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## AN ANNOTATED LIST OF THE COLLEMBOLA (SPRINGTAILS) OF MICHIGAN \*

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When work began on the Michigan Collembola in 1959, the Entomology Museum at Michigan State University included only one specimen of the order in its catalog of insects. The University of Michigan had a few vials of specimens determined by Harlow B. Mills, and a modest number was in the Robert R. Dreisbach collection at Midland, Michigan.

At the beginning of my investigation very little was known about the order in Michigan, although monographs had been written on the collembolan faunae of the nearby states of Minnesota (Guthrie, 1903), Iowa (Mills, 1934) and New York (Maynard, 1951). I expected to find species that had been recorded from surrounding areas, and hoped to find a few new to science. Both aims have been fulfilled. In addition, some European species are recorded from North America for the first time. These include *Orchesella irregularilineata* Stach, *Tetracanthella montana* Stach, *Odontella lamellifera* (Axelson), *Sminthurinus bimaculatus* Axelson, and *Sminthurinus igniceps* (Reuter). A new subspecific name is proposed for *Sminthurinus quadrimaculatus bimaculatus* Maynard. The present paper lists 132 species and subspecies of 46 genera that occur in Michigan. New species will be described in the future.

The present work follows a style similar to that of Sherman Moore's *A Revised Annotated List of the Butterflies of Michigan* (1960), except that keys to the genera and species have been included. The taxonomy follows that of Salmon (1964); thus instead of the usual two suborders, four are recognized.

To record distribution, Moore divided the state into three zones; the southern lower peninsula (SLP), the northern lower peninsula (NLP) and the upper peninsula (UP). The scheme has been followed here, and is illustrated in Figure 1, which may be used in conjunction with the text and maps for greater clarity. Maps are provided for only the more common species. Zones are given under the species headings with reference to the maps; or, if distribution is represented by less than six locations, county names are provided. The range of dates indicates the earliest and latest known occurrence of each species during the year.

\*This study, which is respectfully dedicated to the memory of the late Robert R. Dreisbach, was supported by U.S. Public Health Service research grant CC 00 246, from the National Communicable Disease Center, Atlanta, Georgia, and by the Michigan State University Agricultural Experiment Station, for which this is journal article 4198.

Certain areas of the state have been subject to intensive collection, and are frequently mentioned in the list. Baker Woodlot, on the campus of Michigan State University in Ingham County, is among these. The Kellogg Forest, part of the Kellogg Biological Station at Gull Lake, Kalamazoo County, was the site of an arthropod study conducted by H. O. Schooley in 1963: much of the material he collected is discussed here for the first time. In 1965 Dr. James W. Butcher initiated a soil biology project in Monroe County that resulted in many records which are discussed below. James J. Shaddy's 1956 faunistic study of Wexford and Grand Traverse Counties contributed numerous new data.



Figure 1. Map of Michigan, showing counties and zones. (After Moore, 1960.)

The collections discussed are housed at two institutions. The bulk of the material, including the Dreisbach collection, is at the Entomology Museum, Michigan State University, East Lansing. The remainder is in the Museum of Zoology, University of Michigan, Ann Arbor. Most of the specimens are preserved in alcohol, although almost one thousand slides have been examined.

In studying collembolan taxonomy I have had constant access to three works which form the core of our American literature, the cited monographs by Guthrie, Mills and Maynard. Useful in clarifying determinations were Folsom's study of the Isotomidae (1937), Folsom and Mills' revision of *Sminthurides* (1938), and Christiansen's revisions of *Tomocerus* (1964), *Entomobrya* (1958) and *Arrhopalites* (1966). Other helpful studies are included in the Selected Bibliography below.

It is hoped that the present paper will serve as a guide to investigators in the Great Lakes area, and form the foundation of a future monographic study.

#### ACKNOWLEDGMENTS

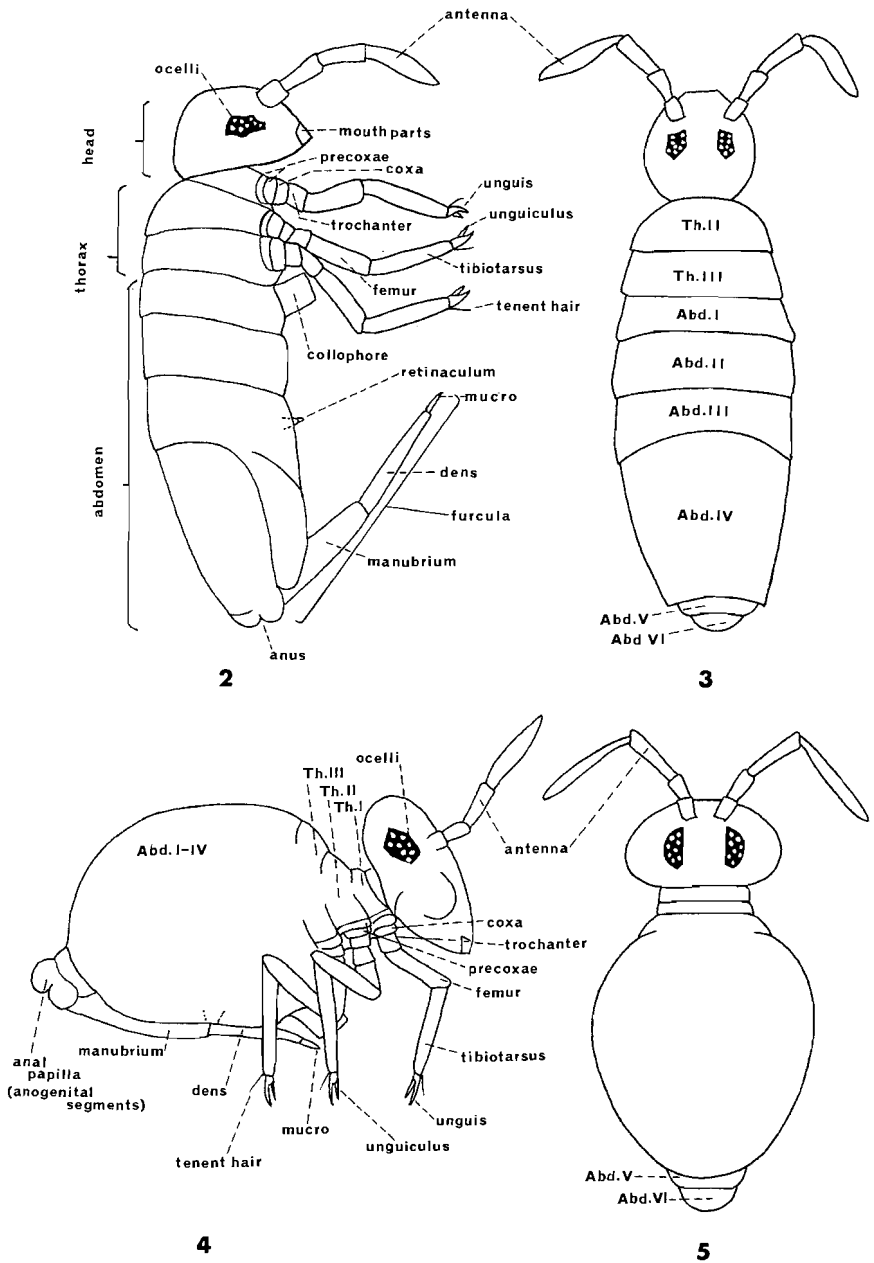
I wish to thank Dr. Gordon Guyer, Chairman, and Dr. James W. Butcher, Professor, Department of Entomology, Michigan State University, who gave continued support to this work and made facilities for study available. Research was performed under the Department of Entomology Soil Zoology Project. Thanks are also due to Dr. Roland L. Fischer, Curator of Insects, who encouraged and helped me to get started in Collembola taxonomy. Specialists in the study of Collembola who have been of immense aid include: Dr. Harlow B. Mills, Dr. Kenneth Christiansen, the late Dr. Hermann Gisin, Dr. David L. Wray, Dr. Peter Bellinger, Dr. John T. Salmon, and Mrs. Mary Quigley.

Those who have contributed specimens to the collection and spent many hours in this specific endeavor deserve sincere thanks. The list of collectors includes: J. Aitkens, N.T. Baker, D.E. Bixler, R.C. Brock, D.B. Crockett, J.F. Donahue, L.C. Drew, R. R. Dreisbach, G.C. Eickwort, J.D. Fenstermacher, R.L. Fischer, F.E. Giles, J.H. Graffius, F.W. Grimm, K.L. Hays, T. Hlavac, R.W. Hodges, J.J. Jackson, G. Klee, R. W. Koss, R. Lazer, G.V. Manley, R.W. Matthews, M.C. Nielsen, H.D. Niemczyk, T.W. Porter, R. A. Scheibner, H.O. Schooley, R.T. Schuh, J. H. Shaddy, J. G. Truchan, W. T. VanVelzen, A. L. Wells, R. B. Willson, and B.A. Wilson.

Similar thanks go to Kathy Toland, Carol Heney, Kathy Myers, Nancy Bishop Nilson, Donna Miller, Stephen Vore, Richard Hatch, and Mauricio Alegria. Without their many hours of sorting through samples, this work would never have reached its present proportions.

#### MORPHOLOGY

The members of the order Collembola are usually characterized by two basic body forms; the elongate (Figs. 2, 3) which includes the suborders Arthropleona, Metaxypleona, and Nearthropleona, and the globular-shaped Symphypleona. (Figs. 4,5).



Figures 2 and 3. Lateral and dorsal views of the elongate body form, indicating general morphology.

Figures 4 and 5. Lateral and dorsal views of the globular body form, indicating general morphology.

The collembolan head is a most interesting structure (Fig. 6). One pair of four-segmented antennae, whose segments vary in length, can be easily seen. Occasionally subsegmentation takes place. In the case of the Orchesellini the antennae appear to be five- or six-segmented due to the subdivision of the first and second segments. Figures 7 to 11 illustrate various modifications of segmentation. At the tip of the fourth antennal segment there is sometimes a retractile knob (Fig. 14). In the genus *Sminthurinus*, segment three may have a simple (Fig. 13) or divided (Fig. 12) sensory papilla. Other papillae, pegs, and organs can occur on the antennae. All of these structures are of significant taxonomic value; and the reader is referred to Mills (1934) and Maynard (1951) for further information. Relative lengths of the segments can also be important. A simple method of expressing this is in the form of a ratio from segment one to four, e.g., 2:3:4:6.

Located posterior to the antennae are the ocellar patches (Fig. 6). The Collembola may have as many as eight ocelli on either side (Fig. 17), located on these pigmented areas. Reduction in number is common within families, and it is not surprising to find the number of ocelli per patch varying from eight to four or five within a genus (Figs. 15, 16). Some individuals are blind and lack ocellar patches altogether.

Between the ocelli and bases of the antennae are located structures known as the post-antennal organs (PAO). They are depressions in the integument which may contain tubercles sensitive to heat, light and barometric pressure (Chang, 1966). Some post-antennal organs are simple blister-like swellings (Figs. 18-20), while others are sculptured in a bizarre manner (Figs. 21-24). The presence or absence of the PAO is an important taxonomic character for separation of genera and species. Care should be taken to locate this structure with the compound microscope using well-cleared slide mounts.

The mouthparts consist of the mandibles, maxillae, labrum, clypeus, labium, maxillulae and lingua. Modification of these parts is quite common, the result being either chewing mouthparts with a well developed molar plate on the mandible (Fig. 26) or sucking mouthparts with a styliform mandible and no molar plate (Fig. 25). The sucking mouthparts are usually contained in a cone, while the chewing variety are exposed or withdrawn into a buccal cavity formed by the extension of the genae.

The thoracic area is typically insect, with three regions; pro-, meso-, and metathoracic segments. Each segment bears a pair of legs consisting of two precoxae, coxa, trochanter, femur, tibiotarsus and pretarsus. The pretarsus is a structure unique to the Collembola. It may or may not have a movable process. In the European literature the fixed part is called the empodium, and the movable process is called the empodial appendage. In current American literature they are referred to as the unguis (plural: ungues) and unguiculus, respectively (Figs. 52-56). The unguis may be toothed (Fig. 54) or untoothed. Likewise the unguiculus may have teeth (Fig. 54). If a serration or series of teeth protrudes laterally from the unguis, it is called a pseu-

donychium (Fig. 56). In some Collembola the outer edge may be covered with a tunica (Fig. 56). In some individuals, the unguiculus has a sub-apical needle (Fig. 56) which can be branched (Figs. 57, 58).

Just above the tarsus on the tibia are located, in some species, one or more tenent hairs. These specialized setae are probably sensory organs. They may be simple (Fig. 53), clavate (Fig. 54) or knobbed (Fig. 55). Also located on the tibiotarsus is the "tibiotarsal organ" (Fig. 47), usually seen in the genus *Sminthurides*, and often specialized setae.

The first abdominal segment (ABD I) bears a remarkable structure known as the ventral tube or collophore. From this tube the spring-tail can evert a bilobed vesicle which may be smooth (Fig. 40) or warty (Fig. 41). There is evidence that this organ may be a water collecting structure (Chang, 1966). The second abdominal segment (ABD II) does not have any particular external structure associated with it, although there is an appendage seen in the early embryonic stage which disappears. Abdominal segment three, however, has a bilobed appendage called the retinaculum (Fig. 46). It consists of a corpus and toothed rami.

