

July 2017

A Key and Annotated List of the Scutelleroidea of Michigan (Hemiptera)

J.E. McPherson

Southern Illinois University

Follow this and additional works at: <http://scholar.valpo.edu/tgle>



Part of the [Entomology Commons](#)

Recommended Citation

McPherson, J.E. (2017) "A Key and Annotated List of the Scutelleroidea of Michigan (Hemiptera)," *The Great Lakes Entomologist*: Vol. 3 : Iss. 2 , Article 1.

Available at: <http://scholar.valpo.edu/tgle/vol3/iss2/1>

This Peer-Review Article is brought to you for free and open access by ValpoScholar. It has been accepted for inclusion in The Great Lakes Entomologist by an authorized administrator of ValpoScholar. For more information, please contact a ValpoScholar staff member at scholar@valpo.edu.

A KEY AND ANNOTATED LIST OF THE SCUTELLEROIDEA OF MICHIGAN (HEMIPTERA)

J. E. McPherson

Department of Zoology, Southern Illinois University
Carbondale, Illinois 62901

Although Hussey (1922) compiled a list of the Hemiptera of Berrien County, and Stoner (1922) contributed a list of the Scutelleroidea of the Douglas Lake region, no publications have dealt with Michigan Scutelleroidea on a state-wide basis. However, collections in the Entomology Museum of Michigan State University (MSU), East Lansing, and in the Museum of Zoology of the University of Michigan (UMMZ), Ann Arbor, indicate that collecting has been extensive throughout the state (Fig. 1). The key and annotated list are based on material I identified in these two collections.

In the present paper, distribution data for each species (Figs. 2 - 70) are based on county records, and dates are those of the earliest and latest collections of adults taken in the state. If only a few specimens of a species have been collected in Michigan, the collector of each specimen and the museum in which it is housed are given. Several name changes have occurred since the last major treatment of the Scutelleroidea as a whole (Torre - Bueno, 1939), and these changes have been incorporated into the present list and key.

Scutelleroidea are found throughout Michigan, with some species having a very limited distribution. They are generally plant feeders, although some (e.g., *Brochymena*) are omnivorous, and others (e.g., *Podisus*) are apparently entirely predaceous. The majority appear to be univoltine, normally with over-wintering adults.

Life histories are poorly known, and most biological information (such as life cycles and feeding habits) has been gathered on economically important species. However, scattered information is available for most species occurring in Michigan, and is included for these taxa whether or not the biological notes were collected in Michigan.

ACKNOWLEDGMENTS

I wish to thank Dr. R. L. Fischer, museum curator, and Dr. Gordon E. Guyer, Chairman, Department of Entomology, Michigan State University, who provided me with research facilities, advice and encouragement during this study. Thanks are also due to Dr. Irving J. Cantrall for allowing me to examine the collection of Scutelleroidea in the Museum of Zoology, University of Michigan.

The majority of data for this paper were compiled while I was on a postdoctoral scholarship granted by the Department of Entomology, Michigan State University (October 1968 - June 1969).

Superfamily SCUTELLEROIDEA Key to the Families

1. Scutellum large, U-shaped, longer than corium, covering most of the abdomen 2
- 1'. Scutellum usually shorter than corium, more or less triangular-shaped; if scutellum is large and U-shaped, then the colors are bright and contrasting (*Stiretrus*) or a prominent tooth or point is present just anterior to the lateral angles of the pronotum (*Amaurochrous*) 3

- 2(1). Tibiae armed with strong spines; small, shining black bugs CORIMELAENIDAE
. (p.37)
- 2'. Tibiae not armed with strong spines; color not shining black . SCUTELLERIDAE (p.35)



Fig. 1. The counties of the State of Michigan.

- 3(1'). Tibiae armed with strong spines; front legs fossorial CYDNIDAE (p.40)
 3'. Tibiae not armed with strong spines; front legs not fossorial . PENTATOMIDAE (p.42)

Family SCUTELLERIDAE
 Key to the Michigan Genera

1. Fourth and fifth abdominal sterna with stridulatory areas (Tetyrinae) 2
 1'. Abdominal sterna lacking stridulatory areas (Odontotarsinae) 4

- 2(1). Pronotum with distinct transverse groove; head deflexed. ACANTHOLOMIDEA (p.36)
- 2'. Pronotum without transverse groove; head gradually declivent3

- 3(2'). Second antennal segment equal to or exceeding length of third; osteolar opening not extended as canal towards lateral margin of supporting plate; length 12mm or more TETYRA (p.36)
- 3'. Second antennal segment distinctly shorter than third; osteolar opening extended as long, slender canal towards lateral margin of supporting plate; length 9mm or less HOMAEMUS (p.36)

- 4(1'). Scutellum covering at least apical third of connexivum; osteole indistinct without evident canal PHIMODERA (p.37)
- 4'. Scutellum narrower, exposing connexivum; osteole distinct with evident canal EURYGASTER (p.37)

Subfamily TETYRINAE
Genus TETYRA Fabricius

bipunctata (Herrich-Schaeffer). (Fig. 2). 26 May to 18 September. This species attacks pines (Smith, 1910). Gilbert, Barras and Norris (1967) collected *bipunctata* from red and jack pine and were able to rear it successfully in the laboratory on tips and female cones of jack pine.

Genus ACANTHOLOMIDEA Sailer

denticulata (Stal). (Fig. 3). Berrien Co., 6 May 1968, E. J. Kochenderfer (MSU); Washtenaw Co., 3 June 1930, R. I. Sailer (UMMZ). This species is occasionally taken from beach drift (Torre-Bueno, 1939). It feeds on seeds of *Ceanothus pubescens* (Watson) and *C. ovatus* Desfontaines (Harris & Andre, 1934).

Genus HOMAEMUS Dallas

aeneifrons (Say). (Fig. 4). 4 July to 16 October. *H. aeneifrons* is collected on swamp grasses (Torre-Bueno, 1939) and vegetation in drier habitats (Stoner, 1922). It occurs in large numbers on *Solidago* (Parshley, 1923).

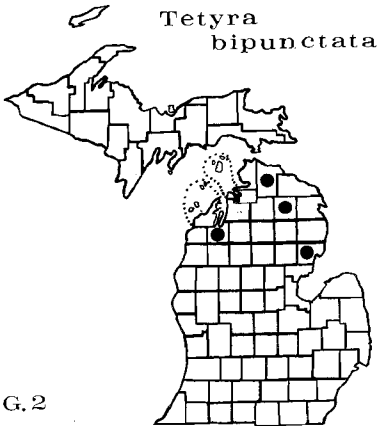


FIG. 2

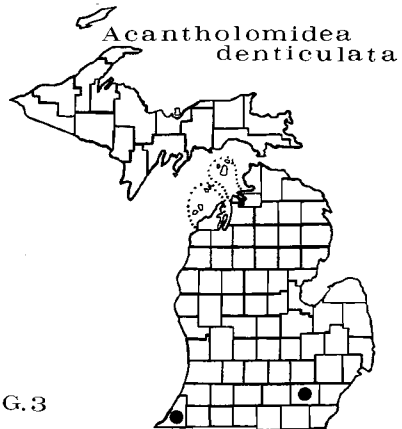


FIG. 3

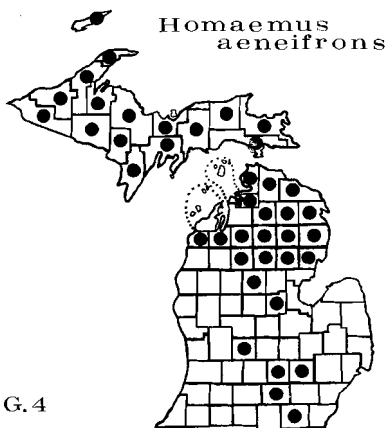


FIG. 4

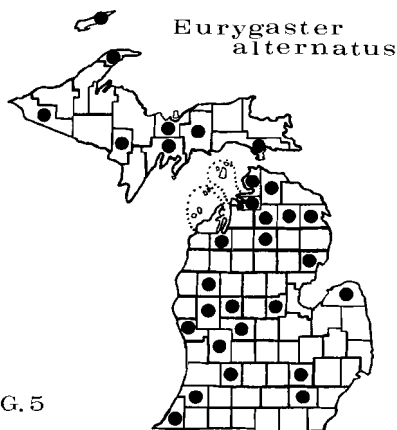


FIG. 5

Subfamily ODONTOTARSINAE

Genus EURYGASTER Laporte

alternatus (Say). (Fig. 5). 14 May to 13 September. This species is found on timothy and blue-grass growing in low swampy areas and along roadsides (Stoner, 1920). It has been noted feeding on wheat in Utah (Pack and Knowlton, 1930).

Genus PHIMODERA Germar

binotata (Say). (Fig. 6). Mackinac Co., St. Ignace, 24 July 1921, T. H. Hubbell (UMMZ). To my knowledge, nothing is known about the biology of this species.

Family CORIMELAENIDAE¹

Key to the Michigan Genera

- 1. Pronotum and scutellum forming continuous convex line in profile; costal margin bordered within by definite groove GALGUPHA (p.37)
- 1'. Pronotum and scutellum not forming continuous convex line in profile but with transverse declivity between; costal margin not bordered within by definite groove CORIMELAENA (p.39)

Genus GALGUPHA Amyot & Serville

Key to the Michigan Species and Subspecies

- 1. Lateral area of metapleuron punctate interiorly *nitiduloides nitiduloides*
- 1'. Lateral area of metapleuron impunctate 2
- 2(1'). Disc of pronotum and scutellum distinctly punctate. 3
- 2'. Disc of pronotum and scutellum weakly punctate, surface appearing highly polished 5

¹This family (treated as a subfamily) is thoroughly considered taxonomically in a monograph by McAtee and Malloch (1933).

