

INSECT ADAPTATIONS (CHIRONOMIDAE) TO ANOXIA AND HYPOXIA

Summary

Insects show remarkable adaptations to life in terrestrial or aquatic habitats with periodically lower (hypoxia) or absent oxygen contents (anoxia). To these kind of habitats belong aquatic systems, ice encasement, high altitudes, and microhabitats such as mammalian alimentary tracts, carrion, dung, wood and grains. In these environments many insect taxa may exhibit one or two of the main patterns of adaptations: the ability to switch from aerobic to anaerobic metabolism, to alter behavior or to enlarge tracheal system volumes.

In this review special attention was paid to physiology of two common freshwater dipteran families: Chironomidae and Chaoboridae, with different modes of life. Many species of chironomid larvae

(known as bloodworms) possess hemoglobin, which store oxygen. When hemoglobin oxygen is depleted chironomid larvae rely on alcoholic fermentation (from glycogen) for anaerobic energy production. Thanks to ethanol larvae are able to maintain high level of ATP during anoxic exposure. In contrast to the permanently benthic chironomids chaoborid larvae exhibit daily migration. During daylight *Chaoborus* larvae rest in anoxic mud (anaerobiosis) and at this time rely on malate fermentation with principal end products, succinate, while at night they move into normoxic surface water to feed on zooplankton and to restore the high concentration of malate.