

AQUATIC AND SEMIAQUATIC HEMIPTERA OF MISSISSIPPI

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I. INTRODUCTION

This investigation was undertaken to obtain information on the distribution and biology of the families of aquatic and semiaquatic Hemiptera that occur in Mississippi. Since no previous studies, other than a few brief lists of species, are reported in the literature, special effort was made to collect specimens from as wide a range of habitats as possible. The major portion of the collecting was done during the spring and fall months, and part of one summer was spent on the Gulf Coast where opportunity for the study of aquatic and semiaquatic Hemiptera was provided by the Gulf Coast Research Laboratory.

The project consisted primarily of collection, preservation, mounting and identification of specimens along with observations on habitat preferences, associations of species, mating habits, food habits and other biological data. This work includes data on 132 species in 13 families.

II. REVIEW OF THE LITERATURE

There have been no comprehensive studies dealing specifically with the aquatic and semiaquatic Hemiptera of Mississippi. Various checklists have included records of species from Mississippi and these papers are noted in the distributional data. Drake (1922) described a new species of *Plea* from the state and listed 17 other species of aquatic and semiaquatic Hemiptera that he collected in one pond. A list of 17 species, collected in Marshall and Lafayette counties, Mississippi, was published by Penn and Ellis (1949).

This literature review will be limited to a brief survey of selected publications that contain information useful to students of the Mississippi fauna.

A number of species of aquatic Hemiptera was described by Say (1832) in his series of works on the insects of North America. Although his descriptions of species were brief, they provided a basis for future taxonomists to build on. Useful lists of species with notes on habitats were published by Uhler (1876, 1877, 1878). A number of the species he reported were collected by early explorers of the United States west of the Mississippi River. Since it represents some early collecting in a neighboring state, Townsend's (1886) report of three

species of aquatic Hemiptera collected in Louisiana is of interest. A short list of aquatic Hemiptera found in the Mississippi River bottoms near Quincy, Illinois was published by Garman (1890). Summers (1891b) did considerable collecting in Tennessee and published a bulletin giving keys to 10 families and a few common genera. However, he did not include any locality data in this publication.

Bueno in a long series of papers issued from 1905 to 1942 added greatly to our knowledge of the general occurrence and distribution of many American species. Bueno made contributions to the taxonomy of several families of aquatic and semiaquatic Hemiptera, which will be reviewed under the appropriate family headings below. Bueno and Brimley (1907) listed a few aquatic Hemiptera from North Carolina.

Barber (1913b) published a short paper on aquatic Hemiptera which was a popular, general account of the habits of this group of insects. The following year a list of the known species of the aquatic Hemiptera of Florida appeared (Barber, 1914). Riley (1918) wrote a general account on the food and feeding habits of aquatic Hemiptera. The handy and widely used catalogue of the Hemiptera of America North of Mexico by Van Duzee became available in 1917. This work treats the synonymy and distribution of all species of Hemiptera known at that time. The classic and extremely useful work on the biology and ecology of aquatic and semiaquatic Hemiptera was the next comprehensive, general publication that became available (Hungerford, 1920). Hungerford has published a number of other detailed works on specific families which will be reviewed under the appropriate headings below. A paper by Hussey (1919) covering the so-called "waterbugs" of the Douglas Lake region of Michigan (even though far removed from Mississippi ecologically) is of interest since it contains useful keys.

Britton et al (1923), published the Hemiptera of Connecticut, a useful work that included many southern species. Parshley's (1925) bibliography of the American Hemiptera-Heteroptera provides a convenient, fairly complete listing of references arranged alphabetically by author. The following year a work covering the Heteroptera or true bugs of eastern North America was pub-

lished and filled the need for a convenient manual for the identification of all Hemiptera (Blatchley, 1926). It still remains a most valuable aid to the general student of the Hemiptera.

Unger et al (1948, 1956) published excellent papers on the aquatic insects of California. They are complete with keys to families, genera and species and available biological data.

Ellis (1952) listed forty species, exclusive of Corixidae and Saldidae from southeastern Louisiana. He included locality and ecological data for twenty-eight species, ten species of which were not previously reported from Louisiana. A series of papers by Herring (1950a, 1950b, 1951a, 1951b) includes locality records, biological data and keys to the aquatic and semiaquatic Hemiptera of northern Florida.

III. TECHNIQUES AND PROCEDURES

Accurate identification of a number of species made examination of the genitalia necessary. Essentially, the technique followed was that described by Hungerford (1933a). The genitalia must be placed on the pins with the specimens from which they came; thus, they are readily available for study and are not likely to be lost or confused with other specimens.

All measurements were made with an eyepiece micrometer using either 20 or 40 magnifications, and are reported in millimeters or fractions of a millimeter. Unless indicated otherwise, all lengths of insects were measured from the tip of the clypeus to the apex of the abdomen and all widths were across the widest part of the pronotum. Where the wings exceeded the tip of the abdomen, the length included this extension.

Abbreviations are used as follows: J.T.P. = J. T. Polhemus, C.A.W. = the writer, M.S.C. = Mississippi State College collections. All other collectors names are given in the locality data sections. For brevity, localities only are listed where 10 or more records are available for a species.

Specimens collected in the state and used as the basis for this study are in the personal collection of the writer, indicated by (C.A.W.) or in the collections of other workers as indicated in parentheses after locality records. Also, duplicate specimens of most species have been deposited in the

collections of the Department of Zoology and Entomology at Mississippi State College.

IV. ECOLOGICAL CONSIDERATIONS

This study was concerned with aquatic habitats of many kinds, widely scattered over the state, therefore some general statements relative to the various soil areas or types might be pertinent. The state has been divided into the following soil areas by soil scientists.

Northeast Highlands.—In this region are found some of the steepest hills in the state, and these have been cut up by erosion to form deep gullies in many places. Pine and oak stands cover much of the area providing protection to the soil by reducing the rapid run-off of water. Stock ponds, small streams and borrow pits comprise common collecting habitats encountered in the area. The soils were formed mostly from coastal plain deposits of gravel, clay and sand. The soils are quite sandy in texture generally, and drainage is good.

Northeast and Central Prairies.—The topography of this region is flat to gently rolling with heavily sodded areas limited primarily to river bottoms. Some post oak and hickory stands occur in parts, however. Stock ponds, sink holes, artificial lakes and small streams are common collecting habitats noted. The soils of this area were developed primarily from chalky limestone and clays which are coastal plain deposits. Due to the nature of the parent material, the soils possess textures of the clay and heavy clay classes. The soils are characteristically dark in color, or where heavy sheet erosion has occurred, chalky-white in color.

Pontotoc Ridge.—The topography of this region varies from rolling to rough and rugged, with much of the area bisected by deep gullies. Pine stands, oak groves and fruit orchards are common. Ponds, small upland streams, small rivers and roadside ditches are typical habitats. The soils were derived from marine deposits of sands and reddish clays. Soil texture varies from clay to sandy loam, and has suffered greatly from erosion due to the texture and the topography of the land.

Flatwoods.—This region is level to gently rolling and in general heavily covered with trees such as pine, oak and hickory. Internal drainage of the soil is poor and this provides

many aquatic collecting habitats. Stock ponds, woodland pools and streams abound. The soils were derived from a marine deposit of sour unstratified clay, commonly called "soap stone". The texture of the soils varies from silt loam to fine sandy loam and the color varies from grey to pale yellow.

Sand-Clay Hills.—The topography varies from very hilly to gently rolling and in many places erosion has made considerable progress forming large, steep-banked gullies. A wide variety of collecting habitats occur in the area due to the variability of the topography. Typical forest trees include extensive stands of pine, oak, hickory and other hardwoods in the uplands, with various species of gum and willow common in the swamps. The soils of the area were derived from inter-mixed coastal plain deposits of sands, clays, shales and lignite. Soil texture varies from light sandy loams to heavy clays. Drainage is generally good. Predominating soil colors are red and yellow.

Brown Loam.—Topography varies from gently rolling to steeply rolling with bluffs and steep banks in many places. Collecting habitats are limited mostly to streams and roadside ditches. Hay crops and livestock are common. The forests consist mostly of miscellaneous hardwoods. Soils of the area were derived from windblown deposits high in silt content and rich in lime and other bases. Texture of the soils varies from silt loams to silty clay loams with the color predominantly brown to buff. Drainage is generally very good.

Mississippi Delta.—The topography is very flat with the main problem being drainage. Aquatic habitats are numerous and all types were present. Many swamps and river bottoms containing heavy growths of mixed hardwoods are scattered throughout the delta. The soils of the region were formed from alluvial deposits transported by the Mississippi river and other smaller streams. The soils of this region are the most recent deposits in the state. Drainage varies from very good to very poor and the soil texture from light sand to heavy clay.

Longleaf Pine.—The topography varies from hilly to almost level. Habitats for aquatic insects are restricted mostly to streams, marshes and seepage areas since ponds and lakes are quite rare. The predominant tree is the longleaf pine with mixed

hardwoods common in the swamplands. Soils developed primarily from relatively young marine deposits of sands, clays and gravel. Drainage is generally good because of the coarse sandy texture of the soils.

Gulf Coast.—Topography is very flat and there are a few streams. Also, there are numerous tidal marshes, a few ponds and some seepage areas suitable for aquatic collecting. Many interesting brackish areas were found. Soils are mostly sand and tidal marsh lands from recent marine deposits that have not developed very far. Internal drainage is good due to the sandy nature of the soil.

A study of the locality data on all species indicates that faunal areas may be present to some extent in the state, although they are not clearly defined. In the families Belostomatidae, Hydrometridae, Hebridae, Ochteridae and Naucoridae certain species were taken only in the Gulf Coastal region of the state. Study of collection data from the other families reveals no clear-cut faunal areas.

V. KEY TO MISSISSIPPI FAMILIES OF AQUATIC AND SEMIAQUATIC HEMIPTERA

The arrangement of Van Duzee (1917) has been followed for the general taxonomic treatment of families, with modifications within certain families as treated by more recent workers. The families where arrangements of authors other than Van Duzee (1917) have been followed include: Belostomatidae, De Carlo (1938); Corixidae, Hungerford (1948); Gerridae, Drake and Harris (1934); Hebridae, Porter (1950); Hydrometridae, Hungerford (1934); Nepidae, Hungerford (1922); Notonectidae, Hungerford (1933); Saldidae, Drake and Hoberlandt (1951).

1. Antennae shorter than head 2
Antennae as long as or longer
than head 8
2. Ocelli present; semiaquatic 3
Ocelli absent; aquatic 4
3. Antennae exposed; front and
middle legs similar; eyes not
protuberant; beak reaching
to or beyond the hind coxae
..... PELOGONIIDAE Leach

Antennae concealed; front legs
formed for catching prey;
eyes protuberant; beak very
short, hidden by front fem-
ora GELASTOCORIDAE Kirkaldy

4. Hind tarsi with indistinct setiform claws except in *Plea* (which is less than 3 mm long) 5
- Hind tarsi with distinct claws 6
5. Head overlapping thorax dorsally; front tarsi one-segmented, shovel-shaped CORIXIDAE Leach
- Head inserted into thorax; front tarsi two-segmented except in a few males NOTONECTIDAE Leach
6. Membrane of hemelytra net-veined 7
- Membrane of hemelytra without veins NAUCORIDAE Fallen
7. Terminal appendages of abdomen as long as, or almost as long as abdomen; tarsi one-segmented NEPIDAE Latreille
- Terminal appendages of abdomen flat and much shorter than abdomen; tarsi two-segmented BELOSTOMATIDAE Leach
8. Head as long as or longer than thorax HYDROMETRIDAE Billberg
- Head shorter than thorax plus scutellum 9
9. Claws of at least the front tarsi distinctly antepical, with terminal tarsal segment more or less cleft 10
- Claws all apical, last segment entire 11
10. Tip of hind femur extending much beyond apex of abdomen; intermediate and hind pairs of legs approximated, very distant from front pair; beak four-segmented GERRIDAE Amyot and Serville
- Tip of hind femur subequally reaching apex of abdomen; intermediate pair of legs about equidistant from front and hind pairs except in *Rhagovelia*; beak three-segmented VELIIDAE Amyot and Serville
11. Tarsi two-segmented HEBRIDAE Amyot and Serville
- Tarsi three-segmented 12
12. Membrane without veins; clavus and membrane of similar structure; corium thicker than clavus; apterous forms slender in shape generally MESOVELIIDAE Douglas and Scott
- Membrane with veins; clavus and membrane unlike in structure; corium and clavus similar in structure SALIDAE Amyot and Serville

VI. ANNOTATED LIST

A. Family *HEBRIDAE* Amyot and Serville, 1843

Review of the literature.—Porter (1950) studied the ecology of the Hebridae in Kansas and Michigan. He concluded that the type of soil has very little influence on their choice of habitats. However, the insects do require moist cover to hide in. Light is not important in their choice of habitat. Porter found that plant species in a habitat do not limit hebrid species, and that mites parasitize these insects. Predaceous larvae were observed feeding on hebrids.

This family of small, difficult-to-collect insects has been studied by relatively few taxonomists in previous years. One of the early papers was by Drake (1917) on the North American species of *Merragata*. Following Drake's paper, Hungerford (1918b) published brief notes on the oviposition habits of *Hebrus*. Descriptions of new species of Hebridae in the Hungarian National Museum by Horvath (1929a) included some American forms. Harris (1942a) established the priority of the family name Hebridae over Naeogetidae which had been used interchangeably with Hebridae by taxonomists before 1942. Also, he established that *Hebrus* Curtis takes precedence over *Naeogens* Laporte. Drake and Harris (1943) published keys, descriptions, synonymy and distributional data on western hemisphere Hebridae. A list of the Hebridae of Missouri by Froeschner (1949) includes two genera and six species from that state. The taxonomy and natural history of the American Hebridae were investigated by Porter (1950), and this work served as a guide to the writer in his collection and study of Mississippi Hebridae.

Key to the Mississippi Genera of
HEBRIDAE Amyot and Serville

- Antenna with apparently four segments, but actually five *MERRAGATA* White
- Antenna with five distinct segments *HEBRUS* Curtis

Key to the Mississippi Species of
HEBRUS Curtis

1. Median longitudinal sulcus of the pronotum wide and shallow, ending anteriorly in two well defined pits *consolidus* Uhler

- Median longitudinal sulcus of the pronotum narrow, not or scarcely wider than deep anteriorly 2
2. Median longitudinal sulcus of vertex deep
..... *buenoi* Drake and Harris
- Median longitudinal sulcus of vertex absent 3
3. Inner vein of hemelytron rounded or angulate at the distal end
..... *burmeisteri* Lethierry and Severin
- Angle of the inner vein of the hemelytron produced at the distal end 4
4. Male genital capsule, when viewed from the posterior, smaller (0.20-0.22 mm wide), and more rounded; hook of paramere shorter than wide
..... *concinus* Uhler
- Male genital capsule, when viewed from the posterior, larger (0.25-0.33 mm wide), and half-moon shaped; hook of paramere as long as wide
..... *sobrinus* Uhler

Hebrus buenoi Drake and Harris, 1943

Biological notes.—Porter (1950) reared this insect in the laboratory and observed its life stages from egg to adult. He obtained eggs on moss leaves where they were glued with a gelatinous mass secreted by the female. The time required for hatching varied from 10 to 22 days, the first stadium, 5 to 9 days; the second stadium, 4 to 9 days; the third stadium, 5 to 9 days; the fourth stadium, 5 to 7 days and the fifth stadium, 5 to 6 days. The total development time from egg to adult varied from 34 to 62 days. Molting activities were similar in all instars.

Locality data.—Previously recorded from Wiggins by Drake and Harris (1943). The writer has not taken it in Mississippi.

Hebrus burmeisteri Lethierry and Severin, 1835

Biological notes.—The writer collected this insect at only one locality in the state. This was on the bank of a pond near overhanging vegetation where the water had receded. The specimen was taken in late November which may indicate that it spends the winter in the adult stage in Mississippi.

Hungerford (1920) made a rather thorough study of this insect at Ithaca, New York where he collected it upon the moist earth on the bank of an upland meadow-pool. He observed mating and found that the male

mounts the female and that they remain in copula for varying periods of time. In the laboratory, oviposition was obtained by placing sprigs of moss in a petri dish partially filled with moist sand. The eggs were placed between the leaves and stems of the moss and took about one week for incubation. In the laboratory the bugs fed on plant lice, midges and mosquitoes that were dropped upon the sand of the petri dish.

Porter (1950) reared it in the laboratory. Eggs were placed in the axils of moss leaves and enclosed in a sticky gelatinous mass. The time required for development varied as follows: first stadium, 3 to 5 days; second stadium, 6 to 8 days; third stadium, 6 to 13 days; fourth stadium, 6 to 13 days and fifth stadium, 5 to 9 days. The total developmental period varied from 26 to 48 days.

Locality data.—This species has not been recorded previously from Mississippi. Specimens have been seen as follows: Ocean Springs, May, 1 specimen (J.T.P.); Saltillo, Nov., 1 ♂ (C.A.W.).

Hebrus concinns Uhler, 1894

Biological notes.—This insect frequents the banks of sluggish streams, ponds and shallow drainage ditches, where there is overhanging vegetation present. It is the most common species of the genus in the state. It is quite generalized in its habitat preferences, but as with other small insects the collector must work carefully and diligently to avoid overlooking it. Dousing the overhanging vegetation with water and dipping the specimens off the water surface proved to be the most fruitful method of collecting for the writer.

Uhler (1894) reported finding them on muddy soil and among the roots of grasses near pools of water. Winged specimens were noted swimming on the surface of quiet water.

Bueno (1908d) collected it at White Plains, New York on the muddy bottom of a temporary pool.

Blatchley (1926) records it as occurring in muck, beneath boards and in masses of weeds near ponds. Also, he noted specimens on the surface of ponds and adjacent mud flats.

Locality data.—Previously recorded from the state by Drake and Harris (1943) and Porter (1950). Specimens have been seen

at follows: Biloxi, April, 6 specimens (J.T.P.); Fearn Springs, Sept.-Oct., 1 ♂, 2 ♀♀ (C.A.W.); Fulton, Oct., 2 ♂♂ (C.A.W.); Handsboro, June, 1 specimen (J.T.P.); State College, Sept.-Oct., 2 ♂♂, 6 ♀♀ (C.A.W.); Vancleave, Sept., 6 specimens (J.T.P.).

Hebrus consolidus Uhler, 1898

Biological notes.—Specimens of this species were collected only in the Gulf coastal region by sweeping grasses growing in the water of a shallow freshwater pond fed by the overflow from a deep well on the property of the Gulf Coast Research Laboratory. A dense growth of algae covered the surface of the pond.

Uhler (1894) collected it on muddy soil and among the roots of grasses near pools of water. Hungerford and Beamer (1925) took specimens on the margins of a small pool. Blatchley (1926) indicates that it may be collected by sweeping low herbage along the margins of ponds.

Locality data.—Previously recorded from the state by Drake and Harris (1943) and Porter (1950). Specimens have been seen as follows: Biloxi, April-May, 5 specimens (J.T.P.); Charleston (H. M. Harris); Handsboro, June, 2 specimens (J.T.P.); Laurel (H. M. Harris); Ocean Springs, Aug., 1 ♂, 1 ♀ (C.A.W.).

Hebrus sobrinus Uhler, 1877

Biological notes.—Specimens were collected in two localities in Mississippi, both in the hilly northeastern part. One of the habitats was a large, flat-bottomed drainage ditch partially covered with vegetation and with shallow pot-holes of water in the bottom of the ditch. Also, specimens were taken by sweeping the vegetation in the ditch with a net. The other locality was on the bank of a small, sandy-bottomed stream with clear water and very little vegetation.

Porter (1950) studied its life history in the laboratory at Lawrence, Kansas. Females laid their eggs in the axils of moss leaves in the laboratory and the incubation period varied from 9 to 12 days. The length of time required for the various stadia to be completed was as follows: first stadium, 4 to 6 days; second stadium, 5 to 9 days; third stadium, 6 to 11 days; fourth stadium, 6 to 7 days; and fifth stadium, 9 to 20 days. Time for complete development varied from

39 to 62 days. Activities of individuals of all instars were similar.

Locality data.—Previously recorded from Lucedale by Porter (1950). Specimens have been seen as follows: Fulton, Oct., 1 ♂ (C.A.W.); Pontotoc, Oct., 1 ♂ (C.A.W.).

Key to the Mississippi Species of

MERRAGATA White

1. Apical segment of the antenna elongate *brevis* Champion
Apical segment of the antenna fusiform 2
2. Apex of the scutellum rounded; membrane white *brunnea* Drake
Apex of the scutellum truncate or slightly concave; membrane with four white spots on dark background *hebroides* White

Merragata brevis Champion, 1898

Biological notes.—No information on the biology of this species is available.

Locality data.—This insect has not been recorded previously from the state. Specimens have been seen as follows: Biloxi, April, 4 specimens (J.T.P.); Handsboro, June, 10 specimens (J.T.P.); Meridian, April, 1 ♂ (J. A. Roe).

Merragata brunnea Drake, 1917

Biological notes.—In Mississippi the writer found this to be the second most abundant species in the family. It was most frequently collected on the surface of ponds and sloughs that either were covered with aquatic vegetation or had vegetation hanging into the water from the banks. A long series was collected from a shallow area of a large spring-fed pond which had the surface completely covered with a heavy growth of the sweet-scented pond lily, *Castalia odorata* (Ait.). This bug was taken in association with *Mesovelia mulsanti* White, *Mesovelia amoena* Uhler, *Hebrus concinnus* Uhler and *Merragata hebroides* White. The most abundant was *Mesovelia mulsanti* White, with *Merragata brunnea* Drake second. Another habitat where it was collected was a shady, shallow slough which had the surface densely covered with a mat of *Lemna*. Nymphs were collected in the state as late as November.

Drake (1917) described the habitat preferences of *Merragata brunnea* as being on the secluded coves of ponds, lakes and swampy pools where there is a dense growth of aquatic plants and the water is shallow.

He indicates that he has rarely seen them on the banks and that they usually are found running around on the surface of the water where *Lemna*, *Nymphaea* and other floating aquatic plants are growing. They also can stand submergence in water for approximately half an hour and still come to the surface by their own power.

