

The Great Lakes Entomologist

Volume 2
Numbers 1/2 -- Spring/Summer 1969 *Numbers*
1/2 -- Spring/Summer 1969

Article 1

June 2017

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Manley, Gary V. 2017. "A Pictorial Key and Annotated List of Michigan Pseudoscorpions (Arachnida: Pseudoscorpionida)," *The Great Lakes Entomologist*, vol 2 (1)
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**A PICTORIAL KEY AND ANNOTATED LIST OF MICHIGAN
PSEUDOSCORPIONS (ARACHNIDA: PSEUDOSCORPIONIDA)***

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INTRODUCTION

Berlese or Tullgren funnel methods of extraction of forest litter fauna often produce minute arthropods called pseudoscorpions. These are relatively common but have received little attention. Because of the author's involvement with the Michigan State University soil zoology research project the potential significance of these animals has become a matter of interest. The Pictorial Key (Figs. 1 and 2) has been designed to assist in the identification of Michigan pseudoscorpions, and will be a useful starting point for further study of our species. Because pseudoscorpions are predaceous on many soil arthropods (Hoff, 1949), they are important in soil arthropod population dynamics, food chain and humification-fertility studies, and pesticide residue detoxication.

During this study, collecting was limited mostly to forest situations. Samples were taken from 40 counties throughout Michigan, during four major time periods. During the summer of 1963, a substantial amount of material was collected from Alpena County. In March 1966, forest litter was collected from 20 counties. In the summer of 1966, specimens were collected from Grand Traverse County and surrounding areas. In the spring of 1968, collections were made throughout the northern Lower and Upper Peninsulas.

Litter material was taken at random from a wide variety of forest habitats. When a suitable habitat was observed, the ground litter was scraped off at the soil level, and placed in plastic bags. These samples were transported to the laboratory and stored in a cool place until they could be extracted with Berlese funnels.

Before being treated, the material was allowed to warm at room temperature for two or three hours. The litter was then placed in the funnels under a 100 watt bulb until completely desiccated. As the amount of moisture varied in each sample, drying time differed considerably.

Specimens taken during March 1966 were extracted into ethylene glycol. All other specimens were extracted into 70 per cent ethyl alcohol. Specimens were cleared in lacto-phenol for at least 24 hours and placed in 70 per cent ethyl alcohol for storage until identifications could be made. Most of the specimens were examined in alcohol. Specimens which could not be determined in this manner were mounted on microscope slides in diaphane, as described by Hoff (1949).

*This study was supported by Public Health Service Research Grant CC00246 from the National Communicable Disease Center, Atlanta, Georgia and by the Michigan Agricultural Experiment Station No. 4445. The cooperation of the Entomology Research Division, U. S. D. A. is gratefully appreciated.

