

## SUBORDER ARTHROPLEONA BÖRNER, 1901

Body elongate. Thoracic and abdominal segments usually well separated; but ankylosis of the last 2 or 3 abdominal segments may occur. Sacs of the ventral tube small, never warty. Anal appendages absent.

### Key to the Families of Arthropleona

- Prothorax naked dorsally (fig. 7), often membranous and more or less covered by the forward-projecting mesonotum. Integument smooth or rarely minutely granulate, covered with hairs or scales. Furcula absent (in our fauna) only in *Anurophorus*.....Entomobryidae Tömösváry, p. 39.
- Prothorax with dorsal bristles (fig. 1); never of a different texture from the terga of the other segments or covered by a projecting mesonotum. Integument granulate or tuberculate, never bearing scales. Furcula often absent.....
- Poduridae Lubbock, p. 7.

## FAMILY PODURIDAE LUBBOCK, 1870

Body elongate. Abdomen distinctly segmented. Pronotum well developed, furnished with dorsal setae. Abdominal terga usually not imbricate and without well developed intersegmental membranes. Antennae not much longer than the head, usually thick and heavy. Anal horns often present. Mouthparts chewing or sucking. Postantennal organ present or absent, usually present and well developed. Spring present or absent. Integument granulate, often coarsely so.

### Key to the Subfamilies of Poduridae

1. Mouthparts developed for chewing, mandibles with well developed grinding surface, or absent..... 2
- Mouthparts developed for piercing and sucking, the mandibles rather sharply pointed and without a well developed grinding surface.....Neanurinae Börner, p. 19.
2. Furcula well developed, reaching to the ventral tube. Dentes annulate toward the tip. Unguiculus and postantennal organ absent. Head hypognathous.....Podurinae Börner, p. 8.

- Furcula never reaching to the ventral tube, or absent; the dentes never annulate. Unguiculus and postantennal organ usually present. Head prognathous..... 3
3. Eyes usually present. Postantennal organ, when present, furnished with at the most 12 peripheral tubercles. Pseudocelli absent.....Achorutinae Börner, p. 8.
- Eyes absent. Postantennal organ, when present, usually consisting of numerous tubercles in a transverse groove behind the antennal base. Pseudocelli present. Furcula absent or rudimentary in all known North American species..... Onychiurinae Börner, p. 30.

### SUBFAMILY PODURINAE BÖRNER, 1906

Mandibles for chewing, with well developed molar surfaces. Eyes 8 on each side. Postantennal organ absent. Spring well developed, reaching to the ventral tube; dentes strongly bowed out, and annulate toward the tip. Unguiculus absent. Head hypognathous.

GENUS *PODURA* (L.) TULLBERG (1758) 1871

Characters of the subfamily.

*PODURA AQUATICA* L., 1758.

*P. granulata* MacGillivray, 1893.

Length up to 1.5 mm. Red-brown to blue-black. Unguis long and slender. Mucrones trilamellate, granular.

Ames: June 10. Gilbert: June 18. Little Wall Lake: Oct. 14—G. C. Decker. Mt. Pleasant: Feb. 24—H. R. Knight. Shell-rock: Oct. 14—B. V. Travis.

Ill., Ind., Kans., Mass., Minn., Ohio, Tenn., Tex., Wash., Wis. Alaska, Ontario, Cosmopolitan.

This species, the only representative of the subfamily, is distinctive in the position of the head, the position of the eyespots on the upper part of the head, and the long furcula. It is often present in immense numbers on the surface of stagnant water.

### SUBFAMILY ACHORUTINAE BÖRNER, 1901

Mouthparts for chewing, mandibles with molar surfaces [in *Brachystomella* Ågren, which lacks mandibles, the maxillae are heavy with numerous teeth, and resemble those found in other genera of the subfamily (fig. 31)]. Eyes present or absent. Postantennal organ present or absent. Spring rarely absent, never

reaching the ventral tube, the dentes never annulate. Unguiculus present or absent. Pseudocelli absent. Head prognathous.

Key to the Genera of Achorutinae

1. Furcula and eyes absent.....*Willemia* Börner, p. 17.  
Furcula and eyes present ..... 2
2. Eyes usually 8 on each side. Postantennal organ present.... 3  
Eyes 5 on each side. Postantennal organ absent. Unguiculus  
absent.....*Xenylla* Tullberg, p. 15.
3. Postantennal organ consisting of a single tubercle. Ungui-  
culus and anal horns absent....*Beckerella* Linnaniemi, p. 15.  
Postantennal organ rosette-shaped, often with an independ-  
ent lateral tubercle or "Nebenhöcker." Anal horns pres-  
ent or absent. Unguiculus rarely absent..... 4
4. Mandibles present. Anal horns usually present.....  
*Achorutes* Templeton, p. 9.  
Mandibles and anal horns absent.....  
*Brachystomella* Ågren, p. 18.

GENUS *ACHORUTES* TEMPLETON, 1835

*Hypogastrura* Bourlet, 1839.

Eyes usually 8 on each side. Postantennal organ present, furnished with 4 to 7 tubercles and often a "Nebenhöcker." Furcula present. Unguiculus absent only in the subgenus *Schöttella* Schäffer. Anal horns present. The subgenera represented in our fauna may be keyed out as follows.

- Unguiculus well developed.....*Achorutes* s. str., p. 9.  
Unguiculus absent or rudimentary.....*Schöttella* Schäffer, p. 13.

Key to the Species of *Achorutes* s. str.

1. Dentes dorsally with large, conical teeth ..... 2  
Dentes without large, conical teeth ..... 4
2. Body with large, capitate, serrate setae .....  
*nothus* Macnamara, p. 12.  
Body without capitate, serrate setae (one pair of capitate  
hairs near the anal horns in *A. harveyi*)..... 3
3. Anal horns minute.....*nivicolus* Fitch, p. 12.  
Anal horns subequal to the hind unguis.....  
*harveyi* Folsom, p. 11.
4. Tenent hairs 2 or 3 on each tibiotarsus .....  
*macgillivrayi* Folsom, p. 13.  
Tenent hairs 1 on each tibiotarsus ..... 5
5. Body with stout capitate, serrate setae dorsally.....  
*packardi* Folsom, p. 13.

- Body without erect capitate and serrate hairs..... 6
6. Mucro bluntly rounded, with a triangular external lamella....  
*armatus* Nicolet, p. 10.
- Mucro without a large triangular, external lamella..... 7
7. Mucro heavy and blunt, without a large dorsal lamella.....  
*packardi dentatus* Folsom, p. 13.
- Mucro elongate, with a large dorsal lamella ..... 8
8. Tip of the mucro straight. Anal horns half the length of the  
hind unguis.....*copiosus* Folsom, p. 11.
- Tip of the mucro hooked. Anal horns a fourth the length of  
the hind unguis.....*maturus* Folsom, p. 10.

#### ACHORUTES ARMATUS Nicolet, 1841

*A. boletivorus* Pack., 1873,

*A. pratorum* Pack., 1873,

*A. marmoratus* Pack., 1873.

Length up to 1.5 mm. Color pattern extremely variable, from a dark blue to a canary yellow with various arrangements of spots and irregular stripes. Antennae shorter than the head, the segments as 5:4:5:6, an eversible sac between the 3rd and 4th segments. Postantennal organ of 4 tubercles. Eyes 8 on each side. Unguis slender, 1 inner tooth near the middle. Unguiculus (in typical form) extending as far as the tooth of the unguis, with an elongate basal lamella. Mucro half as long as the dentes, rounded apically, with a large, triangular, lateral lobe. Anal horns 2, longer than the hind unguis. Clothing abundant, of short curving setae and long serrate hairs.

Ames: April 2, 9—A. R. Rolfs, 10—E. D. Ball; May 7, 14. Central City: Mar. 23. Columbus Junction: Sept. 26. Hancock: Oct. 9—F. Andre. Iowa City: Oct. 4; LeGrand: Mar. 22, April 14, Aug. 4. Leon: Oct. 14, 31—B. V. Travis. Little Wall Lake: Oct. 14—G. C. Decker. Maquoketa Caves: May 8. Ottumwa: Sept. 9—F. Andre. Ruthven: Oct. 2—H. M. Harris and B. V. Travis. Shellrock: Oct. 14—B. V. Travis.

Ariz., Colo., Conn., Ill., La., Mass., Me., Minn., Mo., N. H., N. Y., Ohio, Pa., Tex., Wash. Alaska. Greenland. Ontario. Cosmopolitan.

#### ACHORUTES MATURUS Folsom, 1916

*A. schötti* Guthrie, 1903

Length up to 1 mm. Dark blue to light tan; pigment broken by lighter spots. Antennae shorter than the head, with segments

as 11:14:17:26. Postantennal organ of 4 tubercles and a large "Nebenhöcker." Eyes 8 on each side. Unguis heavy. Tenent hair 1, long and knobbed. Mucro to the dens as 2:5, the apex upturned, with an external lamella ending before the apex. Anal horns small, about a fourth the hind unguis, curving. Clothing of short setae.

Ames: Mar. 30; July 15—H. M. Harris and F. Andre; Sept. 25. Central City: July 25. Council Bluffs: Sept. 11. Hampton: June 18. Hancock: Sept. 9—F. Andre. Leon: Oct. 1—B. V. Travis. Maquoketa Caves: May 8. New Sharon: Sept. 19—F. Andre. Ruthven: Oct. 2—H. M. Harris and B. V. Travis.

Calif., Ind., Ill., Kans., Minn., Tex., Utah. Mexico.

*ACHORUTES COPIOSUS* Folsom, 1916

*A. schneideri* Guthrie, 1903

Length up to 2.2 mm. Deep blue-black. Antennae longer than the head, comparatively slender. Eyes 8 on each side. Unguis with an inner tooth beyond the middle. Unguiculus half the unguis, with a large basal lamella. Tenent hair 1, long. Anal horns half the hind unguis, on large, contiguous papillae. Mucro to the dentes as 2:7, with a large dorsal lamella; apex not upturned. Clothing of short, curving setae.

Ames: Feb. 22.

Minn. Ontario. Mexico.

*ACHORUTES HARVEYI* Folsom, 1902

Length up to 2.6 mm. Deep blue-black. Antennae longer than the head, the segments as 10:13:13:20. Postantennal organ of 4 or 5 tubercles. Eyes 8 on each side. Unguis with a tooth beyond the middle. Unguiculus half the claw length, with an oblong basal lamella. Tenent hair 1 on each tibiotarsus. Anal horns subequal to the hind unguis. Dentes with 7 to 18 large pointed teeth dorsally. Mucro a fourth the length of the dens, the apex emarginate as in *A. socialis*. Clothing of simple setae, with 1 large, weakly knobbed hair just outside of each anal horn.

Ames: Jan. 16—H. M. Harris and F. Andre; Mar. 26. LeGrand: Oct. 27.

Conn., Mass., Me., Md., N. Y. Ontario.

## ACHORUTES NIVICOLUS Fitch, 1847

*A. socialis* Uzel, 1890

Length up to 2 mm. Deep blue-black. Antennae subequal to the head, segments as 7:9:10:15. Postantennal organ of 4 (rarely 5) tubercles and a "Nebenhöcker." Eyes 8 on each side. Unguis with an inner tooth a third from the apex. Unguiculus half the claw length, with a large inner basal lamella. Tenent hair 1. Anal horns minute, conical. Dentes dorsally with 4 to 7 large, pointed tubercles. Mucro a fourth the dens, the apex emarginate. Clothing of rather erect, simple setae.

In 1902, Dr. J. W. Folsom reviewed the "snow-flea complex," redescribing Fitch's *Podura nivicola*, and describing *A. harveyi* and *A. packardii*. The name *nivicola* was retained for the species fitting most closely the localities and collection dates recorded by Fitch. The types of the species were not known to exist at that time. In 1890 Uzel gave the first definite description of the species under the name *A. socialis*, and that name has been employed since. Dr. Folsom writes me (in lit., March 6, 1933) that the types of *P. nivicola* have been discovered in the United States National Museum, and have been studied by him. All of the 25 specimens are of the species which has been known as *A. socialis*, confirming his deduction of 1902. Fitch's name antedates Uzel's by 43 years, and will have to replace it.

Ames: Jan. 16.

Mass., Me., Mich., Minn., N. Y., Pa. Ontario. Cosmopolitan.

## ACHORUTES NOTHUS Macnamara, 1922

Length up to 1 mm. Color deep granular blue, lighter ventrally and along the sutures. Antennae subequal to the head, the segments as 5:15:15:22. Postantennal organ of 4 tubercles. Eyes 8 on each side. Unguis with 1 inner tooth near the tip. Unguiculus half the unguis, with a broad basal lamella. Tenent hairs 1 on each tibiotarsus. Anal horns heavy, curving, a third the length of the hind claw. Dentes dorsally with 4 or 5 large conical tubercles. Mucro a fourth the dens and inserted subapically on its inner face, the apex emarginate. The body with long, capitate setae and shorter, curving, serrate ones.

Shellrock: Oct. 14—B. V. Travis.

Ontario.

## ACHORUTES PACKARDI Folsom, 1902

Length up to 2.5 mm. Dark blue-black. Antennae shorter than the head. Postantennal organ with 4 peripheral tubercles. Eyes 8 on each side. Unguis heavy, untoothed. Unguiculus with a basal lamella. Tenent hair 1. Anal horns nearly as long as the hind unguis. Dentes with several dorsal setae, the basal one as long as the furcula. Mucro a fifth the dens. Body with heavy serrate setae, some short and curving, and a series of long, capitate, serrate hairs across each segment.

This is by far the most common cortical species of the genus in Iowa, and it is often found in large colonies.

Ames: Mar. 27—H. Hixson, 30—L. S. Jones; Apr. 9. Jewell: Apr. 9. Mt. Pleasant: Mar. 26—H. R. Knight. Ontario: May 3. Shellrock: Oct. 14—B. V. Travis.

Ill., Mass., Me., Md., N. Y., Ohio, Pa. Ontario.

## ACHORUTES PACKARDI DENTATUS Folsom, 1902

Unguis unidentate. Erect body setae knobbed only at the apex of the abdomen, and then indistinctly. Mucro slightly longer than in *A. packardi*, f. p. Otherwise as in the typical form.

Ames: Oct. 20—F. Andre.

Mass., Me., N. Y., Ohio.

## ACHORUTES MACGILLIVRAYI Folsom, 1916

Length up to 1.6 mm. Dark to pale mottled blue above, lighter beneath. Postantennal organ of 4 or 5 tubercles. Antennae longer than the head, the segments as 7:8:9:20. Eyes 8 on each side. Unguis unidentate toward the apex. Unguiculus more than half the unguis in length, with a round basal lamella. Tenent hairs 3 on each tibiotarsus, sometimes 2 on the front legs. Mucrones a fourth the length of the dentes, rather bluntly triangular. Anal horns a fourth the hind unguis, blunt. Clothing of sparse, short setae, longer on the apex of the abdomen.

Central City: July 25. Maquoketa: May 8. Mt. Pleasant: Mar. 15, Apr. 2—H. R. Knight.

Ill., N. Y., Pa. Ontario.

## Key to the Species of Schöttella

Eyes 8 on each side.....:*glasgowi* Folsom, p. 14.  
Eyes 6 on each side.....*minutissimus* n. sp., p. 14.

## ACHORUTES (SCHÖTTELLA) GLASGOWI Folsom, 1916

Fig. 20

Length up to 1 mm. Body deep blue, with lighter interspersed spots; venter, spring, and intersegmental sutures lighter. Post-antennal organ about the size of an eye, with 4 peripheral lobes. Antennae subequal to the head, the 4th segment with 7 olfactory hairs. Eyes 8 on each side. Unguis untoothed; unguiculus represented by a small bristle. Tenent hairs 2 on each tibiotarsus. Anal horns minute. Dentes (fig. 20) with 4 or 5 dorsal setae. Mucro pointed and slender. Rami of tenaculum 3-toothed. Mandibles with molar surface as in *Achorutes* s. str. Clothing of stout, curving, feebly serrate setae.

Ames: Mar. 27—H. Hixson; June 3. Leon: Oct. 10—B. V. Travis.

Ill., N. Y., Tex.

## ACHORUTES (SCHÖTTELLA) MINUTISSIMUS n. sp.

Figs. 15-19

Length 0.55 mm. Reddish brown to gray. Eyes (fig. 15) 6 on each side. Postantennal organ in a deep triangular groove, composed of 4 unequal tubercles. Antennae clavate, the 3rd and 4th segments fused; shorter than the head, segments 1:2:3 and 4 as 13:14:32. Fourth antennal segment with 5 or 6 olfactory hairs, and a small, retractile, apical sense club. Organ of the 3rd antennal segment with 2 small, nearly free sense clubs, and heavy ventro-lateral and dorso-lateral olfactory hairs. Unguis (fig. 18) long and slender, nearly straight, with a minute inner tooth near the middle. Unguiculus about a fourth the unguis, the distinct inner lamella reaching practically to the apex. Knobbed tenent hairs absent. Rami of tenaculum 4-toothed. Mucrones to dentes as 2:5, the apex hooked, a dorsal lamella ending before the apex. Dentes (fig. 19) with 5 to 7 dorsal setae. Anal horns absent. Clothing of rather long, curving setae, becoming more abundant but not greatly longer posteriorly. Integument coarsely tuberculate.

This species bears a superficial resemblance to the genus *Brachystomella*. It has, however, well developed mandibles of achorutine type. It seems to be a rare inhabitant of decaying, matted vegetation. It resembles *Microgastrura duodecimoculata* Stach (1922b), of Albania.

Ames: Mar. 28, leaf mould. Garden Grove: Oct. 10—B. V. Travis.



GENUS *BECKERELLA* LINNANIEMI, 1912

Eyes 8 on each side. Postantennal organ composed of a single tubercle. Unguiculus and furcul present. Anal horns absent.

This genus has not been found in Iowa. It is possibly represented in North America by *Achorutes tigrina* Harvey.

GENUS *XENYLLA* TULLBERG, 1869

Eyes 5 on each side. Postantennal organ absent. Anal horns 2. Unguiculus absent. Furcula present but reduced; mucro often fused with the dens.

Key to the Species of *Xenylla*

1. Mucro separated from the dens.....*welchi* Folsom, p. 15.  
Mucro and dens confluent ..... 2
2. Mucrodens with a rather broad subapical lamella.....  
*grisea* Axelson, p. 15.  
Mucrodens with a long, slender dorsal lamella.....  
*maritima* Tullberg, p. 16.

*XENYLLA WELCHI* Folsom, 1916*X. subwelchi* Denis, 1924

## Fig. 22

Length up to 1 mm. Blue to gray irregular pigment; legs, furcula, and venter lighter. Antennae shorter than the head, the 4th segment with a retractile knob and 4 heavy olfactory hairs inserted in irregular integumentary folds. Organ of the 3rd antennal segment with 2 rods behind a fold, and 2 blunt, curving setae, 1 on each side of the fold. Eyes 5 on each side. Unguis slender with 1 inner tooth. Unguiculus absent. Tenent hairs on the 3 pairs of legs 1,2,2. Mucro (fig. 22) well developed, slightly shorter than the dens, separated from it, the apex upturned with a large inner lamella. Anal horns minute. Clothing of sparse, short, backward curving setae.

*Xenylla subwelchi* Denis is placed as a synonym of *X. welchi*. It differs apparently only in the position of the mucronal lamella, which is given as external in *X. subwelchi*.

Ames: Apr. 3. Pleasant Valley: Sept. 25—H. D. Tate.

Calif., Ill., Kan., Md., N. Y., Pa. Costa Rica. Europe.

*XENYLLA GRISEA* Axelson, 1900*X. gracilis* Guthrie, 1903

## Fig. 23

Length up to 0.9 mm. Blue to olive, lighter beneath. Body slender and spindle-shaped. Antennae shorter than the head, the

4th segment with a retractile end club and 4 heavy olfactory hairs. Organ of 3rd segment as in *X. welchi*, with a less pronounced fold. Eyes 5 on each side. Unguis with an inner tooth near the tip. Unguiculus absent. Tenent hairs 2,2,2. Mucro and dens (fig. 23) fused, with a broad, subapical lamella and two dorsal setae. Anal horns comparatively long, from a fourth to a third the hind unguis, on well developed, contiguous papillae. Body clothing of rather long setae.

I am informed by Prof. Guthrie that the peculiar hook of the apex of the mucrodens in his figure of *X. gracilis* (1903, Plate 11, fig. 15) is due to an error of the engraver.

This species occurs in colonies beneath bark, and occasionally in leaf mould. It is the most common species of *Xenylla* in the state.

Ames: Feb. 21; Mar. 26; Apr. 14. Anamosa: Aug. 1. Central City: Nov. 25. Columbus Junction: Sept. 26. Jefferson: Dec. 5—G. C. Decker. LeGrand: Apr. 14. Leon: Oct. 10—B. V. Travis. Mitchellville: Mar. 31.

Minn. Europe.

#### XENYLLA MARITIMA Tullberg, 1869

##### Fig. 21

Length up to 1 mm. (1.8 mm. after Linnaniemi). Irregularly gray-blue. Antennae shorter than the head, the 4th segment with a retractile knob and 4 olfactory hairs. Organ of the 3rd segment as in the preceding species, except that the integumentary fold, which encloses the 2 sense clubs, also includes the external blunt hair. Eyes 5 on each side. Unguis occasionally with a small inner tooth. Tenent hairs 1,2,2. Mucro and dens (fig. 21) ankylosed, with a long, slender, abruptly ending dorsal lamella, and 2 dorsal setae. Anal horns about a fourth of the hind unguis, on well developed papillae. Body hairs of medium length, straight or a little curving.

