

Reduction in *Chaetoceros* Population Growth by Antimicrobials

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Abstract - The effect of chloramphenicol and oxytetracycline on population growth of *Chaetoceros* was tested. These two antimicrobials had significant effects on the population growth of *Chaetoceros*.

Several reports are available on the use of chloramphenicol and oxytetracycline to control vibriosis of penaeid shrimps (AQUACOP 1977; Corliss et al. 1977; Lightner 1977, 1985, 1988; Corliss 1979; Takahashi et al. 1985; Baticados et al. 1990; Sindermann 1990a, 1990b; Lightner et al. 1992; Hameed and Rao 1994). These two antimicrobials have been used to control vibriosis caused by a species of *Vibrio* in the larvae and postlarvae of *Penaeus indicus* (Hameed and Rao 1994). The minimum inhibitory concentrations of chloramphenicol and oxytetracycline against *Vibrio* isolated from diseased larvae have been determined as 5 and 150 mg·l⁻¹, respectively (Hameed and Rao 1994). Significant mortality of nauplius and protozoa 1 has been observed when larvae were exposed to chloramphenicol and oxytetracycline at concentrations of 25 and 200 mg·l⁻¹, but no adverse effects on the physical development and molting of protozoa 11 through postlarva 1 were recorded (Hameed and Rao 1994). To assess the suitability of these antimicrobials on the larval culture system, their effect on the population growth of *Chaetoceros* sp., a diatom used as feed for protozoae and mysis, was tested.

Transparent, white bottom, rectangular perspex tanks (5 l) were used for the experiment. Filtered seawater, fertilized with potassium nitrate, potassium orthophosphate, sodium silicate and EDTA disodium salt at the rate of 12, 3, 6 and 6 mg·l⁻¹, respectively, was used for culturing *Chaetoceros* sp. The physiochemical characteristics of the culture water were: salinity 30-34 ppt; pH 7.9-8.3; temperature 29-31 °C and dissolved oxygen 4-5 mg·l⁻¹. The antimicrobials were water soluble compounds purchased locally from medicinal stocks. The antimicrobials were dissolved in culture water to obtain the concentrations of 10 and 25 mg·l⁻¹ chloramphenicol (Parke-Davis, India); and 100 and 200 mg·l⁻¹ oxytetracycline (Pfizer, India). Three replicates of each antimicrobial concentration, and controls without antimicrobials were carried out. *Chaetoceros* populations of uniform density (ini-

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tial density in all runs was 2.1×10^3 cells·ml⁻¹) were placed in all tanks. After 2, 4, 6 and 8 h of experiment, *Chaetoceros* populations were counted with a Sedgwick Rafter slide (McAlice 1971).

The results of this study indicate that chloramphenicol and oxytetracycline had significant ($P < 0.001$) adverse effects on the growth of *Chaetoceros* (Table 1). Chloramphenicol at concentrations of 10 or 25 mg·l⁻¹ held the population growth of *Chaetoceros* at 6.8×10^3 and 3.3×10^3 cells·ml⁻¹, respectively, after 8 h incubation compared to 2.8×10^4 cells·ml⁻¹ in controls without antimicrobials. Oxytetracycline reduced the population growth of this diatom to 1.7×10^3 cells·ml⁻¹ at 100 mg·l⁻¹ and 4.3×10^2 cells·ml⁻¹ at 200 mg·l⁻¹ after 8 h of incubation.

Table 1. Mean densities* of *Chaetoceros* populations ($\times 10^3$ cells·ml⁻¹) exposed to different concentrations of antimicrobials. Values are mean $\pm$ SE.

Sampling at the end of () h	Control (without antibiotics)	Chloramphenicol		Oxytetracycline HCl	
		10 mg·l ⁻¹	25 mg·l ⁻¹	100 mg·l ⁻¹	200 mg·l ⁻¹
0	2.1 $\pm$ 0.22	2.1 $\pm$ 0.22	2.1 $\pm$ 0.22	2.1 $\pm$ 0.22	2.1 $\pm$ 0.22
2	11.1 $\pm$ 0.13	6.2 $\pm$ 0.18 ^a	7.1 $\pm$ 0.26 ^a	6.9 $\pm$ 0.30 ^a	2.8 $\pm$ 0.15 ^b
4	16.4 $\pm$ 0.12	7.1 $\pm$ 0.22 ^b	6.9 $\pm$ 0.20 ^b	3.5 $\pm$ 0.22 ^b	2.2 $\pm$ 0.18 ^b
6	26.3 $\pm$ 0.20	4.4 $\pm$ 0.15 ^b	2.8 $\pm$ 0.14 ^b	1.4 $\pm$ 0.13 ^b	0.6 $\pm$ 0.71 ^b
8	28.4 $\pm$ 0.17	6.8 $\pm$ 0.15 ^b	3.3 $\pm$ 0.16 ^b	1.7 $\pm$ 0.12 ^b	0.4 $\pm$ 0.44 ^b

*Mean of nine replicates.

^a and ^b Statistical significance in comparison to the control group as $P < 0.01$ and $P < 0.001$, respectively.

After 4 h of incubation, golden brown bloom of *Chaetoceros* was observed in the water without antimicrobials; whereas no such bloom was seen in the water treated with 25 mg·l⁻¹ chloramphenicol. A light bloom was observed in the water treated with 10 mg·l⁻¹ chloramphenicol. In the control tanks, long filaments of diatoms were observed, but in the tanks treated with antimicrobials, there were only a few strands of *Chaetoceros*.

Results of the present study show that chloramphenicol and oxytetracycline adversely affected the growth of *Chaetoceros*. Baticados and Gacutan (1977) reported a similar observation of the reduction in *Chaetoceros* populations by Furanace. Hameed and Rao (1994) observed protozoa and mysis with empty stomachs when the larvae were exposed to 25 mg·l⁻¹ chloramphenicol and 200 mg·l⁻¹ oxytetracycline. The inhibited growth of *Chaetoceros* by these antimicrobials as observed in the present study would have resulted in an inadequate quantity of *Chaetoceros* for consumption by the larvae. Hameed and Rao (1994) found that optimum exposure time for protozoa to control the infection caused by *Vibrio campbellii*-like bacterium appeared to be 3 h in 25 ppm or 6 h in 10 ppm, and for mysis 6 h in 25 ppm or 18 h in 10 ppm. Based on the present study, it is suggested that, while treating diseased larvae with chloramphenicol or oxytetracycline, an optimum level of *Chaetoceros* should be maintained as these antimicrobials inhibit their growth.

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