

Annual variation in quantity and quality of newly hatched larvae of *Maja brachydactyla* in captivity

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INTRODUCTION

The spider crab, *Maja brachydactyla* (Decapoda: Brachyura: Majidae), has been recently considered a potential species for aquaculture. Its larval culture is well described and has been recently optimised under intensive conditions (Andrés et al., 2007). To obtain good quality newly hatched larvae all the year round is of paramount importance in order to establish the basis for mass production. The aim of this work was to study the variation in quantity and the biochemical quality of *M. brachydactyla* larvae obtained along a year in order to evaluate the effects of broodstock in captivity.

MATERIALS & METHODS

Adults of *M. brachydactyla* were captured off the Atlantic NW coast of Spain (Galicia) and transported to IRTA where they were kept at 36‰ salinity and temperature of 18°C and fed on fresh mussels and frozen crab. Spawning took place and newly hatched larvae were collected, counted and analysed throughout the year. Individual dry weight (DW), organic matter content (OM) and proximate biochemical composition (protein-PRT, Bradford, 1976; carbohydrates-CH, Du Bois et al., 1956; lipids-LP, Folch et al., 1957) were measured for each batch and grouped in months whereas lipid class composition (Olsen & Henderson, 1989), amino acid (AA) profile (HPLC fluorescence), and the content in vitamins A, E and C (HPLC-UV) were analysed from pooled samples of the spawns obtained during spring (SP), summer (SU) and autumn + early winter (AU+WI).

RESULTS

- In our conditions, spawning took place all the year round (Fig. 1) with 60,000 newly hatched larvae per spawn in average, and the highest larval production recorded in spring and autumn.
- DW of newly hatched larvae decreased significantly along the year (Fig. 2), being the larvae hatched in winter-spring the biggest and those in November the smallest. Ash free DW (OM), followed the same pattern than DW throughout the year indicating that variations in DW were not caused by a differential uptake of minerals.
- Relative content of PRT and LP increased significantly in the larvae hatched at the end of the year (Fig. 3), resulting in the same individual content ($\mu\text{g}\cdot\text{ind}^{-1}$, not shown) than the larvae obtained at the beginning. LP/PRT ratio was maintained all year around 0.2 and CH content did not vary throughout the year.
- No significant differences were found in the major lipid classes at different seasons (Fig. 4).
- AA content, especially essential AA, decreased significantly in AU+WI (Fig. 5).
- A decrease in vitamins A and E was also observed at AU+WI larvae (Table 1) whereas vitamin C increased throughout the year.

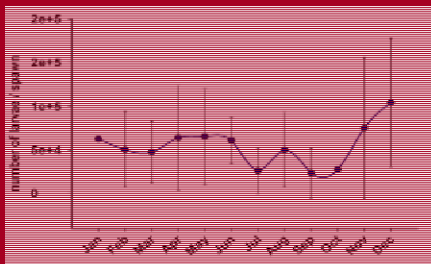


Fig. 1. Variation in the mean number of newly hatched larvae of *M. brachydactyla* obtained per female and month along one year of broodstock rearing.

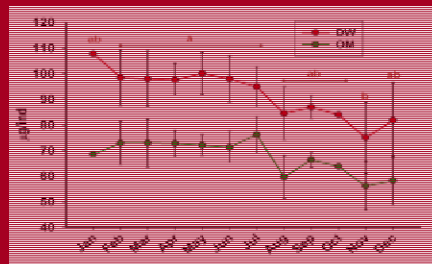


Fig. 2. Variation in DW and OM of newly hatched larvae of *M. brachydactyla* along one year of broodstock rearing. Different letters indicate significant differences between months ($p < 0.05$).

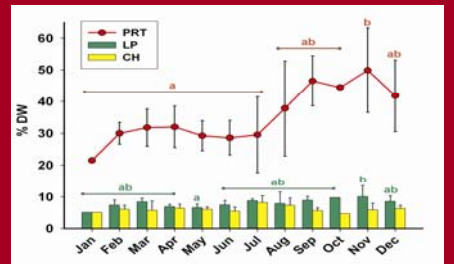


Fig. 3. Variation in PRT, LP and CH (% of DW) of newly hatched larvae of *M. brachydactyla* along one year of broodstock rearing. Different letters indicate significant differences between months ($p < 0.05$).

