Reproductive Modifications of Marine Rotifer in Relation to Thermal Conditions: Implications for Ecological Adaptations

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ABSTRACT

Temperature significantly affects the physiological performance and metabolic acclimation associated with reproduction, survival, and behavior of aquatic organisms. Marine *Brachionus* rotifers constitutes a live food source during the initial phase of larviculture. Furthermore, they are pivotal in ecological adaptability and evolutionary studies due to the reproductive features of cyclical parthenogenesis: sexual versus asexual. The occurrence of a sexual life cycle with the formation of resting (diapausing) eggs could be an effective strategy to improve species fitness to cope with environmental unpredictability. Specific temperature manipulation following the growth preferences of rotifer species has been shown to induce a transition in reproductive patterns. We previously utilized diverse strains of rotifer, *Brachionus plicatilis*, exhibiting two distinct reproductive patterns at 25°C (control; laboratory stock temperature): cyclical (NH1L strain) and obligatory parthenogenesis (Amami and Obama strains). Using these strains, we determined the efficacy of low-temperature induction (incubation at 15°C for 14 days) on sexual reproduction in rotifers by regulating the transcription levels of key biomarkers of endocrine and energy metabolism, including ecdysone-induced 78C, estrogen receptor, and β-glucosidase, as well as cellular stress tolerance, such as heat shock protein 70. While the reason for the reproductive transition triggered by low temperature exposure remains unclear: a short-term stimulatory effect or an adaptive response? Seasonal species replacement often occurs in natural *Brachionus* rotifers populations. The *B. plicatilis* species predominates in winter period, suggesting the reproductive adaptations to low temperatures following ecological preferences. Therefore, we performed further investigations of the reproductive pattern of the three aforementioned strains after acclimation to low-temperature conditions for one and six months. Results showed that following acclimatization to 15°C for one month, the three strains showed significantly faster population expansion during 14 days of cultivation at 15°C (1.6-2.3 folds, $p<0.05$), in comparison to individuals who were not acclimated. Furthermore, species-specific responses to sexual reproduction were observed. The sexual capacity of NH1L from the acclimated group was diminished, compared with that of individuals without low temperature acclimation. Nevertheless, the similar effects of low temperature on the sexual reproduction of the Amami (enhance) and Obama (no change) strains were identified in both acclimated and non-acclimated groups. It is suspected that the differential responses reflect metabolic modifications associated with rapid or prolonged ecological adaptations.

Keyword: Temperature/ Aquatic resource/ Reproduction/ Adaptative strategy/

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