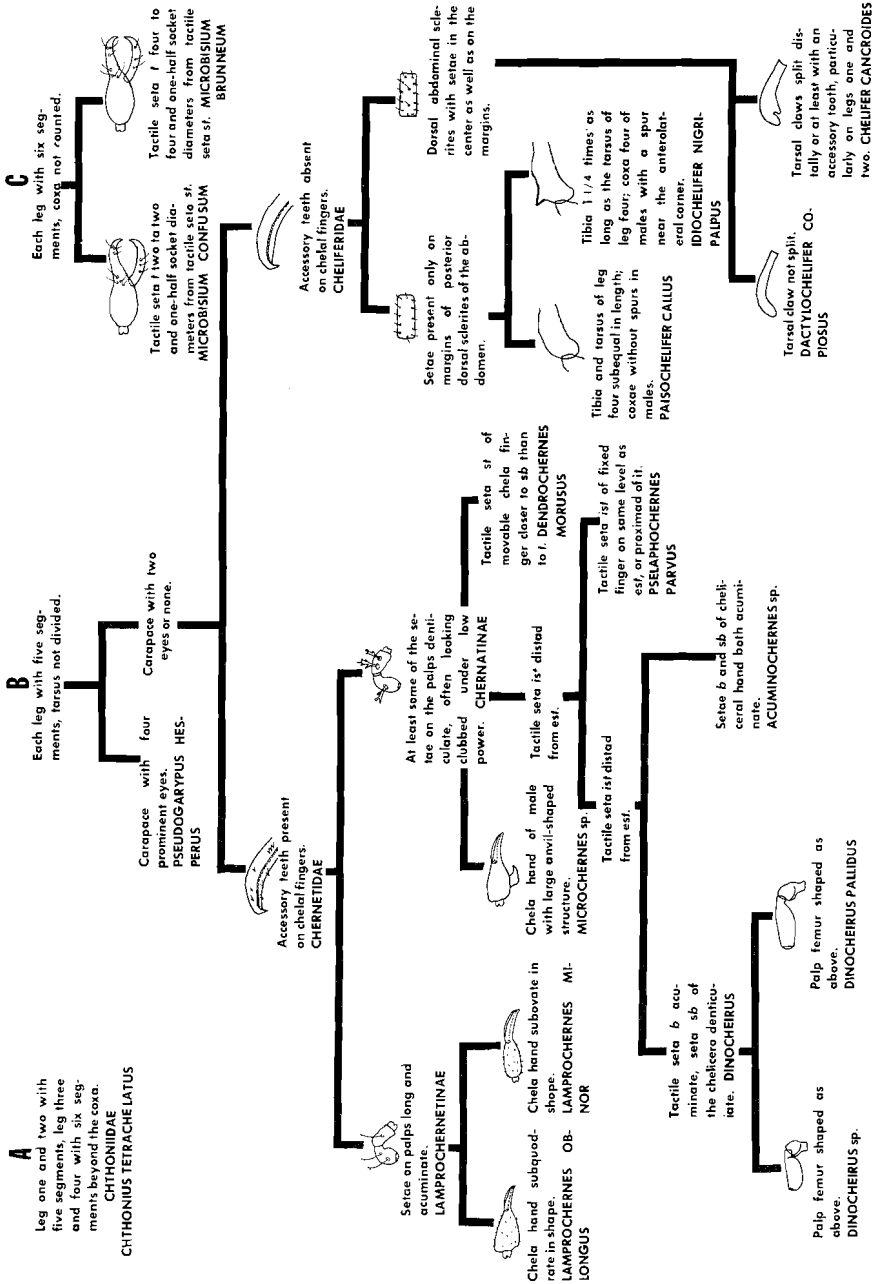


Fig. 1. Pictorial key to the pseudoscorpions of Michigan.

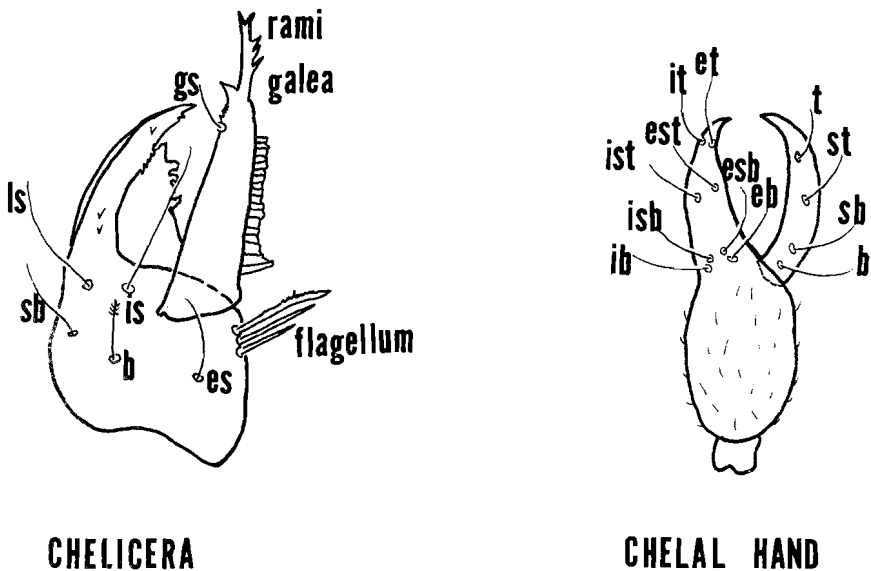


Fig. 2. Detail of taxonomic characters on the chelicera and chelal hand.