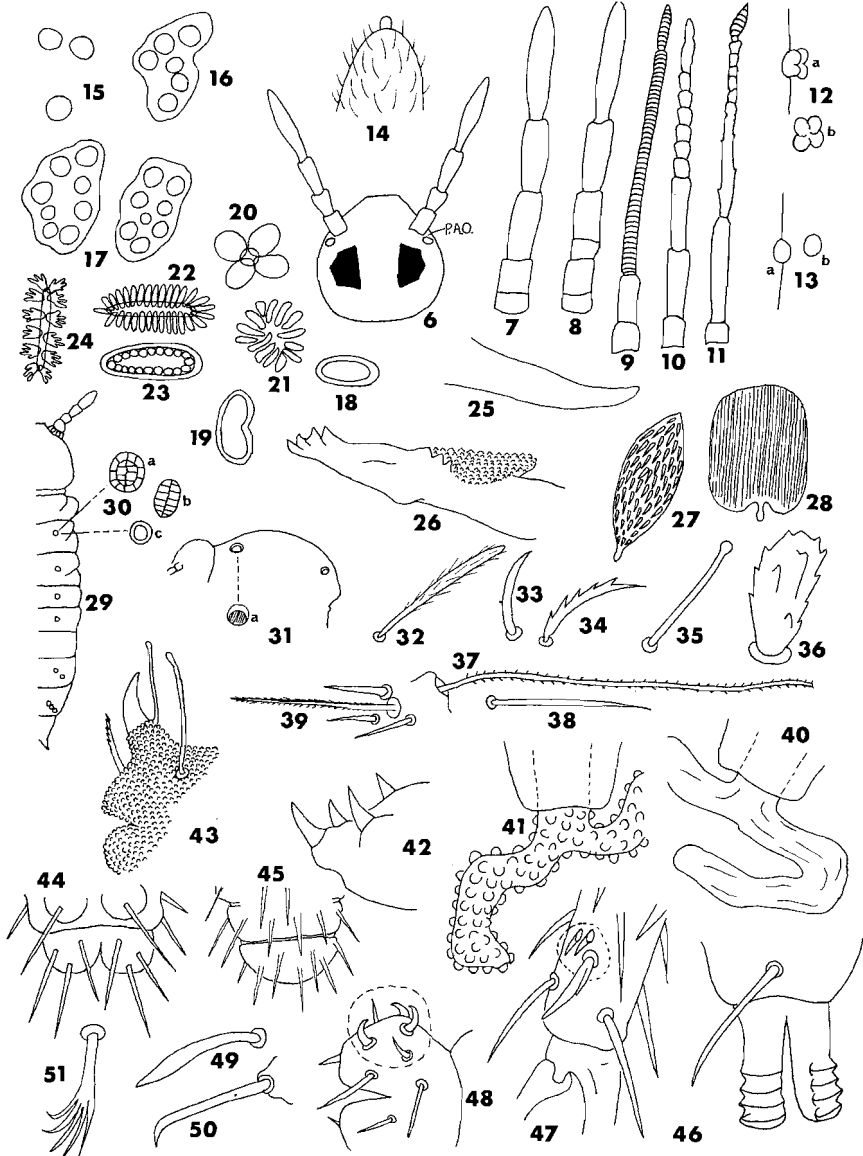
The fourth abdominal segment is the point of attachment for the furcula or spring mechanism from which the order derives its common name (Fig. 59). The furcula is divided into three regions: manubrium, dentes, and mucrones. Occasionally the manubrium will bear some setae or spines of taxonomic importance. The dentes of *Tomocerus* exhibit enlarged scales (Fig. 59a) and spines (Fig. 59b-c) on the dorsum. Other species may have papillae or spines located there as well. The mucrones

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Figures 6-51. 6, typical collembolan head showing position of post-antennal organs and antennae. 7-11, antennal shapes. 12a-b, proximal tubercle of ANT. III, divided. 13a-b, proximal tubercle of ANT. III, simple. 14, tip of ANT. IV with apical papilla. 15, simple ocelli of *Neanura*. 16, ocellar pattern of *Tomocerus*. 17, two examples, of 8-ocellar eye patches. 18-24, post-antennal organs. 25, styliform mandible. 26, mandible with well developed molar plate. 27-28, scale of body. 29, Onychiurid body shape showing location of pseudocelli (after Folsom, 1917). 30a-b-c, examples of pseudocelli. 31, *Megalothorax*, position of sense pits; a. enlargement of sense pit. 32, normal fringed seta. 33, curved seta. 34, serrate seta. 35, capitate seta. 36, clavate seta. 37, lasiotrichium. 38, normal seta. 39, bothriotrichium between normal setae. 40, vesicles of ventral tube, smooth. 41, vesicles of ventral tube, warty. 42, anal spines of *Tetracanthella*. 43, anal spine of *Hypogastrura packardi*. 44, bilobed terminal segments of *Neanura*. 45, normal terminal segments of *Paranura*. 46, frontal view of retinaculum showing rami. 47, distal view of *Sminthurides* tibiotarsus exhibiting tibio-tarsal organ. 48, posterior of male *Bourletiella* showing clasping organ. 49, female appendage of *Ptenothrix*. 50, female appendage of *Heterosminthurus*. 51, female appendage of *Katiannia*.

(Fig. 61-70) are shaped to function in different environments, as on soil, water, and plants. A mucronal bristle is sometimes present (Fig. 70b).

The fifth and sixth abdominal segments are sometimes fused into what is commonly called the anogenital segment. In *Neanura* it may be deeply lobed (Fig. 44), while *Paranura* is normal (Fig. 45). The anogenital segment (anal papilla) usually bears structures which help determine the sex of the individual. Figure 48 is a lateral view of the *Bourletiella*





male anogenital segment. There is a pattern of curved setae, called hooks, which make up a crest referred to as the "male clasping organ." Males of other species may not have any such structures. Females may have on the sixth abdominal segment a pair of specialized setae called the female subanal appendages (Figs. 49-51).

The terminal segments may bear anal horns (Fig. 43), either a single pair or a complex arrangement as in *Tetracanthella* (Fig. 42).

The clothing of the body consists of setae, bothriotrichia, spines, and scales. Setae occur in varying forms: fringed (Fig. 32), normal (Fig. 38), normal curving (Fig. 33), serrate (Fig. 34), capitate (Fig. 35), and clavate (Fig. 36). The trichobothria are cup-shaped depressions from which arise bothriotrichia (long, fine setae) or lasiotrichia (long, ciliated setae) (Fig. 37). The scales have two basic shapes, truncate (Fig. 28) and lanceolate (Fig. 27).

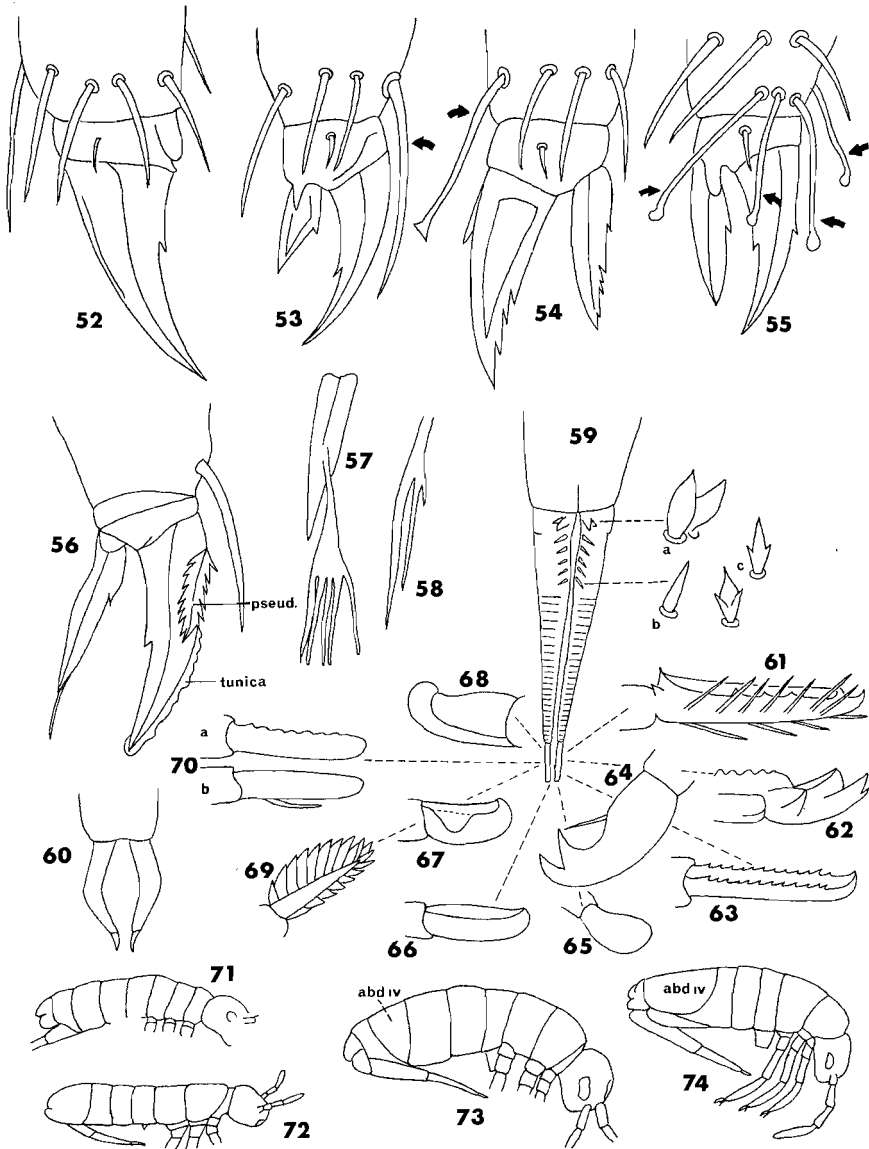
The family Onychiuridae has located on the body segments and head (Fig. 29) structures of unknown function called pseudocelli (Fig. 30 a-b-c). Smiliar to these are the sensory pits of *Megalothorax* (Fig. 31).

The integument of the Collembola can be smooth or granular (pebble-like). Some species have papillate or reticulate integument. The condition of the exoskeleton is of some use in making determinations and is best seen with a compound microscope.




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Figures 52-74. 52, claw of *Anurida tullbergi*. 53, claw of *Hypogastrura nivicola* with pointed tenent hair. 54, *Lepidocyrtus* claw with clavate tenent hair. 55, *Sminthurinus* claw with knobbed tenent hairs. 56, claw of *Sminthurus medialis* showing pseudonychium and tunica. 57, branched subapical filament on unguiculus of *Sminthurides penicillifer*. 58, subapical filament of *S. bifidus*. 59, furcula. 59a, scales of dentes, *Tomocerus*. 59b, dental spine of *Tomocerus flavescens*. 59c, dental spine of *Tomocerus minor*. 60, furcula of *Podura aquatica*. 61, *Tomocerus lamelliferus*, mucro. 62, *Isotomurus*, mucro. 63, *Sminthurinus*, mucro. 64, *Lepidocyrtus*, mucro. 65, *Pseudobourletiella spinata*, mucro. 66, *Bourletiella*, mucro. 67, *Hypogastrura armatus*, mucro. 68, *Hypogastrura packardi*, mucro. 69, *Sminthurides*, mucro. 70a-b, lateral and ventral views of *Sminthurus* mucro showing position on mucronal seta. 71, *Podura*, body shape. 72, *Folsomia*, body shape. 73, Isotomidae, body shape. 74, Entomobryidae, body shape.



Artificial Key to the Genera of Michigan Collembola

1.	Furcula present . . . . .	10
	Furcula absent, or greatly reduced . . . . .	2
2(1).	Unguiculus present (Fig. 53) . . . . .	8
	Unguiculus absent (Fig. 52) . . . . .	3
3(2).	Postantennal organ absent . . . . .	4
	Postantennal organ present . . . . .	6
4(3).	Ocelli reduced in number (less than 8) . . . . .	5
	Ocelli 8 to a side . . . . .	<b>FRESEA</b> (p. 192)
5(4).	Body tubercate; anal segment bilobed (Fig. 44) . . . . .	<b>NEANURA</b> (p. 194)
	Body not tubercate; anal segment normal (Fig. 45) . . . . .	<b>PARANURA</b> (p. 193)
6(3).	Mandibles with well developed molar plate (Fig. 26) . . . . .	<b>WILLEMIA</b> (p. 198)
	Mandibles slender or styliform (Fig. 25) . . . . .	7
7(6).	Maxilla toothed . . . . .	<b>ANURIDA</b> (p. 192)
	Maxilla untoothed . . . . .	<b>MICRANURIDA</b> (p. 193)
8(2).	Unguiculus reduced in size; body without cuticular papillae . . . . .	<b>TULLBERGIA</b> (p. 195)
	Unguiculus well developed; body with cuticular papillae . . . . .	9
9(8).	Postantennal organ simple, vesicles arranged in a rosette or in parallel rows (Figs. 18-23) . . . . .	<b>PROTAPHORURA</b> (p. 195)
	Postantennal organ with vesicles covered with secondary tubercles (Fig. 24) . . . . .	<b>ONYCHIURUS</b> (p. 195)
10(1).	Body elongate . . . . .	11
	Body globular . . . . .	32
11(10).	Head prognathous . . . . .	12
	Head hypognathous . . . . .	<b>PODURA</b> (p. 218)
12(11).	Chewing mouthparts; tenent hairs normally present . . . . .	14
	Sucking mouthparts, projecting into a cone-shape . . . . .	13
13(12).	Ocelli 8 to a side . . . . .	<b>PSEUDACHORUTES</b> (p. 192)
	Ocelli 5 or 6 to a side . . . . .	<b>ODONTELLA</b> (p. 191)

- 14(12). Body segments similar in size; antennae usually short (Fig. 71)  
 . . . . . 15  
 Body segments dissimilar in size and shape; antennae usually  
 long (Figs. 72-74) . . . . . 17
- 15(14). Postantennal organ present; 8 ocelli on a side . . . . . 16  
 Postantennal organ absent; 5 ocelli on a side **XENYLLA** (p. 195)
- 16(15). Unguiculus well developed . . . . . **HYPOGASTRURA** (p. 196)  
 Unguiculus absent or extremely reduced **SCHOTTELLA** (p. 195)
- 17(14). Abdominal segment IV usually longer than III; postantennal organ  
 generally absent (Fig. 74) . . . . . 24  
 Abdominal segment IV shorter than III; postantennal organ pres-  
 ent or absent (Fig. 73) . . . . . 18
- 18(17). Scales present on body . . . . . 19  
 Scales absent from body . . . . . 22
- 19(18). Third antennal segment very long and subannulated, fourth  
 short, also subannulated . . . . . **TOMOCERUS** (p. 216)  
 Third antennal segment simple, similar to other segments . 20
- 20(19). Scales pointed; dentes with setae ventrally **WILLOWSIA** (p. 204)  
 Scales rounded; dentes with scales ventrally . . . . . 21
- 21(20). Ocelli reduced, never 8 to a side . . **PSEUDOSINELLA** (p. 205)  
 Ocelli 8 to a side . . . . . **LEPIDOCYRTUS** (p. 205)
- 22(18). Antennae appear 5 or 6 segmented (Figs. 7-8) . . . . .  
 . . . . . **ORCHESELLA** (p. 198)  
 Antennae 4 segmented (Fig. 6) . . . . . 23
- 23(22). Unguis with two, large lateral external teeth; tibiotarsus without  
 a double row of finely fringed or smooth setae . . . . .  
 . . . . . **ENTOMOBRYA** (p. 201)  
 Unguis without two large lateral external teeth; tibiotarsus with  
 a double row of fringed or smooth setae . . . . .  
 . . . . . **ENTOMOBRYOIDES** (p. 203)
- 24(17). Anal horns present (Fig. 43) . . . **TETRACANTHELLA** (p. 210)  
 Anal horns absent . . . . . 25
- 25(24). Last three segments of the abdomen fused; anus postero-  
 ventral (Fig. 72) . . . . . **FOLSOMIA** (p. 210)  
 Last two or three segments of the abdomen free; anus terminal  
 . . . . . 26

26(25). Last two antennal segments subannulated . . . . .  
 . . . . . **ARCHITOMOCERURA** (p. 212)  
Last two antennal segments simple . . . . . 27

27(26). Furcula not reaching the ventral tube; manubrium equal to or  
 longer than the dens . . . . . 28  
Furcula reaching ventral tube; manubrium shorter than dens  
 . . . . . 29

28(27). Bothriotrichia present on abdominal segments . . . . .  
 . . . . . **HYDROISOTOMA** (p. 212)  
Bothriotrichia absent on abdominal segments . . . . .  
 . . . . . **PROISOTOMA** (p. 212)

29(27). Abdomen with bothriotrichia; mucro lamellate (Figs. 39, 62)  
 . . . . . **ISOTOMURUS** (p. 212)  
Abdomen without bothriotrichia; mucro not lamellate (Fig. 64)  
 . . . . . 30

30(29). Eyes absent; fourth antennal segment with 5-8 large sensory  
 cones . . . . . **ISOTOMINELLA** (p. 216)  
Eyes present; large sensory cones on fourth antennal segment not  
 present . . . . . 31

31(30). Dentes convergent, furcula reaches ventral tube; tenent hairs  
 present . . . . . **VERTAGOPUS** (p. 215)  
Dentes not convergent, furcula reaches only posterior edge of  
 abdominal segment II; tenent hairs present or absent . . . . .  
 . . . . . **ISOTOMA** (p. 214)

32(10). Antennae shorter than head . . . . . 33  
Antennae as long as or longer than head . . . . . 34

33(32). Body with sensory pits (Fig. 31a) . . . . . **MEGALOTHORAX** (p. 218)  
Body without sensory pits . . . . . **NEELUS** (p. 218)

34(32). Integument smooth; sacs of the ventral tube warty (Fig. 41) 39  
Integument granular; sacs of the ventral tube smooth (Fig. 40)  
 . . . . . 35