Blatchley (1926) took numerous specimens from masses of water shield, *Brasenia purpurea* (Michx.), in small ponds.

Porter (1950) observed the details of its life history. Oviposition was obtained on moss leaves and under algae in the laboratory, and incubation time varied from 8 to 12 days. He determined the time required for various stadia as follows: first stadium, 3 to 6 days; second stadium, 3 to 4 days; third stadium, 3 to 4 days; fourth stadium, 5 to 6 days; and fifth stadium, 5 to 6 days. Thus, the total developmental period varied from 31 to 38 days.

Locality data.—Previously recorded from the state by Drake and Harris (1943) and Porter (1950). Specimens have been seen as follows: Charleston, July-Sept., 2 specimens (H. M. Harris); Fearn Springs, Sept., 57 specimens (C.A.W.); Marks, Oct., 1 ♂ (C.A.W.); Minter City, Oct., 1 ♂ (C.A.W.); Ocean Springs, May, 1 specimen (J.T.P.); State College, Sept., 1 ♂, 2 ♀♀ (C.A.W.).

Merragata hebroides White, 1877

Biological notes.—Four years collecting in the state by the writer has revealed that this is the most abundant of the Hebridae. It was found commonly on ponds and lakes that were filled with algal mats. They were observed moving slowly over the surface provided by the thick mats of algae. Some were living in a saline tidal pool at Ocean Springs. At the time the collection was made salinity was 6.6 ‰. The banks and shallow water were filled with grasses and sedges. Clear ponds with overhanging vegetation along the banks proved to be another favorite habitat.

Drake (1917) noted that the habitat preferences of *Merragata hebroides* seemed to be the secluded coves of ponds, lakes and swampy pools where there was a dense growth of aquatic plants and where the water was shallow. He rarely saw them on the banks and they usually were found running around on the surface of the water

where *Lemna*, *Nymphaea* and other floating aquatic plants were growing.

Blatchley (1926) reported that he swept two specimens from low herbage along the side of a ditch.

Porter (1950) observed the life history in the laboratory where eggs were laid on moss leaves. He also found eggs in nature under filaments of algae growing on stones and deposited in small holes which were in the surface of the stones. The incubation period in the laboratory varied from 9 to 12 days. Instar developmental times were as follows: first stadium, 2 to 4 days; second stadium, 3 to 4 days; third stadium, 2 to 3 days; fourth stadium, 3 to 7 days; and fifth stadium, 3 to 6 days. Total developmental time varied from 20 to 36 days.

Locality data.—Previously recorded from the state by Drake and Harris (1943) and Porter (1950). Specimens have been seen as follows: Biloxi, March-April, 95 specimens (C.A.W. and J.T.P.); Fearn Springs, Sept., 1 ♂, 1 ♀ (C.A.W.); Handsboro, June, 3 specimens (J.T.P.); Ocean Springs, May-Aug., 57 specimens (C.A.W. and J.T.P.); Ramsey Springs, Oct., 1 specimen (J.T.P.); State College, May-July, 52 specimens (C.A.W.).

B. Family MESOVELIIDAE Douglas
and Scott, 1867

Review of the literature.—The species in this family are abundant, easily seen and collected and therefore have received considerable attention from taxonomists. A monograph of the family, including considerable data on American species, was written by Horvath (1915). Also, a second paper on the family was published as a fascicle of the general catalogue of the Hemiptera (Horvath, 1929b). Further studies on the life history and habits of *Mesoveliea mulsanti* White were carried out by Hungerford (1917a). The original description of *Mesoveliea cryptophila*, from Michigan, along with notes regarding its life history were published by Hungerford (1924a). Jaczewski (1930) published a revisionary work on *Mesoveliea mulsanti bisignata* Jaczewski. Rather detailed studies of *Mesoveliea mulsanti* White and *Mesoveliea cryptophila* Hungerford in Michigan and Kansas were published by Hoffman (1932b). Harris and Drake (1941) recorded *Meso-*

velia amoena Uhler from Mississippi for the first time. Further work on the distribution and variation of *Mesovelia mulsanti* White was published by Usinger (1942a). A check list of the Mesoveliidae of the western hemisphere (Drake and Harris, 1946) was useful to the writer in this study. Froeschner (1949) recorded locality data on two species of *Mesovelia* from Missouri.

Key to the Mississippi Species of
MESOVELIA Mulsant and Rey

1. Size larger, length, 2.87 to 3.80 mm; front and middle femora each with a row of spines on lower hind margin *mulsanti bisignata* Jaczewski
- Size smaller, 2.8 mm or less; front and middle femora not spined on lower hind margin 2
2. Beak almost reaching apex of hind coxae; slender in shape; length 2.1 to 2.8 mm *cryptophila* Hungerford
- Beak reaching between the middle coxae; robust in shape; length 2.00 to 2.38 mm *amoena* Uhler

Mesovelia mulsanti bisignata Jaczewski,
1930

Biological notes.—Widely distributed in Mississippi and most abundant on ponds, borrow-pits and slow moving streams, this insect was especially abundant on floating vegetation in ponds. The writer usually found the ratio of this species to *Mesovelia amoena* Uhler to be about eight of the former to one of the latter, and they were frequently collected together. Four years observation in Mississippi has shown that it reaches maximum numbers in September. Nymphs were collected as early as March and as late as November at State College, and winged adults were always more numerous than winged specimens.

Three collecting trips during July, 1951 to Deer Island, about one mile off the coast from Biloxi, revealed specimens in fair numbers in a tidal pool on the east end of the island. They were predominantly in the nymphal stage at this time of year. The water in the pool was brackish as determined by taste. It was also collected in brackish tidal pools on both Horn and Cat Islands.

Hungerford (1917a) studied the life history of this insect at Ithaca, New York. He collected it commonly around the margins

of pools upon floating vegetation where it fed upon small organisms that came to the surface from below or that fell upon the surface. It probably passes the winter in the adult stage at Ithaca, and starts ovipositing in the stems of plants or the spongy wood of floating logs. There was a succession of generations throughout the season, each complete cycle requiring about 24 days. The insect flies from pool to pool.

Hoffman (1932b) studied its biology in Kansas and Michigan and his data agree fairly well with Hungerford's. The average time for development of the first instar was 3.4 days; second instar, 3.2 days; third instar, 3.5 days; fourth instar, 4.4 days; and fifth instar, 5.4 days. Average time to maturity from the egg was approximately 20 days, and there was no difference in the length of the developmental period of the sexes. Hoffman reared the insect in the laboratory on houseflies and fruitflies.

Locality data.—Previously recorded from Fayette by Drake (1922) and from Oxford by Penn and Ellis (1949). Specimens have been seen as follows: Beulah; Biloxi; Cat Island; Deer Island; Fearn Springs; Fountainbleau; Glen Allen; Handsboro; Horn Island; Iuka; Jackson; Natchez; Ocean Springs; Okolona; Oxford; Prairie; Ramsey Springs; Saltillo; Saratoga; State College; Terry; Tupelo; Vancleave.

Mesovelia cryptophila Hungerford, 1924

Biological notes.—The habitat in which this bug was collected was a spring-fed, clear pool about thirty feet in diameter and three to five feet deep. It had a gravel bottom and was covered with a mat of dead leaves. The insect was collected from this mat of leaves near the bank of the pool in a densely shaded spot. The water in the pool was very cold.

Harris (1943b) noted that he collected it in stagnant backwater of a stream near Clinton, Iowa. His collecting also revealed it in shady spots near the base of trees in the water. He again collected it in a small pond near Bedford, Iowa along the shady sides of adjacent logs. This series of specimens was taken with *Mesovelia mulsanti bisignata* Jaczewski, *Hydrometra martini* Kirkaldy, and *Microvelia binei* Drake.

Hoffman (1932b) studied its life history in Michigan and found the average duration

of life as follows: first instar, 3.5 days; second instar, 3.6 days; third instar, 4.2 days; fourth instar, 5.8 days. The total life cycle was 17.6 days.

Hungerford (1924a) collected this insect in Michigan and described it as a new species. He noted that it was taken in an upland pond in a dense growth of *chamaedaphne* a short distance back from the open water margin. Hungerford suggested that the retiring habits of the insect accounts for it being unknown so long.

Locality data.—Previously recorded from McComb by Drake and Harris (1928c), from McComb by Harris (1943a) and from Mississippi by Froeschner (1949). Specimens have been seen as follows: Saratoga, Aug., 1 ♂ (C.A.W.).

Mesovelis amoena Uhler, 1894

Biological notes.—This species was associated with *Mesovelis mulsanti bisignata* Jaczewski in every collection taken in the state. Since very little information is available in the literature relative to habitat preference of this insect, the various locations where it was taken will be discussed briefly. At Brookhaven it was collected from along the edge of a ten acre pond which was densely covered with water chinquapin, *Nelumbo lutea* (Willd.). The specimens were taken in shallow water by sweeping with a net among the leaves at water level. The collection at Fearn Springs was near the bank of a small river that was clear of vegetation and had a small amount of floating debris on the surface. The location was densely wooded and thus quite shady. At Ocean Springs it was taken along the edge of a brackish, tidal pool rather heavily covered with emergent vegetation. The salinity of this pool was 6.6 ‰ at the time the insects were collected. The Okolona collection was made in a shallow borrow-pit heavily covered with emergent vegetation. The collection at Prairie was made in a small ditch with overhanging vegetation around the edges; the water was not flowing but had dried up into puddles. It was collected in three habitats at State College, namely a flowing stream filled with algae, along the edge of a shallow pond, and at the base of willow trees in a deep, clear pond.

Uhler (1894) in the original description noted that it was collected in British West

Indies on the surface of a stream and on a pool among grass and weeds. Blatchley (1926) collected a single specimen in Florida on floating mats of duckweed, *Riccia fluitans*, on the surface of sinkhole ponds and from algal mats of a nymphaea marsh.

Locality data.—Previously recorded from Laurel by Harris and Drake (1941). Specimens have been seen as follows: Brookhaven, Nov., 1 ♀ (C.A.W.); Fearn Springs, Sept., 1 ♂, 2 ♀♀ (C.A.W.); Handsboro, June, 3 specimens (J.T.P.); Harrison County, Oct., 1 specimen (J.T.P.); Ocean Springs, July-Aug., 4 ♂♂, 2 ♀♀ (C.A.W.); Okolona, Oct., 1 ♂ (C.A.W.); Prairie, Oct., 3 ♂♂, 4 ♀♀ (C.A.W.); State College, Sept.-Nov., 3 ♂♂, 3 ♀♀ (C.A.W.).

C. Family HYDROMETRIDAE

Billberg, 1820

Review of the literature.—A preliminary study of the life history of *Hydrometra martini* Kirkaldy in the vicinity of Ithaca, New York was made by Martin (1900). He included a drawing of the egg and presented some observations on mating. Further work on the biology of *Hydrometra martini* at Staten Island, New York was done by Bueno (1905a), where he determined the length of the life cycle in that locality. Hungerford's (1923b) paper contains keys to the species found in America north of Mexico with the description of one new species. Bueno (1926a) published a paper on the Hydrometridae of the Western Hemisphere, containing keys, descriptions and a few biological notes on some of the species. Bueno's work was followed a few years later by an extensive monograph of the Hydrometridae of the world (Hungerford and Evans, 1934) containing keys to the species of both the Eastern and Western Hemispheres, descriptions, synonymy and locality data. Many of the key characters are illustrated by drawings. One of the more recent works on this family (Herring, 1948), concerns the Hydrometridae of Florida. Six species are included and detailed locality records are given for the state. Drake and Hottes (1952a) published notes on eleven species of North American *Hydrometra*, including the description of two new species from Mexico. They made *Hydrometra myrae* Bueno a synonym of *Hydrometra australis* Say.

Key to the Mississippi Species of
HYDROMETRA Lamarck

1. Pits on pro- and meso-acetabula
four or more 2
Pits on pro- and meso-acetabula
normally two *martini* Kirkaldy
 2. Pits on pro- and meso-acetabula
normally four; tylus bluntly
jointed as viewed from above 3
Pits on pro- and meso-acetabula
usually eight to ten; tylus
broadly rounded as viewed
from above *wileyae* Hungerford
 3. Male processes on last venter
transversely linear; anteo-
cular distance two and one-half
times postocular distance;
metanotum two-thirds length
of pronotum *australis* Say
- Male processes on last venter
spine-like; anteo-ocular dis-
tance slightly less twice post-
ocular distance; metanotum
one-half length of pronotum
..... *hungerfordi* Bueno

Hydrometra martini Kirkaldy, 1900

Biological notes.—Collections have been made in all sections of Mississippi. The writer was surprised to find it so abundant since literature records indicated that it was much less plentiful than *Hydrometra australis* Say in the southern states. It was collected most commonly in clear, shady streams, ponds covered with emergent vegetation, shallow drainage canals, roadside borrow-pits covered with vegetation, and shady *Lemna*-covered sloughs in swamps.

Hungerford (1920) gave a rather complete account of the biology of *Hydrometra martini*. He found it in habitats in Kansas and New York very similar to those it frequents in Mississippi. The eggs were placed on aquatic plants slightly above the surface of the water. As many as 11 eggs were laid in a single day and the average time for incubation was 7 days, with a range of 4 to 22 days. A female may lay 175 eggs in a season. Each of the five nymphal instars required about 2 days, and the complete life cycle under favorable conditions approximately 15 days. Hungerford found that the main food supply consisted of mosquito larvae, ostracods and emerging midges.

Martin (1900) made observations on its biology at Ithaca, New York. He observed egg-laying and found that the female backs up to grass stems extending above the water to deposit eggs which are glued singly by a

gummy, gelatinous substance. The sticky mass hardens very quickly and the egg is fastened in place before it has left the body. Martin states that they feed mostly on the juices of insects trapped on the surface of the water.

Sprague (1956) published a detailed study of the morphology of all stages and complete biological studies of habitats, collecting and rearing methods, behavior, development and dimorphism.

Locality data.—Previously recorded from Fayette by Drake (1922), Agricultural College, Charleston, McComb, Port Gibson and Woodville, Drake and Harris, (1928c), Hungerford and Evans (1934), and Oxford and Spring Lake by Penn and Ellis (1949). Specimens have been seen as follows: Batesville; Beulah; Biloxi, Brookhaven, Columbus; Fearn Springs; Fulton; Hattiesburg; Mississippi City; Ocean Springs; Okolona; Ramsey Springs; Saltillo; Saratoga; State College.

Hydrometra australis Say, 1832

Biological notes.—The Mississippi specimens were collected in a variety of habitats similar to those for *Hydrometra martini*. However, they did seem to be more common near the edge of ponds with heavily vegetated banks. It is common in Mississippi and was collected somewhat more frequently than *H. martini* Kirkaldy.

Herring (1951b) collected it in Florida from streams, springs, swamp-and-bog streams, and flatwoods ponds. No data is available on the life cycle. However, it is probably quite similar to that of *H. martini*.

Locality data.—Previously recorded from Fayette by Drake (1922) and from Oxford and Spring Lake by Penn and Ellis (1949). Specimens have been seen as follows: Anguilla; Biloxi; Brooklyn; Charleston; Fayette; Fearn Springs; Handsboro; Hattiesburg; Laurel; McComb; Ocean Springs; Port Gibson; Ramsey Springs; Saratoga; Saucier; State College; West Point; Wiggins; Woodville; Wortham.

Hydrometra wileyae Hungerford, 1923

Biological notes.—The writer has not collected it in Mississippi and thus has had no opportunity to observe its habits.

Herring (1951b) collected specimens in Florida only from calcareous streams, which are characterized by clear, cold water derived

from huge springs of a calcareous nature.

Locality data.—Previously recorded from the state by Drake and Hottes (1952a).

Hydrometra hungerfordi Beuno, 1926

Biological notes.—The writer made collections generally in cool, clear, shady streams and ponds. It was also taken commonly in shady, clear, spring-fed seepage areas at the base of hills. Collections were made most easily by quietly observing the surface of the water until the insects were seen, and then capturing them with a small, fine-mesh tea strainer.

Locality data.—Previously recorded from the state by Hungerford and Evans (1934), and Drake and Hottes (1952a). Specimens have been seen as follows: Biloxi, April, 11 specimens (J.T.P.); Brooklyn, Feb., 5 specimens (J.T.P.); Hattiesburg, Feb., 8 specimens (J.T.P.); Ocean Springs, July, 2 ♂♂, 1 ♀ (C.A.W.); Ramsey Springs, Aug.-Oct., 2 ♂♂, 6 ♀♀ (C.A.W. and J.T.P.); Saratoga, Aug., 1 ♂ (C.A.W.); Summit, Sept., 1 specimen (H. M. Harris); Vancleave, Aug., 4 ♂♂, 5 ♀♀ (C.A.W.).

D. Family GERRIDAE Amyot and Serville, 1843

Review of the literature.—This family has received considerable attention from taxonomists throughout the world and there are many publications available for use in the study of the water striders. Only the more significant publications will be reviewed here and other references are in the "references" section of this paper.

An early contributor to the United States literature on Gerridae was Riley (1918, 1919, 1920, 1921a, 1921b, 1922a, 1922b) who published considerable information on the food habits, migration and tropistic responses of water striders. A number of United States records of Halobatinae are included in the paper by Esaki (1926a). Drake and Harris (1927) published notes on *Rhagovelia*, along with descriptions of six new species. A monograph of *Rhagovelia* of the Western Hemisphere, Gould (1931), is especially useful since original descriptions gleaned from many sources are included. Schroeder (1931) published keys to the males of *Rheumatobates* plus original descriptions of species, biological notes and locality records. A monograph of *Metro-*

bates (Anderson, 1932a), contains keys to the North American genera of Gerridae, synonymy of the species of *Metrobates* and copies of the original descriptions of the species. Another paper on *Metrobates* appeared the same year (Drake and Harris, 1932a). A publication on the species of *Trepobates* (Drake and Harris, 1932b), includes keys to species, descriptions and re-descriptions and information on the location of type specimens. The valuable work by Drake and Harris (1934a) on the Gerrinae of the Western Hemisphere contains keys, descriptions and excellent illustrations that make it very useful for the identification of specimens in this subfamily. Keys to the Indiana subfamilies, genera and species of Gerridae along with county distributional data and brief biological notes are included in the paper by Deay and Gould (1936a). Kuitert (1942), in a paper on Gerrinae, recorded three species from Mississippi. The paper was written after a study was made of the Gerrinae in the Snow collections of the University of Kansas.

Key to the Mississippi Subfamilies of GERRIDAE Amyot and Serville

1. Inner margin of eyes not sinuate, either convexly rounded or straight and oblique behind middle. Body comparatively short and stout, abdomen often very short 2
- Inner margin of eyes concavely sinuate behind middle. Body usually comparatively long and slender GERRINAE Bianchi
2. Vertex without an impressed median line. Head produced before the antennae; genae not embracing base of beak HALOBATINAE Bianchi
- Vertex with an impressed median line. Head wide and short, not produced before antennae; genae, as rounded disks, embracing base of beak RHAGADOTARSINAE Lundblad

Key to the Mississippi Genera of GERRINAE Bianchi

1. Body dull. Tarsal segments of fore leg subequal in length. Antennae moderately long, scarcely reaching beyond hind margin of thorax GERRIS Fabricius
- Body shiny. First tarsal segment of fore leg short, much shorter than second LIMNOGONUS Stål

Key to Mississippi Species of
♂ *GERRIS* Fabricius

1. Venter simply emarginate at apex. Connexival spines very long, reaching to or slightly beyond the middle of the last genital segment 2
 Venter doubly emarginate behind, the second emargination forming a more or less distinct notch at the middle. Connexival spines much shorter or wanting 5
2. Antennal segment I subequal to or distinctly longer than II and III conjoined. Color very dark 3
 Antennal segment I shorter than II and III conjoined. Body reddish brown or marked with reddish brown 4
3. Antennal segment I longer than II and III conjoined. Last segment of venter without distinct median depression *conformis* (Uhler)
 Antennal segment I subequal to II and III conjoined. Last segment of venter with a prominent, deep, broad, depressed median furrow *nebularis* Drake and Hottes
4. Smaller, 8 to 11 mm. First genital segment with median keel at base *canaliculatus* Say
 Larger, 12 to 20 mm. First genital segment without keel at base *dissortis* Drake and Harris
5. Large, robust (11 mm or more). Connexival spines rather long and conical. First genital segment with a very strongly elevated, prominent keel *remigis* Say
 Smaller species (less than 11 mm). Connexival spines shorter, angular. First genital segment with keel only moderately prominent or absent 6
6. Antero-lateral stripe of pronotum silvery *argenticollis* Parshley
 Antero-lateral margins of pronotum without silvery stripes 7
7. First genital segment plump, scarcely impressed on each side *insperatus* Drake and Hottes
 First genital segment strongly impressed on each side *marginatus* Say

Key to Mississippi Species of
♀ *GERRIS* Fabricius

1. Larger species, length 12 mm or more 2
 Smaller species, length 11 mm or less 5

2. Antennal segment I equal to or longer than II and III combined 3
 Antennal segment I shorter than II and III combined *dissortis* Drake and Harris
3. Antennal segment I subequal to segments II and III united 4
 Antennal segment I distinctly longer than II and III combined *conformis* (Uhler)
4. Connexival spines long, slender, curved in and upward, as long as genital segments *nebularis* Drake and Hottes
 Connexival spines short, as long as first genital segment *remigis* Say
5. Pronotum without silvery or yellow stripes on anterior side margins 7
 Pronotum with stripes on anterior side margins 6
6. Anterior lateral stripes extending to basal margins of pronotum *argenticollis* Parshley
 Anterior lateral stripes not extending to basal margins of pronotum *canaliculatus* Say
7. Connexival spines thick, not extending to apex of first genital segment *insperatus* Drake and Hottes
 Connexival spines moderately thick, extending to apex of first genital segment *marginatus* Say

Gerris conformis (Uhler), 1878

Biological notes.—Osborn and Drake (1915a and b) noted that in Ohio it occurs in both lakes and flowing streams. It spends the winter as an adult and mating starts in the early spring. Eggs are laid on material just beneath the surface of the water, and incubation is about 11 days. The time for development is about 34 days.

