Effect of the photoperiod on growth, survival and inflation of the swim bladder in dentex larvae (Dentex dentex L.)

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Effect of the photoperiod on growth, survival and inflation of the swim bladder in dentex larvae (*Dentex dentex* L.)

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SUMMARY – Common dentex offers favourable prospects for farming in the Mediterranean area. The effect of the photoperiod on survival, growth and inflation of the swim bladder in dentex larvae has been studied in larval culture, from hatching to day 22, comparing 6 different light:dark regimes: 24:0, 18:6, 12:12, 6:18, 4:8+4:8 and 0:24. Experiments were conducted in circular 1 m^3 tanks in open circuit. Larvae cultured with photoperiods of 0:24, 6:18 and 4:8+4:8 died before day 15. The best results in growth, survival and swim bladder inflation were found with the 18:6 photoperiod.

Key words: Common dentex, larval culture, photoperiod, finfish diversification.

RESUME – *"Effet de la photopériode sur la croissance, la survie et le gonflement de la vessie natatoire chez les larves du denté commun (*Dentex dentex *L.)". La culture du denté commun (*Dentex dentex*) offre de bonnes perspectives sur l'aire méditerranéenne. Nous avons étudié l'effet de la photopériode sur la survie, la croissance et le gonflement de la vessie chez les larves du denté lors de l'élevage larvaire depuis l'éclosion jusqu'à 22 jours en comparant 6 régimes différents lumière:obscurité: 24:0, 18:6, 12:12, 6:18; 4:8+4:8 et 0:24. Les expériences ont été faites dans des réservoirs circulaires d'1 m^3 dans un circuit ouvert. Toutes les larves cultivées avec des photopériodes 0:24, 6:18 et 4:8+4:8 sont mortes avant 15 jours. Les meilleurs résultats relatifs à la croissance, survie et pourcentage de gonflement de la vessie ont été obtenus avec le régime 18:6.*

Mots-clés : *Denté commun, culture larvaire, photopériode, diversification piscicole.*

Introduction

Common dentex (*Dentex dentex*) is a sparid of great interest for the development of marine aquaculture in the Mediterranean area. Although the studies described to date confirm its favourable prospects (Glamuzina *et al*., 1989; Bibiloni *et al*., 1993; Efthimiou *et al*., 1994; Pastor *et al*., 1995; Cardenete *et al*., 1997), some important problems in its culture are still present.

So in terms of the larval stage, high mortality and low larval quality are noted (Efthimiou *et al*., 1994; Riera *et al*., 1995), probably due to inadequate environmental conditions (temperature, photoperiod, light intensity, tank colour, etc.). In any case, when approaching the study of a new species, it is essential to consider the fact that numerous factors are involved – heredity, nutrition, environment – which influence growth, survival and larval quality (Barahona-Fernandes, 1979).

Environmental factors include photoperiod, light intensity, tank colour and larval density as determinants for growth, survival and larval quality, conditioning inflation of the swim bladder (Chatain and Ounais-Guschemann, 1991). Light plays an important role in regulating larval activity in the species classified as visual predators. Selection and location of prey are conditioned by these factors, and largely depend on the intensity of light and contrast between prey and environment (Blaxter, 1980; Kentouri, 1985). Capture of prey is limited by light intensity and photoperiod, so that marine fish larvae require suitable light intensities and photoperiods to make feeding possible during the initial stages of development, and thus ensure higher values of growth and survival (Blaxter, 1968).

Information available on culture conditions in the larval stage of dentex is scarce, and therefore, the definition and optimization of these parameters will, in the future, make it possible to obtain quality larvae with a greater survival rate and better growth, thus optimizing results in the initial stages of culture. This study researches the influence of the photoperiod in the success of bladder inflation, in growth and survival of dentex larvae during the first 22 days of life.

Material and methods

Six different lighting regimes have been tested: 24:0, 18:6, 12:12, 6:18, 4:8+4:8 and 0:24. All assays were conducted in triplicate, in circular 1 m^3 fibreglass tanks, with a water renewal rate of 30%/h equipped with aeration and surface cleaners. Salinity was 37λ and temperature ranged from 22 to 25°C from the start to the end of the culture. Each of the tanks was fitted with a fluorescent tube located 50 cm over the water surface, providing 1000 lux of light intensity. Initial culture density was 40 larvae/l, and feed was based on rotifer from day 4 of life (opening of the mouth) to day 16, and on *Artemia* nauplii from day 12 to 22. Larval size was determined on days 10 and 22, and survival and the percentage of larvae with bladder on day 22, coinciding with the end of the experiment and the beginning of metamorphosis.

To compare the results of larval growth, survival and the percentage of bladder inflation, ANOVA analysis and the Turkey test were performed.

Results and discussion

Figures 1, 2 and 3 show the results of growth, survival and inflation of the swim bladder in larvae during the first 22 days of larval culture. Larvae cultured under photoperiods of 0:24, 6:18 and 4:8+4:8 died on days 8, 13 and 22 respectively. Sizes on day 10 were: 4.54±0.45 mm (24:0), 4.43±0.16 mm (18:6), 4.00±0.18 mm (12:12) and 3.18±0.08mm (6:18). Significant differences in growth were noted between 24:0 and 12:12 ($p < 0.0001$) and between 18:6 and 12:12 ($p < 0.0001$). During the initial days of culture, growth was lower with shorter photoperiods, and higher with photoperiods longer than 18 hours of light.