35(34). Anogenital segments fused; two bothriotrichia on each side of  
 anal papilla . . . . . 36  
Anogenital segments separated; one bothriotrichium on each  
 side of anal papilla . . . . . 37

36(35). Tibiotarsal organ of the third pair of legs present (Fig. 47)  
 . . . . . **SMINTHURIDES** (p. 218)  
Tibiotarsal organ absent . . . . . **SPHAERIDIA** (p. 220)

- 37(35). Tenent hairs absent . . . . . **ARRHOPALITES** (p. 220)  
 Tenent hairs present . . . . . 38
- 38(37). Fourth antennal segment subsegmented (Fig. 10) . . . . .  
 . . . . . **KATIANNIA** (p. 225)  
 Fourth antennal segment entire (Fig. 6) **SMINTHURINUS** (p. 222)
- 39(34). Fourth antennal segment longer than the third . . . . . 40  
 Fourth antennal segment shorter than the third . . . . .  
 . . . . . **PTENOTHRIX** (p. 229)
- 40(39). Tenent hairs present . . . . . 42  
 Tenent hairs absent . . . . . 41
- 41(40). Third antennal segment with heavy, long setae . . . . .  
 . . . . . **SMINTHURUS** (p. 224)  
 Third antennal segment with normal setae . . . . .  
 . . . . . **SPHYROTHECA** (p. 225)
- 42(40). Mucro smooth on both edges . . . . . 43  
 Mucro with one edge toothed . . . . . **NEOSMINTHURUS** (p. 228)
- 43(42). Mucro flat, paddle-shaped; depression on front of head with  
 many fine hairs . . . . . **PSEUDOURLETIELLA** (p. 226)  
 Mucro not flat and paddle-shaped; depression wanting . . . . . 44
- 44(43). Abdomen very globular; males with a crest-like "clasping or-  
 gan" (Fig. 48) . . . . . **BOURLETIELLA** (p. 227)  
 Abdomen with dorsal depression; males without "clasping  
 organ" . . . . . 45
- 45(44). Unguiculus of first leg bristle-like and unlike the other claws  
 . . . . . **HETEROSMINTHURUS** (p. 228)  
 Unguiculus same on all legs. . **DEUTEROSMINTHURUS** (p. 228)

## ACCOUNT OF SPECIES

Suborder NEOARTHROPLEONA  
 Family BRACHYSTOMELLIDAE  
 Genus **ODONTELLA** Schäffer

**lamellifera** (Axelson). SLP: Monroe; June 10-Sept. 27. NLP: Kalkaska;  
 May 1.

This species has only been collected in forest conditions. It seems to prefer the deep litter zones of cedar and hardwood stands where the relative humidity is high and the temperatures cool. This species has not been previously reported from North America.

Family ANURIDAE  
Genus ANURIDA Laboulbene

**tullbergi** Schott. UP: Mackinac, Iron, Houghton; July 6.

The only confirmed date of collection for this species is July 6, 1960 in Mackinac County. The other two records were taken from the Dreisbach collection data and do not have recorded dates. *A. tullbergi* is generally collected along the seashore among debris in Europe. The specimens I have collected were taken under loose bark of a log on Horseshoe Bay beach near St. Ignace.

Genus FRIESEA Dalla Torre

**claviseta** Axelson. SLP: Livingston.

A single specimen of this species exists in the University of Michigan collection. No further collection data are available.

Family NEANURIDAE  
Genus PSEUDACHORUTES Tullberg  
*Key to the Michigan Species*

- 1. Tenent hairs present . . . . . 2  
Tenent hairs absent . . . . . 3
- 2. Tenent hairs with round apical knob; postantennal organ with 5 tubercles . . . . . *corticulus*  
Tenent hairs without a strong apical knob; postantennal organ with 10 to 12 tubercles . . . . . *lunatus*
- 3. Unguis with inner tooth . . . . . 4  
Unguis without inner tooth . . . . . *complexus*
- 4. Retractable knob at apex of fourth antennal segment absent; blue mottling . . . . . *saxatilis*  
Retractable knob present; blue-grey . . . . . *aureofasciatus*

**aureofasciatus millsii** Maynard. NLP: Charlevoix, Beaver Island; May 8. SLP: Kalamazoo, Monroe; May 30-June 29.

Occurs in bracket fungi and hardwood forest litter. This subspecies is light blue in color in contrast to the nominotypical subspecies which has orange bands on the mesothorax and last two abdominal segments. Many specimens have been taken with a Tullgren apparatus. Not uncommon.

**complexus** (MacGillivray). SLP: Kalamazoo; July 14-29.

This species has only been collected in pine litter. During a study of the microarthropods of Kellogg Forest, H.O. Schooley ran many Tullgren samples of litter from which this species was identified. It favors high humidity and should be found in leaf litter.

**corticulus** (Schäffer). NLP: Oscoda; Sept. 3.

The only specimens I have seen came from the shore of Loon Lake, Oscoda County.

**lunatus** Folsom. LP: (Fig. 75); April 25-Sept. 27.

Large numbers of this species have been taken from litter samples. It is common in the hardwood stands of Monroe County, as well as the pine forests of Grand Traverse and Wexford Counties. The use of pit-traps and Tullgren apparatus yields the largest numbers. One collection was made under a pine stump with an aspirator. Common.

**saxatilis** Macnamara. SLP: Monroe; June 10-Sept. 3. NLP: Grand Traverse; July 28.

A large species (3mm) common in hardwood and mixed pine-hardwood forests. The largest numbers came from pit traps.

#### Genus **MICRANURIDA** Börner

**pygmaea** Börner. SLP: Ingham; May 12.

Taken from grass core in Baker Woodlot. Not common.

#### Genus **PARANURA** Axelson

**sexpunctata colorata** Mills. SLP: Berrien; July 2.

At first glance this species could be confused with *Neanura muscorum* Templeton. It differs from that species by not having the large body tubercles and bilobed anal segment. The European form of *sexpunctata* is white, while the North American form is blue. Mills (1934) considers

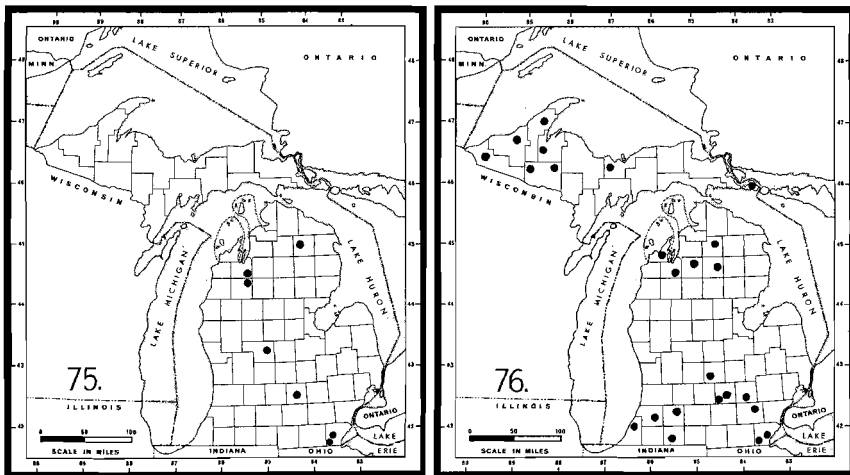


Fig. 75. *Pseudachorutes lunatus* Folsom. Fig. 76. *Neanura muscorum* Templeton.



it uncommon. He obtained specimens from humus. The Michigan specimens came from under the bark of decaying logs.

Genus **NEANURA** MacGillivray  
*Key to the Michigan Species*

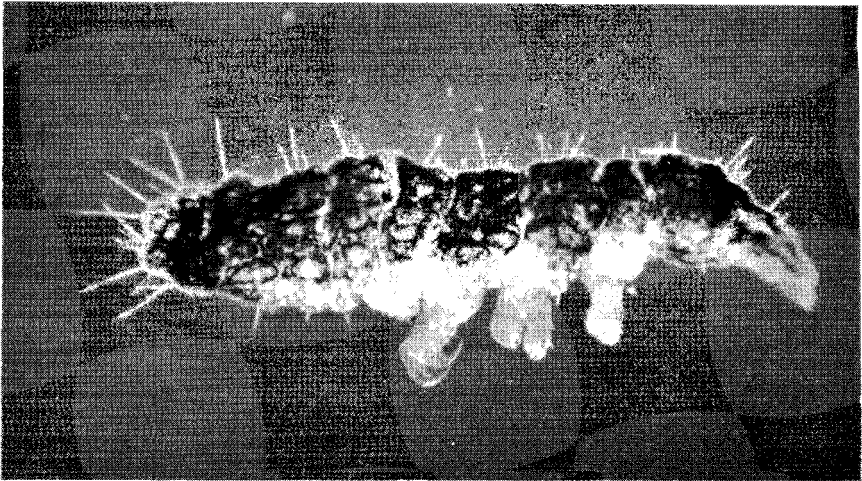
1. Color white, ocelli 2 to a side . . . . . *barberi*
2. Color light blue, ocelli 3 to a side . . . . . *muscorum*

**barberi** Hanschin. SLP: Monroe; July 11. UP: Chippewa (Drummond Island); July 7.

I have encountered this species twice in the state and consider it rare. Intense collecting in Monroe County yielded a single specimen from under the base of a tree. The Drummond Island specimen came from leaf litter.

**muscorum** Templeton. LP and UP: (Fig. 76); April 7-Oct. 30.

A common species found in various woodland situations. It may be collected in the spring while crawling on bark during sunny days. This species tends to form aggregates, and when the weather is cold, can be found in groups under bark. Many collections have been made from leaf mold, under bark, pine litter, and in pit traps.



*Neanura muscorum* Templeton. Photo by Coleman.

Suborder ARTHROPLEONA  
Superfamily HYPOGASTRUROIDEA  
Family ONYCHIURIDAE  
Subfamily TULLBERGIINAE

Genus **TULLBERGIA** Lubbock

**granulata** Mills. SLP: Ingham, Monroe; Jan. 24-Dec. 14.

A common soil species taken throughout the year from core samples. It seems to prefer moist loose soil in fields or woodlots. Disruption of the soil does not seem to affect its presence, and it is usually found in large numbers in agricultural soils.

## Subfamily ONYCHIURINAE

Genus **PROTAPHORURA** Absolon

**armatus** (Tullberg). SLP: Monroe, Ingham, Jackson; April 14-Sept. 20. NLP: Otsego; March 20.

A soil and litter species confined to moist, dark conditions. Common in agricultural soil along with *T. granulata*.

Genus **ONYCHIURUS** Gervais

**subtenius** Folsom. LP and UP: (Fig. 77); Feb. 15-Oct. 25.

This species usually is found in leaf and pine litter. Specimens from Purdy Bog, Barry County were taken from frozen sphagnum and leaf litter on February 15. Contrasted with this were individuals collected from a *Peromyscus* nest in April from Otsego County. Common.

## Family HYPOGASTRURIDAE

Genus **XENYLLA** Tullberg

**welchi** Folsom. SLP: Charlevoix, Beaver Island; May 8.

The only specimens so far collected from Michigan were taken from litter in a birch-aspen woodlot. Maynard (1951) reports it from greenhouses. Not common.

Genus **SCHOTTELLA** Schäffer*Key to the Michigan Species*

1. Tenent hairs present; postantennal organ with four peripheral lobes; dark blue . . . . . *glasgowi*
2. Tenent hairs absent; postantennal organ with eight peripheral lobes; dark blue-black . . . . . *banksi*

**banksi** Maynard. SLP: Kalamazoo; June 23.

Long Island, New York, is the only place where *banksi* has previously been recorded. Maynard (1951) did not state the habitat in his monograph. The Michigan specimens were collected during a study of the pine litter organisms in Kellogg Forest. Not common.

**glasgowi** Folsom. SLP: Monroe, Kalamazoo; June 23-29.

Folsom (1916) records this species from old mines of *Agrilus sinua-*

*tus* in pear. Very little habitat information exists in the literature. Our specimens came from both pine and hardwood litter, indicating a preference by the species for humid conditions. Not common.

Genus **HYPOGASTRURA** Bourlet  
*Key to the Michigan Species*

1. Mucro with large external lamella, triangular shaped . . . *armatus*  
 Mucro without large lamella, heavy and blunt . . . . . 2
2. Dentes with large conical teeth on dorsum . . . . . *nivicola*  
 Dentes without large conical teeth . . . . . 3
3. Tibiotarsus with one tenent hair . . . . . 4  
 Tibiotarsus with two or three well developed tenent hairs . . . . 8
4. Body with stout capitate setae dorsally . . . . . *packardi*  
 Body without capitate setae; normal curving setae present . . . . 5
5. Anal spines long, atleast as long as the hind unguis . . *macrospinata*  
 Anal spines shorter than the hind unguis . . . . . 6
6. Color dark blue . . . . . *matura*  
 Color light, cream, brown, pale violet or purple . . . . . 7
7. Clavate tenent hair well developed . . . . . *brevispina*  
 Clavate tenent hair not developed, similar to other setae . *montana*
8. Small anal spines, less than a quarter the length of hind unguis  
 . . . . . *macgillivrayi*  
 Large anal spines, at least one third or more the length of hind  
 unguis . . . . . *humi*

**armatus** (Nicolet). LP and UP: (Fig. 78); April 14-Sept. 27.

This cosmopolitan species is quite commonly collected in the spring when mating is taking place among thousands of individuals. It seems to prefer the litter of hardwood forests, but is sometimes picked up in pine litter. Other habitats include grassy conditions, under bark, silo leakage, and under boards. I consider it a common species in Michigan.

**brevispina** (Harvey). SLP: Monroe, Ingham. NLP: Wexford, Grand Traverse. April 29-Sept. 27.

This is a common species of the litter zone of hardwood and pine forests. During the spring I have seen thousands of individuals moving in aggregates, like dust clouds, across the forest floor. Their populations tend to decrease in the fall of the year. Some specimens were taken along the margin of ponds by sweeping with a white enamel pan.

*humii* (Folsom). SLP: Monroe, Ingham; June 10-Oct. 25. The species is not often recorded, but when collected it is usually taken in large numbers. Habitats include rotten logs, leaf litter, and silo leakage. I have found *armatus* to be associated with this species. Not common.

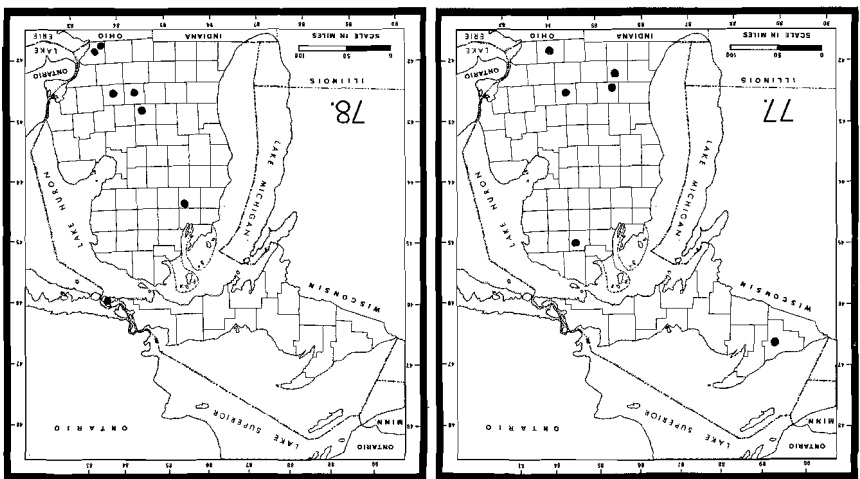
*montana* Maynard. SLP: Ingham; May 12. This species has been taken once in Baker Woodlot, from a core sample in a dry area of the woodlot. On first glance, *montana* is similar to *brevispina*, but differs from it by the paler color and pointed shape of the tenent hair. Not common.

