

The Hemipteroid Orders

1. Introduction

The four orders (Psocoptera, Phthiraptera, Hemiptera, and Thysanoptera) that constitute the hemipteroid group are united by the following features: specialized, usually sucking, mouthparts; small anal lobe in hind wing; wing venation reduced; cerci absent; few Malpighian tubules; and ventral nerve cord with few discrete ganglia. On the whole, the hemipteroid group is more homogeneous than the orthopteroid group, although two evolutionary lines have developed, leading to the Psocoptera-Phthiraptera, on the one hand, and the Hemiptera-Thysanoptera, on the other.

2. Psocoptera

SYNONYMS: Corrodentia, Copeognatha

COMMON NAMES: barklice, booklice, psocids

Small or minute soft-bodied insects; mobile head with long filiform antennae and specialized chewing mouthparts, compound eyes usually prominent but reduced in some species; prothorax small, wings present or absent, legs with two- or three-segmented tarsi; external genitalia of both sexes concealed, cerci absent.

This order, containing about 3200 described species, has a worldwide, though predominantly tropical, distribution. Some 290 species occur in North America, about 80 in Britain, and 300 in Australia.

Structure

Psocoptera are stocky, soft-bodied insects whose length is usually less than 10 mm. The large, mobile head bears a swollen postclypeus, long filiform antennae, and, usually, prominent compound eyes, though the latter are reduced in some wingless species. Three ocelli are usually present in winged forms but absent in apterous species. The Y-shaped epicranial suture is prominent. The mouthparts, though retaining a chewing function, are specialized. The mandibles are dissimilar, though each has both grinding and cutting edges. In the maxillae the cardo and stipes are not always distinct. The galea is a large, fleshy lobe,

whereas the lacinia is a narrow, sclerotized rod (the pick), which may be used to scrape food from the substrate. The hypopharynx, which is able to take up water from the atmosphere (Rudolph, 1982), has a characteristic structure. The lingua bears a pair of ventral sclerites that are connected to the median sitophore sclerite by five ligaments. The sitophore sclerite is situated on the ventral surface of the base of the cibarium. Opposite to it, on the dorsal surface of the cibarium wall, is a knoblike process that is believed to move against the sclerite in the manner of a mortar and pestle and facilitate the grinding up of food.

In winged forms the small prothorax is largely concealed by the pterothorax. The wings are membranous and have a prominent but reduced venation. The anterior pair is larger than the hind pair. At rest they are held rooflike over the body. The fore and hind wings are coupled both during flight and at rest. Varying degrees of brachyptery occur, even within the same species, and aptery is common, especially in females. The legs are usually slender and similar; in some species the hind coxae carry what is believed to be a stridulatory organ. The abdomen is 10-segmented and terminates in a dorsal epiproct and a pair of lateral paraprocts that may represent the 11th segment. The external genitalia of males are weakly developed, and their homologies are uncertain. A small ovipositor is usually present in females, though it is much reduced or absent in some forms. Cerci are never present.

Four Malpighian tubules originate at the posterior end of the midgut, which is long and convoluted. The nervous system is highly modified and comprises only five ganglionic centers: brain, subesophageal ganglion, prothoracic ganglion, a composite pterothoracic ganglion, and a composite abdominal ganglion. The tracheal system usually opens to the exterior by means of two pairs of thoracic and eight pairs of abdominal spiracles. Each ovary contains three to five polytrophic ovarioles. The lateral oviducts are short and open into a larger median duct. A spermatheca is present. The testes are roundish or three-lobed. The vasa deferentia lead into large seminal vesicles that appear to produce the material of the spermatophore.

Life History and Habits

Most Psocoptera are found on vegetation or under bark, though some live among leaf litter, under stones, or in caves. A few species are associated with humans and may be encountered in houses or buildings in which food materials are stored. Though they may occur in vast numbers, they are seldom of economic importance. They are primarily phytophagous, feeding on algae, lichens, fungi, pollen, and decaying fragments of higher plants; occasionally they eat dead animal matter. Species associated with humans live on cereal products or, in the case of the common booklice, molds that develop on old books. Many species are gregarious, with individuals of all ages living together, often beneath a silken web produced from secretions of the modified labial glands. Most outdoor species are fully winged, though brachyptery and aptery are common under certain environmental conditions.

Males are unknown in some species, while in others facultative parthenogenesis may occur. In dioecious species a male typically courts a female prior to mating. Eggs, between 20 and 100 at a time, are laid singly or in groups, usually on vegetation or under bark, and they may be covered with silk, particles of debris, or fecal material. They have a thin chorion and lack micropyles and aeropyles. A few species are viviparous. Larvae usually pass through six instars prior to metamorphosis, but this figure is often reduced in polymorphic species. Typically the apterous morphs have one fewer instar than the fully winged