IAF/IAA SPACE LIFE SCIENCES SYMPOSIUM (A1)
Biology in Space (8)

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ZOOPLANKTON FOR THE PRODUCTION OF BIOMASS IN BIOREGENERATIVE LIFE SUPPORT SYSTEMS IN SPACE

Abstract

Zooplankton, like the water flea *Daphnia magna*, plays a key role in the aquatic food web as a link between oxygen-producing microalgae and higher trophic levels such as fish. The major part of zooplankton consist of tiny crustaceans. These animals form an enormous amount of biomass and are therefore of great ecological importance. This renders them good candidates for protein supply in aquatic bioregenerative life support systems (BLSS) aboard space stations or in extreme habitats. Little is known about the effect of gravity, respectively weightlessness, on the behaviour and physiology of zooplankton organisms so far. Therefore, it is necessary to test its impact on possible candidates for future life support systems in space. One step to this objective is to analyse the behaviour of different zooplankton species under diminished gravity conditions by the use of parabolic flights and sounding rockets, and to test whether they are able to adapt to the altered environmental conditions. Since the examination of gravi-perceptive organs in zooplankton has received little attention in the past, the identification of these structures is part of our research project. We were able to show that the perception of gravity in *Daphnia* is accomplished in an indirect manner by a mechanoreceptor which is associated with the postabdominal setae of the animal. This represents a novel mechanism of graviperception and may be true for other zooplankton organisms as well. Therefore, we analyse the development of graviperception in zooplankton in an evolutionary context.

A further component of our research project deals with the reproduction of zooplankton in altered gravity conditions. Here, experiments with the 2D-clinostat have provided insights in the hatching of different zooplankton species from dormant stages and the embryonic development, under simulated microgravity. Another important prerequisite for an operative BLSS is the consistency of interactions between different trophic levels, like predator-prey interaction, in microgravity, which was addressed with an experiment on a sounding rocket. A further key aspect of our research project deals with the impact of altered gravity on the cellular and molecular level in the model organism *D. magna*.

The combination of behavioural, ecological and molecular research will enable the identification of zooplankton organisms, which are suitable for the long-term utilisation in BLSS in prospective manned space missions. The findings gained with this project also offers potential for transferring them into the sector of green economy.