*matura* (Folsom). SLP: Shiawassee, Clinton; May 14-June 14. A recent addition to our collection, *matura* was taken with pit traps in litter areas of Burke Lake, Clinton County, and floodplain of the Looking Glass River, Shiawassee County. Not common.

*macrospinata* Maynard. SLP: Oakland, Ingham; April 11-July 3. This is an uncommon species in Michigan. Found in soil-muck conditions and leaf litter. Easily recognized by its large, curving spines.

*mcgillivrayi* (Folsom). NLP: Wexford; Aug. 23-Sept. 7. Maynard (1951) reports this species from the surface of water and under damp leaves. The collections recorded here were taken from pit traps set in jack pine plantations.

Fig. 77, *Onychinus subtenus* Folsom. Fig. 78, *Hypogastrura armatus* (Nicolet).



**nivicola** (Fitch). LP and UP: (Fig. 79); Feb. 15-July 7.

The "snowflea" occurs in great numbers during the spring. Even in late winter it may be seen by the thousands, jumping about on sunny areas of snow. The best collecting time is during April and May when vast numbers are easily taken on logs and from the surface of vernal puddles. The habitats from which this species has been recovered include sphagnum bogs, under bark, hardwood litter, pond margins, and on snow. I have seen uncountable numbers feeding on maple sap in the spring. Common.

**packardi** (Folsom). SLP: Allegan; July 27. UP: Marquette; Sept. 15.

Individuals have been taken from under bark and the bracket fungus *Polyporus*. Maynard (1951) reported that this species may multiply to the millions in a single aggregate.

Genus **WILLEMIA** Börner

**intermedia** Mills. SLP: Ingham; July 12-Sept. 7

Mills (1934) reports that *intermedia* is a resident of moss and decaying vegetation. In my studies of soil Collembola, I have found it in corn field plots. It is never very common, but it is usually present in most of the samples taken.

Superfamily ENTOMOBRYOIDEA

Family ENTOMOBRYIDAE

Subfamily ENTOMOBRYINAE

Genus **ORCHESELLA** Templeton

*Key to the Michigan Species*

1. Antennae apparently 6 segmented (Fig. 8) . . . . . 3  
 Antennae apparently 5 segmented (Fig. 7) . . . . . 2  
 the segments, sometimes with dusting of light purple posteriorly
2. Color basically yellow, with variable amounts of purple between the segments, sometimes with dusting of light purple posteriorly . . . . . *albosa*  
 Color yellow with transverse bands of deep purple-black on body segments, antennae circled with same color apically. *hexfasciata*
3. Body with blotches of color, no crossbands or longitudinal stripes . . . . . *villosa*  
 Body with longitudinal stripes and/or crossbands . . . . . 4
4. Body color basically greenish-yellow with a fine purple broken line dorsally . . . . . *irregularilineata*  
 Body color other than above . . . . . 5

5. Body yellow to yellow-brown with four longitudinal blue-black stripes, abdominal segments II to VI sometimes heavily pigmented. . . . . *ainsliei*  
 Body red-brown or black with yellow, white, or yellow-brown markings, abdominal segment III with a dark band . . . . . *cincta*

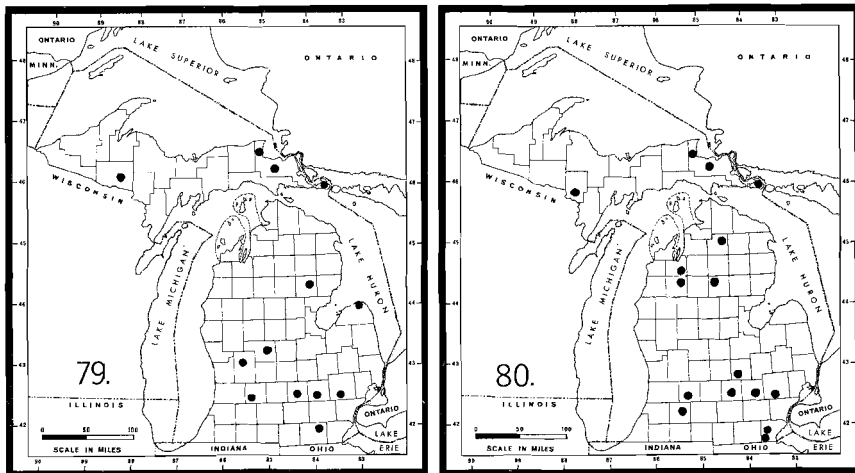


Fig. 79, *Hypogastrura nivicola* (Fitch). Fig. 80, *Orchesella ainsliei* Folsom.

*ainsliei* Folsom. LP and UP: (Fig. 80); March 30-Sept. 27.

A common woodland species in both the upper and lower peninsulas. Various habitats were sampled and include grass sweepings, loose bark, leaf litter, pine litter, sphagnum bogs, flood plains and clover fields. A large number of specimens was taken with pit traps in the hardwood stands of Monroe County. This species has a wide temperature preference and tolerance to desiccation.

*albosa* Guthrie. LP and UP: (Fig. 81); April 29-Sept. 30.

This species is extremely variable in color, which may range from entirely yellow to yellow heavily dusted with purple in the posterior region. It can be found in dry to wet situations for a large part of the year. We have collected specimens in leaf litter, sphagnum bogs, and agricultural fields. Large numbers have been recovered from Monroe County using pit traps. I consider this a common species within the state.

*cincta* (Linnaeus). NLP: Mackinaw Island; Sept. 7.

Some individuals of this seemingly rare species were collected from grass sweepings. The habitat was unusual: the city park area with short clipped grass, fairly dry, and exposed to bright sunlight.



*Orchesella hexfasciata* (Harvey). Photo by Snider.

I have not as yet taken any specimens from the mainland adjacent to the island. Maynard (1951) relates that he has seen only a single specimen of *cincta* in New York. Not common.

*hexfasciata* (Harvey). LP and UP: (Fig. 82); April 3–Oct. 30.

An easily recognized species found in leaf litter and under bark. Specimens have also been taken from *Polyporus* caps. Common.

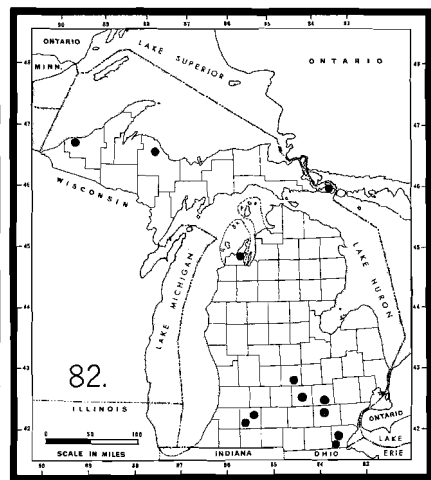
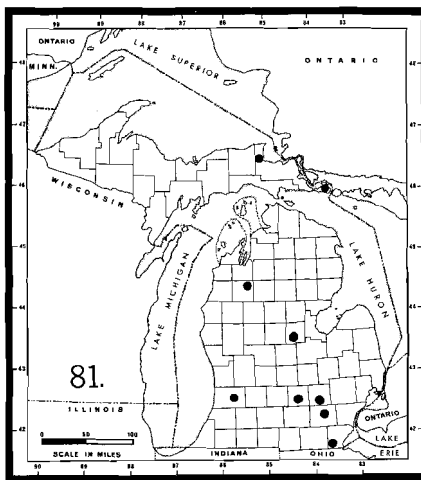


Fig. 81, *Orchesella albosa* Guthrie. Fig. 82, *Orchesella hexfasciata* (Harvey).

**irregularilineata** Stach. SLP: Ingham; April 28-May 19.

A few individuals recovered from grass cores taken in Baker Woodlot during an ecological study of the microarthropod fauna by J. H. Shaddy. The only other records of this species are from the Caucasus. Rare.

**villosa** (Geoffroy). SLP: St. Clair, Ingham, Clinton; April 3-Nov. 8.

This very setaceous species seems to prefer low humidity conditions. The specimens examined were taken from dried pond beds, a strawberry patch, and overgrown drainage ditches. Maynard (1951) records *villosa* from New York. This is the only other record outside of Michigan I have seen.

Genus **ENTOMOBRYA** Rondani

*Key to the Michigan Species*

1. Body unicolorous, purple, grey, greenish . . . . . *griseoolivata*  
Body with dark color patterns . . . . . 2
2. Each body segment with heavy transverse band of color . . . . . 3  
Some body segments with weakly developed bands . . . . . 4
3. Abdominal segment IV with a dark band anteriorly, weakly connected  
at the dorsum . . . . . *multifasciata*  
Abdominal segment IV with a dark band posteriorly, in the form  
of a "U" . . . . . *nivalis*
4. Body dorsoventrally depressed . . . . . *assuta*  
Body not depressed . . . . . 5
5. Body white to yellow with dark saddle shaped band from metathorax  
to abdominal segment IV . . . . . *clitellaria*  
Body olivaceous to purple with mid-dorsal stripe . . . . . *unostrigata*

**assuta** Folsom. LP: (Fig. 83): April 9-Sept. 18.

This is a litter and cortical species. Individuals have been taken from pine litter with pit traps and from bird's nests using the Tullgren apparatus. As is true with most of the Entomobryidae, *assuta* tends to aggregate.

**clitellaria** Guthrie. LP and UP: (Fig. 84); March 28-Sept. 7.

A colorful and easily identified species which has been collected in Michigan under dry bark and in rotten logs. Some specimens have been taken from jack pine litter and corn fields.

**griseoolivata** (Packard). LP and UP: (Fig. 85); June 23-Sept. 7.

Commonly taken in leaf and pine litter, grass sweepings, and core samples from fields.



**multifasciata** (Tullberg): LP and UP: (Fig. 86); April 7-Nov. 14.

A highly cosmopolitan species. Its habitats include window ledges, leaf litter, pine litter, catbird nest, under bark, grass sweeping, in loose soil, and sand blows. Common throughout the state.

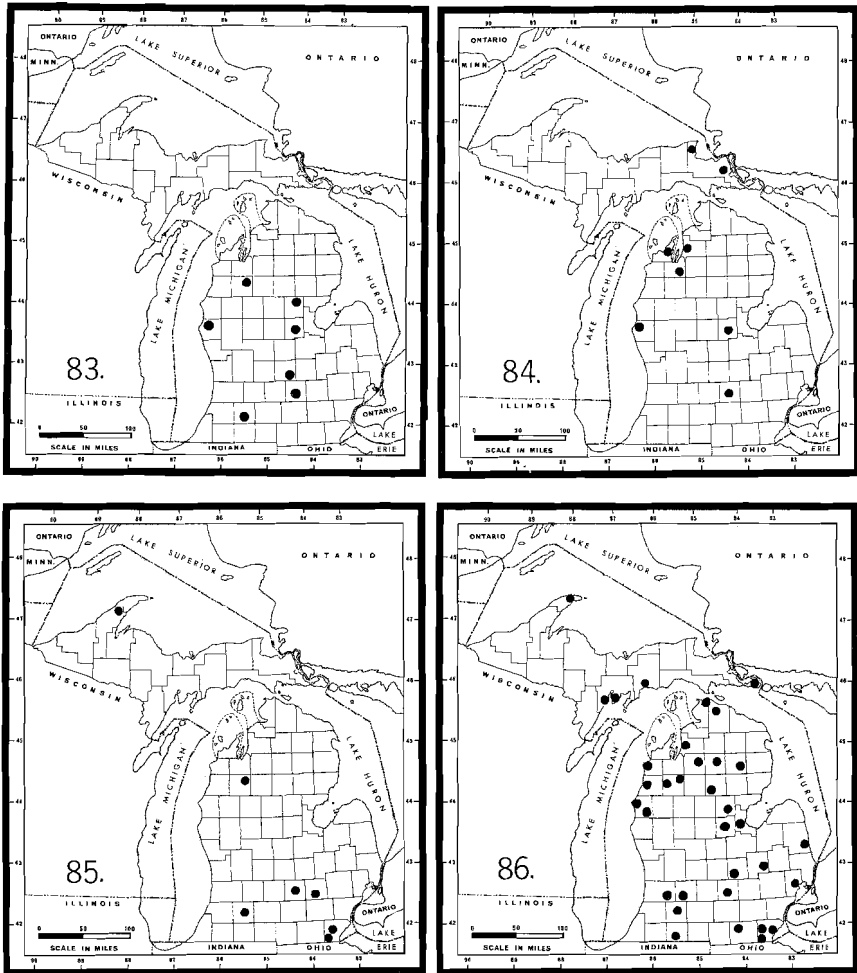


Fig. 83, *Entomobrya assuta* Folsom. Fig. 84, *Entomobrya clitellaria* Guthrie. Fig. 85, *Entomobrya griseoolivata* (Packard). Fig. 86, *Entomobrya multifasciata* (Tullberg).

**nivalis** (Linnaeus). LP and UP: (Fig. 87); April 5-Sept. 9.

This species can be distinguished from *E. multifasciata* by the “U” shaped mark on the posterior of Abd. IV. Habitats sampled are under

bark, grass sweepings, pine litter and loose soil of agricultural fields. A common species in Michigan.

**unostrigata** Stach. SLP: Berrien, Van Buren, Monroe, Ingham; April 28-Oct. 4.

Commonly found in dry areas. The first specimens were taken from sandy soil in a hardwood forest in Warren Dunes State Park, Berrien Co. Later, collecting in dry litter and loose soils yielded many specimens. Specimens from solitary wasp nests in sandy conditions were also collected.

Genus **ENTOMOBRYOIDES** Maynard  
Key to the Michigan Species

1. Color black to blue in a granular pattern; median tooth of unguis longer than basal. . . . . *guthriei*
2. Color bluish-purple, uniform to irregular; median tooth of unguis not usually longer than basal. . . . . *purpurascens*

**guthriei** (Mills). SLP: Shiawassee; NLP: Grand Traverse. UP: Chippewa. April 2-July 28.

Various habitats for this species include leaf litter, ant nests, moss, and pine-oak stands. There is a high tolerance for low humidity. Not common.

**purpurascens** (Packard). LP and UP: (Fig. 88); March 20-Sept. 27.

This species is quite common throughout the state. Collection sites

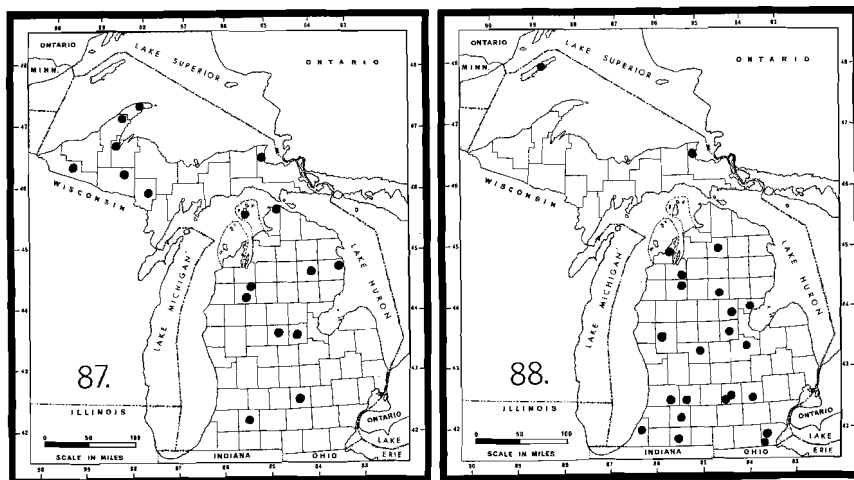


Fig. 87, *Entomobrya nivalis* (Linnaeus). Fig. 88, *Entomobryoides purpurascens* (Packard).

are generally restricted to dry habitats, such as loose bark, sandy fields, leaf litter, pine litter, and loose agricultural soils. There has been a tendency to confuse this species with *Entomobrya griseoolivata*. To separate the two, examine the unguiculus; in *purpurascens* it is ciliated along the outer margin, while in *griseoolivata* it is smooth.