Locality data.—Has not been recorded from the state previously. Specimens have been seen as follows: Houlika, 1 specimen (M.S.C.); State College, June, 1 specimen (M.S.C.); Sturgis, April, 1 specimen (M.S.C.).

Gerris nebularis Drake and Hottes, 1925

Biological notes.—This large, swift gerrid inhabits the flowing smaller streams and rivers of Mississippi. It prefers open water and treads water quite swiftly, alternately resting and then moving short distances. When approached it will retreat to the cen-

ter of a stream. Mating was observed as early as mid-April in the central part of Mississippi. It was observed feeding upon small insects on the water surface on several occasions.

Herring (1950a) collected adults in Florida throughout most of the year. He took nymphs along the more secluded areas of streams in February, April and May. Deer flies killed and thrown upon the surface of the water were eaten.

Locality data.—Previously recorded from A. & M. College and Charleston by Drake and Harris (1928c, 1934a) and Kuitert (1942). Specimens have been seen as follows: Charleston, Sept., 2 specimens (M. S.C.); Fearn Springs, April-Sept., 4 ♂♂, 5 ♀♀ (C.A.W.); State College, July, 1 ♂, 1 ♀ (C.A.W.); Vancleave, May, 7 ♂♂, 4 ♀♀ (J.T.P.).

Gerris canaliculatus Say, 1832

Biological notes.—Adults have been collected in Mississippi every month of the year. Nymphs were taken as late as mid-October in the northern part of the state. This is the most common water strider in the state, and was collected in a wide range of habitats. It was taken in small streams, springs, rivers, lakes, ponds, drainage ditches, borrow-pits, sloughs and bayous.

Penn and Goldsmith (1950) studied the life history of this insect in Louisiana. They were able to rear the nymphs to maturity on a diet of freshly killed small insects dropped on the water surface each morning. The adults were kept alive quite successfully when fed adult mosquitoes. The life cycle from egg-laying to emergence of adults was completed in an average of 27 to 28 days, with a minimum of 24 days and a maximum of 32 days. The incubation period for eggs averaged 7 days and the length of time required for the instars was as follows: first instar, 3.7 days; second instar, 3.4 days; third instar, 4.4 days; fourth instar, 5 days and fifth instar, 5.4 days.

Herring (1950a) reared specimens in Florida on a diet of coccinellid beetle larvae. They preferred beetle larvae, and would eat adult mosquitoes only when no beetles were available for long periods of time. Herring determined that the length of time required for hatching of the eggs was a little less than 6 days, and that the total time from

egg to adult was 30. Breeding was observed in Florida throughout most of the year.

Locality data.—Previously recorded from Fayette by Drake (1922), Agricultural College, Charleston, McComb, Port Gibson and Woodville (Drake and Harris, 1928c), Kuitert (1942) and from Oxford and Spring Lake by Penn and Ellis (1949). Specimens have been seen as follows: Batesville; Biloxi; Bovina; Brookhaven, Brooklyn; Burnsville; Charleston; Cleveland; Columbus; Crowder; Fearn Springs; Fulton; Glen; Glen Allen; Greenwood; Hattiesburg; Iuka; Jackson; Lorman; Louise; Lucedale; McComb; Marks; Mississippi City; Natchez; Ocean Springs; Oxford; Pass Christian; Port Gibson; Prairie; Ramsey Springs; Saratoga; Saucier; Schlater; State College; Stewart; Sturgis; Vancleave; Vicksburg; Webb; Wiggins.

Gerris dissortis Drake and Harris, 1930

Biological notes.—This insect is common in the northern part of the United States, and the writer has not had the opportunity to observe it. Blatchley (1926) indicates that it ranges from New England and Quebec west to British Columbia and California and southwest to North Carolina. It occurs in ponds, lakes and ditches, especially those particular bodies of water located in the mountainous regions. Eggs are laid on the floating leaves of aquatic plants just below the surface. Occasionally they are deposited on small sticks and other objects in the water.

Bueno (1913c) indicated that it is Palearctic in origin and that it has migrated 15,000 miles to establish colonies throughout the North Temperate zone of the world. He records it as predaceous.

Locality data.—Has not been recorded from Mississippi and the writer has not collected it in the state. However, it is included since Drake and Harris (1934a) report it from Indiana and Missouri.

Gerris remigis Say, 1832

Biological notes.—Essenberg (1915) observed its life history at Berkeley, California. In that locality it winters in the adult stage, hibernating under rubbish, rocks, and logs. Egg laying starts in the early spring, and they are deposited on grasses just beneath the water surface. The eggs hatch in about 3 weeks. The food supply consists primarily

of living and dead insects found upon the surface of the water. Essenberg observed that it was cannibalistic.

Bueno (1917b) found breeding and oviposition as early as February in New York, and mating as early as April. Nymphs were found from late May to the middle of October. The eggs were laid end to end along the edges of grasses and other vegetation growing in the water. Laboratory observations by Bueno showed that the eggs develop in approximately 10 days or 2 weeks; the first instar, 4 to 7 days; the second instar, 4 to 6 days; the third instar, 5 to 10 days; the fourth instar, 5 to 10 days and the fifth instar about 15 days. Thus, the complete life cycle from egg to adult extended over a period of from 43 to 60 days.

Riley (1919, 1920, 1921a, 1921b) published notes indicating that they are cannibalistic, positively phototactic and positively thigmotactic.

Hungerford (1920) studied this insect in Kansas and noted that it was found most commonly on running water, or pools connected with running water. It was observed to winter as an adult under brush and logs near water. The incubation period for the egg stage was about two weeks. There are five instars, each lasting about one week. The food consisted largely of midges, notonectid nymphs, jassids and other insects cast upon the water. On one occasion he noted them feeding upon snails left in a dried-up pond.

Deay and Gould (1936a) collected specimens most commonly on ponds and lakes in Indiana, where schools of the insect were seen in late fall and again in early spring. It hibernates as an adult in Indiana.

Locality data.—Previously recorded from the state by Drake and Harris (1934). One specimen has been seen from Tupelo, April, 1 ♂ (H.C.R.).

Gerris insperatus Drake and Hottes, 1925

Biological notes.—Specimens were collected in quiet pools of shady, upland streams. It seems to prefer streams that are spring-fed and once it was taken in a small spring in a hilly region of the state. Adults were taken from February to November and nymphs were collected as late as September. Only macropterous specimens were taken.

No literature references were noted on the biology of this species.

Locality data.—Previously recorded from the state by Kuitert (1942). Specimens have been seen as follows: Brooklyn, Feb., 15 specimens (J.T.P.); Enterprise, June, 6 specimens (M.H. Brunson); Fearn Springs, May, 1 ♂ (C.A.W.); Hattiesburg, Feb., 22 specimens (J.T.P.); Ramsey Springs, Aug., 9 ♂♂, 9 ♀♀ (C.A.W.); Wiggins, Nov., 1 specimen (J.T.P.).

Gerris marginatus Say, 1832

Biological notes.—This gerrid is quite common in Mississippi, although it was not collected as commonly or in as wide range of habitats as *Gerris canaliculatus*. Based on collection data, it seems to prefer large, shady ponds, larger streams and large springs. Specimens were taken every month from February through August. It is very active and moves over the water surface at a rapid rate. Occasionally it spends considerable time remaining stationary on the water surface. It feeds upon small insects on the water surface, capturing them with the armed front legs. The mating process lasts for several hours. On several occasions mating pairs were captured in a net, then released, and they remained attached. The female swims about with the male on her back.

Bueno (1917c) on Long Island found that it preferred quiet pools rather than open waters. The eggs hatch in about 10 days or two weeks; the insect has five molts, reaching the adult stage in about five or six weeks.

Hungerford (1920) noted that the eggs are laid as by *Gerris remigis*, and that there are five instars, each requiring from 3 days to one week for completion.

Locality data.—Previously recorded from Charleston by Drake and Harris (1928c, 1934a). Specimens have been seen as follows: Crowder, Sept., 1 ♂ (M.S.C.); Fearn Springs, May-Aug., 4 ♂♂, 3 ♀♀ (C.A.W.); Hattiesburg, Feb.-April, 2 ♂♂, 2 ♀♀ (C.A.W. and J.T.P.); Perkinston, April, 1 ♂ (C.A.W.); Rienzi, Sept., 1 ♂ (M.S.C.); State College, May-Aug., 14 ♂♂, 6 ♀♀ (C.A.W.).

Gerris argenticollis Parshley, 1916

Biological notes.—Habitats in Mississippi in which this water strider was taken included small ponds, streams and shady sloughs. It was found with about equal frequency in all of the habitats mentioned.

Nothing has been published on the biology of this insect. Specimens were successfully reared in the laboratory at Mississippi State College at a constant temperature of 60° F on a diet of houseflies or freshly killed corixids.

The insects were isolated in pairs in 10 cm petri dishes. A block of wood $\frac{1}{4}$ by $\frac{1}{4}$ by 1 inch was placed in each dish for the females to oviposit on. Mating occurred within minutes after isolation of the pairs in every case. The male circled the female popping the water with his abdomen, then very rapidly mounted the female to complete the act. Time required for mating averaged 30 seconds, and usually four or five matings were performed in succession. Five days after mating, eggs were found on the blocks of wood. They were pearly-white in color, 1.5 mm long by 0.5 mm wide, and were attached flatly to the wood. Within 24 hours there appeared down each side of the egg two rows of brown dots and by the third day red eye spots were clearly visible. After this the egg became dark yellowish-brown and on the six day the molting line appeared. Hatching was noted on the seventh day. Table 1 gives the average length and width of specimens and the duration of each instar for the 17 specimens reared.

TABLE 1.
Life history data for Gerris argenticollis

Instar	Length mm	Width mm	Duration in days
First	2.00	1.25	2
Second	3.20	1.80	5
Third	3.50	2.20	6
Fourth	5.50	2.20	4
Fifth	6.60	2.40	5

Locality data.—Previously recorded from the state by Drake (1920b) and Blatchley (1926) and from Agricultural College by Drake and Harris (1928c). Specimens have been seen as follows: Biloxi, Feb., 1 specimen (J.T.P.); Brooklyn, Feb.-April, 3 ♂♂, 8 ♀♀ (C.A.W.); Fearn Springs, April-May, 1 ♂, 2 ♀♀ (C.A.W.); Hattiesburg, Feb., 5 specimens (J.T.P.); State College, May, 1 ♂ (C.A.W.).

Limnogonus hesione (Kirkaldy), 1902

Biological notes.—Four years of collecting in Mississippi has shown this to be one of the most abundant water striders in the state. Collections were made in a wide variety of

habitats including ponds, streams, lakes, borrow-pits, sloughs, springs, seepage areas, and others. Specimens frequently were found in association with other water striders, especially *Gerris canaliculatus*. In central Mississippi nymphs were taken as early as April 1st, and as late as November 15th, and mating was observed as late as November 15th. Thus, breeding is continuous over a good part of the year in the state. The ratio of winged to wingless individuals in the collections made in the state averaged about one winged to twenty wingless. Specimens feed on insects that fall into the water.

Osborn and Drake (1915a and b) observed that the long-winged form is quite rare in Ohio. Pairs were found *in coitu* for several days at a time. Eggs are laid on the underside of sticks and leaves just below the water surface. The eggs are enlarged at one end and are approximately three times as long as wide. They are dirty greenish yellow in color when laid and become somewhat darker with age. The nymph passes through five instars, and the time required for nymphal development was approximately 50 days in Ohio.

Herring (1950a) collected this species in Florida from quiet lakes and ponds. Also, it was taken frequently from *Nymphaea* marshes, sinkholes and vegetation-filled, roadside ditches. Herring noted that macropterous individuals were taken commonly in Florida.

Locality data.—Previously recorded from Fayette by Drake (1922); from Charleston, Fayette, McComb, Summit and Vicksburg by Drake and Harris (1928c, 1934a); and from Oxford and Spring Lake by Penn and Ellis (1949). Specimens have been seen as follows: Batesville; Beulah; Biloxi; Brookhaven; Brooklyn; Charleston; Cleveland; Columbus; Corinth; Fearn Springs; Fulton; Greenwood; Hattiesburg; Iuka; Jackson; Laurel; Louise; Marks; Minter City; Ocean Springs; Perkinson; Port Gibson; Ramsey Springs; Saucier; Starkville; State College; Terry; Tutwiler; Vancleave; Webb.

Key to the Mississippi Genera of *HALOBATINAE* Bianchi

1. Tibia and first tarsal segment of middle leg with a fringe of long hairs ————— *HALOBATES* Esch.
- Tibia and first tarsal segment of middle leg without a fringe of long hairs ————— 2

2. Antennal segment I subequal in length to other three united, distinctly longer than II and III *METROBATES* Uhler

Antennal segment I much shorter than other three united, sometimes shorter than II and III 3

3. Abdomen as long as remainder of body, pointed at apex, antennal segment IV subequal to III in length *RHEUMATOBATES* Bergroth

Abdomen much shorter than remainder of body; antennal segment IV slightly longer than III *TREPOBATES* Uhler

Metrobates hesperius Uhler, 1871

Biological notes.—The preferred habitat in the state was flowing streams relatively free of vegetation. On one occasion several schools of specimens were observed in a large sandy-bottomed river in southern Mississippi. They avoided the swiftly flowing parts of the stream except when feeding. They feed on small insects in the water, which they capture by "treading water" in the faster flowing areas. Nymphs were collected in large numbers as late as October in the southern part of the state, and frequently in association with other water-striders, especially *Rheumatobates rileyi palosi*, *Rheumatobates tenuipes*, and occasionally *Gerris canaliculatus*.

Summers (1890) collected winged specimens in Tennessee.

Parshley (1917a) recorded an unusual case on Long Island where he encountered large numbers of individuals with fully developed wings. By actual count of a random collection he found 269 winged and 234 wingless specimens. A drawing of a winged adult male is included in the paper.

Drake and Harris (1932a) noted that it is common in the eastern part of North America and frequently is found in association with species of *Trepobates* and *Rheumatobates* and occasionally with *Tenagopogonus*, *Gerris*, and *Rhagovelia*.

Locality data.—Previously recorded from the state by Anderson (1932a) and Drake and Harris (1932a). Specimens have been seen as follows: Biloxi, Oct., 57 specimens (J.T.P.); Cleveland, Oct., 26 ♂♂, 29 ♀♀ (C.A.W.); Harrison County, Oct., 7 specimens (J.T.P.); McComb, Sept., 1 ♂ (M.S.C.); Ramsey Springs, Aug., 2 ♂♂ (C.A.

W.); Schlater, Oct., 23 ♂♂, 5 ♀♀ (C.A.W.); Vancleave, Aug., 1 ♂ (C.A.W.).

Metrobates alacris Drake, 1955

Biological notes.—Nothing is known of the life history.

Locality data.—The type locality is Tallulah, Louisiana. It has not been collected in Mississippi.

Key to the Mississippi Species of ♂ *TREPOBATES* Uhler

1. Intermediate legs with femora and basal portion of tibiae clothed within with a fringe of hairs whose lengths are subequally as great as the diameter of the segment at the point where they arise 2

Intermediate femora and tibiae clothed on their inner margins with much shorter setose hairs, these never longer than half the diameter of segments where they arise *pictus* (Herrich-Schäffer)

2. Antennal segment III clothed within a row of long hairs, these often closely appressed to the segment; first genital segment rather thickly clothed beneath with moderately long, erect, pale hairs *knighti* (Drake and Harris)

Antennal segment III without long hairs; the first genital segment not noticeably hairy beneath 3

3. Second genital segment thickly pilose beneath; antennal segment II shorter than III *inermis* Esaki

Second genital segment without long hairs beneath; II and III antennals subequal *subnitidus* Esaki

Key to the Mississippi Species of ♀ *TREPOBATES* Uhler

1. Connexivum produced outward and upward at apex into long, curved spines *knighti* (Drake and Harris)

Apices of connexivum not strongly produced 2

2. Metanotum produced posteriorly into a blunt spine; apical margin of last segment of venter clothed with long hairs *pictus* (Herrich-Schäffer)

Metanotum not produced posteriorly into a blunt spine; last segment of venter not ciliate at apex 3

3. Segments II and III of antennae subequal *subnitidus* Esaki
 Segment II of antennae distinctly shorter than segment III *inermis* Esaki

Trepobates knighti (Drake and Harris, 1928)

Biological notes.—This insect has not been collected in Mississippi and no references to its life history were found in the literature.

Locality data.—It has been recorded from Arkansas and Missouri (Drake and Harris, 1928c, 1932b), and therefore is included here.

Trepobates subnitidus Esaki, 1926

Biological notes.—This is one of the common species in the state. It was usually taken in association with other *Trepobates* and several species of *Gerris*. The habitats in which it was most frequently encountered included bayous, sloughs, ponds, brooks and flowing streams. Algal filled ponds seemed to be a favorite habitat. The insects were found extremely abundant on ponds in the vicinity of State College and the writer observed their activities on many occasions. Mating was observed from May until October, and the latest in the season that an adult was collected, at State College, was November 29th. They were noted feeding on small insects on the water surface. The winged form, previously unknown, was collected by the writer at State College on June 25, 1951.

Locality data.—Previously recorded from Summit by Drake and Harris (1932a). Specimens have been seen as follows: Beulah; Charleston; Cleveland; Escatawpa; Eupora; Glen Allen; Greenwood; Itta Bena; Ramsey Springs; Scott; Starkville; State College; Stoneville; Vancleave; Wortham.

Trepobates inermis Esaki, 1926

Biological notes.—It was usually collected along with *Trepobates subnitidus* in the state. Extensive observation showed that it is quite similar to *Trepobates subnitidus* in biological habits. A considerable number of winged specimens were collected, especially during May and June.

Locality data.—Previously recorded from the state by Drake and Harris (1928c, 1932b). Specimens have been seen as follows: Beulah; Biloxi; Carthage; Charleston; Cleveland; Escatawpa; Eupora; Fayette;

Greenwood; Grenada County; Heidelberg; Laurel; Mathiston; Natchez; Ramsey Springs; Schlater; State College; Stoneville; Vancleave; Vicksburg; Washington; Wiggins.

Trepobates pictus (Herrich-Schäffer, 1848)

Biological notes.—In Mississippi it is found only in running streams, springs and clear borrow-pits. Also, the species definitely seems to be limited to the hill sections and coastal areas of the state, since long series of specimens were taken there and not one was taken in the Mississippi Delta. It occurs in schools and feeds on small insects that fall on the water surface. Adults and nymphs were collected in Mississippi from early April until early November. Apparently it winters in the adult stage in Mississippi.

Hungerford (1920) was able to obtain oviposition in the laboratory, and he also found egg masses on the underside of leaves and sticks in a pond. There were 3 to 10 eggs in a mass and they hatched in the laboratory in five days.

Locality data.—Previously recorded from the state by Drake (1922), and Drake and Harris (1928c, 1932b), all three records being the same collection from Fayette. Specimens have been seen as follows: Bude; Columbus; Eupora; Fearn Springs; Harrison County; Hazelhurst; Jackson; Lorman; Ocean Springs; Ramsey Springs; Saratoga; State College; Stewart; Sturgis; Toccopola; Union; Vancleave; Winona.

Trepobates citatus Drake and Chapman, 1953

Locality data.—Recorded from Pascagoula by Drake and Chapman (1953).

Key to the Mississippi Species of
 ♂ *RHEUMATOBATES* Bergroth

1. Hind legs slender, straight; tibiae of the middle legs straight *tenipes* Meinert
 Hind legs thickened, curved 2
2. Hind femora without long hairs on basal third of posterior margin *trulliger* Bergroth
 Hind femora with long hairs on the basal third of the posterior margin 3
3. Spur on terminal antennal segment beyond the middle *rileyi rileyi* Bergroth

Spur on terminal antennal segment before the middle
.....*rileyi palosi* Blatchley

Key to the Mississippi Species of
♀ *RHEUMATOBATES* Bergroth

1. Mesonotum and metanotum with yellow triangular shaped spot; ovipositor as viewed from above more blunt shaped
.....*rileyi palosi* Blatchley

Mesonotum and metanotum with yellow rectangular spot, or spot entirely absent; ovipositor as viewed from above more tapering.....*tenuipes* Meinert

Rheumatobates rileyi rileyi Bergroth, 1892

Locality data.—Reported from the state by Hungerford (1954).

Rheumatobates rileyi palosi Blatchley, 1926

Biological notes.—Studies on this insect made in the state indicate that it prefers ponds and lakes or the quiet pools of larger streams and rivers. The writer observed their activities on many occasions and the food consisted of small insects encountered in the water. Winged specimens of both males and females were collected on several ponds in the vicinity of State College in May. Mating takes place on the water surface, and numerous females with the wings broken off in the typical manner were noted in collections made during May.

Specimens were reared successfully in the laboratory at Mississippi State College at a constant temperature of 60° F during June and July, starting with stock cultures collected from nearby ponds. The 60° F temperature was necessary to prevent the formation of a scum on the water surface. If the scum was allowed to form, the hairs on the legs quickly became matted and the insects would sink and die.

The insects were isolated in pairs and placed in 10 cm petri dishes with a small piece of Johnson grass leaf. After a lapse of several days mating was observed. The male would dart around the female, pounce on her, lock his antennae around her head just back of the eyes and clasp her around the abdomen with his hind femora. The female would then flex her abdomen upward to complete the mating act. The total time required for the process was about 15 seconds. Mating was usually repeated three times in a period of five minutes. Egg laying occurred 3 days after mating.

The eggs were pearly white with a brownish-red stripe on each side when they were deposited. In 3 days the red eye spot became prominent; on the sixth day a bubble formed dorsad to the eyes and a white line appeared between the eyes and extended to the metathorax. On the seventh day hatching occurred in the usual manner. Table 2 gives the average length and width of specimens and the duration of each instar for a total of 52 specimens which were reared.

TABLE 2.
Life history data for Rheumatobates rileyi palosi

Instar	Length mm	Width mm	Duration in days
First	0.60	0.35	2
Second	1.20	0.70	5
Third	1.60	0.75	7
Fourth	2.20	1.00	4
Fifth	2.60	1.30	3

The insects are cannibalistic. One case was noted where a first instar nymph attacked a full grown male, inserting its beak at the base of the adult's head.

