

A SYSTEMATIC STUDY OF AQUATIC
AND SEMI-AQUATIC HEMIPTERA
OCCURRING IN LOWER MICHIGAN

Thesis for the Degree of M. S.
MICHIGAN STATE COLLEGE

Harold Clyde Chapman
1950



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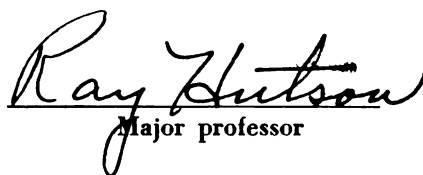
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A SYSTEMATIC STUDY OF AQUATIC AND
SEMI-AQUATIC HEMIPTERA OCCURING
IN LOWER MICHIGAN

by

HAROLD CLYDE CHAPMAN

A Thesis

Submitted to the School of Graduate Studies of Michigan
State College of Agriculture and Applied Science
in partial fulfillment of the requirements
for the degree of

MASTER OF SCIENCE

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1950

THESIS

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Acknowledgment is extended to Dr. Hungerford of Kansas State for his literature, comments, and suggestions. Many thanks both to Dr. R. R. Dreisbach of Midland, who so generously allowed the writer to examine the specimens and records of his collection and to Dr. T. Hubbell, who as curator of insects at the University of Michigan, allowed the writer to examine the Michigan collection on several occasions. Lastly the writer is very grateful to Dr. Carl J. Drake of Iowa State, who so generously checked my determinations of my SALDIDAE and sent all available literature plus invaluable suggestions on synonymy and collecting hints on SALDIDAE.

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INTRODUCTION

There are thirteen families of aquatic and semi-aquatic Hemiptera and they may be roughly divided into three groups: those families which live on top of the water, usually near or on the shore around emergent vegetation, such as MESOVELIIDAE, HEBRIDAE, HYDROMETRIDAE, GERRIDAE, and VELIIDAE; families which live almost completely along the shore and seldom venture into or on the water such as SALDIDAE, OCHTERIDAE, and GELASTOCORIDAE; lastly those families which live at least partially below the surface of the water such as NAUCORIDAE, NEPIDAE, BELOSTOMATIDAE, NOTONECTIDAE, and CORIXIDAE. The latter group plus GERRIDAE are most commonly seen and collected; the rest of the families may or may not be common, but due to either their size, coloration, or habitat, are usually overlooked by the casual collector. Very little systematic work has been done on these aquatic and semi-aquatic Hemiptera in Michigan, except in Cheboygan county, where Hungerford has spent many summers at the University of Michigan summer school.

METHODS AND APPARATUS

An attempt was made by the author to collect as many species as possible in lower Michigan from the thirteen families. This collecting, which extended from spring of 1949 to spring of 1950, was concentrated in Ingham, Kalamazoo, and Van Buren counties. All types of water habitat were visited, from bogs, rivers, lakes, to drainage ditches. Time did not permit an intensive survey of these counties.

Land collecting was done with a general collecting net, while that and an aquatic dip net were used for water collecting. The specimens were killed in a cyanide jar, pinned, labeled, and notes on their specific habitat were recorded. About 3,000 specimens were collected in this manner. Also specimens from the Michigan State College collection, the collections of the Museum of Zoology at the University of Michigan, and R. R. Driesbach were examined.

PROCEDURE

All specimens were studied under a 45 power binocular scope. Keys of authorities in each group were used in determining the specimens to species. All specimens were determined by the author, but my determinations of my SALDIDAE were checked by Dr. Carl J. Drake who is writing on the SALDIDAE of the world. The author was very fortunate in that it was possible to compare practically all of his determined species with material in the Michigan State College, in R. R. Driesbach's, and the University of Michigan collections, which have been determined by experts.

All available records and literature were checked to discover which species have been recorded from Michigan or might occur within the borders of Michigan, especially in the lower portion of the state. Complete descriptions are included both for those species collected by the author, and those species which have been recorded from the lower portion of Michigan. Generic and species keys are included which should be applicable to any water bugs collected in Michigan.

LIST OF AUTHORITIES USED IN DETERMINATIONS

<u>MESOVELIIDAE</u>	. . . . .	Hungerford
<u>HEBRIDAE</u>		
<u>Merragata</u>	. . . . .	Blatchley
<u>Hébrus</u>	. . . . .	Hungerford
<u>HYDROMETRIDAE</u>	. . . . .	Torre-Bueno
<u>GERRIDAE</u>		
<u>Gerris</u> and <u>Limnogonus</u>	. . . . .	Kuitert
<u>Metrobates</u>	. . . . .	Gould
<u>Trepobates</u>	. . . . .	Gould
<u>Rheumatobates</u>	. . . . .	Schroeder
<u>VELIIDAE</u>		
<u>Microvelia</u>	. . . . .	Torre-Bueno
<u>Rhagovelia</u>	. . . . .	Gould
<u>SALDIDAE</u>	. . . . .	Drake
<u>OCHTERIDAE</u>	. . . . .	Hungerford
<u>GELASTOCORIDAE</u>	. . . . .	Martin
<u>NAUCORIDAE</u>	. . . . .	Hungerford
<u>BELOSTOMATIDAE</u>		
<u>Benacus</u> and <u>Belostoma</u>	. . . . .	Hungerford
<u>Lethocerus</u>	. . . . .	Cummings
<u>NEPIDAE</u>	Hungerford
<u>NOTONECTIDAE</u>		
<u>Notonecta</u>	Hungerford
<u>Bueno</u>	Bare
<u>Plea</u>	Blatchley

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CORIXIDAE. Hungerford

Hungerford is considered to be the foremost authority on aquatic and semi-aquatic Hemiptera. Therefore, an attempt was made to follow either his literature or that literature put forth by graduate students and associates under the guiding hand of Hungerford.

SYNONYMY

MESOVELIIDAE

Mesovelia mulsanti White -- Mesovelia bisignata

Hungerford, Kans. Univ. Sci. Bull.,
XI, 1919, p. 99.

HEBRIDAE ----- NAEOGEIDAE

Hebrus concinnus Uhler -- Naeogeus concinnus Blatchley,
Het. East. North America, 1926, p.
607.

Hebrus burmeisteri L&S -- Naeogeus burmeisteri
Blatchley, Het. East. North Amer-
ica, 1926, p. 609.

Merragata hebroides White -- Merragata foveata
Blatchley, Het. East. North Amer-
ica, 1926, p. 610.

HYDROMETRIDAE ----- LIMNOBATIDAE

Hydrometra martini Kirkaldy -- Hydrometra lineata
Blatchley, Het. East. North Amer-
ica, 1926, p. 966.

GERRIDAE ----- HYDROBATIDAE

Gerris conformis Uhler -- Hygrotrechus conformis
Uhler, Proc. Bost. Soc. Nat. Hist.,
XIX, 1878, p. 435.

Gerris dissortis Drake & Harris -- Gerris rufoscut-
ellatus Riley, Ent. Rec. & Jour.
Var., XXVII, 1925, pp. 65-72.

Limnoporus rufoscutellatus Comstock, Intro. to Int., 1948, p. 371.

Gerris remigis Say -- Gerris robusta Hungerford, Kans. Univ. Sci. Bull., XI, p. 109.

Hygrotrechus robusta Uhler, Am. Jour. Sci., Ser. 3, I, 1871, p. 105.

Limnogonus hesione Kirkaldy -- Tenagogonus hesione Stal Blatchley, Het. East. North America, 1926, p. 978.

Gerris hesione Kirkaldy, Ent., XXXV, 1902, p. 137.

SALDIDAE ----- ACANTHIIDAE

Salda boucherrillei Prov. -- Lampracanthia anthracina Uhler, according to Drake's letters.

Lampracanthia coriacea Uhler, according to Drake's letters.

Pentacora ligata (Say) -- Pentacora variegata Prov. Drake, American Saldidae, Psyche, Vol. 56, No. 4, 1949, p. 189.

Pentacora hirta (Say) -- Pentacora pellita Uhler Drake, American Saldidae, Psyche, Vol. 56, No. 4, 1949, p. 189.

Saldula lubricus Say -- Saldula major Uhler Drake, Correspondence from Drake.

Saldula pallipes Fabr. -- Saldula interstitialis (Say), Correspondence from Drake.

1. The first part of the document discusses the importance of maintaining accurate records of all transactions. It emphasizes that proper record-keeping is essential for the integrity of the financial system and for the ability to detect and prevent fraud.

2. The second part of the document outlines the specific procedures for recording transactions. It details the steps involved in the accounting cycle, from identifying the transaction to posting it to the appropriate ledger account.

3. The third part of the document discusses the importance of reconciling accounts. It explains how regular reconciliations help to ensure that the records are accurate and that any discrepancies are identified and corrected promptly.

4. The fourth part of the document discusses the importance of maintaining proper documentation. It emphasizes that all transactions should be supported by appropriate evidence, such as invoices, receipts, and contracts.

5. The fifth part of the document discusses the importance of maintaining proper internal controls. It explains how internal controls help to prevent errors and fraud by establishing a system of checks and balances.

6. The sixth part of the document discusses the importance of maintaining proper communication. It emphasizes that all parties involved in the financial process should be kept informed of the status of transactions and any issues that arise.

7. The seventh part of the document discusses the importance of maintaining proper security. It explains how security measures help to protect the financial records from theft, loss, and damage.

8. The eighth part of the document discusses the importance of maintaining proper confidentiality. It emphasizes that financial records are often sensitive and should be kept confidential to protect the privacy of the individuals and organizations involved.

9. The ninth part of the document discusses the importance of maintaining proper accuracy. It explains how accuracy is essential for the reliability of the financial records and for the ability to make informed decisions based on the data.

10. The tenth part of the document discusses the importance of maintaining proper consistency. It emphasizes that the financial records should be consistent over time and across different periods to ensure that the data is reliable and comparable.

Saldula reperta (Uhler),

Correspondence from Drake.

Saldula confluenta (Say) -- Saldula confluens (Say)

Blatchley, Het. East. North Amer-
ica, 1926, p. 1010.

OCHTERIDAE ----- PELOGONIDAE

Ochterus americanus Uhler -- Pelogonus americanus

Hungerford, Kans. Univ. Sci. Bull.,
XI, 1919, p. 51.

GELASTOCORIDAE ----- NERTERIDAE

GALGULIDAE

MONONYCHIDAE

Gelastocoris oculatus (Fabricus) -- Gelastocoris

subsimilis Blatchley, Martin,
Kans. Univ. Sci. Bull., XVIII,
1928, p. 359.

NEPIDAE

Ranatra fusca Palisot Beauvois -- Ranatra americana

Mont'd, Hungerford, Kans. Univ.
Sci. Bull., XIV, No. 18, p. 437.

Ranatra nigra Herrich Schaeffer -- Ranatra protensa

Mont'd, Hungerford, Kans. Univ.
Sci. Bull., XIV, No. 18, p. 437.

BELOSTOMATIDAE

Benacus griseus (Say) -- Belostoma griseus Say

DuFour, Ann. Soc. Ent. Fr., Ser. 4,
III, 1863, p. 400.

Benacus Haldermanus Leidy, DuFour,
Ann. Soc. Ent. Fr., Ser. 4, III,
1863, p. 363.

Lethocerus americanus (Leidy) -- Belostoma americanum
Leidy, Uhler, Bull. U.S. Geol.
Geog. Surv., I, 1867, p. 337.

Lethocerus obscurus DuFour, Bueno,
Psyche, XXII, 1915, p. 17.

Belostoma flumineum Say -- Zaitha fluminea Hunger-
ford, Kans. Univ. Sci. Bull., XI,
1919, p. 144.

NOTONECTIDAE

Notonecta insulata Kirby -- Notonecta rugosa Fieber,
Rhynchotographieen, 1851, pp. 476-
477.

Notonecta lunata Hungerford -- Notonecta variabilis
Hungerford, Ent. News, XXVIII,
1917, p. 267.

Notonecta borealis Bueno & Hussey -- Notonecta lutea
Bueno Hungerford, Kans. Univ. Sci.
Bull., XI, 1919, p. 331.

Buenoa margaritacea Bueno -- Anisops platycnemis
Uhler, Blatchley, Het. East. North
America, 1926, p. 1058.

CORIXIDAE

Trichocorixa macroceps (Kirkaldy) -- Arctocorisa

macroceps Kirkaldy, The Can. Ent.,
Vol. 40, 1908, pp. 118-119.

Corixa macroceps VanDuzee, E. P.,
Cat. Hemip. Amer. North of Mex.,
1917, p. 486.

Trichocrixa micronectoides Blatch-
ley, Het. East. North America,
1926, p. 1085.

Trichocrixa calva (Say) -- Corixa calva Say's Ent.,
Le Conte, Vol. I, 1832, p. 366.
Corixa burmeisterii Abbott, Bull.
Brook. Ent. Soc., Vol. 8, 1851,
p. 87.

Trichocorixa burmeisterii Lund-
bland, Zoologischer Anzeiger,
Bd. 96, 1931, Heft 3/4, pp. 85,
87-89, 91.

Trichocorixa nalias (Kirkaldy) -- Corixa sexlineata
Champion, Rhynchoto. Het. II,
Biol. Centrali Amer., 1901, p. 379.
Arctocorisa nalias Kirkaldy &
Bueno, Proc. Wash. Ent. Soc., Vol.
10, 1908, p. 196.
Trichocorixa championi Jaczewski,
Ann. Zool. Mus. Poland Hist. Nat.,
Vol. 6, 1927, No. 3, p. 367.

Trichocorixa sexlineata Lundbland,
Ent. Tidskrift, Vol. 48, Haft 4,
1928, p. 242.

Hesperocorixa --- Corisa

Corixa

Arctocorisa

Arctocorixa

Sigara (Anticorixa)

Hesperocorixa atopodonta (Hungerford) -- Hespero-
corixa dubia Blatchley, Het. East.
North America, 1926, p. 1069.

Hesperocorixa escheri (Heer) -- Arctocorixa scabric-
ula Walley, Can. Ent., LXVIII,
1936, pp. 56-58.

Sigara ----- Corisa

Corixa

Arctocorisa

Arctocorixa

Sigara (Arctosigara) decoratella (Hungerford) --
Corisa limitata Fieber, Species
Genoris Corisa, 1851, p. 35.

Sigara (Lasiosigara) trilineata (Provancher) --
Arctocorixa trivittata Kirkaldy &
Bueno, Cat. Proc. Ent. Soc. Wash.,
X, Nos. 3-4, 1909, p. 197.

Sigara (Vermicorixa) alternata (Say) -- Arctocorixa

erichsonii VanDuzee, Cat. Hemip.

Amer. North Mex., 1917, p. 480.

Arctocorixa parshleyi Blatchley,

Het. East. North America, 1926,

pp. 174-177.

Sigara (Vermicorixa) mullettensis (Hungerford) --

Arctocorixa impersonata Walley,

Bull. Brook. Ent. Soc., Vol. XXV,

No. 4, 1930, pp. 204-205.

Sigara (Phaeosigara) signata (Fieber) -- Arctocorixa

seriata (Abbott) Blatchley, Het.

East. North America, 1926, p. 1073.

Sigara (Phaeosigara) zimmermanni (Fieber) -- Arcto-

corixa compressa Blatchley, Het.

East. North America, 1926, p. 1078.

KEY TO THE FAMILIES OF HEMIPTERA

- A Antenna exposed, as long or longer than the head
 (Gymnocerata). ----- H
- A Antenna hidden or nearly so and shorter than head
 (Cryptocerata). ----- B
- B Hind tarsi with indistinct setiform claws (this is
 not applicable to Plea of the family NOTONECTIDAE
 which are less than 3 mm in length. ----- C
- B Hind tarsi with distinct claws. ----- D
- C Base of head overlapping pronotum; fore tarsi
 paleaform with no claws. ----- CORIXIDAE
- C Base of head inserted in prothorax; fore tarsi
 with distinct claws; body keeled above for
 swimming on back. ----- NOTONECTIDAE
- D Head with ocelli (bugs that usually live under
 the surface of water). ----- E
- D Head without ocelli (bugs that usually live on
 the edges of water bodies). ----- G
- E Membrane without distinct veins. ----- NAUCORIDAE
- E Membrane with distinct veins. ----- F
- F Caudal appendages of abdomen long, slender,
 nonretractile; body elongate. ----- NEPIDAE
- F Caudal appendages of abdomen short, flat,
 retractile; body broad and flat. ----- BELOSTOMATIDAE
- G Fore legs very stout; antenna concealed. ~~GELASTOCORIDAE~~ GELASTOCORIDAE
- G Fore legs slender; antenna short and exposed. --
 ----- OCHTERIDAE

- H Body linear; head about as long as thorax with eyes situated at the middle of the head. HYDROMETRIDAE
- H Body of various shapes but head is shorter than thorax and eyes situated normally. ----- I
- I Last tarsal segment bifid or split; tarsal claws anteapical. ----- J
- I Last tarsal segment not bifid or split; tarsal claws apical. ----- K
- J Hind femur extending far beyond the apex of the abdomen; middle and hind legs approximate, about equal distance from fore legs. ----- GERRIDAE
- J Hind femur extending but very little beyond apex of abdomen; middle legs about equidistant from front and hind legs (except in Rhagovelia). ----- VELIIDAE
- K Tarsi 2-jointed; apterous form with very short velvety pile. Macropterous form with clavus similar in texture to membrane. ----- HEBRIDAE
- K Tarsi 3-jointed. ----- L
- L Membrane with three to five looped cells. -- SALDIDAE
- L Membrane without veins or cells; similar in texture to clavus. Apterous form with more or less greenish velvety pile. ----- MESOVELIIDAE

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CHECK LIST OF SPECIES IN THESIS

FAMILY HEBRIDAE

- * Merragata brunnea Drake
- * Merragata hebroides White
- Hebrus concinnus Curtis
- * Hebrus burmeisteri L. & S.

FAMILY MESOVELIIDAE

- * Mesovelia mulsanti White
- Mesovelia cryptophila Hung.
- Mesovelia douglasensis Hung.

FAMILY HYDROMETRIDAE

- * Hydrometra marteni Kirkaldy

FAMILY GERRIDAE

- * Gerris conformis Uhler
- Gerris nebularis Drake & Harris
- * Gerris dissortis Drake & Harris
- Gerris canaliculatus Say
- * Gerris remigis Say
- * Gerris comatus Drake & Hottes
- * Gerris buenoi Kirkaldy
- * Gerris argenticollis Parshley
- * Gerris alacris Hussey
- * Gerris marginatus Say
- * Gerris inseparatus Drake & Hottes
- Gerris incurvatus Drake & Hottes

* Collected by the writer.

- * Limnogonus hesione Kirkaldy
- * Metrobates hesperius Uhler
- * Trepobates pictus Herrich & Schaeffer
- * Trepobates inermis Esaki
- Rheumatobates rileyi Bergroth
- * Rheumatobates rileyi var. palosi Blatchley

FAMILY VELIIDAE

- * Rhagovelia oriander Parshley
- * Rhagovelia arctoa Bueno
- Rhagovelia obesa Uhler
- * Microvelia borealis Bueno
- * Microvelia hinei Drake
- * Microvelia americana (Uhler)
- * Microvelia buenoi Drake
- Microvelia fontinalis Bueno

FAMILY SALDIDAE

- Pentacora ligata (Say)
- Pentacora hirta (Say)
- Salda littoralis (Linn.)
- Salda boucherrellei Prov.
- Salda buenoi (McDonnough)
- Lampracanthia crassicornis (Uhler)
- * Micracanthia humilis Say
- Saldula zanthochila (Fieber)
- Saldula lubricus Say
- * Saldula confluenta (Say)

Saldula orbiculata (Uhler)

Saldula illinoiensis Drake

* Saldula opacula (Zett.)

* Saldula pallipes (Fabr.)