- 3(2). Scutellum abruptly declivous in profile at apical one-third; branches of exocorial vein subparallel *aterrima*
- 3'. Scutellum not abruptly declivous in profile at apical one-third, more rounded; branches of exocorial vein divergent 4

- 4(3'). Anterior margin of prosternum beneath each eye produced into an explanate lobe with the anterior and ventral margin finely striate; apex of head disc concave on either side of tylus; a distinct tuft of hairs present in concavity of posterior margin of male hypopygium *laboprostethia*
- 4. Anterior margin of prosternum not produced into an explanate lobe beneath each eye and without anterior and ventral margins finely striate; apex of head disc flat on either side of tylus; tuft of hairs absent *ovalis*

- 5(2'). Body form, viewed from above, definitely more narrowly rounded posteriorly than anteriorly; dorsal rim of male hypopygium with distinct carina on each inner anterior side *carinata*
- 5'. Body form, viewed from above, barely more rounded posteriorly than anteriorly; dorsal rim of male hypopygium lacking carinae *atra*

aterrima Malloch. (Fig. 7). 22 March to 13 November. This species is frequently collected in weedy fields (Froeschner, 1941). In addition, Hussey (1922) collected it from ground vegetation on dunes.

atra Amyot & Serville. (Fig. 8). 13 May to 12 September. *G. atra* occurs in summer on grass and weeds in moist soil along roadsides, stream borders, and forests and can be collected on barley and *Plantago aristata* Michaux (Stoner, 1920). Stoner (1922) reports it from redtop grass.

carinata McAtee & Malloch. (Fig. 9). Washtenaw Co., Ann Arbor, 2 August 1919, 3 specimens, R. F. Hussey (UMMZ). There is no biological information available on this species.

laboprostethia Sailer. (Fig. 10). Otsego Co., 8 August 1940 (MSU). The species is very rare in Michigan; nothing is known about its biology.

nitiduloides nitiduloides (Wolff). (Fig. 11). 22 May to 13 November. This subspecies is found on vegetation, especially hazel and milkweed, along the margins of woodlands



FIG. 6

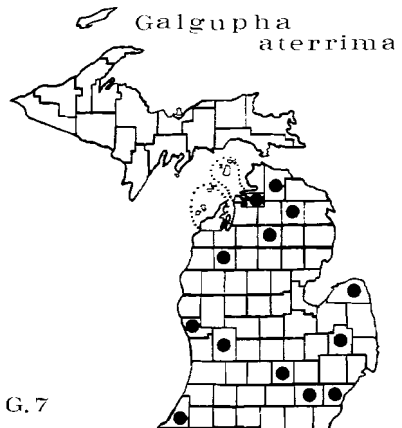


FIG. 7

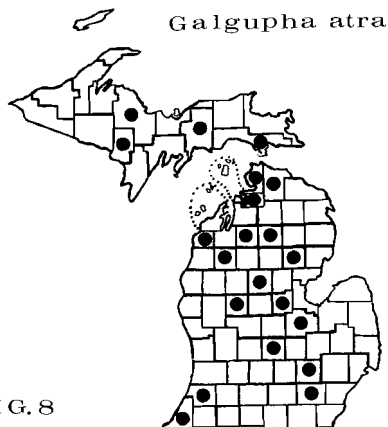


FIG. 8

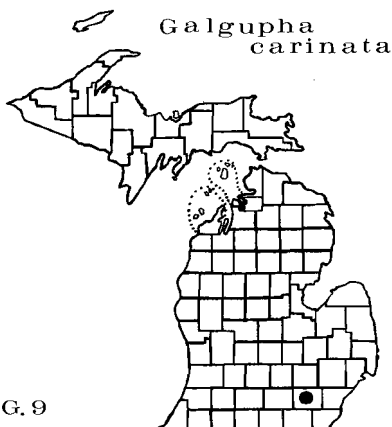


FIG. 9

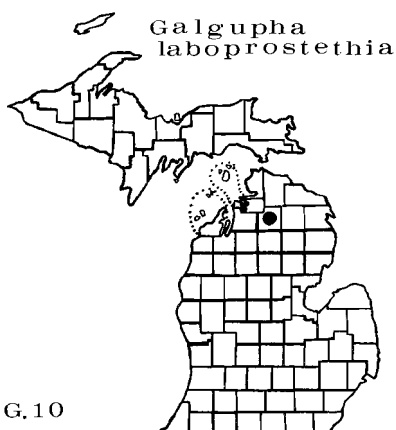


FIG. 10

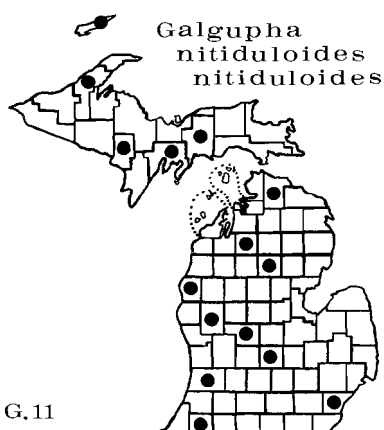


FIG. 11

and cultivated fields (Blatchley, 1926). It also occurs on *Plantago purshii* Roemer & Schultes (Torre-Bueno, 1939).

ovalis Hussey. (Fig. 12). 20 May to 13 November. *G. ovalis* is found in weedy fields and edge growth during warmer months and under rocks, mullein leaves and logs during colder months (Froeschner, 1941).

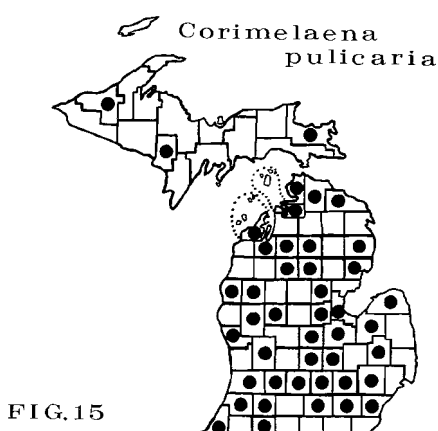
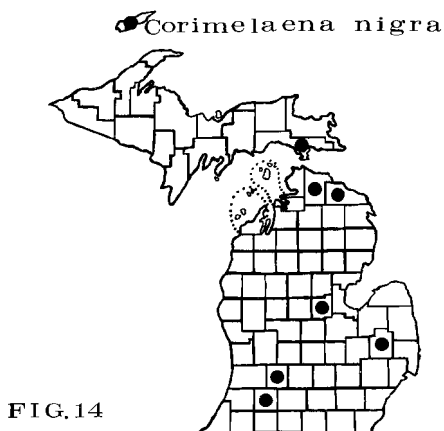
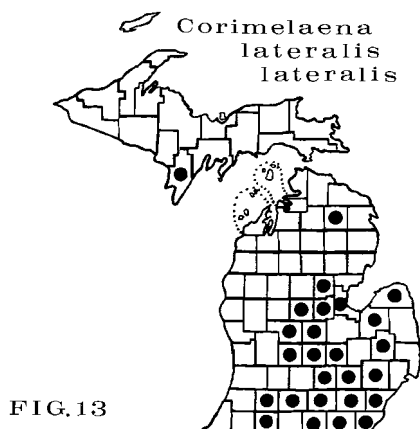
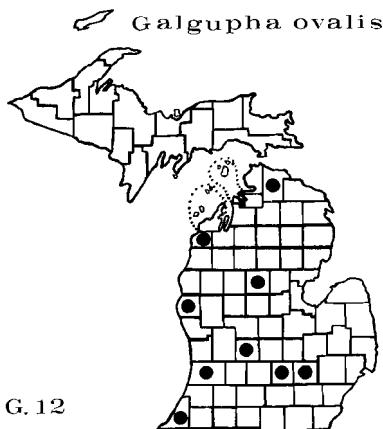
Genus CORIMELAENA White
Key to the Michigan Species and Subspecies

- 1. Corium entirely black *nigra*
- 1'. Corium with yellowish-white marking along costal margin 2
- 2(1'). Yellowish-white marking along costal margin widened near base *pulicaria*
- 2'. Yellowish-white marking along costal margin narrowed near base *lateralis lateralis*

lateralis lateralis (Fabricius). (Fig. 13). 14 May to 26 August. This subspecies occurs on ferns in dense hammocks and on leaves of semi-aquatic plants near borders of ponds in Florida, and on weeds and tall grasses near water in Indiana (Blatchley, 1926).

nigra Dallas. (Fig. 14). 30 May to 12 September. *C. nigra* is found on weeds near water during the summer (Blatchley, 1926) and is known to feed in large numbers on *Ranunculus* seeds (Linsley & MacSwain, 1959).

pulicaria (Germar). (Fig. 15). 27 April to 13 November. This species is common in the state. It attacks several hosts including New Jersey tea, Spanish needles, wheat, blue-grass, strawberry, celery (Forbes, 1905), wild plum (Blatchley, 1926), toadflax (Smith, 1959), potato (Stoner, 1920), corn and some ornamental flowers (Metcalf, Flint & Metcalf, 1962). The secretions of *pulicaria* also give an unpleasant taste to raspberries and blackberries (Metcalf, Flint & Metcalf, 1962).



Family CYDNIDAE²

²A comprehensive study of the Cydnidae of the western hemisphere has recently been published (Froeschner, 1960).

Key to the Michigan Genera

- 1. Clavi meeting beyond scutellum and forming commissure (Amnestinae); front margin of head denticulate AMNESTUS (p.41)
- 1'. Clavi not meeting beyond scutellum and forming commissure (Sehirinae); front margin of head not denticulate SEHIRUS (p.41)

Subfamily AMESTINAE
Genus AMNESTUS Dallas
Key to the Michigan Species

- 1. Jugae each with four submarginal teeth *pusillus*
- 1'. Jugae each with five submarginal teeth 2
- 2(1'). Color dark chestnut brown; labium reaching at least base of abdomen *spinifrons*
- 2'. Color reddish-brown; labium not reaching base of abdomen *pallidus*

pallidus Zimmer. (Fig. 16). 1 May to 9 August. This species is found on vegetation along roadsides (Blatchley, 1926). It is recorded from *Antennaria plantaginifolia* (Linnaeus) (Torre-Bueno, 1939).

pusillus Uhler. (Fig. 17). 20 May to 5 September. *A. pusillus* occurs on low vegetation by streams and margins of cultivated fields and roadsides (Blatchley, 1926).

spinifrons (Say). (Fig. 18). 19 April to 5 June. *A. spinifrons* is collected on weeds in low moist areas (Blatchley, 1926) and blue-grass on sandy knolls (Stoner, 1920). It has been found on beets in Utah (Knowlton, 1932).

