

HOW TO SURVIVE IN EXTREME ENVIRONMENTS? ADAPTATIONS OF CHIRONOMIDS

Summary

Chironomidae (Diptera) live in almost every conceivable freshwater environment but there are also species living in moist soil or vegetation and others that are truly terrestrial. Some of chironomid species are inhabitants of ephemeral water-bodies such as temporary rain-pools, phytotelmata (small aquatic habitats associated with living plants, including water-filled tree-holes), freshly filled ponds or soil layers; all these environments seasonally dry out. Chironomids utilize these habitats either by physiological and behavioural adaptations (in situ resistance includes desiccation resistance, often combined with cocoon building and larval migration into deeper, wetter layers of mud, soil or other porous material) or by repeated recolonization of temporarily suitable habitats. The second kind of adaptations concerns the local populations that are able to recolonize any other available habitat. A comparison of these two kinds of chironomid strategies (*in situ* resistance versus recolonization) leads to the conclusion that species that use the recolonization strategy tend to be better at migration and show higher fertility and shorter development time.

Some chironomid species live in arctic areas and show a wide range of adaptations to their extreme severity and seasonality. Chironomids have developed efficient strategies that enable them to adapt physiologically well to low temperatures. These are: morphological (melanism, reduction in size and wings, hairiness), behavioural (habitat selection and cocoon building), ecological (extension of the development time to several years by quiescence or diapause and reduction of the number of generations per year), physiological and biochemical adaptations. The last ones, called cold hardiness, include freezing tolerance (hibernation) and freezing avoidance (supercooling). Both these mechanisms may be accompanied by diapause.

Imagines of Chironomidae are also active in winter in the temperate zone when the temperatures range between -1 to 5°C . Adults appear on the snow surface when temperatures are favourable for copulation or for migration, which when it is colder they remain below the snow, in the subnivean space.