INTRODUCTION

This work on the Collembola of Iowa is the result of four years' study of a collection of many thousand specimens, taken in all parts of the state. It without doubt contains a great majority of the indigenous species, but it is not complete. Some forms, because the material is insufficient or in too poor condition for complete study, have been omitted.

A number of the species dealt with in this work have not been recorded from North America heretofore. The matter of identifying our forms with exotic forms has been approached with caution, for the collections of foreign material at hand are extremely meager. Some of the inclusions in this work differ in minute, however, distinct, details from European species, but may, upon comparison, prove to be synonymous with them. It is believed better to describe them as new than to commit the oft-repeated mistake of erroneously recording exotic forms as occurring within our territory.

Cotypes of the new species are at present in the collections of the author and of Iowa State College.

COLLECTION AND PRESERVATION

A great deal of the collecting was done with a Berlese funnel. An instrument of great value in hand collecting was a rubber tube with a glass mouthpiece at one end, and, inserted in the other end, a glass tube drawn out to a small aperture distally and closed with bolting cloth at the base. By quick inhalation, springtails were drawn from cracks into the small nozzle and against the bolting cloth, and were shaken into a bottle of alcohol with the appendages, hairs and scales of the body uninjured.

Specimens were kept in alcohol (80 to 90 percent) until they could be examined. For clearing purposes, diaphanol worked well with the unpigmented forms (*Tullbergia,* etc.), as did also lactic acid; a concentrated solution of KOH was used for dark species. Specimens were mounted in Berlese's fluid.*

*Gum arabic 12 gm., distilled water 20 gm., chloral hydrate 20 gm., concentrated glycerine 8 gm. or 6 c.c.

MORPHOLOGY AND TERMINOLOGY

The peculiar morphological structure of this group of insects has necessitated a rather distinct terminology. The head may be either prognathous or hypognathous. The antennae are typically four-segmented, but sometimes, however, they are subdivided into five or six segments. The third and fourth segments may be annulated or subsegmented. The eyes are typically eight on each side, but often are fewer in number. Mouthparts are either for chewing or for sucking, and, because of embryonic outgrowths of the genae, they appear to be withdrawn into the head. The type of mouthparts is of importance in classification.

Several kinds of sense organs occur on the head. Directly behind the antennal bases are found the postantennal organs, which in their simplest form are single cuticular swellings. These organs are extremely variable in shape. Near the apex of the third antennal segment is found a sense organ, which, in its simplest form, is composed of two sensory pegs, but in the Onychiurinae it forms a complex organ furnished with papillae, sense clubs, sense rods, and protective hairs. Thick, blunt olfactory hairs occur on the third and fourth antennal segments in the more primitive forms, and a retractile sense knob is often present at the apex of the fourth segment.

The three regions of the thorax are well separated. The prothorax is smallest, often membranous dorsally and devoid of bristles. In some of the Entomobryidae the mesonotum projects over the pronotum and sometimes over the base of the head.

The legs are composed of two precoxae, coxa, trochanter, femur, tibio-tarsus, and a small apical praetarsus or transtarsus. Two claws are typically present, a large claw called the unguis, and a small opposing claw, the unguiculus; the latter may be absent. These claws are often toothed. The ungues of *Sinella* and *Pseudosinella* bear large basal paramedian teeth or "wing teeth," besides the smaller, more distal median teeth. Lateral teeth or pseudonychia may also occur on the ungues. On the inner face of the hind tibiotarsus near the apex, in the genus *Sminthurides*, are sac-like swellings and an enlarged hair, which compose the "tibiotarsal organ."

The abdomen is composed of six segments. In the Arthropleona it is elongate and the segments are well separated. In the Symphypleona it is fused with the thorax into a globular mass, and the segmental sutures are obliterated or indistinct. In the latter

group, however, the last two segments are usually well separated from the large abdominal region (the furcal segment) and form the anal papilla. The fifth abdominal segment bears ventrally the genital opening and the sixth bears the anus. On each side of the anus in females of most of the Smithuridae are found chitinous structures known as the anal appendages. Dorsally on the head and body in the Onychiurinae are found circular depressions called pseudocelli. The third segment bears ventrally a small structure, the tenaculum, which holds the spring in place beneath the body. The spring or furcula is attached to the venter of the fourth segment (apparently to the fifth in most Entomobryidae). It is composed of a proximal piece, the manubrium, and two distal pieces called the dentes, each of which is tipped by a small chitinous, sometimes lamellate structure, the mucro. The dentes bear ridges basally on their inner surfaces, which are very large and hook-like in the genus *Isotomodes*, and upon which the teeth of the tenaculum catch when the spring is held beneath the body. In some genera, especially in the Tomocerinae, there are inward-pointing spines at the base of the dentes.