* Saldula pallipes var. dimidiata (Curt.)

* Saldula saltatoria (Linn.)

* Saldula c-album (Fieber)

FAMILY OCHTERIDAE

Ochterus americanus (Uhler)

FAMILY GELASTOCORIDAE

* Gelastocoris oculatus (Fabr.)

FAMILY NAUCORIDAE

* Pelocoris femoratus (Pal. De Beau.)

FAMILY NEPIDAE

* Nepa apiculata Uhler

* Ranatra kirkaldyi Bueno

* Ranatra kirkaldyi var. hoffmanni Bueno

* Ranatra nigra Herrich & Schaeffer

* Ranatra fusca Pal. De Beau.

FAMILY BELOSTOMATIDAE

* Benacus griseus (Say)

* Lethocerus americanus (Leidy)

* Belostoma flumineum Say

Belostoma testacum (Leidy)

FAMILY NOTONECTIDAE

* Buenoa margaritacea Bueno

* Collected by the writer.

- * Buenoa elegans (Fieber)
- Buenoa macrobatialis Hung.
- Buenoa limnocastoris Hung.
- * Plea striola Fieber
- * Plea harnedi Drake
- * Notonecta lunata Hung.
- Notonecta borealis Bueno & Hussey
- * Notonecta insulata Kirby
- * Notonecta irrorata Uhler
- * Notonecta undulata Say

FAMILY CORIXIDAE

- Cymatia americana Hussey
- Callicorixa alaskensis Hung.
- Callicorixa audeni Hung.
- Palmacorixa gillettei Abbott
- Palmacorixa buenoi Abbott
- Palmacorixa nana Walley
- * Trichocorixa calva (Say)
- * Trichocorixa nalias (Kirkaldy)
- * Trichocorixa macroceps (Kirkaldy)
- Hesperocorixa minorella (Hung.)
- * Hesperocorixa atopodonta (Hung.)
- * Hesperocorixa michiganensis (Hung.)
- * Hesperocorixa semilucida (Walley)
- * Hesperocorixa kennicottii (Uhler)
- * Hesperocorixa escheri (Heer)

* Collected by the writer.

- * Hesperocorixa lucida (Abbott)
- * Hesperocorixa vulgaris (Hung.)
- Hesperocorixa nitida (Fieber)
- * Hesperocorixa obliqua (Hung.)
- Hesperocorixa lobata (Hung.)
- Hesperocorixa interrupta (Say)
- * Sigara decoratella (Hung.)
- Sigara bicoloripennis (Walley)
- Sigara penniensis (Hung.)
- Sigara conocephala (Hung.)
- * Sigara decorata (Abbott)
- Sigara trilineata (Prov.)
- Sigara douglasensis (Hung.)
- * Sigara alternata (Say)
- * Sigara defecta Hung.
- * Sigara solensis (Hung.)
- * Sigara mathesoni Hung.
- * Sigara modesta (Abbott)
- * Sigara grossolineata Hung.
- Sigara mullettensis (Hung.)
- Sigara transfigurata (Walley)
- Sigara knighti Hung.
- * Sigara signata (Fieber)
- Sigara zimmermanni (Fieber)
- * Sigara compressoidea Hung.

*Collected by the writer.

Sigara machinacensis (Hung.)

Sigara variabilis (Hung.)

Sigara macropala (Hung.)

Sigara dolabra Hung. & Sailer

* Graptocorixa serrulata (Uhler)

* Collected by the writer.

FAMILY HEBRIDAE Amyot & Serville

The Velvet Water-Bugs

Very small, less than 3 mm in size, plump bugs with the body clothed with dense velvety pile. The eyes are coarsely granulated and large. The antennae are slender and either four or five segmented. Beak usually reaches or surpasses the hind coxae. Ocelli are present in mature specimens. In winged form, the clavus and membrane are membranous and without veins. The legs are short and the tarsi are two-segmented. Two genera are found in this vicinity.

Key to the Genera of HEBRIDAE Am. & Ser.

- A Antennae are five-jointed with the terminal joints slender. ----- Hebrus Curtis
- A Antennae are four-jointed with the fourth joint usually fusiform. ----- Merragata White

Genus Merragata White (4,27)

The antennae as in generic key. The head generally with fainter pronounced longitudinal grooves. Apterous, brachyterous, and macropterous forms are common in this genus. Rest as in family description. Two species are reported from this area.

Key to the species of Merragata White

- A Apterous form with disk of pronotum with a narrow insignificant median groove; macropterous form

with membrane milky white. ----- brunnea Drake
 A Apterous form with the disk of pronotum with a
 wide, deep longitudinal furrow; macropterous
 form with membrane not milky white but having
 fuscous spots. ----- hebroides White

Merragata brunnea Drake

Both the dorsal and ventral surface of the body is dark and covered with short pile. Fourth antennal segment is longest, fuscous, and fusiform; rest of antenna and legs are yellow-brown. Eyes are reddish and coarsely granulated. The wings are represented by short white wing pads in the brachypterous form. In macropterous form the membrane is milky white and the inner nervures are prominent and rounded. Length 1.3 - 1.5 mm. 82 specimens collected as follows:

2 October in Kalamazoo county from Douglas Lake.

22 April, 23 April, 3 May, 19 September, 1 October,
 7 October in Ingham county.

29 April in Washtenaw county.

29 April in Livingston county.

Specimens seen from the following counties:

Berrien, Calhoun, and Washtenaw.

All were brachypterous with the exception of one macropterous specimen. Very numerous in Baker Woodlot pond with other VELIIDAE and MESOVELIIDAE.

Merragata hebroides White

The color is very dark fuscous black above and below. The vertex and two round spots on the lobes of pronotum are reddish-brown. The legs and antenna except for the fourth segment of antenna are reddish-yellow. The fourth segment is fuscous, fusiform, and slightly larger than the rest. Pronotum has a broad deep median furrow. Membrane is fuscous with white spots and the inner nervures angulate. Length 1.7 - 1.8 mm.

3 specimens collected as follows:

2 October in Kalamazoo county from Douglas Lake.

This is the first record of this species reported from Michigan. All specimens are macropterous.

Genus Hebrus Curtis (4,27)

The antennae are five segmented and the body is more plump and larger than in Merragata.

Key to the species of Hebrus Curtis

- A Apex of scutellum is obtusely angulate, not or very feebly notched or bifed. ----- concinus Uhler
- A Apex of scutellum is subtruncate, distinctly notched or bifed. ----- burmeisteri Leth. & Serv.

Hebrus concinns Curtis

An oblong, robust, and minutely pubescent with reddish to fuscous color. First antennal segment about one-half longer than second segment and segments three

to five are very slender with three the longest and joints four and five subequal. The clavus with a vague milky white spot covering the basal half and a long narrow pale line on corium. The membrane is fuscous brown with a vague yellowish spot each side of base and sometimes with three faint whitish ones on disk. Hemelytra reaching to the tip of abdomen or in brachypterous forms with hemelytra reaching only to the middle of abdomen. Length 2.0 - 2.3 mm.

This species is reported from Indiana and Illinois but no records from Michigan have been found.

Hebrus burmeisteri Leth. & Serv.

The antenna is distinctly shorter and stouter than in H. concinnus Uhler with the joints about the same length. The ocelli are very distinct. Membrane has four white marks and the clavus and corium are marked as in H. concinnus. Scutellum as in species key. Length 1.8 - 2.1 mm.

24 specimens collected as follows:

29 April in Washtenaw county.

3 May in Ingham county.

Specimens seen from the following counties:

Huron and Berrien.

A great deal of patience is required to collect these insects.

FAMILY MESOVELIIDAE Douglass & Scott (27,29)

Water Treaders

Small (1.5 - 5 mm), rather slender, green to brown semi-aquatic insects found on the surface of water usually near or on the shore. The tarsi are three-jointed, not split, and the claws are apical. The antennae are fili-form, long, and four-jointed. The beak is long, slender, and generally reaching to or beyond the base of hind coxae. Apterous, brachypterous, and macropterous forms are common in this family.

These water treaders are predacious on small insects that fall into the water and also on small Crustaceans. One genus and three species are found in Michigan.

Genus Mesovelgia Mulsant & Rey

The head is prolonged before the eyes. The hemelytra, when present, has the clavus and membrane membranous and without veins and the corium with long veins. The legs are sub-equal. Rest as in the family description.

Key to the species of Mesovelgia Mulsant & Rey

- A Rear margin of front and middle femur with row of spines; tip of beak reaching to base of posterior coxae. ----- mulsanti White
- A No row of spines present on rear margin of front and middle femur; beak tip reaching almost to apex of posterior coxae. ----- B

- B Two slender parallel lines on head; head and thorax with gray bloom. Middle segment of hind tarsi is slender and plainly longer than terminal segment. ----- cryptophila Hungerford
- B Two broad brown bands on head with slender line between; middle segment of hind tarsi sub-equal to terminal segment. ----- douglasensis Hungerford

Mesovelia mulsanti White

The male is elongate slim with the female orbicular. The general color is green to brownish yellow and covered with short velvety pile. Segments one and three of the antennae are longest and sub-equal while segment two is slightly shorter than segment four. There is a median narrow yellow line present from prothorax to metathorax. The winged form has the hind lobe of pronotum dark with a median yellow line. Scutellum has a bright yellow spot at the middle of the base. Clavus and membrane are milky white with the embolium and corium smokey; veins are dark brown. Length 2.8 - 4.0 mm.

60 specimens collected as follows:

9 October in Van Buren county.

10 August, 11 August, 20 September, 2 October in Kalamazoo county.

2 August, 7 August, 19 September, 27 September,

21 October in Ingham county.

Specimens seen from the following counties:

Charlevoix, Huron, Berrien, Benzie, Cheboygan,
Livingston, and Washtenaw.

Apterous, brachypterous, and macropterous specimens
have been collected with the apterous form most common.

Mesovelia cryptophila Hungerford

This is a slender species which is olive green
above with the surface frosted with gray bloom especially
on the head and thorax. First antennal segment is
slightly longer than the second which is the shortest
segment, and the third and fourth are sub-equal, longest,
and twice the length of second. Male lacks both black
tufts of hair on the first genital segment and females
lack the spines fringing the ventral abdominal segments.
Rest as in species key. Length 2.1 - 2.8 mm.

Reported in Michigan only from Cheboygan county.

Mesovelia douglasensis Hungerford

This is a small robust species with the head and
thorax colored olive-green with gray patches. The abdomen
is brown with various light spots. First segment of
antennae is somewhat longer than second which is the
shortest, the third segment is more than twice the second
segment, with the fourth segment a little longer than
the third. Length 1.8 - 2.1 mm.

Reported in Michigan only from Cheboygan county.

FAMILY HYDROMETRIDAE Billbery (27,43)

Marsh treaders or Water-measurers

The members of this family are very slender insects with long legs and antennae. The head is very long with the eyes placed just before the middle. The antennae are four-segmented and are inserted at the swollen apex of the head. The beak is three-segmented, long and almost reaching prosternum. Tarsi are three-segmented and with apical claws. Membrane, if present, is as wide or wider than the abdomen and it reaches to fifth or sixth dorsal abdominal segment.

These insects creep slowly over the surface of the water around emergent vegetation. They are predacious on small forms of aquatic life which they pierce with their long beak. Only one genus occurs in this family.

Genus Hydrometra Lamarck

The characteristics for the genus are the same as for the family. Only one species occurs in this range.

Hydrometra marteni Kirkaldy

This is a very slender small insect with a deep brown color. Eyes are coarsely granulated and placed just before the middle of the long head. First antennal segment very short with third segment very long and with segment four a little longer than segment two. Beak is long and almost reaching prosternum with apical portion

black. Pronotum with a vague median whitish line. Two pits on sides above middle coxae. Hemelytera reaching fifth or sixth dorsal segment; color a smokey brown with darker veins. Ventral side of body is light brown to yellow. The apex of the abdomen is swollen and the last dorsal of male with a definite spinose projection.

Length 8.1 - 10.8 mm.

75 specimens collected as follows:

23 April, 29 April, 3 May, 20 May, 10 June, 11 June,
14 June, 21 July, 1 August in Ingham county.

11 July, 11 August in Kalamazoo county.

Specimens seen from the following counties:

Berrien, Cheboygan, Oceana, Washtenaw, Midland,
Livingston, Gladwin, Mecosta, and Calhoun.

Apterous form is common but three of the author's specimens are macropterous.

FAMILY GERRIDAE Amyot & Serville (17)

Water-striders

Middle and hind coxae are about equidistant from anterior coxae. Anterior legs are short and raptorial while the middle and hind legs are long and slender. Body is covered with short, dense, velvety pile. Claws are anteapical on the last tarsal segment. The antennae are four-segmented, filiform, and inserted in front of the eyes.

These are the common water striders which skip over the surface of most bodies of water. Gerridae are very agile and difficult to capture. These insects seek hibernation quarters quite late in the fall as the author has collected them up to 12 November. Brachypterous, apterous, and macropterous forms exist in this family. Five genera and seventeen species may occur in lower Michigan.

Key to the Genera of GERRIDAE

- A Body usually long and narrow; inner margin of eyes sinuate or concave. ----- B
- A Body usually short and broad; inner margin of eyes entire. ----- C
- B First tarsal segment about one-half the length of second; pronotum usually glabrous and shining. ----- Limnogonus Stal

- B First tarsal segment about the same length as second; pronotum is dull and sericeous. - Gerris Fabr
- C First antennal segment much longer than second and third segments and almost as long as the three segments united; hind femur twice the length of hind tibia. ----- Metrobates Uhler
- C First antennal segment not much longer or slightly shorter than two and three united. ----- D
- D Fourth antennal segment equal to or shorter than the third segment; abdomen tapering strongly toward apex. ----- Rheumatobates Bergroth
- D Fourth antennal segment definitely longer than third segment; abdomen shorter than rest of body. Color pattern is black and yellow. ----- Trepobates Uhler

Genus Gerris Fabricus (7,17,19,32)

The largest and most common water striders belong here. The body is subparallel and clothed with short golden hairs. Apterous forms have the pronotum quite long while in macropterous forms the nervures of hemelytra are raised and prominent. Eleven species may be found in Michigan. Keys in present use are only applicable to males; females may be separated by experience and good judgment.

Key to the species of Gerris Fabricius (Males)

- A Apex of venter is singly concave; spines of last segment reaching to or slightly beyond the middle of last genital segment. ----- B
- A Apex of venter is doubly concave, the second concavity forming a notch at the middle of first; spines of last segment much shorter or wanting. ----- E
- B First antennal segment subequal or longer than second and third segments combined; color somewhat dark. ----- C
- B First antennal segment shorter than second and third combined; body is reddish-brown or marked with reddish-brown. ----- D
- C First antennal segment longer than second and third segments combined; last segment of venter without distinct median depression. - conformis Uhler
- C First antennal segment subequal to second and third combined; last segment of venter with a prominent, deep, broad, depressed median furrow. ----- nebularis Drake & Harris
- D Larger (12 - 15 mm); first genital segment without median keel at base. Front lobe of pronotum with black spot on each side of pale median line. ----- dissortis Drake & Harris
- D Smaller (8 - 11 mm); first genital segment

- with median keel at base. Front lobe of
 pronotum without two black spots. - canaliculatus Say
- E 11 mm or more in length. Large robust species
 which has connexival spines long and
 conical. ----- remigis Say
- E Less than 11 mm. Connexival spines are short
 and angular. ----- F
- F Tuft of hairs in each depression of first
 ventral genital. ----- comatus Drake & Harris
- F No such tuft of hairs present in each depression.-- G
- G Side margins of front lobe of pronotum with
 a pale stripe. ----- H
- G Side margins of front lobe of pronotum without
 pale stripe. ----- I
- H Stripe yellow; notch at apex of sixth ventral
 subrectangular. ----- buenoi Kirkaldy
- H Stripe usually silver; notch at apex of sixth
 ventral rounded. ----- argenticollis Parshley
- I Omphalium strongly produced, prominent; (elevated
 median gland opening located posteriorly on
 metasternum). First antennal segment one-fourth
 longer than fourth segment. ----- alacris Hussey
- I Omphalium not strongly prominent; first antennal
 segment one-sixth or less longer than fourth
 segment. ----- J
- J First genital segment plump and scarcely

- impressed on either side and with no median ridge. Second concavity of venter is deeply and roundly notched. -----inseperatus Drake & Hottes
- J First genital segment strongly impressed on either side. ----- K
- K Second concavity of venter is broadly rounded. ----
----- incurvatus Drake & Hottes
- K Second concavity of venter is U-shaped, deeper but not so broadly rounded. ----- marginatus Say

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Gerris conformis Uhler

Similar in size of G. remigis and G. nebularis. Distinct median carina on pronotum. The under surface is usually yellowish and clothed with dense silver gray pubescence. Antennae is as in key. Legs are very slender and long with the middle and posterior femur longer than the body. Last segment of the venter is broadly concave with no distinct median depression. Connexival spines are as long as genital segment. Length 15 - 16.3 mm. 2 macropterous specimens collected 7 October in Ingham county.

Specimens and records seen from the following counties:
Washtenaw, Jackson, Grand Traverse, and Saginaw.

Gerris nebularis Drake & Harris

Large-sized and is similar in appearance to G. conformis except for antennae and last segment of venter as in the species key. Length 15.4 - 16 mm.

No records of this species from Michigan but it does occur in Illinois and Indiana.

Gerris dissortis Drake & Harris

This insect is slim, elongate, with sides parallel. Pronotum is brown except for front lobe which has two black spots the width of pronotum separated by a median brown yellow line. Median carina is evident. Hemelytra is darker brown with costal edges fringed with black. Sides of thorax and abdomen have definite short yellow pile. Antennae are half as long as body. The middle and hind legs are very long. Connexival spines are slightly longer than the genital segment. Length 13.2 - 15 mm. 5 macropterous specimens collected 4 July in Van Buren county from a small drainage ditch.

Specimens or records seen from the following counties:

Menominee, Berrien, Schoolcraft, Charlevoix, Jackson, Oscoda, Cheboygan, Washtenaw, Emmett, Huron, Oakland, Isle Royal, Alpena, Marquette, Crawford, Midland, and Ontonagan.

Gerris canaliculatus Say

Very slender and elongate; antennae slender and slightly more than half the length of body. Connexival spines as long as genital segment. Rest as in species key. Length 9.5 - 10.5 mm.

No records of this species from Michigan but it has been recorded from Ohio and Indiana.

Gerris remigis Say

Form is robust and elongate. The upper surface is dark with median yellow line on front lobe of pronotum and no median carina. Sides of thorax and abdomen are clothed with silver gray pile. The antennae is short with segment one long, longer than segments two and three combined. Connexival spines are not reaching the apex of genital segment. Rest as in species key.

Length 13 - 16 mm.

60 specimens collected as follows:

18 June, 22 June, 23 June, 11 August, 20 September,
in Kalamazoo county.

8 May and 9 October in Van Buren county.

5 May, 20 May, 1 August, 11 August, 2 October,

3 October, in Ingham county.

Specimens or records seen from the following counties:

Alcona, Alpena, Benzie, Berrien, Barago, Cheboygan,
Huron, Lake, Luce, Isabella, Keweenaw, Crawford,
Otsego, Newago, Washtenaw, Schoolcraft, Wexford,
Marquette, Jackson, Mackinac, Iosco, Midland, and
Montmorency.

This is one of the most common water striders of lower Michigan. Any number could have been collected, especially along creeks where they congregate in great numbers. All but two specimens are apterous which is the common form of this species.

Gerris comatus Drake & Hottes

Slender small species. Pronotum has a median stripe on front lobe, two spots at base of vertex, front coxae, trochanter and base of tibia, and lateral edges of connexivum yellow. Sides of thorax and abdomen are covered with silver gray pile. First antennal segment is longer than the fourth, with segments two and three smallest and subequal. Male with tufts of hair present in depressions of genital segment as in key and second concavity is deeply rounded. Length 8.7 - 9.8 mm.

