Vibrio Bacterin and Carboxymethyl β-1,3-Glucans Protect Penaeus monodon from Vibrio harveyi Infection

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Abstract

The aims of this study were to determine the effects of Vibrio bacterin, with or without carboxymethyl β-1,3-glucans (CMBG), on the protection of black tiger shrimp Penaeus monodon against V. harveyi infection, and to determine the mechanisms underlying the protection. The study was done with two groups of shrimp, one in short-term treatments in concrete tanks and the other in long-term treatment in commercial ponds. Healthy juvenile black tiger shrimp were provided with formalin-killed V. harveyi (bacterin) and CMBG, which were top-dressed on commercial pellets, for 10 d. They were then challenged with virulent V. harveyi and the relative percent survival (RPS) was determined. The shrimp hemolymph was also studied to determine hemocyte counts and phagocytic, bactericidal, and phenoloxidase activities. In the commercial ponds, the shrimp were given commercial pellets top-dressed with the two substances for 2 months. The shrimp were sampled and challenged with virulent V. harveyi and the RPS determined. In the experimental tanks, the shrimp receiving the bacterin, CMBG, and the combination thereof survived better than the control. After 10 d of the treatments, total hemocyte counts and their individual types (hyalinocytes, semigranulocytes, and granulocytes) were significantly increased. The levels of phagocytosis of hemocytes, bactericidal activities of mixed cell and hemocyte fractions, and prophenoloxidase of hemolymph lysate supernatant fluids were significantly higher than those of the control group. Protection against V. harveyi of shrimp from the commercial ponds treated with bacterin and CMBG was also detected as judged from the greater than 60% RPS in most cases. In all the parameters tested, no significant differences were detected among the shrimp treated with bacterin, CMBG, or the combination thereof. These studies suggest that both bacterin and CMBG could separately induce internal defenses of the shrimp against V. harveyi infection and that the mechanisms include stimulation of the shrimp's cellular and humoral factors.

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