One sexually dimorphic winged female was observed in a large collection of winged males taken at State College.

In Kansas, Hungerford (1920), noted that they live on quiet waters. He suggested that the nature of the ovipositor indicated that the eggs are hidden in the tissues of plants.

Herring (1950a) fed *Rheumatobates rileyi* on a diet of small moths, ants and psychodid moths in the laboratory.

Locality data.—This insect has not been recorded previously from the state. Specimens have been seen as follows: Batesville; Beulah; Bovina; Charleston; Columbus; Escatawpa; Fearn Springs; Greenwood; Prairie; Ramsey Springs; State College; Wiggins; Grenada County; Laurel; McComb.

Rheumatobates tenuipes Meinert, 1895

Biological notes.—Collections in Mississippi indicate that the open water of creeks, rivers, ponds and bayous is preferred. On two occasions collections were made from tidal brackish pools near the Gulf of Mexico in Jackson County. Salinity of the water in one of the pools was 6.6 ‰ at the time of the collection. Larger numbers were observed where the collections were made and they were found in association with other species of *Rheumatobates* and *Trepobates*. Since this insect is a very active swimmer,

swift action with the net was necessary to capture it. Food consists of small insects on the surface of the water.

Herring (1950a) made collections from the deeper pools of calcareous and sand-bottomed creeks in Florida. He observed that it preferred the sluggish portions of the stream. The eggs were placed in the stems and leaves of aquatic plants.

Locality data.—Recorded previously from Charleston by Drake and Harris (1928c) and from the state by Hungerford (1954). Specimens have been seen as follows: Beulah; Biloxi; Cleveland; Columbus; Escatawpa; Greenwood; Grenada; Ocean Springs; Schlater; Vancleave; Wiggins.

Rheumatobates trulliger Bergroth, 1915

Biological notes.—This species was encountered only once by the writer. It was collected in a clear, gently flowing stream in Pearl River swamp, which contained no vegetation. Only 4 specimens were collected and they were in association with large numbers of *Rheumatobates rileyi palosi* and *Trepobates pictus*. All were wingless.

Locality data.—Previously reported from Charleston and Shipman by Drake and Harris (1928c) and from the state by Hungerford (1954). Specimens have been seen as follows: Carthage, Aug., 4 specimens (H. G. Johnston); Charleston, Aug.-Sept., 2 specimens (H. M. Harris); Fearn Springs, Sept., 3 ♂♂ (C.A.W.); Laurel, Sept., (H. M. Harris).

E. Family VELIIDAE Amyot and Serville, 1843

Review of the Literature.—Taxonomic keys to three genera and nine species of Veliidae were included in a paper by Bueno (1916a). Parshley (1921b) published a brief monograph on the genus *Microvelia* Westwood. A survey of the species of *Microvelia* of the Western Hemisphere with keys to the species (Bueno, 1924a) was followed the same year by a similar type of taxonomic treatment of the nearctic *Rhagovelia* (Bueno, 1924b). Drake and Harris (1927) described six new species of *Rhagovelia* and published distributional notes on the genus. Further notes on the genus *Rhagovelia* were recorded by Drake and Harris (1931). That same year, Gould (1931), published a monograph on the genus *Rhagovelia* of the Western Hemisphere. Bueno (1924a)

wrote a survey of the species of the genus *Microvelia* of the western world, including new species from the southern United States. Drake (1951a, 1951b, 1951c, 1951d, 1952b) described a number of new species of Veliidae from the Americas and recorded data on distribution for some of the species. Drake and Hussey (1955) published a check-list of American forms with descriptions of two new species.

Key to Mississippi Genera of VELIIDAE (Amyot and Serville)

1. Middle tarsi deeply cleft, with leaflike claws and plumose hairs arising from base of cleft 2
Middle tarsi not deeply cleft and without plumose hairs arising from base of cleft 3
2. Posterior tarsi 2-segmented, the basal segment very short; apterous, marine *TROCHOPUS* Carpenter
Posterior tarsi 3-segmented, the basal segment very short; apterous or macropterous *RHAGOVELIA* Mayr
3. Tarsal formula 3:3:3. First segment of antennae distinctly longer than the others *VELIA* Latreille
Tarsal formula 1:2:2. First segment of antennae subequal to others *MICROVELIA* Westwood

Key to the Mississippi Species of MICROVELIA Westwood

1. Antennae subequal to or shorter than head and thorax united; abdomen of wingless form without silvery pubescence 2
Antennae longer than head and thorax combined; abdomen of wingless form often with silvery pubescence 6
2. Length: macropterous form, 2.4 mm; apterous form, 2.5 mm *pulchella* Westwood
Length not greater than 2.0 mm 3
3. Antennae shorter than head and thorax united; hind tibiae curved in male; pronotum, wingless form, with a transverse linear impression before the middle; male elongate, fusiform; female orbicular *borcalis* Bueno
Antennae subequal in length to head and thorax united; hind tibiae straight in both sexes; pronotum without the linear impression; sexes quite similar in form 4

4. Color sooty-black; wingless form with pronotum produced backward to second dorsal segment and minute white elytral pads present; length 1.6-2.0 mm *atrata* Bueno

Color pale to dark-brown; wingless form with pronotum not produced backward, reaching at most the base of first dorsal segment and elytra wholly absent 5

5. Antennal segment IV slightly longer than width of interocular area, approximately two and one-fourth times as long as II *hinei* Drake

Antennal segment IV a little less than the width of interocular area, and about one-fourth longer than segment II *austriana* Bueno

6. Segment I of antennae shorter than III, IV subequal to II and III united; hemelytra with several white spots; wingless form shining, almost smooth; length: brachypterous form, 2.13-2.50 mm; apterous form, 2.1-2.3 mm *albonotata* Champion

Segments I and III of antennae subequal in length; wingless form pubescent, opaque 7

7. Segment IV of antennae slightly longer than II and III united; abdomen and connexivum of wingless form with conspicuous tufts of silvery pubescence; length 1.7-2.0 mm *buenoi* Drake

Segment IV of antennae shorter than II and III united; length 2.0-3.3 mm 8

8. Dorsum of abdomen with patches of fine bluish-gray pubescence on base and apex; wingless form with mesonotum concealed by pronotum; winged form unknown *fontinalis* Bueno

Dorsum of abdomen with patches of silvery-white pubescence; wingless form with mesonotum visible 9

9. Wingless form predominantly light brown dorsally; winged form with hemelytra light brown and usually unicolorous *americana* (Uhler)

Wingless form predominantly black, covered with patches of silvery pubescence; hemelytra of winged form smoky-gray colored; posterior-lateral margins of scutellum lemon-yellow in color

..... *paludicola* Champion

Microvelia albonotata Champion, 1898

Biological notes.—This interesting species seems to prefer the shady, cool, quiet surfaces of spring-fed marshes in Mississippi. On one occasion it was taken from the surface of a farm pond that was spring-fed and contained an abundant supply of algae and some emergent vegetation. Adults were collected as late as mid-November in central Mississippi. The apterous form was predominant in all collections made.

Herring (1950b) collected it in Florida from a sand-bottomed lake.

Locality data.—This species has not been previously recorded from the state. Specimens have been seen as follows: Biloxi, Jan.-March, 17 specimens (C.A.W. and J.T.P.); Brooklyn, Feb., 1 specimen (J.T.P.); Crystal Springs, Nov., 3 ♂♂, 2 ♀♀ (C.A.W.); Fearn Springs, Sept., 1 ♂, 1 ♀ (C.A.W.); Glen, Nov., 2 ♂♂, 4 ♀♀ (C.A.W.); Mississippi City, March, 1 ♂, 1 ♀ (C.A.W.); Ocean Springs, July, 7 ♂♂, 4 ♀♀ (C.A.W.); Ramsey Springs, Aug., 13 specimens; Vancleave, Aug., 17 specimens (C.A.W.); Wiggins, Nov., 1 specimen (J.T.P.).

Microvelia americana (Uhler), 1884

Biological notes.—This species was collected from the surface of sluggish streams, springs, ponds and similar habitats in the state. Specimens moved over the surface of the water swiftly and the collector had to work rather quickly to capture them. These were collected from water that contained abundant vegetation as well as from areas without vegetation.

Bueno (1910) studied the life history in New York and New Jersey. In that region it could be found on the banks of any body of water. They live both on the bank and on the water surface, moving out away from shore when disturbed. The eggs are laid singly or in clusters on pebbles or stones and are glued in place by a transparent gelatinous material. The egg stage lasts for two or three weeks. There are five instars, each requiring 2 to 10 days for completion with the fifth stadium the longest. Food consists of water-fleas, small insects and ostracods on the water surface. They are living flies avidly when fed in the laboratory.

Locality data.—It has not been recorded previously from the state. Specimens have been seen as follows: Charleston; Crowder;

Enterprise; Fearn Springs; Hattiesburg; Hazelhurst; Longview; Macon; McComb; Oxford.

Microvelia atrata Bueno, 1916

Biological notes.—The writer has not collected this species in the state and has had no opportunity to observe its natural history. Blatchley (1926) reported that it was collected at the base of dense clumps of a tall wire-grass growing in the pine-barrens of Florida about one-fourth mile from water.

Locality data.—It has not been recorded from Mississippi, however, it has been reported from Georgia by Van Duzee (1917) and Hungerford (1920), from Georgia and Florida by Blatchley (1926), from Georgia, Florida and Louisiana by Drake and Hussey (1955); and Louisiana by Ellis (1952).

Microvelia austrina Bueno, 1924

Biological notes.—The writer collected specimens once, in the hilly section of extreme northeastern Mississippi, in a small, clear, shallow woodland pool with a mat of oak leaves on the surface.

Locality data.—This species has been reported previously from Charleston by Drake and Harris (1928c) and from Mississippi by Drake and Hussey (1955). Specimens have been seen as follows: Charleston, Sept., 1 specimen (H. M. Harris); Tishomingo, Nov., 1 ♂ (C.A.W.).

Microvelia pulchella incerta (Kirby), 1890

Biological notes.—The habitat preferences in Mississippi include the surfaces of quiet streams, ponds and sloughs. Collections indicate there are several generations in a season, and nymphs were taken as late as mid-November in central Mississippi. It was collected at only three localities indicating that it is not common.

Bueno (1917a) observed the life history in New York. He found eggs on the underside of duck weed leaves, with the anterior end pointed toward the edge of the leaf. Incubation time was seven to twenty-three days and there were four instars.

Hungerford (1917d) reared it and observed its life history in Kansas. He collected it in pools filled with cat-tail, on floating mats of algae, and on dead *Typha* stems. Egg laying in nature is on stones, pebbles, and other plants above the water surface

where the female glues the egg with a gelatinous material. Time for incubation in the laboratory was about 6 days, and each female laid about 5 eggs per day. From 10 to 20 days are required for the insect to reach the adult stage. The bugs ate plant-lice, house flies and ostracods when they were offered in the laboratory. Hungerford found more than four instars in some specimens he reared.

Herring (1950b) found this the most abundant *Microvelia* in Florida. He collected it from roadside ditches, fluctuating ponds, sand-bottomed creeks, calcareous streams and marshes.

Locality data.—This species has been reported previously from Charleston, Crowder, Port Gibson, Vicksburg and Woodville by Drake and Harris (1928c). Specimens have been seen as follows: Charleston, Aug.-Sept., 4 specimens (H. M. Harris); Jackson, Nov., 1 ♂ (C.A.W.); Laurel, Aug., 4 specimens (H. M. Harris); Saratoga, Aug., 1 ♂ (C.A.W.); State College, June, 1 ♂, 2 ♀♀ (C.A.W.); Vicksburg, July, 1 specimen (C. J. Drake).

Microvelia buenoi Drake, 1920

Biological notes.—This is a northern United States species and the author was quite surprised to obtain it in one locality in the northern part of Mississippi. It was collected along with numerous specimens of *Microvelia hinei* and Mesoveliidae from a quiet stream which had overhanging vegetation around the edges.

Drake (1920b) indicated that it lives in small, secluded coves near the shore, usually under the shelter of overhanging vegetation or among plants in the water. He also took a few specimens from moist soil near the edge of the water.

Herring (1950b) caught one male from a mat of sphagnum moss along the shore of a swampy stream in Alachua County, Florida.

Locality data.—It has not been recorded previously from the state. One specimen has been seen as follows: Prairie, Oct., 1 ♂ (C.A.W.).

Microvelia fontinalis Bueno, 1916

Biological notes.—Specimens have been taken from the surface of a small spring-fed stream which contained overhanging vegetation along the banks. The clear, cool water contained no floating vegetation or algae.

Bueno (1916a) collected it in Westchester County, New York from a spring in a marshy woodland, where it clung to the mosses growing in the water or was on the water surface a short distance from the rocks.

Blatchley (1926) collected specimens in Indiana from pools below a spring along a hillside.

Locality data.—Recorded from the state by Drake and Hussey (1955). Specimens have been seen as follows: Charleston, July, 22 specimens (H. M. Harris); Sturgis, Oct., 6 ♂♂, 3 ♀♀ (C.A.W.).

Microvelia binei Drake, 1920

Biological notes.—This is the most abundant *Microvelia* in the state. It prefers quiet waters covered with vegetation, but it has been collected on some occasions where vegetation was absent. Favorite habitats include sloughs, drainage ditches, stagnant lakes, turbid ponds, spring-fed streams, spring-fed ponds, quiet pools in rivers, and brackish pools along the Gulf coast. The writer on one occasion observed specimens on a heavily vegetated pond at Fearn Springs in such numbers that thousands could be captured in the net with a few sweeps over the surface of the water. This was in September, which seems to be the peak month of abundance. It feeds on small insects in the water, and is extremely active on the surface when disturbed.

Drake (1920b) notes that in Ohio it lives in small ponds, stagnant pools and small lakes.

Blatchley (1926) reported collecting specimens in Florida from small pools, ditches, the margins of lakes and decaying weeds in a slough.

Herring (1950b) found it on mats of sphagnum moss in acid swamps and bog streams in Florida.

Locality data.—Previously recorded from Fayette by Drake (1922) and Blatchley (1926), and from Charleston, Crowder, Fayette, McComb, Ocean Springs and Woodville by Drake and Harris (1928c). Specimens have been seen as follows: Batesville; Biloxi; Cat Island; Charleston; Edwards; Fearn Springs; Fountainbleau; Fulton; Hattiesburg; Iuka; Laurel; Lorman; Marks; McComb; Minter City; Mississippi City; Ocean Springs; Okolona; Oxford; Ramsey

Spring; Saltillo; Saratoga; State College; Sturgis; Toccopola; Tutwiler; Webb.

Microvelia paludicola Champion, 1898

Biological notes.—This species seems to be a dweller in sluggish streams in the state. It was collected frequently in pot-holes bounded by overhanging vegetation and occasionally in ponds. The apterous form was more common, and of several hundred specimens that the writer mounted, only about ten were winged.

Locality data.—Recorded from the state by Drake and Hussey (1955). Specimens have been seen as follows: Bude; Fearn Springs; Jackson; Longview; Natchez; Ocean Springs; Oxford; Pontotoc; Prairie; State College; Sturgis; Toccopola; Tupelo.

Microvelia pulchella Westwood, 1834

Biological notes.—Specimens were collected at two localities in the state. The habitats were a turbid roadside puddle and a rather muddy cow-pond free of vegetation.

Locality data.—Reported from the state by Drake and Hussey (1955). Specimens have been seen as follows: Ocean Springs, July, 1 ♂ (C.A.W.); Saltillo, Nov., 1 ♀ (C.A.W.).

Key to the Mississippi Species of

RHAGOVELIA Mayr

Meso- and metanota broadly exposed behind the pronotum; first segment of connexivum of female with a tuft of long matted hairs arising from its hind angle; front trochanters of males with a stout, black spine on outer face.....*obesa* Uhler

Mesonotum wholly and metanotum in great part, concealed beneath pronotum; first segment of female connexivum without tuft of hairs; front trochanters of males unarmed.....*choreutes* Hussey

Rhagovelia obesa Uhler, 1871

Biological notes.—Only the apterous form of this insect was collected in Mississippi. It was taken in two types of habitats, a swiftly flowing spring-fed stream with a sandy bottom and a deep pond free of vegetation. It is an extremely fast swimmer and difficult to capture in a net. These insects dive under water for a considerable distance when chased.

Bueno (1907a) observed that mating oc-

curs in June and July, when the schools are composed almost completely of mating pairs *in copula*.

Gould (1931) wrote that *Rhagovelia* are gregarious, and that they are predators and feed on insects which the current brings to them.

Locality data.—It has not been recorded previously from the state. Specimens have been seen as follows: Columbus, Oct., 4 ♂♂, 2 ♀♀ (C.A.W.); Oxford, Oct., 1 ♂ (C.A.W.).

Rhagovelia choreutes Hussey, 1925

Biological notes.—This insect was collected on the waters of inlets of rivers near the Gulf coast of Mississippi from April through October.

Gould (1931) reports that this species was collected in the Arbuckle Mountains, Davis, Oklahoma and from Eddy County, New Mexico, but he gives no data on the type of habitats yielding the specimens.

Herring (1950b) collected this insect from calcareous streams and swiftly flowing sand-bottomed creeks in Florida. He indicated that specimens were collected abundantly along the shore, beneath bridges, or in the shade of trees where they congregate in schools. They zig-zag in a circular fashion over the surface and return to the same spot time after time, even when disturbed with the collecting net. Whole colonies can be collected easily due to this habit of returning to the same area.

Locality data.—Reported from Mississippi by Bacon (1956). Specimens have been seen as follows: Biloxi, April-Oct., 151 specimens (J.T.P.); Brooklyn, Feb., 2 specimens (J.T.P.); Harrison County, Oct., 5 specimens (J.T.P.).

Trochopus plumbea (Uhler), 1894

Biological notes.—The writer has not collected this species in the state; however, it is included here because it has been reported from the salt water bays of Florida by Gould (1931) and others.

Uhler (1894) reported collecting it on the surface of the sea in the Bay of St. George's, Grenada, B.W.I. where it was observed mating. He also noted that it is gregarious in habit, with fifty to sixty captured together.

Locality data.—Has not been collected in Mississippi.

Key to the Mississippi Species of
VELIA Latreille

1. Intermediate tarsi, with second segment longer than third; antennae, with segment I one-half longer than II; legs rather short *brachialis* Stål
- Intermediate tarsi, with segments II and III subequal; legs slender 2
2. Hind margin of pronotum (brachypterous form) without a fringe of long hairs; tubercles on sides of pronotum scarcely evident *stagnalis* Burmeister
- Hind margin of pronotum with a fringe of long hairs; tubercles on sides of pronotum distinct 3
3. Genital segment short, usually about 0.28 mm; pronotal horns very evident; width across fifth abdominal segment about 1.12 mm *watsoni* Drake
- Genital segment long, usually about 0.52 mm; pronotal horns less distinct than above; width across fifth abdominal segment about 0.75 mm *paulineae* Wilson

Velia stagnalis Burmeister, 1835

Biological notes.—This species was collected infrequently in the state. The writer took it from the surface of shady *Lemna*-covered sloughs at two localities in Mississippi. At both stations the water was quite clear and fairly shallow. It was in association with large numbers of *Microvelia*, *Mesovelia* and *Merragata*.

Davis (1911) reported sifting specimens from old leaves in the District of Columbia.

Blatchley (1926) took one specimen from a tuft of weed roots on the margin of a lake at Dunedin, Florida.

Locality data.—It has not been recorded previously from the state. Specimens have been seen as follows: Marks, Oct., 1 ♂, 1 ♀ (C.A.W.); Webb, Oct., 1 ♂ (C.A.W.).

Velia brachialis Stål, 1860

Biological notes.—This species is quite abundant in the state although it never seems to occur in large numbers. Typically, it was collected by sweeping overhanging vegetation along the banks of ponds. Specimens will swim on the water surface, but prefer vegetation or damp soil near the water edge. Specimens were taken from the following types of habitats: shallow borrow-

pits densely covered with vegetation; along the banks of small ponds with overhanging vegetation; large ponds with overhanging vegetation, sloughs densely covered with *Lemna* and large lakes with vegetation along the edges.

In a pond near State College the writer observed the biology of this insect. There are several generations in a season with the peak of abundance in September. Nymphs were found at late as October 19th. Winged forms were more common in May and June, but were collected as late as September 17th.

Nine specimens were successfully reared in the laboratory at Mississippi State College at a constant temperature of 60° F on a diet of housefly larvae and adults.

Specimens were isolated in pairs in 10 cm petri dishes with stems and leaves of *Lemna*. The insects are shy and mating did not occur immediately after isolation. The female mounted the male to initiate mating. After the female mounted the male, she worked her hind tibiae forward and backward on the male's abdomen, then the male organ was forced out and up and the female settled upon it, flexing her abdomen and rubbing it with her tibiae. Duration of mating averaged about 15 minutes, after which the female lunged free and retreated quickly. The day after mating eggs were found deposited in and on the stems of *Lemna*. The eggs were greenish-yellow when deposited and averaged 1.6 mm in length by 0.6 mm in width. The eye spots were brown on the fifth day, becoming dark red by the ninth day. Incubation period in the laboratory averaged eleven days. Table 3 gives the average length and width of specimens and the duration of each instar for 9 specimens reared to maturity.

TABLE 3.
Life history data for Velia brachialis

Instar	Length mm	Width mm	Duration in days
First	2.00	1.00	7
Second	2.50	1.20	5
Third	3.20	1.80	5
Fourth	4.00	1.80	5
Fifth	4.70	2.00	5

Herring (1950b) collected this species in Florida most often from crevices in logs or upon rocks or stumps along the edge of the water, and beneath the cover of short vege-

tation. Specimens were seldom collected from the open surface film.

Locality data.—Previously recorded from Fayette by Drake (1922). Specimens have been seen as follows: Anguilla; Bixoli; Brookhaven; Charleston, Fearn Springs; Handsboro; Laurel; Marks; Okolona; Oxford; Port Gibson; State College.

Velia watsoni Drake, 1919

Biological notes.—Drake (1919) indicated that the eggs are deposited just beneath the surface on floating sticks and floating aquatic plants.