RESULTS AND DISCUSSION

Fenstermacher (1959) conducted the first survey of Michigan pseudoscorpions. The present study revealed several genera and species previously unrecorded in Michigan, as well as many new distributional records and ecological associations.

Prior to these studies, only one record of *Idiochelifer nigripalpus* (Ewing) was known for the state. *Pselaphochernes parvus* Hoff and *Dactylochelififer copiosus* Hoff, previously recorded only from the southern part of the state, are now known to exist in the northern part of the lower peninsula. For *Microbisium brunneum* (Hagen), the most northern previous record was Midland County. This species has now been collected in Grand Traverse, Alpena, and Montmorency Counties in northern lower Michigan. *Lamprochernes minor* Hoff had never been reported from farther north than Midland County, but was taken in Alpena County in these collections.

Microbisium confusum Hoff is distributed throughout the state and is probably present in all counties. This species appears to have a wide habitat tolerance and is found in many types of litter. The species was by far the most common pseudoscorpion in most of our Berlese samples and is commonly found in samples which contain microorganisms. In some cases the species may outnumber any other arthropod in the sample.

This study added considerable ecological information to our knowledge of pseudoscorpions. New habitats were recorded for some species, such as *Lamprochernes oblongus* (Say). Except for a specimen found under the elytra of a beetle (Fenstermacher 1959), Michigan ecological data had been lacking

AN ANNOTATED LIST OF MICHIGAN PSEUDOSCORPIONS

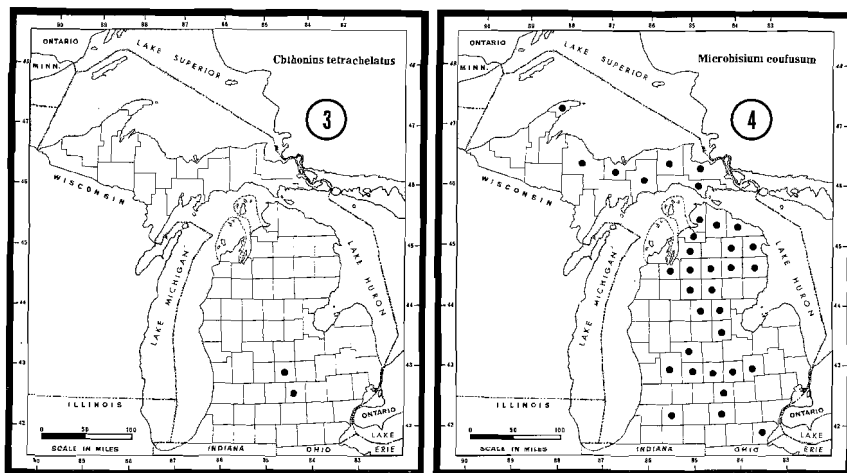
Chthonius tetrachelatus (Preysslner) (Fig. 3). Lower Peninsula (LP): April 24-August 16. This is the only species of the Order Heterosphyronida so far collected from Michigan. The species can be distinguished from others in the state by having a divided tarsus on the fourth leg and the first leg. This species has a very characteristic appearance with a long thin chela and large prominent chelicera. Its movements are faster than those of other pseudoscorpions I have observed.

C. tetrachelatus has been collected from Berlese extractions of forest litter, liverworts growing on sandstone outcroppings, and from under debris in an old barn. I have cultured this species on a diet of live Collembola.

