

9

The Panorpid Orders

1. Introduction

In this and the following chapter we shall deal with the endopterygote insects—those that have a distinct pupal instar in which the insect undergoes a drastic metamorphosis from the larval to the adult form. As noted in Chapter 2, Section 3.2, considerable difficulty has arisen in deciding whether the endopterygote orders have a common origin or are polyphyletic. The five orders considered in this chapter, Mecoptera, Diptera, Siphonaptera, Trichoptera, and Lepidoptera, show clear affinities that enable them to be grouped together as the panorpoid complex. Within the complex there are two sister lines of evolution: the Antliophora (first three orders) and the Amphiesmenoptera (Trichoptera and Lepidoptera). The remaining orders, Megaloptera, Raphidioptera, Neuroptera, Coleoptera, Hymenoptera, and Strepsiptera, dealt with in Chapter 10, show few affinities with the panorpoid group.

2. Mecoptera

SYNONYMS: Panorpatae, Panorpina, Panorpida

COMMON NAME: scorpionflies

Slender medium-sized insects; head usually prolonged ventrally into a broad rostrum with long filiform antennae, well-developed compound eyes, and biting mouthparts; usually with two pairs of identical membranous wings with primitive venation and carried horizontally at rest; abdomen with short cerci and, in males, prominent genitalia.

Larvae usually eruciform with simple eyes, biting mouthparts, and thoracic legs; abdominal legs present or absent. Pupae decticous and exarate.

This is a small order containing about 500 known species, about 90% of which belong to two families, Panorpidae and Bittacidae. The order is particularly common in the Northern Hemisphere and includes about 75 North American and 4 British species. About 30 species occur in Australia.

Structure

Adult. A characteristic feature of most Mecoptera is the ventral prolongation of the head into a broad rostrum. Incorporated into this structure are the clypeus, labrum, and maxillae. Compound eyes are well developed, and in most species there are three ocelli. The antennae are multisegmented and filiform. The mouthparts are mandibulate, except in *Nannochorista*, where they are specialized and may be interpreted as foreshadowing the suctorial type seen in lower Diptera. The prothorax is small, the pterothorax well developed. The legs are long and thin and adapted for walking. They have a five-segmented tarsus. In Bittacidae the fifth tarsal segment folds back on the fourth and is used for catching prey. Two pairs of fully developed, identical, membranous wings are present in most species; the venation is primitive. In Boreidae the wings of females are small sclerotized pads while those of males are hooklike and used to grasp the female during mating. Wings are reduced in some female Panorpididae and Bittacidae, and absent in female Apteropanorpidae. The abdomen of females is 11-segmented and usually carries 2-segmented cerci (unsegmented in Bittacidae and Boreidae). In female Boreidae the 10th tergum is prolonged and together with the pointed, sclerotized cerci forms a functional ovipositor. In males segment 9 is bifurcate and bears a pair of bulbous claspers. Segment 10 is inconspicuous and bears unsegmented cerci. The aedeagus lies at the base of the claspers. In Panorpidae the terminal segments are turned upward and resemble somewhat a scorpion's sting, hence the common name for the order.

The foregut has two interesting features. The esophagus contains two dilations that appear to form a sucking apparatus, and the crop is provided with long setae (acanthae) that may act as a filter. Six Malpighian tubules occur. The nervous system is generalized, with three thoracic and between five and eight abdominal ganglia (males usually with one more than females). Each testis comprises three or four follicles. The paired vasa deferentia open separately into a median seminal vesicle, which also receives paired accessory glands. In females each ovary contains 7–19 polytrophic ovarioles (panoistic ovarioles in Nannochoristidae and Boreidae). The paired oviducts unite before entering a genital pouch. The ducts from the spermatheca and accessory glands also lead into the pouch.

Larva and Pupa. Larvae are typically caterpillarlike, with a distinct head capsule that bears simple eyes. Prolegs occur on the first eight abdominal segments, and the apex of the abdomen bears either a suction disc or a pair of hooks. In Boreidae and Panorpididae larvae are grublike, lacking prolegs and a terminal suction disc. Larvae of Nannochoristidae are very elongate, lack prolegs, but have a pair of apical hooks. Pupae are decticious and exarate.

Life History and Habits

Adult scorpionflies are most frequently encountered in cool, shaded locations, especially among low vegetation, though a few species occur in semidesert habitats. They can fly actively when disturbed, though they normally rest on grass, under leaves, etc. Adult Panorpidae feed mostly on dead soft-bodied arthropods (including insects caught in spiders' webs); they also eat nectar, pollen, and fruit juices. Bittacidae, by contrast, are insect predators, catching their prey either in flight or by hanging under vegetation till it comes within range. In members of both of these families much of the food of females is provided in the form of a nuptial gift by a male during courtship (see Chapter 19, Section 4.2). The food item may be an arthropod recently obtained by the male or a mass of saliva secreted from the male's greatly enlarged salivary glands. Adult Boreidae feed on mosses,