); Endosulfan(6,7,8,9,10,10-hexachloro-1,5,5a,6,9,9a-hexahydro-6,9- methano-2,4,3-benzodioxathiopin-3-oxide); Chlorpyrifos (0,0-diethyl O-3,5,6-trichloro-2 pyridyl phosphorothioate) by two nitrogen fixing anoxygenic phototrophic bacteria was investigated.

MATERIALS AND METHODS

The anoxygenic photosynthetic bacteria were isolated by enrichment techniques (Biebl & Pfennig 1981) by adding effluent water sample into the Biebl and Pfennig's medium. The culture bottles, thus, prepared were incubated anaerobically in the light. Identification of bacteria isolated was done by studying the cultural, morphological and biochemical characteristics. Tolerance to various concentrations of pesticides was determined by inoculating 1mL log phase cultures of two anoxygenic phototrophic bacteria into 15 mL of liquid Biebl and Pfennig's medium with different concentrations of pesticides. The tubes were incubated at 32°C under the light intensity of 2000 lux in screw cap tubes. At the end of 7 days of incubation, growth and pH changes were determined. All the experiments were run in triplicate. Growth was determined by measuring optical density at 660 nm using UV-Vis spectrophotometer. Final pH was determined with the help of a pH meter.

Table 1: Effect of some pesticides on the growth of two anoxygenic phototrophic bacteria.

	Name of the organism						
	Rb. capsulatus			*Rps.acidophila*			
Pesticide (mg/L)	Growth (in O.D.)	Final pH	Inhibition (%)	Growth (in O.D.)	Final pH	Inhibition (%)	
Kitazin							
Control	1.15	7.2	-	0.96	5.8	-	
100	1.05	7.2	8.69	0.91	6	5.2	
200	0.98	7.4	14.78	0.88	6	23.47	
300	0.95	7.4	17.39	0.86	6	10.41	
400	0.88	7.4	23.47	0.79	6	17.7	
500	0.81	7.4	30	0.66	6	31.25	
600	0.68	7.4	40.86	0.58	6	39.58	
Rogor							
Control	1.15	7.2	-	0.96	5.8	-	
50	0.86	7.2	25.21	0.68	5.9	27.65	
100	0.78	7.4	32.17	0.62	5.9	35.41	
150	0.71	7.4	38.26	0.59	5.9	38.54	
200	0.65	7.5	43.47	0.54	5.9	43.75	
250	0.58	7.5	50	0.48	6	50	
300	0.36	7.5	68.69	-	6	-	
Methyl Parathion							
Control	1.15	7	-	0.96	5.9	-	
0.25	1.02	7.2	11.3	0.81	5.9	15.62	
0.5	0.93	7.2	19	0.53	5.9	44.79	
0.75	0.76	7.2	33.91	0.31	6	67.7	
1.0	0.62	7.4	46.08	-	6	-	
1.25	0.42	7.4	63.47	-	6	-	
1.5	-	7.4	-	-	6	-	
Endosulfan							
Control	1.15	7	-	0.96	5.6	-	
50	0.76	7.2	33.92	0.71	5.9	26.04	
100	0.72	7.4	37.39	0.58	6	39.58	
150	0.63	7.4	45.21	0.47	6	51.04	
200	0.56	7.4	51.3	0.32	6	66.66	
250	0.38	7.4	66.9	-	6	-	
300	-	7.4	-	-	6.2	-	
Chloropyriphos							Control
1.15	7.2	-	0.96	5.6	-		0.12
0.89	7.2	22.6	0.76	5.9	20.83		0.25
0.58	7.2	50	0.43	6	55.2		0.5
0.32	7.4	72.17	-	6	-		0.75
-	7.4	-	-	6	-		
1.0	-	7.4	-	-	6	-	

RESULTS AND DISCUSSION

The results of the study on effect of the pesticides on growth of the two anoxygenic phototrophic bacteria are given in Table 1. Of all the pesticides chlorpyrifos was the most potent as it inhibited the growth of *Rhodopseudomonas acidophila* even at low concentrations. *Rhodobacterium capsulatus* could survive about 0.5mg/L of chlorpyrifos, whereas *Rps. acidophila* could tolerate about 0.25mg/L concentration of the pesticide. Kitazin could not inhibit the growth of all the organisms under study even at a concentration of 600mg/L. Rogor and endosulfan were responsible for 50% growth inhibition of both the organisms at a concentration of about 250 mg/L. Methyl parathion inhibited the growth of *Rb. capsulatus* and *Rps. acidophila* at a concentration of 1.5 mg/L and 1.0 mg/L respectively. pH changes were marginal and towards alkaline side. In general, *Rb. capsulatus* was more resistant than *Rps. acidophila.* Brown et al. (1990) have reported that *Rps. palustris* and *Rc. gelatinosus* were less resistant than was *Rps. acidophila* to the herbicide atrazine. Such a species variation was also reported by Chalam et al. (1992). Higher resistance to pesticides of anoxygenic phototrophic bacteria than cyanobacteria makes them more suitable for use as biofertilizers. Based on the present studies *Rb. capsulatus* was more tolerant to pesticides than *Rps. acidophila* and can be used for improving soil fertility in pesticide contaminated soils.

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