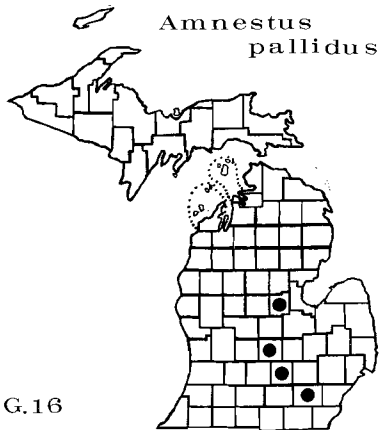


FIG. 16

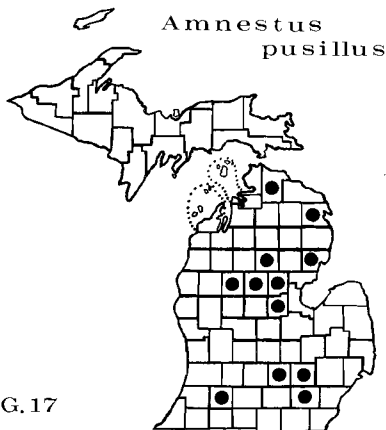


FIG. 17

Subfamily SEHIRINAE
Genus SEHIRUS Amyot & Serville
Key to the Michigan Subspecies

- 1. Corium marked with white at apex of radial vein; jugal margins elevated above dorsum of head in profile *cinctus albonotatus*

- 1'. Corium not marked with white at apex of radial vein; jugal margins lower than dorsum of head in profile *cinctus cinctus*

cinctus albonotatus Dallas. (Fig. 19). 16 May to 31 August. This subspecies attacks raspberry (Parshley, 1923), Compositae, Cyperaceae and Graminae (Hendrickson, 1930). McDonald (1968a) found that it would feed on *Stachys palustris* Linnaeus under laboratory conditions.

cinctus cinctus (Palisot de Beauvois). (Fig. 20). 6 May to 3 September. This subspecies is collected on a variety of host plants including sweet clover, *Stachys* sp. (Hart, 1919), raspberry, wild cherry, grasses (Blatchley, 1926), mint and nettles (Torre-Bueno, 1939).

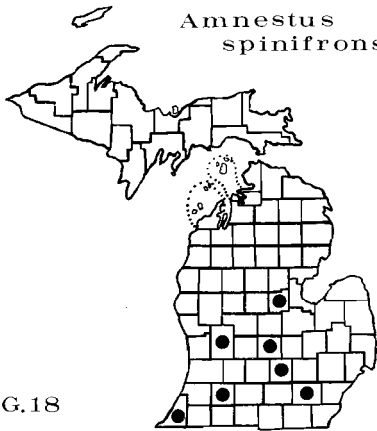


FIG. 18

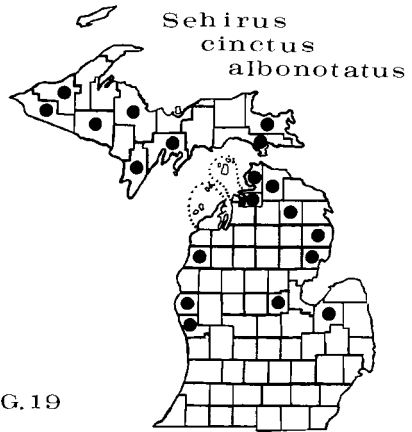


FIG. 19

Family PENTATOMIDAE
Key to the Michigan Genera

- 1. Scutellum U-shaped, reaching tip of abdomen or nearly so; frena much less than one-fourth as long as scutellum (Graphosomatinae) . AMAUROCHROUS (p.44)
- 1'. Scutellum of various shapes but not reaching apex of abdomen; frena at least one-fourth as long as scutellum 2
- 2(1'). Tarsi two-segmented; thoracic and abdominal sterna with centrally located longitudinal ridge (Acanthosominae) 4
- 2'. Tarsi three-segmented; thoracic and abdominal sterna without longitudinal ridge ... 3
- 3(2'). Beak directed away from head; first segment short, thick, free and with only base between bucculae which converge beneath (Asopinae) 5
- 3'. Beak not directed away from head, first segment slender and lying between bucculae which are subparallel (Pentatominae) 10
- 4(2). Inner ends of posterior margin of pronotum produced posteriorly; osteolar canal short, reaching only middle of supporting plate MEADORUS (p.56)
- 4'. Inner ends of posterior margin of pronotum not produced posteriorly; osteolar canal long, much surpassing middle of supporting plate .. ELASMOSTETHUS (p.56)

5(3). Ventral side of front femora armed with small spine in distal one-third	6
Ventral side of front femora unarmed	7
6(5). Scutellum U-shaped, very broad at apex, much wider than corium and with frena about one-fourth its length	STIRETRUS (p.57)
6'. Scutellum not U-shaped, not wider than corium at apex or only slightly so and with frena about one-half its length	PERILLUS (p.57)
7(5'). Jugae much longer than tylus and meeting in front; osteolar canal short	RHACOGNATHUS (p.58)
7'. Jugae at most, slightly longer than tylus, not meeting in front; osteolar canal long and curved	8
8(7'). Second abdominal sternite armed with slender spine; color not dark metallic blue to black	9
8'. Second abdominal sternite unarmed; color dark metallic blue to black	ZICRONA (p.61)
9(8). Length usually more than 14mm; jugae slightly exceeding tylus; female genital plate with three basal lobes	APATETICUS (p.58)
9'. Length usually less than 12mm; jugae equaling tylus; female genital plate with two basal lobes	PODISUS (p.59)
10(3'). Jugae with tooth on outer side near tips	BROCHYMENA (p.45)
10'. Jugae without tooth on outer side near tips	11
11(10'). Body broad, flat with margins explanate, broadest behind middle; head nearly as wide as base of scutellum	SCIOCORIS (p.45)
11'. Not as above	12
12(11'). Second abdominal sternite armed with spine	13
12'. Second abdominal sternite unarmed	15
13(12). Jugae surpassing tylus	DENDROCORIS (p.56)
13'. Jugae not surpassing tylus	14
14(13'). Length more than 13mm; spine of second abdominal sternite well-developed; second antennal segment more than one-half length of fifth	ACROSTERNUM (p.54)
14'. Length 12mm or less; spine of second abdominal sternite tuberculate; second antennal segment less than one-half length of fifth.	BANASA (p.55)
15(12'). Osteolar opening normally with distinct auricle and, at most, a short abruptly - ending canal; orifice rounded on inner side	16
15'. Osteolar opening without auricle but existing as long tapering canal; orifice V-shaped on inner side	25
16(15). Posterior margins of humeral angles emarginate	PRIONOSOMA (p.53)
16'. Posterior margins of humeral angles not emarginate	17

- 17(16'). Scutellum shorter than corium with apical third narrower than apex of corium and with tip not broadly rounded 18
- 17'. Scutellum equal to or longer than corium with apical third wider than apex of corium and with tip broadly rounded 22
- 18(17). Hind tibiae distinctly sulcate dorsally throughout their length 19
- 18'. Hind tibiae not distinctly sulcate dorsally throughout their length 21
- 19(18). Pronotal margins crenulate *EUSCHISTUS* (p.48)
- 19'. Pronotal margins not crenulate 20
- 20(19'). Margins of pronotum strongly explanate; labium reaching second abdominal sternite; length 1.2mm or more *MENECLIS* (p.53)
- 20'. Margins of pronotum not strongly explanate; labium not passing hind coxae; length 1.1mm or less *HYMENARCYS* (p.51)
- 21(18'). Humeral angles spined *OEBALUS* (p.48)
- 21'. Humeral angles not spined *MORMIDEA* (p.48)
- 22(17'). Head horizontal or slightly declivent; tylus distinctly elevated above jugae
. *COENUS* (p.51)
- 22'. Head more deflexed; tylus scarcely elevated above jugae 23
- 23(22'). Jugae longer than tylus and meeting in front; body not marked with red 24
- 23'. Jugae not longer than tylus; body marked with red or yellow. *COSMOPEPLA* (p.52)
- 24(23). Pronotum with three ridges *AELIA* (p.51)
- 24'. Pronotum with only a single median ridge *NEOTTIGLOSSA* (p.52)
- 25(15'). Jugae longer than tylus and usually meeting in front *PERIBALUS* (p.46)
- 25'. Jugae not longer than tylus 26
- 26(25'). Body distinctly pubescent, especially sides of abdominal sternae; frena not reaching middle of scutellum *TRICHOPEPLA* (p.47)
- 26'. Body not pubescent or only very slightly so; frena surpassing middle of scutellum. 27
- 27(26'). Osteolar canal extending beyond middle of supporting plate to outer front angle
. *THYANTA* (p.54)
- 27'. Osteolar canal not extending beyond middle of supporting plate
. *CHLOROCHROA* (p.48)

Subfamily *GRAPHOSOMATINAE*
Genus *AMAUROCHROUS* Stal³
Key to the Michigan Species

³This genus has been recently revised by Barber and Sailer (1953) in their study of the tribe Podopini.