Microbisium confusum Hoff (Fig. 4). Upper Peninsula (UP): Aug. 2-Sept. 4. LP: all year.

Since *Microbisium* is the only member of the suborder Diplosphyronida known from Michigan it can easily be distinguished from other genera. It is the only known genus in the state which lacks a "galea." *M. confusum* is separated from the closely related *M. brunneum* (Hagen) by the positioning of tactile setae on the chela fingers (Fig. 1). The femur length of *confusum* is between 2.42 and 2.89 times the width and under 0.4mm in length.

M. confusum is collected from very diverse habitats and has been taken from very dry situations, such as open fields of *Carex pensylvanica*, as well as forests, swamps, and flood plain conditions. It is by far the most abundant pseudoscorpion in litter collections. *M. confusum* is distributed throughout the midwestern and eastern United States (Fenstermacher, 1949).



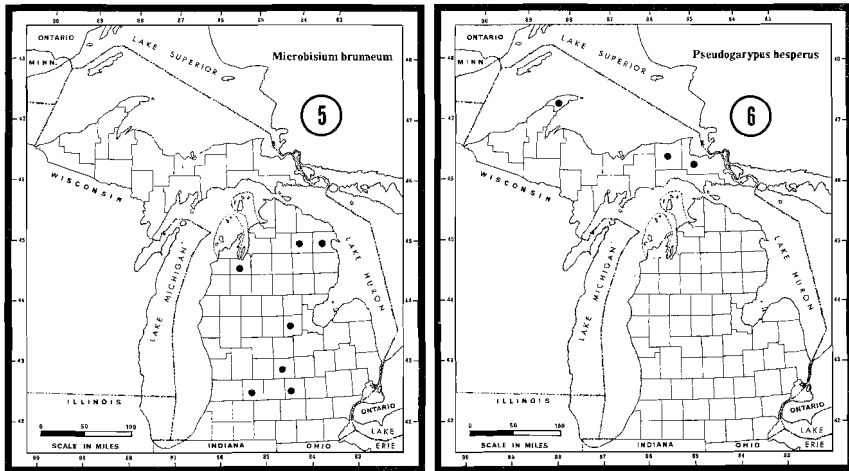
Microbisium brunneum (Hagen) (Fig. 5). LP: March-August.

This species can be separated from *M. confusum* by the placement of the tactile setae (Fig. 1). It is the larger of the two species, with the palpal femur more than 0.4mm in length and between 2.87 to 3.2 times longer than wide.

The species is most commonly taken from sphagnum bogs. It appears to be associated with acid substrates. *M. brunneum* has been collected from

sphagnum bogs, from dense moss cover beneath jack pine in northern Michigan, and from under elm bark in a flooded area near Lansing. While the species appears to be more limited in habitat diversity than *M. confusum*, it is not uncommon to find the two species in the same sample.

Pseudogarypus hesperus Chamberlin (Fig. 6). UP: April-June. This species is in the Monosphyronida, Superfamily Faealloidea, and differs from all others in the suborder by having four eyes. Previously known in Michigan from a unique female (Fenstermacher, 1949), this species has been collected in substantial numbers in widely separated areas of the Upper Peninsula. It has been collected from hollow trees, under bark, and in rotten logs in various parts of Keweenaw Co.



Lamprochernes oblongus (Say) (Fig. 7). LP: March 25-September 23.

The genus *Lamprochernes* is readily separated from other Michigan genera by accessory teeth and acuminate setae on the palps. Acuminate setae are the best spot characters for this genus. They are often denticulate near the distal end. With *L. oblongus*, and to a lesser degree *L. minor*, body form will help to separate the species. The abdomen generally is elongate and appears somewhat truncate. *L. oblongus* can be separated from *L. minor* by the shape of the chela hand (Fig. 1).