51 specimens collected as follows:

5 May, 17 May, 21 July, 10 November, 11 November,

12 November in Ingham county.

29 April in Washtenaw county.

Specimens seen from the following counties:

Cheboygan, Oceana, and Marquette.

All specimens are macropterous. This appears to be the most common species in Gerris with the exception of G. remigis.

Gerris buenoi Kirkaldy

Small for Gerris and is robust. Median line on front lobe of pronotum, fore coxae, trochanter, and base of tibia, middle and posterior coxae, trochanter, and most of tibia yellow to brown. Lateral margins of thorax and abdomen are covered lightly to heavily with yellow pile. The lateral margins of front lobe of pronotum have a yellow

to orange stripe. First antennal segment longest, slightly longer than fourth, segment three slightly longer than two. Second concavity of male is subrectangular. Connexival spines are obtuse. Length 6.6 - 8.9 mm.

53 specimens collected as follows:

31 March, 22 April, 23 April, 29 April, 4 June,
21 July, 2 August, 7 October, 10 November, 11 November
in Ingham county.

8 May and 9 October in Van Buren county.

29 April in Washtenaw county.

Specimens seen from the following counties:

Benzie, Berrien, Cheboygan, Jackson, Iosco, Huron,
Livingston, Charlevoix, Marquette, Gogebic, Mont-
morency, Oakland, Midland, and Washtenaw.

All but one specimen ~~were~~ macropterous and were found to be commonly collected in the company of G. comatus Drake & Hottes. The brachypterous form was quite common in the University of Michigan collection.

Gerris argenticollis Parshley

The insect is slightly smaller than G. marginatus Say but with coloring about the same. Silver stripe on side margins of front lobe of pronotum is the distinguishing characteristic. First two joints of beak, mesopleura, and part of metapleura have conspicuous yellow velvety pile. Rest of abdomen is covered beneath with silver gray pile. Segment one of antennae is longest,

slightly longer than segment four; segments two and three subequal. Second concavity of male venter is semi-circular. Connexival spines are short and blunt. Length 8.0 - 8.1 mm.

40 macropterous specimens collected as follows:

22 April, 23 April, 29 April, and 17 May in Ingham county.

8 May in Van Buren county.

Specimens and records seen from the following counties:

Berrien and Washtenaw.

Gerris alacris Hussey

Male has abdomen tapering apically. The wings reach the third abdominal segment in brachypterous forms. The sides of thorax and abdomen are covered with yellow velvety pile. The male has definite omphalium as in species key. First antennal segment longest, much longer than fourth, with second segment slightly longer than third. Broad median yellow stripe on mesosternum. The second concavity of male venter is broadly rounded and the connexival spines are very short and blunt. Length 8.2 - 9.6 mm.

3 specimens collected 7 July, 11 July, and 2 October in Kalamazoo county.

Two specimens were brachypterous while the remaining one was macropterous.

Reported in Michigan from Berrien and Washtenaw counties only.

Gerris marginatus Say

This species is elongate, parallel-sided with coloring about the same as other species of about the same size. Lateral and ventral abdominal and thoracic segments are covered with silver gray pile. First antennal segment is just slightly longer than the fourth with segments two and three much shorter and subequal. Second concavity of male venter is somewhat narrowly rounded and as in species key. Connexival spines are not blunt and in the females are quite long. Length 8.2 - 10.0 mm.

32 specimens collected as follows:

22 April, 29 April, 12 May, 20 May, 21 July in
Ingham county.

8 May and 9 October in Van Buren county.

29 April in Washtenaw county.

All specimens are macropterous.

Specimens seen from the following counties:

Berrien, Benzie, Charlevoix, Cheboygan, Gogebic,
Jackson, Huron, Livingston, Mackinac, Ontonagon,
Oakland, and Washtenaw.

Gerris inseparatus Drake & Hottes

Elongate species with same typical coloring as medium sized Gerris species. First antennal segment shorter than the fourth and with both second and third segments much shorter and subequal. Second concavity of male venter is deeply rounded with first genital

segment plump and scarcely impressed on each side (no keel).

Connexival spines are quite long. Length 9.1 - 10.0 mm.

12 specimens collected as follows:

5 May and 17 May in Ingham county.

8 May in Van Buren county.

All are macropterous.

No other Michigan records seen.

Gerris incurvatus Drake & Hottes

The male as in key. The female first antennal segment slightly longer than two and three together and about one-third longer than segment four. Connexival spines of female are strongly incurved and the tips with short hairs. Length 7.6 - 8.7 mm.

One specimen from Washtenaw county determined by Hussey in the University of Michigan collection. This is the only Michigan record I have seen.

Genus Limnogonus Stal (7,17,19,32)

The head and pronotum are glabrous and shiny. The antennae are shorter than the body with basal segment of antennae the longest. First segment of anterior tarsi only about one-half the length of second tarsi. Middle and posterior legs long. The eyes are faintly sinuate on inner margin. Only one species is found in Michigan.

Limnogonus hesione Kirkaldy

The pronotum, mesonotum, and head are glabrous and

shiny. Vertex, occiput, median central spot plus hind angles of pronotum are reddish-yellow. Prosternum, all coxae plus fore trochanter and base of tibia, and portion of the ventral side of abdomen are yellow. Ventral aspect of thorax, beak, and dorsal view of abdomen densely covered with silvery pubescence or pile. First antennal segment longest; just longer than segments two and three combined which are subequal, and segment four is slightly longer than two. Hind and middle femur greatly surpassing apex of abdomen. Length 4.8 - 6.5 mm.

6 specimens collected as follows:

29 October in Ingham county from Three Lakes.

9 October in Kalamazoo county.

All specimens are apterous.

Specimens seen from the following counties:

Washtenaw and Cheboygan.

Genus Metrobates Uhler (1,17)

The large, coarsely granulated eyes project back over the sides of the pronotum. Pronotum is wider than long with a median groove. Mesonotum quite large and also has a median impression. Middle and hind legs are very long with hind femur twice as long or more than hind tibia. Antennae as in generic key. Only one species known from Michigan.

Metrobates hesperius Uhler

The eyes are coarsely granulated and project along side of pronotum. Interocular area is reddish-brown. Median stripe of pronotum and mesonotum, dorsal surface of abdomen, and ventral surface of insect is covered with blue-gray bloom. The body is usually quite hairy and the middle and hind legs are long. First antennal segment stout and about as long as remaining three segments; second segment next in size with segments three and four subequal. Segments two and three are swollen at the apex while segment four is fusiform.

Nymphs have an elongate median spot on pronotum, part of dorsal surface of abdomen, and most of ventral surface of body light yellow. Structural characteristics the same. Length 4.1 - 4.6 mm.

27 specimens collected as follows:

27 September, 3 October in Ingham county.

11 August in Kalamazoo county.

All are apterous.

Specimens seen from the following counties:

Midland, Berrien, and Gogebic.

Genus Trepobates Uhler (9,17)

The pronotum is wider than long with its front and hind margins truncate. Mesonotum is large. The abdomen is short with connexiva strongly reflexed. Middle and

hind legs quite long but not as long as in Metrobates.
Antennae as in generic key. Genital plate of male is
convex and short; apex of the last ventral of female is
truncate. The color is black and yellow. Two species
occur in Michigan.

Key to the species of Trepobates Uhler

- A Male with fringe of hair on inside of femur and
base of tibia of middle legs not over half as
long as diameter of leg at point of origin.
Female with apical margin of mesonotum prolonged
backward into a horn-like process. -----
----- pictus Herrich & Schaeffer
- A Male with fringe of hair on inside of femur and
base of tibia of middle legs as long as diameter
of leg at point of origin. Female without
prolonged mesonotum. ----- inermis Esaki

Trepobates pictus Herrich & Schaeffer

Typical color is mostly yellow intermingled with
black stripes which makes this a very strikingly colored
insect. Median stripe on head, four stripes on pronotum,
one median and three lateral stripes on mesonotum, and
edges of dorsal abdominal segments are black. The rest
is yellow. Rest as in species key. Length 3.1 - 3.6 mm.
5 specimens collected as follows:

27 September and 29 September in Ingham county.

All specimens are apterous and were collected from a
small creek.

Specimens seen from Washtenaw county.

Trepobates inermis Esaki

The color is variable but generally black above except for stripe on base of vertex, two to four spots on pronotum, none or two small spots on mesonotum, lateral stripe on mesonotum, and underside of insect almost completely yellow. Females with reflexed connexivum and abdominal segments in part yellow. Rest as in species key. Length 3.2 - 3.4 mm.

5 specimens collected as follows:

29 October from Three Lakes in Ingham county.

9 October in Van Buren county.

This is the first record for Michigan that I could find. The reason for this is that most systematists have this species still classified with T. pictus H. & S. I have seen specimens from Livingston and Washtenaw counties wrongly labeled T. pictus in the University of Michigan collection.

Genus Rheumatobates Bergroth (17,39,40)

The head is wider across the eyes than long and the eyes are very large and coarsely granulated. Male antennae are odd appearing, being strongly curved and armed with several spines. Pronotum broader than long with base and apex truncate. Middle legs of male very long and usually fringed on inner side with long hairs. Hind legs of male may or may not be curiously swollen, curved, and covered with long hairs. Two species may be present in Michigan.

Key to the male species of Rheumatobates Bergroth

- A Fourth antennal segment with spine placed
beyond the middle. ----- rileyi Bergroth
- A Fourth antennal segment with spine placed
before the middle. ----- rileyi var. palosi Blatchley

Rheumatobates rileyi var. palosi Blatchley

Male with broad median stripe on pronotum, base of first antennal segment, prosternum and mesosternum, all coxae and trochanters, and small round spot on lateral mesonotum are all yellow. Rest is black with leaden bloom on abdomen. First antennal segment is swollen and armed beneath with two spines; segment two very small and armed at base with spine; third segment long, strongly curved, and armed at apical third with spinose fossa; apical segment with spine placed before the middle. The middle legs are longest with femur and basal half of tibia fringed with long hairs. Hind coxae with tufts of hair; the femur is curved and with long thick tufts of hair on basal third. Tibia is also fringed with hairs and with tufts of long hair glued together and projecting backward on basal fourth.

Female has normal antennae and hind legs. The color is variable but the more common form is quite dark with mesonotum with no median yellow spot. Length 2.8 - 3.1 mm. 9 specimens collected as follows:

27 September in Ingham county.

9 October in Van Buren county.

Specimens seen from the following counties:

Berrien, Cheboygan, and Huron.

All specimens, both in the Michigan State College collection and the University of Michigan collection, were wrongly labeled R. rileyi Bergroth.

Rheumatobates rileyi Bergroth

The male as in the variety except the spine is placed beyond the middle and the tufts of hair on the hind femur are shorter and less abundant. Females of R. rileyi Bergroth and its variety are very difficult to separate. A diamond-shaped marking on mesonotum, edges of connexivum, and spot on first genital segment are yellow but this does not always hold true for this species. Length 2.8 - 3.0 mm.

This species has not been reported from Michigan as yet but Gould reports it from Indiana. The above was described from a series of six apterous specimens collected by the author from Calhoun, Georgia.

FAMILY VELIIDAE Amyot & Serville

Broad-shouldered water-striders

Quite small (1.2 - 7.0 mm) plump-bodied insects which are usually broadest through the shoulders. The antennae is four-segmented and the head is shorter than the thorax. The middle legs are placed equidistant from front and posterior legs except in the genus Rhagovelia. The hind femur not or slightly longer than the tip of the abdomen. The beak is four-segmented and long. The claws are anteapical.

The members of this family inhabit the surface of the water, often near or on the shores. They usually run along the water instead of rowing as do the Gerridae. These Veliids are usually overlooked because of their small size and their resemblance to a nymph of larger families. All members are predacious on smaller insects and Crustaceans. Two genera which include eight species may be found in Michigan.

Key to the Genera of VELIIDAE Amyot & Serville

- A First antennal segment longest; third segment of middle tarsi slit and with feathery hairs in slit. ----- Rhagovelia Mayr
- A First antennal segment longest; third segment of middle tarsi normal. ----- Microvelia Westwood

Genus Rhagovelia Mayr (6,15,16,42)

Very robust medium-sized species. The antenna is four segmented with first segment by far the longest and four the shortest; segments two and three subequal. The beak is three-segmented. All tarsi are three-segmented with third segment of middle legs split as in key. The pronotum is variable as to species and sex. Hemelytra is usually wanting.

The purpose of the split middle third tarsi is an aid for swimming in swift currents which is the usual habitat of this genus.

Three species may occur in Michigan.

Key to the species of Rhagovelia Mayr

- A Pronotum of female produced backward into a knobbed process; male pronotum has the posterior angles sharply angulate. ----- oriander Parshley
- A Pronotum not as above. ----- B
- B Anterior trochanters of male are armed with a black spine. Male and female with middle and usually hind coxae and trochanters, and base of anterior femur dark. ----- arctoa Bueno
- B Anterior trochanters of male are without a black spine. Male and female have all coxae, trochanters, and base of anterior femur pale to yellow. ----- obesa Uhler

Rhagovelia oriander Parshley

This is a broad blue-gray species. The basal third of antennae, fore and posterior coxae and trochanters, sternal plates around coxae, and edges of female connexivum are yellow. Orange spot present each side of middle on front lobe of pronotum. The dorsal surface is brownish-gray with the ventrals bluish. The head has a median impressed line extending the full length. First antennal segment twice the fourth, with the second and third segments slightly shorter than the fourth, and subequal. The pronotum of male and female is very distinctive as in generic key. Male abdomen is very shiny with connexivum not reflexed. Female connexivum strongly reflexed but not quite meeting on the last dorsal abdominal segment. The hind femur of female is armed with two large spines almost of equal size and about six smaller ones. Length 3.5 - 3.6 mm.

2 specimens collected 3 October in Ingham county from Red Cedar River.

This is the first Michigan record for this species. Previously reported from Ohio.

Rhagovelia arctoa Bueno

This is a stout medium-sized bug with about same coloring as in R. oriander Parshley. Antennal segments about the same. The hind femur of male with a large spine and six succeeding smaller spines. Female femur

with one very large spine and three or four very small ones. Male anterior trochanter armed with black spine while trochanter of female is unarmed. Male and female pronotum are truncate and not produced in apterous forms. Connexivum of female is strongly reflexed and meeting above last abdominal segment and terminating in two long spines. The apical dorsal edge of first connexival with bunch of long hairs resembling a spine. Length 3.4 - 3.9 mm.

29 specimens collected as follows:

10 August and 20 September in Kalamazoo county from Augusta Creek.

All specimens are apterous. This species is very close to R. obesa Uhler with whom Blatchley places it. Reported from Michigan previously. This species was found only in fast water around overhanging bushes.

Rhagovelia obesa Uhler

Size, color, and markings similar to R. arctoa Bueno except all coxae, trochanters, and base of front femur are yellow. Fore trochanters of male without black spine. Hind femur of both sexes armed with yellow black tipped, curved, large spine and this followed toward apex by several smaller spines. Female connexivum is strongly reflexed and appears to meet at fourth segment, depart, and then meet again at last abdominal segment. Posterior tips of last abdominal segment prolonged into longer

slender spines. Length 3.5 - 4.0 mm.

This is supposedly the most common species of Rhagovelia in Michigan but has not been collected by the author. There are specimens from the following counties in the University of Michigan collection:

Oakland, Cheboygan, Washtenaw, and Berrien which are labeled R. obesa Uhler, but in using Gould's keys, all of these specimens would be included in R. arctoa Bueno because all of the males had the spine on the fore trochanter.

The above is described from a series of specimens collected from Calhoun, Georgia.

Genus Microvelia Westwood (23,35,36,41)

Robust, very small (1.2 - 3.0 mm) species. The head is inserted in the thorax to the eyes and the head with a median impressed line. Eyes are prominent and coarsely granulated. The humeral angles of the front lobe of pronotum are usually very prominent. Both apterous and macropterous forms are common. The hemelytra is membranous and with few cells. The legs are subequal and short. Fore tarsi are two-segmented, with intermediate and posterior tarsi three-segmented, with the basal segment the smallest.

To this genus belong the most common species of the broad-shouldered water-striders which are found on the edges of most bodies of water. Five species have been reported from Michigan.

Key to the species of Microvelia Westwood

- A Antennae as long as or shorter than the head
 and thorax together. ----- B
- A Antennae longer than the head and thorax together.- C
- B Antennae shorter than head and thorax together; fe-
 male broadly oval; male elongate with curved
 posterior tibia; pronotum of apterous form with
 transverse linear impression before the
 middle. ----- borealis Bueno
- B Antennae as long as the head and thorax together;
 both sexes with similar shape and the male with
 hind tibia straight; pronotum without transverse
 linear impression. ----- hinei Drake
- C Fourth antennal segment longer than segments
 two and three combined. Smaller species.
 (1.6 - 2.0 mm) ----- buenoi Drake
- C Fourth antennal segment not longer than segments
 two and three combined. Larger species.
 (2.0 - 3.0 mm) ----- D
- D Mesonotum concealed by pronotum; bluish-gray
 pubescence on dorsal abdominal segments. -----
 ----- fontinalis Bueno
- D Mesonotum not concealed by pronotum; silvery-
 gray pubescence on dorsal abdominal segments. -----
 ----- americana (Uhler)

Microvelia borealis Bueno

The males and females appear very different. Males are elongate and slender while females are broad and almost orbicular. Color is variable but both sexes with transverse stripe on front lobe of pronotum, prosternum, coxae, base of femur, and middle of abdomen is dull yellow. The rest of ventrals with leaden bloom. Dorsal surface of female with first three abdominal segments black at the middle, with the next two completely black, and the rest of the segments with leaden bloom. Female connexivum somewhat reflexed. Male hind tibia curved. Fourth segment of antennae very long with one and three subequal and segment two the shortest. Front lobe of pronotum with transverse linear impression. Metanotum is faintly visible. The macropterous forms of male and female are more similar. The hemelytra is all membranous and of fuscous brown to gray color with two apical cells with a white stripe. Length 1.3 - 1.9 mm.

95 specimens collected as follows:

2 August, 7 August, 19 September, 27 September,
7 October in Ingham county.

10 August, 11 August, 20 September, and 2 October in
Kalamazoo county.

This is the most common species of VELIIDAE. About one-third of specimens were macropterous with the rest being apterous. Plentiful along the edges of most any pond and usually in the company of Mesovelia mulsanti White.

Specimens seen from the following counties:

Berrien, Benzie, Cheboygan, Oakland, Washtenaw.

Microvelia hinei Drake

Smaller; male and female about the same shape but female still slightly broader. Transverse stripe on front lobe of pronotum, ventral portion of head, coxae trochanters and basal half of femur is yellow to red. The rest of ventrals are black with leaden bloom especially on lateral margins. Upper surface is black except for sixth and seventh abdominal segments which have a bluish bloom with a median polished black line. Fourth antennal segment is very long with two shortest. A transverse curved row of punctures near front margin of pronotum. Winged form with hemelytra pale brown; clavus and corium with an oblique stripe and corium with oblique oval spot behind these stripes. Membrane with three white spots present. Length 1.2 - 1.3 mm.

48 specimens collected as follows:

22 April, 23 April, 3 May, and 19 September in Ingham county.

All are apterous and were collected in Baker woodlot pond. This species was reported from Michigan previously only by Blatchley from Washtenaw county.