I have compared the Iowa form with New York specimens identified and sent to me by Mr. E. A. Maynard. From the New York material the Iowa species differs in having but 1 tenent hair on the anterior legs, more curving body hairs, slightly shorter anal horns, and a darker color.

Central City: Aug. 11.

Calif., N. Y. Ontario. Europe.

Eyes absent. Postantennal organ present. Anal horns present. Unguiculus present. Furcula absent.

Postantennal organ of 4 tubercles.....*intermedia* n. sp., p. 17.  
Postantennal organ elliptical, with 8 to 12 tubercles.....  
*similis* n. sp., p. 17.

**Figs. 24, 25**

This species differs from *W. anophthalma* Börner, its nearest relative, in its smaller size, shorter antennae, and in the shape of the organ of the 3rd antennal segment organ. In 3 examples studied critically I have been unable to see more than 2 olfactory hairs on the 4th antennal segment. In the form of *W. anophthalma* which has anal horns, there are also 5 or 6 postantennal organ tubercles.

Ames: July 15; Sept. 16—F. Andre; Sept. 26. Columbus Junction: Sept. 26. Hampton: June 19—G. C. Decker and B. V. Travis. Shellrock: Oct. 14—B. V. Travis.

**Figs. 26, 27**

Color white. Eyes absent. Antennae clavate, to the head as 4:5, the segments as 2:3:3:3, the 3rd and 4th segments nearly

ankylosed. The 4th segment with 6 olfactory hairs, a simple, retractile knob, and a subapical papilla. Organ of the 3rd segment (fig. 27) with 2 rods curving toward each other and separated basally by a papilla-like fold, a blunt hair on each side, and 3 guard setae. Postantennal organ (fig. 26) elliptical, with 8 to 12 tubercles. Mandibles 2- or 3-toothed at the apex, with a median molar surface and a strong basal tooth. Unguis un-toothed. Unguiculus about half the unguis, with an inner basal lamella. Tenent hairs absent, but 3 apical tibiotarsal bristles are longer than the rest and overhang the base of the claw. Furcula absent. Anal horns present, equal in height to their papillae, about a third the hind unguis. Integument finely granulate. Body hairs irregular on the nota, forming 2 transverse rows across the 1st 3 abdominal segments, becoming irregular and longer posteriorly. Length 0.84 mm.

This species is also a resident of moss and leaf mould.

Ames: Mar. 28; Nov. 17. Bixby Ice Cave: May 8. Jefferson: Dec. 5—G. C. Decker. Leon: Oct. 31—B. V. Travis.

Kansas: Atchison: Nov. 27—C. J. Drake and H. M. Harris.

#### GENUS *BRACHYSTOMELLA* (AGREN) STACH, (1903) 1929

*Chondachorutes* Wahlgren, 1906

Eyes usually 8 on each side, rarely reduced in number. Postantennal organ 4 to 8 tubercles. Mandibles absent. Unguiculus absent. Furcula present. Anal horns absent.

#### Key to the Species of *Brachystomella*

Postantennal organ of 5 to 8 tubercles. Red-violet.....  
*parvula* Schäffer, p. 18.  
 Postantennal organ of 4 tubercles. Blue-gray.....*stachi*, n. sp., p. 19.

#### *BRACHYSTOMELLA PARVULA* (Schäffer), 1896

Figs. 28-30

Length up to 1 mm. Irregularly red-violet, lighter at the segments, and with 2 irregular longitudinal dorsal stripes. Eyes (fig. 29) 8 on each side. Postantennal organ of 5 to 8 tubercles in a rosette. Mucrones (fig. 30) more than a third the dentes, triangular in outline. Unguis (fig. 28) rather broad, with 2 lateral teeth and one inner tooth. Tenent hairs, unguiculus, and anal horns absent.

Taken from leaf mould by means of a Berlese funnel.

Ames: Sept. 25. Jefferson: Dec. 5—G. C. Decker.

Oregon. Europe. Palestine. North Africa.

## BRACHYSTOMELLA STACHI n. sp.

Figs. 31-35

Irregularly light blue, sometimes rusty-colored anteriorly, lighter along the sutures, and with 2 interrupted dorsal stripes. Eyes (fig. 33) 8 on each side. Postantennal organ of 4 tubercles, about twice the diameter of an eye. Antennae shorter than the head, the organ of the 3rd segment as in fig. 32; 4th segment with about 6 olfactory setae, and a simple, retractile end knob. Mandibles absent. Maxillae (fig. 31) with 7 or 8 teeth. Unguis (fig. 34) long and slender, slightly curving, with an inner tooth near the middle. Tenent hairs absent or represented by 1 weakly knobbed hair. Mucrones nearly half the dentes, elongate triangular. Dentes (fig. 35) tuberculate dorsally, with 6 dorsal setae. Sparse, short, curving setae on head and body, longer on the last 2 segments of the abdomen. Length 0.7 mm.

I sent structural drawings of this species to Dr. Stach, who states that it is different from any known species of *Brachystomella*. I take pleasure in dedicating it to Dr. Stach.

Taken from leaf mould and moss with a Berlese funnel.

Ames: July 15—H. M. Harris and F. Andre.

Florida: Marianna: Feb.—A. C. VanHyning.

## SUBFAMILY NEANURINAE BÖRNER, 1901

Mouthparts piercing and sucking, usually projecting in a cone beneath the head. Mandibles present or absent; when present, never with a grinding surface. Unguiculus usually absent. Post-antennal organ present or absent. Furcula present or absent. Head prognathous.

## Key to the Tribes of Neanurinae

Sixth abdominal segment small, rounded, never bilobed. Body without large segmental tubercles.....

*Pseudachorutini* Börner, p. 19.

Sixth abdominal segment comparatively large, strongly bilobed.

Body with large dorsal segmental tubercles.....

*Neanurini* Börner, p. 28.

## TRIBE PSEUDACHORUTINI BORNER, 1906

Segmental tubercles absent. Furcula present or absent. Anal segment small, round, not bilobed.

## Key to the Genera of Pseudachorutini

1. Furcula present ..... 2

Furcula absent (see also *Friesea pentacantha*)..... 5

2. Eyes 8 on each side ..... 3  
 Eyes 5 or 6 on each side ..... 4
3. Anal horns usually present, 3 or more. Furcula greatly reduced or absent. Postantennal organ absent. Mouthparts not produced into a cone.....*Friesea* Dalla Torre, p. 20.  
 Anal horns absent. Postantennal organs present (in all of our species). Furcula not large, but well developed. Mouthparts produced into a cone.....  
*Pseudachorutes* Tullberg, p. 22.
4. Mucrones with longitudinal lamellae. Unguiculus present. Anal horns well developed. Postantennal organ 3 lobed....  
*Xenyllodes* Axelson, p. 26.  
 Mucrones with obliquely transverse lamellae, forming 2 cup-like folds. Unguiculus absent. The 2 anal horns greatly reduced. Postantennal organ 4-lobed.....  
*Odontella* Schäffer, p. 25.
5. Postantennal organ absent.....*Paranura* Axelson, p. 27.  
 Postantennal organ present ..... 6
6. Mouthparts reduced, the maxillae lance-like, and without teeth.....*Micranurida* Börner, p. 26.  
 Maxillae not lance-like, bearing numerous teeth at the apex....  
*Anurida* Laboulbène, p. 26.

GENUS *FRIESEA* (DALLA TORRE) DENIS, (1895) 1931b

*Triaena* Tullberg, 1871,

*Polycanthella* Schäffer, 1897.

Eyes 8 on each side. Furcula greatly reduced or absent. Postantennal organ absent. Unguiculus absent. Anal horns usually 3, varying from none to 7. Mouthparts not projecting in a pointed cone beneath the head.

#### Key to the Species of *Friesea*

1. Anal horns 5. Furcula absent.....*pentacantha* n. sp., p. 20.  
 Anal horns 3. Furcula present ..... 2
2. Anal horns nearly straight. Furcula without a mucro.....  
*grandis* n. sp., p. 21.  
 Anal horns curving. Mucro present....*claviseta* Axelson, p. 21.

*FRIESEA PENTACANTHA* n. sp.

Figs. 43-46

Yellow-gray with light blue dorsal pigment. Eyespots weakly pigmented. An enlarged, granular swelling in the region of the clypeus. Antennae to the head as 5:8. Apex with a retractile knob and 3 olfactory hairs, 2 lateral and 1 dorsal. Organ of the

3rd segment with 2 minute sense rods and 2 enlarged hairs. Eyes 8 on each side. Postantennal organ absent. Mouthparts typical of the genus. Unguis (figs. 44, 45) broad, unarmed. Unguiculus absent. Tenent hairs absent. Furcula and tenaculum absent. Anal horns 5 (fig. 43), 4 in the anterior row and 1 posteriorly, on small papillae. Short hairs in 2 rows across each body segment, longer and more abundant posteriorly. Length 0.6 mm.

This species resembles *F. (Polycanthella) quinquespinosa* Wahlgren (1900) of Greenland, from which it differs in the absence of a furcula, the number of eyes, size, etc. The specimens may be young. Taken in humus.

Shellrock: Oct. 14—B. V. Travis.

*FRIESEA GRANDIS* n. sp.

Figs. 36-42

Body subcylindrical, slender, deep blue but for lighter areas along the sutures and at muscle insertions. Antennae shorter than the head, conical, the 3rd and 4th segments united. The 4th segment with a retractile sense club and 2 enlarged olfactory hairs dorsally. The 3rd antennal segment with 2 curved rods behind a fold, and large ventro-lateral and dorso-lateral hairs. Eyes 8 on each side. Postantennal organ absent. Unguis (fig. 36) regularly curving, untoothed. Each tibiotarsus with 5 tenent hairs. Furcula (figs. 37, 41) composed of 2 papillae, each bearing 3 short setae. Mucro absent. Tenaculum nearly as large as the furcula, rami bidentate. Anal horns 3 (fig. 40) nearly straight. Body covered with short, curving setae and longer, straight hairs, some of which (fig. 42) are serrate. A pair of hairs on each side of the anal horns serrate and knobbed, indefinitely so in young individuals. Length 1.7 mm.

Stach (1922) describes a variety of *F. claviseta* Ax. without a mucro as *F. claviseta emucronata*. The Iowa specimens are so distinct structurally from *F. claviseta*, that I would hesitate to identify them with Stach's variety.

The form is known only from the edge of shallow lakes where it was taken with *Anurida tullbergi* Schött and *Proisotoma schötti* D. T.

Little Wall Lake: Oct. 14—G. C. Decker. Ruthven: Oct. 2—H. M. Harris and B. V. Travis.

*FRIESEA CLAVISETA* Axelson, 1900

*F. sublimis* Macnamara, 1921

Length up to 0.8 mm. Blue-gray. Antennae shorter than the





ing. Deep blue, lighter along the sutures. Buccal cone rather long. Mandibles obliquely truncate, weakly 2-toothed. Maxillae styliform. Antennae directed anteriorly, shorter than the head, the segments as 15:18:16:23; 4th segment (fig. 50) with a slender, subapical, trilobed, retractile knob, and 5 olfactory hairs. Sense organ of the 3rd segment with 2 strongly curving sense clubs and 2 blunt hairs. Eyes (fig. 49) 8 on each side. Postantennal organ circular, with 5 tubercles. Unguis (fig. 48) slightly curving, with an inner tooth near the apex. Unguiculus absent. Tenent hair long, slender, strongly knobbed. Mucro to dens (fig. 47) as 2:5, elongate, upturned, with a slender dorsal lamella ending before the apex. Dentes with 5 dorsal setae. Rami of tenaculum 3-toothed. Numerous knobbed hairs apically on the abdomen, appearing as far anteriorly as the 2nd segment.

My specimens differ from the description and figures of Linnaniemi (1912) in the postantennal organ, the knobbed hairs anteriorly on the abdomen, the shape of the retractile knob at the apex of the antenna, and the tooth near the tip of the unguis. Dr. Stach writes me that they resemble more closely specimens from Poland than those from Finland from which Linnaniemi drew up his description.

Taken from leaf mould.

Hancock: Oct. 9—F. Andre. Shellrock: Oct. 14—B. V. Travis. Traer: Nov. 5—H. M. Harris.

Europe.

#### PSEUDACHORUTES LUNATUS Folsom, 1916

Length up to 3 mm. Gray-blue, lighter below. Antennae shorter than the head. Eyes 8 on each side. Postantennal organ oval, with 10 to 12 tubercles. Unguis stout, with 1 inner tooth. Unguiculus tuberculate. A single tenent hair, often but weakly knobbed, on each tibiotarsus. Mucro a third of the dens, sub-crescentic, with a pair of dorsal lamellae ending before the upturned tip. Clothing of short hairs, longer at the apex of the abdomen.

The Iowa material differs from the description of the species in that the tenent hair is reduced and not strongly clavate.

Ames: Sept. 4. Hampton: June 18—G. C. Decker and B. V. Travis.

Ill., Tex. Ontario.

#### PSEUDACHORUTES AUREOFASCIATUS (Harvey), 1898

Length 1 mm. (1.5 mm. after Folsom). Gray-blue, with or without the mesothorax and last 2 abdominal segments orange-

yellow. Antennae shorter than the head, the 4th segment with a trilobed retractile knob and olfactory hairs. Eyes 8 on each side. Postantennal organ of 12 to 15 tubercles in a circle. Mouth cone extending well beyond the tip of the head. Unguis with 1 or 2 inner teeth. Unguiculus tuberculate. Tenent hairs absent. Mucro more than half the dens, spoon-shaped,, slightly curving distally, with a large dorsal lamella ending before the apex. Rami of the tenaculum 3-toothed. The 6th abdominal segment small, well separated from the 5th. Long blunt hairs on head and body, longer on the last 2 segments. Integument coarsely tuberculate, extremely so on the 6th abdominal segment and the dens, where they form large, conical teeth.

The single specimen taken in Iowa lacks the orange cross-bands present in the Maine material.

Ottumwa: Nov. 28—F. Andre.

Me., N. Y.

*PSEUDACHORUTES SAXATILIS* Macnamara, 1920

Figs. 51-55

Length up to 1.5 mm. Irregularly blue, with lighter spots dorsally. Legs, furcula, and venter lighter. Body heavy and broad, the segments bulging. Antennae subequal to the head, the segments as 23:28:27:35: 4th segment with 6 to 8 olfactory hairs, but no retractile end knob. Postantennal organ (fig. 51) elliptical, with 19 to 28 tubercles. Unguis (fig. 52) unidentate internally. Unguiculus tuberculate. Tenent hairs absent. Mucro (fig. 53) about a fourth the dens, with a large dorsal lamella ending before the apex. Body with short, curving hairs and long, blunt ones.

Taken in leaf mould.

Columbus Junction: Dec. 25—L. Weber. Eldora: Nov. 10. Hancock: Oct. 8—F. Andre. Jefferson: Dec. 5—G. C. Decker. Ottumwa: Sept. 9—F. Andre.

*PSEUDACHORUTES SUBCRASSOIDES* n. sp.

Figs. 56, 57

Length up to 1 mm. Body with light gray speckled pigment; darker anteriorly. Under parts lighter. Antennae subequal to the head, 4th segment with a retractile 3-lobed knob, and several olfactory hairs. Postantennal organ (fig. 56) oval, with 8 to 10 tubercles. Mouth cone not strongly produced. Body not expanded, rather cylindrical. Unguis with a weak inner basal

tooth. Unguiculus tuberculate. Tenent hairs absent. Dentes twice the mucro (fig. 57), which is crescentic, and bears a dorsal lamella ending before the apex. Body hairs sparse, short, curving, longer toward the apex. Several down-curving hairs dorsally on the 6th segment.

This species differs in several respects from *P. subcrassus* Tullberg, its closest relative, according to Dr. Stach.

Taken in leaf mould and beneath bark.

Ames: May 9. Jefferson: Dec. 5—G. C. Decker. New Sharon: Sept. 19—F. Andre.

#### GENUS *ODONTELLA* SCHÄFFER, 1897

Eyes 5 on each side. Postantennal organ of 4 (5) lobes, situated in a deep groove. Antennae short and conical. Unguiculus absent. Furcula present, the mucro long, with 2 dorsal, pocket-like lobes. Anal horns usually represented by enlarged cuticular tubercles, 2 in number. Integumentary tubercles very large and coarse.

#### *ODONTELLA* CORNIFER, n. sp.

Figs. 58-61

Color pale speckled blue, lighter beneath, the eyespots dark. Antennae shorter than the head, as 11:19, the segments as 16:16:17:18; organ of the 3rd segment (fig. 59) with 2 clavate rods behind a fold; a heavy, blunt, curving hair on each side; and 2 guard setae. Mouth cone (fig. 60) well developed, reaching to the 3rd antennal segment in specimens expanded in lactic acid. Eyes 5 on each side. Postantennal organ with 4 lobes, in a deep pit. Body somewhat spindle-shaped, the segments from the head to the 6th abdominal segment, inclusive, as 25:8:13:12:10:10:9:11:8:7. Unguis (fig. 61) slender, with a basal inner tooth and lateral teeth. Unguiculus absent. Claw overhung by 2 slender, non-capitate hairs. Dentes with 5 dorsal setae. Mucrones subequal to the dentes, or slightly longer, the apex blunt, dorsally with 2 lamellate, obliquely placed cups. Rami of the tenaculum 3-toothed. Integument coarsely tuberculate, more so on the 6th segment, which bears 2 distinct anal horns (fig. 58) on the large papillae. Body covering sparse, longer on the 5th and 6th segments. Length 0.9 mm.

Taken from decaying ground cover.

Ames: Apr. 9—R. Roudabush. Columbus Junction: Sept. 26.

GENUS *XENYLLODES* AXELSON, 1903

Eyes 5 on each side. Postantennal organ trilobed. Unguiculus present. Furcula well developed. Anal horns 2.

This genus has not as yet been found in our territory.

GENUS *ANURIDA* LABOULBÈNE, 1865

*Aphoromma* MacGillivray, 1893,

*Anuridella* Willem, 1896.

Eyes 10 or none. Postantennal organ present. Maxilla head bearing 3 toothed lamellae. Unguiculus, anal horns, and furcula absent.

Key to the Species of *Anurida*

Color blue. Eyes 5 on each side. Postantennal organ elliptical, of 17 to 30 tubercles.....*tullbergi* Schött, p. 26.

Color white. Eyes absent. Postantennal organ of 12 to 21 tubercles in a rosette.....*granaria* Nicolet, p. 26.

*ANURIDA TULLBERGI* Schött, 1891

Figs. 62, 63

Length up to 3 mm. Blue to blue-black, lighter beneath. The 4th antennal segment with 5 olfactory hairs and a retractile 3-lobed knob. Postantennal organ (fig. 63) with 17 to 30 tubercles, elliptical. Unguis (fig. 62) unidentate inwardly.

This species is a littoral form.

Ruthven: Oct. 2—H. M. Harris and B. V. Travis.

Fla., Minn., N. Y. Ontario. Europe.

*ANURIDA GRANARIA* (Nicolet), 1847

Length up to 1.8 mm. Pure white. Eyes absent. Postantennal organ with 12 to 21 tubercles in a rosette. The 4th antennal segment with 8 olfactory hairs and an apical 3-lobed knob. Unguis without teeth.

Bixby Ice Cave: May 8. Shellrock: Oct. 14—B. V. Travis.

Ill., Mass., Minn. Throughout the northern hemisphere.

GENUS *MICRANURIDA* BÖRNER, 1901

Eyes present or absent. Postantennal organ present, with 6 to 22 tubercles. Unguiculus and anal horns absent. Furcula absent or represented by a tubercle. Maxilla head simple, stiletto-like.

Key to the Species of *Micranurida*

Eyes 2 on each side. Furcula absent.....*pygmaea* Börner, p. 27.

Eyes absent. Furcula represented by a tubercle.....  
*furcifera* n. sp., p. 27.

## MICRANURIDA PYGMAEA Börner, 1901

## Figs. 64, 65

Length up to 0.8 mm. White to blue-gray. Antennae shorter than the head, 3rd segment with 2 capitate sense rods and 2 blunt hairs, 4th segment (fig. 64) with 5 swollen obconical olfactory hairs, and a 3-lobed retractile knob. Postantennal organ (fig. 65) with 6 to 8 tubercles in a circle. Eyes 2 on each side. Unguis unarmed. Unguiculus and tenent hairs absent.

Taken from decaying vegetation with a Berlese funnel.

Ames: Apr. 27. Leon: Oct. 10—B. V. Travis. Ruthven: Oct. 2—H. M. Harris and B. V. Travis. Traer: Nov. 5—H. M. Harris. Calif. Europe.