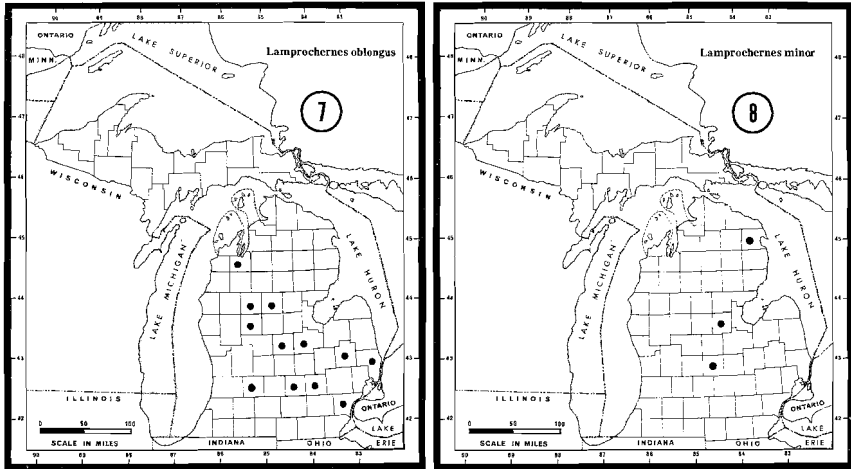
All the examined *L. oblongus* were single collections taken from under bark of dead logs and stumps. The species has been taken from and around grain bins (Fenstermacher, 1949). One *oblongus* specimen was found on June 9, 1967 in a silken cocoon under the bark of a hickory stump. When collected, the specimen had a definite blue cast. In approximately five days the exoskeleton had hardened, and the specimen assumed a typical reddish-brown color. This species is widely distributed, covering most of the eastern United States.

Lamprochernes minor Hoff (Fig. 8). LP: August 8- October 24.

This species is much like *L. oblongus* in having long acuminate setae on the palps. The two can readily be separated by the shape of the chela hand, which

is subovate in *L. minor* (Fig. 1) and subquadrate in *L. oblongus*.

Collections of this species were hitherto confined to grain bins and other situations near grain. In Alpena County several specimens were collected from under boards lying on a sawdust pile.

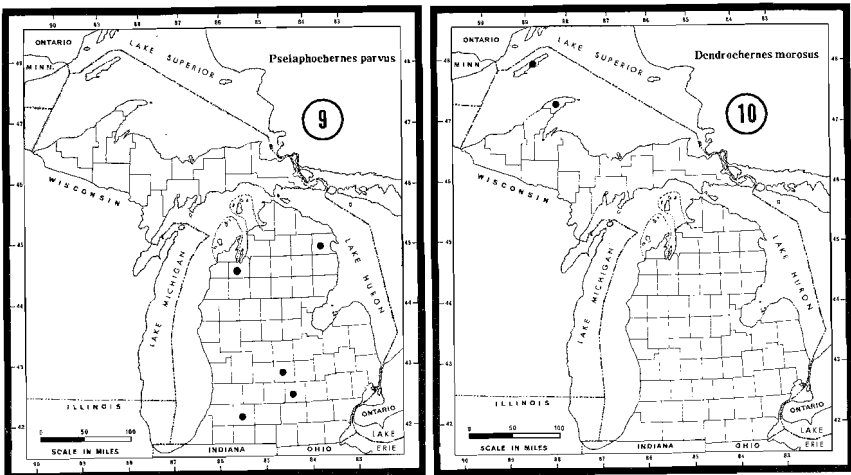


Pselaphochernes parvus Hoff (Fig. 9). LP: May 11-September 8.

This species is separated from others by the placement of tactile setae on the fixed finger of the chela (Fig. 1). *P. parvus* is of a median size. It is most commonly collected from rotten wood and forest litter. I took one specimen from a mouse nest.

Dendrochernes morosus (Banks) (Fig. 10). UP: March 11.

The species is characterized by having venom apparatus only in the movable chelal finger. Pleural membrane either rugose or granulate, and movable chelal finger with the subterminal tactile seta nearer the subbasal



than the terminal.