The body may be either clothed with scales or hairs; it sometimes may appear nearly naked. The hairs vary greatly. They may be short and smooth or strongly clavate and fringed. Long, extremely slender hairs, arising from cups in the integument, are sometimes present and are known as bothriotricha.

The Iowa list at present includes 132 species distributed in 43 genera. Of these species, 59 are known to be holarctic or cosmopolitan in their range. Numerous groups which are given a family standing today are not recognized as such in this work. The tendency seems to be to divide and redivide this small group to a point where its classification becomes cumbersome. The conservative classification used here, which follows closely the arrangement of Linnaniemi (1912), is as follows:

CLASSIFICATION OF COLLEMBOLA

Order Collembola Lubbock.
- Suborder Arthropleona Börner.
  - Family Poduridae Lubbock.
    - Subfamily Podurinae Börner.
      - Genus *Podura* Linnaeus.
    - Subfamily Achorutinae Börner.
      - Genus *Achorutes* Templeton.

*Genus *Beckerella* Linnaniemi.
Genus *Xenylla* Tullberg.
Genus *Willemia* Börner.
Genus *Brachystomella* Ågren.
Subfamily Neanurinae Börner.
Tribe Pseudachorutini Börner.
Genus *Friesea* Dalla Torre.
Genus *Pseudachorutes* Tullberg.
Genus *Odontella* Schäffer.
*Genus *Xenyllodes* Axelson.
Genus *Anurida* Laboulbène.
Genus *Micranurida* Börner.
Genus *Paranura* Axelson.
Tribe Neanurini Börner.
*Genus *Protanura* Börner.
*Genus *Morulina* Börner.
Genus *Neanura* MacGillivray.
Subfamily Onychiurinae Börner.
*Genus *Tetrodontophora* Reuter.
Genus *Onychiurus* Gervais.
*Genus *Kalaphorura* Absolon.
Genus *Tullbergia* Lubbock.
Family Entomobryidae Tömösváry.
Subfamily Isotominae Schäffer.
*Genus *Uzelia* Absolon.
Genus *Anurophorus* Nicolet.
*Genus *Tetracanthella* Schött.
Genus *Folsomides* Stach.
Genus *Isotomodes* Axelson.
Genus *Folsomia* Willem.
Genus *Folsomina* Denis.
*Genus *Guthriella* Börner.
*Genus *Archisotoma* Axelson.
*Genus *Ågrenia* Börner.
*Genus *Axelsonia* Börner.
Genus *Architomocerura* Denis.
Genus *Proisotoma* Börner.
*Genus *Spinisotoma* Stach.
Genus *Isotomurus* Börner.
Genus *Isotoma* Bourlet.

*Genera not as yet found in Iowa.

Subfamily Entomobryinae Schäffer.
Tribe Entomobryini Börner.
Genus *Sinella* Brook.
Genus *Entomobrya* Rondani.
*Genus *Drepanura* Schött.
Genus *Sira* Lubbock.
Genus *Lepidocyrtus* Bourlet.
Genus *Drepanocyrtus* Handschin.
*Genus *Lepidocyrtinus* Börner.
Genus *Pseudosinella* Schäffer.
Tribe Orchesellini Börner.
*Genus *Typhlopodura* Absolon.
Genus *Heteromurus* Wankel.
Genus *Orchesella* Templeton.
Tribe Cyphoderini Börner.
Genus *Cyphoderus* Nicolet.
Subfamily Tomocerinae Schäffer.
Genus *Tomocerus* Nicolet.
*Genus *Tritomurus* Frauenfeld.

Suborder Symphypleona Börner.
Family Neelidae Folsom.
*Genus *Neelus* Folsom.
Genus *Megalothorax* Willem.
Family Sminthuridae Börner.
Subfamily Sminthuridinae Börner.
Genus *Sminthurides* Börner.
Genus *Arrhopalites* Börner.
Genus *Sminthurinus* Börner.
Genus *Neosminthurus* new genus.
Subfamily Sminthurinae Börner.
Genus *Bourletiella* Banks.
Genus *Deuterosminthurus* Börner.
Genus *Sminthurus* Latreille.
*Genus *Allacama* Börner.
*Genus *Sphyrotheca* Börner.
Subfamily Dicyrtominae Börner.
*Genus *Dicyrtomina* Börner.
Genus *Dicyrtoma* Bourlet.
Genus *Ptenothrix* Börner.