Genus **WILLOWSIA** Shoebotam  
 Key to the Michigan Species

1. Body blue to violet with yellow or pale head . . . . . *buski*
2. Body pale to yellow with crossbands and spots of blue . . . . .  
 . . . . . *platani nigromaculata*

**buski** (Lubbock). LP and UP: (Fig. 89); April 9-Sept. 21.

This colorful species is quite often associated with domestic habitats. I have collected it on cement porches and window ledges. In natural environments it can be found in leaf litter, under logs, under loose bark, in loose soil and jack pine litter. *W. buski* is heavily scaled and can live in relatively dry habitats. Common throughout the state.

**platani nigromaculata** (Lubbock). SLP and NLP: (Fig. 90); May 6-Nov. 14.

Like its relative, *W. buski*, *platani nigromaculata* is heavily scaled and is usually found in association with it. Some habitats where this species has been collected include window ledges, catbird nests, grass sweepings, leaf and pine litter, and loose soil. Common throughout Michigan.

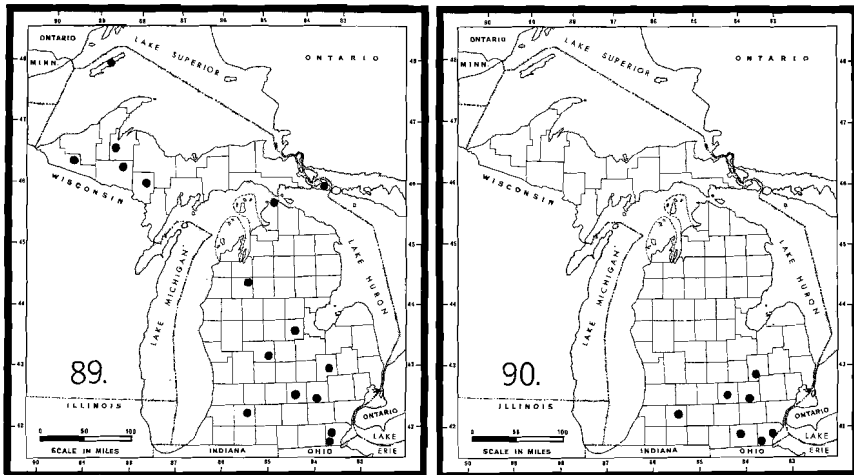


Fig. 89, *Willowsia buski* (Lubbock). Fig. 90, *Willowsia platani nigromaculata* (Lubbock).

Genus **PSEUDOSINELLA** Schäffer  
*Key to the Michigan Species*

1. With three ocelli on each side of the head . . . . . *sexoculata*  
 Without ocelli . . . . . 2
2. Mesonotum same size as metanotum . . . . . *violenta*  
 Mesonotum expanded, capelike . . . . . *rolfsi*

**rolfsi** Mills. SLP: St. Joseph, Kalamazoo, Ingham; June 22-Oct. 16.

This species is not common in most collections. It is generally found associated with *P. violenta*. A fast runner like *violenta*, it can also jump with great speed when agitated. Moist habitats are usually preferred; some of them include under boards and logs lying in grass, under moist bark, and moist pine litter.

**sexoculata** Schott. SLP: Ingham. NLP: Cheboygan, Emmett. UP: Chippewa. April 14-Sept. 7.

Only recently have I discovered that this species seems to be common in loose soil. At first glance it is easily confused with *violenta*, however, if care is taken to locate the minute ocelli, which are black in this species, there will be no confusion. *P. sexoculata* is also collected under logs and loose bark. As yet I would not consider it a common species for the state.

**violenta** (Folsom). LP and UP: (Fig. 91); April 5-Aug. 30.

Because of its agility, Dr. Folsom dubbed the species "the scooter." When encountered, care must be taken to collect this insect quickly as it has the ability to find cover very speedily. Quite often I have encountered it in ant and termite colonies, where it seems to feed on waste products and leavings without disturbing its hosts. Other habitats include pine and leaf litter, loose soil, rotten wood, and under rocks along beaches. Common throughout the lower peninsula. More collecting has to be done in the upper peninsula before any statement can be made about its distribution there.

Genus **LEPIDOCYRTUS** Bourlet  
*Key to the Michigan Species*

1. Antennal segments I and II as well as the legs with scales . . . 2  
 Antennal segments I and II as well as the legs without scales . 8
- 2 (1). Basic body color blue or dark violet . . . . . 3  
 Basic body color yellow or white with some blue markings . . 4
- 3 (2). Mesothorax cone shaped; blue-violet; large (3mm) . . . *paradoxus*  
 Mesothorax rounded in front; blue-violet; average (1.5mm) . . .  
 . . . . . *violaceus*

4 (2).	Body yellow, with or without small traces of pigment . . . . .	5
	Body with pigment throughout . . . . .	7
5 (4).	Abdominal segment IV with blue-black saddle of pigment . . . . .	
	. . . . . <i>unifasciatus</i>	
	Abdominal segment IV without such pigment. . . . .	6
6 (5).	Mesothorax with blue pigment on anterior edge; large (3mm) . . . . .	
	. . . . . <i>curvicollis</i>	
	Mesothorax without blue pigment, body yellow; average (1.5 mm)	
	. . . . . <i>lignorum</i>	
7 (4).	Body deep reddish with a yellow head . . . . .	<i>guthriei</i>
	Body with flicks of red-orange and light intersegmental areas . . . . .	
	. . . . . <i>aurantiacus</i>	
8 (1).	Body with blue or grey pigment; mesonotum rounded . . . . .	9
	Body white; mesonotum cone-shaped, projecting forward . . . . .	
	. . . . . <i>lanuginosus</i>	
9 (8).	Body sprinkled with gray pigment, forming bands on all segments . . . . .	<i>cinereus</i>
	Body with blue pigment. . . . .	10
10 (9).	Body dark blue throughout . . . . .	<i>cyaneus</i>
	Body with various amounts of light blue, forming weak bands on the segments . . . . .	11
11 (10).	Blue pigment weakly developed on all body segments, intersegmental areas wide, abdominal segment IV with a weak band . . . . .	<i>pallidus</i>
	Blue pigment heavy on all body segments except abdominal segment IV, which has a band not quite meeting dorsally; intersegmental areas narrow . . . . .	<i>helenae</i>

**aurantiacus** Maynard. NLP: Otsego; March 20.

As yet I have only seen a few specimens. It is easily distinguished by its reddish orange pigment which is distributed in distinct flecks over the body. The collection was made in a sandy cut-over field. Litter from the area was collected and put into a Tullgren funnel for extraction. Not a common species.

**cinereus** Folsom. LP and UP: (Fig. 92); April 12-Sept. 3.

At first glance *cinereus* may be confused with *violaceous*, which it resembles in size and pattern. But *cinereus* is lead gray, not blue-violet in color. It is commonly collected in the same habitats with other members of the genus. This species has been taken under loose bark, leaf and pine litter, loose soil, and grass sweeping. Common in the lower peninsula.

**curvicollis** Bourlet. NLP: Cheboygan; June 20. UP: Iron; July 6.

This is not a common species in Michigan. It has frequently been confused with *lignorum*. *L. curvicollis* is large (3mm) and creamy white, lacking blue-violet pigment on the body. I have only collected it under boards.

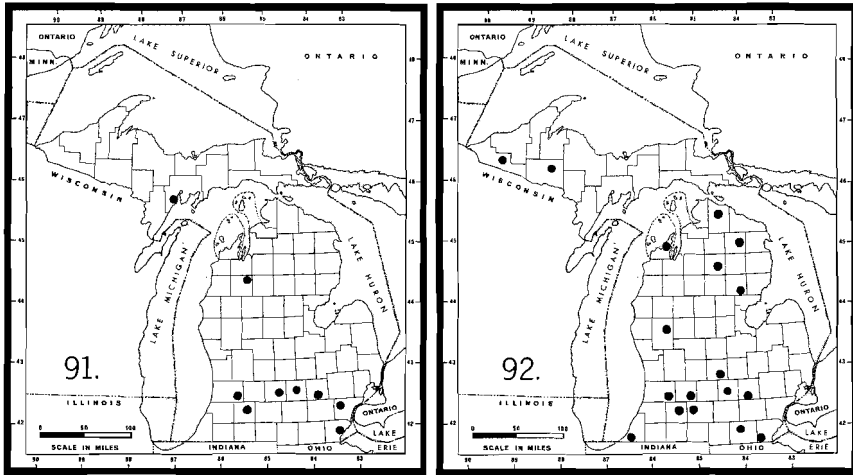


Fig. 91, *Pseudosinella violenta* (Folsom). Fig. 92, *Lepidocyrtus cinereus* (Folsom).

**cyaneus** Tullberg. LP and UP: (Fig. 93); Feb. 15-Sept. 8.

A striking blue species with yellow legs and furcula. The scales of living specimens have a bronze cast when observed in bright light. At one time it was easily confused with *violaceus* because color alone was used as a distinguishing character. *L. cyaneus* lacks scales on the legs and first two segments of the antennae, thus placing it in a group apart from *violaceus*. Habitats preferred by this species include leaf and pine litter, under loose bark, tall grass, and some mosses. The February record came from a bog in Barry County. Common throughout the state.

**guthriei** Maynard. LP: Ottawa; Oct. 15.

With its yellow head and bright blue body, *L. guthriei* is readily identified. The only specimen taken in Michigan came from the city of Holland on, of all things, a windmill. Not common.

**helenae** Snider. LP: (Fig. 94); April 2-Sept. 7.

Recently described from the State, this species is probably common throughout the lower peninsula. It was easily overlooked in our collections because it somewhat resembled *violaceus*. Collections were made from pine and leaf litter, moss, a mouse nest, and loose soil. The species is very common in Monroe County woodlots.

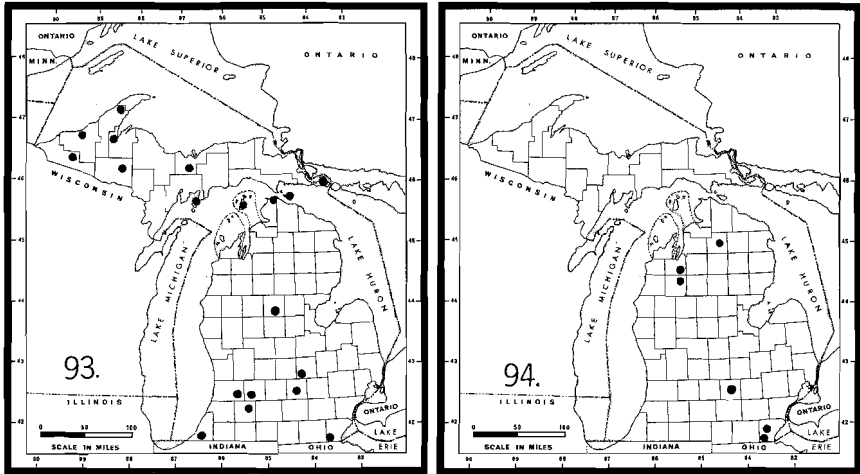
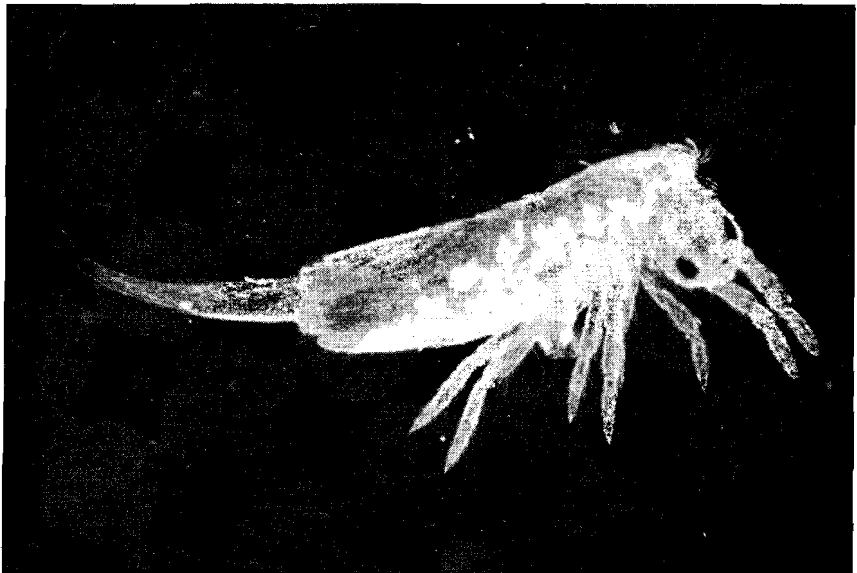


Fig. 93, *Lepidocyrtus cyaneus* (Tullberg). Fig. 94, *Lepidocyrtus helenae* Snider.

*lanuginosus* (Gmelin). SLP: Mourue, Ingham, Barry. NLP: Roscommon, July 5-Sept. 27.

Habitats where this species has been located are grass, leaf litter, and loose soil. Not common.



*Lepidocyrtus lanuginosus* (Gmelin). Photo by Coleman.

**lignorum** (Fabricius). LP and UP: (Fig. 95); May 30-Aug. 27.

This not uncommon species inhabits tall grass, bogs, and leaf litter. As more intensive collecting is done, I am sure this will prove to be a common species in our state.

**pallidus** (Reuter). SLP: Monroe, St. Joseph, Ingham. NLP: Lake, Otsego, Wexford. April 29-Aug. 30.

This species, with its light dusting of violet pigment, is rather drab compared to other members of the genus. It has been taken in dry sandy fields, loose soil, grass sweepings and under bark. Not a very common species, usually in association with *violaceous*.

**paradoxus** Uzel. SLP: (Fig. 96); April 21-Sept. 27.

An easily identified species because of its dark blue color, large size (3mm) and pronounced cone-shaped mesonotum. Most often it has been taken in grass sweepings, litter samples and loose soils. Pit traps are a very good method of capturing this active species. Common in the southern lower peninsula.

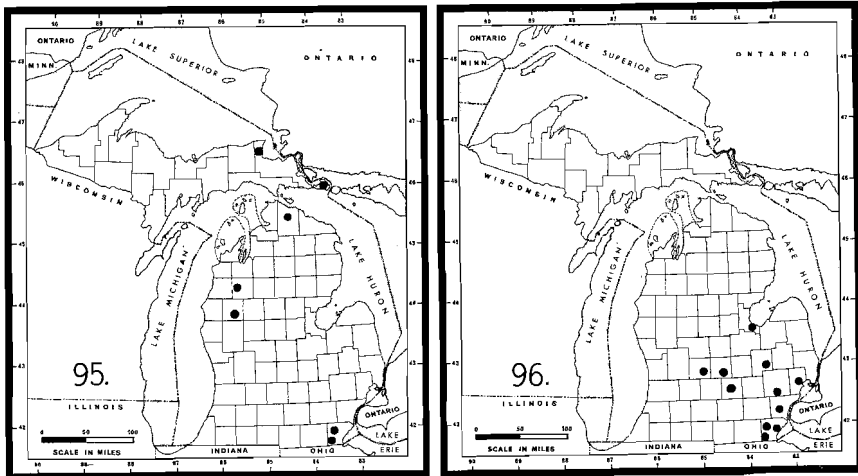


Fig. 95, *Lepidocyrtus lignorum* (Fabricius). Fig. 96, *Lepidocyrtus paradoxus* Uzel.