Hoffman (1925a) observed its life history in Kansas. The insects were obtained from stagnant pools in the bed of a small stream. They were reared in the laboratory in tin boxes containing damp vegetation. They were both predaceous and cannibalistic, hence no more than one nymph could be reared in a jar, even if ample food was provided. The food used was either living, crippled or dead insects; these included cockroaches, flies, cicadellids, cercopids, mirids, grasshopper nymphs, adult *Tribolium*, *Bruchus*, *Dermestes* and others. In an aquarium the eggs were laid on the sides of the glass and on rocks and floating objects in the water. The incubation period at room temperature was about twelve days. The length of the five nymphal instars varied as follows: first instar, 3 to 10 days; second instar, 2 to 8 days; third instar, 2 to 8 days; fourth instar, 4 to 8 days; fifth instar, 5 to 10 days. Thus, the total developmental period from egg to adult varied from 32 to 46 days.

Herring (1950b) stated that in Florida the insect prefers the emergent vegetation along the shore line, and that they ran upon the surface film only when molested. Other habitats where it was collected were a swamp, bog stream, and rafts of leaf debris in a small cove.

Locality data.—Previously recorded from the state by Drake (1951b). The writer has not collected it in Mississippi.

Velia paulineae Wilson, 1953

Biological notes.—One specimen was collected from damp soil along the edge of a small, temporary upland ditch. The water was about two inches deep and contained some vegetation.

Locality data.—Fearn Springs, Sept. 11,

1949, 1 ♂ (C.A.W.). This is the type locality for the species.

F. Family *SALDIDAE* Amyot and Serville, 1843

Review of the Literature.—The literature on this family is quite scattered and no thorough monographs are available to taxonomists. However, some of the more general publications that are available on this family include a paper by Osborn (1901) which is of special interest since it concerns two interesting little *saldids* that he collected in Florida and named as new species. Slosson (1901, 1908) published notes on her collecting experiences with this insect on a Florida beach. She described in some detail the difficulty encountered in capturing specimens. Reuter (1912) separated the family into thirteen genera and established taxonomic characters for these genera. Usinger (1945) recorded the range of *Saldoida* as far north as Georgia and Virginia, and also included a key to the species. Several new species of *Saldidae* from the Western Hemisphere were described by Hodgen (1949). Drake (1949a, 1950) published descriptions of new species from North America and included some distributional data. He recorded *Pentacora hirta* (Say) and *Pentacora sphacelata* (Uhler) from Mississippi. A catalogue of all known generic and specific names of *Saldidae* of the world along with general distributional notes on the species was issued by Drake and Hoberlandt (1950a). In a series of papers, Drake and Hottes (1950a, 1950b, 1951a), described a number of new species of *Saldidae* from the Americas. A paper on the stridulatory organs in certain species of *Saldidae* (Drake and Hottes, 1951b) includes photomicrographs and drawings of the structures in some of the species studied.

Key to the Mississippi Genera of *SALDIDAE* Amyot and Serville

1. Five complete areoles on membrane — *PENTACORA* Reuter
Membrane with four areoles, with the subexternal areole shorter than the others, third and fifth areoles more or less contiguous toward the apices — 2
2. Membrane with its inner basal area prolonged two-fifths or one-half beyond the base of the next area; elytra often punctuate, without silky patches; embolium completely black — *SALDA* Fabricius

Membrane with its inner basal area prolonged slightly or not more than one-third of its length beyond the next area; embolium not completely black — 3

3. Two entirely distinct veins present on corium, the inner one branched near apex, the branches touching the suture of the membrane; apex of first or inner cell extending to or almost to apex of second cell — *SALDULA* Van Duzee

Corium with indistinct veins; apex of first or inner cell of membrane distinctly beyond the apex of the second cell — *MICRACANTHIA* Reuter

Key to the Mississippi Species of *PENTACORA* Reuter

1. Upper surface dull, varicose, with appressed pubescence — 2
Upper surface shining, black and yellow, with numerous long, erect hairs — *hirta* (Say)
2. Lateral margins of pronotum and elytra with a row of very short erect setae; segment II of antennae much longer than segments III and IV combined; length, 6.5-8.0 mm — *signoreti* (Guerin)
Lateral margins of pronotum and elytra without setae; segment II of antennae equal to or shorter than segments III and IV combined; length, 5.0-6.0 mm — 3
3. Dorsal color mostly black; costal area narrowly yellow with edge black; elytra with numerous short suberect hairs — *ligata* (Say)
Dorsal color mostly dull-yellow; costal area con-colorous; elytra with very short inclined bristle-like hairs — *sphacelata* (Uhler)

Genus *PENTACORA* Reuter 1912

Biological notes.—The writer collected specimens of this genus on the sandy banks of pools, both brackish and fresh water. They were more numerous where short grasses and weeds were growing along the banks. Specimens were found running around on the sand between the clumps of vegetation and would fly a short distance when approached. Quick movement was required to capture them.

Hungerford (1920) in Maryland observed *Pentacora signoreti* Guerin moving swiftly over a sand beach in association with *Ci-*

cindela dorsalis, and inserting their beaks into dead flies and other insects.

Drake and Hottes (1951b) reported the presence of a series of "spine-like" or "peg-like" organs on each side of the second visible connexival segment of the males. They assumed that these organs were stridulatory in function. A drawing and a photograph of the subbasal hemelytron notch in *Pentacora signoreti* (Guerin) are included in the paper.

Pentacora signoreti (Guerin), 1857

Locality data.—It has not been collected in Mississippi, but is included here because it has been reported from North Carolina, Georgia, Florida and Texas by Van Duzee (1917); from Florida and Texas by Hungerford (1920) and Blatchley (1926).

Pentacora birta (Say), 1832

Locality data.—Previously recorded from the state by Drake (1949a). Specimens have been seen as follows: Bixoli, May-Aug., 13 specimens (J.T.P. and H. M. Harris); Deer Island, July, 3 ♂♂, 1 ♀ (C.A. W.); Pascagoula, Aug., 1 specimen (C. J. Drake).

Pentacora ligata (Say), 1832

Locality data.—This species has not been collected in Mississippi. It is included here because it has been reported from North Carolina by Van Duzee (1917), Blatchley (1926), and Hungerford (1920). Dr. H. M. Harris has 12 specimens from Baton Rouge, Louisiana, collected Aug. 27, 1930.

Pentacora sphaelata (Uhler), 1877

Locality data.—Previously recorded from the state by Drake (1949a). Specimens have been seen as follows: Biloxi, Feb.-Aug., 42 specimens (H. M. Harris and J.T.P.); Cat Island, Aug., 3 ♀♀ (C.A.W.); Deer Island, July, 2 ♂♂, 8 ♀♀ (C.A.W.); Fountainbleau, March, 4 specimens (J.T.P.); Ocean Springs, Feb., 1 specimen (J.T.P.); Pascagoula, Aug., 1 specimen (C. J. Drake); Pass Christian, March, 3 specimens (J.T.P.).

Genus *SALDA* Fabricius 1803

Biological notes.—Hungerford (1920) indicated that these insects live commonly on damp soils about pools, on the shores of fresh and salt waters and along the margins of ponds. He observed some biological habits of *Salda anthracina* Uhler near Ithaca, New York. Last instar nymphs were brought into the laboratory and within 4 to

8 days all were in the adult stage. They were fed various dead insects. Mating occurred and eggs were found about 10 days later. The eggs were laid, usually singly, beneath sheaths of shore grasses or between leaflets of moss.

Brimley (1934) collected *Salda littoralis* Linnaeus at Cley, England on salt marshes and took them into the laboratory for rearing. Mating was observed, and 4 days later one female deposited 8 eggs in the wet mud.

Drake and Hottes (1951b) reported the presence of a series of "peg-like" or "spine-like" organs on each side of the second visible connexival segment of the males. These organs are assumed to be stridulatory in function.

Salda bouchervillei (Provancher), 1872

Locality data.—This species has not been collected in Mississippi. It is included here since it has been reported as occurring in Tennessee by Drake and Hottes (1950a).

Genus *SALDULA* Van Duzee 1914

Biological notes.—Species in this genus were collected from small upland ponds with sandy loam banks and with vegetation hanging over the banks and extending down near the water's edge. Another common habitat was on the sandy banks of beaches along the Gulf of Mexico. The beaches along the mainland and the beaches of the islands visited in Mississippi Sound were favorite habitats.

Very little has been written about the biology of the genus. Drake and Hottes (1951b) reported the presence of a series of "spine-like" or "peg-like" organs on each side of the second visible connexival segment of the males. These organs are assumed to be stridulatory in function.

Key to the Mississippi Species of
SALDULA Van Duzee

1. Pronotum with lateral margins yellowish; dorsal surface without erect hairs; corium and membrane pale, cells of membrane with dark spots; length, 3 mm *coralis* (Stål)
- Pronotum with lateral margins black; dorsal surface with erect hairs present or absent; length, more than 3.0 mm 2
2. Corium with costal area almost completely black; dorsal surface black with a few pale spots; length, 6-8 mm *lugubris* (Say)

- Corium with costal area white or yellowish, usually spotted with darker spots; length variable, 5 mm or less 3
3. Dorsal surface of body with long, erect hairs .. *orbiculata* (Uhler)
Dorsal surface of body without long, erect hairs... *pallipes* (Fabricius)
2. Size larger; length, 3.00-3.70 mm; shape oval *humilis* (Say)
Size smaller; length, 2.95 mm or less; shape more elongate..... 3
3. Antennal segment II one-third longer than I *husseyi* Drake and Chapman
Antennal segment II twice as long as I *pumpila* Blatchley

Saldula lugubris (Say), 1832

Locality data.—This species has not been collected in Mississippi. It is included here since it has been reported from Missouri and Texas by Drake and Hottes (1950a).

Saldula orbiculata (Uhler), 1877

Locality data.—Has not been collected in Mississippi. It is included here since it has been reported from Texas and Illinois by Uhler (1877) and Van Duzee (1917), and from Texas by Hungerford (1920) and Blatchley (1926).

Saldula pallipes (Fabricius), 1794

Locality data.—Has not been recorded previously from the state. Specimens have been seen as follows: Deer Island, July, 1 ♂ (C.A.W.); State College, Oct., 2 ♀♀ (C.A.W.).

Saldula coxalis (Stål), 1873

Locality data.—This species has not been collected in Mississippi. It is included since it has been reported from New Jersey to Florida by Van Duzee (1917).

Genus *MICRACANTHIA* Reuter 1912

Biological notes.—The writer found that in Mississippi the species in this genus preferred the leaves of floating aquatic plants. Pools containing an abundance of floating vegetation therefore proved to be the best areas for collecting. *Micracanthia husseyi* Drake and Chapman was taken in large numbers from the floating leaves of the sweet-scented pond lily, *Castalia odorata* (Ait.). The water was deep and clear but had a dense growth of vegetation. At another location they were collected from a shallow pool filled with a heavy growth of vegetation.

There is little information in the literature on the biology of this genus.

Key to the Mississippi Species of

MICRACANTHIA Reuter

1. Two transverse light-yellow spots on costal area of corium *quadrimaculata* (Champion)
Entire costal area of corium light yellow 2

Micracanthia humilis (Say), 1832

Locality data.—Previously recorded from Fayette by Drake (1922). Specimens have been seen as follows: State College, Sept., 4 ♂♂, 8 ♀♀ (C.A.W. and M.S.C.).

Micracanthia husseyi Drake and Chapman, 1952

Locality data.—Previously recorded from Pascagoula by Drake and Chapman (1952). Specimens have been seen as follows: Cat Island, Aug., 4 ♂♂, 6 ♀♀ (C.A.W.); Ocean Springs, Aug., 6 ♂♂, 3 ♀♀ (C.A.W.); Vancleave, Aug., 2 ♂♂ (C.A.W.).

Micracanthia pumpila Blatchley, 1928

Locality data.—Previously recorded from the state by Drake and Hoberlandt (1950a).

Micracanthia quadrimaculata (Champion), 1900

Locality data.—Previously recorded from the state by Drake and Hoberlandt (1950).

Micracanthia floridana Drake and Chapman, 1954

Locality data.—Reported from Vicksburg (1 specimen) by Drake and Chapman (1954).

Genus *SALDOIDA* Reuter 1901

Biological notes.—These rare insects are collected very infrequently and therefore little is known about their biology. Both *Saldoida slossoni* Osborn and *Saldoida cornuta* Osborn have been collected in Mississippi. They were taken along the Gulf coast by Mr. J. T. Polhemus and the writer is grateful to him for supplying these brief biological notes. The specimens were collected beside a stream supplied from an artesian well. The stream ran through a pasture into a small pond. The soil where they were collected was packed with old cattle hoof marks and was damp from seepage water. The specimens were taken from the damp ground around the hoof marks but never on wet ground. An aspirator was used to capture them. The insects were constantly on the move, their conspicuous an-

tennae continually waving. The area where they were collected was covered with grasses and broken sticks and similar debris. The *Saldoida* collected in Mississippi were taken in association with ants, which agrees with Mrs. Slosson's observation in connection with her collection of the type specimens of *Saldoida cornuta* Osborn and *Saldoida slossoni* Osborn in Florida.

Slosson (1908) recorded her search for *Saldoida* Osborn near Dunedin, Florida. She indicated that they move swiftly about waving their antennae from side to side. She found them most commonly in damp, grassy places where sun-dew, *Drosera*, was growing. They were difficult to capture, but the best method found was to "drive" the specimens into an insect net.

Key to the Mississippi Species of *SALDOIDA* Osborn

Anterior lobe of pronotum and spines black, clothed with appressed white pubescence. Humeri more or less strongly produced into elevated, subacute spines. Scutellum black with appressed pubescence, the disk only slightly elevated apically *cornuta* Osborn

Anterior lobe of pronotum and spines ochraceous to fulvous or even darker, but with the spines glabrous except for a few stiff black hairs. Humeri scarcely produced, rounded. Disk of scutellum strongly inflated apically *slossoni* Osborn

Saldoida slossoni Osborn, 1901

Locality data.—Previously recorded from the state by Drake and Hoberlandt (1950a). The writer has not collected this species in Mississippi.

Saldoida cornuta Osborn, 1901

Locality data.—This species has not been recorded previously from Mississippi. Specimens have been seen as follows: Ocean Springs, May 25, 1950; July 7, 1950 and Sept. 4, 1950 (J.T.P.).

G. Family NOTONECTIDAE Leach, 1815

Review of the literature.—Bare (1926) obtained data on the life histories of several species of Notonectidae in Kansas. A very prolific worker on this family has been Hungerford (1933a), whose monograph of the *Notonecta* of the world includes keys, descriptions, synonymy, biological notes and

locality data on all the known species. The paper contains colored plates of a number of species plus drawings of the male genital capsules. Rice (1942) published notes on the biology of eight notonectids observed at Reelfoot Lake, Tennessee. Information was presented on food preferences, oviposition habits and metamorphosis for the eight species.

Key to the Mississippi Genera of NOTONECTIDAE Leach

Hemelytral commissure without definite hair-lined pit at anterior end *NOTONECTA* Linnaeus

Hemelytral commissure with definite hair-lined pit at anterior end *BUENOA* Kirkaldy

Key to Mississippi Species of *NOTONECTA* Linnaeus

1. Last abdominal sternite of female large but strongly constricted just before the tip; male with digitate prolongation on genital capsule *irrorata* Uhler

Last abdominal sternite of female not large nor strongly constricted just before the tip; male without digitate prolongation on the genital capsule 2

2. Mesotrochanter plainly angulate or produced into a tooth or stout spinelike process 3

Mesotrochanter rounded or nearly so 4

3. Synthipsis very narrow, not more than one-sixth the anterior margin of the vertex as seen from above; hemelytra brick-red to orange with black blotch on corium *uhleri* Kirkaldy

Synthipsis usually broader than above, about one-fourth width of eye; hemelytra not red or orange *raleighi* Bueno

4. Anterior margin of vertex (seen from above) straight and width less than length of vertex; anterior trochanter of male with a stout conspicuous hook; male clasper broad, shallowly incised at tip. Last abdominal sternite of female with apical notch broader than deep if present; color variable from broad black band to no band across distal end of hemelytra *indica* Linnaeus

Anterior margin of vertex rounded and width subequal to length of vertex; anterior trochanter of male with a medium-sized hook; male clasper deeply incised. Last abdominal sternite of female with apical notch deeper than broad; typical color with narrow undulate band across hemelytra *undulata* Say

Notonecta irrorata Uhler, 1879

Biological notes.—The writer took specimens from sluggish streams, pot-holes in ditches, borrow-pits covered with vegetation, cold, clear spring-fed streams, muddy, shallow ponds, shady sloughs in the Delta, and cool, clear springs. Thus, in the state this insect has a wide range of habitats and is usually one of the easiest of all aquatic insects to locate and collect. It frequently stings swimmers and occurs commonly.

Hungerford (1933a) notes that it lives in open ponds or in shady situations near banks with overhanging vegetation. At Ithaca, New York the winters are spent in deeper ponds and it flies to shallower waters for breeding. Specimens were observed swimming under ice in early February. Mating was observed as early as April, and eggs were deposited in the tissues of plants. The egg stage extended for about two or three weeks and there were five nymphal instars.

Rice (1942) found the average length of the complete life cycle was about 60 days at Reelfoot Lake, Tennessee. She also confirmed Hungerford's observations that eggs are deposited in plant tissues.

Locality data.—Previously recorded from Fayette by Drake (1922), from Mississippi by Blatchley (1926), from Agricultural College, Charleston, Crowder, Hamilton, Iuka, Scooba and Smithville by Hungerford (1933a), and from Oxford by Penn and Ellis (1949). Specimens have been seen as follows: Anguilla; Batesville; Beulah; Biggersville; Biloxi; Booneville; Charleston; Columbus; Crowder; Edwards; Escatawpa; Fearn Springs; Glen; Hazelhurst; Houlika; Iuka; Longview; Mabon; McComb; Okolona; Picayune; Prairie; Ramsey Springs; Saltillo; Saratoga; State College; Sturgis; Toccoola; Vancleave.

Notonecta uhleri Kirkaldy, 1897

Biological notes.—This species is encountered infrequently and therefore little is known about its biology. The writer col-

lected a series of specimens in October at Anguilla in a shallow roadside borrow-pit. This habitat contained no appreciable amount of vegetation. Another collection was made in August at Escatawpa in a cool, shady, deep stream which contained no vegetation.

Rice (1942) at Reelfoot Lake, Tennessee found nymphs abundant in shallow pools in the saw grass and smart weed zones whereas the adults migrated to the deeper bayous.

Locality data.—Previously recorded from Leland by Hungerford (1933a). Specimens have been seen as follows: Anguilla, Oct., 1 ♂, 2 ♀♀ (C.A.W.); Biloxi, Nov., 1 specimen (J.T.P.); Escatawpa, Aug., 1 ♂ (C.A.W.); Charleston, Aug.-Sept., 6 specimens (H. M. Harris).

Notonecta undulata Say, 1832

Biological notes.—This insect has not been collected in Mississippi nor in any of the southeastern states. Hungerford records it from St. Louis, Missouri and northwestern Arkansas.

Bare (1926) reared the species to maturity in 40 to 52 days, using mosquito larvae as food.

The life history has been observed by Hungerford (1917f) in Kansas and New York. The elongate white egg is attached to submerged objects in the water. There are five nymphal instars. Food of the early instars consists largely of ostracods and similar organisms. The winter is passed in the adult stage, and two broods are reared in a season in Kansas.

Locality data.—This species seems to be supplanted in the state by *Notonecta indica* Linnaeus, which is a very common species.

Notonecta indica Linnaeus, 1771

Biological notes.—Next to *Notonecta irrorata* Uhler, this is the most common notonectid in Mississippi. It occurs commonly in ponds, borrow-pits and small streams. Large series were collected from various parts of the state and an extremely wide variation in the color markings was noted.

Rice (1942) observed this insect at Reelfoot Lake, Tennessee and found that the eggs were glued to the surface of weed stems, grass, and sticks present in the water. The developmental period was about 8 to 10 days for eggs and 40 to 60 days for nymphs depending upon various ecological factors.

Locality data.—Previously recorded from Fayette by Drake (1922), from Agricultural College, Fayette and Natchez by Hungerford (1933a), from Oxford by Penn and Ellis (1949). Specimens have been seen as follows: Anguilla; Biggersville; Biloxi; Booneville; Cleveland; DeLisle; Edwards; Fountainbleau; Handsboro; Marks; Natchez; Pontotoc; State College; Charleston.

Notonecta raleighi Bueno, 1907

Biological notes.—Specimens were collected fairly commonly by the writer. Adults were taken as late as November, whereas no nymphs were found late in the season. It lives in a wide variety of habitats including large, artificial lakes, sloughs, bayous, ponds, and spring-fed marshes. It was not encountered in running streams or borrow-pits. Most of the habitats in which it was collected were filled with vegetation.

Rice (1942) made a study of its life history at Reelfoot Lake, Tennessee and illustrated the life stages. Eggs were laid on stems and leaf surfaces in the water; they hatched in 8 to 10 days and completed all instars in 40 days. Nymphs appeared in greatest numbers in June, while a scattering of nymphs was found all summer.

Locality data.—Previously recorded from Oxford and Spring Lake by Penn and Ellis (1949). Specimens have been seen as follows: Brookhaven; Columbus; Corinth; Greenwood; Itta Bena; Iuka; Midnight; Scott; Charleston; Fayette.

Key to Mississippi Species of
BUENOA Kirkaldy

1. Rostral prong longer than third rostral segment..... *artafrons* Truxal
- Rostral prong equal to or shorter than third rostral segment..... 2
2. Small species, less than 6 mm long; scutellum reduced, narrow and not as long as pronotum..... *confusa* Truxal
- Larger species, more than 6 mm long; scutellum broad, as long as or longer than pronotum..... 3
3. Stridular area on inner lateral face of front femora of males small, oval, with not more than 15 cross ridges; body smaller and more slender; femoral spines spaced approximately twice their diameters apart; length 6.7 to 8.1 mm..... *margaritacea* Bueno

Stridular area on inner lateral face of front femora of males sword-shaped, with 30 or more cross ridges; pronotum in both sexes with very feeble or no depressions; femoral spines spaced approximately their diameters apart; length 6.5 to 7.5 mm..... *scimitra* Bare

Buenoa margaritacea Bueno, 1908

Biological notes.—Hungerford (1920) studied the biology of this insect in Kansas. Collections were made most commonly in ponds, and eggs were oviposited mainly in smartweed stems and cattail leaves. The female slits the tissues and inserts the eggs singly, leaving a small amount of the egg showing. He found five nymphal instars, and adults were collected from early spring to late fall. The anterior legs are adapted for catching prey, and the food consists mostly of small entomostracan Crustacea.