Microvelia americana (Uhler)

This is a large robust species for this genus. An orange transverse stripe on front lobe of pronotum which

is immediately followed by a transverse linear impression. Round spot on each connexival, prosternum, all coxae, trochanters, and part or all of tibia are yellow. Rest of underside with dull bloom and above surface is black with minute oppressed hairs. Silvery-gray pubescence scattered on abdomen and sometimes on pronotum. Fourth segment of antennae slightly longer than segment one which is the stoutest and slightly longer than segment three; segment two is the shortest. The winged form with hemelytra fuscous brown with pale cells. Length 2.2 - 3.0 mm.

40 specimens collected as follows:

10 August, 11 August, and 20 August in Kalamazoo county.

8 May and 9 October in Van Buren county.

5 May in Ingham county.

All specimens are apterous. This species was collected both in fast-and slow-moving streams.

Specimens and records seen from Berrien and Washtenaw counties.

Microvelia buenoi Drake

The color is blackish-brown. Male is elongate with spot of silvery hairs on the sides of first two dorsal abdominal segments. Female is orbicular with spot of silvery hairs on each side of first two and last two dorsal abdominal segments and on each connexival. Segment four of antennae is longer than two and three

together. Macropterous form elongate with head, pronotum, and ventrals dark velvety brown. Hemelytra is brown with cells of membrane white. Mesonotum not visible. Length 1.7 - 2.0 mm.

100 specimens collected as follows:

22 April, 23 April, 3 May, and 5 May in Ingham county.

All were apterous with the exception of three macropterous specimens.

Specimens seen from Berrien county in the University of Michigan collection.

Microvelia fontinalis Bueno

A robust, oblong-oval to sub-fusiform species. Dorsal surface is dark reddish-brown and clothed with fine yellow oppressed hairs. The middle of first and second dorsal abdominal segments and above and below each connexival is brownish-yellow. The sides of second and third dorsal abdominal segments and all of sixth and seventh are bluish-gray. Antennae with fourth segment longest, one and three subequal with two the shortest. Pronotum with two distinct rows of punctures. Connexivum is strongly reflexed, more so in the female. Length 2.0 - 2.3 mm.

I have seen specimens from Berrien and Washtenaw counties in the University of Michigan collection.

FAMILY SALDIDAE Amyot & Serville (4,10,11,12,13 43)

Shore Bugs

Our members of this family are small (2.5 - 8.0 mm) oval or elongate dull-colored bugs. Eyes are large, coarsely granulated, and strongly exserted. Two ocelli are usually present but may be subcontiguous. The long antenna are composed of four segments and are inserted on the sides of the cheeks. The beak is four-segmented, with the first segment very short. The pronotum is trapezoidal with the apex shortest. The scutellum is large and almost equal sided. Hemelytra with margins curved and the membrane with four or five looped cells. The legs are all long and thin with the posterior coxae broad, large, long, and fitted for leaping. The tarsi are three-segmented, with the first segment very short; the second and apical segment are subequal. The tarsal claws are very long and slender.

These agile bugs may be found along the shores of most pools and streams but are very difficult to see and more difficult to capture. They vault into the air with their long hind coxae, and at the same time use their wings; usually they fly only a few feet and then light again in a protected spot. Saldids are predacious on small insects.

This family is in the process of being revised as Dr. Drake of Iowa State is writing the Saldidae of the

world. Therefore all of the synonymy has not been worked out as yet and the family is very difficult to work with. Drake has helped the author immeasurably by checking my *Saldid* determinations, sending me his literature, and by giving me many helpful suggestions on determinations, synonymy, and collecting of the Saldidae. About six genera and nineteen species might be found in Michigan. I have seen records of fourteen species collected in Michigan.

Key to the Genera of SALDIDAE

- A Membrane with five longitudinal looped cells;
 last female ventral in truncate. --- Pentacora Reuter
- A Membrane with four longitudinal looped cells. ----- B
- B First or inner looped cell of membrane produced
 one-half or two-fifths its own length above the
 base of the second looped cell; hemelytra often
 punctate, always without sericeous spots;
 embolium wholly black. ----- Salda Fabricus
- B First or inner looped cell of membrane produced
 but slightly, or but little more than one-
 third its own length above the base of the
 second. ----- C
- C Two distinct veins in the corium with the inner
 vein forked toward apex and the branches reaching
 membranal suture; apex of inner cell reaching or
 nearly reaching the apex of the second. -----

- Saldula Van Duzee
- C Inner vein of the corium frequently obliterated toward the apex or both veins entirely obliterated; apex of inner cell placed distinctly above the apex of the second. ----- D
- D Apex of pronotum always distinctly narrower than head with eyes; sides of pronotum more or less sinuate and the apical callus occupying its entire width; pronotum with margin very narrow or obsolete; entire hemelytra is very shining, convex, coriaceous, and membrane scarcely differentiated. ----- Lampracanthia Reuter
- D Apex of pronotum subequal to head in width; apical callus of pronotum never reaching the lateral margins; pronotum with side margins flattened. ----- E
- E Hemelytra nearly, or entirely, opaque or sericeous opaque; both veins or corium completely obsolete; embolium discolored. --- Micracanthia Reut.
- E Hemelytra white marked, greasy-shining, with sericeous black spots; embolium black; exterior cordial vein distinct, and sometimes also the base of the interior vein. ----- Teloleuca Reuter

Genus Pentacora Reuter

The members of this genus are above average in size and have the five looped cells of nearly equal size. Two

species may be found in Michigan.

Key to the species of Pentacora Reuter

- A Upper surface dull and with oppressed pubescence;
hemelytra with short sub-erect hairs. -- ligata (Say)
- A Upper surface shining and without oppressed
pubescence but with numerous long erect
dark hairs. ----- hirta (Say)

Pentacora ligata (Say)

Elongate oval. The general facies dark and clothed with gray pubescence. The margins of pronotum and hemelytra, two basal spots on pronotum, four spots on large scutellum, one spot on inner apical angle of clavus, and six or eight spots on corium and embolium dull yellow. The membrane fuscous brown with about four vague median yellow marks. The beak is brown and it reaches between the middle coxae. The fourth segment of the antennae is much longer than the first segment and much shorter than the third segment. The pronotum is about four times as wide as long at the middle; the hind margin is deeply concave with the humeral angles wide, prolonged, sub-depressed, and with a small rounded black callus present. Length 5.5 - 6.0 mm.

Records and specimens seen from the following counties:

Gogebic, Marquette, Charlevoix, Mackinac, and Huron.

Pentacora hirta (Say)

The dorsal color is dull straw-yellow with a narrow forked median stripe between the eyes, large median callus on front lobe of pronotum, three spots on hind lobe, scutellum except apex, and hemelytra except embolium are dark brown and shining. Antennal segments three and four are subequal and united and are slightly longer than segment two. Length 4.8 - 5.5 mm.

Not recorded from Michigan but has been recorded from Indiana.

Genus Salda Fabricius

A robust ovate species having the head slightly prolonged behind the eyes. The beak reaches between the posterior coxae. The pronotum has a convex callus of the front lobe reaching the basal third and bounded on each side and behind by a deeply impressed line. The corium with its costal margin broadly curved. The rest as in the generic key. Three species may be found in Michigan.

Key to the species of Salda Fabricius

- A Apical half of clavus with pale yellow spot. ----- littoralis (Linn.)
- A Apical half of clavus without pale yellow spot but is entirely black. ----- B
- B Dorsal surface is black and very shining; hem-

elytra is faintly coarsely punctate. Form usually more orbicular with apex of pronotum narrower than the width across the eyes. -----
 ----- boucherrillei Prov.

- B Dorsal surface is not shiny and hemelytra is finely punctate and with faint yellow hairs. Apex of pronotum about as wide as across the eyes. ----- buenoi (McDonnough)

Salda littoralis (Linn.)

This species is broadly oval with the general facies black and clothed dorsally and ventrally with closely oppressed yellow hairs. The apical half of the clavus with an oblong yellow spot. The corium has a row of four yellow spots between the first and second veins, and one of two smaller spots on the inner apical third. The antennae thickly pilose with blackish hairs; segments three and four subequal, black, and together slightly longer than segment two which is brown at the base and darker at the tips. Length 5.5 - 7.0 mm.

This species has never been reported from Michigan but its range reaches Illinois and also has been recorded from Indiana.

Salda boucherrellei Prov.

Elongate, oval, or orbicular species. The dorsal surface is usually entirely shiny black or the membranous area may be pale to fuscous. There is a great variance

in this species. The orbicular specimens are very wide in the middle, completely black, and the membrane is small and difficult to distinguish. The elongate oval specimens are not so wide across the middle and have a pale area around the membrane. Brachypterous forms exist which are elongate with the membrane absent. Segment one of antennae is the stoutest and shortest with segment two much the longest; segments three and four subequal and combined are subequal to two. Legs are yellow to piceous. Length 6.0 - 8.1 mm.

Specimens and records seen from the following counties:

Charlevoix, Cheboygan, Berrien, Oakland, Mackinac,
Midland and Van Buren.

Salda buenoi (McDonnough)

An elongate oval species which has its dorsal surface completely black, punctate, and covered with fine yellow oppressed hairs except for membrane. The apical half of scutellum has many lateral striations. Segment one of antennae is very stout and shortest, with two the longest; segment three appears slightly longer than four and combined is subequal to two. The antennal segments are quite hairy. Length 6.2 mm.

Not reported from Michigan but Drake says this species might occur here.

Genus Lampracanthia Reuter

The sides of the pronotum are more or less sinuate with the callus occupying its entire breadth and with the margin very narrow obsolete. The entire hemelytra is very shining, convex, and coriaceous with the membrane scarcely differentiated. The sulcus back of callus is placed far behind the middle. One species might be found in Michigan.

Lampracanthia crassicornis (Uhler)

Oval to convex in form which is strongly shining with a faint brassy tinge. Antennal segments one and two are yellow with segments three and four black, fusiform, and strongly swollen. Hind lobe of pronotum is very short. Callus of apical lobe is large, strongly convex, and reaches the side margins. Hemelytra punctate with each puncture having a long erect black hair. Membrane absent and clavus and corium very similar and surpassing apex of abdomen. Length 4.0 - 4.7 mm.

Not reported from Michigan but has been recorded from northern Indiana.

Genus Micracanthia Reuter

The members of this genus have a narrow interocular area and are usually small in size. The sides of the pronotum are straight and converge strongly. The hemelytra are tectiform and have no corial veins as in the

key. Apex of first cell placed distinctly above apex of the second. Drake says that two or three species may occur in Michigan. I have seen only M. humilis Say and have seen only literature referred to this species so I am unable to make a key to the other species. M. fennica (Reuter) is one of the species which has been recorded from New York by Drake and which he states could occur in Michigan.

Microcanthia humilis Say

Oval oblong species. The head, pronotum, and scutellum black and clothed with thick yellow oppressed hairs. Hemelytra except membrane also covered with short yellow hairs. The clavus is dark brown with small apical white spot. The clavus is of the same color which gives the clavus a definite outline; there are two medium white spots along lateral margin and a small white spot at apex. Embolium with small area at the base, large median spot, and a small apical spot fuscous brown. Membrane with the four looped cells with a few pale scattered fuscous markings present. The beak is long and reaches the hind coxae. Antennae with basal segment shortest, half as long as the second segment, with segments three and four slightly longer than basal segment. The trochanters and basal half of femur is yellow with the rest of legs fuscous brown. Sternum area black; ventral of abdomen reddish-brown. Length 3.2 - 3.5 mm.

6 specimens collected as follows:

5 May, 9 September, 12 September, and 19 September
in Ingham county.

8 May in Van Buren county.

Specimens seen from the following counties:

Wayne, Ingham, Kalkaska, Saginaw, Mecosta, Bay,
Kalamazoo, Berrien and Midland.

Genus Teloleuca Reuter

Drake says that species of this genus may occur in Michigan in the mountainous or hilly terrain. I have seen no records, specimens, or literature pertaining to this genus which is characterized in the key.

Genus Saldula Van Duzee

The majority of the species in the family belong here. The corium with its two fully distinct veins which branch as in the generic key plus the fact that the apex of the first, or interior, cell reaching, or nearly reaching, the apex of the second will separate this genus from others. Nine species and a variety are recorded from Michigan.

Key to the species of Saldula Van Duzee

- A A yellow stripe on side margins of pronotum. -----
----- zanthochila (Fieber)
- A Side margins or pronotum are concolorous. ----- B

- B Upper surface of body with long erect hairs. ----- C
- B Upper surface of body with no erect hairs. ----- E
- C Much larger species; 6 mm or more in
length. ----- confluenta (Say)
- C Much smaller species; less than 5 mm in length. --- D
- D Lateral edges of embolium are pale; apical callus
of pronotum is raised and more prominent. -----
----- orbiculata Uhler
- D Lateral edges of embolium completely black
or with small apical pale spot; apical callus
of pronotum is flatter and less prominent. -----
----- illinoiensis Drake
- E Upper surface is black with a few pale spots;
costal area of corium almost wholly black.
Larger species. ----- lubricus Say
- E Costal area of corium white to yellowish,
usually spotted with darker. Smaller species. ---- F
- F Front side of anterior tibia with long basal
and short apical dark stripe. ----- G
- F Front side of anterior tibia with either three
interrupted stripes or with a short basal stripe
and a very short apical stripe. ----- H
- G Hemelytra is mostly dark except for few
scattered pale spots and membranous area. -----
----- pallipes (Fabricius)
- G Hemelytra almost entirely pale but for short

- broad dark band at base and a few fuscous spots. ----- pallipes var. dimidiata Curtis
- H Front side of fore tibia with short basal and very short apical stripe; embolium pale except at base; side margins of pronotum about straight. ----- opacula (Zett.)
- H Front side of fore tibia with three interrupted stripes; side margins of pronotum are curved. ----- I
- I Sides of pronotum somewhat straighter; a c-shaped marginal pale mark in front of middle of hemelytra. ----- c-album (Fieber)
- I Sides of pronotum more rounded; a dark stripe runs through the c-mark leaving a pale marginal stripe and two small spots within in front of middle of hemelytra. -----
----- saltatoria (Linn.)

Saldula zanthochila (Fieber)

This species is oblong oval. The lateral margins of pronotum are yellow. The head, pronotum, and scutellum are black. Clavus is black with a small oval pale spot near the apex. Corium in general is sordid white with costal area blackish. The membrane is dull white, veins are brown, and three of the cells with fuscous spots. Antennae with two the longest, and two and one-third times as long as segment one; segments three and four are sub-

equal and united are somewhat shorter than two. Length 3.8 - 4.4 mm.

Records and specimens seen only from Gladwin county in Michigan.

Saldula lubricus Say

An elongate oval species which has the dorsal surface almost entirely black but for membrane. Dorsal surface is covered with thick oppressed yellow hairs. The membrane is dusky to white with a median fuscous spot in each cell. The corium may have a few scattered pale spots present. Front callus of pronotum is large and slightly more than half as long as pronotum at the middle. The margins of the pronotum are curved. The antennal segments with one very stout and short; segment two is slender and longest; segments three and four stouter, and united are slightly longer than two. Legs pale to fuscous. Length 6.5 - 8.0 mm.

Specimens and records seen from the following counties:

Cheboygan, Emmett, Gogebic, Marquette, Midland,
Berrien, Huron, and Washtenaw.

Saldula confluenta (Say)

This is an elongate oval species which is black and shining above. Upper surface, especially interocular area, pronotum, and hemelytra but not membrane, are covered with long, black, erect hairs. Embolium is pale except for dark area at base, large spot at middle, and

a small spot at apex. Apex of clavus with small pale spot. Corium has two small pale spots towards apex. Membrane pale with scattered fuscous spots. First antennal segment two-fifths as long as two with the third and fourth segments subequal and united one-fifth shorter than two. Length 6.4 mm.

1 specimen collected 30 June in Kalamazoo county.
Specimens and records seen from the following counties:
Charlevoix, Kalamazoo, Gogebic, Berrien and Marquette.

Saldula orbiculata (Uhler)

Oval to orbiculate species which has the upper surface, except the membrane, covered with long black erect hairs and also covered with coarse yellow pubescence. The embolium is about completely pale yellow and corium has three pale yellow spots which are located near its base, middle, and medianly on apex. These three spots may also be a pale blue color. The membrane is fuscous brown with the tips paler. The eyes may be covered with a few black hairs. The legs, beak, and antennae are about completely dull yellow. Segment one of antennae is stoutest. Segments one, three, and four are subequal with two being the longest and about three-fifths longer than each of the other segments. Length 3.5 - 4.5 mm.

Specimens and records seen only from Berrien county in Michigan.

Saldula illinoiensis Drake

Oval to orbicular species. The dorsal surface is almost completely black but for the membranal area. The upper surface is covered with long erect hairs which also cover the membrane in the orbicular form which has a reduced membrane. The upper surface, except membrane, is covered with oppressed yellow pubescence. Embolium has pale spot just before apex. Membrane is pale with scattered fuscous spots. The legs are completely yellow. First antennal segment is piceous, short and stoutest; segment two is the longest, and segments three and four subequal and united are shorter than two. Length 3.3 - 4.5 mm.

Records and specimens seen from Grand Traverse county only in Michigan.

Saldula opacula (Zett.)

An elongate to oval species which has the dorsal surface black except for hemelytra (the clavus is black except for apical yellow spot). The upper surface is covered with thick yellow oppressed pubescence. Side margins of pronotum about straight. The entire lateral edge of embolium is yellow except at base. Corium with small scattered fuscous spots and with a spot at the half-way mark, spot on inner apical angle, and spot near the outer apical angle are white to pale blue. The membrane is very pale with a few fuscous markings. The legs and

beak are mostly dull yellow. Antenna as in S. orbiculata (Uhler). Length 3.0 - 3.6 mm.

29 specimens collected 8 May in Van Buren county.

Records and specimens seen from the following counties:

Huron, Cheboygan, and Livingston.

Saldula pallipes (Fabr.)

This is an elongate oval species which has a very variable color pattern. The common form has the head, pronotum, and about three-fourths of the hemelytra somewhat shiny black and covered with yellow opressed hairs. Rest of hemelytra is pale with fuscous spots. Membrane smooth and a brown fuscous spot in each cell. Front callus of pronotum is not prominent and is impressed in the middle. Legs are yellow with fuscous markings. The front margin of fore tibia with a long fuscous basal stripe and a short fuscous apical stripe. The first antennal segment the shortest with two the longest; segments three and four subequal and combined slightly shorter than two. Length 3.8 - 4.8 mm.

140 specimens collected as follows:

8 May, and 9 October in Van Buren county.

29 April, 2 May, 3 May, 1 August, 10 September, 12 September, 19 September, 7 October, 19 October, 21 October, 24 October, and 29 October in Ingham county.

Specimens and records seen from the following counties:

Berrien, Cheboygan, Charlevoix, Huron, Iosco, Ingham, Gladwin, Livingston, Lelanau, Keweenaw, Mackinac, Montcalm, Mecosta, Midland, Oscoda, St. Joseph, and Van Buren.

This is by far the most common shore bug in Michigan and can be seen by almost any damp area.

Saldula pallipes var. dimidiata (Curt.)

Differs from S. pallipes (Fabr.) in that the hemelytra is completely pale except at the base of corium and embolium, most of clavus, and the inner apical angle of corium which are black to fuscous. Also the embolium has about three dark spots with two at about the middle and one at the apex. Length 3.8 - 4.6 mm.

10 specimens collected as follows:

19 July, 10 September, 12 September, 19 October, and 24 October in Ingham county.

Records and specimens seen from the following counties:

Cheboygan, Wayne, Oceana, and Ingham.

Saldula saltatoria (Linn.)

Small, elongate oval species. Upper surface is faintly covered with fine pubescence and the color is dark with a few pale markings which are variable as to size and color as they may be pale yellow to pale blue. The head, pronotum, and scutellum are all black. Clavus has a pale spot near apex. Embolium as in the key and also an apical marginal pale spot on embolium with a round white spot

beside it. Membrane is pale with brown veins and with a dark fuscous median spot in each cell. Sides of pronotum somewhat curved. Callus on front lobe is prominent. The black stripes on front of anterior and middle tibia are usually not as dark as in S. c-album (Fieber). Second antennal segment the longest, with one, three, and four about subequal. Length 3.0 - 3.4 mm.