Previously known only from Isle Royale, several specimens were taken in 1969 from under the bark of a dead spruce on the mainland of Keweenaw Co.

Chelifer cancroides (L.) (Fig. 11). (The Domestic Pseudoscorpion) LP: all year.

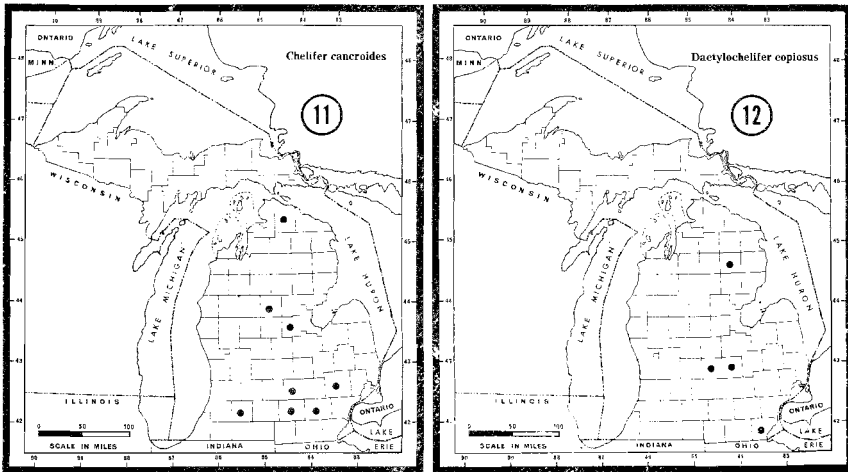
The most important characters for identification are the lack of accessory teeth, large dorsal plates with setae in the middle, plus peripheral setae and the characteristic split tarsal claw on the fourth leg (Fig. 1).

This species has a world-wide distribution, and is commonly collected in houses and such other buildings as barns and abandoned structures. *C. cancroides* is large and active. It is aggressive, and will attack and feed readily when hungry.

Dactylochelifer copiosus Hoff (Fig. 12). UP: March 22-October 14.

Superficially *D. copiosus* looks much like other species in the Cheliferinae. Like *C. cancroides*, the dorsal abdominal plates contain setae in their centers, but the species lacks the split tarsal claw.

D. copiosus is associated with forest situations where relative humidity is fairly low; apparently it can withstand extreme periods of drought. Specimens taken from Oscoda County were extracted from extremely dry "reindeer moss" in a cut-over jack-pine area.



Idiochelifer nigripalpus (Ewing) (Fig. 13). LP: all year.

The male of this species is readily identified by the large coxal spine present on the fourth coxa. The relation of the length of the tibia to the tarsus will help to separate the females of the species (Fig. 1).

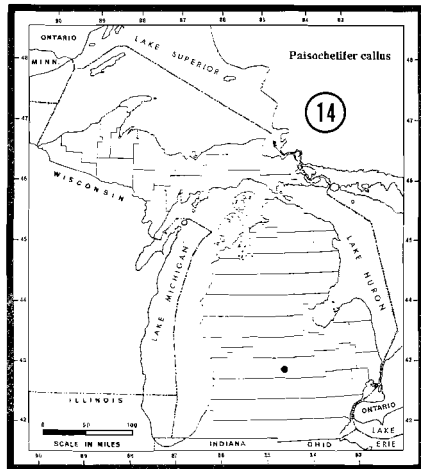
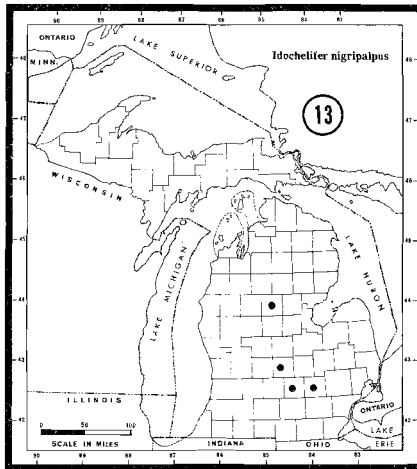
Only one record previously existed from the state, and no ecological information is available on that specimen. Hoff (1949) reported collections in Illinois from under bark, and my data support his information in Michigan.

