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SHORT COMMUNICATION

Potential uses of bacterin to prevent shrimp vibriosis

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Enhancement of growth in tiger shrimp (*Penaeus monodon*) by oral bacterin prepared from *Vibrio vulnificus* has been previously reported (Song & Sung, 1990). In this experiment, we repeated our trial of immersion delivery of bacterin, this time adjusting its concentration to 10% with pond water. Post-larvae 13 were immersed in the aerated bacterin for 2·5 h and their density was adjusted to 500 individuals/l of bacterin. Booster immersion was not administered. Twenty shrimp were captured randomly at 5–7-day intervals after treatment. The body length and weight of each shrimp were measured and the growth curves were plotted, demonstrating that shrimps grew faster in the immersion group than in the control group (Fig. 1). This result disproves previous conjectures that post-larvae 13 are too young to be immunised by immersion application or that a single administration is insufficient. It shows that a higher dosage of bacterin is required for

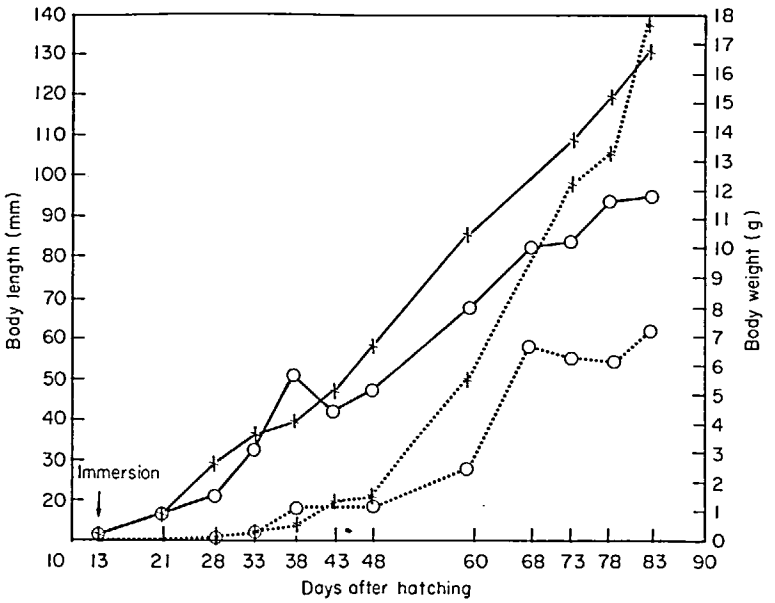

Fig. 1. Effect of *Vibrio vulnificus* bacterin on the growth of tiger shrimp (*Penaeus monodon*). (+), Immersion; (O), control; (–), body length; (···), body weight.

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Table 1. Concentration of haemocyanin and copper in haemolymph collected from tiger shrimp (*Penaeus monodon*) after bacterin treatment

Bacterin	Haemocyanin ($\mu g\ \mu l^{-1}$)		Copper ($\mu g\ \mu l^{-1}$)	
	60 days after hatching	91 days after hatching	60 days after hatching	91 days after hatching
Oral	41·5 (20)*	87·7 (10)	46·9 (20)	113·0 (10)
Immersion	45·4 (20)	97·5 (10)	46·5 (20)	114·8 (10)
Control	33·3 (10)	88·0 (8)	41·5 (10)	98·5 (8)

*Sample size.

immersion treatment of shrimp. However, our analysis of protection from oral, injection (Cheng, 1989) and water-borne challenges failed for technical reasons. We investigated the question of whether the bacterial cells, especially those in the oral treatment, serve as nutrient elements to increase the anabolic rate or as bacterin to enhance disease resistance. Haemolymph was collected twice from the pericardial cavities of shrimp, on the 60th and 91st day after hatching, respectively. Serum was separated by centrifugation at 735 *g* for 10 min at 4° C. Quantitative comparison of the metabolic-related haemocyanin by the assay of single radial immunodiffusion showed no difference in the serum haemocycin concentration between immersion and control groups (Table 1). This tends to rule out the possibility of bacterial cells as nutrient elements. This result was further confirmed by appraising haemolymph copper using the atomic absorption spectrophotometric method (Table 1). Although no Ig-like components were detected with inhibition ELISA (Chart *et al.*, 1984), there must be certain disease resistance factors responsible for the enhancement of growth. Measurement of phagocytic activity of extracted haemocytes in terms of chemiluminescence will be undertaken. Thus, both oral and immersion administrations of bacterin have been shown to enhance shrimp growth, but the latter is more applicable and less costly.

Both immersion and oral administrations of *Vibrio vulnificus* bacterin have been shown to enhance the growth of cultured shrimp (*Penaeus monodon*). We showed that 10% concentration of bacterin is required for the immersion treatment.

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