

# TAXONOMY 3.0 – Inside Tardigrada’s apomorphy: The study of feeding apparatus of tardigrades integrating molecular & morphological evo-devo, phylogeny, ecology, and computer-based solutions

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## **Abstract**

The feeding apparatus of tardigrades is the apomorphy of the phylum (i.e., it represents the evolutionary novelty of the clade). It is one of the few chitinous structures - together with claws, cuticle, and eggshell ornamentations - taxonomically and systematically relevant to describe taxa of tardigrades. The studies on the general morphology of the feeding apparatus are widely diffuse, but its origin, development, ultrastructure, chemical composition, relation between form & function, and species ecology are almost neglected.

The main aims of this project are the study, based on innovative technological solutions, of the ultrastructure, origin, and development of the feeding apparatus of tardigrades to investigate the deep phylogenesis of the phylum Tardigrada and its position in the clade Panarthropoda. Besides, this project will reveal the relations between the morphology of the feeding apparatus and its function and ecology.

The first step of the project is the reconstruction of the diversity of the feeding apparatus among Tardigrada taxon to investigate on the morpho-functional relation and to select relevant characters of the apparatus to reconstruct the phylogenetic relation and the ancestral condition of the phylum. Thus, it will be studied the arrangement and depositional scheme of the chitin and calcium within the feeding apparatus’ parts during the development of the embryos and during the periodic accretion ecdysis in species selected for their position in the phylogenetic tree as well as the chemical composition of the main structures of the feeding apparatus (i.e., perforating stylets, stylets furcae, buccal or buccopharyngeal tube, and placoids).

The genes involved in the formation of the feeding apparatus will be investigated and the hypothesis interpreting the feeding apparatus as modified claws will be hence tested with integrated morphological and molecular approach.

The data collected during the project will be organized, together with literature data, to build a Taxonomy 3.0 online opensource taxonomic key based on the integration of molecular, morphological, ecological, biogeographic, and evolutionary information. This key will allow a faster compilation of species inventories that are essential for the implementation of conservation policies, to mitigate biodiversity loss, and for countless researches in various fields such as phylogenetics, wildlife ecology, and conservation biology.

The expected result of the project is the increased knowledge on the feeding apparatus to understand the selective pressures that led to the diversity of tardigrades and the radiation of the phylum Tardigrada in the clade Panarthropoda.

Moreover, the new knowledge on the ecology and the morpho-functional investigations, together with the 3.0 taxonomic key will asset a starting point for the prediction of where-to-find a species of tardigrade required for experimental settings or peculiar investigations and human-relater stressor assessment.