## MICRANURIDA FURCIFERA n. sp.

## Figs. 1, 66-69

Entirely white. Eyes absent. Postantennal organ (fig. 67) with 8 to 11 tubercles in an ellipse. Antennae shorter than the head, the segments as 13:11:8.5:10, the 3rd and 4th segments (fig. 66) weakly separated; organ of 3rd segment with 2 sense clubs and 2 large, elongate sense hairs, 4th segment with 6 curving olfactory hairs; retractile end knob of the 4th segment not evident but occasionally a structure which appears to be a thin-walled, eversible, lobed sac may be seen in its place. Mandibles and maxillae long and slender. Unguis (fig. 68) falcate, unarmed. Unguiculus and tenent hairs absent. Furcula represented by a biscuit-shaped tubercle (fig. 69) bearing 6 setae. Abdominal segments with 2 transverse rows of setae, the anterior short and curved, the posterior long and straight. Length 0.7 mm.

Taken from moss and leaf mould.

Ames: Aug. 28. Hampton: June 18—G. C. Decker and B. V. Travis. Ottumwa: Sept. 9—F. Andre.

GENUS *PARANURA* AXELSON, 1902

Eyes present or absent. Postantennal organ absent. Unguiculus, furcula, and anal horns absent. Maxilla head slender, pointed, without lamellae.

Key to the Species of *Paranura*

Eyes absent.....*caeca* Folsom, p. 27.  
Eyes 3 on each side.....*sexpunctata* Axelson, p. 28.

*PARANURA CAECA* Folsom, 1916

Length up to 2.5 mm. White or light yellow. Antennae shorter than the head, with 9 or 10 olfactory hairs, including 1 extremely

large one. Eyes absent. Unguis unarmed. Unguiculus tuberculate. Tenent hairs absent. Body covering of long, slender, simple setae.

Taken from leaf mould.

Columbus Junction: Sept. 26.

III.

*PARANURA SEXPUNCTATA COLORATA* n. var.

Fig. 74

Length up to 1 mm. Color white with light blue, granular pigment. Eyes (fig. 74) 3 on each side, 2 anterior and 1 posterior. Antennae conical, 4th segment with 6 or 7 olfactory hairs, organ of 3rd segment with 2 sense rods and 2 long blunt hairs. Mouth cone short and heavy. Unguis unarmed. Unguiculus tuberculate. Several slender, unknobbed hairs overhang the unguis. Integument with large, pointed granules. Body covering of rather long, straight hairs.

This species is a rather uncommon member of the humus fauna. The European forms of this species are white. All the Iowa specimens show the blue coloration, however, and, according to Dr. Stach, the body hairs are considerably longer than in the principal form.

Ames: Mar. 28; Sept. 18—F. Andre. Eldora: Nov. 10. Columbus Junction: Sept. 26. Ruthven: Oct. 2—H. M. Harris and B. V. Travis.

Ontario?

TRIBE NEANURINI BÖRNER, 1901

Segmental tubercles (large integumentary humps) present. Furcula absent. Anal segment large, bilobed.

Key to the Genera of Neanurini

1. Maxilla head lance-like, without teeth or lamellae.....  
*Neanura* MacGillivray, p. 29.  
Maxilla head with both teeth and lamellae..... 2
2. The 6th abdominal segment hidden dorsally by the 5th, which extends back over it.....*Morulina* Börner, p. 29.  
The 6th abdominal segment visible from above.....  
*Protanura* Börner, p. 28.

GENUS *PROTANURA* BÖRNER, 1906

Segmental tubercles present. Eyes present. Unguiculus, furcula and anal horns absent. Maxilla head with a toothed lamella.

This genus is not known from the United States.

GENUS *MORULINA* BÖRNER, 1906

The 6th segment practically hidden by the 5th. Very broad and heavy. Otherwise as the preceding genus.

*M. gigantea* Tullberg is known in the United States only along the Pacific coast. The genus is not known in Iowa.

GENUS *NEANURA* MACGILLIVRAY, 1893

*Achorutes* of recent European Authors.

Segmental tubercles present. Eyes usually present. Post-antennal organ present or absent. Unguiculus, furcula, and anal horns absent. Maxilla head slender, without teeth or lamellae.

Key to the Species of *Neanura*

1. White. Eyes 2 on each side.....*barberi* Handschin, p. 29.  
Blue to brown. Eyes 3 on each side..... 2
2. Anterior eyes placed mesad to the others, and against the ocular tubercle.....*muscorum* Templeton, p. 29.  
Anterior eye placed laterad to the others, and away from the ocular tubercle.....*persimilis* n. sp. p. 30.

*NEANURA BARBERI* Handschin, 1928

*N. quadrioculata* Guthrie, 1903

Length up to 1.8 mm. White. Eyes 2 on each side. Postantennal organ absent. Antennae shorter than the head, the 4th segment with 8 olfactory hairs including a "giant hair." Unguis without teeth. Unguiculus absent. Head with 10 tubercles, prothorax with 4, mesothorax to 4th abdominal segment with 6 each, 5th with 4, and 6th with 2.

Taken from humus.

Leon: May 20—B. V. Travis; Oct. 10—B. V. Travis.

Md., Minn., N. Y., Tex., Va. Mexico.

*NEANURA MUSCORUM* (Templeton), 1835

*Anoura gibbosa* Packard, 1873,

*Anoura sextuberculata* Harvey, 1896.

Length up to 2 mm. Gray to deep blue, lighter beneath. Eyes 3 on each side, against the ocular tubercle. Postantennal organ absent. Antennae conical, shorter than the head. Tuberculation as follows: head 12, prothorax 6, mesothorax to 4th abdominal segment with 8 each, 5th segment 4, 6th segment 2; the segments reticulate. Unguis untoothed, unguiculus absent.

A common cortical species, taken also in humus.

Algona: Apr. 16—E. L. Mills. Ames: Mar. 29; Apr. 2, 7, 9, 26; May 7, 24; June 10; July 13, 15—H. M. Harris and F.

Andre; Sept. 4; Oct. 20. Eldora: Nov. 14. Leon: Oct. 14—B. V. Travis. Ontario: May 3. Shellrock: Oct. 14—B. V. Travis. Tabor: Sept. 15.

Conn., Ill., La., Mass., Minn., Me., N. H., N. Y., Ohio, Pa. Ontario. Europe.

NEANURA PERSIMILIS, n. sp.

Fig. 70

Blue-gray, through buff to brown. Lighter beneath. Antennae conical, shorter than the head, the segments as 13:15:13:11, the 3rd and 4th segments nearly fused. Organ of the 3rd segment with 2 bent sense rods and 2 blunt hairs; 4th segment with 9 olfactory hairs and an apical 3-lobed knob. Eyes 3 on each side (fig. 70), the 2 posterior ones against the ocular tubercle and the anterior one laterad, away from the tubercle. Postantennal organ absent. Buccal cone well developed. Segmental tubercles not or indistinctly reticulate, arrangement as follows: head with 12, 3 on each side, 2 dorsal ocular, and 4 in a posterior row; pronotum with 6, mesonotum to 4th abdominal segment, inclusive, with 8 each; 5th with 4; 6th with 2. The most evident tubercles are those of the 5th and 6th segments, the 2 external tubercles on each side of the 4th, and the lateral tubercles on each side of the other segments. The dorsal ones are greatly reduced. Unguis heavy, unarmed. Unguiculus absent. Tenent hairs absent. Large hairs of the body pointed and minutely serrate. Length 3.5 mm.

The species closely resembles *N. muscorum*, from which it differs in the position of the eyes, the absence of the large mid-dorsal tubercle on the head, and the absence or near-absence of reticulation on the segmental tubercles. I have taken it in the same situation with the preceding species.

Ames: May 3—H. Hixson; Oct. 3, 17. Columbus Junction: Sept. 25. LeGrand: Apr. 14. Leon: Oct. 31—B. V. Travis.

Texas: Waco: Aug. 7.

SUBFAMILY ONYCHIURINAE BÖRNER, 1901

Eyes absent. Postantennal organ absent only in *Tetrodonto-phora*, usually large and placed in a transverse groove behind the antennal bases. Pseudocelli present. Organ of 3rd antennal segment complex, composed of guard setae, papillae, sense rods, and large sense clubs. Furcula usually absent. Anal horns present or absent. Mandibles with a molar surface.



## Key to the Genera of Onychiurinae

1. Furcula well developed, with manubrium, dentes and mucrones. Postantennal organ absent. Large, 5 to 9 mm. long.....*Tetrodontophora* Reuter, p. 31.  
 Furcula absent or at the most a cuticular fold or tubercle, which may be divided. Postantennal organ well developed. Usually less than 5 mm. in length..... 2
2. The 2 smooth sense clubs of the 3rd antennal segment organ bending toward each other. An accessory club ventro-laterally on the 3rd segment. Body very slender. Furcula absent.....*Tullbergia* Lubbock, p. 36.  
 The 2 large sense clubs of the 3rd antennal segment organ never bending toward each other. No ventro-lateral club on the 3rd segment. Body not markedly slender. Furcula absent or vestigial ..... 3
3. Pseudocelli with definite chitinous borders. Integument finely granulate. Rudimentary furcula, when present, not bearing branched hairs.....*Onychiurus* Gervais, p. 31.  
 Pseudocelli without definite chitinous borders. Integument coarsely granulate. Furcula present, bearing branched bristles.....*Kalaphorura* Absolon, p. 35.

GENUS *TETRODONTOPHORA* REUTER, 1882

Furcula well developed. Postantennal organ absent. Sense organ of the 3rd antennal segment with 14 or 15 papillae. Very large.

This European cavernicolous genus has not been recorded from North America.

GENUS *ONYCHIURUS* GERVAIS, 1841

*Lipura* Burmeister, 1838,

*Aphorura* MacGillivray, 1893.

Postantennal organ present, usually multi-tuberculate. Sense clubs of the 3rd antennal segment organ straight or slightly bent, never bending toward each other; papillae usually 4 or 5. Head and body rather broad. Anal horns present or absent. Pseudocelli with external chitinous ring. Rudimentary furcula, when present, without branched hairs.

Key to the Species of *Onychiurus*

1. Vestige of a furcula ventrally on the 4th abdominal segment ..... 2  
 Vestige of furcula absent ..... 3

2. Furcula represented by an integumentary fold. Tenaculum absent. Tubercles of the postantennal organ at right angles to the long axis of the organ.....*armatus* Tullberg, p. 32.  
Furcula represented by 2 large tubercles. Tenaculum represented by 2 small warts. Tubercles of the postantennal organ small and irregularly placed.....*obesus* n. sp. p. 35.
3. Tubercles of the postantennal organ compound (fig. 75).... 6  
Tubercles of the postantennal organ simple (figs. 71, 76).. 4
4. Tubercles of the postantennal organ 8 to 14, more or less parallel to the long axis of the organ (fig. 76). No pseudocelli on the pronotum.....*subtenuis* Folsom, p. 34.  
Tubercles of the postantennal organ 14 to 25, more or less at right angles to the long axis (fig. 71). Pronotum with 2 pseudocelli on each side ..... 5
5. Postantennal organ with 14 to 22 tubercles. Unguiculus about half the unguis. Anal horns about half the hind unguis. Length 0.9 mm.....*parvicornis* n. sp., p. 33.  
Postantennal organ of about 25 tubercles. Unguiculus extending nearly to the tip of the unguis. Anal horns slightly shorter than the hind unguis. Length 1.3 mm.....  
*encarpatus* Denis, p. 32.
6. Anal horns absent.....*pseudofimetarius* Folsom, p. 34.  
Anal horns present.....*ramosus* Folsom, p. 34.

#### ONYCHIURUS ARMATUS (Tullberg), 1869

Length up to 1.8 mm. White. Postantennal organ with 18 to 44 simple tubercles. Antennae subequal to the head; sense organ of the 3rd segment with 5 guard setae, 5 papillae, 2 sense rods, and 2 tuberculate sense clubs. Dorsal pseudocelli on each side as follows: antennal bases 3, 4th segment 4 (1 lateral), and 5th segment 3. Unguis rarely with 1 inner tooth. Unguiculus gradually tapering, subequal to the unguis. Furcula represented by a cuticular fold. Anal horns nearly as long as the hind unguis.

This species is occasionally taken both in humus and beneath bark, as are most of the species of the genus found in the state.

Ames: Mar. 29; Apr. 2, 9; June 28; July 13; Oct. 25. LeGrand: Apr. 14; Aug. 18. Ottumwa: Sept. 16—Zella Beck. Ruthven: Oct. 2—H. M. Harris and B. V. Travis. Tabor: Sept. 15.

Calif., Ill., La., Me., Md., N. Y., Ohio, Utah. Europe.

#### ONYCHIURUS ENCARPATUS Denis, 1931

Length up to 1.3 mm. Postantennal organ with about 25 simple tubercles. Antennae subequal to the head; organ of the

3rd segment with 5 guard setae, 5 papillae, 2 rods, and 2 leaning, granular clubs. The 4th segment with a subapical pit. Abdomen rather dilated and flat. Pseudocelli on each side as follows: antennal base 3, back of head 2, prothorax 2, mesothorax to the 5th abdominal segment 3 each. Unguis unarmed. Unguiculus narrow basally, subequal to the unguis. Anal horns slightly shorter than the hind unguis. Suranal lobe divided into 6 more or less definite smaller lobes.

Ames: Sept. 25; Oct. 20. Columbus Junction: Sept. 26. Leon: May 28; Oct. 10—B. V. Travis. Hancock: Oct. 8—F. Andre.

Costa Rica.

ONYCHIURUS PARVICORNIS n. sp.

Figs. 71-73

White. Postantennal organ (fig. 71) with 14 to 22 simple tubercles, placed at right angles to its long axis. Antennae shorter than the head; organ of the 3rd segment with 5 guard setae, 5 papillae, 2 rods, and 2 nearly spherical, smooth sense clubs; 4th segment with 8 to 10 olfactory hairs and a subapical sense pit. Abdomen bluntly rounded apically. Pseudocelli on each side as follows: antennal bases 3, back of head 2, prothorax 2, mesothorax to 5th abdominal segment 3 each. Unguis (fig. 72) rather broad and heavy, unarmed. Unguiculus about half the unguis, with a broad basal lamella and an acuminate apex. Anal horns 2 (fig. 73), slightly curving, to the hind unguis as 5:11; papillae greatly reduced, flat, non-contiguous. Body covering sparse, short. Length up to 0.9 mm.

Taken from humus with a Berlese funnel. This species approaches closely the *armatus* form of *O. zschokkei* Handschin. It differs as follows:

*O. zschokkei armatus*

*O. parvicornis*

End club on the 4th antennal segment.

Subapical pit on the 4th antennal segment.

Tubercles of the postantennal organ 20 to 28.

Tubercles of the postantennal organ 14 to 22.

Pronotal pseudocelli absent.

Pronotal pseudocelli 2.

No basal lamella on the unguiculus.

Unguiculus with basal lamella.

Unguis slender.

Unguis broad.

Anal horns rudimentary.

Anal horns to hind unguis as 5:11.

Ames: Apr. 27; Sept. 26. Eldora: Nov. 10. Hampton: June 18—G. C. Decker and B. V. Travis. Leon: May 28; Oct. 10—B. V. Travis. Ottumwa: Sept. 9—F. Andre. Ruthven: Oct. 2—H. M. Harris and B. V. Travis. Woodbury Co.: Sept. 28—G. C. Decker.

*ONYCHIURUS SUBTENUIS* Folsom, 1917

Fig. 76

Length up to 2 mm. White. Rather slender. Postantennal organ (fig. 76) of 8 to 14 elongate tubercles. Antennae shorter than the head; organ of the 3rd segment with 5 guard setae, 5 papillae, 2 rods, and 2 tuberculate clubs. Dorsal pseudocelli on each side as follows: Antennal base 2 (3), mesothorax to 2nd abdominal segment 1 each, 4th segment 2, 5th segment 3 (4). Unguis unidentate inwardly. Unguiculus with a basal lamella, more than half the unguis. Anal horns half the hind unguis.

Algona: Apr. 16—E. L. Mills. Ames: Feb. 21, 23; Apr. 15; July 15—H. M. Harris and F. Andre. Columbus Junction: Sept. 26. Eldora: Nov. 10. Hampton: June 18—G. C. Decker and B. V. Travis. Leon: Oct. 10—B. V. Travis. Ottumwa: Sept. 9—F. Andre, 16—Zella Beck.

Ill., Mo., N. Y., Pa., Utah. Ontario.

*ONYCHIURUS RAMOSUS* Folsom, 1917

Fig. 75

Length up to 1.3 mm. White. Postantennal organ (fig. 75) of 10 to 13 compound tubercles. Antennae shorter than the head; sense organ of the 3rd segment with 3 guard setae, 4 papillae, 2 rods, and 2 tuberculate clubs. Dorsal pseudocelli on each side as follows: behind antennal base 2, mesothorax to 1st abdominal segment 1 each, 4th and 5th abdominal segments with 2 each. Unguis unarmed. Unguiculus half the unguis. Anal horns half the unguis.

Algona: Apr. 16—E. L. Mills. Ames: Feb. 21, 23; Apr. 15; July 15—H. M. Harris and F. Andre. Columbus Junction: Sept. 26. Eldora: Nov. 10. Hampton: June 18—G. C. Decker and B. V. Travis.

Ill. Ontario.

*ONYCHIURUS PSEUDOFIMETARIUS* Folsom, 1917

Length up to 1.5 mm. White. Postantennal organ with about 16 compound tubercles. Antennae shorter than the head; organ of the 3rd segment with 5 guard setae, 5 papillae, 2 rods, and 2

smooth oblique clubs. Dorsal pseudocelli on each side as follows: Antennal base 2, behind the antennal base 1, back of head 3, mesothorax to 5th abdominal segment with 3 each. Unguis unarmed. Unguiculus half the unguis, with a basal lamella. Anal horns absent.

Ames: Apr. 2. Leon: May 28—B. V. Travis. Ottumwa: Sept. 9—F. Andre. Shellrock: Oct. 14—B. V. Travis.

Ill., Minn. Europe.

ONYCHIURUS OBESUS n. sp.

Figs. 2, 77-81

Yellowish-white. Postantennal organ (fig. 77) with 40 to 50 irregular tubercles. Antennae to the head as 4:5, the segments as 5:7:6:10. Organ of the 3rd segment with 4 or 5 guard setae, 4 or 5 papillae, 2 rods, and 2 smooth, oblique, subreniform sense clubs, the 4th segment with numerous olfactory hairs and a sub-apical pit which is overhung by 3 heavy, short, blunt sense clubs. Body broad and heavy (fig. 2). Pseudocelli small, on each side as follows: Behind the antennal base 3, mesonotum 1, metanotum 1 or 0, 4th abdominal segment 2, 5th segment 3. Furcula and tenaculum present (fig. 81), each lobe of the furcula bearing 3 setae. Unguis (fig. 80) moderately slender, unarmed. Unguiculus with a broad, elongate basal lamella, and a slender tip reaching to the apex of the unguis. Anal horns 2 (figs. 78, 79) to the hind unguis as 9:34, usually obliquely truncate, sometimes pointed. Integument coarsely granulate, the interspaces obscurely reticulate. Clothing of sparse, short, spinelike setae. Length 1.3 mm.

A very distinct species in the shape of the postantennal organ. I have been unable to discern large compound tubercles as in the *ramosus* and *fimetarius* groups, the organ seeming to be a single mass of small tubercles as in some of the species of *Tullbergia*. The *Maquoketa* specimens differ from the Bixby Ice Cave material in the presence of pointed anal horns, and in the absence of the metathoracic pseudocelli. They may represent a distinct variety. The species is at least partially cavernicolous in its habits.

Bixby Ice Cave: May 8. *Maquoketa*: May 8.

GENUS *KALAPHORURA* ABSOLON, 1901

Postantennal organ present. Organ of the 3rd antennal segment as in *Onychiurus*. Anal horns 2. Pseudocelli without ex-

ternal chitin rings. Rudimentary furcula present, bearing branched hairs.

This genus has not been recorded from North America.

GENUS *TULLBERGIA* LUBBOCK, 1871

*Stenaphorura* Absolon, 1900,

*Mesaphorura* Börner, 1901,

*Börneria* Willem, 1902.

Postantennal organ present, large. Sense clubs of the 3rd antennal segment organ bending toward each other, papillae present or absent; an accessory sense club ventro-laterally on the same segment. Anal horns 2 to 6. Head and body extremely slender.

Key to the Species of *Tullbergia*

1. Pronotum with pseudocelli. Postantennal organ with about 75 tubercles in 4 irregular rows.....*collis*, Bacon, p. 36.  
 Protonum without pseudocelli. Tubercles of the postantennal organ in 2 rows (rarely a partial 3rd)..... 2
2. The 5th abdominal segment with 2 heavy, spinelike processes posteriorly. Anal horns less than the hind unguis.....  
*iowensis* Mills, p. 37.  
 None of the hairs on the posterior margin of the 5th abdominal segment enlarged and spinelike. Anal horns subequal to or longer than the hind unguis..... 3
3. Pseudocelli present from the mesothorax to the 5th abdominal segment, inclusive. Dorsum of the 6th abdominal segment with irregular transverse rows of large tubercles.....  
*granulata*, n. sp., p. 37.  
 Pseudocelli absent from the mesothorax, 1st, 3rd, and 6th abdominal segments. Granulation of the dorsum of the 6th abdominal segment not greatly different from that on the rest of the body.....*clavata*, n. sp., p. 38.

