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Waste-grown phototrophic bacterium supports culture of the rotifer, *Brachionus rotundiformis*

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Abstract

The present and commonly used batch culture system (BCS) as adopted by many small-scale tropical hatcheries is beset by poor rotifer production and sudden crashes. This study aimed to produce nutritive rotifers and evaluate their performance based on the BCS by using phototrophic bacteria (PB) that can be easily and cheaply cultured from palm oil mill effluent (POME), an agro-industrial byproduct usually discarded as waste. *Brachionus rotundiformis* given a sole diet of POME-grown PB (*Rhodovulum sulfidophilum*) grew as well as on the commercially produced microalgae, *Nannochloropsis*. Production, growth rate and fecundity of rotifers fed condensed bacterial cells (bPB) and culture broth of bacteria grown in POME (cPB) were evaluated. The best performance in terms of the stated parameters was obtained for rotifers fed 200 mL of cPB in 3 L of culture water; this media sustained a mean rotifer density of 600–900 individuals mL^{-1} after 3–6 days of culture. The biochemical composition of rotifers fed PB was comparable to those fed microalgae, except that the former contained more polyunsaturated fatty acids.

Keywords: palm oil mill effluent, phototrophic bacteria, rotifer, growth, egg ratio, nutrition

Introduction

Species of brackish water rotifers from the genus *Brachionus* are the most commonly used live food for feeding newly hatched fish larvae. In the tropics, rotifers are often extensively cultured in outdoor tanks or ponds to minimize the production costs. However, fish farmers often face the difficulty of producing stable cultures of high rotifer density due to unpredictable outdoor conditions. Although high technology intensive systems, such as recirculation systems (Suantika, Dhert, Sweetman, O'Brien & Sorgeloos 2003) and the chemostat system (Fu, Hada, Yamashita, Yoshida & Hino 1997), are currently available to produce rotifers at very high densities of up to 9500 rotifers mL^{-1}, such systems are very demanding in terms of technological know-how and high costs. Hence, these limitations have constrained their adoption by the aquaculture industry in many developing countries. Until such limitations are removed in many small-scale hatcheries, the simple and economical batch culture method of seeding, growing and complete harvest seems the obvious choice in many tropical countries. Almost similar across Southeast Asian countries, the rotifer culture is sustained by a fermented broth made of trash fish. Trash fish is a common by-catch of the trawl fishing industry, but nevertheless, a diminishing resource due to overfishing. The batch culture system (BCS) produces rotifer populations of low yield, often with unexpected crashes and the fermented fish broth used as feed introduces bacteria, viruses and protozoans that not only compete with and suppress the growth of rotifers (Maeda & Hino 1991; Cheng, Aoki, Maeda & Hino 2004) but may also harm the cultured fish larvae.

In BCS, the best rotifer density achieved using microalgae as feed has been reported at 200–400 rotifers mL^{-1} (Isao, Takashi, Ikuro, Yotaro & Kazutsugu 1997; Abdul-Reza, Abdullah & Hadis 2011). This limitation is due to suboptimal conditions as a result of both abiotic (e.g. temperature,

