

Temperature induced changes in physiological traits and expression of selected candidate genes in black tiger shrimp *Penaeus monodon* larvae

ABSTRACT

Temperature is an important abiotic factor influencing growth, development, metabolic performance and sex determination of aquatic organisms. The present study was conducted to test the effect of six different temperature levels (24°C, 26°C, 28°C as control, 30°C, 32°C and 34°C) on the physiological (growth, developmental durations, survivability, sex ratios and O₂ consumption) and genetic (changes in expression pattern of seven candidate genes: three male sex determining genes, three female sex determining genes and a single thermal stress response gene) aspects of black tiger shrimp (*Penaeus monodon*) larvae. Temperature treatments significantly altered the growth performance of shrimp individuals ($P < 0.05$) with the highest growth performance obtained at 32°C, moderate levels were obtained at 28–30°C and the lowest levels were obtained at the remaining temperatures. Temperature treatments significantly shortened the larval developmental durations at 28°C, 30°C and 32°C (required 44–46 days for sex differentiation) while 52–63 days were required at 24°C, 26°C and 34°C. Temperature treatments also altered sex ratios of experimental *P. monodon* individuals; significantly higher ($P < 0.05$) proportions of males (coupled with higher expression levels of male sex determining genes) were obtained at lower temperatures (24°C and 26°C) while larger proportions of females (with higher expression levels of female sex determining genes) were obtained at higher temperature levels (30°C, 32°C and 34°C). The thermal stress response gene, heat shock protein (HSP70) showed constant expression levels at 28°C but higher expression levels were obtained at other temperatures. Results imply that higher temperature can significantly increase the expression of female sex determining genes to produce larger proportions of females in *P. monodon* that in turn can help to improve aquaculture production.

Keyword: Sex determination; Gene expression; HSP70; *Penaeus monodon*