**unifasciatus** James. LP and UP: (Fig. 97); March 28-Sept. 27.

An outstanding species in the field, whose blue 'saddle' across the abdomen makes it recognizable to the collector. Its habitats include leaf and pine litter, grass, loose bark, bogs, and loose soils. Not an uncommon species, especially in the lower peninsula.

**violaceous** (Geoffroy). LP and UP: (Fig. 98); Feb. 15- Sept. 27.

Collected from sphagnum moss, under rocks, loose bark, leaf and pine litter, grass, and loose soil. Common.



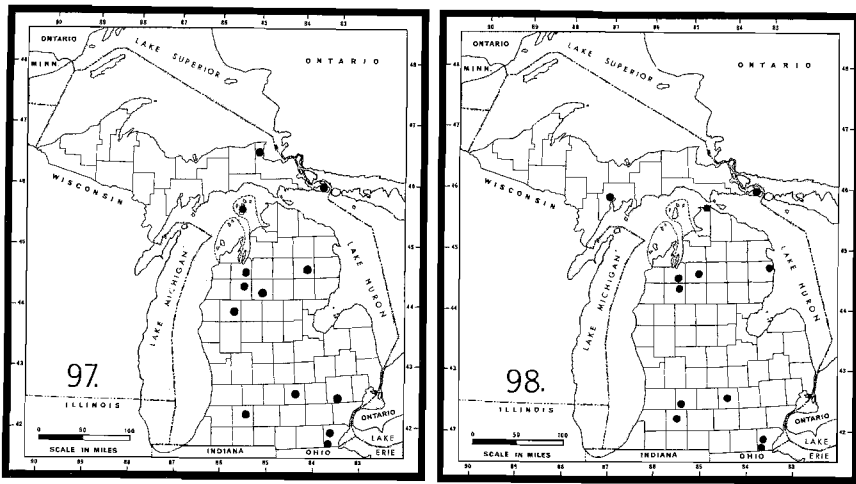


Fig. 97, *Lepidocyrtus unifasciatus* James. Fig. 98, *Lepidocyrtus violaceus* (Geoffroy).

Family ISOTOMIDAE  
Subfamily ANUROPHORINAE

Genus **TETRACANTHELLA** Schott

**montana** Stach. SLP: Monroe; June 17.

This is the first North American record for this species. Specimens for identification came from soil cores taken from the bases of trees in hardwood lots.

Subfamily PROISOTOMINAE

Genus **FOLSOMIA** Willem  
*Key to the Michigan Species*

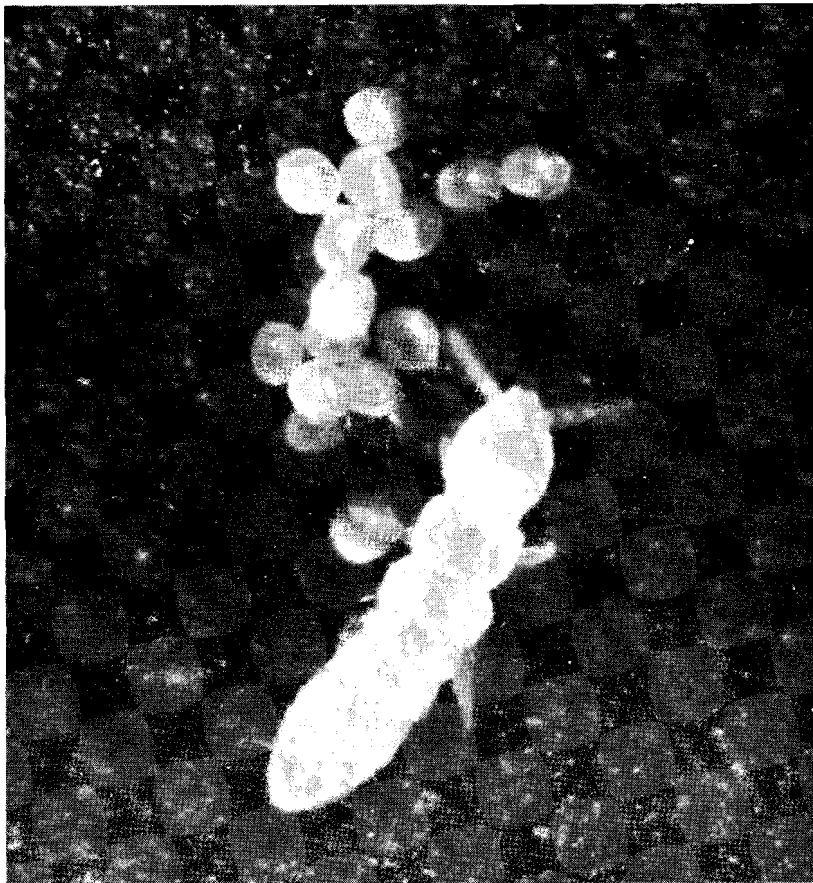
1. Ocelli reduced or absent, less than 8 to a side . . . . . 3  
Ocelli 8 to a side . . . . . 2
2. Tenent hairs present; body white, mottled with blue . . . . *silvestrii*  
Tenent hairs absent; body grayish, bluish, or brownish . . . *elongata*
3. Ocelli absent; body white . . . . . *fimetaria*  
Ocelli 4 to a side; body blackish to grey . . *quadrioculata americana*

**elongata** (MacGillivray). SLP: Lenawee; April 10. NLP: Otsego; March 20.

This species has been taken in both instances from cut-over old fields. Uncommon.

**fimetaria** (Linnaeus). LP and UP: (Fig. 99); Jan. 25-Oct. 18.

Apparently *fimetaria* is confused in what other authors call the "candida" group. Until the taxonomic status has been worked out, I shall refer to such members as *fimetaria*. Specimens have been obtained from soil cores from agricultural and forest soils, leaf litter, and a *Peromyscus* nest. Common soil species.



*Folsomia fimetaria* (Linnaeus). Photo by Shaddy.

**quadriculata americana** Stach. SLP: Van Buren; June 24. NLP: Wexford; June 30.

This subspecies has been taken in leaf and pine litter. Not common in our collections.

**silvestrii** Folsom. SLP: Barry; Feb. 15. NLP: Wexford, Grand Traverse; July 28-Sept. 21.

Cold weather does not seem to alter the activity of this species. The Barry County specimens were taken from frozen Purdy Bog litter. Other habitats were leaf and pine litter.

Genus **HYDROISOTOMA** Stach

**schafferi** (Krausbauer). SLP: Barry, Kalamazoo, Shiawassee; April 18-Dec. 1.

The first Michigan specimens were collected in Purdy Bog, Barry County by J. H. Graffius, who was amazed that he had found them under three inches of ice on the water surface. This is a species which is aquatic and tolerant of cold. Krausbauer reports specimens taken from leaves under ice at less than 0° C. All of the Michigan specimens have come from ponds surrounded with mosses or dense plant material where the temperatures were cool. Not common.

Genus **PROISOTOMA** Börner

*Key to the Michigan Species*

- 1. Ocelli 8 to a side; gray to bluish . . . . . *minuta*  
     Ocelli 5 to a side; white, sometimes with black stippling . . . . .  
     . . . . . *sepulcralis*

**minuta** (Tullberg). SLP: Kalamazoo, Ingham; Jan. 24-Oct. 18.  
A common species of soil and litter.

**sepulcralis** (Folsom). SLP: Ingham; April 21.

Not very often encountered in collections. Our specimens were found by J. H. Shaddy in soil cores from Baker Woodlot on the M.S.U. campus. Folsom (1937) reports that *sepulcralis* "is a species of the soil. Though the specimens that I examined in preparing the original description numbered more than 5,400, they are the only examples of the species that I have ever seen. They were collected from graves in Washington, D.C., during the summers of 1896 and 1897. . . ." Not common.

Subfamily: ISOTOMINAE

Genus **ARCHITOMOCERURA** Denis

**crassicauda** Denis. SLP: Ingham; May 5.

There is much argument as to whether this is a valid species or an immature tomocerid. I am inclined to agree with those who consider it a valid species. Specimens were taken from cores in Baker Woodlot.

Genus **ISOTOMURUS** Börner

*Key to the Michigan Species*

- 1. Body yellow-green or green . . . . . *palustris prasinus*  
     Body color variable, with median dorsal stripe . . . . . 2

2. Body without dark bands . . . . . *palustris palustris*  
 Body with dark bands on the posterior of the segments . . . . .  
 . . . . . *palustris balteatus*

***palustris palustris*** (Müller). LP and UP: (Fig. 100); March 5-Oct. 8

This common species is generally associated with aquatic situations. It may assume various colors and patterns, but never has dark bands and is never unicolorous. It has been collected in habitats which include lake shorelines, detritus of beaches, swamps, muck, roadside ditches, wet grass, leaf litter, and under logs. Bright, sunny days seem to yield the best collections. (See front cover illustration.)

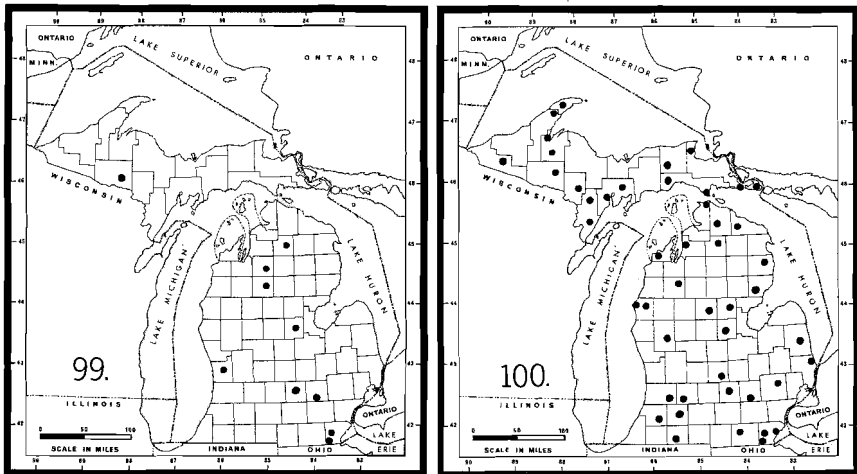


Fig. 99, *Folsomia fimetaria* (Linnaeus). Fig. 100, *Isotomurus palustris palustris* (Müller).

***palustris balteatus*** (Reuter). SLP: Ingham, Kalamazoo; May 16-July 6. UP: Houghton; July 12. (See back cover illustration.)

Although this subspecies has been rarely taken in nature, I have nevertheless found it in greenhouses by the thousands. Not common.

***palustris prasinus*** (Reuter). SLP: Kalamazoo; June 24. NLP: Roscommon; June 20.

I have seen this subspecies only once on the surface of a pond. The other record is from the Dreisbach collection and has no habitat notation.

Genus **ISOTOMA** Bourlet  
 Key to the Michigan Species

1. *Mucrones tridentate* . . . . . 5  
*Mucrones quadridentate* . . . . . 2
2. Large species (max. length 6 mm); unguis with teeth . . . . *viridis*  
 Small species (max. length 1.5 mm); unguis usually without teeth  
 . . . . . 3
3. Ocelli 8 to a side . . . . . 4  
 Ocelli 4 to a side . . . . . *eunotabilis*
4. Postantennal organ elongate and narrow; body white with black spots  
 . . . . . *difficilis*  
 Postantennal organ oval; body gray to bluish, sometimes blackish,  
 with pale intersegmental bands . . . . . *trispinata*
5. Color white to yellow . . . . . *albella*  
 Color variable, usually with dark pigment . . . . . 6
6. Body purple with a black patch on head, abdominal segments II and  
 III with white bands . . . . . *nigrifrons*  
 Color not as above . . . . . 7
7. Color dark purple, blue, or clear purple . . . . . *violacea*  
 Color yellow with brownish mottling, sometimes a touch of blue be-  
 coming greenish in alcohol . . . . . *olivacea*

**albella** (Packard). LP and UP: (Fig. 101); April 11-Oct. 21.  
 A cortical species that is occasionally found in leaf and pine litter.  
 The bark must be moist in the underside for this species to survive.  
 Common throughout the state.

**difficilis** (Folsom). SLP: Monfoe, Ingham; April 21-June 17.  
 Folsom (1937) reported taking this species during February in leaf  
 litter. We have recovered the species from cores taken in field and  
 forest conditions with plant cover.

**eunotabilis** (Folsom). SLP: Monroe, Ingham, Kalamazoo, Livingston;  
 April 14-Sept. 27. UP: Gogebic.  
 Large numbers taken from pine litter in the Kellogg Forest. Other  
 habitats collected were leaf litter and cores of loose soil from grassy  
 areas in woodlots.

**nigrifrons** Folsom. SLP: Clinton, Ingham; March 18-April 12.  
 Folsom (1937) reports this species from moss on a rocky bluff.  
 The Michigan specimens came from under bark. Not common.

**olivacea** Tullberg. LP and UP: (Fig. 102); April 29-Sept. 7.

An extremely cosmopolitan species, which Folsom reports as a summer species. It prefers damp conditions and has been taken on puddles of water. The habitats from which it has been recovered include under loose bark, leaf litter, and loose soil. Common.

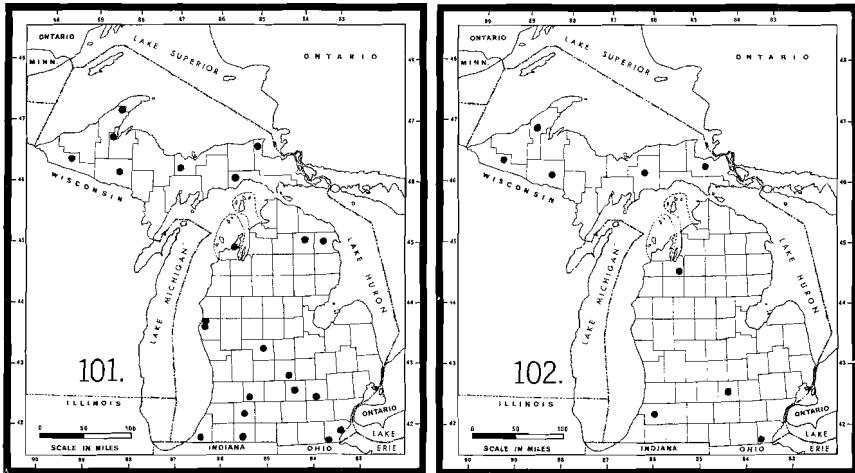


Fig. 101, *Isotoma albella* (Packard). Fig. 102, *Isotoma olivacea* Tullberg.

**trispinata** MacGillivray. LP and UP: (Fig. 103); April 21-Oct. 21.

Known from pine and leaf litter, lakeshores, and loose soil. Common.

**violacea** Tullberg. SLP: Monroe; Sept. 3. Chippewa; May 30.

This species is one which may be taken in the winter. It has been collected in spruce and leaf litter. Not common.

**viridis** Bourlet. LP and UP: (Fig. 104); Feb. 15- Oct. 21.

This species is one of our most abundant collembolans in North America. Folsom (1937) reports that adults may be found all year round. A moist environment dictates where *viridis* will be found. Collections have been made in leaf and pine litter, grass, lakeshores, bogs, and moist loose soils. Common.

