

Does phytoplankton play a role in the nutrition of the larvae of the prawn, *Macrobrachium rosenbergii* (De Man) ?

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Abstract

Two schools of thought exist concerning the optimum conditions for rearing larvae of the giant freshwater prawn, *Macrobrachium rosenbergii*, one in which larvae are reared in phytoplankton-rich (or "green") water and the other in which clear water is used. Although phytoplankton cells have been observed in the gut of the larvae, the ability of larvae to digest and assimilate algal cells has not been demonstrated. Several workers have shown that lipids can provide up to 95% of energy requirements of prawn larvae and it seems likely, therefore, that any nutritional role of the phytoplankton would be reflected in their lipid metabolism. This was investigated by comparing the lipid composition of larvae reared in green and in clear water, particular attention being given to fatty acid composition. No significant differences were found and it was concluded that phytoplankton contributed little to larval energy metabolism.

Introduction

Two types of rearing systems have been used for the larvae of the giant freshwater prawn *Macrobrachium rosenbergii* (De Man). In the "green-water" technique, larvae are reared in phytoplankton-rich water, whereas in the "clear-water" technique, no phytoplankton are added to the water. The "green-water" system, which many workers claim improves larval growth rates (e.g. Manzi et al., 1977), was first described by Fujimura (1966) and Fujimura and Okamoto (1972). This system utilises well-aerated, static water tanks which are supplemented with dense phytoplankton cultures. Cell density is about 750 000 to 1 500 000 cells-ml and *Chlorella* spp. generally dominate (New and Singholka, 1985; New, 1990). In contrast to this, the larval culture method developed by the AQUACOP team (AQUACOP, 1977; 1979) and favoured by New (1990) and Daniels et al. (1992) utilises a closed, recirculating "clear-water" system where water quality is maintained with aeration and biofilters.

When used in cultures of molluscan larvae, phytoplankton cells are probably filtered by the larvae and used directly as food. In the case of crustacean larvae, however, the role of the phytoplankton is less obvious. Various advantages of phytoplankton supplementation in cultures of penaeid prawns have been reported (Cook and Murphy, 1969; Mock and Murphy, 1971; Meyers, 1971), and Emmerson (1980) stated that larval development and growth of *Penaeus indicus* was positively correlated to the ingestion rate of algal cells. Fujimura and Okamoto (1972) reported that in larviculture of *M. rosenbergii*, algal supplementation resulted in better survival rates and faster larval growth.

In larval culture systems where algal supplementation is used, the precise role of the algae has not been conclusively demonstrated. Although Maddox and Manzi (1976) were able to show that the algal cells were actually ingested by the larvae and Cohen et al. (1976) concluded that algal supplements enhanced growth, they were not able to demonstrate that the larvae derived any direct nutritional benefit from them. They suggested that algae could enhance growth indirectly by removing toxic metabolites, such as ammonia, from the rearing tanks. Maddox and Manzi (1976) could not, however, demonstrate any correlation between the presence of

algae and the levels of nitrate, nitrite or ammonia.

Several workers have investigated the possibility that algae could contribute indirectly to prawn nutrition by serving as food for the *Anemia* nauplii which form the main food item for cultured prawn larvae. The nutritional value of *Anemia* nauplii has been shown to be determined partly by their content of n-3 highly unsaturated fatty acids (HUFA) (Watanabe et al., 1978, 1980; Leger et al. 1986; Navarro and Amat, 1992). Lavens et al. (1989) found that it was possible to manipulate the fatty acid profiles of *Anemia* cysts and nauplii by means of dry diets administered to the adults. Equally important was the finding of Navarro and Amat (1992) who were able to demonstrate that the fatty acid profiles of *Artemia* cysts were affected by the phytoplankton upon which the parent adults had been fed.

The objective of the present study was to determine whether the presence of phytoplankton in the culture medium of *Macrobrachium* larvae affected their growth, particular attention being given to the lipid and fatty acid metabolism of the larvae.

Materials and methods

Larval rearing

Eggs and larvae were obtained from the Camaron Hatchery in Mauritius where the normal practice is to rear larvae in the "green-water" system (Thompson, 1980). Adult female prawns were transferred from fresh-water broodstock ponds into brackish water tanks where maturation and hatching were induced. After hatching, the larvae were transferred to 24 m³ rearing tanks where they went through the 11 larval stages, finally metamorphosing into post-larvae (PL) after about 45 d. Classification of the larval stages was according to the system described by Ling (1969). Initial concentration of larvae in the rearing tanks was about 40 animals per litre and with the enormous number of larvae contained in each tank, removal of larvae for analysis had no significant effect on stocking density. There were no significant differences in the survival rates of larvae in any of the rearing tanks. Water was kept at a salinity of 12 to 15 mg l⁻¹, a pH of 7.5 to 8 and a temperature of 27 to 30°C.

For the purpose of this study, 2 of the 24 m³ larval tanks were enriched with phytoplankton (Cultures 1 and 2), whilst in the third (Culture 3) the larvae were reared in phytoplankton-free, clear

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