*TULLBERGIA COLLIS* Bacon, 1914

Length up to 1.5 mm. White. Postantennal organ with about 75 tubercles in 4 rows. Antennae shorter than the head, the 4th segment with about 8 olfactory hairs and an apical club. Organ of the 3rd segment with 4 guard setae, an inner curving club, and 2 smooth clubs which converge apically and which overhang 2 sense rods behind a basal fold. A large ventro-lateral club is present on the same segment. Pseudocelli on each side as follows: antennal base 1, base of head 1, protonum to 5th abdominal

segment 1 each. Unguis unarmed, unguiculus spine-like. Anal horns 2, subequal to the hind unguis.

*T. collis* has been known heretofore only from the western part of the country. It was taken from humus with a Berlese funnel.

Leon: May 28—B. V. Travis. Shellrock: Oct. 14—B. V. Travis. Calif., Wash. Mexico.

TULLBERGIA IOWENSIS Mills, 1932

Length up to 0.6 mm. White. Very slender. Postantennal organ broad, with 30 to 40 tubercles in 2 rows. Antennae shorter than the head, the 4th segment with about 5 olfactory hairs and a subapical sense pit. Organ of the 3rd segment with 2 converging sense clubs between which are 2 sense rods which are practically hidden behind an integumentary fold: a ventro-lateral sense club present on the same segment. Rosette-like pseudocelli present on each side as follows: antennal base 1, base of head 1, mesothorax, 1st, 4th and 5th abdominal segments 1 each. Unguis unarmed, unguiculus tuberculate. The 6th abdominal segment with 2 dorsal semicircular ridges, with their bases against the 5th segment. The 5th segment with 2 heavy spines posteriorly which overhang the pseudocelli of that segment and are directly anterior to the folds of the 6th segment. Anal horns 2, shorter than the hind unguis, on nearly contiguous papillae.

I have redescribed this species because of the rather incomplete and in some respects inaccurate original description. Since its description I have been able to examine a large series of specimens from various parts of the state. It approaches the European *T. krausbaueri* Börner. I have submitted specimens to Dr. Jan Stach, who states that it is not *T. krausbaueri*, but another species, which he has known for some time in Poland.

Taken in moss and humus.

Algona: Apr. 16—E. L. Mills. Ames: July 15—H. M. Harris and F. Andre; Aug. 28. Columbus Junction: Sept. 26. Hampton: June 18—G. C. Decker and B. V. Travis. Leon: May 28—B. V. Travis; Oct. 10—B. V. Travis. Rock Rapids: Aug. 16—E. L. Mills. Ruthven: Oct. 2—H. M. Harris and B. V. Travis. Shellrock: Oct. 14—B. V. Travis. Woodbury Co.: Apr. 8—G. C. Decker.

Calif., Idaho, La., Nebr., Tex., Utah. Poland.

TULLBERGIA GRANULATA n. sp.

White. About 6 times as long as broad. Postantennal organ elongate, transverse, with 30 to 40 tubercles in 2 rows with an

occasional partial 3rd row at the outer end of the organ. Antennae shorter than the head, not strongly clavate, the 3rd segment not strongly pedunculate. Organ of the 3rd antennal segment with 2 converging clubs separated by an irregular basal fold which protects 2 clavate rods; guarded by 3 setae. Ventro-lateral club heavy, with 3 guard setae. The 4th segment with a minute apical club and about 6 olfactory hairs. Pseudocelli on each side as follows: antennal base 1, base of head 1, mesothorax to 5th abdominal segment with 1 each. Unguis broad and unarmed. Unguiculus minute, bristle-like. Anal horns 2, on contiguous papillae, subequal to or slightly longer than the hind unguis. Hairs on the body segments in 2 irregular rows of short, curving setae; each with occasional interspersed longer hairs, more abundant posteriorly. Dorsal granulations heavier than the ventral. Irregular rows of coarse granules across the dorsum of the 6th abdominal segment. Length 1 mm.

Taken from moss and humus with a Berlese funnel.

Ames: Aug. 28; Sept. 25. Eldora: Nov. 10. New Sharon: Sept. 19—F. Andre. Valley Junction: May 1.

*TULLBERGIA CLAVATA* n. sp.

Figs. 82-85

White. Nearly 6 times as long as broad. Postantennal organ very slender, consisting of 30 to 45 tubercles in 2 rows. Antennae (fig. 83) shorter than the head, clavate, the 3rd segment pedunculate at the base, rapidly enlarging at about the middle, a suture separating it from the 4th segment. Antennal organ of the 3rd segment (fig. 82) with 2 smooth, converging, sense clubs, separated at the base by a fold which encloses 2 sense rods, and 3 guard setae. Ventro-lateral club (fig. 85) guarded by 3 setae. The 4th segment with 6 or 7 olfactory hairs, and a minute, apical sense club. Antennal bases well developed. Pseudocelli on each side as follows: antennal base 1, base of the head 1, mesothorax 1, 2nd, 4th and 5th abdominal segments 1 each. Unguis (fig. 84) broad, unarmed. Unguiculus absent. Anal horns 2, nearly twice the hind unguis, on contiguous papillae. Dorsum roughly, venter finely granulate. Posterior third of each segment from the mesothorax to the 5th abdominal segment finely and transversely granulate. Dorso-lateral area on the 3rd and 4th antennal segments coarsely granulate. Body with short, backward-pointing setae and long sensory hairs, the short ones in 2 rows across the first 4 abdominal segments and the longer ones interspersed in



the anterior row. Long hairs more abundant on the head and the 5th and 6th abdominal segments. Length 1.2 mm.

Taken beneath pieces of decaying wood and in humus.

Ames: Apr. 2, 3, 9—Reid Davis. Traer: Nov. 5—H. M. Harris.

### FAMILY ENTOMOBRYIDAE TÖMÖSVARY, 1883

Body elongate, distinctly segmented. Pronotum greatly reduced, usually membraneous and devoid of bristles. Mesonotum often projecting more or less over the pronotum. Abdominal terga usually imbricate, with well developed intersegmental membranes. The 4th abdominal tergum often much longer than the 3rd. Antennae subequal to, to much longer than the head, the segments usually slender, the joints easily articulating. Anal horns rarely present. Chewing mouthparts, the mandibles with molar surfaces. Head prognathous. Postantennal organ present or absent. Spring rarely absent. Integument rarely granulate.

#### Key to the Subfamilies of Entomobryidae

1. Tergum of the 4th abdominal segment subequal to the 3rd.  
Antennae 4-segmented. Inner edge of the unguis not split longitudinally ..... 2

Tergum of the 4th abdominal segment much longer than the 3rd (if subequal, then the antennae are 5- or 6-segmented). Postantennal organ absent. Antennae 4- to 6-segmented. Inner edge of the unguis split longitudinally. Posterior abdominal segments never ankylosed (fig. 7).....

Entomobryinae Schäffer, p. 63.

2. Body scaled. The 3rd and 4th antennal segments definitely annulate; the 4th segment much shorter than the 3rd. Mucrones elongate and hairy. Postantennal organ absent. Posterior abdominal segments never ankylosed.....

Tomocerinae Schäffer, p. 82.

Body not scaled. The 3rd and 4th segments of the antennae rarely annulate; 4th segment subequal to or longer than the 3rd. Mucrones not usually long, never hairy. Postantennal organ very rarely absent. The last 2 or 3 abdominal segments sometimes ankylosed (fig. 5).....

Isotominae Schäffer, p. 39.

### SUBFAMILY ISOTOMINAE SCHÄFFER, 1896

Postantennal organ usually present, consisting of a single tubercle. The 3rd and 4th abdominal segments subequal. Antennae 4-segmented, subequal to the length of the head. Body never scaled. Inner edge of the unguis not longitudinally split. Mu-

crones sometimes with a single mucronal bristle but never hairy.

Dr. J. W. Folsom has at the present time a monograph of the Nearctic Isotomid forms in press. As it is impossible to tell whether its publication will antedate the publication of this monograph, Dr. Folsom has kindly sent descriptions of new species included in that paper and occurring in Iowa. These descriptions are placed in quotation marks, and credited to him.

Key to the Genera of Isotominae

1. Furcula absent. Anal horns 2, when present..... 2  
     Furcula present (absent only in the European *Tetracanthella afurcata* Handschin, which has 4 anal horns)..... 3
2. Anal horns absent. Unguiculus present.....  
     *Anurophorus* Nicolet, p. 42.  
     Anal horns present. Unguiculus absent.....  
     *Uzelia* Absolon, p. 42.
3. Anal horns present ..... 4  
     Anal horns absent ..... 5
4. Furcula never reaching the ventral tube. Anal horns 4,  
     not arranged in a transverse line. Anus ventral.....  
     *Tetracanthella* Schött, p. 42.  
     Furcula reaching to the ventral tube. Anal horns arranged  
     in a transverse line across the tergum of the 5th abdominal  
     segment. Anus posterior.....*Spinisotoma* Stach, p. 54.
5. Abdominal segments distinct, the segments not modified in  
     relation to the small furcula, which reaches only to the  
     middle of the 3rd segment. Manubrial hooks not well de-  
     veloped. Eyes reduced in number. Body extremely elon-  
     gate, white (fig. 3).....*Folsomides* Stach, p. 42.  
     Last 2 or 3 abdominal segments often ankylosed; modified  
     for the insertion of the furcula..... 6
6. Antennae inserted on rather well-developed antennal bases,  
     which are approximate on the front. Furcula reaching to  
     the middle of the 3rd abdominal segment. Manubrial  
     hooks well developed, very evident. Sense rods of the 3rd  
     antennal segment organ seated in deep cups. Eyes absent.  
     Body elongate, white (fig. 4).....*Isotomodes* Axelson, p. 46.  
     Antennae not inserted on well developed antennal bases,  
     placed some distance apart and antero-laterally on the  
     front. Furcula reaching at least to the anterior margin  
     of the 3rd abdominal segment. Sense rods of the 3rd an-  
     tennal segment free or behind a fold..... 7
7. The last 3 abdominal segments ankylosed. Mucro never

- lamellate, usually slender, 2-toothed or falcate. Body pigment and number of eyes usually reduced. Furcula not reaching the ventral tube. Anus ventro-terminal..... 8
- The last 3 abdominal segments never ankylosed, although the last 2 may be. Mucro variable. Body usually well pigmented; eyes usually 8 on each side. Furcula often reaching to the ventral tube. Anus terminal..... 9
8. Mucro 2- (rarely 3-) toothed, never falcate.....  
*Folsomia* Willem, p. 47.  
 Mucro falcate.....*Folsomia* Denis, p. 49.
9. Hind femora with a thorn-like process. Found along sea coasts.....*Archisotoma* Axelson, p. 50.  
 Hind femur without a thorn-like process. Variable in habitat ..... 10
10. Organ of the 3rd antennal segment with 15 to 20 clubs.....  
*Axelsonia* Börner, p. 50.  
 Organ of the 3rd antennal segment with 2 clubs..... 11
11. Unguis with a membranous basal tunica.....  
*Agrenia* Börner, p. 50.  
 Unguis without a basal tunica..... 12
12. Body segments bulging; with deep intersegmental constrictions. Terga (except genital and anal) not imbricate, without well developed intersegmental membranes. Pronotum tuberculate; not greatly reduced. Tibiotarsus with a distal subsegment. Integument tuberculate. Dark blue.....*Guthriella* Börner, p. 49.  
 Body segments not bulging, without deep intersegmental constrictions. Terga imbricate, with definite intersegmental membranes. Pronotum not tuberculate, the integument rarely so..... 13
13. The last 2 antennal segments annulate.....  
*Architomocerura* Denis, p. 50.  
 The last 2 antennal segments simple..... 14
14. The 4th abdominal segment longer than the 3rd, the 3rd not prolonged backward beneath the 4th to any extent. Furcula seldom reaching the ventral tube. Dentes usually subequal to the manubrium, which is naked ventrally, or bears few subapical setae. Corpus of tenaculum usually with 1 to 4 anterior setae. Clothing of short, simple setae.....*Proisotoma* Börner, p. 50.  
 The 4th abdominal segment subequal to or shorter than the 3rd, which is prolonged ventro-laterally beneath the 4th.

- Furcula usually reaching the ventral tube. Manubrium much shorter than the dentes, with many ventral setae. Corpus of tenaculum usually with several anterior setae. Clothing of rather long setae, the longer ones sometimes fringed ..... 15
15. Abdomen bearing bothriotricha. The long posterior hairs on the abdomen fringed on all sides. Mucrones lamellate, 4-toothed.....*Isotomurus* Börner, p. 54.  
Abdomen without bothriotricha; the long posterior hairs on the abdomen smooth or unilaterally serrate. Mucrones rarely lamellate (fig. 5).....*Isotoma* Bourlet, p. 55.

GENUS *UZELIA* ABSOLON, 1901

## PROTANUROPHORUS Womersley, 1926

Body slender. Antennae slightly shorter than the head. Eyes 8 on each side. Postantennal organ present. Unguiculus and furcula absent. Anal horns 2.

This genus has been found in Europe and Great Britain, but is not known from North America.

GENUS *ANUROPHORUS* NICOLET, 1841

Body slender. Eyes 8 on each side. Postantennal organ present. Unguiculus present. Furcula and anal horns absent.

*ANUROPHORUS LARICIS* Nicolet, 1841

Length up to 1.5 mm. Deep blue, with lighter spots and intersegmental sutures. The 4th antennal segment with a 2-lobed sense knob and several olfactory hairs. Eyes 8 on each side. Postantennal organ elliptical, twice the diameter of an eye. Unguis unarmed. Unguiculus about a fifth the unguis. Tibiotarsus with 3 weakly developed tenent hairs. Furcula and anal horns absent. Anus ventral.

Taken from humus with a Berlese funnel.

Traer: Nov. 5—H. M. Harris.

Minn., N. Y. Europe.

GENUS *TETRACANTHELLA* SCHÖTT, 1891

Eyes 8 on each side. Postantennal organ present. Unguiculus present. Furcula usually present. Anal horns 4.

An alpine and boreal genus, not as yet known from our territory.

GENUS *FOLSOMIDES* STACH, 1922

“Genotype.—*Folsomides parvulus* Stach, 1922.

“Body cylindrical, greatly elongate, segments not strongly

imbricate. Prothorax unusually long. The abdominal segments are simple rings, subequal in length (excepting the anal segment) and without ankylosis; fourth segment slightly longer than the third; genital and anal segments relatively unmodified. Anus caudal. Head prognathous, mandibulate; mandibles with well developed molar surface. Eyes reduced in number (either one or two on each side, in the known species). Post-antennal organs present, relatively large, elongate, narrow, straight to feebly curving, with thick wall. Antennae arising relatively far forward, four-segmented. Sense organ of third antennal segment consisting of a pair of papillae, each situated in a pit. Fourth antennal segment with slender curving olfactory setae. Unguiculus present. Tenent hairs absent. Ventral tube emitting a pair of short rounded vesicles. Furcula present, small, appended to the fourth abdominal segment. Manubrium much longer than the dens plus mucro; manubrial hooks undeveloped. Dentes smooth dorsally, not crenulate or tuberculate. Mucro bidentate, either separated from the dens by a suture or confluent with dens. Anal spines absent. Clothing of short simple setae. Body pigment absent.

"Hitherto only a single specimen of this peculiar genus has been known: the genotype, *F. parvulus*, found in Hungary and described by Stach, to whose generic description I have added a little.

"*Folsomides* is evidently next to *Isotomodes*, in which, however, the genital and anal segments are ankylosed, the anus is ventral, and the manubrial hooks are strongly developed.

"*Folsomides* is unique among Collembola in the primitive nature of the segmentation of the body. The abdomen, with its simple, ringlike equal segments is almost vermiform; even the genital and anal segments are relatively unmodified, as compared with those segments in other Collembola. Both *Folsomides* and *Isotomodes* show affinities with *Folsomia* and *Proisotoma*."

### Key to the Species of *Folsomides*

Eyes 2 on each side. Mucrodentes about half the manubrium.....  
*parvus* Folsom, n. sp., p. 43.

Eyes 1 on each side. Mucrodentes about two-thirds the manubrium.....*stachi* Folsom, n. sp., p. 45.

FOLSOMIDES PARVUS Folsom, n. sp.

**Fig. 3**

“White. Greatly elongate: body subcylindrical, six times as

long as broad. Eyes 2 on each side: equal, one in front of the other, separated, each on a small irregular black spot. Postantennal organ close to the anterior eye, narrowly elliptical or subelliptical, thick walled, varying in length from a little shorter to a little longer than the width of the first antennal segment, with four guard setae. Antennae inserted forward on the head, two-thirds as long as the latter, with segments in relative lengths about as 2:3:3:5; fourth segment stout, elliptical, with slender curving olfactory setae. Sense organ of third antennal segment with a pair of papillae, each in a shallow pit. Thorax long, three-fifths as long as abdomen, with tergites in relative lengths as 10:18:15. Abdominal segments without ankylosis, in relative lengths about as 13:14:13:15:13:9; fourth segment thus a little longer than the third. Anal segment simple, unmodified. Anus caudal. Ungues feebly curving, simple, untoothed. Unguiculi minute, lanceolate, acuminate, untoothed, extending about one-third as far as the ungues. Tenent hairs absent. Ventral tube simple, with a pair of hemispherical vesicles, side by side. Furcula small, appended to the fourth abdominal segment and extending slightly beyond it. Manubrium stout, not tapering, rounded apically, about twice as long as the dens plus mucro, with several short, stiff dorsal setae. Dens and mucro confluent. Mucrodens gradually narrowing from the base, smooth dorsally, with three short stiff dorsal setae; mesally with a pair of narrow chitinous basal ridges. Mucro subequally bidentate; apical tooth hooked; anteapical feebly hooked. Clothing of sparse minute equal stiff setae, longer and more numerous posteriorly; sensory setae longer, stiff, outstanding, simple, in a row across the middle of the body segments; longest and most numerous on the anal segment. Integument smooth. Length 0.75 mm.

"*Folsomides parvus* differs from *parvulus* Stach chiefly in the following respects:

	<i>parvulus</i>	<i>parvus</i>
Ant. I:II	1:2	2:3
Postantennal organ	bent	straight
Unguiculus	Stout, subovate	slender, lanceolate
Mucro	demarcated from dens	confluent with dens
Long tibiotarsal hair	present	absent

"*Parvulus* was taken in Hungary under a large stone on moist soil in a farmyard near a cowbarn. The five cotypes of *parvus*

were found in Douglas fir soil, at an elevation of 8,500 feet.

"In Homer, Illinois, May 13, 1924, under a log in damp bottom land, I found a single specimen of a species of *Folsomides* which is extremely close to Stach's *parvulus*. Additional material is necessary, however, for definite determination.

"Colorado.—Eastern slope of Pikes Peak, July 1, Engelman Canyon, G. W. Goldsmith."—J. W. F.

My records are as follows:

Ames: Apr. 8—G. C. Decker; July 15; Sept. 16—F. Andre; Oct. 15. Columbus Junction: Sept. 26. Hampton: June 18—G. C. Decker and B. V. Travis. Ottumwa: Sept. 16—Zella Beck. Rock Rapids: Aug. 16—E. L. Mills. Shellrock: Oct. 14—B. V. Travis. Valley Junction, May 1. Woodbury Co.: Apr. 8—G. C. Decker.

*FOLSOMIDES STACHI* Folsom, n. sp.

"White. Greatly elongate; body cylindrical, in length six times the height of the abdomen. Eyes one on each side, each on a small round black spot. Postantennal organ close to the eye, narrowly elliptical, straight or feebly curving, in length about four times the diameter of the eye, with four guard setae. Antennae about two-thirds as long as the head, with segments in relative lengths about as 5:6:7:8. Body segments in relative lengths about as 14:27:25:21:23:24:27:20:15. Fourth abdominal segment thus a little longer than the third. Genital and anal segments not ankylosed. Anus caudal. Ungues stout, curving, untoothed. Unguiculi extending one-half as far as the ungues on the hind feet, one-third as far on the remaining feet, lanceolate; acuminate, untoothed. Tibiotarsus with a distal subsegment indicated. Tenent hairs absent. Furcula small, appended to the posterior part of the fourth abdominal segment, and extending not quite to the middle of the third. Manubrium longer than the mucrodens (about as 3:2), gradually narrowing, with five pairs of setae in the dorsal aspect. Dens and mucro confluent. Mucrodens stout, gradually tapering from the base, with three small dorsal setae; mesally with a pair of narrow chitinous basal ridges. Mucro minutely bidentate; apical tooth hooked; ante-apical tooth retrorse. Rami of tenaculum tridentate; corpus with an anterior median basal lobe. Clothing of minute stiff simple setae, limited to a few transverse rows across the middle of each body segment, with a few longer erect sensory setae; genital and anal segments with a few longer erect sensory setae. Integument smooth. Length 0.6 mm.

"This new species, which I dedicate with pleasure to colleague Dr. Jan Stach, was taken by me at Tallulah, Louisiana, April 7, in humus in a cypress forest."—J. W. F.

My data are as follows:

Ottumwa: Sept. 9—F. Andre.

Fla., La., Tex.

GENUS *ISOTOMODES* AXELSON, 1907

Body long and slender, with little, if any, pigment. The 5th and 6th abdominal segments ankylosed. Anus postero-ventral. Furcula very short, reaching about to the middle of the 3rd abdominal segment. Manubrial hooks greatly enlarged. Antennae inserted close together on the front. Postantennal organ present. Sense rods of the 3rd antennal segment situated in deep cups. Eyes absent.

