The food quality of *Tetraselmis suecica* slurry for *Crassostrea gigas* spat

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ABSTRACT

In an attempt to provide cost-effective alternatives to live microalgae and to simplify hatchery-nursery procedures, concentrated microalgae appear to be very promising. Due to its high preservation ability, Prasinophytes appear to be good candidates for such alternative diets. Nevertheless, in a previous study the utilization of *Tetraselmis suecica* was only conceivable for old *Crassostrea gigas* larvae. In the present work its nutritional quality has been accordingly searched on Japanese oyster's juveniles. Whatever the assemblages and condition, fresh or preserved microalgae, *T. suecica* did not allow an adequate postlarval development in *C. gigas*.

RÉSUMÉ

Valeur alimentaire du concentré de *Tetraselmis suecica* pour les post-larves de *Crassostrea gigas*

L'utilisation de microalgues concentrées et conservées est une des voies envisagées pour améliorer les procédures en écloserie-nurserie de mollusques et en diminuer les coûts de production. Comme elles présentent de bonnes aptitudes à la conservation, les Prasinophycées s'avèrent de bons candidats potentiels. Au cours d'une précédente étude il a été démontré que l'utilisation de *Tetraselmis suecica* n'était envisageable que chez des larves âgées de *Crassostrea gigas*. Dans le présent travail, la valeur alimentaire de cette algue fraîche et conservée a donc été recherchée sur des juvéniles de l'huître japonaise. Quel que soit l'assemblage considéré et quelle que soit sa forme, fraîche ou conservée, *T. suecica* ne permet pas un développement postlarvaire satisfaisant chez *C. gigas*.

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INTRODUCTION

In an attempt to provide cost-effective alternatives to live microalgae and to simplify hatchery-nursery procedures, substitution products have been tested over the past few years (for reviews see Robert and Trintignac, 1997; Knauer and Southgate, 1999) but resulted generally in lower growth and higher mortalities than those recorded for control fed live microalgae. However, concentrated microalgae (slurry or paste) appear to be the most promising alternative product (Nell and O'Connor, 1991; Robert and Trintignac, 1997; McCausland *et al.*, 1999) but the limiting factor for developing this technique for aquaculture feeds is the preservation method which should maintain unaltered the nutritional properties (food value) that characterize "living" algae. It has been shown that the Prasinophyceae *Tetraselmis suecica* might be preserved at low positive temperature (4° C), without apparent cells viability alteration (Tredici *et al.*, 1996) and with stability of its biochemical composition, such as fatty acid profiles (Montaini *et al.*, 1995). The food value of *T. suecica* as fresh microalgae (on site production) and slurry (remote production) have been recently investigated for *Crassostrea gigas* larvae (Robert *et al.*, 2001). The size of this microalgae limits its use by larvae but its potential for spat has to be considered. The present work reports its effects as preserved microalgae (remote production) on *C. gigas* postlarval development.

MATERIALS AND METHODS

T. suecica (strain Orbetello) was produced in Florence in 40L alveolar plate reactors following methods already described (Tredici *et al.*, 1996). The biomass was harvested by centrifugation and transported as concentrated slurry to Brest at 4°C, resuspended in fresh medium at a concentration of 23.10^6 cells.mL^{-1} and kept refrigerated in the dark. The other microalgae were grown at Brest in 300 L batch cultures. Juvenile *Crassostrea gigas* (≈ 1 to 1.5 mm) were obtained from a commercial hatchery (SATMAR, Normandie, France). Oysters were divided into 18 groups of similar weight (≈ 5 g wet weight) and placed into rectangular PVC chambers (51 mm length x 51 mm width x 25 mm depth) with a 400 µm nylon mesh base. Each chamber was suspended 10 mm from the base of a tub filled with 26 L seawater. Seawater (34-35 ppm, 17.5° C) was constantly dripped into the top of each chamber at a flow rate of 700 mL.min^{-1} (downweller system). A total ration of 5.10^4 phytoplancton cells.mL^{-1} (final concentration after dilution with the seawater) was also delivered continuously into each chamber. Duplicate chambers were assigned to each of nine dietary treatments. The following diets, with a similar amount of food in term of volume, were used: no additional microalgae (no food); fresh *T. suecica* (Tetra) ; preserved slurry of *T. suecica* (Slurry) ; *Isochrysis aff. galbana* (T. Iso) ; *Chaetoceros calcitrans* (Chaeto) ; *Isochrysis aff. galbana* + preserved *T. suecica* (T. Iso + Slurry) ; *Chaetoceros calcitrans* + preserved *T. suecica* (Chaeto + Slurry) ; *Isochrysis aff. galbana* + *Chaetoceros calcitrans* (T. Iso + Chaeto) ; *Isochrysis aff. galbana* + *Chaetoceros calcitrans* + preserved *T. suecica.* (T. Iso + Chaeto + Slurry). On day 21, growth estimates were based on measurements, from each treatment replicate, of oyster length and dry weight (100 and 200 individuals oyster respectively) on day 21.

