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Structure and synthesis of the peritrophic membrane in Trichoptera larvae

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Abstract

The peritrophic membrane (PM) in Trichoptera larvae was examined by light, scanning and transmission electron microscopy. The gut of most insects produces 2 fundamental types of PM: Type I is synthesized and secreted by the entire midgut epithelium in response to the ingestion of food; type II is synthesized by specialized cells of the cardiac valve located in the anterior midgut independent from food ingestion. Corallini (2003) described, in the midgut of Limnephilidae larvae, a type I PM which is also secreted by unfed larvae. In this study, both types of PM were observed. Type I PM was evident in larvae of Rhyacophilidae, Leptoceridae, Sericostomatidae and Odontoceridae; the type II PM was observed in larvae of Philopotamidae, Polycentropodidae and Hydropsychidae.

Key words: midgut, peritrophic membrane, Trichoptera, larvae

Introduction

Studies on the presence of the gregarine intestinal parasites in the larvae of several species of Trichoptera (Moretti & Corallini Sorcetti 1981), on the morphology of the midgut of *Rhyacophila italica* Moretti (Corallini Sorcetti & Catapano 1999) and on the peculiar digestion patterns in *Ceraclea fulva* (Rambur) (Corallini & Gaino 2001) have shown the presence of a robust peritrophic membrane (PM) in the midgut of Trichoptera larvae.

The PM is a semipermeable membrane that surrounds the alimentary content, and is composed of chitin, glycoproteins, proteoglycans, proteins (especially peritrophins) and mucine (Spence 1991, Peters 1992, Tellam 1996, Tellam *et al.* 1999). Secreted by the epithelial cells of the midgut, the PM partitions the intestinal lumen between endoperitrophic and ectoperitrophic spaces. The PM function is the mechanical protection of the midgut epithelium from the abrasion of food, parasites and also toxic material.

Wigglesworth (1930, 1972) described 2 types of PM. Type I is synthesized and secreted by the entire midgut epithelium in response to the ingestion of food, but it is also produced by unfed larvae (Baines 1978, Ramos *et al.* 1994, Lehane 1997). Corallini (2003) showed that secretion occurs also in unfed Limnephilidae larvae. Type I PM is widespread in insects, especially in lepidopterans (Spence 1991, Ryerse *et al.* 1992). Type II is synthesized by a specialized ring of cells, the cardiac valve, located in the anterior midgut. Columnar cells, near the stomodeal valve, also contribute to the secretion of PM layers. Type II produces a tube-like PM independent from food ingestion. Type II PM is frequently present in Diptera larvae (Peters 1992, Tellam & Eisemann 2000). Regarding the chemical composition, there are no major differences between the two types of PM. Both have a porous structure.