Rice (1942) found that it preferred stock ponds and roadside pools in the vicinity of Reelfoot Lake, Tennessee.

Locality data.—Reported from Fulton and State College by Truxal (1953).

Buenoa scimitra Bare, 1925

Biological notes.—Extensive collecting has shown this to be the most abundant *Buenoa* in Mississippi. It has a preference for sparsely vegetated, muddy, roadside puddles, streams, small ponds, and borrow-pits. Adults were taken from March to December.

Bare (1926) made some observations on the life history in Kansas. The total period of development from egg to adult varied from 58 to 77 days. Eggs were laid in the laboratory in the stems of *Ceratophyllum*. Two broods per season seems to be the rule in Kansas. Nymphs and adults grew well in the laboratory on a diet of mosquito larvae or Entomostraca. Hibernating adults were found in the deeper and more permanent ponds in the winter in Kansas.

Locality data.—Truxal (1953) reported it from Vicksburg and Woodville. Specimens have been seen as follows: Biggersville; Biloxi; Booneville; Charleston; Edwards; Handsboro; Natchez; Ramsey Springs; Schlater; State College; Toccopola.

Buenoa confusa Truxal, 1953

Biological notes.—The writer collected this pretty little species at the edge of a large brackish pool on Cat Island. The pool was

filled with a heavy growth of cattail (*Typha angustifolia* Linnaeus), and the sepcimens were taken from the bottom within approximately three feet of the bank. They were not very abundant and repeated sweepings with the net produced only a few specimens.

Bare (1926) made observations on its life history in Kansas, and was able to rear it in the laboratory on a diet of mosquito larvae. Eggs were found in the stems of grasses and sedges in a pond where adults were collected. Mating and egg laying were observed throughout the summer—when the females were ovipositing the males swam about them in an excited fashion. Developmental time from egg to adult varied from 42 to 52 days. The feeding habits were about the same as the other species of the genus, except they were more cannibalistic.

Rice (1942) found this species rare in Tennessee. The Tennessee specimens were taken in clear water containing considerable plant growth.

Locality data.—Truxal (1953) reported it from Shuqualak and Bay St. Louis. Specimens have been seen as follows: Biloxi, Sept., 2 specimens (J.T.P.); Cat Island, Aug., 1 ♂, 1 ♀ (C.A.W.); Charleston, Sept., 30 specimens (H. M. Harris).

Buenoa artafrons Truxal, 1953

Locality data.—Has not been collected in Mississippi, however Truxal (1953) reported it from Florida and Georgia.

H. Family PLEIDAE Fieber, 1851

Review of the Literature.—The description of *Plea barnedi* from Mississippi was published by Drake (1922). Ellis (1950), after studying a large series of specimens from Louisiana, placed *P. barnedi* Drake in synonymy with *P. striola* Fieber. He stated that *P. barnedi* was a color variation of *P. striola*. Drake and Chapman (1953) published a report on the Pleidae of the Americas in which *P. barnedi* was restored as a species based on size of reticulations and relative size of the species. After studying specimens from Mississippi the writer believes *P. barnedi* to be a mere color variant of *P. striola*, and thus Ellis (1950) was correct in placing *P. barnedi* in synonymy with *P. striola*. However, in this paper I am following Drake and Chapman (1953) since their paper is the most recent treatment of the *Plea* complex.

Plea are most commonly collected in Mississippi from alongside banks of ponds, lakes and sluggish streams from beneath overhanging vegetation or from exposed tree roots (especially willow) extending into the water.

Plea puella Barber, 1923

Locality data.—Previously recorded from Mississippi by Drake and Chapman (1953). The writer collected two specimens at Ocean Springs in August.

Plea striola Fieber, 1844

Biological notes.—The writer found this insect throughout the summer at State College in masses of willow roots floating near the surface of a pond. Nymphs and adults were collected in considerable numbers from May to October. Other habitats included a shady slough in the delta and a cool, clear, heavily vegetated pond along the Gulf coast.

Bare (1926) observed mating in a pond in Kansas. A single female lays approximately 30 eggs, and the period of development from egg to adult was slightly over two months. He reared them successfully on a diet of ostracods and mosquito larvae.

Clark (1925) collected specimens in Manitoba, Canada among the tangles of *Chara*, *Elodea*, *Myriophyllum* and other aquatic plants.

Hungerford (1920) determined that this species eats ostracods and other small Crustacea. Frequently several specimens were eaten one after another by a single insect. He was able to obtain eggs by placing the insects in an aquarium with *Elodea* and *Chara*. The eggs were inserted into the tissues of the plants.

Rice (1942) found that the length of time required for egg development in the laboratory was from 8 to 21 days. Specimens were collected most commonly in Reelfoot Lake from *Elodea* and coon-tail beds, and in the heavy vegetation of the bayou. She observed that this insect appears to be an important item of food for two top minnows, *Fundulus dispar* and *Fundulus chrysotus*.

Locality data.—Previously recorded from Fayette by Drake (1922) and Blatchley (1926). Specimens have been seen as follows: Batesville, Oct., 2 specimens (C.A.W.); Charleston, Aug.-Sept., 65 specimens

(H. M. Harris); Ocean Springs, Aug., 3 specimens (C.A.W.); State College, May-Oct., 46 specimens (C.A.W.).

Plea barnedi Drake, 1922

Locality data.—Previously recorded from Mississippi by Drake (1922) and Drake and Chapman (1953).

Plea notata Drake and Chapman, 1953

Locality data.—Previously recorded from Mississippi by Drake and Chapman (1953).

Plea apopkana Drake and Chapman, 1953

Locality data.—Previously recorded from Mississippi by Drake and Chapman (1953).

I. Family NAUCORIDAE Fallen, 1814

Review of the literature.—This family is represented in Mississippi by only one genus, *Pelocoris* Stål. Bueno (1903) published brief notes on the habits and life history of *Pelocoris femoratus* (Palisot de Beauvois). The biology of *Pelocoris femoratus* was studied by Hungerford (1927a) who recorded information on its food, oviposition habits and habitat preferences. Probably the most energetic workers on this group of insects have been Usinger and LaRivers. They have published keys, descriptions of new species and biological data on a number of species from the areas mentioned above, (Usinger, 1938, 1941, 1942b, 1944, 1946a, 1947; LaRivers, 1948a, 1948b, 1950, 1951).

Key to Mississippi Species of

PELOCORIS Stål

Sixth ventral abdominal segment of female rot or only weakly cleft; male dorsal aedeagal plate emarginate at tip; pronotum greenish in color — *femoratus* (Palisot de Beauvois)

Sixth ventral abdominal segment of female with a narrow, but deep V-shaped cleft at mid line, the notch two to three times as deep as wide; male dorsal aedeagal plate abruptly truncate at tip; pronotum light brown in color

———— *carolinensis* Bueno

Pelocoris femoratus (Palisot de Beauvois),
1805

Biological notes.—The writer collected a long series of specimens in March from a shallow borrow-pit filled with aquatic vegetation. The water was muddy and the insects were clinging to the vegetation. They prefer these shallow heavily vegetated borrow-pits or similar areas in the state.

Bueno (1903) made a study of its life history in New York. The eggs were oviposited on the surface of submerged plants and hatched in approximately 24 days. The length of time required for the instars varied as follows: first instar, 8 days; second instar, 6 to 9 days; third instar, 8 days; fourth instar, 10 to 12 days; fifth instar, 16 days. The total length of time for development was found to be about 77 days.

Hungerford (1927a) reared this species in the laboratory and made observations on the egg laying, hatching and nymphal development. He fed the insects a diet of mosquito larvae, *Chironomus* larvae, corixids and entomostracans but had difficulty in keeping them alive. The eggs were glued to the stems and leaflets of *Nitella* and other aquatic plants with an adhesive which the bug secreted. There were five nymphal instars. Time required for hatching was approximately 40 days and for total nymphal development, 50 to 62 days.

Locality data.—Previously recorded from the state by Hungerford (1920), from Fayette by Drake (1922), from Charleston by LaRivers (1948a) and from Spring Lake by Penn and Ellis (1949). Specimens have been seen as follows: Biloxi, Feb.-May, 6 ♂♂, 10 ♀♀ (C.A.W. and J.T.P.); Charleston, Sept., 10 specimens (H. M. Harris); Handsboro, June, 4 specimens (J.T.P.); Laurel, Aug., 30 specimens (H. M. Harris); Wiggins, Aug., 15 specimens (H. M. Harris).

Pelocoris carolinensis Bueno, 1907

Biological notes.—In Mississippi specimens were collected exclusively in clear streams or pools containing abundant vegetation. The writer was stung on the right thumb while removing a specimen from the net. The pain was rather sharp, and severe, smarting, pulsating pain continued for approximately five minutes. Then the pain gradually diminished and had disappeared in approximately fifteen minutes.

Locality data.—Previously recorded from Saucier by Penn (1951). Specimens have been seen as follows: Big Point, June, 6 specimens (G. H. Penn); Biloxi, Jan.-Oct., 78 specimens (J.T.P.); Ocean Springs, July, 1 ♂, 1 ♀ (C.A.W.); Saucier, April, 6 ♂♂, 8 ♀♀ (C.A.W.).

J. Family NEPIDAE Latreille, 1802

Review of the literature.—Several interesting papers on the physiology of various species in the genus *Ranatra* were published by Holmes (1904, 1906, 1907, 1912). Bueno (1905c) gave a few preliminary taxonomic notes on three species of *Ranatra* from the northeastern United States. A monograph of the Nepidae of America north of Mexico (Hungerford, 1922a) contains keys to genera and species, descriptions, synonymy and locality data. The paper treats eleven species. Hoffman (1927, 1930, 1933) made detailed studies of the life histories of several Chinese species of Nepidae; these papers are noted because they contain information on rearing techniques that might prove useful. Kuitert (1948, 1949) described several new species of Nepidae from the Americas.

Key to the Mississippi Genera of
NEPIDAE Latreille

1. Body broadly oval and flat
..... *NEPA* Linnaeus
Body elongate 2
2. Prothorax a little broader than head; body elongate-oval
..... *CURICTA* Stål
Prothorax narrower than head;
Body elongate..... *RANATRA* Fabricius

Nepa apiculata Uhler, 1862

Biological notes.—Kirkaldy (1906) noted that food consists of *Daphnia*, *Cyclops*, fish eggs, small fish and tadpoles.

Severin and Severin (1911a) studied its behavior. They noted the predatory habits in captivity. It would not run in order to overtake its prey, but when houseflies or dragon flies were placed near the insect it would grasp them securely with its front legs and insert its beak and feed.

Hungerford (1920) indicated that it is a mud-loving species and usually may be collected in mud and trash near the edge of the water. At Ithaca, New York it spends the winter as an adult. The eggs bear eleven filaments, and are inserted into the tissues of decaying plants. Two insects were placed in a deep aquarium without vegetation and the smaller one killed the larger one.

Locality data.—This species has not been collected in Mississippi. It has been reported from Georgia by Van Duzee (1917) and Blatchley (1926).

Curicta drakei Hungerford, 1922

Biological notes.—Wiley (1922b) studied the biology of this insect in Texas. Both nymphs and adults were collected in rotten pieces of wood and in tangled plant roots along the banks. Eggs were discovered in the tissues of dead plant stems in nature after careful search. The nymphs were found to be quite agreeable, and did not feed on others of their kind. The nymphs were fond of small notonectids, corixids, small carabids, fresh water shrimp and mosquito larvae, but failed to eat small minnows. The egg is elongate-oval with a rosette of fifteen long filaments. Twelve days after mating one female laid seven eggs on wet sand in an aquarium. The following day three more eggs were discovered, and after three more days six additional eggs were found hidden among the roots of water plants and in the crotch of a dead twig. The insects were reared to maturity and had five instars.

Wiley (1924) reported further on its biology. She collected specimens in Texas and transported them alive to Minnesota where they were reared for two years. For egg deposition it prefers mud over rotten wood, decayed vegetation, or live water plants. The female lays five to ten eggs in a group by placing the ventral surface of her abdomen close to the mud. Only the crown of the filaments remain visible after the eggs are laid. The incubation period varies from 12 to 13 days. Five nymphal instars were observed, with the average duration of each as follows: first instar, 14 days; second instar, 22½ days; third instar, 23½ days; fourth instar, 23½ days; fifth instar, 46 days. Thus, the total time required for development from egg to adult was approximately 142 days. Drawings of all five nymphal stages and the adult are given in the paper.

Locality data.—The writer has not collected this insect in Mississippi. The species is included here since it has been reported from southeastern Louisiana by Hungerford (1922a) and Ellis (1952).

Genus *RANATRA* Fabricius, 1790

Biological notes.—Since all the species in this genus apparently are quite similar in habits, the biology will be discussed here.

This genus is well represented in the Mississippi fauna. Specimens were collected

most commonly from muddy, stagnant or polluted quiet waters. Ponds, borrow-pits, muddy lakes and roadside puddles are typical habitats. The richest single find was a large borrow-pit that had been used for several years as a dumping place for tin cans. The bottom was silted in about one foot deep with mud and there was practically no vegetation. Numerous specimens could be taken with a single sweep of the net, and four species were found here living together. The four were *Ranatra australis* Hungerford, *R. buenoi* Hungerford, *R. drakei* Hungerford and *R. nigra* Herrich-Schäffer. Species in this genus do not necessarily always occur in muddy and polluted habitats. At Port Gibson the writer collected specimens of *R. buenoi* Hungerford, *R. nigra* H.-S. and *R. fusca*, P. de B., from a five acre artificial lake that contained clear, clean water. The specimens could be seen swimming under the water before they were collected. The lake contained no aquatic plants but the bottom was filled near the edge with several inches of mud, and the place where the insects were collected was densely shaded by willow trees.

Enock (1900) observed the process of oviposition. The female grasped a floating leaf of *Alisma* with the middle and hind legs, and inserted the ovipositor into the leaf to make a hole, then withdrew the ovipositor partially and placed an egg in the hole. The process was repeated after the female moved about one-fourth of an inch. In addition to the leaves, eggs were laid in half decayed stems and occasionally in green stems.

Marshall and Severin (1904) found these insects buried in mud in creeks or pools during the winter.

Bueno (1905b) made a rather thorough study of *Ranatra quadridentata* Stål. He indicated that it lives in deep water where it hangs on to the stems of grasses and rushes. It was found wintering as an adult and sometimes frozen in ponds. The mating process according to Bueno "is rather unorthodox in that the male is below and to one side of the female". The incubation period varied from two to three weeks. Bueno reared the insect through five instars and found the time required for each instar varied as follows: first instar, 8 to 14 days; second instar, 9 days; third instar, 7 days;

fourth instar, 8 days; fifth instar, 8 days. Thus, about 61 days elapse between the egg and the adult stage.

Hungerford (1920) added some notes on the biology of these insects. He collected them in weedy pools and on floating debris. The mating process was quite prolonged, and incubation covered a period of about one month.

Herring (1951a) collected them in Florida from all habitats where leaf debris and silt were found on the bottom of protected coves and bays. Eggs were collected along the edge of streams from grass stems.

Key to the Mississippi Species of *RANATRA* Fabricius

1. Antennae simple, distal end of next to last segment without lateral prolongation; front femora broad and stout and not narrowed near middle
..... *kirkaldyi* Bueno
- Antennae with distal end of next to last segment with a lateral prolongation; front femora somewhat narrowed in their middle section..... 2
2. Lateral prolongation of next to last segment of antennae not greater than one-half the length of the ultimate segment..... 3
- Lateral prolongation of next to last segment of antennae greater than one-half the length of the ultimate segment..... 4
3. Prosternum with a single wide, deep longitudinal trough; eyes very prominent
..... *buenoi* Hungerford
- Prosternum without the deep trough, but possessing two longitudinal depressed lines characteristic of most species of *Ranatra*
..... *nigra* Herrich-Schäffer
4. Front femur broad and without apical tooth..... *australis* Hungerford
- Front femur with apical tooth..... 5
5. Anterior portion of prothorax fully twice as long as thickened posterior portion; eyes large, plainly greater than interocular space; jugae of head prominent; front femur long and slender; hind femur surpassing middle of next to last abdominal segment; caudal filaments as long as body
..... *drakei* Hungerford

Anterior portion of prothorax shorter than above; eyes not much, if any, greater than interocular space; jugae not so prominent; front femur fairly stout; middle and hind femora short, not attaining middle of next to last abdominal segment

fusca Palisot de Beauvois

Ranatra kirkaldyi Bueno, 1905

Locality data.—Previously recorded from Spring Lake by Penn and Ellis (1949). Specimens have been seen as follows: Vancleave, Sept., 6 specimens (J.T.P.).

Ranatra buenoi Hungerford, 1922

Locality data.—Previously recorded from Aberdeen and Leland by Hungerford (1922a) and from Spring Lake by Penn and Ellis (1949). Specimens have been seen as follows: Beulah; Biloxi; Charleston; Columbus; Crowder; Greenwood; Louise; Okolona; Port Gibson; Scott; State College; Vancleave; Wiggins.

Ranatra nigra Herrich-Schäffer, 1853

Locality data.—This species has not been recorded previously from Mississippi. Specimens have been seen as follows: Biloxi, Jan., 1 specimen (J.T.P.); Marks, Oct., 1 ♂ (C.A.W.); Port Gibson, Nov., 1 ♂, 1 ♀ (C.A.W.); State College, July, 2 ♂♂ (C.A.W.).

Ranatra fusca Palisot de Beauvois, 1805

Locality data.—Previously recorded from Fayette by Drake (1922) and from Oxford and Spring Lake by Penn and Ellis (1949). Specimens have been seen as follows: Edwards, Nov., 2 ♂♂, 7 ♀♀ (C.A.W.); Handsboro, May, 2 ♀♀ (J.T.P.); Port Gibson, Nov., 1 ♂, 1 ♀ (C.A.W.); State College, Oct., 25 specimens (M.S.C.).

Ranatra australis Hungerford, 1922

Locality data.—Previously recorded from Fayette and McComb by Hungerford (1922a) and from Spring Lake by Penn and Ellis (1949). Specimens have been seen as follows: Biloxi, Oct., 7 specimens (J.T.P.); Edwards, Nov., 3 specimens (C.A.W.); Lyman, Oct., 1 specimen (J.T.P.); Port Gibson, Nov., 2 specimens (C.A.W.); Charleston, Sept., 6 specimens (H. M. Harris).

Ranatra drakei Hungerford, 1922

Locality data.—This species has not been recorded previously from Mississippi. Specimens

have been seen as follows: Biloxi, Oct., 2 specimens (J.T.P.); Edwards, Nov., 1 ♀ (C.A.W.).

K. Family BELOSTOMATIDAE Leach, 1815

Review of the literature.—The literature on this family is extensive, but only the more comprehensive works will be reviewed here. Notes on the biology of *Lethocerus americanus* (Leidy) were published by Hoffman (1924b). Additional notes on the life cycle of this same species appeared a year later (Hungerford, 1925). Cummings (1933) wrote a paper on the American Belostomatidae complete with keys, description, synonymy and distributional data. The genus *Abedus* Stål was studied by Hidalgo (1935) who gave keys to the four American genera and to nine species of the genus *Abedus*. The publication contains synonymy, descriptions of species and locality data. *Lethocerus americanus* (Leidy) was again the subject of a life history study by Rankin (1935). A most active worker in this family is De Carlo, who has published several useful revisions and monographs. Three papers (De Carlo, 1932, 1935, 1938b) were concerned with the description of new species. A monograph of the Belostomatidae of the Americas (De Carlo, 1938a), includes descriptions, synonymy and locality data on all North and South American species that were known at that time. Craik (1948) revised the family for the Western Hemisphere, but the work was never published. Therefore, the writer has followed the works of De Carlo in studying this family. The excellent revision of the genus *Abedus* (De Carlo, 1948), contains keys, descriptions and synonymy of the known species for both of the Americas. A plate of photographs of common species is appended.

Key to the Mississippi Genera of BELOSTOMATIDAE Leach

1. Membrane of hemelytra reduced *ABEDUS* Stål
 Membrane of hemelytra not reduced 2
2. Fore femora not grooved for reception of tibia; length 50 mm or more *BENACUS* Stål
 Fore femora grooved for reception of tibia, length less than 50 mm 3

3. Elongate-oval; genae meeting in front of tylus; beak elongate-conical or awl-shaped, its first segment shorter than second; length 40 mm or more *LETHOCERUS* Mayr

Broadly-oval; genae not meeting in front of tylus; beak sub-cylindrical, acute, its first segment longer than second; length less than 30 mm
..... *BELOSTOMA* Latreille

Benacus griseus (Say), 1832

Biological notes.—This large insect is collected in Mississippi in ponds, streams and borrow-pits throughout the warm season. It is readily attracted to lights at night. Several references were found in the literature relative to this species killing small fish. Its food consists primarily of fish and other small pond-inhabiting animals.

Needham (1907) made observations on its egg laying and hatching. Egg masses are laid on sticks and other rubbish at the margin of ponds. The egg clusters are two to three inches long, and each mass contains 75 to 100 large eggs. Accurate information on the incubation period was not obtained but it seemed to be about 10 days. Hungerford (1925) observed the hatching process and noted that the cap at the cephalic end was forced up by a bubble confined by a delicate transparent membrane. Then the insect emerged, head first into the space delimited by the membrane of the bubble which then burst and rumbled up about the opening of the chorion.

Locality data.—Previously recorded from Fayette (Drake, 1922), and from Oxford (Penn and Ellis, 1949). Specimens have been seen as follows: Columbus, 2 specimens (M.S.C.); Lake, 1 specimen (M.S.C.); State College, April-Sept., 6 ♂♂, 9 ♀♀ (C.A.W.).