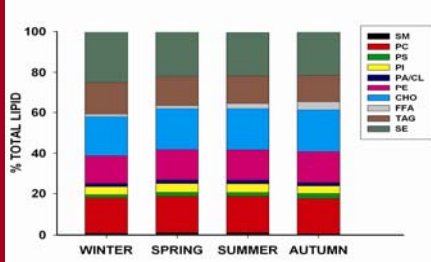


Fig. 4. Lipid class composition of newly hatched larvae of *M. brachydactyla* along four seasons of broodstock rearing (SM= sphingomyelin; PC= phosphatidylcholine; PS= phosphatidylserine; PI= phosphatidylinositol; PA/CL= phosphatidic acid/cardiollipin; PE= phosphatidylethanolamine; CHO= cholesterol; FFA= free fatty acids; TAG= triglycerides; SE= sterol esters/waxes).

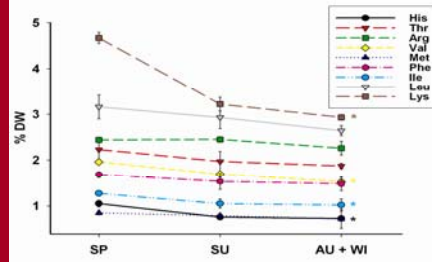


Fig. 5. Essential amino acid (AA) profile variation in newly hatched larvae of *M. brachydactyla* along three seasons of broodstock rearing. An asterisk near a certain AA line indicates a seasonal statistical difference in the quantity of this AA. ($p < 0.05$) (SP= spring; SU= summer; AU+WI= autumn and early winter).

| | SP | SU | AU + WI |
|------------------|--------------------------|---------------------------|----------------------------|
| Vit A (U/g DW) | 5.15 ± 0.00 ^a | 2.23 ± 0.55 ^b | 1.52 ± 0.15 ^c |
| Vit E (mg/Kg DW) | 326.12 ± 12 ^a | 276.9 ± 0.00 ^b | 245.00 ± 5.58 ^c |
| Vit C (mg/Kg DW) | 3.09 ± 0.00 ^a | 3.82 ± 0.00 ^b | 4.38 ± 0.06 ^c |

Table 1. Variation in vitamin contents of newly hatched larvae of *M. brachydactyla* along the seasons of broodstock rearing. Different letters in superscript indicate seasonal significant differences ($p < 0.05$).

DISCUSSION & CONCLUSIONS

- Although larvae of *M. brachydactyla* were obtained along the whole year, peaks in larval production were recorded in spring and autumn similarly to those reported in the wild.
- The larvae obtained after one year in captivity were smaller in size and weight but with a higher relative content of PRT and LP than those obtained at the beginning. Thus, the individual biochemical content of newly hatched larvae was maintained throughout the year.
- Lipid class composition of larvae hatched in captivity along the year remained constant. The higher lipid content observed in the larvae after one year was not a consequence of a preferential accumulation of any lipid class in particular but rather a similar distribution among the different types.
- The decrease in essential AA and vitamin larval contents along the year might indicate a negative effect of broodstock captivity.
- The results presented here suggest that *M. brachydactyla* ensures its larval success providing them with similar PRT and LP content all year round independently of larval size. Nevertheless, a lack of essential nutrients in broodstock diets (namely essential AA and vitamins) might have an effect on larval quality.
- Further studies on the annual variation of the fatty acid profile of the larvae may help to elucidate whether larval lipid composition is threatened by broodstock kept in captivity and to confirm if such effects are a consequence of the diet.

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REFERENCES

- Andrés, M., Estévez, A., Rotllant, G., 2007. Growth, survival and biochemical composition of spider crab, *Maja brachydactyla* (Bass, 1922) (Decapoda: Majidae) larvae reared under different stocking densities, prey: larvae ratios and diets. *Aquaculture* 273: 494-502.
- Bradford, M.M., 1976. A rapid and sensitive method for the quantitation of microgram quantities of protein utilizing the principle of protein-dye binding. *Anal. Biochem.* 72: 248-254.
- DuBois, M., Gilles, K.A., Hamilton, J.K., Rebers, P.A., Smith, F., 1956. Colorimetric method for determination of sugars and related substances. *Anal. Chem.* 28: 350-356.
- Folch, J., Lees, M., Sloane Stanley, G.H., 1957. A simple method for the isolation and purification of total lipides from animal tissues. *J. Biol. Chem.* 226: 497-509.
- Olsen, R.E., Henderson, R.J., 1989. The rapid analysis of neutral and polar marine lipids using double-development HPTLC and scanning densitometry. *J. Exp. Mar. Biol. Ecol.* 129: 189-197.