9 specimens collected as follows:

2 May, 5 May, and 9 October in Ingham county.

21 April in Clinton county.

8 May in Van Buren county.

Specimens and records seen only from Berrien county.

This species is very difficult to separate from S. c-album (Fieber) because of the variation in both. However the typical forms are quite simple to determine.

Saldula c-album (Fieber)

Very similar in color and structure except in the embolium markings and the sides of pronotum as stated in the species key. Also the dark stripe on front of anterior and middle tibia are usually dark. Length 3.3 - 4.7 mm.

48 specimens collected as follows:

21 April in Clinton county.

29 April in Washtenaw county.

27 April, 2 May, 3 May, and 5 May in Ingham county.

Records and specimens seen from the following counties:

Washtenaw, Livingston, and Berrien.

FAMILY OCHTERIDAE Kirkaldy (4,27,38)

Velvety shore bugs

The members of this family are small, oval, black or brown insects. They possess strongly convex eyes and two ocelli. Antennae are four-segmented, shorter than the head, and with the two basal joints shorter than the apical segments. It is not hidden in repose. The fore and intermediate tarsi are two-segmented, with the posterior tarsi three-segmented, and with the basal segment small in all cases. All legs are fitted for running. The beak is very long and it reaches the hind coxae with its basal segment very stout. Scutellum is large, triangular. The hemelytra is as long as the abdomen and the membrane has crossveins.

These velvety shore bugs are littorial and are considered the connecting link between the GELASTOCORIDAE of the Cryptocerata and the SALDIDAE of the Gymnocerata. Few species are known and none seem to be common. They live on the shores of streams and ponds among vegetation and all are predacious on insects. One genus and species might occur in Michigan.

Genus Ochterus Latrielle

The front of the head is blunt. Membrane of hemelytra has seven cells. The rest is as in the family description.

Ochterus americanus (Uhler)

An oblong, oval insect with a velvety blue hue above and black beneath. Above is marbled with deep black and sprinkled with golden yellow points. Face is black with the piceous. Each side of the prothorax has a variable-sized bright yellow spot and the costal margin of the corium has five not very distinct yellow spots. The slender legs are dull yellow, tinged with piceous, and the knees, tips of shanks, and apex of tarsi are pitch brown. The first antennal segment is shortest and cylindrical; the second segment is twice the length of the first and is subclavate; third and fourth segments are subequal and each twice the length of two. Length 4.5 - 5.0 mm.

Not reported from Michigan. This insect has a very wide range and is reported from Illinois and Ohio.

FAMILY GELASTOCORIDAE Kirkaldy (4,27,34)

Toad-bugs or Toad-shaped bugs

The body is short, broad, and of a very rough appearance. The eyes are protuberant and project upward and outward. Antennae are hidden beneath the eyes and the beak is short, stout, and four-segmented. The fore legs are raptorial with femur strongly swollen and grooved for reception of tibia. The middle and hind legs are slender and very spiny.

The toad-bugs live on the margins of bodies of water but are usually overlooked due to their harmonizing colors with their environment and their similarity to a young toad. These bugs are predacious on any insect which they can jump on and defeat. One genus and species occur in Michigan.

Genus Gelastocoris Kirkaldy

The body is thicker in front than behind and finely and densely granulate above. The front of the head is triangular. The compound eyes have the inner and lower sides concave with the inner concavity filled by a lobe of the vertex. The sides of pronotum are strongly sinuate with the front angles expanded and concave beneath. The disk of the pronotum and scutellum has blunt tubercles or warts. Hemelytra with inner margins curved and strongly overlapping and membrane not distinct. Rest

as in family description.

Gelastocoris oculatus (Fabricus)

The eyes are very protuberant and widely emarginate from above. Color pattern is extremely variable from yellow-gray, to reddish, to blackish, with many intermediate stages. Surface of the body is finely and coarsely granulated. Front lobe of pronotum has many small ridges and is convex. Legs are distinctly annulate and the femur especially with many spines. Scutellum has the median lobe with a lateral large wart on each side. The hemelytra is as long or longer than abdomen. Connexivum is exposed or not but the apical third of each segment bears hairs. Length 6.4 - 8.0 mm.

71 specimens collected as follows:

11 July in Kalamazoo county.

8 May, 3 July, and 9 October in Van Buren county.

3 May, 28 May, 7 October, 19 October, 24 October in Ingham county.

This species is very common around bodies of water which have a sandy shoreline but are very easy to overlook.

Specimens seen from the following counties:

Wayne, Huron, Midland, and Montcalm.

FAMILY NAUCORIDAE Fallen (27,33,45)

Creeping water bugs

The members of this family are broadly oval and very flat-bodied insects. The head is inserted into the thorax to the middle of the lunate eyes while the antennae are concealed beneath the eyes. Beak is three-segmented and is covered by the labrum at the base. The fore femur are greatly swollen and rapacious. The middle and hind legs are fitted for crawling rather than for swimming. The tarsi are two-segmented. Hemelytra are without veins and have a distinct clavus and corium.

These insects are predacious on anything they can overcome. Their favorite haunts are near shore in grassy and reedy places, where they creep and swim about searching for food. While they are not built for swimming, they are still very capable swimmers. One genus and species is found in Michigan.

Genus Pelocoris Stal

The eyes are lunate and widely separated with the inner margins slightly sinuate. Labium is prominent, almost triangular, and the beak is short and stout. Front femur is very swollen with the tibia slender and folded back in a groove on femur. Front tarsi with one segment which is clawless. Middle and hind tibia and tarsi are spiny.

Pelocoris femoratus (Palisot Beauvois)

Body is oval and somewhat flattened with the head and thorax more or less tinged with green. Interocular area is light brown. The pronotum with a median apical dark brown spot and then speckled and dotted with dark brown. Scutellum and hemelytra finely punctate with a pale median spot on margin of corium and membrane. Embolium is green to yellow except for dusky apex. Apical fourth of each connexival segment with oblong brown spot; all segments with long hairs. Legs are tinged with green and middle and hind femur spiny. The under surface of abdomen is with thick yellow velvety pile. Length 8.6 - 11.0 mm.

80 specimens collected as follows:

7 July, 3 October in Kalamazoo county in Douglas Lake.

22 May, 24 October, 10 November, 12 November in Ingham county.

29 April in Livingston county.

Only found plentiful in Douglas Lake and Lake Lansing. These insects will jab with no provocation and can inflict a very nasty wound followed by extreme pain.

FAMILY NEPIDAE Latrielle (25,27)

Water Scorpions

The members of this family have two long respiratory filaments at the apex of the abdomen and raptorial fore legs with very long coxae. The beak is short and three-segmented. Antennae are very short and hidden in a pocket beneath each eye. Water scorpions may be found on the edges of almost any pond, creek, or even in stagnant waters providing there is vegetation and debris present. They are predacious upon anything they can capture with their raptorial forelegs and vicious beak. The bite may be very painful and care should be exercised in the handling of them. Two genera and five species occur in Michigan.

Key to the Genera of NEPIDAE Latrielle

- A Body is flat and broadly oval. ----- Nepa Linnaeus
- A Body is very elongate. ----- Ranatra Fabricus

Genus Nepa Linnaeus

Very flat and broadly oval insects which have the head inserted in the thorax to the eyes. The front legs are raptorial. One species is found in Michigan.

Nepa apiculata Uhler

Color is a dull fuscous gray with the base of abdomen tinged with reddish. Surface and margins of the head and thorax are roughly granulated. The thorax has a ridged

median line and three short ridges on each side.

Scutellum, corium, and clavus covered with short stiff pile. Length of body 15 - 18 mm. Length of respiratory filaments 6.4 - 8.0 mm.

6 specimens collected as follows:

25 February, 21 April, 10 November, 13 November, 18 November, 25 November in Ingham county.

This species is either quite rare or is easily overlooked by the collector.

Specimens seen from the following counties:

Berrien, Cheboygan, Oceana, and Washtenaw.

Genus Ranatra Fabricus

Elongate and slender species which have prominent and protruding eyes. Fore legs are very raptorial and the tail filaments usually quite long. Three species and one sub-species are recorded from Michigan.

Key to the species of Ranatra Fabricus

- A Antennae simple; penultimate segment
without lateral branch. ----- B
- A Antennae not simple; penultimate segment
with lateral branch. ----- C
- B Front femur without marked sinuosity or
preapical tooth. ----- kirkaldyi Bueno
- B Front femur with marked sinuosity or
preapical tooth. ----- kirkaldyi var. hoffmanni Bueno

- C Lateral branch of penultimate segment of antennae not greater than one-half the length of the ultimate segment; front femur is very slender and without a preapical tooth. -----
----- nigra Herrich & Schaeffer
- C Lateral branch of penultimate segment of antennae greater than one-half the length of the ultimate segment; front femur not so slender and with a preapical tooth. -----
----- fusca Palisot De Beauvois

Ranatra kirkaldyi Bueno

The front femur is not narrowed near the middle and without a preapical tooth or sinuosity. Antennae as in the species key. Eyes are small and not as prominent. Respiratory filaments shorter than the length of abdomen with the tarsi extending beyond the middle of the filament. Length of body 24 - 27 mm. Length of respiratory filament 12 - 15 mm.

7 specimens collected as follows:

29 October, 17 November in Ingham county.

2 October in Kalamazoo county from Stony Lake.

21 April in Clinton county.

This is the smallest of our Ranatra and it is not too common.

Specimens seen from the following counties:

Berrien, Monroe, and Washtenaw.

Ranatra kirkaldyi var. hoffmanni Bueno

Differs from R. kirkaldyi Bueno in that the front femur has a preapical tooth. Length of body 28 mm. Length of respiratory filaments 14 - 16 mm.

5 specimens collected as follows:

24 October and 29 October in Ingham county.

Hungerford says this variety is stouter, shorter, and with the preapical tooth. My specimens agree in being stouter and having the preapical tooth but are slightly longer than R. kirkaldyi Bueno.

Ranatra nigra Herrich & Schaeffer

Eyes are quite protuberant and transverse. The front femur are long and slender and with no preapical tooth or sinuosity. Antennae as in species key. Body is narrow and may be light brown to yellow in color. Hemelytra with membrane which is darker. Length of body 29 mm. Length of respiratory filaments 19 mm.

1 specimen collected 29 October in Ingham county.

Specimens seen from the following counties:

Lake, Monroe, Calhoun, and Washtenaw.

Ranatra fusca Palisot De Beauvois

Eyes are very protuberant. Prothorax is narrow in the middle and wider at both ends especially at the base. Front femur has a distinct preapical tooth and the femur is about one-half longer than coxae. The antennae as in the species key. Length of body 31 - 40 mm. Length of

respiratory filaments 18 - 33 mm.

170 specimens collected as follows:

9 October in Van Buren county.

7 July, 11 July, 20 September in Kalamazoo county.

8 May, 2 June, 21 June, 25 October, 29 October,

11 November, 12 November, 13 November, 17 November,

18 November, 25 November in Ingham county.

This is by far the most common Ranatra in Michigan.

A few hours collecting along almost any stream will yield over one hundred specimens. There is a great variance in size in this species.

Specimens seen from the following counties:

Arenac, Alcona, Berrien, Cheboygan, Lake, Monroe, Kent, Montmorency, Mackinac, Huron, Iosco, Grand Traverse, Jackson, Saginaw, Tuscola, Washtenaw, Shiawassee, Wayne, and Midland.

FAMILY BELOSTOMATIDAE Leach

Giant Water bugs

This family includes medium-sized to very large species (18 - 110 mm) which are flat and oval to almost oblong. Eyes are large and project backward over the front angles of the pronotum. Antennae are small, four-segmented, and hidden beneath the eye. The beak is very stout and three-segmented. Hemelytra has clavus, corium, embolium, and membrane present; membrane has many longitudinal veins. Two straplike retractile respiratory filaments are present at apex of abdomen. The front legs are raptorial with femur enlarged and grooved more or less for reception of tibia; fore tarsi with single claw. Middle and posterior legs are ciliated and clothed with long hairs for swimming, middle and hind tarsi have two claws.

Some of the larger species are called "electric light bugs" because the adults are attracted to lights at night in the summer. Our largest species of the order HEMIPTERA are in this family.

All members are predacious rulers of their habitat, and feed on most water dwelling creatures including fingerling fish. Care should be exercised in the handling of any of these bugs because they are capable of inflicting a nasty painful wound with beak. Three genera and about four species are found in Michigan.

Key to the Genera of Belostomatidae Leach

- A Anterior femur not grooved for reception
of tibia. ----- Benacus Stal
- A Anterior femur grooved for reception of tibia. ---- B
- B Head conically produced; beak long and thin;
species less than 30 mm. ----- Belostoma Latrielle
- B Head not conically produced; beak short and
stout; species over 40 mm. ----- Lethocerus Mayr

Genus Benacus Stal (4,27)

This genus contains the largest member of this family in our territory. Fore femur is without grooves and is not swollen as in Lethocerus. One species is found in Michigan.

Benacus griseus (Say)

An elongate oval large species. The vertex and front, median stripe on front lobe of pronotum are orange yellow. The rest of upper surface is dull yellow brown. Sternum area is yellow except for three black stripes and the ventrals of the abdomen are fuscous. Legs are yellow to fuscous. Pronotum has a median impressed narrow line. Inner sides of fore femur, tibia, and tarsi are covered with rough orange pile. Length 70 mm. 1 specimen collected 7 August in Ingham county.

This large species seems to be much less common than Lethocerus americanus Leidy.

Specimens seen from the following counties:

Berrien, Cheboygan, Midland, and Washtenaw.

Genus Lethocerus Mayr (5,37)

An elongate oval species which approaches the smaller Benacus in size and color but the fore femur is grooved for reception of the tibia and the fore femur is more swollen. The legs appear somewhat shorter than in Benacus. One true species exists in Michigan.

Lethocerus americanus (Leidy)

Elongate oval species with the dorsal color yellow and fuscous brown. The scutellum is fuscous with a pair of yellow lines extending back on lateral sides. Head with faint longitudinal median carina. Front lobe of pronotum with a faint impressed longitudinal median line and the hind lobe of pronotum plus scutellum with faint median carina. Sternum more or less yellow with the abdomen fuscous. The middle and hind femur are somewhat annulate with tarsi and tibia yellow to fuscous. The fore femur is fuscous with a deep groove on inner side which is covered with thick orange pile. Interocular space at narrowest point is equal to the width of an eye. Hemelytra has a median oblong oblique spot of long oppressed golden hairs on corium just before the membrane. Length 40 - 58 mm.

6 specimens collected as follows:

14 October, 29 October, 12 November, 13 November,
in Ingham county.

The smaller males of this species have been called
L. obscurus Dufour by Blatchley and others but this is
not a good species according to Cummings.

Specimens seen from the following counties:

Berrien, Jackson, Ionia, Monroe, Livingston,
Midland, and Washtenaw.

Genus Belostoma Latrielle (4,27)

Species in this genus are medium-sized (18 - 30 mm)
and are oval. The beak is produced beyond the apex of the
cheeks and is long and thin. The anterior legs are
short and somewhat stout with femur and tibia grooved
and the middle and posterior legs are longer and thin.
Membrane is separated from corium by a straight vein.
Oval spot of oppressed golden hairs is present on inner
apical angle of corium.

The eggs of this genus are placed on the back of the
male by the female and are carried there until the eggs
hatch. Two species occur in Michigan and are often
referred to as "toe-biters".

Key to the species of Belostoma Latrielle

- A Head short obtuse with apex blunt; usually less
than 19 mm in length. ----- testaceum (Leidy)
- A Apex of head not blunt but pointed; more than
19 mm in length. ----- flumineum Say

Belostoma testaceum (Leidy)

Broadly oval species. Color pattern is similar to B. flumineum Say. Head is short obtuse with apex blunt. Rest as in B. flumineum Say. Length 14 - 18 mm.

Reported from Michigan by Blatchley but not collected as yet by the author.

Belostoma flumineum Say

A medium-sized oval species. Large fuscous spot between the eyes and extending from the apex of the eyes to tip to tylus. Dorsal surface is brownish-yellow to fuscous with the ventral surface yellow-brown spotted with fuscous. Large fuscous spots on the legs. Front lobe of pronotum has a median impressed longitudinal line. Length 19 - 23 mm.

290 specimens collected as follows:

8 May, 4 July and 9 October in Van Buren county.

7 July, 11 July and 20 September in Kalamazoo county.

5 June, 11 June, 21 July, 19 September, 27 September,

14 October, 21 October, 26 October, 29 October,

5 November, 7 November, 12 November, 13 November,

18 November in Ingham county.

Specimens seen from the following counties:

Barry, Berrien, Cheboygan, Monroe, Mecosta, Midland, Isabella, Tuscola, Oakland, Clare, Wayne, Washtenaw, Livingston, Huron, Luce, Monroe, and Saginaw.

This species is by far the most common species of

BELOSTOMATIDAE and it may be collected from about any type of water habitat around vegetation.

FAMILY NOTONECTIDAE Leach

Back-swimmers

The members of this family swim on their backs and so their structures are modified to suit this odd life. The body is deep and boat-shaped with the dorsal surface convex and obtusely keeled. Eyes are large, prominent, and sinuated twice on the outer side. Ocelli are absent. The antennae are short and partially concealed by the eyes. Legs are all different; anterior pair are short and used for grasping prey; middle pair are longer and are used for grasping vegetation; the posterior pair are the longest, flattened, and fringed with hairs for swimming. The abdominal sternites are keeled and the keel plus the sides of the sternites are fringed with hairs. Hemelytra is without veins; clavus, corium, and membrane have about the same texture.

Backswimmers have a worldwide distribution and inhabit almost any type of water. All members are predacious on anything they can overcome. Care should be exercised in the handling of backswimmers, especially in the genus Notonecta which are capable of puncturing the skin with their beak which causes intense pain. Three genera and about eleven species may be found in Michigan.

Key to the Genera of NOTONECTIDAE Leach

A All legs are similar. ----- Plea Leach

- A All legs are not similar with the hind legs flattened and fringed with long hairs for swimming. ----- B
- B Claval orifice (Hemelytral commissure pit) present near apex of scutellum. ----- Buenoa Kirkaldy
- B Claval orifice not present. ----- Notonecta Linn.

Genus Buenoa Kirkaldy (2,3,4)

These backswimmers are quite slender and small (4.5 - 9.0 mm) and are generally referred to as the "slender backswimmers". The eyes are not contiguous and the interocular area is long and narrow. Antennae is three-segmented with the last segment longer than the penultimate segment. Anterior and middle legs are armed with spines and the tarsi are two-segmented. Fore and middle tarsi with claws but the hind tarsi with no visible claws. The keel of venter of abdomen is very pronounced. Hemelytra is much more transparent than in Notonecta species and the claval orifice is present as in the key.

The members of this genus do not rest on the surface of the water as do Notonecta but rest in midwater some distance beneath the surface. They are predacious on Entomostraca. Four species are reported from Michigan.

Key to the species of Buenoa Kirkaldy

- A Scutellum broad and as long or longer than pronotum. ----- margaritacea Bueno
- A Scutellum reduced and narrow; not as long

- as pronotum. ----- B
- B Length less than 6 mm; interocular area very
small.----- elegans (Fieber)
- B Length greater than 6 mm; interocular area
greater. ----- C
- C Male pronotum tricarinate; front femur and
tibia large. ----- macrobatialis Hungerford
- C Male pronotum large, inflated, and not
carinate; front femur and tibia normal. -----
----- linnocastoris Hungerford

Buenoa margaritacea Bueno

Elongate and somewhat slender. *Synthlipsis* to vertex is straw-yellow and from vertex to beak is brown. The eyes are large with narrowest point about one-half the widest point at vertex. Dorsal surface is straw-yellow and hyaline except for scutellum which is generally bright orange. Some black may show through the hyaline surface of dead specimens, especially on the pronotum. The first three or four dorsal abdominal segments generally bright orange showing through hyaline surface of hemelytra. Ventral surface is black. Male pronotum appearing tricarinate and female with only a vague median carina. Length 6.6 - 7.4 mm.