Key to the Mississippi Species of

LETHOCERUS Mayr

Interocular space not narrower than width of an eye. Sides of elytra obviously, but feebly, curved; middle and hind legs vaguely if at all annulate; length 40 to 60 mm
..... *americanus* (Leidy)

Interocular space narrower than width of an eye. Sides of elytra straight and subparallel from base to apical third; middle and hind legs distinctly annulate; length 45 to 55 mm
..... *uhleri* (Montandon)

Lethocerus americanus (Leidy), 1847

Biological notes.—Rankin (1935) in observing the life history of this insect noted that it places its egg clusters on reeds above the water surface. There are five nymphal instars. Using tadpoles as food, he found that the average developmental period from egg to adult for field reared specimens was 33.4 days, and for laboratory reared specimens 58.9 days. Tadpoles and small frogs proved to be the best food. He noted that of the seven pairs of abdominal spiracles functional in the nymph only the last pair was functional in the adult. These are located near the base of the retractile caudal filaments.

Hoffman (1924b) made a rather thorough study of the biology of this insect in Minnesota. The specimens were found in December hibernating in a stream. Some were buried about six inches deep in the bottom muck and others were at the edge among *Typha* roots. Nymphs were successfully reared on grasshoppers, tadpoles, young frogs, fish, flies, beefsteak and other similar foods. Nymphs and adults would kill food only when they were hungry enough to eat what they killed. Time for complete development was not given; however, the fifth instar was of fifteen or more days duration.

Hungerford (1925) found an egg mass on a dried cat-tail stalk near St. Paul Minnesota. The stalk was inclined a few degrees from perpendicular and the egg mass was on the lower side about six inches above the water surface. There were 119 eggs arranged in six longitudinal rows.

Locality data.—Has not been collected in Mississippi, however, it is included since it has been recorded from Florida (Blatchley, 1926), Tennessee and Texas (Van Duzee, 1917), and southeastern Louisiana (Townsend, 1886).

Lethocerus uhleri (Montandon), 1896

Biological notes.—This species is common in Mississippi, and is collected frequently at lights. Specimens are active during the winter; they were collected at lights on February 8, 1950 at Starkville. The fish-killing habits of this insect are well known and the writer has on several occasions received complaints from minnow pond operators in Mississippi who were losing large numbers of fish to this insect.

On October 9, 1950 while on a collecting

trip near Columbus, Mississippi the writer observed this insect in the act of killing a banded water snake, *Natrix sipedon fasciata* (Linnaeus). The observation was made in a concrete pool filled with about six inches of water. The insect had its beak inserted into the snake near the middle portion of the snake's body. The snake was about twelve inches long, and was almost completely immobilized at the time the observation was made. The snake died after it was brought into the laboratory for observation.

Hungerford (1920) obtained egg clusters in an aquarium and there were 7, 7, 6 and 3 respectively in the clusters. The egg clusters were held together by irregular globose masses of gelatinous material.

Locality data.—Has not been recorded previously from the state. Specimens have been seen as follows: Biloxi; Columbus; Ellisville; Fenton; Kosciusko; Magnolia; Ocean Springs; Scott; State College; Starkville.

Key to the Mississippi Species of *BELOSTOMA* Latrille

1. Length, 20 to 26 mm 2
Length, 16 to 18 mm *testaceum* (Leidy)
2. Silken stripe on sides of abdomen narrow, confined to the middle of the side pieces of the ventrals; shape of elytra broadly oval, strongly tapering posteriorly *lutarium* (Stål)
- Silken stripe on sides of abdomen wider, covering side pieces completely and impinging upon median plates of the ventrals; shape of elytra more elongate, not strongly tapering posteriorly *flumineum* Say

Belostoma flumineum Say, 1832

Biological notes.—Its biology has been studied by Hungerford (1920). He found in Kansas that it lives in the trash of stagnant waters. Mating takes place in the water and frequently lasts for several hours. Hungerford observed that the eggs are glued to the back of the male in systematic rows. From 65 to 158 eggs are deposited on the back of the male where they remain until they hatch in one or two weeks. The average length of time required for a complete generation is six or seven weeks. In Kansas the winter is spent in the adult stage in mud and trash in pools.

Locality data.—Previously recorded from Fayette (Drake, 1922). One male has been seen from Columbus (M.S.C.).

Belostoma lutarium (Stål), 1855

Biological notes.—This is a very common insect in Mississippi. Adults were collected from March to November and nymphs from June to November. Males carrying eggs on their backs were collected as early as March 29 at Biloxi, in the extreme southern part of the state.

The author collected specimens August 3, 1951 on Cat Island, approximately sixteen miles off the Gulf coast from Gulfport. The collection was made in a shallow inland brackish pool, which contained a heavy growth of cat-tail, *Typha angustifolia* Linnaeus, and had a coarse, sandy bottom.

In the vicinity of State College it was collected most frequently in shallow stock ponds filled with submerged and emergent vegetation. Considerable variation in color of specimens from various sections of the state was noted. Specimens from the Gulf coastal region are noticeably darker, due apparently to the dark brown or almost black waters encountered in that section of the state.

Locality data.—Previously recorded from Fayette (Drake, 1922) and from Oxford and Spring Lake (Penn and Ellis, 1949). Specimens have been seen as follows: Anguilla; Biloxi; Brookhaven; Edwards; Fulton; Handsboro; Itta Bena; McComb; Natchez; Okolona; State College; West Point.

Belostoma testaceum (Leidy), 1847

Biological notes.—The one specimen collected by the writer was taken from a shallow, shaded pool in a dense swamp. The bottom of the pool was filled with leaves and was soft and spongy and the water murky.

Blatchley (1926) in studying specimens from North Carolina and Florida noted that the Florida specimens were all much darker, and theorized that this was due to the coffee-colored surface waters of the Florida region.

Locality data.—Has not been recorded previously from the state. One male has been seen from Columbus, Sept. (C.A.W.).

Abedus (Microabedus) immaculatus (Say), 1832

Biological notes.—The Mississippi specimens were collected about 15 miles north

of Biloxi in a temporary pond. Hussey and Herring (1950a) collected it in shallow "flatwoods" ponds in north-central Florida, a permanent stream forming the outlet from Kissengen Springs near Bartow, Florida, and from a shallow cypress swamp near Lakeland, Florida.

Locality data.—Has not been recorded previously from the state. Specimens have been seen as follows: Biloxi, Sept., 5 specimens (J.T.P.).

L. Family GELASTOCORIDAE

Kirkaldy, 1897

Review of the literature.—*Gelastocoris oculatus* (Fabricius), was first described and placed in the family Naucoridae by Fabricius (1798). Since that time other authors have placed *Gelastocoris oculatus* and other new species under the family names Galgulidae, Mononychidae and Gelastocoridae. Hungerford (1920) suggested that the male genitalia might be of value in helping to distinguish between the species in this family. Hungerford (1922b) gave information on the laboratory rearing of a number of pairs of *Gelastocoris oculatus*, including techniques for rearing, observations on habitats, mating, oviposition, hatching and molting. A study of characters of specific taxonomic value in the genus *Gelastocoris* was made by Martin (1928) who reached the following conclusions after the investigation.

"The genitalia of the male supply certain stable characters, as do also the lateral margins of the prothorax of both male and female, and the ventrocaudal segments of the abdomen of the male, with due regard for the range of variation of each specific character. The combination of the structural features mentioned above may be relied upon to differentiate the species in this exceedingly difficult genus."

Key to Mississippi Genera of
GELASTOCORIDAE Kirkaldy

Forewings free

..... *GELASTOCORIS* Kirkaldy

Forewings fused together

..... *NERTHRA* Say

Gelastocoris oculatus oculatus
(Fabricius), 1798

Biological notes.—The writer observed the mating habits of this species at State College. On June 13, 1951, at a pond on the campus, numerous mating pairs were noted on the bank. The mating pairs moved

around constantly. A mating pair was placed on a dish of damp sand in the laboratory June 13th and observed. Matings were frequent and on some days quite extended in time. On June 13th mating extended for approximately four hours; June 14, five hours; June 15, six hours; June 16, one hour; June 17, no mating observed and on June 18, both insects died. Observation at the pond on June 19 and again on June 29 revealed large numbers of mating pairs on the sandy bank. The mating pairs were observed on both dates on damp sand at about noon in bright sunlight. The male clings to the lateral margins of the wings of the female with his middle pair of legs, while the female moves around constantly during copulation. The male rests at an angle of about 30° above the longitudinal axis of the female, maintaining this position for several hours at a time without releasing his hold. Attempts were made to disengage mating pairs by striking them with a small stick, but the male in every case refused to release his hold.

Hungerford (1922b) studied the life history of *Gelastocoris oculatus oculatus* in Kansas and wrote a rather complete report on its life cycle there. He observed that the insect oviposits in the sand and the eggs hatch in approximately 12 days. There are five nymphal instars, the first averaging 15 days in length, second instar 16 days, third instar 15 days, fourth instar 15½ days, and fifth instar, 22 days. The average total time for development from hatching to emergence was 70½ days. A female was found to deposit as many as 12 eggs in a day with the average being from 2 to 6 per day. Nymphs were predaceous and were similar to the adult in other habits also.

Locality data.—Previously recorded from Fayette by Drake (1922) and from Oxford by Penn and Ellis (1949) and from the state by Todd (1955). Specimens have been seen as follows: Batesville; Belmont; Cleveland; Crystal Springs; Eupora; Fearn Springs; Glen Allen; Greenwood; Itta Bena; Maben; Natchez; Ocean Springs; Ramsey Springs; Ruleville; Schlater; State College; Stewart; Vancleave.

Nerthra stygica Say, 1832

Locality data.—This rare species has been reported from Georgia by Say (1832), and from Georgia and Florida by Blatchley

(1926), Hungerford (1920) and Van Duzee (1917). The species has not been collected by the writer in Mississippi.

M. Family PELOGONIIDAE Leach, 1815

Review of the literature.—The original description of *Ochterus americanus* Uhler, the first species in this family discovered in the United States, was published about 75 years ago (Uhler, 1876). Another paper by the same writer, Uhler (1884), described briefly the biology and known distribution of this species in North America. Champion (1897) published keys, descriptions and locality data on four American species. The second United States species, *Ochterus banksi* Barber, was described and a list of the known North American species published by Barber (1913a). Brief notes were published by Hungerford (1927a). Schell (1943) published a paper on the Pelegoniidae of the Western Hemisphere including keys to genera and species, descriptions of new species and distributional notes. A recent paper by Drake (1952a) contains a list of American species; two species, *Ochterus americanus* (Uhler) and *Ochterus banksi* Barber, are recorded from Mississippi. Bobb (1951) published detailed drawings and descriptions of life stages of *Ochterus banksi*.

Key to the Mississippi Species of
OCHTERUS Latreille

Scutellum from one-half to two-thirds as long as wide, not transversely furrowed; lateral margins of pronotum with a pale spot anteriorly
americanus (Uhler)

Scutellum approximately as long as wide, transversely furrowed; entire lateral pronotal margins usually broadly pale
banksi Barber

Ochterus americanus (Uhler), 1876

Biological notes.—The writer collected specimens in a drainage ditch containing water about two inches deep. There was some vegetation growing in the ditch and the insect was swept off the vegetation from above the water.

Drake (1952a) indicated that the typical habitat is along the borders of sandy streams and ponds. Their mobility and ability to survive submergence makes these insects fairly independent of wave action, flash floods and seasonal variations in shore line. During rainy days the adults often travel some dis-

tance from shore in search of food. Due to the protective coloration, selective habitats, and the jumping and leaping habits they are usually poorly represented in collections.

Schell (1943) reported that the reduction in size of the ovipositor suggests that eggs are deposited on the surface of objects rather than inserted into plant tissues. She says that the eggs are deposited on the surface of grains of sand, plant detritus, and other similar materials. The insect is predacious and feeds on the larvae of horseflies and other insects present.

Locality data.—Previously recorded from Aberdeen by Schell (1943) and Drake (1952a). Specimens have been seen as follows: Fulton, Oct., 1 ♂ (C.A.W.); Ocean Springs, May, 5 specimens (J.T.P.).

Ochterus banksi Barber, 1913

Biological notes.—According to Schell (1943) it resembles *Ochterus americanus* (Uhler) in habits. Both species occur in similar types of breeding areas.

Locality data.—Previously recorded from the state by Drake (1952a). One specimen has been seen from Biloxi, April (J.T.P.).

N. Family CORIXIDAE Leach, 1815

Review of the literature.—This family has received the attention of many taxonomists through the years. Fieber (1851) wrote a review of the literature up to that time and treated all of the Corixidae except the extremely small species with a distinct scutellum which were assigned to *Sigara*. Fieber's *Corisa* contained 51 species known to him, plus 20 others he had not seen but one of which he renamed. Abbott (1912-1923) studied North American Corixidae and in a series of papers described 17 species, 6 of which are now synonyms. Walley (1936) described several new species of Corixidae and recorded *Arctocorixa hubbelli* Hungerford from Natchez, Mississippi. Millsbaugh (1940) made an interesting report on the ecology of nine species of Iowa Corixidae. A very thorough investigation of the life history, environment and structure of *Ramphocorixa acuminata* (Uhler) was conducted by Griffith (1945). The monumental monograph of the Corixidae of the Western Hemisphere (Hungerford, 1948) is copiously illustrated with figures of taxonomic characters, and contains keys, descriptions of all known species, locality records and much

biological data. Leading up to this extensive monograph, Hungerford published a number of shorter papers (Hungerford, 1917a, 1917b, 1920, 1923a, 1926c, 1926d, 1928e, 1929c, 1939, 1942a, 1942b, 1944, 1947).

Key to the Mississippi Genera of
CORIXIDAE Leach

1. Small insects, less than 5.6 mm in length; male asymmetry sinistral, the fore tibia produced apically over the short, triangular pala; female with apex of clavus not reaching beyond a horizontal line extending through the costal margins of the hemelytra at the nodal furrows

..... *TRICHOCORIXA* Kirkaldy

Insects longer than 5.6 mm (except some *CORISELLA*); male asymmetry dextral, the fore tibia not produced apically over the pala; female with apex of clavus reaching to or beyond a horizontal line extending through the costal margins of hemelytra at the nodal furrows

2

2. Width of an eye much greater than interocular space; head sharply curved along rear margin, embracing a very short pronotum; hook-like projection present on dorsal median lobe of seventh abdominal segment; body surface rugulose *PALMACORIXA* Abbott

Width of an eye subequal to, slightly greater than or less than interocular space; head variable, not as above; hook-like projection absent on dorsal median lobe of seventh abdominal segment; body surface not or only faintly rugulose

3

3. Usually smooth and shining, never more than vaguely rugulose; prothoracic lateral lobe typically with sides tapering to a narrowly rounded apex; pala of male triangular, subequal in length to tibia, and with peg row located near dorsal margin and in or near the upper palmar row of bristles *CORISELLA* Lundblad

Usually rastrate, rugulose or effaced; prothoracic lateral lobe with sides not tapering to a narrowly rounded apex; pala of male rectangular, and with peg row centrally located on lateral surface of the pala

4

4. Pala of male with dorsal surface deeply incised; vertex of male tapering to a point; palmar claw serrate at base in both sexes; pattern of hemelytra usually indistinct

..... *RAMPHOCORIXA* Abbott

Pala of male with dorsal surface not deeply incised; vertex of male not pointed; palmar claw not serrate at base; pattern on hemelytra usually quite distinct

5

5. Pruinose area along claval suture very short; pronotum rastrate (except in *H. laevigata*); hemelytra either rastrate or with one or two stout pegs on dorsal surface of hind femur; hemelytral pattern not reticulate (except in *H. laevigata*); length 7 mm or more

..... *HESPEROCORIXA* Kirkaldy

Pruinose area along claval suture longer than above; pronotum not rastrate; hemelytra reticulate; length less than 7 mm *SIGARA* Fabricius

Palmocorixa buenoi Abbott, 1913

Biological notes.—Specimens of this interesting little species were collected at two localities in Mississippi by the writer. One locality was a large, shallow, spring-fed pond with sandy banks. The insects were collected by dredging algae out of the water and examining it for them. There was an extremely heavy growth of the algae in the pond, as well as other types of aquatic vegetation. The other habitat where specimens were collected was a large, deep, clear pond fed by seepage. The insects were taken near the edge of the water from floating willow roots. They were tangled in the masses of roots and had to be extracted one at a time. The water where the specimens were collected was approximately three feet deep. Thus, this species seems to prefer permanent ponds filled with matted vegetation.

Hungerford (1920) observed its life history at Ithaca, New York. He discovered that the species winters as a fourth instar nymph in that area. In nature it reaches the adult stage around June 1st and begins oviposition eight days after reaching maturity. This generation reaches the adult stage in late August and produces the generation that spends the winter as fourth instar nymphs. It can live in very large numbers in a small pond and consumes large amounts

of filaments of *Spirogyra* and other lower plant organisms. This herbivorous habit is probably the cause of their successful survival in large numbers in a small pond. Nymphs have been found in the stomachs of fishes. The egg and all five nymphal instars are described in detail.

Hungerford (1948) indicated that adult specimens were collected in Alabama in March which probably indicated that the winter was spent in the adult stage. He indicated that the species seems to be associated with streams of more or less permanent waters.

Locality data.—This species has not been recorded previously from Mississippi. Specimens have been seen as follows: Fearn Springs, Sept., 1 specimen (C.A.W.); State College, Oct., 2 specimens (C.A.W.).

Corisella edulis (Champion), 1901

Biological notes.—The writer collected this species from a muddy cow-pond in the northeast prairie section near State College.

Locality data.—Previously recorded from Fulton and State College by Hungerford (1948). Specimens have been seen as follows: State College, May, 1 specimen (C.A.W.); State College, Aug., 1 specimen (M.S.C.)

Key to the Mississippi Species of the Genus *TRICHOCORIXA* Kirkaldy

1. Nodal furrow located at apex of embolar groove or apparently absent 2

Pruinose area of embolar groove divided into apical and basal portions by the nodal furrow 4
2. Pronotal disk approximately one-fourth as long as wide *macroceps* (Kirkaldy)

Pronotal disk one-third or more as long as wide 3
3. Pronotum with the black transverse bands separated by not more than five yellow lines; hemelytra with costal margins slightly emarginate anterior to nodal furrows *minima* (Abbott)

Pronotum with the black transverse bands separated by six or more yellow lines (occasionally broken); hemelytra with costal margins deeply emarginate anterior to nodal furrows *naias* (Kirkaldy)
4. Synthlipsis width exceeding the width of an eye as seen from above along its posterior margin *reticulata* (Guerin-Meneville)

Synthlipsis width usually less than the width of an eye as seen from above along its posterior margin 5
5. Males 6

Females 8
6. The apices of clavi not reaching a line produced through the costal margins of the hemelytra at the nodal furrows 7

The apices of clavi extending to or beyond a line produced through the margins of the hemelytra at the nodal furrows 11
7. Pronotum with the black transverse bands separated by not more than five yellow lines; pala with peg row almost straight and parallel to the inner margin of palm *minima* (Abbott)

Pronotum with the black transverse bands separated by six or more yellow lines; pala with peg row distinctly curved near apex and oblique *naias* (Kirkaldy)
8. Apices of clavi with conspicuous tufts of hairs *louisianae* Jaczewski

Apices of clavi without conspicuous tufts of hairs, or with two or three setae 9
9. Polished area along costal margin of hemelytra anterior to nodal furrow equal to or less than length of middle tibia *verticalis* (Fieber)

Polished area along costal margin of hemelytra anterior to nodal furrow greater than length of middle tibia 10
10. Hemelytra with margins of polished prenodal area parallel to apex, and the costal margin suddenly emarginate; two or more patches of bristlelike setae on venter of seventh segment located on right side in region of spiracle *kanza* Sailer

Hemelytra with margins of polished prenodal area not parallel to apex, and the costal margin gradually emarginate anteriorly; only slightly longer pubescence on venter of seventh segment *calva* (Say)

11. Left posterior lobe of abdomen with the lateral anterior angle produced to form a lobe, causing the lateral margin to appear concave at some region along the distance to apex.....*verticalis* (Fieber)

Left posterior lobe of abdomen with the lateral margin convex, frequently expanded from anterior lateral angle to apex12

12. Strigil seemingly little more than a heavy dark line along lateral margin of the left tergal lobe of sixth segment of abdomen, and usually sharply curved upward at the medial apex*calva* (Say)

Strigil of normal shape, with distinct comblike rows of teeth13

13. Strigil with posterior and anterior margins parallel or almost so; dorsal margin of pala angulate, with pegs arranged in the shape of an inverted "V"*kanza* Sailer

Strigil with posterior and anterior margins not parallel, and with one part noticeably thicker than the rest; lateral half of strigil (relative to dorsum) distinctly widened; vertex rounded anterior to eyes, not projecting one-third the length of an eye along inner margin as seen from above

.....*louisianae* Jaczewski

Genus *TRICHOCORIXA* Kirkaldy 1908

Biological notes.—The writer found the species in the genus common and widely distributed in the state. These insects choose a wide range of habitats, although they seem to prefer small ponds or similar types of water devoid of vegetation and with muddy bottoms. Habitats frequented in Mississippi include sluggish streams, large artificial lakes, cow-ponds, spring-fed ponds, spring-fed streams, sloughs, small puddles and potholes in ditches, borrow-pits and roadside water-holes. Two species, *Trichocorixa louisianae* Jaczewski and *Trichocorixa verticalis* (Fieber), were collected from saline water near the Gulf of Mexico at Mississippi City and Biloxi.

Sailer (1948) indicated that almost every species in this genus may become adapted to life in either fresh or salt water. Little is known concerning the life histories and food habits. However, it seems that all of them overwinter as adults.

Trichocorixa calva (Say), 1832

Biological notes.—Sailer (1948) collected this species from beneath ice in midwinter in Kansas. They were brought into the laboratory and fed on algae diatoms and the flocculent bottom ooze provided. They were also observed frequently feeding on spirogyra. This feeding was accomplished by a curious movement of the anterior legs which were used to clasp the filaments until the contents of each cell was withdrawn. In the aquarium they fed on their own eggs, but it is not known whether or not this occurs in nature.