*ISOTOMODES TENUIS* Folsom, n. sp.

Figs. 4, 86

"Greatly elongate, length about nine times the height of the body. White, or with a few scattered black specks, largest and most numerous on the posterior part of the abdomen. Eyes absent. Postantennal organ elongate, a little shorter than the width of the first antennal segment, straight or slightly curving, with almost parallel sides, usually emarginate at the middle of the anterior margin, six to eight times as long as broad, with a posterior row of strong guard setae seated on a cuticular thickening. Antennae shorter than the head (as 5:7), with segments in relative lengths about as 4:7:6:10. Sense organ of third antennal segment with a pair of rods immersed in a deep pit. Fourth antennal segment with olfactory setae. Body subcylindrical; abdomen slightly dilating posteriorly. Prothorax not unusually long (one-fifth to one-half as long as mesothorax); fourth abdominal segment longer than the third (as 6:5); anal segment not evident. Anus ventral. Claws largest on third pair of feet. Unguis slender, curving, untoothed. Unguiculus extending less than half as far as the unguis, lanceolate, pointed, untoothed. Tenent hairs absent. Furcula appended to the fourth abdominal segment, short, extending scarcely to the middle of the third abdominal segment. Manubrium stout, longer than dentes (as 5:3), with several dorsal setae and two pairs of ventral subapical setae. Dens stout, narrowing but little, with unusually thick ventral wall, without dorsal crenulations, with a few setae dorsally and ventrally, and with a pair of basal hooks exceptionally large.



Mucro half as long as dens, subequally bidentate; apical tooth feebly hooked; antepical tooth suberect. Rami of tenaculum quadridentate, slender, tapering; corpus with a single long curving seta. General clothing of short stiff simple setae becoming longer and more curving toward the end of the abdomen; erect sensory setae short and simple. Integument minutely granulate. Maximum length, 1 mm.

"Massachusetts: Arlington, Mar. 20, in damp moss on stones in a bog, J. W. Folsom."—J. W. F.

My Iowa data follow:

Ames: Mar. 1; July 15—H. M. Harris and F. Andre; Nov. 24.  
LeGrand: Apr. 15—E. M. Mills. Ottumwa: Sept. 16—Zella Beck. Valley Junction: May 1.

#### GENUS *FOLSOMIA* WILLEM, 1902

Eyes usually reduced in number, or absent. Body pigment also often reduced. Unguiculus and furcula present; mucro with 2 (rarely 3) teeth. The 4th to 6th abdominal segments ankylosed, sometimes, however, with evidence of a dorsal suture between the 4th and 5th segments.

In this genus of well-marked species, 5 forms are known to occur in Iowa although others should be found in the state.

#### Key to the Species of *Folsomia*

1. Eyes 8 on each side ..... 2  
Eyes less than 8 on each side ..... 3
2. Tenent hairs 1 or 2. The 2 inner proximal eyes on each side reduced.....*prima* Mills, p. 47.  
Tenent hairs absent. All the eyes subequal.....  
*elongata* MacGillivray, p. 48.
3. Eyes 2 on each side.....*quadrioculata* Tullberg, p. 48.  
Eyes less than 2 on each side ..... 4
4. Eyes 1 on each side.....*diplophthalma* Axelson, p. 48.  
Eyes absent.....*fimetaria* Linnaeus, p. 48.

#### *FOLSOMIA PRIMA* Mills, 1931

Length up to 1 mm. Olive to gray. Eyes 8 on each side, the 2 inner proximals smaller. Postantennal organ elongate, usually emarginate on both sides. Antennae subequal to the head. Unguis with a pair of lateral teeth, and 1 minute inner one. Unguiculus broadly rounded inwardly, about 0.6 the unguis. Tenent hairs 1 or 2, feebly knobbed. Furcula reaching to the posterior margin of the 2nd abdominal segment. Manubrium and dentes subequal, or the dentes slightly longer. Mucro 2-toothed.

Taken beneath bark and in humus.

Ames: Feb. 21, 23; Mar. 31; Sept. 16—F. Andre; Oct. 3.  
Columbus Junction: Sept. 26. Hampton: June 18—G. C. Decker  
and B. V. Travis. Leon: Oct. 10—B. V. Travis.

FOLSOMIA ELONGATA (MacGillivray), 1896

*Isotoma bidenticula* Guthrie, 1903

Length up to 1.5 mm. Gray to deep brown. Eyes 8 on each side, subequal. Postantennal organ elongate-oval. Antennae subequal to the head. Unguis unarmed. Unguiculus more than half the unguis. Tenent hairs absent. Furcula reaching the posterior margin of the 2nd abdominal segment. Manubrium longer than the dentes. Mucro 2-toothed.

Found commonly beneath pieces of wood and in humus.

Ames: Mar. 30; Apr. 2, 6, 7; May 9; Oct. 10. Eldora: Nov. 10.  
Hancock: Oct. 8—F. Andre. Leon: Oct. 31—B. V. Travis. Otumwa: Nov. 28—F. Andre. Ruthven: Oct. 2—H. M. Harris and B. V. Travis. Shellrock: Oct. 14—B. V. Travis. Woodbury Co.: Apr. 8—G. C. Decker.

Colo., Ill., Kans., Me., Minn. Ontario.

FOLSOMIA QUADRIOCULATA (Tullberg), 1871

Length 1 mm. Dirty gray. Eyes 2 on each side. Tenent hairs absent. Claws unarmed. Furcula short, mucro bidentate.

Shellrock: Nov. 6—B. V. Travis.

FOLSOMIA DIPLOPHALMA Axelson, 1902

Length up to 1.2 mm. White to dirty gray. Eyes 1 on each side. Postantennal organ elongate. Antennae subequal to the head. Unguis unarmed. Unguiculus half the unguis. Tenent hairs absent. Furcula short, dentes as long as the manubrium, mucro 2-toothed.

Columbus Junction: Sept. 26. Leon: Oct. 10—B. V. Travis.  
Shellrock: Oct. 14—B. V. Travis.

Idaho. Europe.

FOLSOMIA FIMETARIA (L.), 1758

Length up to 2 mm. White. Eyes absent. Postantennal organ elongate. Antennae longer than the head. Unguis toothed or not. Unguiculus slightly longer than half the unguis. Tenent hairs absent. Dentes twice the manubrium. Mucro 2-toothed.

This species occurs with us in 3 forms which may be differentiated as follows:

1. Unguis unarmed. Large posterior hairs of the abdomen simple ..... *fimataria* f. p.  
     Unguis toothed ..... 2
2. Long posterior hairs of the abdomen serrate.....

*caldaria* Axelson.

Long posterior hairs of the abdomen smooth. Unguis strongly unidentate ..... *dentata* Folsom.

Ames: Sept. 1, 2, 4; Oct. 20. Bixby Ice Cave: May 8. Columbus Junction: Sept. 26. Hampton: June 18—G. C. Decker and B. V. Travis. Leon: Oct. 31—B. V. Travis. Ruthven: Oct. 2—H. M. Harris and B. V. Travis.

Calif., D. C., Ill., Kans., Mass., Md., Me., Minn., Mo., N. J., N. Y., Ohio, Utah, Wash. Alaska. Arctic Islands. Europe.

#### GENUS *FOLSOMINA* DENIS, 1931b

Eyes and postantennal organs absent. The 4th antennal segment with 2 bulbous, blunt processes, besides several well-developed olfactory hairs. Unguiculus and furcula present; mucro falcate. Abdominal segments 4 to 6 ankylosed, an obscure dorsal suture, however, between the 4th and 5th.

#### *FOLSOMINA* ONYCHIURINA Denis, 1931b

Figs. 87, 88

Length up to 0.6 mm. White. Eyes and postantennal organ absent. Body segmentation as in *Folsomia*. Antennae longer than the head, 4th segment (fig. 88) with 5 large olfactory hairs, several more slender ones, and 2 large lobes, each with 3 longitudinal ribs. Unguis untoothed. Unguiculus half the unguis. Manubrium to dentes as 2:5. Mucro falcate (fig. 87). Body with numerous short hairs and a row of longer ones across each segment.

Taken from humus with a Berlese funnel.

Ames: July 15—H. M. Harris and F. Andre; Aug. 28. LeGrand: Apr. 14—E. M. Mills. New Sharon: Sept. 19—F. Andre. Ottumwa: Sept. 9—F. Andre.

Fla. Costa Rica. Australia.

#### GENUS *GUTHRIELLA* BÖRNER, 1906

Eyes 8 on each side. Postantennal organ present. Body segments bulging, 5th and 6th abdominal segments alone imbricate, and with intersegmental membranes. Integument, including pronotum, tuberculate.

This genus has not been recorded from Iowa, but should occur in this state.

GENUS *ARCHISOTOMA* LINNANIEMI, 1912

Body broad, *Isotoma*-like. Eyes 8 on each side. Postantennal organ present. The 5th and 6th abdominal segments ankylosed. Hind femora each with a large, thorn-like process. Corpus of tenaculum with a large, anterior, accessory lobe. Abdomen with naked bothriotricha.

Not found in Iowa.

GENUS *AGRENIA* BÖRNER, 1906

Eyes 8 on each side. Postantennal organ present. Unguiculus and furcula present. Unguis with an external basal tunica. Mucro 2-toothed, over-reached by a long seta.

Unknown in Iowa.

GENUS *AXELSONIA* BÖRNER, 1907

Eyes 8 on each side. Postantennal organ absent. Unguiculus and furcula present. A pair of slender filaments attached to the base of the unguis. Organ of the 3rd antennal segment with 15 to 20 sense rods. Bothriotricha present on the abdomen.

Not known in Iowa.

GENUS *ARCHITOMOCERURA* DENIS, 1931a

Eyes 6 on each side. Postantennal organ minute. The 3rd and 4th antennal segments annulate. Unguiculus and furcula present. Abdomen with bothriotricha.

*ARCHITOMOCERURA CRASSICAUDA* Denis, 1931a

Length up to 0.75 mm. White but for bluish antennae and blue-black eyespots. Antennae longer than the head, the last 2 segments annulate, segmental proportions as 12:15:34:44. Eyes 6 on each side. Postantennal organ minute, obscure. Unguis unarmed, unguiculus broadly lanceolate. Tenent hairs absent. Furcula reaching the ventral tube, manubrium to dentes to mucrones as 3:6:1. Mucro bilamellate, with an apical and sub-apical tooth, and a toothed external lamella. Long bothriotricha present.

Recovered from humus with a Berlese funnel.

Ames: Sept. 4; Oct. 20—F. Andre. Ottumwa: Oct. 9—F. Andre.

Fla., Wash. Europe.

GENUS *PROISOTOMA* BÖRNER, 1906*ISOTOMINA* Börner, 1903

Eyes variable in number. Postantennal organ present. Unguiculus and furcula present. The 4th abdominal segment longer than the 3rd, which is not prolonged back beneath the 4th to any

extent. Furcula not generally reaching the ventral tube. Dentes usually subequal to the manubrium which bears few ventral setae. Corpus of the tenaculum usually with 1 to 4 anterior setae, or bare. Tibiotarsus often with a distal subsegment. Tenent hairs present or absent.

#### Key to the Species of Proisotoma

1. Eyes 5 on each side.....*americana*, n. sp. p. 51.  
    Eyes 8 on each side ..... 2
2. Mucro with 2 teeth ..... 3  
    Mucro with 3 teeth ..... 4
3. Mucro lamellate; 5th and 6th abdominal segments distinct....  
    *schötti* Dalla Torre, p. 52.  
    Mucro not lamellate; 5th and 6th abdominal segments anky-  
    losed.....*thermophila* Axelson, p. 53.
4. A large, lateral, hyaline bulb at the apex of each dens.....  
    *bulbosa* Folsom, n. sp. p. 52.  
    Dentes without bulbous appendages....*minuta* Tullberg, p. 54.

#### PROISOTOMA AMERICANA n. sp.

##### Figs. 89-91

White but for blue eyespots and minute blue spots on the head and rarely on the body. Eyes 5 on each side (fig. 89). Postantennal organ oval, about twice the diameter of an eye. Antennae shorter than the head, segmental proportions 11:16:17:30; numerous slender olfactory hairs present on the 4th segment. Organ of the 3rd segment with 2 slender rods. Unguis (fig. 90) broad basally, pointed, untoothed. Unguiculus lanceolate, half the length of the unguis. Tenent hairs absent. Furcula not reaching the ventral tube (fig. 91). Manubrium slightly longer than the dens and mucro together, with a few dorsal setae and a pair of ventral subapical bristles. Dentes irregularly roughened dorsally, with 3 dorsal setae and 2 pairs of ventral bristles. Mucro 3-toothed, with an apical, a subapical, and a lateral tooth, the lateral tooth nearly opposite the subapical one. Rami of the tenaculum 3-toothed, the corpus with 1 anterior seta. Apex of the abdomen bluntly rounded, the 5th and 6th segments separated only by a weak dorsal suture; the 3rd segment to the 4th as 4:5. Body covered with hairs of an even length, slightly longer posteriorly. Maximum length 0.9 mm.

Other than in the arrangement of the eyes, this species differs from its nearest relative, *P. minima* Absolon, in the following manner:

*P. minima*

Body hairs short.  
 Postantennal organ 4 times the diameter of an eye.  
 "Ant. IV mit plumpen Riechhaaren."—Handschin, 1929.  
 Dorsal dental setae 5.

*P. americana*

Body hairs not especially short.  
 Postantennal organ 2 times the diameter of an eye.  
 Ant. IV with slender olfactory hairs.  
 Dorsal dental setae 3.

Taken from humus.

Ames: Oct. 15, 20; Nov. 1, 17. Traer: Nov. 5—H. M. Harris.

## PROISOTOMA SCHÖTTI (Dalla Torre), 1895

Figs. 93. 94

Length up to 2 mm. Blue-brown. Eyes 8 on each side. Postantennal organ oval, twice the diameter of an eye. Antennae subequal to the head, the segments as 5:5:6:13. The 3rd abdominal segment is to the 4th as 2:3. Unguis untoothed (fig. 94). Unguiculus broad basally, half the unguis. Tenent hairs absent. Proportions of the furcula: 10:8:3. Mucro (fig. 93) large, bilamellate, with 2 apical teeth. Dentes heavy, not or slightly tapering dorsally.

A littoral form taken along the shore of Mud Lake.

Ruthven: Oct. 2—H. M. Harris and B. V. Travis.

Calif., N. Y., Wash. Europe.

## PROISOTOMA BULBOSA Folsom, n. sp.

Fig. 92

"Blackish blue, including the appendages. A stout species. Eyes eight on each side, one or both of the inner proximal eyes on each side being smaller than the others. Postantennal organ subelliptical but somewhat irregular, twice as long as the diameter of an adjacent eye, with an exceptionally thick bordering ridge. Antennae slightly longer than the head (as 7:6), with segments variable in relative lengths; third segment usually a little shorter than the second, occasionally a little longer; fourth two to three times as long as second. Sense organ of third antennal segment with a pair of feebly curving rods in a deep groove, with four guard setae. The curving setae of the fourth antennal segment are strong, but not evidently differentiated as olfactory setae. Tibiotarsi not subsegmented. Unguis weakly curving, with a pair of lateral teeth two-fifths from the base, and an inner tooth one-third from the apex. Unguiculus extend-

ing three-fifths to four-fifths as far as the unguis, sublanceolate, acute, untoothed. One tenent hair, weakly knobbed. Third abdominal segment shorter than the fourth (about as 19:22). Genital and anal segments ankylosed, with the dorsal suture often indicated, however; dorsally with coarse tuberculate ridges. Furcula appended to the fifth abdominal segment, not attaining the ventral tube but extending as far as the second abdominal segment, stout. Manubrium about seven-eighths as long as dentes, setigerous on all sides. Dentes stout, not tapering, broad apically, each with a lateral protuberance one-fourth from the base, and with about eight large dorsal semicircular folds. Dentes with a few setae dorsally, and many stiff setae laterally and ventrally. At the end of the dens is a conspicuous lateral expansion in the form of a transparent bladder extending half the length of the mucro. Mucro stout, quadridentate (fig. 92). Apical tooth small, slightly curving or almost straight; second and third in line with the first, subequal, directed slightly forward; fourth tooth lateral, oblique. Ventral aspect of the mucro in lateral aspect almost straight proximally. Rami of tenaculum quadridentate; corpus with three ventral setae. General clothing of short strong curving simple setae, becoming longer in the genital and anal segments. Erect sensory setae apparently absent. Integument minutely tuberculate, becoming smooth and reticulate on the posterior regions of the body segments and on the intersegmental membranes. The coarse dorsal tubercles of the ano-genital segment form several crenulate ridges. Length 1.2 mm.

"Maine.—Orono, March 10, in moss in pine woods, F. L. Harvey."—J. W. F.

My data are as follows:

A single specimen of this species was taken in humus.

Columbus Junction: Sept. 26.

#### PROISOTOMA THERMOPHILIA Axelson, 1907

Figs. 95, 96

Length up to 1 mm. Light gray. Eyes 8 on each side. Post-antennal organ oval, nearly 4 times the diameter of an eye. Antennae longer than the head, the segments as 8:13:14:26. The 3rd abdominal segment to the 4th as 13:16. Unguis (fig. 96) with 1 inner tooth. Unguiculus half the unguis, unarmed. Tenent hairs absent. Dentes more than twice the manubrium. Mucro 2-toothed (fig. 95), the apex upturned. The 5th and 6th abdominal segments ankylosed.

Taken in moss and humus.

Ames: Sept. 4; Oct. 15, 20. Leon: Oct. 10—B. V. Travis. Pleasant Valley: Sept. 25—H. D. Tate.

Fla., Tex., Utah. Costa Rica. Europe.

*PROISOTOMA MINUTA* (Tullberg), 1871

Length up to 1 mm. Gray to nearly white. Eyes 8 on each side. Postantennal organ elongate-elliptical, 3 times the diameter of an eye. Antennae longer than the head. The 5th and 6th abdominal segments weakly separated; 3rd and 4th segments subequal. Unguis unarmed. Unguiculus more than half the unguis. Tenent hairs absent. Manubrium and dentes subequal. Mucro 3-toothed.

Ames: Mar. 22; Apr. 3; May 7, 9, 23; July 15—H. M. Harris and F. Andre; Aug. 24; Sept. 2, 25. Bixby State Park: May 8. Hampton: June 16—G. C. Decker and B. V. Travis. New Sharon: Sept. 19—F. Andre. Smithland: Dec. 5—G. C. Decker.

Calif., Conn., Ill., Kans., La., Mass., N. Y., Pa., Tex., Utah. Alberta. Europe.

GENUS *SPINISOTOMA* STACH, 1926

Eyes 8 on each side. Postantennal organ present. The 4th abdominal segment not longer than the 3rd. Furcula reaching the ventral tube. The 5th abdominal segment dorsally with 4 heavy spines.

Recorded only from Poland.

GENUS *ISOTOMURUS* BÖRNER, 1903

Eyes 8 on each side. Postantennal organ present, of the usual *Isotoma* type. Unguiculus and furcula present, the dentes long and slender, with dorsal corrugations. Bothriotricha present posteriorly on the abdomen. Mucro 4-toothed, lamellate.

*ISOTOMURUS PALUSTRIS* (Müller), 1776

*Isotoma aequalis* MacGillivray, 1896,

*I. tricolor* Packard, 1873.

Figs. 97, 98.

Length up to 3 mm. Extremely variable in color. Eyes 8 on each side. Postantennal organ oval, somewhat longer than the diameter of an eye. Unguis with lateral teeth and as a rule without an inner tooth. Unguiculus broad basally, two-thirds the unguis. Dentes twice the manubrium. Mucro 4-toothed (fig. 98), lamellate.



1.	Body all one color .....	2.
	Body with a dark pattern .....	3.
2.	Body yellow-green ..... <i>prasina</i> Reuter.	
	Body red-violet ..... <i>fucicola</i> Reuter.	
3.	Body greenish, with a dorsal and irregular lateral stripes.....	
	<i>palustris</i> f. p.	

Ames: Feb. 21; Mar. 7, 27, 29; June 3, 14; Oct. 10—L. Weber.  
Columbus Junction: Sept. 25. Little Wall Lake: Oct. 14—G. C.  
Decker. Mt. Pleasant: Mar. 6—H. R. Knight. Ruthven, Oct. 2—  
H. M. Harris and B. V. Travis.

GENUS *ISOTOMA* BOURLET, 1839

Eyes variable. Postantennal organ rarely absent. Unguiculus and furcula present. Dentes much longer than the manubrium, which usually bears many ventral setae. Corpus of tenaculum usually with many anterior setae. The 3rd and 4th abdominal segments subequal, the 3rd projecting ventro-laterally beneath the 4th. Bothriotricha absent; some of the larger abdominal hairs, however, unilaterally serrate.

This large genus has been divided into 3 subgenera, *Isotoma* s. str., *Vertagopus* Börner, and *Pseudisotoma* Handschin. *Pseudisotoma* was erected for *I. sensibilis* Tullberg, in which the 5th and 6th abdominal segments are entirely ankylosed. *Vertagopus* includes those species which have tenent hairs, and in which the last 2 abdominal segments are distinct. In North America there is a variety of *I. arborea* (L.) with tenent hairs and another without them. Hence *I. arborea* falls in *Isotoma* s. str., and its variety *nigra* MacGillivray falls in the subgenus *Vertagopus*. This subgenus, although convenient, is not a natural grouping and is not recognized in this work.