RESULTS

The growth of *C. gigas* spat fed on different diets is shown in Figure 1. One-way ANOVA confirmed the highly significant effect of diet on postlarval length ($F = 173$; $p < 0.001$) and dry weight ($F = 216$; $p < 0.001$). Scheffés' multiple comparaison tests showed significant differences between most of the diets except between both *T. suecica* conditioning (fresh microalgae or slurry) and, for dry weight only, between the ternary diet (T. Iso + Chaeto + Slurry) and the unialgal diets Chaeto and T. Iso. No growth in length or weight was noted for unfed spat, while those fed

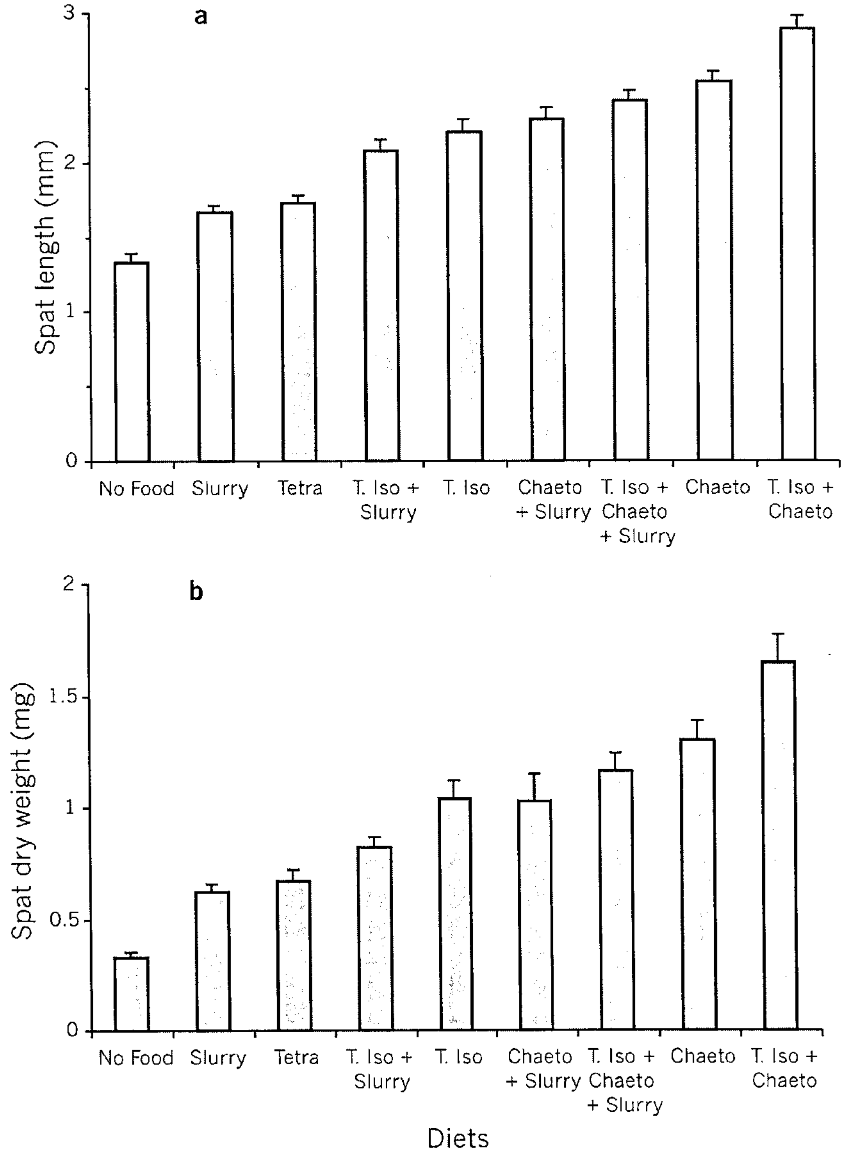

Fig. 1. Effect of different diets on *C. gigas* spat length (A) and dry weight (B) after 3 weeks of rearing (mean values ± 95% confidence intervals).

unialgal diets showed the lowest growth rate except those fed *C. calcitrans*. The binary diet (T.Iso + Chaeto) led to the highest length and weight increments (71.5 $\mu m.d^{-1}$ and 0.065 $mg.d^{-1}$). The addition of preserved *T. suecica* to any diet depressed the growth while spat fed with fresh or preserved *T. suecica* showed similar development (18.5 $\mu m.d^{-1}$ and 0.018 mg. d^{-1} *vs* 16.0 $\mu m.\ d^{-1}$ and 0.016 mg. d^{-1}respectively).

DISCUSSION AND CONCLUSION

Unfed spat showed no significant growth confirming the effectiveness of the seawater filtration system and providing confidence that growth on experimental algal diets was not supplemented measurably by natural seston. Whatever the diets, addition of preserved *T. suecica* depressed growth. Therefore it has been shown that the food quality of *T. suecica* slurry did not change apparently during the first month of storage (Robert *et al.,* 2001). Moreover, when fed as unialgal diets with fresh *T. suecica* or slurry, oyster spat exhibited similar development. This indicates that the preservation process is not the cause of such depression but the species itself which seems to be poorly assimilated by *C. gigas* spat. The size or weight depression corresponds accordingly to a lack of good food compared to the other more well balanced diets.