Locality data.—Previously recorded from Beaumont, Columbus, Fayette, Fulton, Hamilton, Ireland, Lauderdale, Leland, Lucedale, Port Gibson and Waveland by Sailer (1948). Specimens have been seen as follows: Batesville; Biggersville; Booneville; Burnsville; Charleston; Corinth; Crowder; Fearn Springs; Ita Bena; Longview; Lorman; Marks; Okolona; Pickwick Lake; Prairie; State College.

Trichocorixa kanza Sailer, 1948

Biological notes.—Sailer (1948) collected this species from beneath ice in midwinter in Kansas. They were brought into the laboratory and fed on algae, diatoms and the flocculent bottom ooze provided. The females laid eggs on eel grass and stems, attaching them with a sucker-like disk. Feeding was accomplished by a curious movement of the anterior legs which were used to clasp the filaments until the contents of each cell was withdrawn. In the aquarium they fed on their own eggs, but it is not known whether or not this occurs in nature.

Locality data.—Previously recorded from Ireland, Ocean Springs, Port Gibson, Vicksburg and Woodville by Sailer (1948). Specimens have been seen as follows: Anguilla; Fearn Springs; Ita Bena; luka; Marks; Oxford; Pickwick Lake; State College; Stoneville; Toccopola; Tutwiler.

Trichocorixa louisianae Jaczewski, 1931

Biological notes.—Sailer (1948) noted that this species lives by preference in more or less saline water.

Locality data.—Previously recorded from Bay St. Louis, Beaumont and Ocean Springs by Sailer (1948). Specimens have been seen as follows: Biloxi, March, 4 specimens (C.A.W.); Mississippi City, March, 3 specimens (C.A.W.).

Trichocorixa macroceps (Kirkaldy), 1908

Locality data.—Previously recorded from Columbia and Lucedale by Sailer (1948). Specimens have been seen as follows: Fearn Springs, Sept., 23 specimens (C.A.W.); Lucedale, April, 5 specimens (C.A.W.).

Trichocorixa minima (Abbott), 1913

Locality data.—This species has not been recorded from Mississippi. However, the writer is including it here since it has been reported from Georgia and Florida by Sailer (1948).

Trichocorixa nairs (Kirkaldy), 1908

Locality data.—Previously recorded from Ireland and Bay St. Louis, by Sailer (1948). The writer has not collected this species in Mississippi.

Trichocorixa reticulata (Guerin-Meneville), 1857

Biological notes.—Sailer (1948) noted that this species lives by preference in more or less saline water. He also reported that it was collected in the desert regions of Nevada and southern California which strongly suggests ability to live in alkaline water.

Locality data.—This species has not been recorded from Mississippi. However, the writer is including it here since it has been reported from Florida and Texas by Sailer (1948).

Trichocorixa verticalis verticalis (Fieber), 1851

Biological notes.—Specimens apparently winter as adults in Mississippi, since full grown specimens were taken as early as March.

Hutchinson (1931) collected two living males in Delaware Bay associated with typical marine planktonic organisms, whereas no living specimens of any other insects were taken. This was noted by Hutchinson as good substantiating evidence for ocean current dispersal.

Pearse (1932) observed the biology of *Trichocorixa verticalis verticalis* especially with reference to its ability to thrive in salt water. His observations were as follows:

"Tortugas, Fla. June 7, 1931; pond 2, Bush Key, salinity 2.46."

"Tortugas, Fla. June 24, 1931; pond 1, Long Key, salinity 2.34."

"Tortugas, Fla. June 8, 1931; Garden Key, salinity 1.98."

Sailer (1948) noted that it lives by preference in more or less saline water.

Locality data.—Previously recorded from Bay St. Louis, Ocean Springs and Waveland by Sailer (1948). Specimens have been seen as follows: Biloxi, March, 1 specimen (C.A.W.); Gulfport, May, 16 specimens (M.S.C.); Itta Bena, Oct., 23 specimens (C.A.W.); Scott, Oct., 35 specimens (C.A.W.); Stoneville, Oct., 32 specimens (C.A.W.).

Ramphocorixa acuminata (Uhler), 1897

Biological notes.—The writer collected this insect in a muddy, shallow pond which contained practically no vegetation and was approximately ten feet square.

A considerable amount of information is available in the literature on its biology.

Forbes (1878) was apparently the first worker to report the interesting fact that the eggs of the corixids are attached in large numbers to a crayfish (*Orconectes immunis*). The collection was made in a stagnant pond in midsummer in central Illinois.

Forbes (1878) again reported taking corixid eggs on two species of crayfish and mollusc shells from ponds in central Illinois. The crayfish were *Orconectes immunis* and *Procambarus blandingi acutus*.

Abbott (1912a) collected them from a small pond near Columbia, Missouri and reared them in a large zinc-lined tank with a soft mud bottom. Five nymphal instars occurred. The approximate duration of each instar was as follows: first instar, 8 days; second instar, 8 days; third instar, 7 days; fourth instar, 4 days and the fifth instar, 7 days. He also collected crayfish with the corixid eggs attached.

Abbott (1912c) again noted the collection of the crayfish *Orconectes immunis* with corixid eggs attached in Texas, Missouri and Illinois. He suggested that the distribution of the corixid might be conditioned by the association with the crayfish, and that the eggs, with adherent debris, might camouflage the crayfish, while receiving protection from egg predators.

Hungerford (1920) reviewed some work he did on its biology in Kansas. It typically inhabits muddy, stagnant ponds and probably hibernates as an adult. Eggs occasionally were attached to sticks and floating plants. The positions of eggs on the crayfish were tabulated, and preference was noted for the

regions most affected by the currents from the gill chambers. He theorized that these oviposition sites insured aeration. Specimens were successfully reared to the adult stage in a balanced aquarium.

Hungerford (1923a) again made note of the selective deposition of corixid eggs on crayfish for the aerative benefits of gill currents.

Other workers who have published notes on the curious egg-laying habits include Comstock (1924), Wellhouse (1926), Blatchley (1926), Jaczewski (1931) and China (1931).

Griffith (1945) published a very thorough report on a study of the environment, life history and structure of the species as it was observed in Kansas. The three published theories on the corixid—crayfish association are: (1) protection of eggs from drought by the migratory habit of the crayfish; (2) protection of eggs from enemies by the pugnacious nature of the crayfish, and a theory of symbiosis; and (3) aeration of the eggs, largely through activity of the gills of the crayfish. The latter theory is the one most generally accepted now. The corixid deposited eggs most frequently on *Orconectes immunis*, probably due to its common occurrence in ponds inhabited by the bugs. It winters in the adult stage in ponds in Kansas. There are marked periods of oviposition in the late spring and early fall, indicating a two-generation cycle in that state. The corixid was carried through the five nymphal instars in an aquarium and the time required for the various stadia varied as follows: first stadium, 7 days; second stadium, 6 days; third stadium, 7 days; fourth stadium, 6 days and the fifth stadium, 9 days.

Locality data.—Previously recorded from Lauderdale, Ocean Springs, Scooba, Vicksburg and Woodville (Hungerford, 1948). Specimens have been seen as follows: Booneville, Nov., 1 specimen (C.A.W.); State College, 2 specimens (M.S.C.).

Genus *HESPEROCORIXA* Kirkaldy 1908

Biological notes.—In Mississippi species in this genus occurred most commonly in upland muddy streams, woodland pools, borrow-pits, sloughs, lakes and marshy seep-areas.

Other than general biological notes on

corixids as noted above under the discussion of the family, no references were found in the literature on the biology of this genus.

Key to the Mississippi Species of *HESPEROCORIXA* Kirkaldy

1. Prothoracic lateral lobe less than or subequal to width of the mesoepimeron at level of the scent gland osteole 2
 - Prothoracic lateral lobe distinctly wider than the mesoepimeron at level of the scent gland osteole 3
2. Length 7.5 mm or less *semilucida* (Walley)
 - Length 8.00 mm or more *brimleyi* (Kirkaldy)
3. Prothoracic lateral lobe narrow, distinctly longer than wide; length less than 8 mm *minor* (Abbott)
 - Prothoracic lateral lobe broader; length more than 8 mm 4
4. Color pattern on dorsal surface normal 5
 - Color pattern in part indistinct, at least on corium *lucida* (Abbott)
5. Hemelytral pattern reticulate; pronotal surface not rastrate *laevigata* (Uhler)
 - Hemelytral pattern not reticulate; pronotal surface faintly to strongly rastrate 6
6. Corium with pale bands beyond hemelytral suture forming slender transverse series; corium not distinctly separated from the membrane *vulgaris* (Hungerford)
 - Corium with pale bands beyond hemelytral suture not forming slender transverse series; or, if so, then corium distinctly separated from the membrane 7
7. With a row of approximately 10 spines located ventrally on distal part of rear margin of hind femur *nitida* (Fieber)
 - With a row of approximately 6 spines located ventrally on distal part of rear margin of hind femur 8
8. Species more than one-third as wide as long, and short and stout, heavily rastrate hemelytra; stout and spinose middle femora *martini* (Hungerford)
 - Species approximately one-third as wide as long; lightly rastrate hemelytra; middle femora not spinose and stout 9

9. Corium and membrane distinctly separated, frequently by a pale line; pala of male with upper distal angle not acutely, obliquely produced

interrupta (Say)

Corium and membrane not distinctly separated; pala of male with upper distal angle acutely, obliquely produced

obliqua (Hungerford)

Hesperocorixa semilucida (Walley), 1930

Locality data.—This species has not been collected in Mississippi. It is listed here since it has been reported from Louisiana, Tennessee, North Carolina and Florida by Hungerford (1948).

Hesperocorixa brimleyi (Kirkaldy), 1908

Locality data.—This species has not been recorded previously from Mississippi. Specimens have been seen as follows: Burnsville, Nov., 2 specimens (C.A.W.).

Hesperocorixa minor (Abbott), 1913

Locality data.—Previously recorded from Lauderdale by Hungerford (1948). Specimens have been seen as follows: Iuka, Nov., 4 specimens (C.A.W.); Lucedale, April, 4 specimens (C.A.W.); Tishomingo, Nov., 6 specimens (C.A.W.).

Hesperocorixa lucida (Abbott), 1916

Locality data.—This species has not been collected in Mississippi. It is listed here since it has been reported from Arkansas, Florida, Georgia and Texas by Hungerford (1948).

Hesperocorixa laevigata (Uhler), 1893

Locality data.—Previously recorded from State College by Hungerford (1948). The writer has not collected this species in Mississippi.

Hesperocorixa vulgaris (Hungerford), 1925

Locality data.—Previously recorded from Agricultural College by Hungerford (1948). Specimens have been seen as follows: State College, 8 specimens (M.S.C.).

Hesperocorixa nitida (Fieber), 1851

Locality data.—Previously recorded from Beaumont, Hamilton, Iuka, Lauderdale and Vicksburg by Hungerford (1948). Specimens have been seen as follows: Anguilla; Beulah; Biggersville; Booneville; Burnsville; Crowder; Edwards; Greenwood; Itta Bena; Iuka; Louise; Marks; Perkinson; Saltillo; State College; Toccopola; Tutwiler.

Hesperocorixa martini (Hungerford), 1928

Locality data.—This species has not been

recorded from Mississippi; however, it is included here since it has been reported from Georgia and Florida by Hungerford (1948).

Hesperocorixa obliqua (Hungerford), 1925

Locality data.—Previously recorded from the state by Hungerford (1948). One specimen has been seen from State College (M.S.C.).

Hesperocorixa interrupta (Say), 1825

Locality data.—This species has not been previously recorded from the state. The writer has seen specimens as follows: Dossville, 1 specimen (M.S.C.); State College, 10 specimens (M.S.C.).

Genus *SIGARA* Fabricius 1775

Biological notes.—In Mississippi they live in a very wide range of habitats: sloughs, muddy pools, upland streams, pot-holes in ditches, borrow-pits and large ponds. The species of *Sigara* evidently spend the winter in the adult stage in Mississippi, since adults were collected as early as March and as late as November.

Key to the Mississippi Species of *SIGARA* Fabricius

1. Insects 6.3 mm long, or more
 — *S. (Vermicorixa) alternata* (Say)
- Insects less than 6.3 mm long
 (except *saileri* Wilson) 2
2. Median longitudinal pale line
 evident on pronotal disk 3
- Median longitudinal pale line
 on pronotal disk absent or
 only faintly visible 4
3. Moderately rastrate; clavus
 and corium with pale fig-
 ures on distal half arranged
 longitudinally in more or
 less connected series; mem-
 branal pattern distinct
 — *S. (Phacosigara) mississippiensis*
 (Hungerford)
- Strongly rastrate; distal half
 of clavus and usually the
 corium with transverse pale
 figures; membranous pattern
 indistinct or effaced
 — *S. (Phaeosigara) compressoidea*
 (Hungerford)
4. Corium either solid black or
 with scattered, small, irreg-
 ular pale punctuations only 5
- Corium not as above 6
5. Clavus and corium solid black;
 pronotum black, with three
 or four transverse pale lines
 — *S. (Pediosigara) hydatotrepes*
 (Kirkaldy)

- Clavus, corium and membrane solid black except for scattered, small irregular pale colored punctuations; pronotum with five or six transverse pale lines
 *S. (Pediosigara) saileri* Wilson
6. Metaxyphus longer than broad 7
 Metaxyphus not longer than broad 8
7. Lateral lobe of the prothorax subequal in width to the mesoepimeron at the level of the scent gland osteole
 *S. (Phaeosigara) macrocephoidea* (Hungerford)
- Lateral lobe of the prothorax much narrower than the mesoepimeron at the level of the scent gland osteole
 *S. (Phaeosigara) signata* (Fieber)
8. Scent gland osteole located closer to the lateral bend of the mesoepimeron than to its tip
 *S. (Vermicorixa) modesta* (Abbott)
- Scent gland osteole located closer to the tip than to the lateral bend of the mesoepimeron 9
9. Lineations on clavi slightly forked or more or less entire 10
 Lineations on clavi broken into many fragments 15
10. Pattern on corium in more or less definite series 11
 Pattern on corium not in definite series 12
11. Dorsal surface of hind femur with 4 to 6 pegs; disk of pronotum reduced laterally
 *S. (Vermicorixa) hubbelli* (Hungerford)
- Dorsal surface of hind femur with at least 12 pegs; disk of pronotum not reduced laterally *S. (Vermicorixa) defecta* (Hungerford)
12. Peg row on pala of male located nearer the dorsal margin than the palm 13
 Peg row on pala of male located nearer the palm than the dorsal margin; pala with a dorsal hump
 *S. (Vermicorixa) pectenata* (Abbott)
13. Pala of male with from 20 to 26 pegs 14
 Pala of male with more than 30 pegs
 *S. (Vermicorixa) virginicensis* (Hungerford)
14. Disk of pronotum heart-shaped and laterally reduced
 *S. (Vermicorixa) scabra* (Abbott)
- Disk of pronotum not heart-shaped nor laterally reduced
 *S. (Phaeosigara) macropala* (Hungerford)
15. Interocular space subequal to the width of an eye; postocular space quite broad; a sheath present on distal portion of right clasper of male
 *S. (Phaeosigara) paludata* (Hungerford)
- Interocular space distinctly narrower than the width of an eye; postocular space not broad; sheath not present on distal portion of right clasper of male 16
16. Length less than 4 mm; 7th abdominal segment of male without a lateral projection on right margin; pala of female not depressed
 *S. (Phaeosigara) bradleyi* (Abbott)
- Length more than 4 mm; 7th abdominal segment of male with a lateral projection on right margin; pala of female depressed dorsally near apex 17
17. Length 4.1 to 4.5 mm; hind femur with a row of short spines on dorsal surface and pubescent ventrally for only slightly more than one-half its length
 *S. (Phaeosigara) sigmoidica* (Abbott)
- Length 4.5 to 5 mm; hind femur with two or three spines or none on dorsal surface and pubescent ventrally for two-thirds its length
 *S. (Phaeosigara) zimmermanni* (Fieber)
- Sigara (Pediosigara) hydatotrephe* (Kirkaldy), 1908
- Locality data.*—This species has not been recorded previously from Mississippi. Specimens have been seen as follows: Burnsville, Nov., 10 specimens (C.A.W.); Fearn Springs, May, 1 specimen (C.A.W.).
- Sigara (Pediosigara) saileri* Wilson, 1953
- Locality data.*—The type locality for this species is Burnsville. The author has the following specimens in his collection from the type locality: Burnsville, Nov., 6 ♂♂ and 16 ♀♀ (C.A.W.).
- Sigara (Vermicorixa) alternata* (Say), 1825
- Biological notes.*—Hungerford (1917b) wrote a very interesting account of the

successful rearing of this corixid in close quarters at Ithaca, N. Y. It was reared in small glass petri dishes using sediment from the bottom of ponds as food. Fresh pond ooze was obtained daily. Eggs were laid on bits of cottonwood leaves placed in the containers. In the field eggs were found on the stems and dead leaves of plants lodged in the water. Other objects selected for oviposition included tin cans, boards, the shells of living snails and the bodies of crayfishes. At Ithaca the species apparently winters in the adult stage. The time required for development from egg to adult in the laboratory varied from 43 to 53 days.

Locality data.—This species has not been recorded previously from the state. Specimens have been seen as follows: Beulah, Oct., 1 specimen (C.A.W.); Biggersville, Nov., 1 specimen (C.A.W.); Charleston (H. M. Harris).

Sigara (Vermicorixa) modesta (Abbott),
1916

Locality data.—Previously recorded from Agricultural College, Iuka and Smithville by Hungerford (1948). Specimens have been seen as follows: Charleston, Sept., 1 specimen (H. M. Harris); Okolona, Oct., 3 specimens (C.A.W.); Pontotoc, Oct., 6 specimens (C.A.W.); Prairie, Oct., 9 specimens (C.A.W.); State College, Sept., 1 specimen (C.A.W.); Tupelo, Oct., 8 specimens (C.A.W.).

Sigara (Vermicorixa) virginienensis
Hungerford, 1948

Locality data.—This species has not been recorded previously from the state. Specimens have been seen as follows: Charleston, Aug.-Sept., 4 specimens (H. M. Harris); Corinth, Nov., 1 specimen (C.A.W.); Glen, Nov., 12 specimens (C.A.W.); Iuka, Nov., 2 specimens (C.A.W.); State College, Sept., 1 specimen (C.A.W.); Sturgis, Oct., 2 specimens (C.A.W.); Toccoola, Oct., 4 specimens (C.A.W.); Wiggins, Aug., 1 specimen (H. M. Harris).

Sigara (Vermicorixa) hubbelli
(Hungerford), 1928

Locality data.—Previously recorded from Lauderdale, Vicksburg and Woodville by Hungerford (1948). Specimens have been seen as follows: Booneville, Nov., 3 specimens (C.A.W.); Edwards, Nov., 1 specimen (C.A.W.); Toccoola, Oct., 1 specimen (C.A.W.).

Sigara (Vermicorixa) pectenata (Abbott),
1913

Locality data.—Previously recorded from Beaumont, Columbus and Lauderdale by Hungerford (1948). Specimens have been seen as follows: Biggersville, Nov., 2 specimens (C.A.W.); Booneville, Nov., 10 specimens (C.A.W.); Cornith, Nov., 1 specimen (C.A.W.); Oxford, Oct., 1 specimen (C.A.W.); Toccoola, Oct., 2 specimens (C.A.W.).

Sigara (Vermicorixa) scabra (Abbott),
1913

Locality data.—Previously recorded from Green Springs by Hungerford (1948). The writer has not collected it in Mississippi.

Sigara (Phaeosigara) bradleyi (Abbott),
1913

Locality data.—Previously recorded from Fulton and Waveland by Hungerford (1948). It has not been collected in the state by the writer.

Sigara (Phaeosigara) sigmoidea (Abbott),
1913

Biological notes.—This species was taken in March from a brackish pool near the Gulf of Mexico at Biloxi.

Locality data.—This species has not been recorded previously from the state. Specimens have been seen as follows: Biloxi, March, 2 specimens (C.A.W.)

Sigara (Phaeosigara) zimmermanni
(Fieber), 1851

Locality data.—Previously recorded from Beaumont by Hungerford (1948). The writer has not collected it in the state.

Sigara (Phaeosigara) compressoidea
(Hungerford), 1928

Locality data.—This species has not been recorded from Mississippi. However, it is included here since it has been reported from North Carolina and South Carolina by Hungerford (1948).

Sigara (Phaeosigara) mississippiensis
Hungerford, 1942

Locality data.—Previously recorded from Lauderdale by Hungerford (1942b and 1948). The writer has not collected it in Mississippi.

Sigara (Phaeosigara) macropala
(Hungerford), 1926

Locality data.—This species has not been recorded from the state. However, it is included here since it has been reported from northern Florida by Hungerford (1948).

Sigara (Phaeosigara) bernerii Hungerford and Hussey, 1957

Locality data.—This species has not been reported from Mississippi. However, it is included here since it has been reported from southern Georgia (type locality) by Hungerford and Hussey (1957).

Sigara (Phaeosigara) signata (Fieber), 1851

Locality data.—It has not been recorded from Mississippi. However, it is included here since it has been reported from Georgia, North Carolina and South Carolina by Hungerford (1948).

Sigara (Phaeosigara) paludata Hungerford, 1942

Locality data.—Previously recorded from Nealy by Hungerford (1942b and 1948). The writer has not collected it in Mississippi.

Sigara (Phaeosigara) macrocephoidea Hungerford, 1942

Locality data.—Has not been recorded from Mississippi. However, it is included here since it has been reported from Georgia and Texas by Hungerford (1948).

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ABSTRACT

This paper contains data on distribution, habitat preferences, mating habits, food habits and other observed biological data for 132 species of aquatic and semiaquatic Hemiptera collected in Mississippi. Included are keys to families, genera and species for all 13 families. Detailed locality data for each species is given along with the numbers of each sex taken, where available. Under each species the writer has reviewed the more important notes on biology obtained from the literature. A general review of the more pertinent literature on aquatic and semiaquatic Hemiptera along with a brief discussion of ecological conditions encountered in the various soil areas of Mississippi is given.