The 5th and 6th abdominal segments ankylosed. Tenent hairs present.....*Pseudisotoma* Handschin, p. 56.  
The 5th and 6th abdominal segments distinct. Tenent hairs present or absent.....*Isotoma* Bourlet, p. 55.

Key to the Species of *Isotoma*

1. Eyes reduced in number..... 2.  
     Eyes 8 on each side..... 4.
2. Eyes and postantennal organs absent.....  
     *minor* Schäffer, p. 57.  
     Eyes and postantennal organs present..... 3.
3. Eyes 3 on each side. White.....*andrei* n. sp. p. 58.  
     Eyes 4 on each side. Blue-gray.....  
     *eunotobilis* Folsom, n. sp. p. 58.
4. Tenent hairs present..... 5.  
     Tenent hairs absent..... 6.
5. Color blue-black. Ventral edge of mucro curved.....  
     *arborea* L., p. 57.  
     Color gray. Ventral edge of the mucro nearly straight.....  
     *cinerea* Nicolet, p. 57.
6. Mucro 3-toothed, or apparently so..... 7.  
     Mucro 4-toothed ..... 8.
7. Unguis unidentate. Apical tooth of the mucro pointed  
     postero-dorsally, long.....*trispinata* MacGillivray, p. 62.  
     Unguis bidentate. Apical tooth of mucro strongly up-  
     curved.....*viridis* Bourlet, p. 63.
8. Head extremely large. Antennae to the head as 5:6. Post-  
     antennal organ lateral, against the base of the antenna.....  
     *grandiceps* Reuter, p. 60.  
     Head not extremely large. Antennae longer than the head.  
     Postantennal organ close to the eyespot..... 9.
9. Lateral teeth of the unguis large, scale-like. Body irregu-  
     larly purple. A broad blue-black band across the front....  
     *nigrifrons* Folsom, n. sp., p. 60.  
     Lateral teeth of the unguis small, pointed. Front of head  
     not with a blue-black band..... 10.
10. Color white to yellow. Elongate. The 2nd antennal seg-  
     ment straight or bowed.....*albella* Packard, p. 62.  
     Color dark. The 2nd antennal segment straight..... 11.
11. Color blue-black. Postantennal organ subequal to the  
     diameter of an eye.....*arborea nigra* MacGillivray, p. 57.  
     Color blue to gray. Postantennal organ about 3 times the  
     diameter of an eye.....*olivacea* Tullberg, p. 61.

ISOTOMA (PSEUDISOTOMA) SENSIBILIS (Tullberg), 1876.

Figs. 99, 100

Length up to 2 mm. Gray to purple-black, irregularly spotted with light, and lighter along the sutures. Head to the antennae as 4:5, the antennal segments as 8:11:12:20. Eyes 8 on each

side. Postantennal organ oval, about the size of an eye. The 5th and 6th abdominal segments ankylosed, showing at times, however, evidence of a dorsal, dividing suture. Unguis (fig. 99) with lateral teeth and 1 inner tooth. Unguiculus often with an inner notch. Tenent hairs 1 to 3 on each tibiotarsus. Manubrium to dentes as 4:11. Mucro (fig. 100) 3-toothed, the 2 subapical teeth not opposite. Longer abdominal hairs unilaterally serrate.

Taken abundantly from moss.

Ames: Sept. 25. Columbus Junction: Sept. 26. Ottumwa: Sept. 9—F. Andre.

Fla., Ill., La., Mass., Minn., N. Y., Ohio. Ontario. Europe.

*ISOTOMA CINEREA* (Nicolet), 1841

*I. latraria* MacGillivray, 1896

Length up to 1.5 mm. Gray. Antennae longer than the head. Eyes 8 on each side. Postantennal organ 1 to 2 times the diameter of an eye. Unguis with 1 inner tooth and lateral teeth. Unguiculus with an inner notch. Each tibiotarsus with 2 to 3 tenent hairs. Dentes twice the manubrium. Mucro 4-toothed, the apical tooth short and directed posteriorly. The ventral edge of the mucro nearly straight.

A rather common cortical species.

Ames: Feb. 21; Mar. 14; Apr. 21; Oct. 3, 17. Leon: Oct. 31—B. V. Travis.

Ill., Mass., Me., N. Y., Ohio. Ontario. Holarectic.

*ISOTOMA ARBOREA* (L.) 1758, f. p.

Length up to 2 mm. Deep blue-black. Legs and furcula white or yellowish. Eyes 8 on each side. Postantennal organ oval, about the size of an eye. Antennae longer than the head. Unguis with lateral teeth and 1 inner tooth. Unguiculus with an inner tooth-like notch. Tenent hairs 2:3:3. Dentes more than twice the manubrium. Mucro 4-toothed, the ventral edge curving. Long hairs on the abdomen serrate.

*ISOTOMA ARBOREA NIGRA* MacGillivray, 1896

Very similar to the typical form but for the absence of tenent hairs.

Ames: Feb. 23; Apr. 2.

Ill., Mass., Me., Minn., N. Y., Ohio. Ontario. Europe.

*ISOTOMA MINOR* Schäffer, 1896.

Fig. 101

Length up to 1 mm. White. Eyes and postantennal organs absent. Antennae longer than the head, the 4th segment with

5 to 8 (commonly 6) heavy olfactory clubs lateroventrally (fig. 101). Claws without teeth. Tenent hairs absent. Manubrium to the dentes as 11:30. Mucro with 3 teeth. Long hairs of the abdomen serrate.

Taken in humus.

Ames: Apr. 2. Algona: Apr. 16—E. L. Mills. Columbus Junction: Sept. 26. Hampton: June 18—G. C. Decker and B. V. Travis. Ottumwa: Sept. 9—F. Andre.

Fla., Ill., Mass. Europe.

ISOTOMA ANDREI n. sp.

Figs. 5, 102-104

White. Eyespots and scattered specks on the head black. Body rather broad. Antennae a third longer than the head, the segments as 8:14:15:23. Eyespots small, each bearing 3 eyes. Postantennal organ large (fig. 104), irregular, the edges lobed. Unguis curving (fig. 103), with baso-lateral teeth, 1 inner tooth, and basal folds as in *I. viridis*. Unguiculus half the unguis, with a large inner tooth. Tenent hairs absent. Manubrium with numerous ventral setae; to the dentes as 2:7. Dentes long and slender, terminated by tridentate mucrones (fig. 102). Tenaculum with numerous anterior setae, the rami 4-toothed. The 3rd and 4th abdominal segments subequal. Body covered with short, reclinate hairs, and long, unilaterally serrate setae. Length 1.2 mm.

Taken from moss with a Berlese funnel. This species is named for Mr. Floyd Andre, who collected this and other interesting species of Collembola in the state.

Ottumwa: Sept. 9—F. Andre, 16—Zella Beck; Nov. 29—F. Andre.

ISOTOMA EUNOTABILIS Folsom, n. sp.

“General color grayish, greenish, or bluish. Head and body finely mottled with bluish gray pigment interrupted by closely-set round pale spots. Body segments narrowly bordered posteriorly with blackish. Eyes connected anteriorly by a narrow  $\Delta$ -shaped mark. Legs and furcula pale. Antennae pale, with segments more or less purplish distally. Young individuals may be white, with minute specks of blackish pigment. Eyes four on each side, equal, arranged as in fig. 338, on a small roundish black patch. Postantennal organ relatively large, elliptical, close to the eyes, three or four times as long as the diameter of an eye.

Antennae longer than the head (as 1.5:1), with segments in relative lengths about as 10:16:16:33. Sense organ of third antennal segment with a pair of small, slightly curving rods, subtended by a chitinous ridge. Fourth antennal segment with a few stout, slightly curving olfactory setae. Unguis simple, without lateral or inner teeth. Unguiculus extending half as far as the unguis, broadly sublanceolate, pointed, untoothed. Tenent hairs absent. Third abdominal segment slightly shorter than the fourth (as 28:33). Genital and anal segments ankylosed, with often a trace of a dorsal suture. Furcula appended to the fifth abdominal segment, extending to the ventral tube. Manubrium much shorter than dentes (as 6:17), with many stiff setae on all sides. Dentes slender, gradually tapering, crenulate dorsally, with many ventral setae and a few erect dorsal proximal setae. Mucro small, tridentate. Apical tooth small, hooked. Anteapical tooth smaller than the apical, inclined or suberect. Third tooth proximo-lateral, curving dorsally more or less and projecting caudo-laterally. Dentes with a strong subapical ventral seta projecting as far as the end of the mucro or slightly beyond it. Rami of tenaculum quadridentate, corpus with two ventral setae (rarely with three). General clothing of numerous short setae, most of which are simple; the longest setae, near the extremity of the abdomen, are, however, feebly unilaterally spinulate. Sensory setae simple, or with two or three branches unilaterally, erect, scarcely longer than the inclined setae. Length, 0.7 mm.

"In moderately pigmented individuals the minute specks of pigment form a loose network, outlining the hypodermis cells.

"This species is very close to the European *notabilis* Schäffer, of which I have studied three specimens from Finland, sent to me by Linnaniemi. Both species have four eyes on each side, but the arrangement of the eyes differs in the two species. In *notabilis* the third abdominal segment is to the fourth as 46:47; while in *eunotabilis* the ratio is 56:66. In *notabilis* the larger posterior setae of the abdomen are more strongly feathered than in *eunotabilis*. I do not know whether *notabilis* ever has the interocular  $\Delta$ -shaped mark; my specimens from Finland having very little pigment. In other respects this species agrees with *notabilis*, even to the presence of feathered setae on the bases of the legs.

"*Isotoma eunotabilis* belongs to the fauna of the soil. It is common on damp ground under logs and among dead leaves. I have often taken it under damp boards on grass.

"Illinois.—Homer, February 28, March 3, 14, 25, April 2, 11, 12, 14, 15, 16, 21, 25, May 2, 3, 14, 16, June 6.

"Wisconsin.—Beloit, October, V. G. Davidson.

"Canada, Ontario, November, C. Macnamara."—J. W. F.

My Iowa data are as follows:

Ames: Apr. 2. Columbus Junction: Sept. 26. Hampton: June 18—G. C. Decker and B. V. Travis. Leon: May 28—B. V. Travis. Rock Rapids: Aug. 16—E. L. Mills. Ruthven: Oct. 2—H. M. Harris and B. V. Travis. Smithland: Dec. 5—G. C. Decker.

ISOTOMA GRANDICEPS Reuter, 1891

*I. macnamarai* Folsom, 1918

Figs. 105, 106

Length up to 1.7 mm. Body deep blue, head greenish. Antennae purple toward the apex. Legs lighter at the tip. Dentes pale. Head extremely large, to the antennae as 6:5. Eyes 8 on each side. Postantennal organ oval, placed laterally at the base of the antenna. Unguis (fig. 106) with large lateral teeth and an inner tooth. Unguiculus broad, with an inner tooth. Tenent hairs absent. Manubrium to dentes to mucrones as 4:7:1. Mucro 4-toothed (fig. 105). Long hairs of the abdomen smooth.

Taken from humus. The occurrence of this boreal species in Iowa is of interest.

Columbus Junction: Dec. 25—L. Weber.

Mass. Ontario. Siberia.

ISOTOMA NIGRIFRONS Folsom, n. sp.

Figs. 107, 108

"Pigment purple. In moderately pigmented individuals the front is covered with a large blackish patch that includes the antennal bases, connects the eyespots anteriorly, and extends backward between the eyes as a triangular mark, at the apex of which there is a median transverse irregular mark, or two such marks, one in front of the other. Occiput whitish. Usually the first four body segments are pigmented throughout, and the second, third and fourth abdominal segments have each a broad white posterior band. Often the thorax is heavily pigmented with purple, while the posterior part of the abdomen is paler in color. Antennae purplish throughout, or with the first three segments whitish except apically. Legs purple basally, otherwise whitish, tinged with brownish or greenish. Furcula white. Eyes eight on each side, the two inner proximal eyes smaller than

the others. Postantennal organ elliptical, from one-fourth longer to twice as long as the diameter of the adjacent eye. Antennal bases well developed. Antennae longer than the head as 7:5, with segments in relative lengths about as 12:25:23:36. Sense organ of third antennal segment with a pair of linear curving rods and a chitinous ridge. Fourth antennal segment without special olfactory setae. Third abdominal segment slightly longer than the fourth. Genital and anal segments not clearly ankylosed, though the dorsal suture is sometimes faint. Unguis with a pair of lateral teeth and an evident tooth at the middle of the inner margin. Unguiculus lanceolate, acuminate, strongly unidentate, extending about half as far as the unguis on the second and third pairs of feet, and less than half as far on the first pair. Tenent hairs absent. Furcula extending not quite to the ventral tube. Manubrium with many stiff setae dorsally and ventrally, crenulate dorsally, the crenulations ending distally before the apex, leaving a smooth surface three times as long as the mucro. Mucro half as long as hind unguiculus, quadridentate; apical tooth large, hooked; antepical tooth large, subconical, erect; third and fourth teeth small, subequal, erect or oblique, almost opposite each other; fourth tooth lateral. Rami of tenaculum quadridentate; corpus with about twelve setae. Clothing of dense simple setae of moderate length, longer posteriorly; sensory setae long, outstanding, simple. Maximum length, 2.1 mm.

"This new species occurred in large numbers in moss on rock bluffs, and in some individuals the intestine was full of moss spores.

"Illinois: Alto Pass, Mar. 4; Makanda, Mar. 5; T. H. Frison and H. H. Ross."—J. W. F.

In Iowa I have the species from Ottumwa: Nov. 28—F. Andre, and Ledges State Park: Apr. 10, also from moss.

ISOTOMA OLIVACEA Tullberg, 1871

Figs. 109, 110

Length up to 2.5 mm. Yellow-brown to gray; blue in the variety *neglecta* Schäffer. Antennae longer than the head, the segments as 13:25:27:42. Eyes 8 on each side. Postennal organ (in the Iowa forms) 2 to 3 times the diameter of an adjacent eye. Unguis with lateral teeth and 1 inner tooth. Unguiculus often with an inner tooth. The manubrium is to the dentes as 18:41. Mucro 4-toothed (figs. 109, 110). Long bristles of the abdomen smooth.

This species is found in Iowa in 2 forms which may be separated in the following manner:

Yellow-brown. Apical tooth of the mucro pointing posteriorly.....  
*grisea* Lubbock.

Gray. Apical tooth of the mucro pointing postero-dorsally.....  
*olivacea* f. p.

Ames: Feb. 29; Apr. 27. Columbus Junction: Sept. 26; Dec. 25—L. Weber. Woodbury Co.: Sept. 28—G. C. Decker.

Ill. Canada. Europe.

#### ISOTOMA ALBELLA Packard, 1873

##### *I. walkeri* Packard, 1873

Length up to 1.5 mm. White, buff, or rarely gray. Body elongate. Antennae longer than the head, the 2nd segment often bowed out. Eyes 8 on each side. Postantennal organ oval, 3 times the diameter of an eye. Unguis long and slender, with lateral teeth and 1 inner tooth. Unguiculus with a broad basal lamella. Tenent hairs absent. Spring long and slender, the dentes twice the manubrium. Mucro with 4 teeth; a far-reaching apical tooth, a large anteapical one, and a pair of smaller, opposite, basal ones. The few longer hairs of the abdomen smooth.

This species is very characteristic of the cortical fauna, being found abundantly beneath the moist, loosening bark of newly fallen trees, especially cottonwood (*Populus*) and elm (*Ulmus*).

The 2 varieties of the species found in Iowa are differentiated as follows:

Color white ..... *albella* f. p.  
Color yellow to buff ..... *leonina* Packard.

Ames: Apr. 11, 25, 26; May 7; July 12; Aug. 24.

Ill., Mass., Me., N. Y. Europe.

#### ISOTOMA TRISPINATA MacGillivray, 1896

Length up to 1.5 mm. Bluish-gray; legs, furcula and venter lighter. Antennae longer than the head. Eyes 8 on each side. Postantennal organ broadly oval, about twice the diameter of an eye. Unguis unarmed. Unguiculus unarmed, the inner margin, however, sometimes sharply angular. Dentes long and slender. Mucro 3-toothed, the 2 subapical teeth not opposite. Longer abdominal hairs smooth.

Taken in humus.



Bixby State Park: May 8. LeGrand: Oct. 27. Leon: Oct. 10—  
B. V. Travis. Ottumwa: Sept. 16—Zella Beck.  
Ill., N. Y.

ISOTOMA VIRIDIS Bourlet, 1839  
*I. Belfragei* Packard, 1873,  
*I. tricolor* Packard, ad. p., 1873,  
*I. purpurascens* Packard, 1873,  
*I. plumbea* Packard, 1873,  
*I. capitola* MacGillivray, 1896,  
*I. glauca* MacGillivray, 1896.

Figs. 111, 112

Length up to 4 mm., rarely as much as 7 mm. Extremely variable in color. Usually deep blue-green with darker pigment. Antennae longer than the head, the segments as 9:20:20:24. Eyes 8 on each side. Postantennal organ oval, about the size of an eye. Unguis (fig. 112) with lateral and 2 inner teeth, and basal folds. Unguiculus with an inner notch. Tenent hairs absent. Manubrium to the dentes as 2:5. Mucro (fig. 111) 3- (rarely 4-) toothed, when 4-toothed the apical one is minute and obscure; the 2 basal ones opposite. Longer body hairs serrate.

The Iowa varieties may be distinguished by the following key:

1. Mucro with an obscure apical tooth.....*catena* Guthrie.  
Obscure apical tooth absent..... 2.
2. Deep green, without color pattern.....*viridis* f. p.  
Deep green with a dark mid-dorsal line.....*riparia* (Nicolet).

*I. viridis* is a large, conspicuous species, taken commonly in humus soil.

Ames: May 10—J. E. Guthrie; 19. Hampton: June 18—G. C. Decker and B. V. Travis. Leon: Oct. 10—B. V. Travis. Malvern: Sept. 10, 14.

Calif., Colo., D. C., Ill., La., Mass., Me., Minn., N. Y., Ohio, Okla., Tenn., Tex., Utah, Va., Wash. Alaska. Ontario. Greenland. Cosmopolitan.

#### SUBFAMILY ENTOMOBRYINAE SCHÄFFER, 1896

Postantennal organ absent in all of our species. The 4th abdominal segment usually much longer than the 3rd dorsally, if subequal then the antennae are 5- or 6-segmented or the 4th antennal segment is as long as the body; otherwise the antennae are 4-segmented and the 4th segment is much shorter than the body. Unguiculus and furcula always present. Inner edge of

the unguis split longitudinally. Body scaled or hairy. Bothriotricha present.

Key to the Tribes of Entomobryinae

1. Antennae 4- to 6-segmented (if 4-segmented the 4th segment is annulated and as long as the whole body). The 4th abdominal tergite usually subequal to or a little longer than the 3rd. Mucro with an apical tooth, an anteapical and a basal spine.....*Orchesellini* Börner, p. 77.
- Antennae 4-segmented, the 4th segment never approaching the length of the body..... 2.
2. Mucro as in the *Orchesellini*, or falcate. Dentes dorsally crenulate, bare or with fringed setae.....  
*Entomobryini* Börner, p. 64.
- Mucro long and slender, with apical and usually dorsal teeth. Dentes not dorsally crenulate, bearing large fringed scales on the upper surface.....*Cyphoderini* Börner, p. 81.

TRIBE ENTOMOBRYINI BÖRNER, 1906

Antennae 4-segmented. The 4th abdominal segment usually at least 2.5 times the 3rd dorsally. Dentes dorsally crenulate. Mucro usually with an apical and an anteapical tooth and a basal spine; rarely falcate.

Key to the Genera of Entomobryini

1. Scales absent ..... 2.
- Scales present ..... 4.
2. A double row of smooth bristles on the inside of the tibiotarsus. Tenent hair not strongly developed. Unguis often with a pair of strongly developed paramedian teeth. Eyes usually reduced.....*Sinella* Brook, p. 65.
- Smooth bristles (other than 1 subapical one) usually absent from the inner side of the tibiotarsus. Tenent hair well developed. Unguis without well developed paramedian teeth. Eyes 8 on each side..... 3.
3. Mucro falcate.....*Drepanura* Schött, p. 71.
- Mucro with 2 teeth and a basal spine.....  
*Entomobrya* Rondani, p. 66.
4. Dentes ventrally with hairs. Scales with pointed tips and coarse, heavy ribs.....*Sira* Lubbock, p. 71.
- Dentes ventrally with scales. Body scales with rounded apices and with fine, short striations..... 5.
5. Mucro with 2 teeth and a basal spine..... 7.
- Mucro falcate ..... 6.

6. The 4th antennal segment annulate.....  
*Lepidocyrtinus* Börner, p. 73.  
 The 4th antennal segment simple.....  
*Drepanocyrtus* Handschin, p. 73.
7. Unguis with well developed paramedian teeth. Tenent hair usually reduced. Pigmentation and eye number usually reduced, many species entirely white and blind.....  
*Pseudosinella* Schäffer, p. 73.  
 Unguis with normal basal teeth. Tenent hair well developed. Pigmentation usually well developed. Eyes 8 on each side.....*Lepidocyrtus* Bourlet, p. 72.