T. suecica is of poor food value for *C. gigas* spat. Because it has been already shown that due to its size its use was limiting for the Japanese oyster larvae, this Prasinophyceae is accordingly of low interest for *C. gigas* rearing.

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REFERENCES

Knauer, J. & Southgate P.C., 1999. A review of the nutritional requirements of bivalves and the development of alternative and artificial diets for bivalve aquaculture. *Reviews in Fisheries Science* 7(3-4): 241-280.

McCausland M.A., Brown M., Barret S.M., Diemar J.A. & Heasman M.P., 1999. Evaluation of live microalgae and microalgal pastes as supplementary food for juvenile Pacific oysters (*Crassostrea gigas*). *Aquaculture* **174**: 323-342.

Montaini E., Chini Zitelli G., Tredici M.R., Molina Grima E., Fernández Sevilla J.M. & Sánchez Pérez J.A., 1995. Long term preservation of *Tetraselmis suecica:* influence of storage on viability and fatty acid profile. *Aquaculture* **134**: 81-90.

Nell J.A. & O'Connor W.A., 1991. The evaluation of fresh algae and stored algal concentrates as a food source for Sydney rock oyster, *Saccostrea commercialis*, larvae. *Aquaculture* **99**: 277-284.

Robert R. & Trintignac P., 1997. Substitutes for live microalgae in mariculture. *Aquatic Living Resources* **10**, 315-327.

Robert R., Parisi G., Rodolfi L., Poli B.M. & Tredici M.R., 2001. Use of fresh and preserved *Tetraselmis suecica* for feeding *Crassostrea gigas* larvae. *Aquaculture* **192**: 333-346.

Tredici M.R., Chini Zitelli G. & Montaini E., 1996. Cold-preservation of microalgae aquaculture feeds. Refrigeration and Aquaculture proceedings, Bordeaux France, 20-22 March 1996, 25-32.