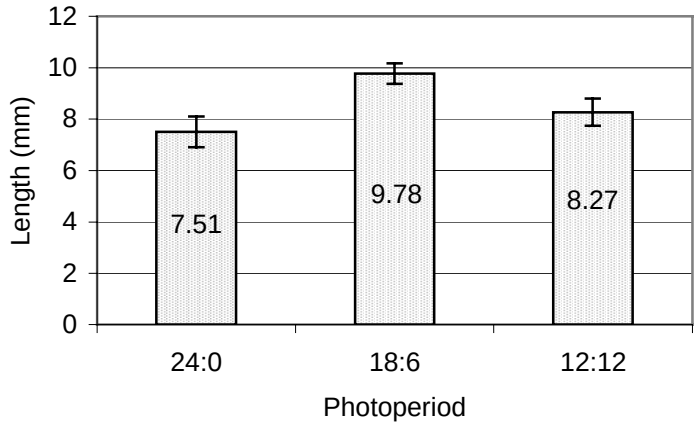

Fig. 1. Size (mean±SD) of dentex larvae on day 22 subjected to different photoperiods.

Survival rates on day 22 were 2.2% (24:0), 7.5% (18:6) and 5.4% (12:12). The percentage of larvae with swim bladder was 26.6% (24:0), 84.6% (18:6) y 47.1% (12:12). The final average sizes were 7.5±0.5 mm (24:0), 9.8±0.4 mm (18:6) y 8.3±0.5 mm (12:12). Best growth results at day 22 were obtained with the 18:6 treatment, significant differences being noted from 24:0 to 18:6 ($p < 0.0001$), 24:0 to 12:12 ($p < 0.05$) and from 12:12 to 18:6 ($p < 0.0001$).

Behaviour of dentex larvae in terms of different photoperiod systems appears to follow the pattern of most fishes. Long photoperiods significantly improve growth, as in *Sparus aurata* (Chatain and Ounais-Guschemann, 1991), *Archosargus rhomboidalis* (Dowd and Houde, 1980), *Dicentrarchus labrax* (Barahona-Fernandes, 1979), *Solea solea* (Fuchs, 1978) y *Rhombosolea tapirina* (Hart *et al.*, 1996).

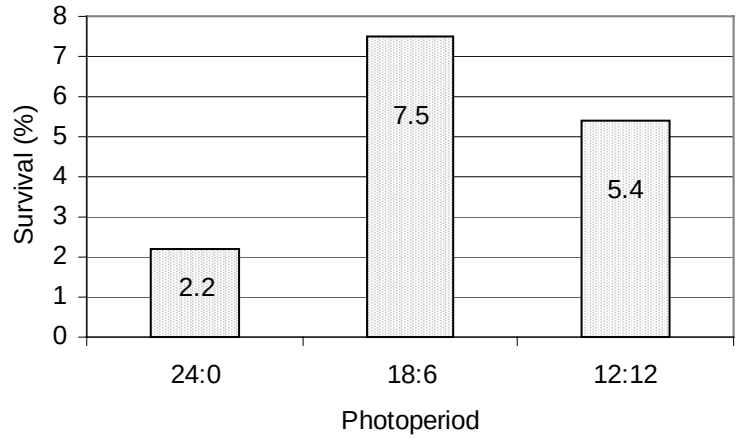

Fig. 2. Survival rate on day 22 of life of dentex larvae subjected to different photoperiods.

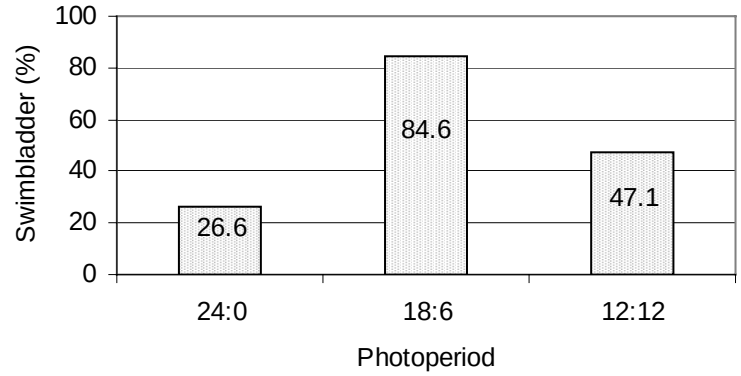

Fig. 3. Inflation rates for swim bladder in dentex larvae after 22 days subjected to different photoperiods.

The results of this research regarding bladder inflation and larval survival were not significantly different, although the best values were obtained with the 18:6 photoperiod; this same photoperiod also gave the best results in growth, so that the interdependence between adequate bladder formation and the growth and survival of larvae appear to be evident. Total darkness caused massive mortalities in the initial days of larval life. A substantial variability was noted between the replicas and a lack of statistical importance between the results obtained, probably due to the multiplicity of factors influencing bladder inflation (Martin-Robichaud and Peterson, 1998); small variations in these factors – such as the degree of environmental turbulence – difficult to detect and to control, may exert a large influence on bladder inflation and, as a result, in the growth of larvae (Chatain and Ounais-Guschemann, 1990).

Conclusions

Continuous darkness and short light periods of less than 18 hours do not appear to be the most suitable for obtaining a favourable survival rate and normal larval development in dentex. Also, continuous exposure to light reduces growth and survival rates.

Acknowledgements

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