- 1. Tylus and jugae equal or subequal; fifth antennal segment slightly longer than third and fourth segments combined; scutellum one-fourth longer than head and pronotum combined *cinctipes*
- 1'. Jugae distinctly longer than tylus and sometimes meeting in front; fifth antennal segment subequal to second, third and fourth segments combined; scutellum more than twice as long as head and pronotum combined *brevitylus*

brevitylus Barber & Sailer. (Fig. 21). Kalamazoo Co., Gull Lake Biol. Stat., 22 June 1963, G. C. Eickwort (MSU). The biology of this species has not been studied to date.

cinctipes (Say). (Fig. 22). 28 April to 23 November. *A. cinctipes* occurs in low marshy areas or in weeds bordering bodies of water (Froeschner, 1941).

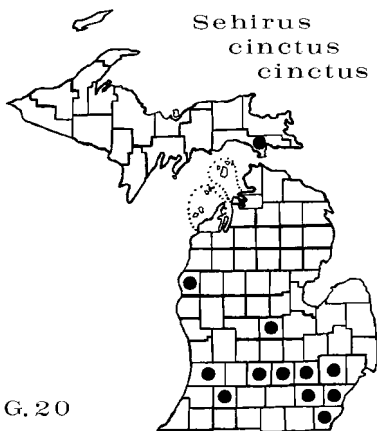


FIG. 20

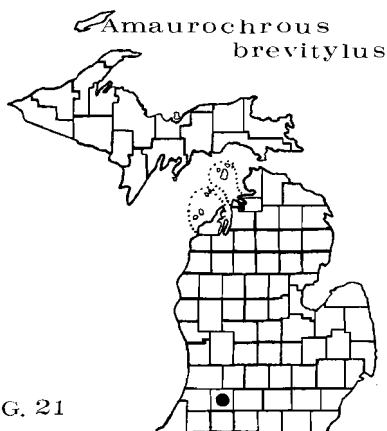


FIG. 21

Subfamily PENTATOMINAE
Genus SCIOCORIS Fallén

microphthalmus Flor. (Fig. 23). Cheboygan Co., Douglas Lake, 12 July 1918, R. F. Hussey (UMMZ); Cheboygan Co., Douglas Lake, 17 to 28 June 1928, W. Clanton (UMMZ); Mackinac Co., St. Ignace, 31 May 1921, S. Moore (UMMZ). The species occurs in grasses and weeds along the edges of woodland streams (Stoner, 1922).

Genus BROCHYMENA Amyot & Serville
Key to the Michigan Species

- 1. Basal third or fourth of scutellum distinctly elevated above remainder; humeral projections subquadrate with large teeth *arborea*
- 1'. Basal third or fourth of scutellum only slightly elevated above remainder; humeral projections subtriangular with small teeth *quadripustulata*

arborea (Say). (Fig. 24). 26 March to 1 November. *B. arborea* is primarily herbivorous feeding on oak, beech, willow, apple, peach, pear, grape and pine (Ruckes, 1946). However, it will attack larvae of the Colorado potato beetle (Hart, 1919).

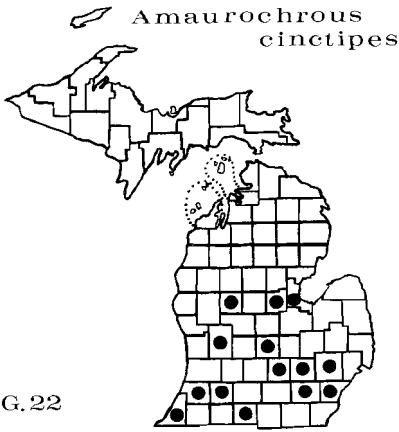


FIG. 22

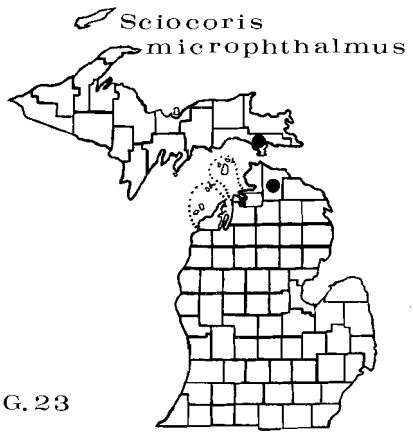


FIG. 23

quadripustulata (Fabricius). (Fig. 25). 22 April to 5 November. This common species is primarily phytophagous and food plants include elm, mountain ash, pine, sumac, grape, cherry, apple and pear (Ruckes, 1946). However, it is occasionally predaceous on soft - bodied larvae (Ruckes, 1946).

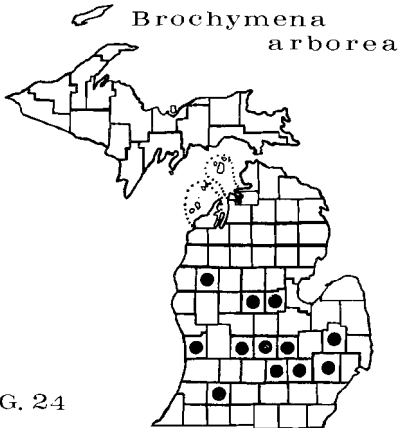


FIG. 24

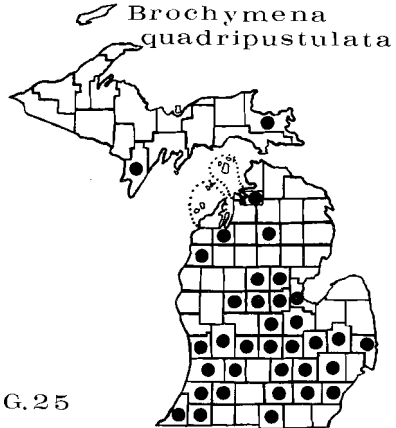


FIG. 25

Genus **PERIBALUS** Mulsant & Rey
Key to the Michigan Species

- 1. Connexivum alternated *abbreviatus*
- 1'. Connexivum black, bordered by pale margin *limbolaris*

abbreviatus (Uhler). (Fig. 26). Montcalm Co., 12 May 1956, R. & K. Dreisbach (MSU). *P. abbreviatus* is found in tall grasses and weeds on moist ranges, in cold cultivated farmsteads (Ruckes, 1938) and is recorded from *Prosopis juliflora* (Schwartz) (Torre-Bueno, 1939).

limbolaris Stal. (Fig. 27). 13 April to 13 November. *P. limbolaris* is wide spread in

Michigan and is recorded especially from Compositae growing on alluvial soils along borders of ponds (Blatchley, 1926). It feeds on goldenrod, cauliflower (Hart, 1919), cabbage, various melon vines (Froeschner, 1941), sweet clover, wild grape, ragweed (Stoner, 1920), wheat (Pack & Knowlton, 1930) and peppergrass (Esselbaugh, 1948).

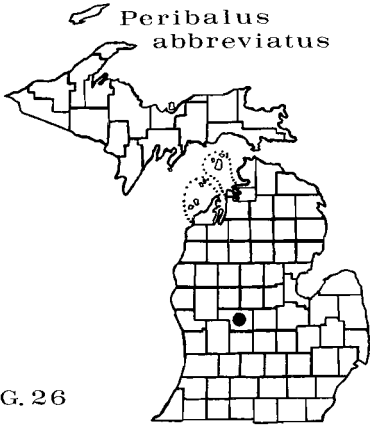


FIG. 26

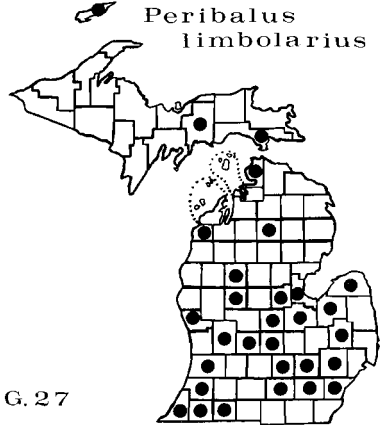


FIG. 27

Genus TRICHOPEPLA Stal
Key to the Michigan Species

- 1. Antennae reddish-brown, apical two segments piceous *semivittata*
- 1'. Antennae black with proximal segment rufous *atricornis*

atricornis Stal. (Fig. 28). 11 June to 14 September. This species occurs on wild carrot (Stoner, 1920).

semivittata (Say). (Fig. 29). 7 May to 26 September. This species is found in fields near wooded areas (Hussey, 1922) and is reported to feed on wild carrot, button snakeroot and other species of Umbelliferae (Blatchley, 1926).



FIG. 28

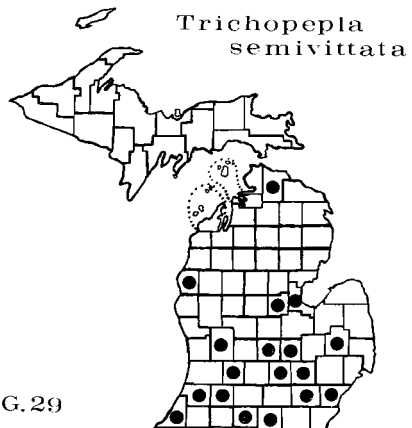


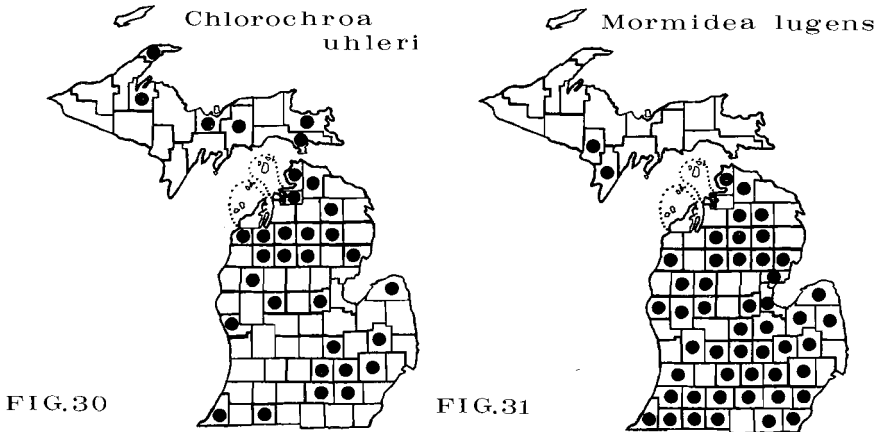
FIG. 29

Genus **CHLOROCHROA** Stal

uhleri Stal. (Fig. 30). 7 May to 17 November. *C. uhleri* attacks toadflax (Smith, 1959), willow, juniper (Torre-Bueno, 1939), heads of wheat (Harris & Sibbitt, 1941), wild buckwheat, mustard, Russian thistle (Walster, 1942), sumac (Stoner, 1922), potato, radish, turnip, pea, bean, cabbage, corn and oat (Stoner, 1920).