77 specimens collected as follows:

10 November and 11 November in Ingham county.

Collected from only one pond in which this species

was very plentiful. This species is the most common one in this genus.

Buenoa elegans (Fieber)

Small, very slender species with head all eyes but for very narrow interocular area. The eyes are almost continuous at the base. Interocular area, basal one-third of the costal margin of hemelytra, round spot in lateral margin of membrane, and a faint median stripe in corium are fuscous brown or black. Rest of dorsal surface is light straw-colored and hyaline. Pronotum has a faint median carina and longer than the scutellum which is humped toward apical half. Length 4.9 - 5.1 mm.

12 specimens collected as follows:

7 October in Ingham county.

This is the smallest species of Buenoa. Found in the same pond with B. margaritacea Bueno.

Records of the following counties:

Huron, Cheboygan, Berrien, and Washtenaw.

Buenoa macrobatialis Hungerford

Dirty white color. Both sexes with median longitudinal carina on pronotum. Fore femur of male is very thick with tibia broad and flat. Length 6.2 - 7.5 mm. Reported in Michigan only from Cheboygan county.

Buenoa limnocastoris Hungerford

Pronotum of male is large, inflated, not carinate

and twice the length of scutellum. Scutellum of female is two-thirds the pronotum.

Reported in Michigan only from Cheboygan county.

Genus Plea Leach (4,27)

Very small (1.2 - 3.3 mm) and convex with a thick body. The head is as wide as the pronotum and the eyes are widely separated and dorsolateral. Base of beak is broad and almost reaches the middle coxae. Legs are all similar except that the hind legs are fringed with a few hairs on tibia and tarsi. Scutellum is small and triangular. The hemelytra all of same texture and meeting down the back in a straight line with the membrane absent. Hind wings may be absent or present. These "Pigmy water bugs" creep and swim about in vegetation where they are predacious on small Crustaceans. Two species occur in Michigan.

Key to the species of Plea Leach

- A Suture between clavus and corium faint or absent; dull yellow color with no distinct fuscous markings; reddish-brown streak between the eyes. ----- striola Fieber
- A Suture between clavus and corium very pronounced; fuscous markings present; large dark spot between the eyes usually. ----- harnedi Drake

Plea striola Fieber

The color above is shining straw-yellow with the surface evenly and coarsely punctate. Eyes are red and coarsely granulated. Head with a reddish-brown streak between the eyes. Ventral aspect plus coxae and trochanters are fuscous brown with the rest of legs lighter color. The rest as in the species key. Length 1.8 - 2.1 mm.

58 specimens collected as follows:

22 April, 23 April, 19 May, 12 June, 15 June, 21 July,
14 September, 27 September in Ingham county.

29 April in Livingston county.

8 May, 1 July, and 8 July in Kalamazoo county.

29 April in Washtenaw county.

This species is very common in most bodies of water.
All specimens have the hind wings absent.

Specimens seen from the following counties:

Gladwin, Isabella, Midland, Mecosta, Antrim, Berrien,
Cheboygan, and Washtenaw.

Plea harnedi Drake

Dorsal color is more gray marked with fuscous brown. Large triangular spot, two stripes on leading edge of pronotum and on lateral sides of pronotum, basal three-quarters of scutellum, edges of claval suture, and corium irregularly splotched with fuscous brown. Ventral surface is blackish. Rest as in species key. Length 2.0 - 2.1 mm.

16 specimens collected as follows:

22 April, 23 April, 3 May, 15 June, and 1 August
in Ingham county.

1 July, 11 August, and 20 September in Kalamazoo
county.

All specimens have full membranous hind wings. It
is not known whether this is a good species or a color
variety of P. striola Fieber. Hungerford informed the
author that all species may or may not have hind wings
developed. It is odd that all of the light colored P.
striola have no hind wings, while all of the darker forms
have full hind wings.

This species has never been reported from Michigan pre-
viously.

Genus Notonecta Linn. (24)

The apical margin or pronotum is truncate and the
head is shorter than the pronotum. The beak and antennae
are four-segmented. The sides of thorax and the plates
covering the bases of the hind coxae are covered with
long hairs. The rest as in family description.

Key to the species of Notonecta Linn.

- A Mesotrochanters acutely angulate. - lunata Hungerford
- A Mesotrochanters more or less rounded. ----- B
- B Keel of fourth abdominal sternite bare. ----- C
- B Keel of fourth abdominal sternite covered with

- long hair. ----- D
- C Synthlipsis slightly less than one-half the vertex; scutellum usually pale yellow and form quite robust. ----- borealis Bueno & Hungerford
- C Synthlipsis more than one-half the vertex; scutellum usually black and form more elongate and less robust. ----- insulata Kirby
- D Synthlipsis about one-third vertex; generally larger; dark species with irrorated brown and black pattern. ----- irrorata Uhler
- D Synthlipsis slightly over one-half vertex; generally smaller; black and white colored species. ----- undulata Say

Notonecta lunata Hungerford

The color is very variable. The front lobe of pronotum is slightly green and the basal lobe of pronotum and scutellum is pale yellow. Hemelytra is pale white with no black marking. Another common form has the front lobe of pronotum appearing green with the basal lobe appearing black. Part of scutellum is fringed with black and the rest yellow. Hemelytra is a darker pale white with large fuscous spot at the apex of corium along the lateral margins. Rest as in the species key. Length 8.5 - 10.0 mm.

172 specimens collected as follows:

7 July, 11 August, 20 September, and 2 October in

Kalamazoo county.

2 June, 27 September, 7 October, 14 October, 21 October, 24 October, 25 October, 29 October, 7 November, 10 November, 12 November, 13 November, 17 November, and 18 November in Ingham county.
21 April in Clinton county.

Specimens seen from the following counties:

Alpena, Cheboygan, Luce, Otsego, Schoolcraft, Saginaw, and Washtenaw.

This is the most common species of Notonecta with the exception of N. undulata Say with whom it commonly is collected in ponds and streams.

Notonecta borealis Bueno & Hussey

This large robust species has the abdomen broader than the pronotum at the humeral angles. Usually pale color above including yellow scutellum. Length 12.4 - 14.2 mm.

I have seen specimens from Cheboygan and Mackinac counties in Michigan and reported only from there.

Notonecta insulata Kirby

Large elongate species with variable color pattern. Typical pattern has the head and front portion of pronotum yellow with hind portion and scutellum solid deep black. Clavus and corium light reddish to orange-yellow except for apex of clavus. Spot at inner apical margin of corium, few interrupted submarginal spots,

and corium all of which are black. Membrane is smokey to black. Ventrals are dark and very hairy with the metaxyphus yellow. Synthlipsis very wide as in key. Keel is as in the key. Length 13.2 - 15.0 mm.

5 specimens collected as follows:

1 May, 2 June, 3 November, and 10 November in Ingham county.

Specimens seen from the following counties:

Cheboygan, Chippewa, and Washtenaw.

Notonecta irrorata Uhler

Large elongate species with a very dark color. Interocular area is light yellow. The apical third of pronotum is light brown to green with basal two-thirds black. The scutellum is solid dull black. Clavus and corium are black with large and small scattered brown freckles. The membrane is smokey black. The ventral surface is mostly black. Length 12.0 - 15.1 mm.

141 specimens collected as follows:

26 March, 9 October in Van Buren county.

21 July, 1 August, 19 September, 1 October, 14 October, 25 October, 10 November, 11 November, 12 November, 13 November, 18 November in Ingham county.

Specimens seen from the following counties:

Alpena, Berrien, Cheboygan, Jackson, Livingston, Saginaw, and Washtenaw.

Notonecta undulata Say

The color of the hemelytra is extremely variable from almost total black to pure white. Scutellum varies from all black to almost solid yellow. The typical color is black and white. Head and legs are often tinged with green and the mesotrochanters are rounded. Last abdominal segment of female is notched at the tip with the notch deeper than wide. Rest as in species key. Length 10.7 - 13.0 mm.

272 specimens collected as follows:

29 April in Washtenaw county.

26 March, 4 July, 9 October in Van Buren county.

7 July, 11 July, and 2 October in Kalamazoo county.

1 May, 2 June, 15 June, 21 July, 1 August, 20 August, 1 October, 14 October, 24 October, 25 October, 29 October, 5 November, 10 November, 11 November, 12 November, 13 November, 18 November and 12 December in Ingham county.

21 April in Clinton county.

Specimens seen from the following counties:

Alcona, Alpena, Berrien, Cheboygan, Chippewa, Charlevoix, Huron, Houghton, Iosco, Jackson, Luce, Muskegon, Monroe, Saginaw, Livingston, Marquette, Schoolcraft, Midland, and Washtenaw.

This species is by far the most common of the back-swimmers and it may be found in almost any type of water habitat.

FAMILY CORIXIDAE Leach (18,22,27,28)

Water boatmen

These are small to medium-sized species (2 - 12 mm) which have a broad head which overlaps the anterior margin of the pronotum. The so-called beak is not segmented and appears very stout. Antennae are three- or four-segmented and are hidden beneath the eyes. The legs all siffer. The fore legs which are modified for scooping, have short hairy palae which are modified tarsi. The middle legs are long, slender, and used for anchoring the insect to a support. The hind legs are flattened and fringed with hair for swimming. All parts of the hemelytra have about the same texture with the membrane being veinless.

This is the only family which is not entirely predacious. A few members of this family are predacious on dipterous larvae, but all of the remaining species are herbiverous. These water boatmen can be found in all types of water and they are very important both as a fish food and in preserving the biotic balance of waters. This family contains by far the most species of any of the water bugs. Six genera and forty-four species have been reported from Michigan. I have added one new genus and 2 new species records for the state.

Key to the Genera of CORIXIDAE Leach

- A Small, shining, non-rastrate insects. Male with sinistral abdominal asymmetry and with a strigil present; palae is short with tibia produced over the base of palae like a spur. Female with apex of clavus not reaching line drawn transversely from the nodal furrow at costal margin. ----- Trichocorixa Kirkaldy
- A Not as above. ----- B
- B Male and female pala narrowly digitiform with male pala with two rows of pegs; row of stout short pegs along upper edge of palm plus lower row of usual pegs. Well developed apical claw on fore tarsi of both sexes. Male strigil dextral. ----- Graptocorixa Hungerford
- B Not as above. ----- C
- C Nodal furrow absent; palae is long and narrow with few hairs and male palae ending in a broad elongate claw. Surface of pronotum shining, and without distinct crossbars. Male asymmetry dextral with strigil absent; post-ocular area of head is broad. ----- Cymatia Flor
- C Not as above. ----- D
- D Nodal furrow present; female palae long and slender and male palae with two rows of pegs; male asymmetry is dextral with the strigil absent. Pronotum and hemelytra are cross-

banded but not so contrasting and heavily
 rastrate. Median lobe of seventh abdominal
 tergite with fringe of long hairs. Interocular
 area broad; postocular area narrow. -----

----- Callicorixa B. White

D Not as above. ----- E

E Pruinose area beyond nodal furrow very long.

Vertex bluntly produced with interocular
 area very narrow; rear margin of head strongly
 curved and embracing a very short pronotum.

Dorsal surface is rugulose and hemelytra
 with vermiculate markings; membrane small
 and undifferentiated and hind wings usually
 aborted. Male asymmetry dextral with
 strigil present; one row of pegs on male palae;
 interocular area much narrower than the

width of eye. ----- Palmocorixa Abbott

E Not as above. ----- F

F Fairly large species; pronotum, clavus, and
 corium usually rastrate. Pruinose area of
 claval suture is usually much shorter (one-
 half to one-third) than pruinose area beyond
 nodal furrow. Male asymmetry dextral and
 strigil present and large. Male palae with
 one row of pegs generally following contour
 of palae. Lateral lobe of prothorax is more
 or less truncate at apex. ---- Hesperocorixa Kirkaldy

F Smaller species; pruinose area of claval suture is as long or longer than pruinose area beyond nodal furrow. Male asymmetry dextral with smaller strigil. One row of pegs usually on male palae; lateral lobe of prothorax is elongate and tongue-shaped. ----- Sigara Fabr.

Genus Cymatia Flor

The face is short and the intraocular area is reduced. The beak is not crossridged. The front tibiae are short. Rest as in the generic key. One species has been reported from Michigan and that in the northern portion of the state.

Cymatia americana Hussey

The head is green with the pronotum dark olive-green to olive-brown. Hemelytra is olive-green marked with black. Clavus has oblique black lines. Corium irregularly punctate with black and separated from membrane by a black line. No distinct cross-bars on pronotum. Male and female palae similar; elongate, spiny, and with few lower palmar bristles. Length 5.9 - 8.3 mm.

Reported in Michigan only from Cheboygan county.

Genus Callicorixa B. White

Medium-sized insects with the surface heavily ras-

trate. The head is short and broadly rounded in dorsal view. Metaxyphus is well developed. Rest as in the generic key. Two species are found in the upper part of lower Michigan.

Key to the species of Callicorixa B. White

- A Male with dense patch on front femur and the palae has apical row of pegs distinctly overlapping basal row of pegs. Apical third of first segment of hind tarsi covered with black spot on both male and female. ----- alaskensis Hungerford
- A Male and female without black infuscated area on first segment of hind tarsi. audeni Hungerford

Callicorixa alaskensis Hungerford

Palae of male which has two rows of overlapping pegs and the dark spot on hind tarsi will separate this species from C. audeni Hungerford. Length 6.9 - 8.1 mm.

Reported in Michigan only from Cheboygan county.

Callicorixa audeni Hungerford

This species lacks the dark spot on the first segment of hind tarsi and the male palae has two rows of pegs which do not overlap. Length 7.1 - 8.1 mm.

Records seen from the following counties:

Cheboygan, Charlevoix, Dickinson, Mackinac, and
Bois Blanc Island.

Genus Palmacorixa Abbott

This is a small, elongate, slender species which has the vertex bluntly produced and the synthlipsis narrow. The pronotum is very short and embraced by the rear margin of the head which is strongly curved. Dorsal surface is rugulose and the hind wings are absent. Male palae are thin with narrow palm. The metaxyphus is short and almost triangular. Rest as in the generic key. Three species have been recorded from Michigan but are quite rare.

Key to the species of Palmacorixa Abbott

- A Male palae is very broad and flat with a cluster of poorly defined pegs near basal part; the black lineations of hemelytra do not form blotches or heavy stripes.- gillettei Abbott
- A Male palae not broad and flattened and pegs in arching row and often crowded apically into two rows of longer pegs. ----- B
- B Middle femur of male with longitudinal row of pegs on ventral surface. ----- nana Welley
- B Middle femur of male without longitudinal row of pegs on ventral surface.----- buenoi Abbott

Palmacorixa gillettei Abbott

Six or more brown cross-bands on pronotum. The hemelytral pattern is reticulate or effaced on the inner

basal area of clavus. Membrane concolorous with corial pattern. Hemelytra is rugulose. Mesoepimeron is slightly broader than lateral lobe of prothorax with osteole scent gland lateral of tip. Metaxyphus is short, triangular, and pointed. Male pala is dilated and much flattened with no definite pegs. The front femur of male has a very large stridular field of pegs on the inner side. Length 4.6 - 6.0 mm.

Records seen from the following counties:

Berrien, Washtenaw, and Cheboygan.

Palmacorixa buenoi Abbott

Four to nine brown cross-bands on pronotum which may be split or broken. The hemelytra is reticulate throughout and rugulose. The mesoepimeron is slightly broader than lateral lobe of prothorax with the scent gland osteole just lateral of tip. Metaxyphus is short, triangular, and pointed. Male with pala which is thin and elongate with pegs in a single row; the front femur with a stridular area of pegs. Length 4.3 - 6.0 mm.

Records seen from the following counties:

Huron, Pigion, and Cheboygan.

Palmacorixa nana Walley

A yellowish-brown color suffused with brown. The pronotum with seven slightly interrupted transverse black cross-bands. Hemelytra with pattern of fairly large coarse blackish flecks and the membrane tinged

with brown. Front femur is twice as long as broad and with a small stridular area. Middle femur with a long row of pegs on lower surface. Pala of male is shorter and stouter than in P. buenoi Abbott and with more slender pegs in a single row. Length 4 - 5 mm.

Records seen from the following counties:

Washtenaw and Pigion River.

Genus Trichocorixa Kirkaldy

Small, shiny, elongate species which never exceeds 5.6 mm in length. The palae as in the key. Female with nodal furrow appearing as a transverse to oblique line across the pruinose area near the apex of the embolar groove. Vein is nearly straight and appears to end some distance before nodal furrow. Rest as in the generic key. Three species have been reported in Michigan.

Key to the species of Trichocorixa Kirkaldy

- A Length of pronotum one-fourth the width.
Hind wings usually vestigial; very small
species. ----- macroceps (Kirkaldy)
- A Length of pronotum one-third the width
and hind wings present. ----- B
- B Costal margin of hemelytra is deeply
emarginate just before the nodal furrow
in some specimens. Female with apical
pruinose area of embolar groove is less

than the length of the nodal furrow with this area small and wedge-shaped. Male strigil is small and oblong. The dark lines of pronotum and hemelytra are usually thicker than the pale interspaces. - naias (Kirkaldy)

- B Costal margin of hemelytra is not deeply emarginate just before the nodal furrow. Female with apical pruinose area of embolar groove is slightly longer than the nodal furrow. Male strigil is little more than a dark line. Dark lines on the pronotum and hemelytra are usually predominant. ----- calva (Say)

Trichocorixa calva (Say)

Pronotum crossed by 8 to 9 somewhat broken or complete brown bands usually narrower than pale lines. Color pattern of hemelytra is similar to T. naias (Kirkaldy) except the pale color is predominant and wider than the black markings. There is a dark spot at the apex of embolar pruinose area, lateral tip of membrane, and on corium near the apex of clavus. Pronotum is minutely rugulose with the hemelytra shiny. A line produced from nodal furrow towards clavus does not reach the apex of clavus of male. Pala of male overlapping greatly by tibial spur with about 16 pegs in a row. Strigil as in the key. Lateral lobe of prothorax all but hidden by the eye and swollen mesoepimeron. Meta-

xyphus is small and almost truncate at the apex. Female with a line produced from nodal furrow towards clavus exceeds the apex of the clavus. Lateral lobe of pronotum not as hidden in female and ventral surface at apex of abdomen appears slightly heavier on the left side. Length 4.2 - 4.9 mm.

8 specimens; 4 males and 4 females collected as follows:

27 September, 3 October, and 14 October in Ingham county.

20 September in Kalamazoo county.

8 May in Van Buren county.

Specimens seen only from Washtenaw county.

Trichocorixa naias (Kirkaldy)

Pronotum is crossed by seven dark brown bands which are slightly broader than the pale bands. Clavus with broken, wavy, lateral narrow pale bands on wider brown background except at inner basal area which is more pale with a few narrow broken black lines. Corium also has pale lines more or less lateral and much narrower than brown lines. The pronotum is rugulose with the hemelytra only slightly so and shiny. Male has the nodal furrow splitting embolium into long basal and short apical sections. A line produced through nodal furrow to clavus does not exceed the apex of the clavus. Pala with single curved row of 14 pegs and the apex of the tibia is produced over the pala. Strigil is small and oval. Lateral lobe of prothorax is elongate and

fairly broad with the inner apex slightly prolonged. Mesoepimeron is slightly narrower with the scent gland osteole lateral of apex. Female has the nodal furrow at the apex of embolar groove and slightly below a line produced from nodal furrow to the apex of the clavus. Outer edge of embolium is sharply emarginate at about the nodal furrow. Female pala is normal. Lateral lobe of prothorax is broad with rounded tip and about as broad as mesoepimeron which has osteole just lateral of tip. Length 3.4 - 3.8 mm.

