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Ultrastructure of the digestive system of *Ramazzottius tribulosus* and *Macrobiotus richtersi* (Eutardigrada) in relationship with diet

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ABSTRACT

The ultrastructure of the digestive system of tardigrades was already described in some species, but it has never been studied in relationship to diet. We performed ultrastructural analyses of the midgut and hindgut of phytophagous Ramazzottius tribulosus *and zoophagous* Macrobiotus richtersi*. In addition, the foregut of* R. tribulosus *was analyzed. New ultrastructural details have been observed. Among them are: (a) distinct transverse pillar-like structures, lacking in electron-dense and compact cuticle of the buccal tube; (b) a hole or groups of holes sometimes present in the buccal tube; (c) a large cavity within each of the salivary glands where secreted mucus accumulates; and (d) already found in zoophagous* Isohypsibius prosostomus*, one valve, formed by folds of the pharynx and located at the transition from pharynx to esophagus. In both analyzed species the increase of midgut surface is identified by two orders of folds of the gut wall and by microvilli. In* R. tribulosus *there are many first-order folds and few second-order folds, whereas in* M. richtersi *the opposite pattern is found. A peritrophic membrane and microvilli with a well developed glycocalyx are found only in the midgut lumen of* R. tribulosus*. The density of microvilli and the ratio between the real surface with microvilli and the hypothetical surface without microvilli is lower in zoophagous* M. richtersi *and* I. prosostomus *than in phytophagous* R. tribulosus*. All of these data represent an indirect indication of differences in digestive physiology between phytophagous and zoophagous tardigrade species. The shape of the hindgut is similar in both species and the lumen of the hindgut looks like a heart-shaped cavity with some narrow cell evaginations.*

Key words: ultrastructure, digestive system, diet, Eutardigrada