

## New records on cyclomorphosis in the marine eutardigrade *Halobiotus crispae* (Eutardigrada: Hypsibiidae)

Nadja MØBJERG<sup>1)\*</sup>, Aslak JØRGENSEN<sup>2)</sup>, Jette EIBYE-JACOBSEN<sup>3)</sup>, Kenneth AGERLIN HALBERG<sup>1,3)</sup>  
Dennis PERSSON<sup>1,3)</sup> and Reinhardt MØBJERG KRISTENSEN<sup>3)</sup>

<sup>1)</sup>Department of Molecular Biology, August Krogh Building, University of Copenhagen, Universitetsparken 13, DK-2100 Copenhagen, Denmark

<sup>2)</sup>DBL – Centre for Health Research and Development, University of Copenhagen, Jægersborg Allé 1D, DK-2920 Charlottenlund, Denmark

<sup>3)</sup>Natural History Museum, Zoological Museum, University of Copenhagen, Universitetsparken 15, DK-2100 Copenhagen, Denmark

\*e-mail corresponding author: nmobjerg@aki.ku.dk

---

### ABSTRACT

*Halobiotus crispae* is a marine eutardigrade belonging to Hypsibiidae. A characteristic of this species is the appearance of seasonal cyclic changes in morphology and physiology, i.e. cyclomorphosis. *Halobiotus crispae* was originally described from Nipisat Bay, Disko Island, Greenland. The present study investigates the distribution of this species and describes the seasonal appearance of cyclomorphic stages at the southernmost locality, Vellerup Vig in the Iseffjord, Denmark. Our sampling data indicate that the distribution of *H. crispae* is restricted to the Northern Hemisphere where we now have found this species at seven localities. At Vellerup Vig data from sampling cover all seasons of the year and all of the originally described cyclomorphic stages have been found at this locality. However, when comparing the lifecycles of *H. crispae* at Nipisat Bay and Vellerup Vig, profound differences are found in the time of year, as well as the period in which these stages appear. Noticeably, at Nipisat Bay the pseudosimplex 1 stage is a hibernating stage occurring during the long Arctic winter. In contrast, at Vellerup Vig, this stage appears during the summer. Thus, while pseudosimplex 1 seems to be an adaptation to withstand low temperatures in Greenland, this stage possibly enables the animal to tolerate periods of oxygen depletion and heat stress during the Danish summer. Moreover, a characteristic of the Danish population is the presence of a prolonged pseudosimplex 2 stage. The environmental or endogenous signals underlying the transition between different stages remain unknown. In addition, we report the genetic diversity and phylogenetic position of *H. crispae* based on the first molecular data obtained from this species. Our molecular data confirm that *H. crispae* from Greenland and Denmark are in fact the same species. Thus, the observed life cycle changes occur within a species and do not represent life cycle variation between different species. In addition, our molecular data suggest that *Halobiotus* has evolved within Isohypsibius. Further investigations on the lifecycle of members of the *Halobiotus* genus as well as other members of the Hypsibiidae is needed in order to establish whether cyclomorphosis is i) a general theme among members of Hypsibiidae or ii) an autapomorphy for *Halobiotus*.

Key words: cyclomorphosis, distribution, Eutardigrada, genetic diversity, life cycle, phylogenetic position

---