Genus **MORMIDEA** Amyot & Serville

lugens (Fabricius) (Fig. 31). 17 May to 20 September. *M. lugens* is most commonly collected by sweeping herbage along roadsides and borders of cultivated fields in dry sandy places (Blatchley, 1926). It occurs on strawberry bush (Blatchley, 1926), *Ceanothus* (Banks, 1912), common mullein (Hart, 1919) raspberry (Hussey, 1922) and blue-grass (Esselbaugh, 1948). I have frequently collected it from grasses in wooded areas.



Genus **OEBALUS** Stal

pugnax (Fabricius). (Fig. 32). Berrien Co., St. Joseph, 30 May 1938, G. Steyskal (UMMZ); Berrien Co., 20 September 1947, R. L. Fischer (MSU); Wayne Co., 7 September 1938, R. Beebe (MSU). I have collected this species on herbage in wooded areas. It is primarily phytophagous and capable of causing economic damage. It attacks many plants including rice, corn, wheat, *Panicum*, *Setaria* (Torre-Bueno, 1939) and asparagus (Esselbaugh, 1948). It has also been reported to attack the cottonworm (Torre-Bueno, 1939).

Genus **EUSCHISTUS** Dallas
Key to the Michigan Species and Subspecies

- 1. Pronotum with irregular raised smooth yellow line between humeral angles . . . *ictericus*
- 1'. Pronotum without raised smooth line between humeral angles 2
- 2(1'). Incisures of ventral abdominal segments with black point in each anterior angle . . . 3
- 2'. Incisures of ventral abdominal segments without black point in each anterior angle . . .
 *variolarius*

- 3(2). Abdomen ventrally with one or more medial black spots 4
- 3'. Abdomen ventrally without medial black spots 5

- 4(3). Humeri rounded; apical one-half of fourth antennal segment and nearly all of fifth brownish-black. *tristigmus luridus*
- 4'. Humeri acute or spinose; antennae entirely rufous or pale ... *tristigmus pyrrhocerus*

- 5(3'). Anterolateral margins of pronotum distinctly sinuate, pale margin not bordered within by well-defined line of black punctures 6
- 5'. Anterolateral margins of pronotum straight or nearly so, pale margin bordered within by well-defined line of black punctures *politus*

- 6(5). Jugae clearly exceeding apex of tylus; connexivum, at most, narrowly exposed *servus euschistoides*
- 6'. Jugae equaling or slightly exceeding apex of tylus; connexivum broadly exposed *servus servus*

ictericus (Linnaeus). (Fig. 33). 28 May to 13 November. *E. ictericus* is found most frequently on vegetation growing in or near water (Blatchley, 1926) and more specifically, on *Salix* (Froeschner, 1941).

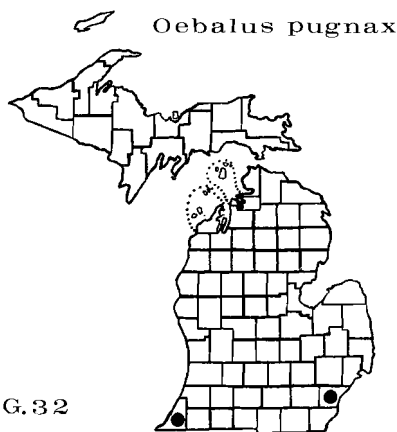


FIG. 32

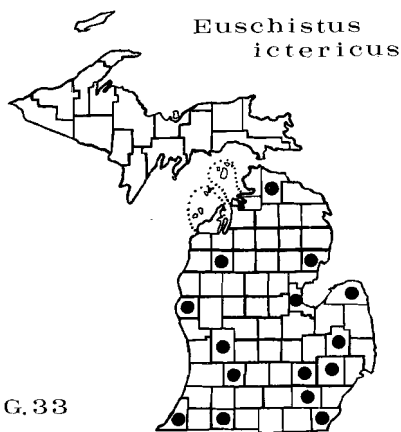


FIG. 33

politus Uhler. (Fig. 34). 28 May to 13 September. *E. politus* occurs on hazel, goldenrod (Blatchley, 1926) and in pine woods on scrub-oak (Olsen, 1912).

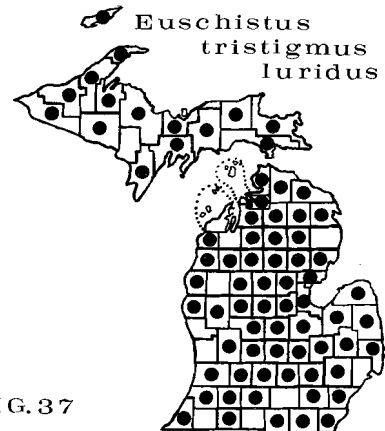
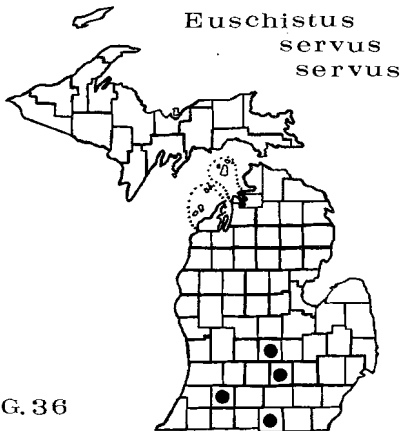
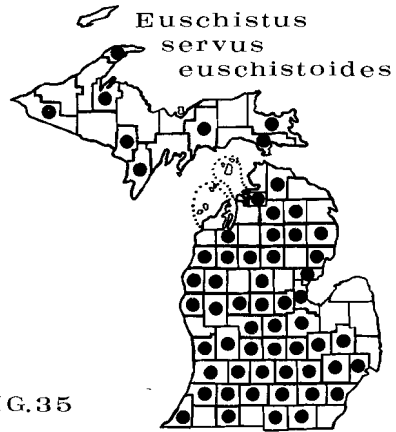
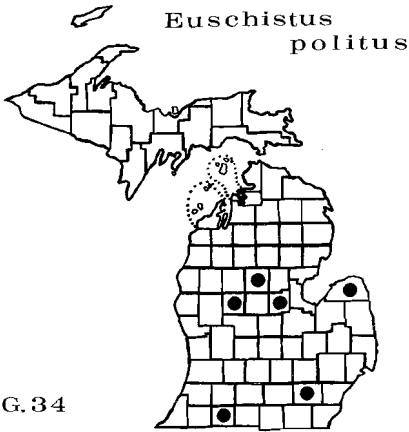
servus euschistoides (Vollenhoven). (Fig. 35). 21 April to 13 November. This economic pest is found on foliage and flowers of dogwood, wild hydrangea, goldenrod, thistle (Blatchley, 1926), red clover, timothy, corn, wheat (Stoner, 1920), raspberry, blackberry (Stoner, 1922), pear (Mundinger & Chapman, 1932), peach (Chandler & Flint, 1939), cantaloupe (Gould, 1943), tobacco (Jewett, 1955) bean, cowpea, squash and tomato (Esselbaugh, 1948).

servus servus (Say). (Fig. 36). 22 April to 31 July. This insect feeds on many plant species and can cause economic damage. It can be collected on goldenrod, thistle (Blatchley, 1926), cotton, corn (Morrill, 1910), peach (Woodside, 1949), buckhorn plantain, oxeye daisy, sweet clover, wild carrot, yarrow, pigweed, chicory, evening primrose and

sunflower (Woodside, 1947). I have also collected it on corn and have noted it feeding on the leaves. In addition, I have collected it on tomato and pepper.

tristigmus luridus (Dallas). (Fig. 37). 28 April to 13 November. *E. tristigmus luridus* attacks several food plants and is capable of causing economic damage. It is reported, for example, from raspberry (Torre-Bueno, 1939), peach (Woodside, 1949), yarrow, oxeye daisy, sweet clover, snap bean, lima bean, chicory and common mullein (Woodside, 1947).

tristigmus pyrrhocerus (Herrich-Schaeffer). (Fig. 38). Berrien Co., 19 September 1947, T. H. Farr (MSU); Hillsdale Co., 13 September 1959, G. C. Eickwort (MSU); Kalamazoo Co., Gull Lake Biol. Stat., 10 August 1957, R. Scheibner (MSU); Kalamazoo Co., Gull Lake Biol. Stat., 18 July 1963 (MSU). This subspecies occurs in tall weeds and grasses growing in alluvial soils along margins of streams, ponds and marshes (Blatchley, 1926) and is reported to feed on oak and blackberry (Froeschner, 1941). I have collected it in large numbers on sweet corn in Illinois.



variolarius (Palisot de Beauvois). (Fig. 39). 9 March to 28 November. This economic pest attacks several plant species. Some of these are pear (Munding & Chapman, 1932), peach (Pack & Knowlton, 1930), corn, oat, wheat, wild rye, blue-grass, red clover,

white clover, gooseberry, tomato, onion, squash, pea, wild sunflower (Parish, 1934), cotton, tobacco, bean, asparagus and raspberry (Esselbaugh, 1948).