Paisochelifer callus (Hoff) (Fig. 14). LP: October 24.

This species can be separated from other Cheliferidae, as it has dorsal abdo-

men plates with only peripheral setae and the male is without a coxal spine. Also, the tibia and tarsus of the fourth leg are subequal in length, opposed to *Idiochelifer* in which the tibia of leg four is 1-1/4 times as long as the tarsus corresponding.

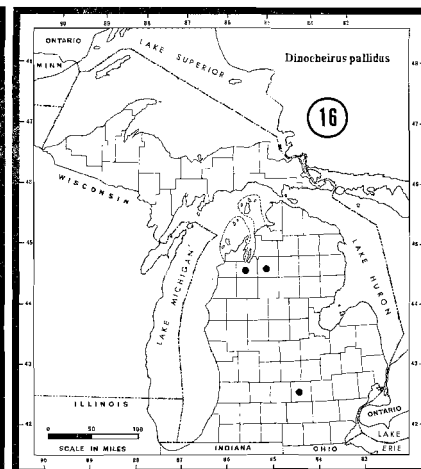
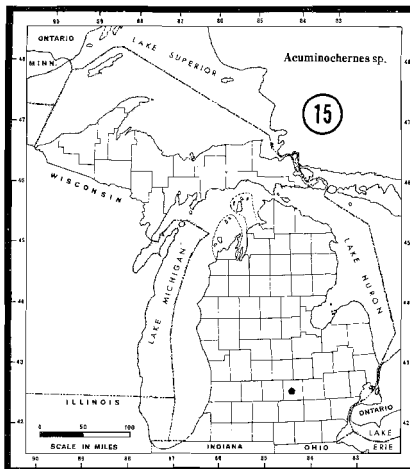
The one specimen collected in Michigan was taken in a grain bin (Fenstermacher, 1959).



Acuminochernes sp. (Fig. 15). LP: April 25.

The genus can be separated from others in the subfamily Chernatinae by the tactile setae on the chelicerae. In particular, seta "b" and "sb" are both acuminate on the chelicera. Setae on the palps are for the most part clavate and denticulate. Dorsal abdominal setae are strongly clubbed and toothed.

Acuminochernes has not been previously collected in Michigan. Several specimens were taken by Berlese extraction of a rodent nest located inside



a large, hollow red maple (*Acer rubrum*) log. The log was filled with leaves and other debris. Both nymphs and adults were removed from the sample, collected in T4N, R1E, Sec. 4, Ingham County.

Dinocheirus pallidus (Banks) (Fig. 16). LP: all year.

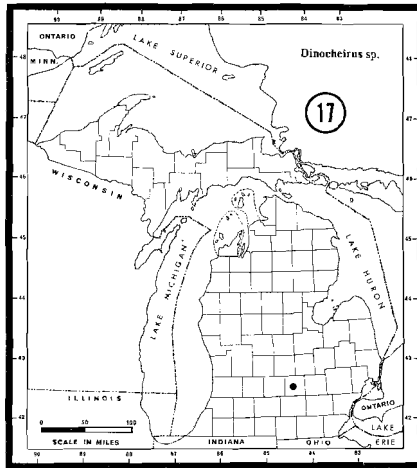
This species is previously unrecorded from the state. It can be separated from *Acuminochernes* by seta "b" being acuminate and setae "sb" denticulate on the chelicera, and from other known Michigan species of *Dinocheirus* by the shape of palp femur (Fig. 1).

All Michigan specimens have come from similar habitats. The first collection came from the dry, dead, insect-chewed wood found in the center of a hollow ironwood tree. Some specimens were collected by hand, and the rest were extracted with a Berlese funnel.