#### Genus **VERTAGOPUS** Börner

##### *Key to the Michigan Species*

1. Furcula long, extending to the ventral tube; ocelli equal in size; blackish or purple . . . . . *arborea*
2. Furcula short, extending to the second abdominal segment; ocelli unequal in size; yellowish, bluish or green . . . . . *cinerea*

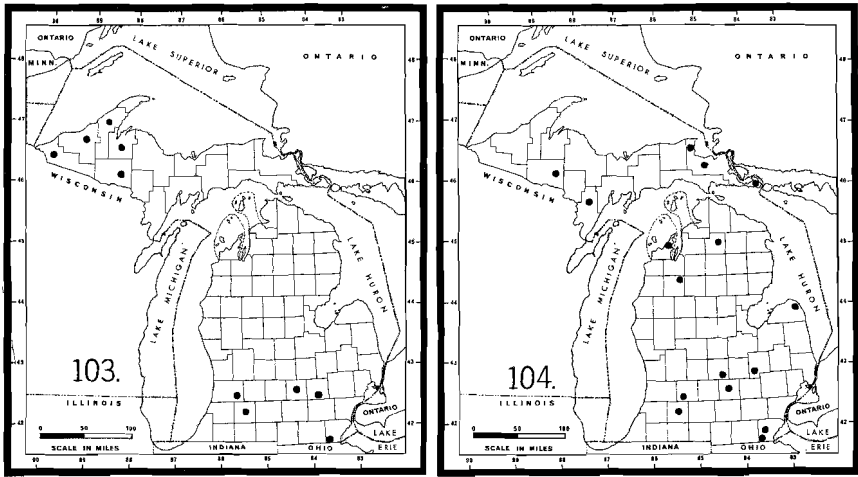


Fig. 103, *Isotoma trispinata* MacGillivray. Fig. 104, *Isotoma viridis* Bourlet.

**arborea** (Linnaeus). SLP: Monroe, Ingham; April 21-June 23.

Folsom (1937) described this species from under loose bark. Our specimens were collected in loose soil and grass within Baker Woodlot.

**cinerea** (Nicolet). SLP: Berrien, Kalamazoo, Monroe; June 23-July 2. NLP: Grand Traverse; July 28. UP: Chippewa (Drummond Island); July 7.

This species is commonly taken under bark and in pine and leaf litter. It prefers moist conditions.

Genus **ISOTOMINELLA** Delamare-Deboutteville

**minor** Schaffer: SLP: Kalamazoo; June 24.

I have only seen one collection of this species, from pine litter in Kellogg Forest.

Family TOMOCERIDAE  
Genus **TOMOCERUS** Nicolet  
*Key to the Michigan Species*

1. Spines of the dentes toothed (Fig. 59c) . . . . . *minor*  
Spines of the dentes smooth (Fig. 59b) . . . . . 2
2. Dentes with scale-like spines at inner base (Fig. 59a) . . *flavescens*  
Dentes without scale-like spines at inner base . . . . . 3

3. Mucro with a lamella (seen in side view) extending from the anteapical tooth to the basal tooth, intermediate teeth present; color off-white with blue mottling (Fig. 61) . . . . . *lamelliferus*  
 Mucro without a lamella; color white with gray mottling . . . *vulgaris*

**flavescens** (Tullberg). LP and UP: (Fig. 105); Feb. 15-Dec. 31.

One of the most cosmopolitan species in North America. Its large size and long antennae, which can be coiled, make this an interesting species to observe in the field. I have had success in collecting *flavescens* under bark. Other habitats which have been collected include pine and leaf litter, along lakeshores, in sphagnum moss, under boards and in pit traps set in forest areas. Common.

**lamelliferus** (Mills). SLP: Livingston; June 4.

Dr. Mills determined the single specimen taken in Michigan. Not common.

**minor** (Lubbock). UP: Ontonagon; July 10.

This species was taken twice on the same date: White Pine Mine and Fire Steel River. The habitats collected were under paper lying in grass and under a post. Not common.

**vulgaris** (Tullberg). LP and UP: (Fig. 106); March 20-Sept. 3.

A widely distributed species in North America. It has been taken in leaf litter, under bark, sandy field, and along lakeshores. Not common.

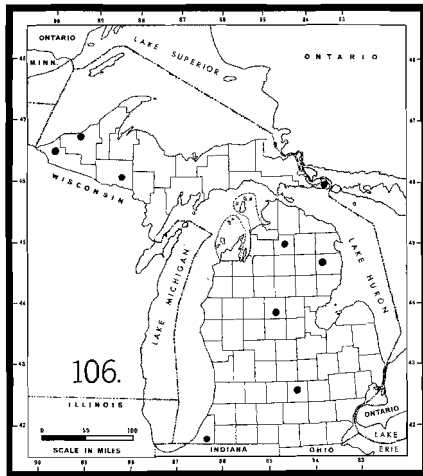
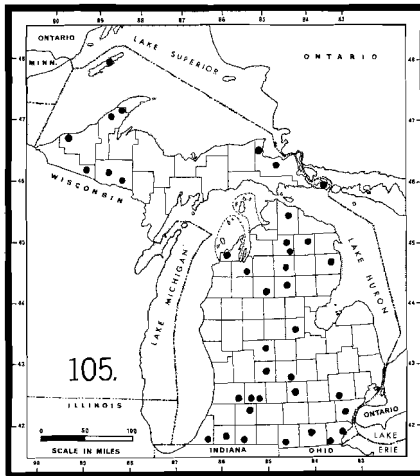


Fig. 105, *Tomocerus flavescens* (Tullberg). Fig. 106, *Tomocerus vulgaris* (Tullberg).



Suborder METAXYPLEONA  
Family PODURIDAE  
Genus **PODURA** Linnaeus

**aquatica** Linnaeus. LP and UP: (Fig. 107); April 9-Oct. 16.

A species which is active in the spring. On warm sunny days it can be seen in large numbers on the surfaces of ponds. Areas where collections are made include swamps, pond surfaces, beaches, and in moist areas along streams. Common.

Suborder SYMPHYPLEONA  
Family NEELIDAE  
Genus **NEELUS** Folsom

*Key to the Michigan Species*

- 1. Dentes five toothed; color ochraceous-buff . . . . . *murinus*
- 2. Dentes six toothed; color bluish-gray . . . . . *minutus*

**minutus** Folsom. SLP: Barry; Aug. 7

Folsom (1901) reported this species from black soil of a pine forest, the immatures occurring in early July. Maynard (1951) reports that it was common on sticks lying on the ground in a woods. I have seen this species only from a sphagnum bog situation only once. Not common.

**murinus** Folsom. SLP: Ingham; July 12.

This species has previously been reported from greenhouse soil, I have collected specimens from agricultural soil. It seems to require relatively high humidity to maintain its existence in the soil. Not common.

Genus **MEGALOTHORAX** Willem

**albus** Maynard. SLP: Oakland, Ingham; May 5-Sept. 6.

I have taken specimens from leaf litter and woodland soil cores. This species is more common than either species of *Neelus*.

Family SMINTHURIDAE  
Subfamily SMINTHURIDINAE  
Genus **SMINTHURIDES** Börner

*Key to the Michigan Species*

- 1. Unguiculus of metathoracic legs divided into branches in female (Figs. 57-58) . . . . . 2
- Unguiculus of metathoracic legs simple . . . . . 3

2. In male, heavy tooth supports outer dorsal lamella of mucro; yellow with median dorsal stripe and lateral dark stripes . . . . . *bifidus*  
In male, tooth of mucro missing; yellow, with lateral violet stripe  
. . . . . *penicillifer*
3. Fourth antennal segment of female simple . . . . . 4  
Fourth antennal segment of female divided into secondary segments  
. . . . . 5
4. Subapical needle of unguiculus not reaching tip of the claw in pro- and mesolegs; mucro half as wide as long . . . . . *aquaticus*  
Subapical needle of unguiculus reaching beyond tip of claw in pro- and mesolegs; mucro a third as wide as long . . . . . *malmgreni*
5. Fourth antennal segment with four subsegments . . . . . 6  
Fourth antennal segment with five subsegments . . . . . *lepus*
6. First antennal segment as long as the fourth . . . . . *assimilis*  
First antennal segment longer than the fourth . . . . . *occultus*

**aquaticus** (Bourlet). SLP: Barry; Aug. 7. NLP: Oscoda; Sept. 3.

Although Maynard (1951) reports this species as common, I have had little success in collecting it. It has been taken twice; on the surface of a swamp pond and in sphagnum moss. Not common.

**assimilis** (Krausbauer). SLP: Ingham, Clinton, Shiawassee; May 6-June 14.

This species has been known to occur in large numbers in greenhouses. The collections made in Michigan came from forest, in litter. Not uncommon.

**bifidus** (Mills). NLP: Wexford, Alcona; Aug. 23-Sept. 3. UP: Chippewa (Drummond Island); July 7.

Mills (1934) records this species from the surface of stagnant water. I have taken it on pond surfaces, stream banks, and on a beach. Not common.

**lepus** Mills. SLP: Kalamazoo, Monroe, Ingham; April 29-Aug. 19. NLP: Wexford; Aug. 23-Sept. 21. UP: Chippewa; May 30.

Mills (1934) reports that *lepus* may be taken from humus and moss. The habitats where it has been taken in Michigan differ somewhat by having rather low humidity conditions. Areas where collections were successful include pine and leaf litter, sphagnum bog and pit traps set in the forest floor. Not uncommon.

**malmgreni** (Tullberg). UP and LP: (Fig. 108); April 18-Sept. 3.

A species found in semiaquatic habitats. Samples have been taken

from pond surfaces, along river banks, moss, sphagnum bogs and woodland litter. Common.

**occultus** Mills. LP and UP: (Fig. 109); April 29-Aug. 25.

A semi-aquatic species which has been collected along river banks, on beaches, and in bogs. Common.

**penicillifer** (Schäffer). SLP: Ingham; April 29. NLF: Grand Traverse; April 2.

Only two collections have been made in bog areas. Probably not an uncommon species.

Genus **SPHAERIDIA** Linnaniemi

**pumilis** (Krausbauer). SLP: Monroe, Kalamazoo, Ingham; April 14-Aug. 16. NLP: Wexford; Sept. 7.

Mills (1934) reported this species from humus. Maynard (1951) took a single specimen from lawn sweepings. The Michigan collections have yielded substantial numbers from pine and leaf litter, cores in grassy areas, and in pit traps.

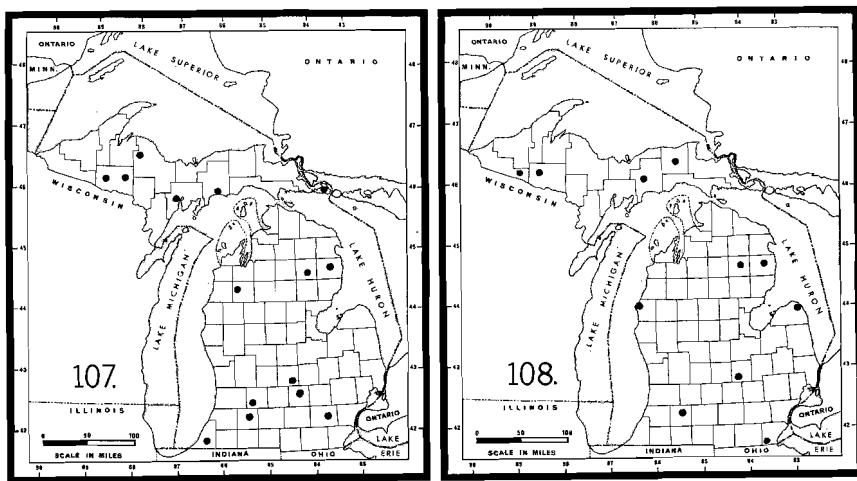


Fig. 107, *Podura aquatica* Linnaeus. Fig. 108, *Sminthurides malmgreni* (Tullberg).

Subfamily SMINTHURINAE  
 Tribe ARRHOPALITINI  
 Genus **ARRHOPALITES** Börner  
*Key to the Michigan Species*

1. Anal valves with minute spines mixed with normal setae . . . *caecus*
- Anal valve without such spines . . . . . 2

2. Subanal appendage of female simple (Fig. 49) . . . . . *pygmaeus*  
 Subanal appendage of female palmate or branched (Fig. 51) . . . . . 3
3. Unguis with an outer tunica (Fig. 56) . . . . . *dubius*  
 Unguis without an outer tunica . . . . . *benitus*

**benitus** Folsom. LP and UP: (Fig. 110); April 14–Oct. 25.

According to Christiansen (1966), *benitus* is about the only species of *Arrhopalites* that can be considered common. It has been collected in rotten wood, under logs, soil cores, leaf litter, and pine litter. High humidity is necessary for this species. Common.

**caecus** (Tullberg). SLP: Kalamazoo, Ingham; June 23–Aug. 10.

Collected from pine litter and core samples in moist forest habitats. Not common.

**dubius** Christiansen. SLP: Monroe, Ingham; Jan. 24–Aug. 24.

Christiansen (1966) states that this may be a geographic variation of *pygmaeus*. These are the first records outside of caves in North America. Our specimens came from soil cores taken in deciduous forests. Not common.

**pygmaeus** (Wankel). SLP: Ingham; April 12.

Christiansen (1966) mentions this as a typical cave collembolan, but occasionally occurs epigeically. I have seen only one specimen from a soil core. Not common.

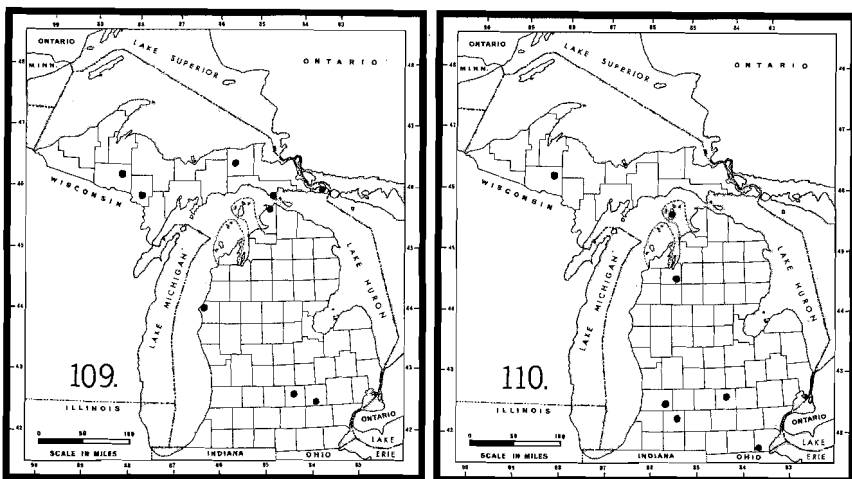


Fig. 109, *Sminthurides occultus* Mills. Fig. 110, *Arrhopalites benitus* Folsom.

Tribe KATIANNINI  
 Genus **SMINTHURINUS** Börner  
 Key to the Michigan Species

1. One edge of mucro serrated . . . . . 2  
 Both edges of mucro serrated (Fig. 63) . . . . . 6
2. Abdomen uniformly colored . . . . . 4  
 Abdomen with white or yellow-white patches and/or dark longitudinal bands . . . . . 3
3. Abdomen white or off-white with five longitudinal dark stripes . . . . .  
 . . . . . *elegans*  
 Abdomen purple-black with a large white macula on either side and sometimes a light area dorsally . . . . . *bimaculatus*
4. Color black . . . . . *minutus*  
 Color not black, rather light . . . . . 5
5. Ungues without an inner tooth; speckled with purple . . *latimaculosus*  
 Ungues with 3 inner teeth; yellow to yellow-brown . . . . . *aureus*
6. Ungues with a lateral serration . . . . . 7  
 Ungues without a lateral serration . . . . . 9
7. Body with one pair of yellow-white spots on a purple-black background . . . . . *quadrimaculatus maynardi*, NEW NAME  
 Body with two pair of yellow-white spots . . . . . 8
8. Body color purple-black . . . . . *quadrimaculatus quadrimaculatus*  
 Body pink-orange and brown . . . . . *quadrimaculatus latipictus*
9. Basal papilla of third antennal segment simple; color dark brown (Fig. 13) . . . . . *brunneus*  
 Basal papilla subdivided into 4 parts (Fig. 12) . . . . . 10
10. Head and body black; mucro serrated, course . . . . . *niger*  
 Head with yellow-white pigment, abdomen bluish-black; mucro serrated, fine . . . . . *igniceps*

**aureus** (Lubbock). SLP: Monroe, Barry, Kalamazoo, Ingham; Feb. 15-July 26.

Maynard (1951) mentions this is a common woodland species throughout the year. The habitats where collections have been made include sphagnum bogs, pine and leaf litter. Not common.