5 specimens: 4 males and 1 female collected as follows:

20 September, 27 September, 3 October, and

1 November in Ingham county.

Records seen from the following counties:

Cheboygan, Berrien, Kalamazoo, Oakland, Midland
and Washtenaw.

Trichocorixa macroceps (Kirkaldy)

Pronotum has two or three indefinite brown cross-bars. The clavus with dark markings coalesced along outer margin with the inner basal area mostly pale brownish-yellow. The corium has indistinct pale markings in a somewhat longitudinal series with the membrane narrow and golden brown. Pronotum is very narrow and slightly rugulose to rastrate with the hemelytra somewhat shiny and slightly wrinkled. The nodal furrow does not divide the embolar groove. The lateral lobe of prothorax is narrow, elongate, and somewhat hidden by the

swollen mesoepimeron. The mesoepimeron is broader than the lateral lobe of thorax and with the scent gland osteole located just lateral of tip. Male pala with about 14 pegs in a single slightly curved row and the pala overlapped by a very large tibial spur. Strigil is elongate oval and small. Female pala is normal. The metaxyphus is as long as broad and arrowshaped with a rounded tip. Length 3.0 - 3.1 mm.

13 specimens collected as follows:

8 May, and 2 October in Kalamazoo county from Douglas Lake.

All have brachypterous hind wings.

Specimens and records seen from the following counties:

Kalamazoo and Livingston.

Genus Hesperocorixa Kirkaldy

These are usually fairly large species which have the clavus and corium rastrate in varying degrees. The pruinose area of embolar groove is as in key. Median vein usually reaches the nodal furrow. The metaxyphus is well developed and long in most species. Lateral lobe of prothorax is trapizoidal and somewhat truncate at the apex. Male has the front tibia with a small bunch of stiff hairs near the apex and pala with a single row of pegs following the curvature of the upper margin. The male abdominal asymmetry is dextral and the strigil

is quite large. Rest as in generic key. Twelve species have been reported from Michigan, and of this number, nine have been found in lower Michigan.

Key to the species of Hesperocorixa Kirkaldy

- A Mesoepimeron at level of scent gland osteole definitely narrower than lateral lobe of prothorax. ----- F
- A Mesoepimeron at level of scent gland osteole as broad or broader than lateral lobe of prothorax. ----- B
- B Dorsal surface of hind femur armed with only two or three very stout spines. minorella (Hungerford)
- B Dorsal surface of hind femur armed with many spines. ----- C
- C Mesoepimeron at level of scent gland osteole about the same width as lateral lobe of prothorax. ----- atopodonta (Hungerford)
- C Mesoepimeron at level of scent gland osteole much broader than lateral lobe of prothorax. ----- D
- D Length 7.5 mm or less. ----- E
- D Length 8.0 mm or more. Pronotum with faint cross-bands and membrane golden brown. -----
----- kennicotti (Uhler)
- E Corial pattern is cross-banded. -----
----- michiganensis (Hungerford)
- E Corial pattern in longitudinal series. -----

- semilucida (Walley)
- F Color pattern usually in part effaced
especially on corium. ----- lucida (Abbott)
- F Color pattern not effaced but normal. ----- G
- G Disk of pronotum less than half as long
as wide. ----- escheri (Heer)
- G Disk of pronotum more than half as long
as wide. ----- H
- H Pale bands of corium, beyond hemelytra suture,
forming transverse lines and corium and
membrane not plainly separated. vulgaris (Hungerford)
- H Pale bands of corium beyond hemelytral
suture not forming transverse lines or if
so then corium and membrane plainly separated. ---- I
- I Hind femur with a row of ten spines on ventral
apical portion of margin. ----- nitida (Fieber)
- I Hind femur with row of six spines on ventral
apical portion of rear margin. ----- J
- J Corium and membrane not distinctly separated;
male with pala obliquely produced at apex;
female with long pala. ----- obliqua (Hungerford)
- J Corium and membrane plainly separated;
male pala not obliquely produced at apex. ----- K
- K Interocular space about equal to width of
one eye; metaxyphus not as broad as long;
male strigil not excessively long. lobata (Hungerford)
- K Interocular space much narrower than width

of eye; metaxyphus no longer than broad;
 male strigil very long. ----- interrupta (Say)

Hesperocorixa minorella (Hungerford)

This species can be distinguished from others by the long slender metaxyphus and the long slender lateral lobe of the prothorax. Also as in the species key.

Length 6.3 - 7.1 mm.

Reported in Michigan only from the northern portion of the state in the following counties:

Cheboygan, Charlevoix, and Beaver Island.

Hesperocorixa atopodonta (Hungerford)

The pronotum is heavily rastrate and with 8 or 9 dark cross bands. General color of hemelytra is quite dark flecked with narrow, wavy, transverse, pale lines except at base of clavus which is broadly cross-banded. Membrane is spotted with pale yellow lines and separated from corium by prominent v-shaped yellow line. The meso-epimeron, at scent gland osteole which is lateral of tip, is about as broad as the lateral lobe of prothorax.

Metaxyphus is arrowshaped and almost longer than broad.

The male pala with about 27 pegs with the apical peg larger and standing away from the rest. Strigil is of average size, longer than broad, and of six combs.

Length 8.5 - 9.2 mm.

31 specimens; 10 males and 21 females collected as follows:

29 April in Livingston county.

11 May, 1 August, 21 October, 24 October, 25
October, 29 October, 10 November, 12 November, 13
November, 18 November in Ingham county.
29 April in Washtenaw county.

Records and specimens seen from the following counties:

Cheboygan, Kalamazoo, Livingston, Mecosta, Luce,
Allegan, Washtenaw, and Lapeer.

This seems to be the most common species of
Hesperocorixa with the exception of H. vulgaris (Hungerford).

Hesperocorixa michiganensis (Hungerford)

The pronotum is heavily rastrate and crossed with
7 or 8 black lines somewhat broken at the apex. Clavus
and corium are dark brown with narrow transverse pale
lines somewhat broken. Membrane is not separated by a
pale line but is smokey brown spotted with pale markings.
The mesoepimeron is very broad with scent gland osteole
closer to lateral emargination, and the mesoepimeron at
the scent gland osteole, much broader than the lateral
lobe of prothorax which is elongate with the anterior
apical angle prolonged. Metaxyphus is arrowshaped and
almost longer than broad. Male pala has 22 pegs in a
single row and the strigil is quite long, slender, and
with five irregular combs. Length 6.3 - 7.5 mm.
2 female specimens collected as follows:

7 August in Ingham county.

20 August in Missaukee county.

Records and specimens seen from the following counties:

Chippewa, Cheboygan, Montgomery, and Washtenaw.

Hesperocorixa semilucida (Walley)

The pronotum is heavily rastrate and crossed with 7 to 9 brown bands. Except at the base of clavus which is somewhat obliquely-banded, the clavus and corium are dark brown with about three or four rows of pale spots arranged more or less in longitudinal series. Membrane is lighter colored to smokey and separated generally from the corium by a pale line. The mesoepimeron, at the scent gland osteole, is much broader than the lateral lobe of prothorax, which has anterior apical angle quite prolonged. The metaxyphus is arrowshaped and somewhat longer than broad. Male pala has a single row of 20 to 22 pegs which lie close to the upper margin of the pala. Strigil is much longer than wide and of five combs.

Length 7 - 7.6 mm.

7 specimens; 3 males and 4 females collected as follows:

24 October in Ingham county.

9 October in Van Buren county.

Only previous Michigan record was from Washtenaw county.

Hesperocorixa kennicottii (Uhler)

The pronotum is heavily rastrate and usually crossed by 7 or 8 heavy brown cross-bands. Clavus is marked with oblique pale wavy lines on a dark background. Corium has transverse pale lines which tend to coalesce along the

inner and outer margins past the apex of clavus. The membrane is smokey-brown to pale yellow with faint markings at base and separated from corium by yellow line. Mesoepimeron is very broad, with the scent gland osteole almost at its bend, and much broader at this point than the lateral lobe of prothorax. Metaxyphus is short and appears broader than long. Male pala with 28 pegs in a single long row and the strigil almost oval and with about eight combs. Length 8.1 - 8.6 mm.

3 specimens; 1 male and 2 females collected as follows:

24 October, and 29 October in Ingham county.

Records and specimens seen from the following counties:

Cheboygan and Washtenaw.

Hesperocorixa escheri (Heer)

Pronotum crossed by eight to nine dark bands with the apical ones somewhat broken. The hemelytra pattern of clavus and corium with regular transverse series of pale lines but pattern of corium and membrane beyond the apex of clavus is very broken. The eyes may be convex and bulging and are more than one-half as long as the pronotum and pronotum is rounded. Pronotum, clavus, and corium are heavily rastrate. The mesoepimeron is slender with scent gland osteole about at the tip. The lateral lobe of prothorax is about as broad as long. Metaxyphus is arrowshaped and slightly longer than broad. Male pala is long and slender with 28 to 30 pegs in a single

row. The male strigil is fairly large, sub-oval, and of 9 to 10 combs. Length 12 - 12.1 mm.

2 female specimens collected 10 November in Ingham county. Only other Michigan record is from Cheboygan county.

Hesperocorixa lucida (Abbott)

The pronotum is heavily rastrate and is crossed by 7 or 8 narrow dark bands which may be difficult to distinguish due to dark background. The clavus has pale transverse lines which are predominant at base and infrequent thereafter on dark brown background. The inner and outer margins of clavus are marked with a yellow line. The corium has pale transverse lines on a dark brown color except near the outer margin which is effaced and smokey. Membrane is smokey with a few faint markings and is separated from corium by a pale line. The mesoepimeron is narrow with the scent gland osteole almost at tip. Lateral lobe of prothorax is quadrate, with the apex truncate, and much broader than the mesoepimeron at osteole. Metaxyphus is arrowshaped and slightly longer than broad. The male pala is truncate at the apex and has 20 to 21 pegs in a single row. The strigil is oval with about nine combs. Length 9.1 - 9.7 mm.

3 specimens; 2 males and 1 female collected as follows:

7 July in Kalamazoo county.

12 November in Ingham county.

Records and specimens seen from the following counties:

Cheboygan, Berrien, and Washtenaw.

Hesperocorixa vulgaris (Hungerford)

The pronotum is heavily rastrate and crossed with about 10 heavy dark bands. Clavus has transverse broad dark bands which almost coalesce towards the inner margin and apex. The corial pattern has narrow wavy pale lines in a transverse series down to membrane, which is not separated from corium, and has a pattern of very broken pale lines. Mesoepimeron is slender with the scent gland osteole located just lateral of the apex. The lateral lobe of prothorax is quadrate and almost rounded at the apex. The metaxyphus is arrowshaped and apparently slightly longer than broad. Male pala with about 21 pegs in a single row and the strigil is quite large, elongate, and with five or six combs. Length 9.2 - 10.0 mm.

195 specimens collected as follows:

4 July in Van Buren county.

20 September, and 2 October in Kalamazoo county.

29 April in Washtenaw county.

21 April in Clinton county.

29 April in Livingston county.

7 June, 21 July, 1 August, 3 October, 7 October,

14 October, 21 October, 24 October, 25 October,

26 October, 29 October, 5 November, 11 November,

12 November, 13 November, and 18 November in

Ingham county.

Specimens and records seen from the following counties:

Washtenaw, Berrien, Livingston, Otsego, Cheboygan,
Luce, Kent, Lenawee, Grand Traverse, Allegan,
Midland, and Bois Blanc Island.

This species is by far the most common collected in
the entire family of CORIXIDAE in Michigan.

Hesperocorixa nitida (Fieber)

Both sexes have a row of about 10 spines on the
distal portion of the rear margin of the hind femur which
will distinguish it from any other species. Also the
male has elongate pala with 22 pegs in a row and strigil
is small with rounded ends and of eight combs. Length
8 - 9 mm.

Reported in Michigan only from Druids Hill.

Hesperocorixa obliqua (Hungerford)

The pronotum is heavily rastrate with 10 to 12
narrow dark lines. Clavus has a few coarse pale bands
at base with a few wavy pale lines towards apex. Corium
with small transverse pale lines at apex and changing to
short chunky broken pale lines and spots right through
into membrane. Membrane is not separated from corium by
a pale line. Mesoepimeron slender with scent gland
osteole about at tip. The lateral lobe of prothorax
broader and quadrate with the apex about truncate. Meta-
xyphus is very large and slightly longer than broad.

Male pala has the apex obliquely produced and with 25 pegs in a single row. Strigil is elongate, large, and with about eleven combs. Female pala is quite elongate and narrow. Length 10.1 -- 11.1 mm.

4 specimens; 1 male and 3 females collected as follows:

7 October, 10 November, and 12 November in Ingham county.

Reported previously in Michigan only from Washtenaw county.

Hesperocorixa lobata (Hungerford)

Pronotum, clavus, and corium are heavily rastrate. Membrane is usually separated from corium by fusion of pale lines. Male pala has the apex truncate with row of 28 to 32 pegs and prominent carina at base. Strigil moderately large, ovate, and with fourteen combs. Rest as in the species key and above should differentiate this species from others. Length 9.4 - 10.5 mm.

Recorded in Michigan only from Cheboygan county.

Hesperocorixa interrupta (Say)

Pronotum is finely rastrate and crossed with 8 to 10 dark bands which may be broken towards the apex. Clavus has dark broad bands interspaced with paler flecks. Corial pattern with narrower dark bands which are less regular. Membranal pattern is quite broken and is separated from corium by the coalescence of paler figures. Clavus and corium are finely rastrate. Mesoepimeron is slender with the scent gland osteole near

the tip. The lateral lobe of prothorax is quadrate, about truncate, and broader than long. Metaxyphus is arrowshaped, no longer than broad. Six stout spines on distal portion of rear margin of the hind femur. Male pala is elongate with 28 to 30 pegs in a single row. The strigil is large, elongate, and with fourteen combs. Length 9 - 11 mm.

Records and specimens seen from the following counties:

Cheboygan and Washtenaw.

Genus Sigara Fabricus

This genus is very large and has been broken up into a great number of subgenera. Metaxyphus is usually small and arrowshaped, triangular or truncate. The underside of the hind femur is pubescent on at least the basal third or often more and the upper surface has two or three spines to two or three rows of spines. Rest as in the generic key.

Key to the species of Sigara Fabricus

- A Length of insects more than 6.3 mm. ----- B
- A Length of insects less than 6.3 mm. ----- F
- B Pala of both male and female with only 14
to 16 lower palmar hairs. -- decoratella (Hungerford)
- B Pala of both male and female with 18 to
22 lower palmar hairs. ----- C
- C Metaxyphus broad, nearly quadrate with a

- median notch at apex; pala claw of male
and female serrate at base.----- decorata (Abbott)
- C Metaxyphus normal; pala claw not serrate. ----- D
- D Pruinosse area apical of nodal furrow is as
long as pruinose area of claval suture. -----
------(in part) alternata (Say)
- D Pruinosse area apical of nodal furrow is
longer than pruinose area of claval suture. ----- E
- E Interocular space is decidedly narrower than
the eye; pala of male with peg row near the
palm. ----- penniensis (Hungerford)
- E Interocular space about equal to width of
eye; pala of male is very elongate with peg
row near the dorsal margin.- conocephala (Hungerford)
- F Dorsal surface of pronotum with a pale
median longitudinal line. ----- G
- F Dorsal surface of pronotum without a pale
median longitudinal line. ----- K
- G Hemelytra nearly black with obscure longi-
tudinal pale markings; dorsal edge of pala of
male thickened with prominent keel on out-
side. ----- variabilis (Hungerford)
- G Hemelytra and male pala not as above. ----- H
- H Strongly rastrate; membranal pattern effaced
or indistinct. Male strigil oval and anal
lobes of female tinged with red. -----

- compressoidea Hungerford
- H Not as above. ----- I
- I Pronotum and hemelytra plus membrane boldly
cross-barred or solid black except for pale
median line on pronotum. Male pala with one
row of pegs. ----- transfigurata (Walley)
- I Not as above; male pala with two rows of pegs. ---- J
- J Male strigil small, transverse, oblong; female
with anal lobes notched on inner ventral
margin. ----- knighti Hungerford
- J Male strigil elongate with parallel sides
and truncate tip; female abdomen normal. -----
----- machinacensis (Hungerford)
- K Pattern of corium in definite longi-
tudinal series. ----- L
- K Pattern of corium not in definite longi-
tudinal series. ----- N
- L Clavus with pale lines in a wavy longi-
tudinal series; hypo-ocular suture ending
lateral of the middle line of the eyes. -----
----- douglasensis (Hungerford)
- L Not as above. ----- M
- M Scent gland osteole remote from tip of meso-
epimeron; male pala with one row of pegs. -----
----- trilineata (Provancher)
- M Scent gland osteole near tip of mesoepimeron;

- male pala with two rows of pegs. -----
----- mullettensis (Hungerford)
- N Metaxyphus longer than broad. ----- O
- N Metaxyphus not longer than broad. ----- Q
- O Mesoepimeron at level of scent gland osteole
about equal in width to lateral lobe of
prothorax. ----- dolabra Hungerford & Sailer
- O Mesoepimeron at level of scent gland osteole
much broader than the lateral lobe of
prothorax. ----- P
- P Pale bands on base of clavus entire; corium
bands transverse; female pala normal; dorsal
surface of hind femur only three or four pegs. ----
----- solensis (Hungerford)
- P Pale bands on base of clavus more or less
broken, may be in faint longitudinal series;
female pala depressed dorsally near apex;
dorsal surface of hind femur with two or three
rows of pegs. ----- signata (Fieber)
- Q Scent gland osteole located nearer the lateral
bend of mesoepimeron than tip. ----- R
- Q Scent gland osteole located nearer the tip
than lateral bend of mesoepimeron. ----- T
- R Pruinoso area along claval suture much shorter
than pruinose area of embolar groove apical of
nodal furrow; mesoepimeron with deep incision

- at or near lateral bend; male strigil
large. ----- mathesoni Hungerford
- R Not as above. ----- S
- S Scent gland osteole located almost in lateral
bend and connected to metasternum with a
usually dark post-coxal piece; metaxyphus
broader than long with apex bluntly
rounded. ----- grossolineata Hungerford
- S Scent gland osteole located about two-thirds
of way to lateral bend; metaxyphus as broad
as long with apex pointed. ----- modesta (Abbott)
- T Lines on clavus more or less entire or
slightly forked. ----- U
- T Lines on clavus broken into many fragments;
obscure markings on clavus and corium in faint
longitudinal pattern. ----- zimmermanni (Fieber)
- U Pattern of corium in more or less longi-
tudinal series. ----- defecta Hungerford
- U Pattern of corium not in longitudinal series. ----- V
- V Metaxyphus tip a right angle.-bicoloripennis (Walley)
- V Metaxyphus tip forming less than a right angle. --- W
- W Male pala with 42 pegs in a single row; meso-
epimeron of equal width from osteole to lateral
bend. ----- (In part) alternata (Say)
- W Male pala with 19 pegs in a single row with
pala widest across apical portion. - macropala (Hungd)

Sigara (Arctosigara) decoratella (Hungerford)

Interocular area very dark. Pronotum, clavus, and corium heavily rastrate. Pronotum crossed by about 8 dark bands with the apical bands coalescing with a brown marginal band. Clavus is cross-banded with pronounced large, transverse dark bands. Corium with pale wavy transverse lines and membranul pattern is reticulate and separated from corium by a pale line. Mesoepimeron, at scent gland osteole which is just lateral of tip, is about as broad as lateral lobe of prothorax which is elongate with apex about rounded. Metaxyphus is arrow-shaped and about as broad as long. Male pala is very elongate with a single row of 38 pegs. Strigil is small, suboval, and with about six or seven combs. Both sexes with only 14 to 16 lower palmar hairs on pala as in the key. Length 7.5 - 8.0 mm.