***Dinocheirus* sp.** LP: all year.

This species differs from *D. pallidus* by the shape of the palp femur.

Specimens of this species were collected from straw under a collapsed barn.



SYSTEMATIC LIST

Order: Pseudoscorpiona

suborder: Heterosphyronida

family: Chthoniidae

genus: *Chthonius*

species: *tetrachelatus*

suborder: Diplosphyronida

superfamily: Neobisioidea

family: Neobisiidae

subfamily: Neobisiinae

genus: *Microbisium*

species: *confusum*

brunneum

- suborder: Monosphyronida
 superfamily: Feaelloidea
 family: Pseudogarypidae
 genus: *Pseudogarypus*
 species: *hesperus*
- superfamily: Cheliferoidea
 family: Chernetidae
 subfamily: Chernetinae
 genus: *Dendrochernes*
 species: *morosus*
 genus: *Pselaphochernes*
 species: *parvus*
 genus: *Acuminochernes*
 genus: *Dinocheirus*
 species: *pallidus*
- subfamily: Lamprochernesinae
 genus: *Lamprochernes*
 species: *oblongus*
 minor
- family: Cheliferidae
 subfamily: Cheliferinae
 genus: *Chelifer*
 species: *cancroides*
 genus: *Dactylochelifer*
 species: *copiosus*
 genus: *Paisochelifer*
 species: *callus*
 genus: *Idiochelifer*
 species: *nigripalpus*

ACKNOWLEDGMENTS

I wish to express my thanks and indebtedness to Dr. T. W. Porter, Department of Zoology, Michigan State University for his generous help and encouragement during the study. Thanks also are due Dr. J. W. Butcher, Department of Entomology, Michigan State University, who gave continued support to this study as a corollary to his Soil Zoology and Pesticide Side Effects Research Project.

I wish to thank also Dr. W. B. Muchmore, Department of Biology, the University of Rochester, for his help in identification of specimens.

Thanks go also to those who have contributed specimens: Dr. Roland Fischer, Curator of Insects, Michigan State University; W. L. Manley, R. S. Snider, G. Klee, N. Barker, D. Siler, and to J. P. Donahue for specimens and advice in preparation of the pictorial key.

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**UNITED STATES RECORDS OF *WILLIAMSONIA FLETCHERI*
(ODONATA: CORDULIIDAE)**

G. H. & A. F. Beatty

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Foley (1966) reported specimens of *Williamsonia fletcheri* Williamson from Grand Traverse County, Michigan as the first record of the species from the lower peninsula and "the second for the United States." However, two other records for the United States were overlooked and this was actually the fourth.

An earlier paper summarizing records of the two species of *Williamsonia* (Montgomery, 1943) includes, besides the original Michigan record (Gloyd, 1932), a record of *fletcheri* from Mount Desert Island, Maine, and citation of a previously published record (Davis, 1940) from Harvard, Massachusetts wherein *fletcheri* was misidentified as *Williamsonia lintneri* Hagen. Thus three United States occurrences of *W. fletcheri* stood recorded in literature before Foley's of 1966. In the manual of North American dragonflies (Needham & Westfall, 1955) Maine and Michigan are cited as comprising the known United States distribution of *W. fletcheri*, but although Montgomery's definitive paper of 1943 is cited under both species of *Williamsonia*, Davis' Massachusetts record remains under *W. lintneri* in spite of Montgomery's correction.

Material in the collection of G. H. & A. F. Beatty provides a fifth United States record, hitherto unpublished, of the occurrence of *Williamsonia fletcheri*. This is a female specimen of *fletcheri* collected by John Gillespie at Chenango Valley State Park, Broome County, New York, on 1 June, 1947. Thus both species of *Williamsonia* are now known to occur in New York as well as in Massachusetts, only *fletcheri* in Maine and Michigan, and only *lintneri* in New Jersey and Rhode Island.

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