

## Gastrotricha in palm houses as a model for research on phenotypic variability and cryptic diversity

**One of the main objectives of this project is to determine the species composition and genetic diversity of the Gastrotricha fauna of palm houses in different parts of Europe.** Gastrotrichs are small invertebrates ranging in size from 50 to 3500  $\mu\text{m}$ . They inhabit all types of marine, brackish, freshwater and semi-aquatic ecosystems (such as sedge swamps, alder woods, peatbogs or riparian forests), in both natural and artificial habitats (they were detected e.g. in palm houses and aquarium filters as well as in sediments from ship ballast tanks). We can conclude how extensive the spectrum of habitats occupied by gastrotrichs is from the fact that they are found, for instance, in water micro-reservoirs formed in the axils of Bromeliaceae, in water reservoirs in caves, and even in extreme ecosystems, such as hot springs or hydrothermal vent zones. Palm houses constitute a frequent and common element of many cities in Europe. Together with the plants, seeds, soil and litter and other components of the exhibitions, many species of animals, both native and foreign, are brought to palm houses in a random and uncontrolled manner. Greenhouses provide these accidentally introduced organisms with specific conditions of colonisation and habitation which are different from the outside anthropogenic habitats, e.g. municipal parks or squares. Thanks to the high temperature and humidity kept at a constant level, they create favourable conditions to form stable and numerous populations of invertebrates which remain and function for many years.

**Within the following objective, I plan to compare species compositions and genetic relationships among the studied habitats and objects.** Greenhouses, as ecosystems that are distant and isolated from their natural counterparts and other objects of this type, may constitute a perfect place for the study of introduced, artificial communities of species and their occupied new areas as well as the variability within and among isolated populations separated from their source habitats. Studies on fauna occurring in palm houses have been conducted in many countries, such as in the Czech Republic, Denmark, Finland, France, Germany, Poland, Romania and Great Britain. However, most of these studies have been fragmentary and selective, and the fauna of municipal greenhouses still remains insufficiently known. The studies previously conducted in palm houses have also included gastrotrichs – the results of the analyses of greenhouse gastrotrichofauna published to date have considered both analyses of bottom sediments and micro-reservoirs forming water micro-reservoirs in the axils of Bromeliaceae, and they have been obtained from 3 greenhouses, i.e. palm houses in Poznań (Poland), in Łódź (Poland) and in Copenhagen (Denmark). Finding in three palm houses 18 species of gastrotrichs that are independent and distant from one another, including one occurring in two greenhouses, indicates that these invertebrates were not accidentally and once brought to a single facility but that they actually constitute a constant and important component of the fauna of anthropogenic habitats. Palm houses were chosen as the place of study as isolated anthropogenic objects that create specific conditions which are different from the other types of artificial or natural ecosystems.

**Another objective is to estimate if and in what manner the specific living conditions in palm houses affect the morphology of individual species.** Fulfilling the objective as set above will allow us to prove whether taxa accidentally brought to palm houses are the same or different species as those recorded in outside habitats. During this research we will gain not only information if individuals from and from outside the greenhouse and between the habitats (bottom sediments, epiphytic communities, water micro-reservoirs formed in the axils of Bromeliaceae) belong to the same species, are representatives of an assemblage of species that are similar morphologically or are a complex of cryptic species. We will also find what the phenotypic variability is within those taxa and by what factors it is conditioned.

**Completing this project will also contribute to finding the range of phenotypic variability depending on habitat conditions and will help prepare a set of taxonomically significant characteristics.** No seasonal or habitat phenotypic changes have been found in gastrotrichs to date which are so well known in other groups of animals inhabiting the same types of environments (e.g. rotifers (Rotifera) or cladocerans (Cladocera)). However, intraspecific variability, both between different populations and within populations, is commonly observed. This variability frequently refers to chosen characteristics that are currently regarded as important in gastrotrich taxonomy, e.g. body length, number and shape of scales or the presence and number of sensory organs. The lack of data concerning the range and factors determining this variability make work on Gastrotricha considerably difficult. The key problem in this discussion is the borderline between intra- and interspecific variability. To obtain the answer to questions concerning species abundance, phenotypic plasticity and genetic diversity, it is important to combine detailed morphological, morphometric and molecular analyses that will contribute to learning the plasticity ranges of individual species and will help dispel doubts about justification of the basic studies, such as taxonomic analyses.

**The last issue I will mention within the framework of this project will be to determine the time range that is necessary for an analysis of gastrotrichofauna of a given substrate from the moment of collection and the conditions in which the material should be stored.** Fulfilling this objective will show how to obtain data on complete species composition occurring in a given habitat. This objective will also contribute to extending knowledge on the phenomenon of mixing and replacing particular taxa in the community (taking into consideration the rate).

The obtained results will affect not only the studied group, i.e. gastrotrichs, but also other poorly known invertebrates for which knowledge about the range of variability and cryptic diversity is limited. This research will result in gaining particular, empirical data on morphological variability within species and between species. It will also allow us to change the approach to classically conducted studies and issues, such as the concept of species, assemblages of species that are similar morphologically and complexes of cryptic species, and, consequently, these studies will contribute to gaining knowledge about occupying habitats, ranges and cosmopolitanism within particular taxa, not only among Gastrotricha but also among other poorly known and understood benthic invertebrates. These results will also contribute to a better understanding of factors affecting the spectrum of forming communities and the relationships between them. Due to a detailed study of the problem of phenotypic and genetic variability in the proposed project, it will supplement the scarce knowledge on small invertebrates and to verify previous views on phenotypic variability, its range and the importance of taxonomic characteristics.