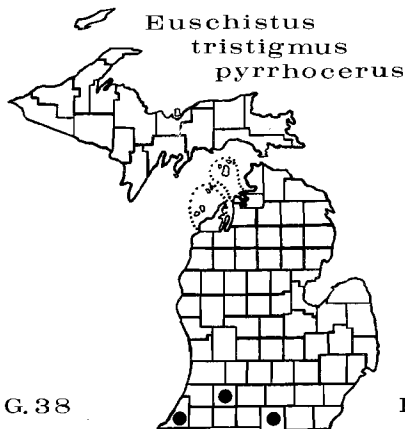


FIG. 38

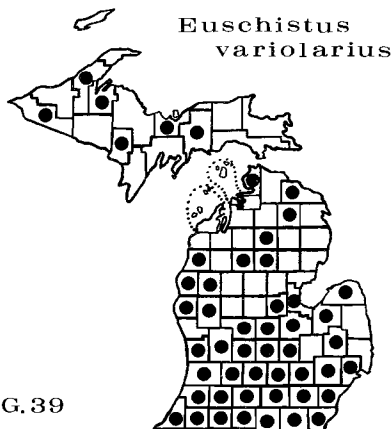


FIG. 39

Genus **COENUS** Dallas

delius (Say). (Fig. 40). 20 March to 11 October. *C. delius* is common in Michigan and generally found on timothy, clover, moth mullein, blue-grass (Torre-Bueno, 1939) and wild raspberry (Stoner, 1922).

Genus **HYMENARCYS** Amyot & Serville
Key to the Michigan Species

- 1. Anterolateral margins of pronotum straight to slightly concavé; veins of membrane not anastomosing; length 6.5-9mm *aequalis*
- 1'. Anterolateral margins of pronotum broadly rounded; veins anastomosing; length 8.5-11.5 mm *nervosa*

aequalis (Say). (Fig. 41). Clinton Co., 14 September 1956, R. Scheibner (MSU); Crawford Co., Higgins Lake, Summer 1932, G. Kelker (UMMZ); Washtenaw Co., Ann Arbor, 4 May 1938, I. J. Cantrill (UMMZ); Wayne Co., 3 October 1938, R. Beebe (MSU). *H. aequalis* occurs on mullein, thistle and other plant species in dry or sandy soils (Blatchley, 1926). It has been observed to feed on corn seedlings and appears to also feed on bean seedlings (Esselbaugh, 1947).

nervosa (Say). (Fig. 42). 6 April to 13 November. Food plants recorded for this species include cotton (Hart, 1919), peach (Rings, 1957) and sunflower (Adams & Gaines, 1950).

Genus **AELIA** Fabricius

americana Dallas. (Fig. 43). Cheboygan Co., 16 July 1931, C. W. Sabrosky (MSU); Cheboygan Co., Douglas Lake, 21 July 1936, C. D. Lyman (UMMZ); Luce Co., 17 July 1946 (MSU); Marquette Co., Huron Mts., July 1921, T. H. Hubbell (UMMZ). The genus attacks wheat kernels (Kretovich, 1944). This particular species is commonly collected from apple tree orchards in Missouri (Froeschner, 1941).

Genus *NEOTTIGLOSSA* Kirby
Key to the Michigan Species

- 1. Head entirely black, with deep and dense punctures; vertex without pale line extending back onto pronotum *trilineata*
- 1'. Head not black, without deep and dense punctures; vertex with median pale line extending back onto pronotum *undata*

trilineata (Kirby). (Fig. 44). Mackinac Co., St. Ignace, 31 May 1921, S. Moore (UMMZ). The biology of this species has not been studied.

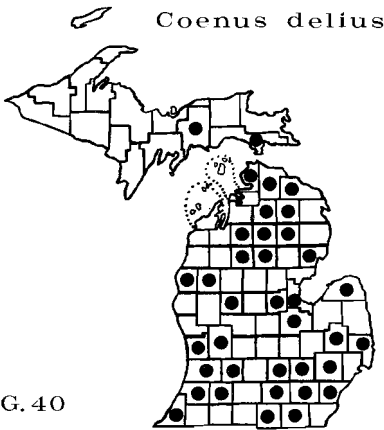


FIG. 40

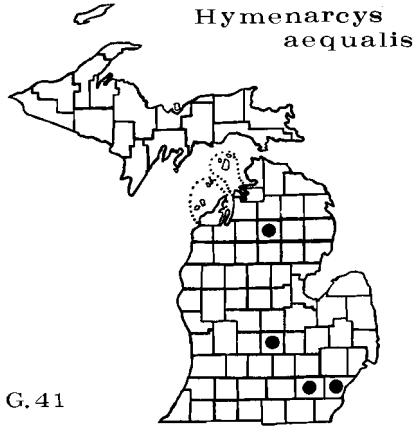


FIG. 41

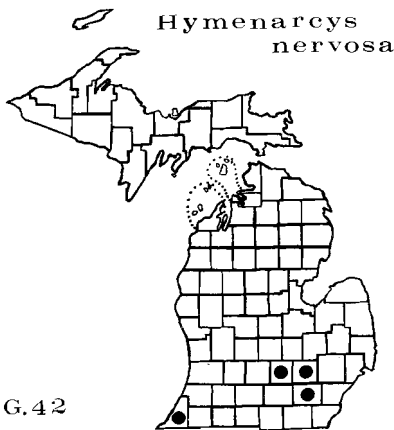


FIG. 42



FIG. 43

undata (Say). (Fig. 45). 18 April to 13 November. This common species is recorded from blue-grass, redbtop grass (Stoner, 1922), red clover, mullein and wild grape (Torre-Bueno, 1939).

Genus *COSMOPEPLA* Stal

bimaculata (Thomas). (Fig. 46). 9 March to 13 November. *C. bimaculata* feeds on many plant species including *Ranunculus*, *Scrophularia nodosa* Linnaeus, currant,

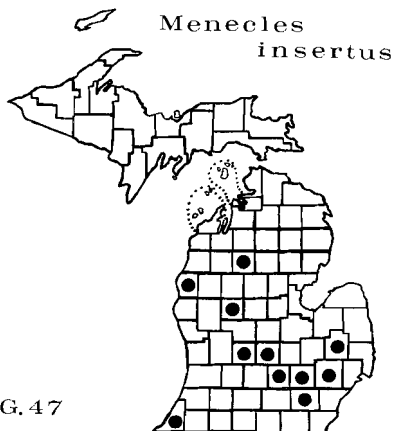
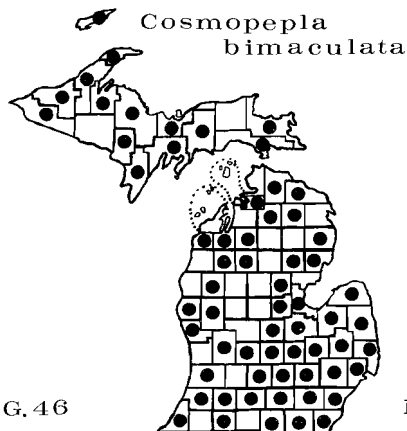
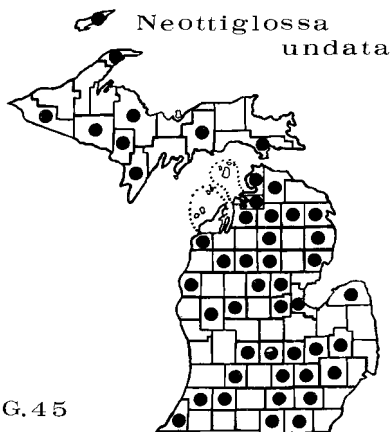
blackberry, mint, mullein, potato, raspberry, pokeberry (Hart, 1919), thistle, goldenrod (Torre-Bueno, 1939) and wild carrot (Stoner, 1920). McDonald (1968b) found that it primarily attacked mature and unripe seeds of *Stachys palustris* Linnaeus, and he was able to successfully rear it on this plant in the laboratory. Esselbaugh (1948) reared *bimaculata* on head lettuce, green beans and corn kernels.

Genus **MENECLIS** Stal

insertus (Say). (Fig. 47). 21 April to 19 December. *M. insertus* is arboreal. It is believed to be phytophagous, and to feed on a diverse group of plant species including elm, hackberry, beech, hard maple and hickory (Balduf, 1945).

Genus **PRIONOSOMA** Uhler

podopioides Uhler (Fig. 48). Hillsdale Co., 5 mi. n.w. Hillsdale, 14 August 1941, 2 specimens, I. J. Cantrall (UMMZ). *P. podopioides* is collected in fields or open woods where large bracted plantain (*Plantago aristata* Michaux) is common (Froeschner, 1941). Ruckes (1937) found it to be abundant in the axils and flowers of wild sunflower in New Mexico.



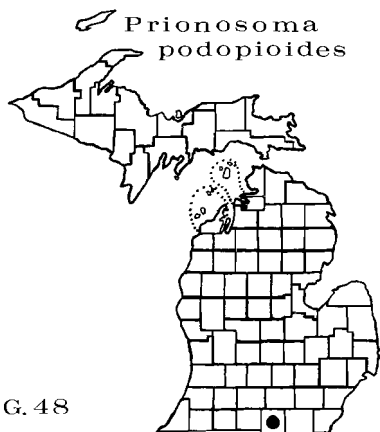


FIG. 48

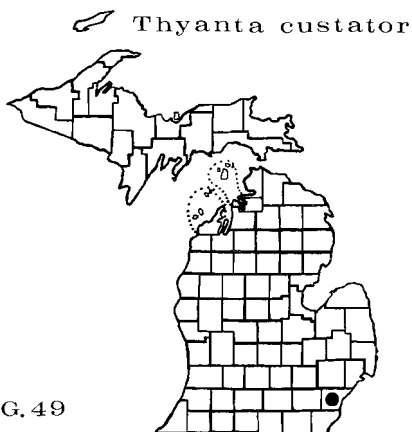


FIG. 49

Genus **THYANTA** Stal ⁴
Key to the Michigan Species and Subspecies

- 1. Anterolateral borders of pronotum, lateral angles of ventral abdominal segments piceous; inner angle of each pronotal cicatrice with piceous spot *custator*
- 1'. Anterolateral borders of pronotum, lateral angles of ventral abdominal segments pale or concolorous; inner angle of each pronotal cicatrice without piceous spot
. *pallido-virens accerra*

custator (Fabricius). (Fig. 49). Wayne Co., 16 May 1940, R. Beebe (MSU). *T. custator* occurs on several plant species including oat, corn, sorghum and cotton (Torre-Bueno, 1939).

pallido-virens accerra (McAtee). (Fig. 50). 23 May to 4 October. This subspecies feeds on several plant species including asparagus, corn (Hart, 1919), wheat (Olsen, 1912), clover, grasses and flowers of goldenrod (Blatchley, 1926).