**bimaculatus** Axelson. SLP: Ingham: April 29.

This is the first North American record of this outstanding species.

I have taken only a single specimen from a bog in the Dansville State Game Area. Not common.

**brunneus** Maynard. SLP: Monroe, Kalamazoo, Ingham; April 28-Sept. 3  
NLP: Grand Traverse; April 2-July 28.

Not uncommon in forest areas. Found in leaf and pine litter. Some specimens taken from moss scrapings.

**elegans** (Fitch). LF and UP: (Fig. 111); April 14-Sept. 6.

A common species which sometimes appears in a darkly colored form. Collections have been made in grass, cement steps, *Taraxacum* flowers, pine and leaf litter. A sun-loving species.

**igniceps** (Reuter). SLP: Monroe; June 17 and 29).

At first glance *igniceps* could be confused with *niger*. However, the latter species has an all-black head. *S. igniceps* seems to be a litter-inhabiting species. Not common. This Palearctic species has not previously been recorded from Michigan.

**latimaculosus** Maynard. SLP: Monroe, Kalamazoo; June 10-Aug. 13.

I have only seen a few specimens of this species in the State. The largest collections came from pine litter in Kellogg Forest. One sample of leaf litter from Monroe County yielded a few specimens. Not common.

**minutus** (MacGillivray). SLP: Monroe; June 29.

Taken in grass cores and leaf litter. Not common.

**niger** (Lubbock). LP and UP: (Fig. 112); March 20-Sept. 8.

This species could prove to be quite common in Michigan. When rough sorting of samples is being done, care should be taken not to confuse this species with the dark form of *elegans*.

**quadrимaculatus quadrимaculatus** (Ryder). SLP: Lenawee, Kalamazoo, Ingham; May 13-July 31. NLP: Wexford; Sept. 7. UP: Chippewa (Drummond Island); July 7.

This species has been taken from rotten logs, under loose bark, grass sweepings, and in leaf litter. Not common.

**quadrимaculatus maynardi** NEW NAME. NLP: Leelanau; Aug. 24. UP: Marquette, Alger; Sept. 8-15.

Collected under bark and in *Polyporus* caps. I here propose the sub-specific name *maynardi* as a replacement for *bimaculatus* Maynard, 1951, which is a junior primary homonym of *bimaculatus* Axelson, 1902.

**quadrимaculatus latipictus** Maynard. SLP: Lenawee; July 13. NLP: Arenac, Crawford; Sept. 2-4.

Collections were made under bark. Not common.

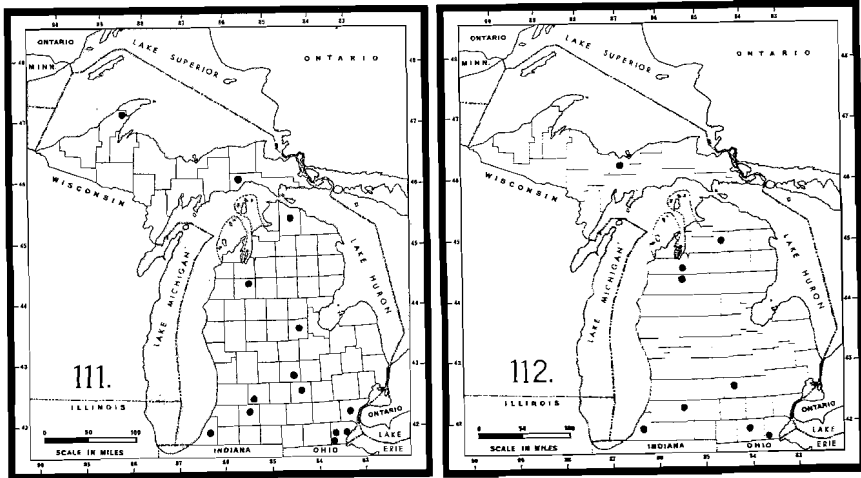


Fig. 111, *Sminthurinus elegans* (Fitch). Fig. 112, *Sminthurinus niger* (Lubbock).

Tribe SMINTHURINI  
Genus **SMINTHURUS** Latreille  
Key to the Michigan Species

- 1. Mucronal bristle absent. . . . . *medialis*  
Mucronal bristle present (Fig. 70b) . . . . . 2
- 2. Body pale yellow-green . . . . . *fitchi*  
Body other than above . . . . . 3
- 3. Body with 3 longitudinal stripes . . . . . *trilineatus*  
Body with mosaics of colors . . . . . *facialis*

**facialis** Banks. SLP: Jackson; June 14. NLP: Midland, Grand Traverse; June 16-July 28.

If any of the North American species of Collembola can be called rare, this one should probably be considered as such. It has been collected in Washington, D.C., New York and now Michigan. Only a few specimens are extant for description, but the characteristic color pattern makes it easily identifiable. Collected in litter and tree foliage. Rare. (See photo on next page.)

**fitchi** Folsom. JP: Keweenaw (Isle Royale); July 12.

A single specimen taken from a swampy situation. Not common.

**medialis** Mills. SLP: Berrien, St. Joseph, Calhoun, Kalamazoo, Ingham; April 29-July 25.

I believe these to be the first records of this species east of Iowa. Grass sweepings, alfalfa sweepings and sphagnum have yielded good numbers of *medialis*. Probably not uncommon.

**trilineatus** Banks. SLP: Monroe; June 10-Sept. 3. UP: Schoolcraft; July 3.

This species goes uncollected for long periods of time. Until recently only two collections had been reported, in 1903 and 1950. Then Pedigo (1966) found it in Indiana. Using pit traps, I have found large numbers in litter. The UP sample was taken by sweeping tall grass. Probably not uncommon.



*Sminthurus facialis* Banks. Photo by Snider.

Genus **SPHYROTHECA** Börner

**minnesotensis** (Guthrie). SLP: Monroe, Ingham; June 10-Sept. 27. NLP: Leelanau; Aug. 24.

This species is typically found in woodlands. Some of our specimens came from loose agricultural soils. Probably not uncommon.

Tribe **BOURLETIELLINI**

Genus **KATIANNIA** Maynard

**macgillivrayi** (Banks). UP and LP: (Fig. 113); April 28-July 19.

This species is more common in the spring than at any other time.



Dry situations do not seem to deter large populations of this sun-loving species. Habitats include pine and leaf litter of open forest, dry soils (sand), and dry log bark. Common.

Genus **PSEUDOURLETIELLA** Stach

**spinata** (MacGillivray). LP and UP (Fig. 117); April 8-Oct. 8.

A very common semiaquatic species. Its large size and dimorphic color patterns make it an interesting subject for observation in the field. Commonly taken along river banks, shorelines of lakes, swamps, bogs or wherever water and vegetation come together.



*Pseudourletiella spinata* (MacGillivray). Photo by Coleman.

Genus **BOURLETIELLA** Banks

*Key to the Michigan Species*

- 1. Body light with brown maculae . . . . . 2  
    Body otherwise . . . . . 3
- 2. Yellow, sometimes with reddish brown on posterior . . . . . *arvalis*  
    Yellow with brown stripes laterally . . . . . *savona*
- 3. Body deep maroon with pale markings . . . . . *juanitae*  
    Body blackish, bluish, with some yellow . . . . . *hortensis*

**arvalis** (Fitch). LP and UP: (Fig. 114); April 21-Oct. 10.

A common species in well-lighted environments. I have collected it in lawns as well as forests. Habitats include: leaf litter, *Spaghnum* sp., loose bark, and flood plains. Common.



Fig. 113, *Katiannia macgillivrayi* (Banks). Fig. 114, *Bourletiella arvalis* (Fitch).

**hortensis** (Fitch). LP and UP (Fig. 115); June 24-Oct. 10.

Commonly called the "garden springtail," *hortensis* was at times an economic problem on young truck garden crops. Today we seldom hear of a serious outbreak of this species. I have collected *hortensis* on *Taraxacum* flowers on bright days. Observations revealed that when the sun was obscured, the insect migrated to the underside of the flower, returning upon the reappearance of the sun. Evidently a sun-loving spe-

cies, it can be found in tall grass, concrete walls, agricultural soils, lawns, and leaf litter exposed to sunlight. Common.

**juanitae** Maynard. SLP: Monroe, Shiawassee; June 4-29.

The few specimens collected came from leaf litter samples. Not common.

**savona** Maynard. SLP: Ingham; May 12.

Collected in a wet grass core from Baker Woodlot.

Genus **DEUTEROSMINTHURUS** Börner  
*Key to the Michigan Species*

1. Body color yellow throughout . . . . . *repandus*  
Body color not as above . . . . . 2
2. Yellow, with brick-red pigment posterior on abdomen . . . . . *russata*  
Pale yellow with purple or brownish pigments . . . . . *fallonae*

**fallonae** (Maynard). SLP: Barry, Kalamazoo; July 15-Aug. 4. NLP: Wexford; June 30-Sept. 7.

Found in grass sweepings and pine-leaf litter. Not uncommon.

**repandus** (Agren). SLP: Monroe, Allegan, Ingham; June 5-July 31. NLP: Wexford, Roscommon, Midland; June 20-Aug. 27.

Commonly found in litter samples. Collections have been made from grass sweepings and on a concrete wall. Probably not uncommon.

**russata** (Maynard). LP and UP (Fig. 116); April 28-Sept. 7.

An attractive species which can be confused with *Heterosmynthurus insignis* (Reuter) if care is not taken in examining the claws. *H. insignis* has a bristle-like unguiculus on the proleg. Found in grass, shorelines, litter and agricultural soil. Common.

Genus **HETEROSMINTHURUS** Stach

**insignis** (Reuter). SLP: Monroe, Ingham; April 14-June 10. NLP: Alcona; Sept. 3. UP: Chippewa (Drummond Island), Schoolcraft; July 7-8.

Found in leaf litter, on beaches, and in grass. Probably not uncommon.

Genus **NEOSMINTHURUS** Mills

**clavatus** (Banks). SLP: Ingham; Oct. 11.

We have only one collection of this species from Baker Woodlot, taken in rotten wood. Not common.

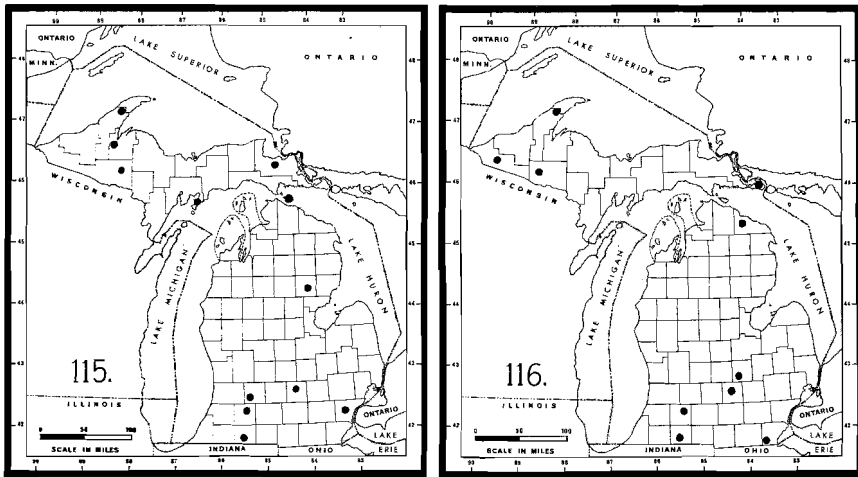


Fig. 115, *Bourletiella hortensis* (Fitch). Fig. 116, *Deuterosminthurus russata* (Maynard).

Subfamily: DICYRTOMINAE  
 Genus **PTENOTHRIX** Börner  
 Key to the Michigan Species

- 1. Abdomen pale, with dark transverse bands . . . . . *pineolae*  
 Abdomen without transverse bands . . . . . 2
- 2. Body almost uniformly colored; purple or dull red . . . . . *unicolor*  
 Body with purple and cream markings in an irregular pattern . . .  
 . . . . . *marmorata*

**marmorata** (Packard). LP and UP (Fig. 118); April 21-Sept. 27.  
 A woodland species preferring humid conditions. Found in leaf litter, pine litter, under loose bark, and stony lakeshores. Common.

**pineolae** Wray. SLP: Monroe; June 10-Sept. 27.  
 I have seen this species only in woodlots, in leaf litter. While collecting I observed some individuals on the undersides of mushrooms. Not common.

**unicolor** (Harvey). LP and UP (Fig. 119); April 21-Sept. 27.  
 A woodland species found in pine and leaf litter and under bark, while some collections were taken along shorelines. Common.

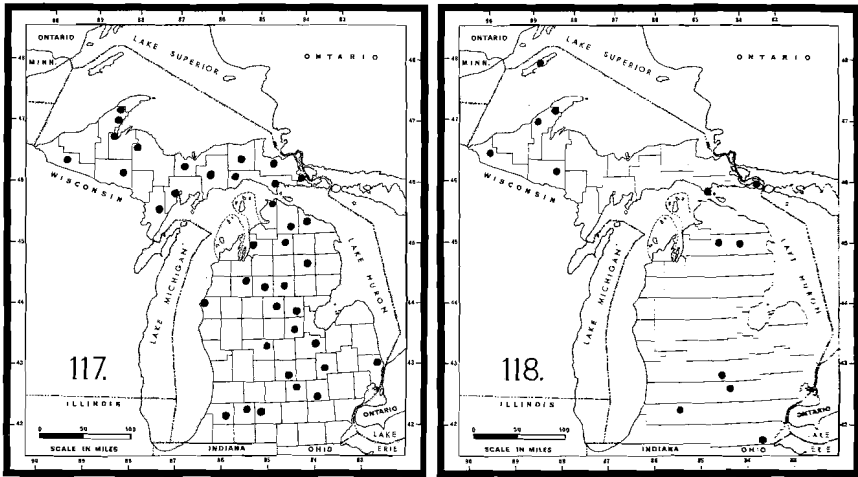


Fig. 117, *Pseudobourletiella spinata* (MacGillivray). Fig. 118, *Ptenothrix marmorata* (Packard).

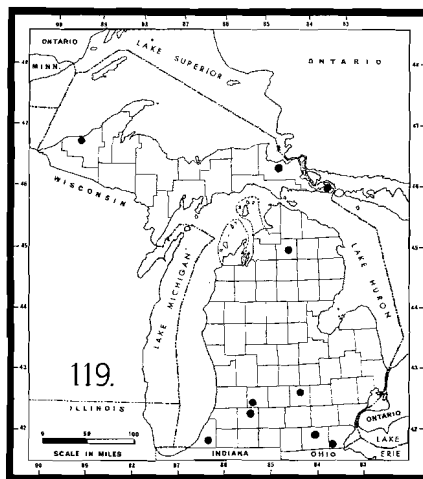


Fig. 119, *Ptenothrix unicolor* (Harvey).

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