2 specimens; 1 male and 1 female collected as follows:

22 June in Kalamazoo county.

Specimens and records seen from the following counties:

Luce, Cheboygan, Mackinac, and Druids Hill.

Sigara (Arctosigara) bicoloripennis (Walley)

Pronotum, clavus, and corium are heavily rastrate. Pronotum is crossed with 7 or 8 dark bands the same width as pale lines. Clavus with alternate dark and pale lines and dark lines tending to coalesce at the middle on inner margin. Corium with pale broken wavy lines arranged more

or less in transverse series. Membrane is reticulate and separated by a pale line. Pruinose area of claval suture and pruinose area apical of nodal furrow of embolium of equal length. Mesoepimeron, with scent gland osteole near the tip, broader than the lateral lobe of prothorax; metaxyphus much broader than long with the apex forming a right angle. Male pala with a single row of 25 pegs which hug the margin of the palm. Length 5.7 - 6.0 mm.

Records seen from the following counties:

Cheboygan, Gogebic, and Washtenaw.

Sigara (Arctosigara) penniensis (Hungerford)

Pale markings of corium are arranged in two or three longitudinal series. Male pala with 30 to 31 pegs in a single row which hug the margin of the palm. The mesoepimeron is slightly narrower than the lateral lobe of the prothorax. Length 7.1 - 7.6 mm.

Records seen from the following counties:

Montcalm, Chippewa, Cheboygan, and Mackinac.

Sigara (Arctosigara) conocephala (Hungerford)

The very long pala of male and female which are about four times as long as broad. Male pala with row of 37 to 38 pegs near the dorsal margin and the last few pegs are spaced widely apart. Male vertex is strongly produced. These characters will separate this species from others. Length 7.4 - 8.8 mm.

Recorded in Michigan only from Mackinac Island.

Sigara (Allosigara) decorata (Abbott)

Pronotum, clavus, and corium are heavily rastrate. Interocular area is yellow-white. Pronotum with about 8 dark cross-bands about the same width as pale bands. Black bands are complete at the base of the clavus but are very broken towards apex. Corium has dark lines tending to form longitudinal series on inner and outer margins. Membrane is reticulate and is separated from corium by a pale line. The mesoepimeron, at scent gland osteole which is about at the tip, slightly narrower than the lateral lobe of prothorax which is elongate and swollen. Metaxyphus is about quadrate with a median notch at the apex. Male pala is strongly curved from base to apex with a faint diagonal ridge across the pala. Pala with single row of 36 pegs which hug the lower margin of the pala. Both sexes with pala terminating into a claw which is definitely serrate at the base. Length 8.5 mm. 1 male specimen labelled 5 August from Allegan county.

This is a new state record of Michigan. Heretofore reported from Minnesota and Illinois but Hungerford had never found it in Michigan.

Sigara (Pileosigara) douglasensis (Hungerford)

This is a shining rugulose species which has a cap-shaped rounded head which is almost as long as the pronotum. Clavus and corium with a pattern of dark and

pale wavy lines in longitudinal series and the membrane separated from corium by a brown line. Rest as in species key. Length 5.2 - 5.8 mm.

Reported in Michigan only from Cheboygan county.

Sigara (Lasiosigara) trilineata (Provancher)

Claval bands are oblique but corium longitudinally striped with three dark well-defined bands. Basal half of anterior surface of femur has a curiously depressed area surrounded by many hairs. Rest as in species key. Length 4.8 - 6.0 mm.

Records seen from the following counties:

Gogebic, Cheboygan, and Bois Blanc Island.

Sigara (Vermicorixa) alternata (Say)

Pronotum, clavus, and corium are heavily rastrate with the clavus with extremely heavy rastrations. Pronotum is cross-banded with seven to nine dark lines which are somewhat narrower than pale lines. Corium with alternate dark and pale lines of about equal width and all usually not broken. Corium has narrow wavy pale lines broken and incomplete and usually a dark area present at inner apical angle. Membrane with a broken pale pattern with the apex brown and separated from corium by a pale line. Length of pruinose area apical of nodal furrow about equal to the pruinose area of claval suture. Mesoepimeron slender with scent gland osteole near tip and

from gland to bend the same width. Metaxyphus is triangular and slightly broader than long. Male pala is thin with a single row of 42 pegs which hug the upper dorsal margin somewhat. The strigil is round, small, and with about seven combs. Length 5.6 - 6.9 mm.

40 specimens collected as follows:

9 October in Van Buren county.

29 April in Livingston county.

22 May, 21 July, 7 October, 14 Octobe, 21 October,

24 October, 29 October, 7 November, 10 November,

11 November, 18 November in Ingham county.

Records seen from the following counties:

Berrien, cheboygan, Gogebic, Luce, Washtenaw, Oceana, Charlevoix, Huron, Kalamazoo, Midland, Beaver Island and Druids Hill.

This was found by the author to be the most common species of Sigara.

Sigara (Vermicorixa) defecta Hungerford

Pronotum, clavus, and corium are moderately rastroate. Pronotum has about 8 dark cross-bands which are slightly narrower than the pale lines. Clavus has dark cross bands which coalesce on the inner margin. Corial pattern has dark lines in a broken longitudinal series and towards the apex the pale lines are in four longitudinal rows. Membrane about reticulate and separated from corium by pale line. Mesoepimeron is narrow with

the scent gland osteole located almost at the tip. The lateral lobe of prothorax is elongate with the apex rounded. Metaxyphus is very small and much broader than long. Male pala is curved at the apex and has a row of 26 pegs with a few apical pegs set slightly apart. Strigil is small, oval, and with six combs. Length 5.8 - 6.3 mm.

7 specimens collected as follows:

15 July, 29 October in Ingham county.

12 July in Kent county.

21 April in Clinton county.

Reported in Michigan previously from only Washtenaw county.

Sigara (Vermicorixa) solensis (Hungerford)

Pronotum, clavus, and corium are finely rastrate. The pronotum is crossed with about 7 dark bands of about the same width as pale bands. Clavus has complete dark cross-bands at the base but these become much broken and forked apically and coalesce in a dark line on the inner margin. Corium with narrow, broken, wavy pale lines in transverse series. Membrane is reticulate and separated from corium by a pale line. Membrane and corium with occasional long pale hairs. Mesoepimeron broad, with scent gland osteole about half the distance to lateral bend. The lateral lobe is elongate with the apex rounded. Metaxyphus is arrowshaped and longer than broad. Length 5.7 mm.

1 female specimen collected 7 November in Ingham county.
Recorded previously in Michigan from Cheboygan county
and Bois Blanc Island.

Sigara (Vermicorixa) mathesoni Hungerford

The vertex is slightly produced and the interocular area is very dark. The pronotum, clavus, and corium are rastrate. Pronotum is crossed by 6 or 7 dark bands and none coalesce along the inner margins. Corium with short pale lines appearing to form faint longitudinal rows separated by two almost solid black longitudinal rows. Membrane is reticulate and separated from corium by a pale line. Mesoepimeron has the scent gland osteole which is located about two-thirds of the way from tip and a deep notch at the lateral bend of mesoepimeron. Metaxyphus is broader than long and pointed at the apex. Length 5.3 mm.

1 female specimen collected 30 June in Kalamazoo county.
Records and specimens seen from the following counties:
Roscommon and Fond Du Lac.

Sigara (Vermicorixa) modesta (Abbott)

The pronotum is rastrate and with about 6 to 8 narrow dark bands. The inner basal angle of clavus is pale, with the rest cross-banded with dark except for dark spot on central portion of clavus. Corium is cross-banded with irregular bands which tend to coalesce into a longi-

tudinal stripe near the inner apical angle. Membrane has its apex smokey with the rest of the pattern sub-reticulate and separated by a pale line from corium. Mesoepimeron is broad at the scent gland osteole which is located about one-third the distance from the lateral bend. The metaxyphus is small, triangular, and with apex pointed. Male pala has 35 pegs in a single row and the strigil is very small with three combs and is located on a small stalk. Length 5.1 - 5.9 mm.

5 specimens; 2 males and 3 females collected as follows:

9 October in Van Buren county.

21 April in Clinton county.

1 August, 12 October, and 24 October in Ingham county.

Records and specimens seen from the following counties:

Huron, Washtenaw, Berrien, and Cheboygan.

Sigara (Vermicorixa) grossolineata Hungerford

Pronotum is crossed with about 8 dark bands. Clavus has a pattern which is usually cross-banded but may be almost all dark or at least the dark coalesced along the hemelytra suture. Corium is banded with wavy broken pale bands. The membrane, which is separated from the corium by a pale line, is marked with a broken pale figures and is brown at the apex. The mesoepimeron, at the scent gland osteole is broad and the osteole is at or near the lateral bend and connected with a dark flange to metasternum. Metaxyphus is small with the apex

bluntly rounded. Male pala has about 34 pegs in a single slightly curving row and the strigil is small and with about three combs. Length 5.0 - 5.5 mm.

31 specimens collected as follows:

1 July, and 7 July in Kalamazoo county.

8 May, and 9 October in Van Buren county.

21 April in Clinton county.

1 August, 7 October, 21 October, and 12 November in Ingham county.

Records and specimens seen from the following counties:

Cheboygan, Livingston, Berrien, Huron, Washtenaw, and Bois Blanc Island.

Sigara (Vermicorixa) mullettensis (Hungerford)

Pale figures of corium are in three transverse rows.

Lateral lobe of prothorax is elongate and constricted at the base. This plus facts in the species key will identify this species. Length 5.3 - 5.9 mm.

Reported in Michigan only from Cheboygan county.

Sigara (Vermicorixa) transfigurata (Walley)

The pronotum has a longitudinal median pale line.

The boldly barred clavus and corium plus the mesoepimeron which is broad and has the base inflated and the scent gland ~~osole~~ almost or at the lateral bend will distinguish this from other species. Also only specimens which have brachypterous hind wings have been found, and so

the pronotum is about one-half the length of the head.

Length 5.4 - 5.9 mm.

Reported in Michigan only from Cheboygan county.

Sigara (Vermicorixa) knighti Hungerford

Pronotum has a median longitudinal pale stripe.

Female with anal lobes incised on the ventral inner margin and pala with 19 hairs in low lapmar row. Male pala with two rows of pegs; 6 pegs in row near the apex and 14 pegs in basal row. Rest as in the species key.

Length 5.5 - 6.2 mm.

Reported in Michigan only from Cheboygan county.

Sigara (Phaeosigara) signata (Fieber)

The pronotum, clavus, and corium are finely rastrate. Pronotum is crossed by 6 to 7 brown bands which are quite difficult to distinguish due to the dark background. Base of clavus has a few transverse lines tending to form longitudinal lines toward the apex and dark areas coalescing on the inner margin. Corial pattern has pale short lines in a faint longitudinal series and is very difficult to see due to the darkness of the dorsal aspect of abdomen. The membranal pattern is indistinct with the apical portion effaced and with the membrane separated from corium by a broad pale line. Mesoepimeron is broad at the scent gland osteole which is located about one-half the distance to the lateral bend. Mesoepimeron at osteole

is broader than lateral lobe of prothorax which is elongate with a rounded apex. Metaxyphus is longer than broad and arrowshaped. Male pala is short, stubby, and with a single row of 16 to 17 pegs curved at the apex. The strigil is large, sub-oval, and composed of three or four combs. Length 4.8 - 5.2 mm.

2 specimens; 1 male and 1 female collected as follows:

20 September in Kalamazoo county.

7 October in Ingham county.

Specimens and records seen from the following counties:

Oceana, Charlevoix, Kalamazoo, Cheboygan, Washtenaw, Bois Blanc Island, and Beaver Island.

Sigara (Phaeosigara) zimmermanni (Fieber)

Pronotum is finely rastrate; clavus and corium are lightly rastrate. Pronotum is crossed with 7 to 9 dark bands. Clavus and corium have obscure pale markings in faint longitudinal series and with pale area at outer apical angle of corium. Membrane is not definitely separated from corium and with obscure markings. Mesoepimeron narrow with scent gland osteole near tip. Lateral lobe of prothorax is elongate with the tip obliquely truncate or rounded. Metaxyphus is little broader than long. Female pala with dorsal margin depressed. Male pala sinuous from dorsal view and with single curved row of 20 pegs. Strigil is elongate, small, and with five combs. Length 4.5 - 5.0 mm.

Recorded in Michigan from Washtenaw county only.

Sigara (Phaeosigara) compressoidea Hungerford

Pronotum, clavus, and corium are heavily rastrate. Pronotum cross banded with 6 to 8 dark bands about as wide as pale bands and a pale median longitudinal line present. Clavus is obliquely cross-banded regularly at the base with pale and dark bands of equal width but towards the apex the dark bands are much thicker and coalesce along the inner margin. Corium with short pale transverse lines arranged more or less in longitudinal series. Membrane is smokey to golden brown with pattern about completely effaced. Anal lobes of female may be tinged with reddish color. Mesoepimeron is medium broad, with the scent gland osteole located about one-half the distance to lateral bend at this point, broader than the lateral lobe of prothorax which is elongate with the apex rounded. Metaxyphus is small, triangular, and much broader than long. Length 5.1 - 5.5 mm.

3 female specimens collected as follows:

2 May, 25 October and 11 November in Ingham county.

Records and specimens seen from the following counties:

Washtenaw, Oceana, Gogebic, Cheboygan, and Bois
Blanc Island.

Sigara (Phaeosigara) mackinacenses (Hungerford)

Pronotum, clavus, and corium are faintly pebbled and only moderately rastrate. Pronotum with 7 or 8 dark

wide cross-bands and with a pale median longitudinal stripe. Clavus with pale bands obliquely transverse at the base and irregular elsewhere. Corium has pale markings arranged roughly in three wavy longitudinal series. Membrane has a few pale transverse markings and separated from corium by a pale line. Mesoepimeron is broad with the scent gland osteole remote from the tip. The thoracic region is inflated and the lateral lobe of prothorax is elongate and truncate at the tip. Metaxyphus is triangular and broader than long. Male pala has pegs in two overlapping rows; 8 pegs in basal row and about 3 pegs in apical row. Strigil is elongate, about oval, and with nine combs. Length 5.0 - 6.0 mm.

Records seen from the following counties:

Cheboygan, Gogebic, Benzie, Washtenaw, and Mackinac.

Sigara (Phaeosigara) variabilis (Hungerford)

General color is dark and pronotum with median pale longitudinal line. Membrane separated from corium by prominent v-shaped pale line. Lateral lobe of prothorax elongate, narrow, with tip inflated and obliquely truncate. Male pala greatly thickened and short. Rest as in the species key. Length 5.3 - 5.9 mm.

Recorded in Michigan only from Cheboygan county.

Sigara (Phaeosigara) macropala (Hungerford)

Pronotum and hemelytra are coarsely rastrate. Lateral lobe of prothorax elongate, slender, and rounded apically.

Mesoepimeron is narrow with the osteole near the tip. Male pala as in the key. Strigil is small, longer than broad, and of four or five combs. All of the above will distinguish this species from others. Length 5.3 - 5.5 mm.

Recorded in Michigan from Cheboygan and Mackinac counties.

Sigara (Phaeosigara) dolabra Hungerford & Sailer

Pale figures of corium are broken and confused.

Membrane is dark with obscure pattern. Metaxyphus is elongate and narrow. Male pala is cultrate and not quite half as broad across middle as long and with 20 to 21 pegs in a single curved row. Strigil rather large, elongate, and with six combs. All of this will distinguish this species from others. Length 5.3 - 6.3 mm.

Reported in Michigan from Cheboygan county.

Genus Graptocorixa Hungerford

The hemelytral surface is heavily rastrate to roughly rugulose and with very pronounced transverse wavy bands. The face is usually quite hairy. Rest as in the generic key. This genus has never been reported from Michigan or in the vicinity of the midwest. The closest record for the genus would be Oklahoma. One species has been found in this genus by the author.

Graptocorixa serrulata (Uhler)

Dorsal surface is very roughly rugulose and ras-
trate. Pronotum crossed by 9 dark bands. The clavus
is crossed by regular broad dark bands. Corial pattern
has thin wavy pale lines which may be broken near the
outer margin. Membrane, which is separated from corium
by running together of pale spots, is dark fuscous brown
with scattered pale spots. The rear margin of the eyes
are concave and the margin of the head is convex which
makes the postocular space broadest at the middle of the
eyes. The lateral lobe of prothorax is elongate with
tip rounded. Mesoepimeron has the scent gland osteole
remote from the tip and connected with a dark flange.
The metaxyphus is as broad as long. Male pala is very
elongate, has a well developed apical claw, and with two
rows of pegs; a row of about 8 coarse widely spaced pegs
close to the upper margin of the palm and a row of 40 to
44 closely set pegs which hug the lower margin of the
palm. Male strigil is dextral, oval, and composed of
five or six combs. Length 7.1 mm.

1 male specimen collected 29 April in Washtenaw county.

This species is recorded from Nevada, Oregon,
Arizona, New Mexico, and Texas according to Hungerford.
This is the first Michigan record for this species.

SUMMARY AND CONCLUSION

The author collected from spring of 1949 to spring of 1950. The collecting was done mostly in Kalamazoo, Van Buren, and Ingham counties with Ingham county, due to its proximity, stressed the most.

Very little systematic work has been done on these water bugs and consequently there are very few county records. Therefore I checked our collection records, University of Michigan records, Dreisbach's records in Midland, and the records in all available literature and if no specific state or county record was found, I recognized my record as being new for the state of Michigan.

Approximately 3000 specimens were collected which contained 72 species and included in this figure were seven new records for Michigan. These new records are: Merragata brunnea Drake (HEBRIDAE); Gerris inseparatus Drake & Hottes (GERRIDAE); Rhagovelia oriander Parshley (VELIIDAE); Ranatra kirkaldyi var. hoffmanni Bueno (NEPIDAE); Plea harnedi Drake (NOTONECTIDAE); Sigara decorata (Abbott) and Graptocorixa serrulata (Uhler) (CORIXIDAE). Graptocorixa is also a new generic record for Michigan. The author was fortunate in that it was possible to examine approximately 5000 specimens in the above collections. About 102 species have been recorded from Michigan previous to my work and the above seven new records bring the total to 109 species. At least

fifteen to twenty-five additional species should be found in Michigan since they are recorded from bordering states.

No species of OCHTERIDAE are recorded in Michigan but continued collecting in the southern portion of the state should yield specimens.

CORIXIDAE is the most common family both in abundance of specimens and the fact that it contains by far the most species in Michigan. This is partly due, of course, to the extensive collecting of Hungerford and his associates in Michigan.

Following is a table which will show the relationship in the various families between the number of records in Michigan, in lower Michigan, and records from my collecting.

		Recorded in Michigan	Recorded in lower Michigan	Collected by the author
1	HEBRIDAE	2	2	3
2	MESOVELIIDAE	3	1	1
3	HYDROMETRIDAE	1	1	1
4	GERRIDAE	13	13	14
5	VELLIDAE	7	6	6
6	SALDIDAE	13	11	7
7	OCHTERIDAE	0	0	0
8	GELASTOCORIDAE	1	1	1
9	NAUCORIDAE	1	1	1
10	NEPIDAE	4	4	5
11	BELOSTOMATIDAE	4	4	3
12	NOTONECTIDAE	10	7	8
13	CORIXIDAE	43	22	22
	TOTALS (Species)	102	73	72

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