Genus **ACROSTERNUM** Fieber
Key to the Michigan Species

- 1. Anterolateral margins of pronotum broadly rounded; head definitely wider across eyes than long *pennsylvanicum*
- 1'. Anterolateral margins of pronotum straight or nearly so; width of head across eyes equal or subequal to length *hilare*

hilare (Say). (Fig. 51). 10 January to 6 November. *A. hilare* is a common species. It attacks cotton, tomato, eggplant, turnip, mustard, pea, orange, bean, cabbage, corn, peach, okra (Morrill, 1910), apricot (Pack & Knowlton, 1930), black cherry (Stoner, 1920), grape, apple, catalpa (Hart, 1919) and asparagus (Esselbaugh, 1948) and can cause economic damage. It is also reported to prey upon some insect larvae (Olsen, 1912).

pennsylvanicum (De Geer). (Fig. 52). Berrien Co., New Buffalo, 2 September 1919, R. F. Hussey (UMMZ); Ingham Co., 24 July 1948 (MSU); Lapeer Co., North Branch, 16

⁴The taxonomic status of *Thyanta custator* and *T. pallido-virens* has recently been considered in a paper by Ruckes (1957).

September 1945, G. Steyskal (UMMZ); Livingston Co., E. S. George Reserve, 5 June 1943, G. Steyskal (UMMZ). *A. pennsylvanicum* occurs on juniper (Blatchley, 1926), New Jersey tea (Banks, 1912), low vegetation on sand dune areas (Hussey, 1922) and weeds in overgrown orchards (Froeschner, 1941).

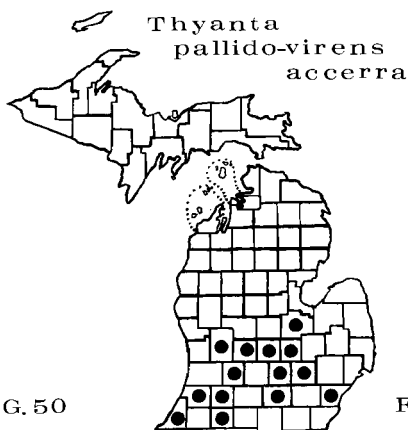


FIG. 50

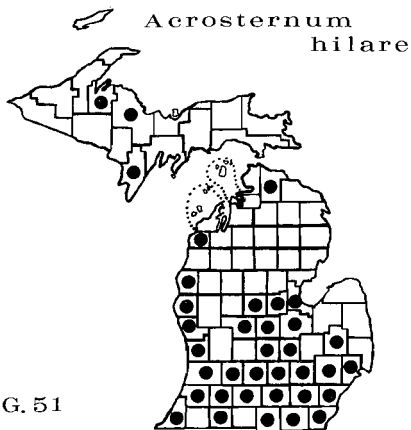


FIG. 51

Genus *BANASA* Stal
Key to the Michigan Species

- 1. Incisures at lateral angles of ventral abdominal segments with conspicuous black spot; second antennal segment about three-fourths length of third *calva*
- 1'. Incisures at lateral angles of ventral abdominal segments with very inconspicuous black spot; second antennal segment about one-half length of third *dimidiata*

calva (Say). (Fig. 53). 27 May to 13 November. This species feeds on native dogwoods and red fruits of deciduous holly (DeCoursey, 1963). Caged nymphs will feed readily on fruits of hawthorn (DeCoursey, 1963).

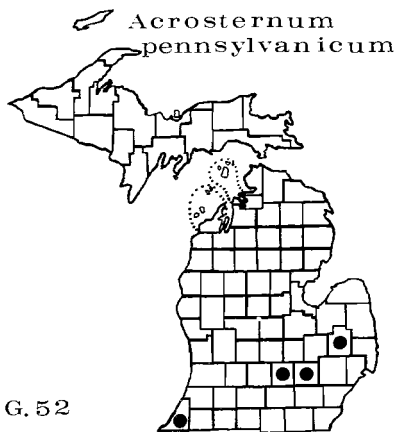


FIG. 52

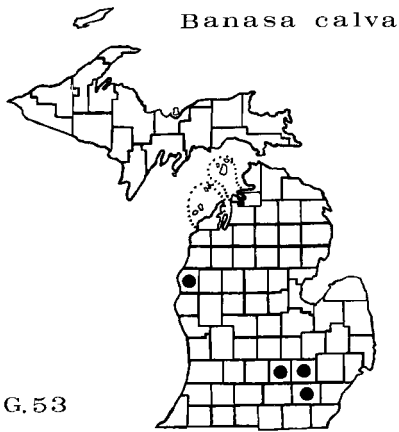


FIG. 53

dimidiata (Say). (Fig. 54). 19 May to 4 November. *B. dimidiata* feeds on dogwood, deciduous holly, blueberry, huckleberry, red garden currant, hawthorn (DeCoursey, 1963), serviceberry and arbor vitae and is found in beach drift (Stoner, 1922).

Genus **DENDROCORIS** Bergroth

humeralis (Uhler). (Fig. 55). 2 May to 13 November. This predaceous species is recorded from oak, hickory, hazel (Torre-Bueno, 1939), pine and small bushes (Nelson, 1955), and attacks larvae of the tent caterpillar and gypsy moth (Kirkland, 1897).

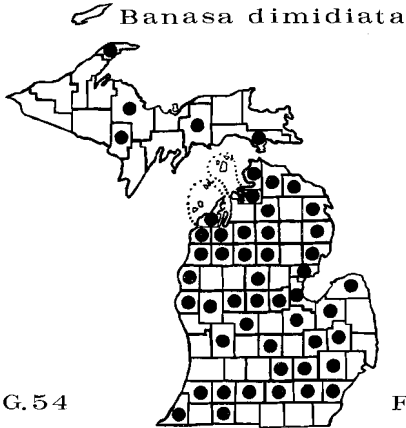


FIG. 54

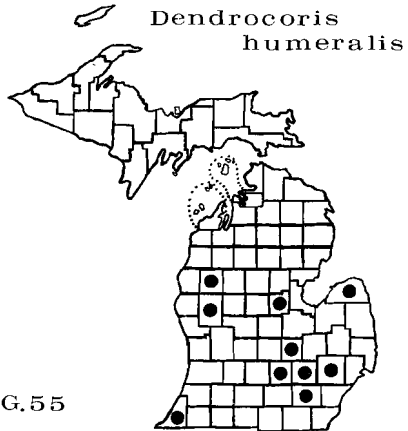


FIG. 55

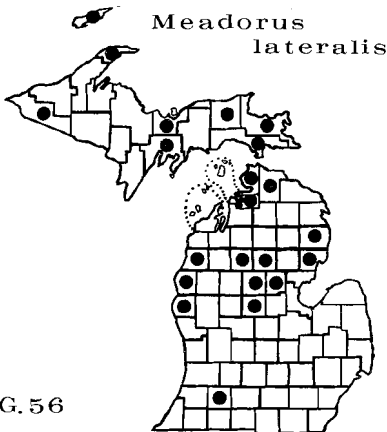


FIG. 56

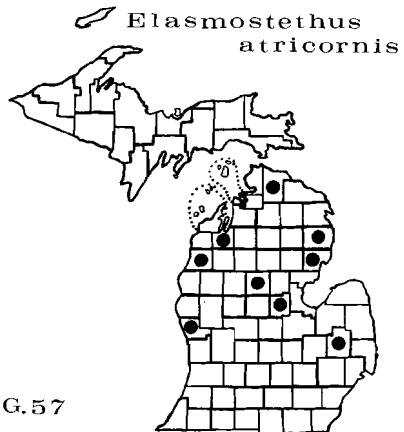


FIG. 57

Subfamily ACANTHOSOMINAE
Genus **MEADORUS** Mulsant & Rey

lateralis (Say). (Fig. 56). 4 May to 25 August. *M. lateralis* occurs on white birch, beech (Torre-Bueno, 1939), yellow birch and leaves and cones of black birch (Frost & Haber, 1944). It has also been collected from vegetation in or by water (Stoner, 1922).

Genus **ELASMOSTETHUS** Fieber
Key to the Michigan Species

- 1. Antennae pale with apical one or two segments darker; humeral angles pale . . . *cruciatus*
- 1'. Antennae entirely piceous or black; humeral angles black *atricornis*

atricornis (Van Duzee). (Fig. 57). 10 July to 10 August. *E. atricornis* is collected on leaves and stems of spikenard (*Aralia racemosa* Linnaeus) and probably reproduces on it (Blatchley, 1926).

cruciatus (Say). (Fig. 58). 8 May to 7 September. This species was reared from a lot of sugar pine cones but this was probably an odd occurrence (Keen, 1958). It has been collected by sweeping swamp vegetation (Stoner, 1922) and beating old escaped apple trees (Ruckes, 1937).

Subfamily ASOPINAE
Genus **STIRETRUS** Laporte

anchorago fimbriatus (Say). (Fig. 59). 18 May to 11 September. This species is predaceous upon coleopterous and lepidopterous larvae. Among larvae attacked are those of the Colorado potato beetle and black swallowtail (Blatchley, 1926).

