Endemic ciliates (Protozoa, Ciliophora) from tank bromeliads (Bromeliaceae): a combined morphological, molecular, and ecological study

At the turn of the millennium, Foissner et al. (2003) discovered a likely specific (endemic) ciliate fauna in tank bromeliads. Ciliates are single-celled organisms (protists) of microscopic size (~15–1000 μm), for instance, the widely known slipper animal (Paramecium). Bromeliads are a group of rosette plants of the Liliidae restricted to Central and South America. The “tanks” (= small bodies of water) are formed by the coalescing leaf axils which collect the rain water and plant litter. Since Picado (1913), it is known that bromelian tanks are inhabited by many specific organisms, now ranging from protists to frogs.

Main objectives and perspectives of this project include:

- To publish the taxonomic data accumulated and those obtained during a planned stay at Jamaica University. Likely, these are about 60 new ciliate species whose distribution will be investigated at various spatial scales. This part of the project should firmly establish the specificity of the bromelian tank ciliate community and thus the occurrence of microorganisms with restricted geographic distribution.
- To contribute to biodiversity of protists from a region of which very few is known.
- Ecological research will focus on the functional ecology of some of the more common endemic tank ciliates and experiments for exploring the unusually high frequency of species which can switch between bacteriophagous microstomes and predaceous macrostomes.
- To educate a young Jamaican scientist in classical and molecular alpha-taxonomy (= description of species), a specific discipline threatened to become extinct in Europe and the USA, at least as concerns heterotrophic, free-living protists.

The full project Abstract can be viewed at http://www.fwf.ac.at/en/abstracts/abstract.asp?L=E&PROJ=P20360

Papers resulting from the ecological part of this joint project:


We investigated the ecology and life strategy of *Glaucomides bromelicola* (family Bromeliophryidae), a very common ciliate in the reservoirs (tanks) of bromeliads, assessing its response to food quality and quantity, and pH. Further, we conducted competition experiments with the frequently coexisting species *Bromeliothrix metopoides* (family Colpodidae). In contrast to *B. metopoides* and many other colpodean ciliates, *G. bromelicola* does not form resting cysts, which jeopardizes this ciliate when its small aquatic habitats dry out. Both species form bactivorous microstomes and flagellate-feeding macrostomes. However, only *G. bromelicola* has a low feeding threshold and is able to adapt to different protist food. The higher affinity to the local bacterial and flagellate food renders it the superior competitor relative to *B. metopoides*. Continuous encystment and excystment of the latter may enable stable coexistence of both species in their natural habitat. Both are tolerant to a wide range of pH (4-9). These ciliates appear to be limited to tank bromeliads because they either lack resting cysts and vectors for long distance dispersal (*G. bromelicola*) and/or have highly specific food requirements (primarily *B. metopoides*).

We investigated the recently described colpodid ciliate Bromeliothrix metopoides in a series of laboratory experiments to reveal the environmental factors that constrain this species to its peculiar habitat, i.e. the tanks of bromeliads. Our results demonstrated that the various life stages of this ciliate (bacterivorous theronts and microstome trophonts, flagellate-feeding macrostomes) have specific demands in terms of food quality and quantity. Bromeliothrix required a high food threshold (>1.4 mg C L-1) in order to thrive. Food quality also affected resting cyst formation of B. metopoides when the experimental containers dried out. Its maximum growth rates (μmax = 4.71 d⁻¹, i.e. 6.8 doublings d⁻¹) belong to the highest ones recorded thus far for free-living ciliates. The pH niche of B. metopoides was relatively wide (pH ~4 to >9) under optimal food conditions. However, its high sensitivity to unfavourable environmental conditions let the population collapse within several hours. We conclude that B. metopoides is a boom and bust ciliate that is specifically adapted to its peculiar habitat but virtually unviable in other environments.

For papers resulting from the morphological and molecular parts of this joint project, see http://www.uni-salzburg.at/orgbiol/wilhelm.foissner

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