Application of Phytoplankters as Live Diet and Biocontrol in Improving the Hatchery Production of Commercially Important Penaeid Shrimp in Asia

[1]Jesse Dapon Ronquillo, [2]Toshio Saisho, [2]Shigehisa Yamasaki

[1]College of Fisheries, University of the Philippines in the Visayas, Miagao, Iloilo, Philippines 5023
[2]Faculty of Fisheries, Kagoshima University, Kagoshima City, Japan 890

ABSTRACT: Four genera and eight species of penaeid shrimp (*Penaeus monodon, P. japonicus, P. semisulcatus, P. latisulcatus, P. chinensis, Metapenaeus ensis, Trachypenaeus curvirostris,* and *Metapenaeopsis barbata*) found in the Indo-West Pacific region were spawned. The general objectives of the study were: (1) to develop innovative, more efficient and less expensive methods of producing healthy "seedlings" of penaeid shrimp; and (2) to develop rearing protocols for the larval production of other species of penaeid shrimp which are not traditionally cultured. Live shrimp were bought from fishermen and spawned in the laboratory. The hatched nauplii were transferred to larval rearing tanks. The first protozoeae (PZ-1) were provided with phytoplankters (*Chaetoceros calcitrans, C. gracilis, Tetraselmis tetrathele*). The myses were likewise fed with phytoplankters and/or zooplankters (*Brachionus plicatilis* and *Artemia salina*) until the first postlarval stage (PL-1). To analyze and correlate the development of the feeding structures in every stage of larval development, the appendages and feeding structures (maxillae, maxillules, maxillipeds, and mandibles) of the larvae were dissected by fine needles, drawn using a camera lucida, and correlated with survival rate and developmental stage. Nutritional values and particle sizes of the different phytoplankters and zooplankters were evaluated. Mortality due to the presence of harmful bacteria was also noted. Based on the inferred morphological function of the feeding structures, observation of larval feeding habits, faster rates of metamorphoses, and high survival rates on mixed phytoplankter diets until the first postlarval strge (PL-1), the early larval stages of penaeid shrimp are filter feeders. However, when the postlarvae of *Penaeus monodon, P. joponicus, P. chinensis,* and *P. semisulcatus* metamorphosed into the first postlarval stage, morphological changes were observed: the plumose setae on maxillae and maxillipeds were lost; endopods and exopods became vestigial; and inner margins of the first to third pereiopod chelae became serrated and functional. These morphological changes corresponded with a change in feeding habits from filter feeding to raptorial omnivore feeding as the planktonic larvae adapted to benthic life. The postlarvae of *Penaeus latisulcatus* and *Metapenaeus ensis* remained as filter feeders until about the fifth postlarval stage (PL-5), but those of *Trachypenaeus curvirostris* and *Metapenaeopsis barbato* were able to subsist on phytoplankters even at PL-15. These results question the practice of feeding the protozoeae and mysis substages of penaeid shrimp with expensive *Artemia* nauplii when the early larval stages are still filter feeders and benefit much from cheaper but nutrilionally efficient nalural diets of phytoplankton. Diatoms and prasinophytes exhibit antagonistic effects on or inhibit the growth of virulent bacteria and are rich in nutrients, which are limiting in artificial diets and zooplankters (*Artemia* nauplii and *Brachionus plicatilis*). Thus, they are ideal live feeds for penaeid shrimp larvae. The presently developed hatchery technique was also applicable to other species of penaeid shrimp which are not traditionally cultured. Adoption of this new technique in shrimp hatchery management could boost the production of healthy "seedlings" and greatly reduce operating costs.

KEYWORDS : Prawn/shrimp hatchery; penaeid shrimps; larval rearing; biocontrol; live diet

Ronquillo JS, Saisho T, Yamasaki S (1998) Application of phytoplankters as live diet and biocontrol in improving the hatchery production of commercially important penaeid shrimp in Asia. *In* Flegel TW (ed) Advances in shrimp biotechnology. National Center for Genetic Engineering and Biotechnology, Bangkok.