GENUS *SINELLA* BROOK, 1882

Pigmentation usually pale or absent. Eyes usually reduced in number. A pair of well developed paramedian teeth present at the base of the unguis. A double row of long, naked (or nearly so) hairs inwardly on the tibiotarsus. Tenent hairs reduced. Scales absent.

Key to the Species of *Sinella*

- Eyes absent. Mucro falcate.....*höfti* Schäffer, p. 65.  
 Eyes 2 on each side. Mucro with 2 teeth and a basal spine.....  
*curviseta* Brook, p. 65.

*SINELLA* HÖFTI Schäffer, 1896*Entomobrya caeca* Schött, 1896,*S. tenebricosa* Folsom, 1902.

## Figs. 113, 114

Length up to 2 mm. White. Eyes absent. Unguis (fig. 113) with 1 external, 2 lateral, and 3 inner teeth. Unguiculus with a large, acute, external lobe on the basal half. Tenent hair greatly reduced. Mucro (fig. 114) falcate, with a long basal spine. Body thickly covered with short, plumose hairs, and longer, clavate, fringed ones.

Taken in a cellar and in a sewage filter.

Ames: Sept. 2. Slater: May 16—H. E. Gorseline.

Calif., Mo., D. C. Cosmopolitan.

*SINELLA* CURVISETA Brook, 1882

Length up to 2 mm. White, with minute rusty spots. Eyes 2 on each side. Unguis with 2 lateral and 3 inner teeth. Ungui-

culus lanceolate, serrate on the outer edge. Tenent hair reduced. Muero with an apical and an anteapical tooth and a basal spine.

Taken in a greenhouse.

Ames: May 18.

Calif., Wash. Cosmopolitan.

GENUS *ENTOMOBRYA* RONDANI, 1861

DEGEERIA Nicolet, 1841.

Eyes 8 on each side. Pigment well developed. Basal teeth of the unguis not developed into large paramedian teeth. Bare bristles on the inner surface of the tibiotarsus usually absent. Muero with an apical and a subapical tooth and a basal spine. Tenent hair well developed. Scales absent.

#### Key to the Species of Entomobrya

1. Unicolorous, or with the posterior margins of the segments darker. Body blue, gray or brown..... 2.  
Not unicolorous. Pigment present in a definite pattern.... 4.
2. Color gray to buff, rarely bluish. Posterior margins of the body segments darker. Inner face of the tibiotarsus with 2 rows of smooth hairs as in *Sinella*.....  
*purpurascens* Packard, p. 67.  
Color blue or olive-gray, posterior margins of the body segments distinctly lined with dark. Inner face of the tibiotarsus without 2 rows of smooth hairs..... 3.
3. Olive-gray. Antennae blue at the apices, segments 1 and 2 as 7:14. Abdominal segments 1 and 3 as 8:9.....  
*griseo-olivata* Packard, p. 68.  
Blue-purple. Antennae all blue, segments 1 and 2 as 7:19. Abdominal segments 1 and 3 as 5:10.....  
*marginata* Tullberg, p. 67.
4. Body with several transverse bands..... 5.  
Body with 1 transverse band which includes several segments ..... 6.
5. Posterior margin of each segment with a well defined blue band and another across the middle of the 4th segment.  
Body yellow to white.....*multifasciata* Tullberg, p. 69.  
Body irregularly banded (figs. 7, 8).....*assuta* Folsom, p. 69.
6. Body gray to bright yellow, with a broad blue band across the dorsum including the metathorax and the 1st 3 abdominal segments.....*clitellaria* Guthrie, p. 70.

Body red to black, with a broad dorsal band including the 1st, 2nd and part of the 3rd segment.....  
*bicolor* Guthrie, p. 70.

ENTOMOBRYA PURPURASCENS (Packard), 1873

Figs. 6, 115, 116

Length up to 2.5 mm. Color extremely variable, blue, brown or tan, the posterior margins of the segments dark. Furcula pigmented nearly to the tip. Legs colored but for the apices of the tibiotarsi. Antennae dark at the base, changing to blue at the tip. Eyes 8 on each side, the 2 anterior eyes larger than the rest. Antennae slender, usually about 2.7 times the head. The 4th abdominal segment 4 times the 3rd. Unguis (fig. 116) straight, with an external, 2 lateral, and 3 pairs of inner teeth. The basal pair are not opposite, the posterior one being more proximal. Unguiculus lanceolate. Tenent hair shorter than the unguis. Manubrium to the dentes as 59:88. Mucro normal. Tibiotarsus with a double row of smooth bristles on the inner face (fig. 115).

This species is the dominant Entomobryan form in the state. It is extremely abundant beneath bark. It is possibly the form described from Washington, D. C., by Moniez (1894) and re-described by Denis (1923), as *E. dissimilis*.

Algona: Apr. 16—E. L. Mills. Ames: Apr. 7, 10; May 23; June 14, 17; July 15—H. M. Harris and F. Andre; Aug. 14; Oct. 4. Columbus Junction: Sept. 26. Ledges State Park: Oct. 31—L. Weber. LeGrand: Apr. 13; Aug. 18. New Sharon: Sept. 19—F. Andre. Shellrock: Oct. 14—B. V. Travis.

Ill., La., Mass., Me., Minn., N. D., N. H., N. Y., Tenn., Tex., Wis. Canada.

ENTOMOBRYA MARGINATA (Tullberg), 1871

Fig. 117

Length up to 2 mm. Deep blue-purple, the posterior borders of the segments dark; a broad, straight line between the eyes, and a dark lateral line on the body. Legs and furcula light. Antennae deep blue, lighter blue at the base. Eyes 8 on each side. Unguis with an outer, 2 lateral, and 3 inner pairs of teeth. Unguiculus slender. Tenent hair longer than the unguis. The 4th abdominal segment 3 or 4 times the 3rd. The 1st antennal segment is to the 2nd as 7:19, and the 1st abdominal segment to the

3rd as 5:10. Apical tooth of the mucro (fig. 117) rather long and out-reaching.

*E. marginata* bears a close superficial resemblance to the following species.

Ames: July 15—H. M. Harris and F. Andre; Nov. 24.  
Ill., Utah, Wash. Europe.

ENTOMOBRYA GRISEO-OLIVATA (Packard), 1873

Fig. 118

Length up to 1.5 mm. Olive-gray, the posterior borders of the body segments with a fine, dark line. A dark V-shaped line connecting the eyespots, and extending between the antennal bases. A dark line is also present along the lateral margins of the meso- and metathorax, extending onto the precoxae of the last 2 pairs of legs. Antennae yellow with the apices of the segments blue. Legs and furcula light. Eyes 8 on each side. Unguis (fig. 118) with an outer, 2 lateral, and 3 pairs of inner teeth. Unguiculus lanceolate. Tenent hair slender, longer than the unguis. The 4th abdominal segment about 3 times the 3rd. Manubrium to the dentes as 7:11. The 1st antennal segment is to the 3rd as 7:14, and the 1st abdominal segment to the 3rd as 8:9. Apical tooth of the mucro roundly curving.

Not uncommonly taken in ground cover.

This species may be distinguished from the preceding by the following comparative table arranged by Dr. Folsom:

<i>E. griseo-olivata</i>	<i>E. marginata</i>
A V-shaped mark between the eyes.	A wide, straight line between the eyes.
Apices of the antennal segments blue.	Antennae colored throughout.
Body olive-gray.	Body purple-blue.
1st antennal segment to the 2nd as 7:14.	1st antennal segment to the 2nd as 7:19.
1st abdominal segment to the 3rd as 8:9.	1st abdominal segment to the 3rd as 5:10.
Smooth distal part of the dens 3.5 times the mucro.	Smooth distal part of the dens 2 times the mucro.
Apical mucronal tooth roundly up-curving.	Apical tooth of the mucro long, extending postero-dorsally.

Ames: July 15. Iowa City: Oct. 4. Malvern: Sept. 8.  
Mass., N. Y., Ohio, Tenn., Wash.

## ENTOMOBRYA MULTIFASCIATA (Tullberg), 1871

*Deegeria decemfasciata* Packard, 1873.

Length up to 2 mm. Yellow to white with blue pigment. A line connecting the eyespots. Mesonotum with anterior, lateral, and posterior pigment. An irregular posterior transverse line across each body segment, and an extra one across the middle of the 4th segment. Antennae blue. Eyes 8 on each side. Antennae 2.5 times the head. The 4th abdominal segment about 3 times the 3rd. Unguis with 1 outer, 2 lateral, and 3 pairs of inner teeth. Tenent hair heavy, subequal to the unguis in length. Mucro normal.

The specimens referred to *E. multifasciata* in the list of Iowa Collembola (Mills, 1930), were heavily pigmented specimens of *E. purpurascens*. It is surprising that it has not been met with more commonly in the state, as it is abundant throughout the country.

Ames: Nov. 24, 30.

Ariz., Calif., Colo., Conn., Idaho, Ill., Kans., Mass., Me., Mich., Minn., Tenn., Tex., Utah. Ontario. Cosmopolitan.

## ENTOMOBRYA ASSUTA Folsom, 1924

Figs. 7, 8

Length up to 2 mm. Light yellow, with blue pigment. Head with a connecting line between the eyes, and darker shading behind the eyespots. Pronotum banded anteriorly and posteriorly with blue, occasionally some blue on the disk. Metanotum light only on the anterior margin. The 1st abdominal segment with a broken, transverse line; 2nd segment with the posterior half colored; 3rd entirely blue dorsally; 4th with the posterior half irregularly colored; 5th and 6th light only dorsally. Eyes 8 on each side. Antennae about twice the head. The 4th abdominal segment 3 to 4 times the 3rd. Unguis with 3 pairs of inner and 1 pair of lateral teeth. Unguiculus slender. Tenent hair well developed. Manubrium 0.6 the dentes. Mucro of the usual shape.

I have seen a completely dark form of this species in Texas.

Not uncommon beneath bark, in company with *E. purpurascens*.

Ames: Mar. 21—J. E. Guthrie; Apr. 7, 26, 28; May 27; June 28; Aug. 21—J. A. Kartchner. Anamosa: July 25. Central City: Aug. 11. Columbus Junction: Sept. 25. Hancock: Oct. 9—F.

Andre. Ledges State Park: July 16. Mt. Pleasant: Mar. 15; Apr. 2—H. R. Knight. Shellrock: Oct. 14—B. V. Travis.  
Ill., Kans., N. Y., Tex., Vt.

ENTOMOBRYA CLITELLARIA Guthrie, 1903

Figs. 10, 119

Length up to 1.8 mm. Color usually light yellow with blue pigment. All specimens taken in Iowa were much darker than the typical Minnesota form. Head with irregular lateral marks. Mesonotum anteriorly and laterally blue, the disk white. A dorsal blue band including the segments from the metathorax to the 3rd abdominal segment; 3rd paratergite blue; 4th abdominal segment clouded laterally and posteriorly, and 5th and 6th segments dorsally. Legs and furcula light. Antennae blue. Eyes 8 on each side. Antennae about 2.5 times the head, the segments as 4:7:6:7. The 4th abdominal segment from 4 to 5 times the 3rd. Unguis (fig. 119) with 1 outer, 2 lateral, and 3 pairs of inner teeth. Unguiculus slender. Tenent hair longer than the unguis. Mucro typical.

Taken beneath bark.

Ames: Mar. 26; Apr. 2; Oct. 3. Ledges State Park: July 16. Leon: Oct. 31—B. V. Travis.

Ill., Minn., N. Y. Ontario. Australia.

ENTOMOBRYA BICOLOR Guthrie, 1903

Length up to 3 mm. Color varying from red through chocolate-brown to black, with a yellow-white transverse band including the 1st, 2nd and part of the 3rd abdominal segments. Under parts lighter. Legs, furcula and antennae yellow, the antennae becoming purple toward the tip. Eyes 8 on each side. Antennae 3 to 4 times the length of the head, the segments as 10:17:17:23. The 4th abdominal segment 6 to 7 times the 3rd. Unguis with a pair of lateral teeth and 3 pairs of inner teeth. Unguiculus slender. Tenent hair well developed. Dentes long and slender. Mucro typical but small.

This is the largest and most striking species of the genus in our territory. Its large size and conspicuous color make it at once evident to the collector. Taken in grass and under bark.

Ames: Mar. 30; May 16, 23; June 10; July 15—H. M. Harris and F. Andre; Aug. 18; Sept. 16—F. Andre. Central City: Nov. 24.

Kans., Minn., N. C.



GENUS *DREPANURA* SCHÖTT, 1891

Entomobryan forms with falcate mucrones.

This genus is known to me in North America in Calif., Tex., Utah, and Wash.

GENUS *SIRA* LUBBOCK, 1869

Eyes 8 on each side. Body scaled, the scales pointed, with heavy ribs. Tenent hairs well developed. Mucro as in Entomobrya. Mesonotum not projecting to any extent over the pronotum. Dentes with hairs ventrally.

Key to the Species of *Sira*

Body blue to violet, the head lighter.....*buski* Lubbock, p. 71.

Body yellow to gray with blue spots and crossbands.....  
*platani* Nicolet, p. 71.

*SIRA BUSKI* Lubbock, 1869

Length up to 2 mm. Blue to violet, the head, legs, furcula and antennal bases lighter. Eyes 8 on each side. Unguis nearly straight, with 2 lateral and 2 pairs of inner teeth. Unguiculus lanceolate. Tenent hair well developed. The 4th abdominal segment 3 to 4 times the 3rd. Mucro normal.

A rather common resident of dwelling houses, also occasionally met with beneath bark.

Ames: Mar. 30; Apr. 1, 2; May 3, 27; June 12, 28; July 13; Aug. 8. Marshalltown: Aug. 7.

Colo., Fla., Ill., Mass., Me., Minn., N. Y., Pa., Vt., Wash. Alberta, Ontario. Europe.

*SIRA PLATANI* (Nicolet), 1841

*S. nigromaculata* Lubbock, 1870,

*S. mimica* Harvey, 1894,

*Lepidocyrtus americanus* Marlatt, 1896.

Length up to 2 mm. Yellow to silver-gray. Irregular blue markings anteriorly on the mesonotum and laterally along the body; crossbands occurring posteriorly on the 3rd, 4th and 5th abdominal segments, the 6th partially or completely blue. A blue spot occurs near the middle on each side of the 4th segment. Antennae darker apically. The 4th abdominal segment 4 to 7 times the 3rd. Unguis with 2 lateral and 2 pairs of inner teeth. Unguiculus lanceolate. Tenent hairs well developed. Mucro normal.

Handschin (1926) has shown that *S. nigromaculata* is a color form of *S. platani* (Nic.). As far as I am aware, the *nigromaculata* form is the only one which occurs in North America, however.

Taken in buildings and rarely beneath bark.

Ames: Mar. 27, 29; Apr. 1, 3, 7; May 19; June 12. Anamosa: July 25. Des Moines: Aug. 15, 26. LeGrand: Aug. 9, 18. Washington: May 19—J. E. Guthrie.

Fla., Ill., Kans., La., Mass., Me., Minn., N. Y., Tex. Ontario. Europe.

#### GENUS *LEPIDOCYRTUS* BOURLET, 1839

Eyes 8 on each side. Body scaled, the scales rounded or irregular, with numerous, fine striations. Basal teeth of the unguis not greatly enlarged. Tenent hair well developed. Mucro as in *Entomobrya*. Mesonotum usually projecting more or less over the pronotum. Dentes ventrally with scales.

#### Key to the Species of *Lepidocyrtus*

Color blue to gray. Prothorax massive, projecting but little anteriorly.....*cyaneus* Tullberg, p. 72.

Color white, with antennae and occasional diffuse pigment anteriorly blue. Pronotum projecting anteriorly over the head.  
*curvicollis* Nicolet, p. 73.

#### *LEPIDOCYRTUS CYANEUS* Tullberg, 1871

##### *L. metallicus* Packard, 1873

Length up to 1.5 mm. Blue to gray, pigment rarely broken to form indefinite crossbands, the anterior borders of the body segments usually lighter. Antennae 2 or 3 times the length of the head. Eyes 8 on each side. Mesonotum massive, but not projecting greatly. The 4th abdominal segment 3 to 4 times the 3rd. Unguis with lateral and 2 pairs of inner teeth. Unguiculus lanceolate. Tenent hair well developed. Manubrium shorter than the dentes. Mucro normal.

*L. cyaneus* is extremely common throughout the state, beneath bark, in humus, and in moss. It is represented by 3 varieties which may be separated as follows:

1. Blue pigment separated into 5 crossbands.....  
*aenescens* Guthrie.  
Pigment lighter anteriorly on the body segments, but not separated into crossbands..... 2.
2. Deep blue.....*cyaneus* f. p.  
Blue-gray.....*cinereus* Folsom.

Ames: numerous collections. Central City: July 25. Columbus Junction: Sept. 26. Jewell: Apr. 9. Ledges State Park: Oct. 31—L. Weber. Leon: May 28—B. V. Travis. Little Wall Lake: Oct. 14—G. C. Decker. Mitchellville: Mar. 31. Ruthven: Oct. 2—H. M. Harris and B. V. Travis.

Ill., Kans., La., Mass., Me., Md., Minn., N. Y., Ohio, Tenn., Tex., Utah, Wash. Alaska. Greenland. Ontario. Cosmopolitan.

LEPIDOCYRTUS CURVICOLLIS Bourlet, 1839

Figs. 9, 120, 121

Length up to 3 mm. Entirely white but for the black eyespots, diffuse pigment on the head, point of mesonotum, coxae, pre-coxae, and antennae. Antennae to the head as 8:5, the segments as 13:22:22:27. Eyes 8 on each side. The 4th abdominal segment about 6 times the 3rd. Unguis (fig. 120) straight, with an external tooth, 2 large pseudonychia, and 3 pairs of inner teeth. Unguiculus slender, sometimes outwardly serrate. Tenent hair well developed. Manubrium to the dentes as 3:4. Mucro normal (fig. 121), the apical tooth not strongly up-curved. Mesonotum projecting strongly anteriorly.

Taken in a cellar and occasionally in humus. The specimens from the cellar were considerably larger than those taken in humus, the latter reaching a length of 1.3 mm.

Central City: July 25; Aug. 11. Eldora: Nov. 10. Ledges State Park: July 16; Oct. 31—L. Weber. Ottumwa: Nov. 28—F. Andre. Ruthven: Oct. 2—H. M. Harris and F. Andre.

Ill., Me., N. Y., Pa. Ontario. Europe.

GENUS DREPANOCYRTUS HANDSCHIN, 1925

*Lepidocyrtus* forms with falcate mucrones, and the 4th antennal segment simple.

A species of this genus occurs in the college greenhouse. I have been unable to identify it.

GENUS LEPIDOCYRTINUS BÖRNER, 1903

*Lepidocyrtus* forms with the mucro falcate and the 4th antennal segment annulate.

Not known in the United States.

GENUS PSEUDOSINELLA SCHÄFFER, 1897

Eyes usually reduced in number or absent. Pigment usually absent. Body scaled as in *Lepidocyrtus*. Paramedian teeth of the

unguis present. Tenent hair usually weakly developed. Muero as in *Entomobrya*.

#### Key to the Species of *Pseudosinella*

1. Eyes present ..... 2.  
Eyes absent ..... 5.
2. Eyes 8 on each side.....*candida* Folsom, p. 74.  
Eyes less than 8 on each side..... 3.
3. Eyes 4 on each side.....*octopunctata* Börner, p. 74.  
Eyes less than 4 on each side ..... 4.
4. Eyes 3 on each side.....*sexoculata* Schött, p. 75.  
Eyes 2 on each side.....*alba* Packard, p. 75.
5. Tenent hair heavy, with a large, triangular, apical swelling.  
Mesonotum extremely massive, cape-like, extending laterally. Broadest at mesonotum.....*rolfsi* Mills, p. 76.  
Tenent hair slender, but slightly knobbed. Mesonotum not strikingly broadened. Body usually spindle-shaped.....  
*violenta* Folsom, p. 76.

#### PSEUDOSINELLA CANDIDA Folsom, 1902

Figs. 122, 123

Length up to 1.1 mm. White but for traces of pigment where the eyespots usually occur, and occasionally a V-shaped interocular mark. Eyes 8 on each side (fig. 122). Antennae slightly longer than the head, the segments as 7:12:10:19. Body segments from the mesonotum posteriorly as 30:14:10:15:15:48:9:8, thus the 4th segment is more than 3 times the 3rd. Unguis (fig. 123) rather straight, with a minute external tooth, and 3 inner teeth, the posterior paramedian tooth proximad of the anterior one. Unguiculus outwardly serrate. Tenent hair weak, not capitate. Manubrium to the dentes as 6:7. Muero slender.

I am identifying this species as *P. candida*, although it differs from the type material in several respects. As the original description (Folsom, 1902) was from 3 specimens, and as I have seen but 2, the variation in the species is unknown.

Taken in sod and beneath bark.

Ames: Oct. 25; Nov.

D. C.

#### PSEUDOSINELLA OCTOPUNCTATA Börner, 1901

Fig. 124

Length up to 1 mm. White, rarely with rusty spots; antennae blue, head light blue-gray. Eyes (fig. 124) 4 on each small, cir-

cular eyespot. Antennae half again as long as the head, the segments as 3:7:8:16. The 4th abdominal segment about 3 times the 3rd. Unguis with a pair of lateral and 3 inner teeth, the 2 paramedian teeth not opposite. Unguiculus lanceolate. Tenent hair slightly capitate. Manubrium and dentes subequal. Mucro of the usual type.

