



Structure and morphological types of the antennal olfactory sensilla in Phryganeidae and Limnephilidae (Insecta: Trichoptera)

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Abstract

Structure of the antennal segments and ultrastructure of the sensilla in representatives of Phryganeidae and Limnephilidae have been investigated using scanning electronic microscopy (SEM) and optical microscopy. Twelve types of antennal sensilla have been observed and their preliminary classification based on cuticular structures is discussed. All types of sensilla are unevenly distributed on the surface of the antennal flagellum. The most characteristic feature is the presence of specialized sensory fields on the antennal segments (flagellomeres). These are the depressed ventral areas in the apical parts of flagellomeres in all Phryganeidae and Dicosmoecinae (Limnephilidae) and the elongate ventrolateral areas in more advanced Limnephilidae from the subfamilies Stenophylacinae and Limnephilinae. In contrast to the lower Dicosmoecinae with a wide variety of pseudoplacoid sensilla, the antennal surfaces of both sexes in the subfamilies Limnephilinae and Stenophylacinae have only specialized, dentate, small pseudoplacoids. These data suggest internal heterogeneity in the family Limnephilidae, where Dicosmoecinae have very different antennal structures, and support an hypothesis of separate status for Dicosmoecinae. The families Phryganeidae, Plectrotarsidae and Goeridae have only the forked sensilla while Apataniidae and Brachycentridae only mushroom-like pseudoplacoids. Comparison to representatives of Rhyacophilidae, Molannidae, Hydropsychidae, and Leptoceridae indicates that there are significant variations in the sensory structures of Trichoptera antennae. Functional aspects of the antennal structures in relation to the behavior interaction with the air currents are discussed.

Key words: Trichoptera, antenna, sensilla, receptor, trichoid, flagellum, segment

Introduction

Insect antennae are the well-known appendages situated on the insect head; they are regarded as the key organ responsible for olfaction (Snodgrass 1935). The receptors for the olfactory signal are various types of sensilla. Structures of the sensilla are very diverse. Generally they are derivatives of attached hairs inserted in circular pits called sockets. There are different systems of terminology (Vshivkova *et al.* 2007). We try to follow the most widely accepted old system by Snodgrass (1935) with some modifications and recognize 12 types of microstructures on the antennae of Trichoptera (Fig. 1). These microstructures can be classified in 2 groups according to the configuration of their cuticular parts, as tall or short sensilla forming the high or low sensory layers on an antenna. The tall microstructures are represented in the studied species of Trichoptera by the following types: straight large trichoid sensilla, or chetoids (Fig. 1a); curved long trichoids with ridges (grooved trichoids,