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Apterygote Hexapods

1. Introduction

Traditionally, the groups included in the term "apterygote hexapods," namely, the Collembola, Protura, Diplura, and Thysanura (including Microcoryphia and Zygentoma), were considered orders of primitively wingless insects and placed in the subclass Apterygota (Ametabola). They show the following common features: lack of wings, lack of a pleural sulcus on the thoracic segments, presence of pregenital abdominal appendages, slight or absent metamorphosis, and indirect sperm transfer. As more information on their structure and habits has become available, it has become apparent that (1) their status as insects (except for Thysanura) is doubtful and (2) the relationship of the groups with each other is more distant than originally believed. Several authors have therefore recommended that the insectan subclass Apterygota be reserved solely for the Thysanura and that the Collembola, Protura, and Diplura each be given the rank of class, with the Collembola and Protura considered as sister groups within the Ellipura (see Figure 1.11). These three groups differ fundamentally from insects in several features; for example, they are entognathous, have intrinsic musculature in the antennae, and lack compound eyes which are characteristic of most insects, at least in the adult stage. Thus, the Ellipura and Diplura are sometimes considered sister groups within the Entognatha. However, other analyses indicate that the Entognatha is a paraphyletic assemblage (see Chapter 1, Section 3.3.1).

The Collembola are probably furthest removed from the winged insects. They possess only six abdominal segments, a postantennal sensory organ similar to the organ of Tömösvary found in myriapods, gonads with lateral (rather than apical) germaria, and eggs in which there is total cleavage. Non-insectan features of the Protura are the absence of antennae (perhaps a secondary condition associated with their soil-dwelling habit), the occurrence of anamorphosis, and a genital aperture that opens behind the 11th segment. Diplura are superficially similar to Thysanura, with which some authors group them. However, in addition to the features mentioned above, they differ from typical insects in having unusual respiratory and reproductive systems. Even though all Thysanura are considered insectan, it is now apparent that the group contains two distinct subgroups, the Microcoryphia and the Zygentoma (= Thysanura *sensu stricto*), to which some authors accord ordinal status. The primary basis for this distinction concerns the mouthparts. In the Microcoryphia (such as *Machilis* and its allies, the bristletails) the mandibles have a single articulation with

the head and bite with a rolling motion. In the Zygentoma (which includes silverfish and firebrats), on the other hand, there is a dicondylic articulation of the mandible, which thus bites transversely as in pterygote insects. As noted in Chapter 1, differences in the structure and operation of the mouthparts are of fundamental phylogenetic importance.

2. Collembola

SYNONYMS: Oligentoma, Oligoentomata COMMON NAME: springtails

Small to minute wingless hexapods; head pro- or hypognathous, antennae segmented, compound eyes absent, mouthparts entognathous; abdomen 6-segmented, typically with three medially situated pregenital appendages (collophore on segment 1, retinaculum on segment 2, furcula on segment 4), gonopore on 5th segment.

Collembola are abundant on every continent, including Antarctica. About 6500 species have been described, including more than 1600 from Australia, 300 from the United Kingdom, and about 840 from North America. Individual species may be quite cosmopolitan, sometimes as a result of human activity when they may become pests.

Structure

Collembola vary in length from about 0.2 to 10 mm. They are generally dark, but many species are whitish, green, or yellowish, and some are striped or mottled. The body is either elongate (Arthropleona) (Figure 5.1B) or more or less globular (Symphypleona and Neelipleona) (Figure 5.1A). The head is primitively prognathous, but is hypognathous

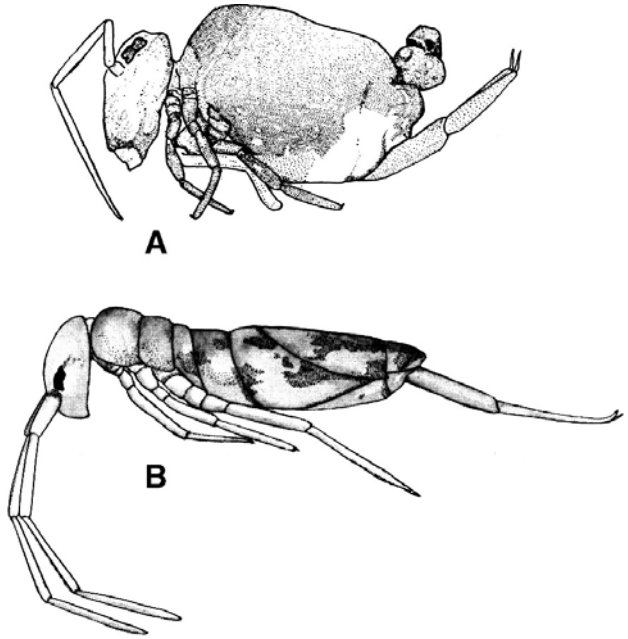

FIGURE 5.1. Collembola. (A) *Sminthurus purpurescens* (Sminthuridae); and (B) *Entomobrya nivalis* (Entomobryidae). [Reprinted from Elliott A. Maynard, 1951, *A Monograph of the Collembola or Springtail Insects of New York State*, Comstock Publishing Co., Inc.]