The identification of this species has been verified by Dr. Stach, to whom I sent specimens.

Taken in humus and on the surface of soil.

Ames: July 15—H. M. Harris and F. Andre; Sept. 18—F. Andre. Hampton: June 18—G. C. Decker and B. V. Travis. LeGrand: Nov. 1. Rock Rapids: Aug. 16—E. L. Mills. Calif., Wash. Europe.

PSEUDOSINELLA SEXOCULATA Schött, 1902

*Lepidocyrtus sexoculatus* Guthrie, 1903

Fig. 125

Length up to 1 mm. White, speckled with red. Eyes black, 3 on each side (fig. 125). Antennae longer than the head, the segments about as 9:13:8:16. The 4th abdominal segment 3 to 4 times the 3rd. Unguis with 2 lateral and 3 inner teeth, the paramedians not opposite. Unguiculus often serrate outwardly. Tenent hair reduced, but slightly capitate. Manubrium slightly shorter than the dentes. Mucro as usual.

Taken in cellars and rarely beneath bark.

Ames: Mar. 7—J. E. Guthrie, 28; June 30; Sept. 2. Anamosa: July 25. Central City: July 25.

Calif., Minn., N. Y., Utah, Wash. Europe.

PSEUDOSINELLA ALBA (Packard), 1873

Length up to 1 mm. White. Eyespots black, each with 2 eyes. Antennae half again as long as the head, the segments about as 10:15:14:25. The 4th abdominal segment 2 to 3 times the 3rd. Unguis with 2 lateral and 3 inner teeth, the paramedians not opposite, the posterior one being more proximal and larger. Unguiculus often serrate on its outer border. Tenent hair reduced. Manubrium to the dentes approximately as 3:4. Mucro as usual.

Taken, but not abundantly, from leaf mold.

Ames: Jan. 25; Apr. 2; Sept. 25; Oct. 20; Dec. 3.

Mass., Me., N. Y., Ohio, Tenn. Europe.

## PSEUDOSINELLA VIOLENTA (Folsom), 1924

*Cyphodeirus albinus* Guthrie, 1903

Length up to 1.5 mm. White. Eyes absent. Body not strikingly broad across the mesonotum, usually spindle-shaped. Antennae half again as long as the head. The 4th abdominal segment is to the 3rd about as 5:2. Unguis with 2 lateral and 3 inner teeth, the paramedian tooth on the posterior lamella enlarged, and the anterior one reduced. Unguiculus lanceolate, with a large, acute outer lobe ending at about half its length. Tenent hair slender, weakly capitate. Manubrium slightly shorter than the dentes. Mucro slender.

This species resembles *P. petterseni* Börner, of Europe, from which it differs in the reduction of the anterior paramedian tooth of the unguis, and in the longer unguiculus. The species recorded from Costa Rica by Denis (1931b, p. 144) as *P. petterseni* forma *C.R.*, is without doubt *P. violenta*. *P. violenta* is the most common species of the genus in our territory, being found in soil, in humus, under bark, in greenhouses, with ants, etc.

Ames: July 15; Oct. 4. Anamosa: July 25. Columbus Junction: Sept. 26. Hampton: June 18—G. C. Decker and B. V. Travis. LeGrand: Aug. 9. Rock Rapids: Aug. 16—E. L. Mills. Ruthven: Oct. 2—H. M. Harris and B. V. Travis. Valley Junction: May 1.

Ark., Calif., Ill., La., Mass., Minn., N. Y., Tenn., Tex., Utah, Wash. Ontario. Costa Rica.

## PSEUDOSINELLA ROLFSI Mills, 1932

## Figs. 126, 127

Length up to 1.8 mm. Eyes absent. White. Mesonotum massive, broad and cape-like. Antennae half again as long as the head. The 4th abdominal segment 3 to 4 times the 3rd. Unguis (figs. 126, 127) with 2 lateral and 3 inner teeth, the posterior paramedian tooth enlarged, and the anterior one greatly reduced. Unguiculus with a large, acute, external lobe ending at about its middle. Tenent hairs extremely heavy, enlarged basally and with a large, triangular, apical swelling. Manubrium to the dentes as 2:3. Mucrones slender, the basal spine long.

Young specimens of this species are very similar to those of the preceding species.

Taken in the same situations as the preceding form.  
Ames: Apr. 20; July 16; Sept. 25. LeGrand: Aug. 9.  
Wash.

**TRIBE ORCHESELLINI BÖRNER, 1906**

Antennae 4-, 5-, or 6-segmented. The 4th abdominal segment less than 3 times the 3rd. Mucro as in *Entomobrya*. Scales present or absent.

**Key to the Genera of Orchesellini**

1. Body scaled ..... 2.  
Body unscaled. Antennae 6-segmented. The 4th abdominal segment about 2 times the 3rd.....  
*Orchesella* Templeton, p. 78.
2. Antennae 4-segmented, the 4th segment annulate and longer than the body. The 4th abdominal segment but slightly longer than the 3rd.....*Typhlopodura* Absolon, p. 77.  
Antennae 5-segmented, the 1st segment small. The 4th abdominal segment never more than 3 times the 3rd.....  
*Heteromurus* Wankel, p. 77.

**GENUS TYPHLOPODURA ABSOLON, 1900**

Eyes absent. Antennae 4-segmented, the 1st segment short, the last annulate and as long as the body. The 4th abdominal segment but slightly longer than the 3rd. Body scaled.

A cavernicolous genus not yet found in North America.

**GENUS HETEROMURUS WANKEL, 1861**

*Templetonia* Lubbock, 1862

Eyes present or absent. Antennae 5-segmented. The 4th abdominal segment never more than 3 times the 3rd. Scales present.

**HETEROMURUS NITIDUS (Templeton), 1835**

*Templetonia americana* Harvey, 1892,

*Lepidocyrtus marmoratus* Packard, 1873.

**Fig. 128**

Length up to 2 mm. White, with salmon-red spots. Eyespots weakly delineated. Antennae twice the length of the head, the 5th segment annulate; the segments about as 3:8:14:17:24. Eyes 2 on each side. Unguis (fig. 128) with 3 inner teeth, 2 lateral teeth, and occasionally an outer tooth. Tenent hair unknobbed. Abdominal segments 3 and 4 as 2:3. Manubrium less than half

the dentes. Mucro as in *Entomobrya*. Bare area at the apex of the dens about 5.5 times the mucro.

Taken in a cellar.

Ames: Sept. 2.

Mass., Me., N. Y. Ontario. Europe.

GENUS *ORCHESELLA* TEMPLETON, 1835

Eyes 8 on each side. Antennae 6-segmented. The 4th abdominal segment never more than twice the 3rd. Scales absent.

#### Key to the Species of *Orchesella*

1. The 3rd antennal segment well formed, distinctly separated from the 4th (fig. 130), and usually with an apical ring of pigment ..... 2.  
     The 3rd antennal segment small, not well separated from the 4th (fig. 131), without an apical ring of pigment..... 3.
2. Color yellow to light brown. Antennae, and rarely diffuse shadings on the cheeks and sides, purplish.....  
     *albosa* Guthrie, p. 80.  
     Yellow to brown, with 4 (rarely 5) longitudinal blue stripes, broadening into crossbands on each segment from the 2nd abdominal posteriorly.....*ainsliei* Folsom, p. 80.
3. Greenish yellow. Purple pigment forming broad crossbands, rarely broken laterally to form indistinct, broken, lateral lines. Front of head not blue-black.....  
     *hexfasciata* Harvey, p. 79.  
     Tawny yellow. Front of head blue-black. Very narrow, dark, posterior borders to some of the body segments. Blue shadings sometimes present laterally .....  
     *annulicornis* n. sp., p. 78.

#### *ORCHESELLA ANNULICORNIS*, n. sp.

Figs 11, 129

Tawny yellow to buff, with purple pigment. Front of the head deep blue. Scattered pigment along the sutures, widening to form a fine, interrupted, mid-dorsal line which is most evident from the metathorax to the 3rd abdominal segment, and a suggestion of a ventro-lateral and a lateral line on each side. Venter blue. The 1st 2 antennal segments blue, 3rd white, 4th white basally, 5th with the apical half blue, 6th light purple but for the base. Tibiotarsi light blue, some external pigment on the femora, trochanters, coxae, and precoxae. Furcula colorless. Eyes 8 on each side. Antennae variable in length, usually more



than 2.5 times the head, the segments approximately as 4:16:6:20:25:30; the 3rd segment rather indistinctly separated from the 4th. The 3rd abdominal segment is to the 4th as 3:4. Unguis (fig. 129) slightly curving apically, with 1 outer, 2 lateral, and 3 pairs of inner teeth. Unguiculus about 0.6 the unguis, with a small outer tooth. Tenent hair well developed. Manubrium to the dentes as 9:14. Large, dorsal dental corrugations gradually tapering out apically, but extending minutely to the base of the mucro, which is of the usual shape. Clothing of short, reclinate setae and longer, fringed, often clavate bristles. Length up to 2.2 mm.

This interesting and well-marked species is a resident of moss, being taken in association with *Isotoma andrei* and *Tomocerus lamelliferus*.

Ottumwa: Sept. 9—F. Andre. Garden Grove: Oct. 10—B. V. Travis.

Florida: Mar. 3—Van Hyning.

#### ORCHESELLA HEXFASCIATA (Harvey), 1895

##### Fig. 131

Length up to 2 mm. Green-yellow, with purple pigment anteriorly and laterally on the mesonotum, and in crossbands anteriorly on the metanotum, brokenly across the 1st abdominal segment, anteriorly on the 2nd, across the middle of the 3rd, posteriorly on the 4th, across the middle of the 5th; 6th segment dark apically. Head lightly and irregularly pigmented, with a black, transverse line across the front. Antennae light basally, dark apically. Legs and furcula sometimes lightly colored. Lateral pigment of the body rarely broken to form 2 broken stripes on each side. Eyes 8 on each side. Antennae slightly more than twice the head, the segments about as 3:12:4:16:19:25; the 3rd segment rather indistinct (fig. 131), and without pigment. The 3rd abdominal segment to the 4th as 7:11. Manubrium to the dentes as 11:15; mucro as usual. Unguis with 1 external, 2 lateral, and 3 pairs of inner teeth. Unguiculus rather broad, with a large external tooth. Tenent hair well developed.

Taken beneath bark and from humus.

Ames: Aug. 8; Sept. 7. Columbus Junction: Sept. 26. Eldora: Nov. 10. Hampton: June 18—G. C. Decker and B. V. Travis.

Ledges State Park: July 16; Oct. 31—L. Weber. LeGrand: Apr. 14—E. L. Mills.

Ill., La., Mass., Me., N. H., N. Y., Va., Wis. Ontario.

ORCHESELLA ALBOSA Guthrie, 1903

Length up to 2.5 mm. White, through yellow to deep buff, rarely a tinge of blue on the genae and on the side of the body. Antennae purple, the pigment deepest at the apex, and forming apical rings on the 4 basal segments. Antennae about 3 times the head, the 5th and 6th segments obscurely annulate, the segmental proportions about as 2:11:5:12:18:26. Eyes 8 on each side. Unguis (fig. 132) with lateral and 3 pairs of inner teeth. Unguiculus lanceolate, with an outer tooth. Tenent hair slightly shorter than the unguis. The 3rd abdominal segment is to the 4th as 7:12. Manubrium to the dentes as 11:15. Muero normal.

The type series was taken beneath boards at Minneapolis by Prof. Guthrie. All of my records are from swampy areas or lake shores, where the species was associated with *Isotomurus palustris*. The first ones were taken while sweeping grass in a boggy pasture.

Ames: May 8, 15, 20, 29; June 17; Oct. 12—L. Weber. Little Wall Lake: Oct. 12—G. C. Decker. Ruthven: Oct. 2—H. M. Harris and B. V. Travis.

Mass., Minn.

ORCHESELLA AINSLIEI Folsom, 1924

Fig. 130

Length up to 2 mm. Yellow to light brown with dark pigment. Body with 2 broken lateral stripes which unite over the dorsum of each segment from the 2nd abdominal segment posteriorly. Venter, legs, furcula, and head (except the genae) light. Antennae dark toward the apex, the 5 basal segments with apical pigment rings. Antennae about 3 times the head, the last 2 segments obscurely annulate. Eyes 8 on each side. Unguis with lateral and 3 pairs of inner teeth. Unguiculus slender, with a minute apical notch. Tenent hair long. The 3rd abdominal segment is to the 4th as 12:19. Manubrium to the dentes as 17:23. Muero normal.

A variable species. Rarely the posterior crossbands are missing, and in Texas I have seen a variety with a slender mid-dorsal line. The species is extremely abundant in the state.

Adel: Sept. 24. Albia: Feb. 27—H. R. Knight. Ames: Mar. 30; Apr. 2; June 10, 17, 25; Aug. 4; Sept. 15—F. Andre, 22—G. O. Hendrickson; Oct. 20—F. Andre; Nov. 8. Ledges State Park: July 16. LeGrand: Apr. 14; Aug. 18; Sept. 1. Mt. Pleasant: Mar. 15—H. R. Knight. New Sharon: Sept. 19—F. Andre. Shellrock: Oct. 14. Valley Junction: May 1.

Ill., La., N. C., N. Y., Pa., Tenn., Tex. Ontario. Europe.

#### TRIBE CYPHODERINI BÖRNER, 1906

Eyes absent. Dentes not corrugated dorsally, bearing on the dorsal surface a double row of large fringed scales. Mucro long and slender, with apical and often dorsal teeth. Scales present.

GENUS *CYPHODERUS* NICOLET, 1841

*Borecus* Folsom, 1923

Postantennal organ absent. Eyes absent. Scales present. Dentes with 2 dorsal rows of fringed scales. Mucro slender, with apical and often dorsal teeth, without mucronal bristles.

*CYPHODERUS SIMILIS* Folsom, 1927

Fig. 133

Length up to 1.2 mm. White. Eyes absent. Antennae longer than the head, proportions of the segments 2:5:3:6. The 4th abdominal segment about 3 times the 3rd. Unguis with large paramedian teeth, the anterior one narrow, the posterior one broad and lanceolate. Median teeth 1 or 2. Unguiculus with a large, pointed outer lobe. Tenent hair weak, shorter than the unguis. Dentes shorter than the manubrium; mucrones about half the dentes. Dens with 5 inner dorsal scales, and 6 or 7 in the outer series, the apical one slightly shorter than the mucro. Mucro (fig. 133) with an apical and an anteapical tooth, a small triangular lamella running from the apex of the anteapical tooth to the shaft of the mucro. Body covered with scales which give it a dusky appearance.

This Central American species has been taken only in the college greenhouse.

The genus probably does not occur in North America outside of such sheltered places. The records of *C. albinus* of Guthrie (1903) and Bacon (1914) refer to *Pseudosinella violenta* Folsom.

Ames: Jan. 8; Apr. 2; July 16; Aug. 16.

## SUBFAMILY TOMOCERINAE SCHÄFFER, 1896

Postantennal organ absent. The 4th abdominal segment subequal to or shorter than the 3rd. Antennae 4-segmented, the last 2 segments annulate, and the 3rd segment much longer than the 4th. Unguiculus and furcula present. Mucro long and slender, with apical and dorsal teeth, covered with hairs. Body scaled. Bothriotricha present. Dental spines present.

## Key to the Genera of Tomocerinae

Eyes present. Tenent hair present.....*Tomocerus* Nicolet, p. 82.  
 Eyes absent. Tenent hair absent....*Tritomurus* Frauenfeld, p. 84.

GENUS *TOMOCERUS* NICOLET, 1841

*Macrotoma* Bourlet, 1839.

Eyes present, 6 on each side. Tenent hair well developed (small in *T. lamelliferus*), with a large distal knob.

To this genus belong our largest and most conspicuous species, some reaching a length of 6 mm.

Börner has placed in the subgenus *Pogonognathus* those species of *Tomocerus* in which the maxilla bears a slender, bearded appendage. The only Iowa species which falls in that group is *T. flavescens* Tullberg.

It is customary to represent the dental spines in a formula, the large spines designated by numbers in bold face type, and the small spines by numbers in the usual type, beginning at the proximal end of the series. The transverse suture of the dens which divides the series of the spines is represented by an oblique line. Extremities in variation are separated by a dash. For example, the dental formula of *T. lamelliferus* (fig. 134) would be represented as follows: 2-3, **1**/1, **1**, 2-3, **1**.

Key to the Species of *Tomocerus*

1. A long, narrow lamella extending from the anteapical tooth of the mucro to the inner basal tooth.....  
*lamelliferus* n. sp., p. 84.  
 Mucro without a long, intermediate lamella..... 2.
2. Intermediate dental spines unequal, with a large spine near the middle of the series; 1 large distal spine.....  
*vulgaris* Tullberg, p. 83.  
 Intermediate dental spines gradually increasing in size distally; 2 large distal spines.....*flavescens* Tullberg, p. 83.

## TOMOCERUS FLAVESCENS (Tullberg), 1871

Length up to 5 (rarely 6) mm. Body yellow to purple-gray when denuded of scales. Antennae shorter than the body. Unguis with 2 to 4 inner teeth, large pseudonychia, and basal folds. Unguiculus lanceolate, usually with an inner tooth. Tenent hair heavy. Eyes 6 on each side. The last 2 antennal segments annulate, the 4th much shorter than the 3rd. Dentes with 7 to 13 inner basal spines of the formula 1-2/4-9, 2. Intermediate teeth of the mucro from 5 to 12, usually 7 or 8.

Very common beneath logs and in decaying leaves.

*T. flavescens* occurs in the state in 2 varieties, separated as follows:

Teeth of the unguis 3, 1 large proximal dental spine.....  
*separatus* Folsom.

Teeth of the unguis 3 or 4, 2 large proximal dental spines.....  
*americanus* Schött.

Ames: Apr. 1, 8; May—J. E. Guthrie; June 17, 18; Aug. 9; Oct. 31. Burlington: July—J. E. Guthrie. Columbus Junction: Sept. 26. LeGrand: Apr. 14; Aug. 18. Maquoketa Caves: May 8.

Calif., Colo., D. C., Ga., Ill., Ind., La., Mass., Md., Me., Mich., Minn., Miss., N. C., N. H., N. M., N. Y., Ohio, Ore., Pa., Tenn., Tex., Wash. Alberta. British Columbia. Nova Scotia. Ontario. Europe.

## TOMOCERUS VULGARIS (Tullberg), 1871

Length up to 4 mm. Body yellow to gray when denuded of scales. Antennae shorter than the body, often with a purple cast. Unguis with 4 to 6 inner teeth, pseudonychia, and basal folds. Unguiculus lanceolate, often with an inner tooth. Tenent hair heavy. Eyes 6 on each side. Last 2 antennal segments annulate, the 4th much shorter than the 3rd. Dentes with 12 to 18 inner basal spines each, usually with 13 to 15, of the formula 4-6, 1/2-5, 1, 2, 1; rarely 4-7, 1/2-5, 1, 1-3, 1. Intermediate teeth of the mucro 7 to 11.

Taken in cellars and in leaf mould.

Ames: Apr. 7; May 13—J. E. Guthrie; June 30; Sept. 2; Oct. 25. Central City: May 23; July 25; Aug. 11. LeGrand: Apr. 13. Tabor: Sept. 15.

Colo., Ill., Mass., Md., Me., Minn., N. H., N. Y., Pa., Tex., Wash. Ontario. Europe.

## TOMOCERUS LAMELLIFERUS n. sp.

Figs. 134-136

Head and body light blue-gray, the front darker. Pigment diffuse, lighter along the sutures. Eyespots black. Antennae blue, deeper toward the apex. Legs, furcula and venter lighter. Scales dusky. Eyes 6 on each side. Antennae about twice the head, the segments approximately as 8:19:60:30, the 3rd and 4th segments annulate. Maxilla head without a tuft of hairs. Unguis (fig. 135) broad, slightly curving apically, with a spine-like inner tooth at the extreme base, and 3 (rarely 4) beyond this basal one. Pseudonychia and basal folds present. Unguiculus broadly lanceolate, without teeth. Tenent hair well developed but small. The 3rd and 4th abdominal segments subequal. Furcula quite slender, the proportions as 14:21:9. Dental formula 2-3, 1/1, 1, 2-3, 1, the basal group not in a straight line (fig. 136). Mucro with an apical and an anteapical tooth, 2 opposite basal teeth, and 1 to 4 intermediate teeth. A long, narrow lamella connects the inner basal tooth with an anteapical one, and small anterior lamellae run from the mucronal base to the apices of the 2 basal teeth. Length up to 2 mm.

This well defined species was taken from moss, humus, and once beneath boards.

Ames: Oct. 16. Columbus Junction: Sept. 26. Ottumwa: Sept. 16—Zella Beck, 19—F. Andre. Traer: Nov. 25—H. M. Harris.

Ontario: Arnprior: May 3—C. Macnamara. Florida: Mar. 3—O. C. Van Hying.

GENUS *TRITOMURUS* FRAUENFELD, 1854

Eyes absent. Tenent hair absent. Otherwise very similar to *Tomocerus*.

Not known in Iowa.