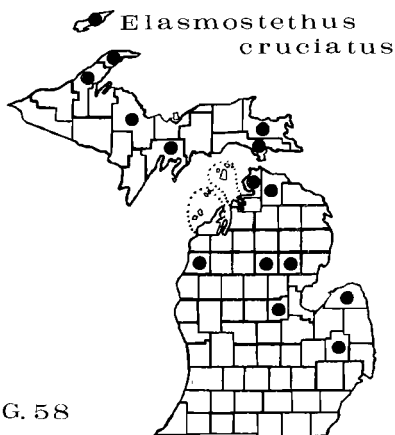


FIG. 58

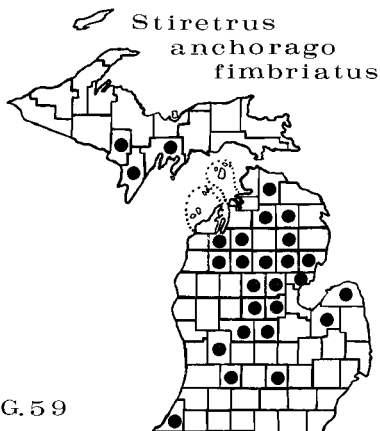


FIG. 59

Genus **PERILLUS** Stal
Key to the Michigan Species

1. Pronotum with continuous anterior transverse dark bar; front femora armed with small tubercle which is not longer than wide *exaptus*
- 1'. Pronotum with transverse dark bar interrupted, forming two spots; front femora armed with spine which is longer than wide 2
- 2(1'). Abdomen with submarginal row of black spots ventrally; antennae black with incisures and, frequently, with first and even second segments pale *bioculatus*
- 2'. Abdomen without submarginal row of black spots ventrally; antennae black with first two segments and basal half of third rufous *circumcinctus*

bioculatus (Fabricius). (Fig. 60). 11 March to 25 December. This predaceous species feeds primarily upon larvae of the Colorado potato beetle (Knight, 1952) but will also feed upon larvae of the asparagus beetle, spinach flea beetle and cabbage looper (Landis, 1937).

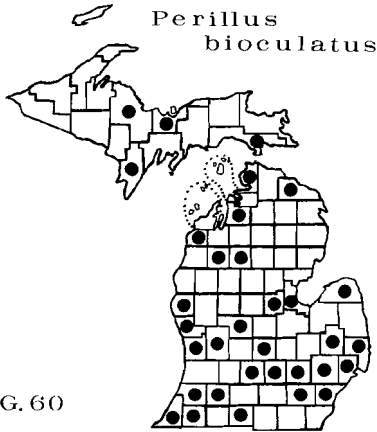


FIG. 60

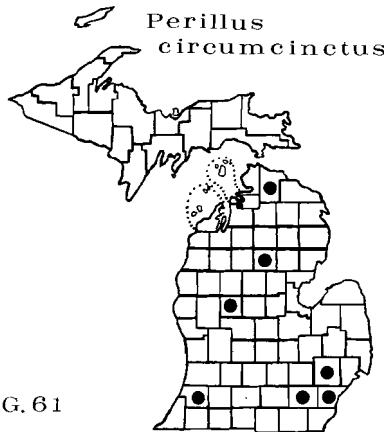


FIG. 61

circumcinctus Stal. (Fig. 61). 27 June to 28 July. *P. circumcinctus* is found on many plant species; it is common on low sumac in Illinois (Hart, 1919). It has been noted feeding on *Trirhabda canadensis* (Kirby) in Missouri (Knight, 1952) and associated with larvae of *Blepharida rhois* (Forster), upon which it was also probably feeding (Hart, 1919).

exaptus (Say). (Fig. 62). 17 April to 22 July. *P. exaptus* occurs in grassy fields (Froeschner, 1941) and marshland (Ruckes, 1937).

Genus RHACOGNATHUS Fieber

americanus Stal. (Fig. 63). Berrien Co., E. K. Warren Preserve, Sawyer Dunes beach drift, 4 July 1920, R. F. Hussey (UMMZ); Clare Co., 11 July 1942, R. R. Dreisbach (MSU); Livingston Co., E. S. George Reserve, 25 May 1933, G. Steyskal (UMMZ); Midland Co., 16 July 1937, R. R. Dreisbach (MSU). No biological information is available for this species.

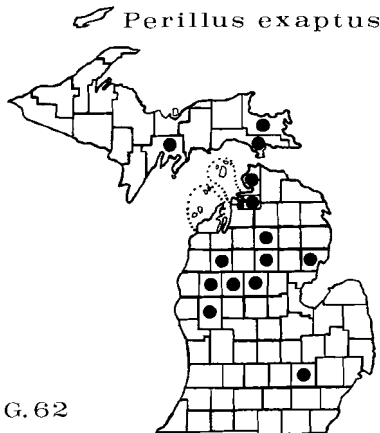


FIG. 62

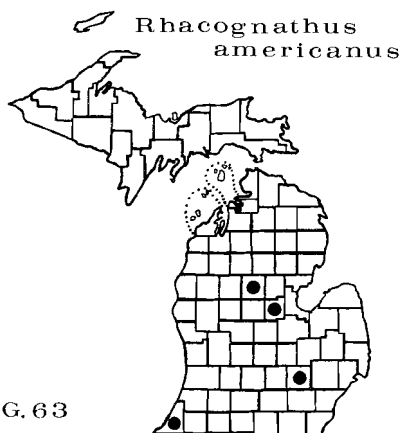


FIG. 63

Genus APATETICUS Dallas
Key to the Michigan Species

- 1. Third antennal segment equal or subequal to fifth; connexivum slightly exposed if at all; pronotum with two or three greenish dots behind front angles; mediobasal lobe of female genital plate quadrangular *cynicus*
- 1'. Third antennal segment shorter than fifth; connexivum rather broadly exposed; pronotum with six small green dots, four in a transverse row and the other two posterior to the end dots; mediobasal lobe of female genital plate triangular. *bracteatus*

bracteatus (Fitch). (Fig. 64). 6 June to 26 September. *A. bracteatus* has been observed feeding on larch sawfly larvae (Muldrew, 1955) and lepidopterous larvae in apple trees (Ruckes, 1937).

cynicus (Say). (Fig. 65). 18 June to 12 November. *A. cynicus* is found on foliage of shrubs and trees at edges of open woods and cultivated fields (Blatchley, 1926) and is reported to be predaceous upon various insect larvae including the Colorado potato beetle (Olsen, 1912) and introduced pine sawfly (Jones & Coppel, 1963). In the laboratory it will feed on larvae of the eastern tent caterpillar, gypsy moth (Stone, 1939) various species of *Datana* Whitmarsh, 1916, and others.

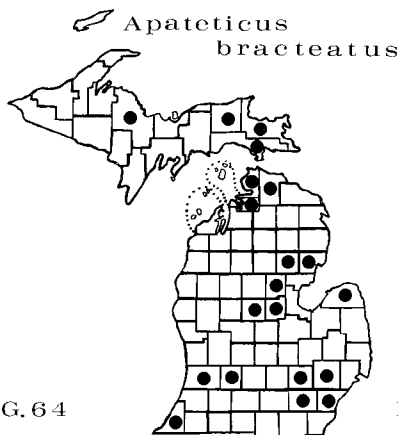


FIG. 64

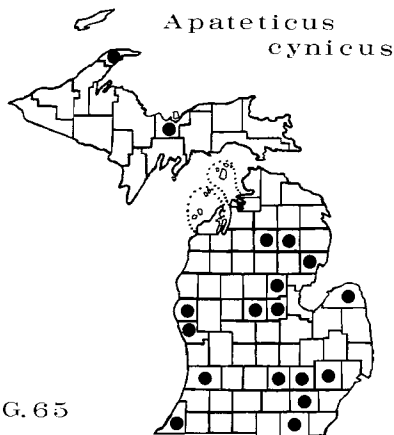


FIG. 65

Genus *PODISUS* Herrich-Schaeffer
Key to the Michigan Species

- 1. Membrane with dark stripe or blotch; anterolateral margins of pronotum concave; humeri spined, acute or rounded 2
- 1'. Membrane without dark stripe or blotch; anterolateral margins of pronotum straight; humeri rounded *placidus*
- 2(1). Humeri produced into outward projecting slender spines *maculiventris*
- 2'. Humeri acute, not produced into outward projecting spines 3
- 3(2'). Femora heavily marked with purplish-black dots *serieiventris*
- 3'. Femora almost devoid of dark dots *modestus*

maculiventris (Say). (Fig. 66). 12 April to 13 November. This species attacks larvae, primarily, of several economic insect species including those of the Colorado potato beetle, elm leaf beetle, striped cucumber beetle, webworm caterpillar, codling moth (Blatchley, 1926), cabbage butterfly (Olsen, 1912), strawberry leaf roller (Bennett, 1961) and introduced pine sawfly (Coppel & Jones, 1962). It has been reared

successfully in the laboratory on larvae of the wax moth (Mukerji & LeRoux, 1969a, b, c).

modestus (Dallas). (Fig. 67). 20 April to 23 September. *P. modestus* is collected by sweeping low herbage in woods (Blatchley, 1926). It preys upon larvae of various insects including the tent caterpillar (Torre-Bueno, 1939), larch sawfly (Olsen, 1912) and introduced pine sawfly (Coppel & Jones, 1962).

placidus Uhler. (Fig. 68). 26 April to 20 September. This species can be collected on scrub-oak (Olsen, 1912) and is reported to be predaceous upon lepidopterous larvae including the tent caterpillar and gypsy moth (Kirkland, 1897). It is also reported to attack chrysomelid larvae (Pack & Knowlton, 1930) and larvae of the introduced pine sawfly (Coppel & Jones, 1962).

serieiventris Uhler. (Fig. 69). 30 April to 7 September. *P. serieiventris* feeds upon lepidopterous and hymenopterous larvae (Prebble, 1941). Some of these prey species are the promethea moth, eastern and forest tent caterpillars, fall webworm, gypsy moth (Hart, 1919), jack pine budworm (Allen, Knight & Foltz, 1970) and introduced pine sawfly (Coppel & Jones, 1962). It has also been noted to feed on the larch sawfly under caged conditions (Ives, 1967).



FIG. 66

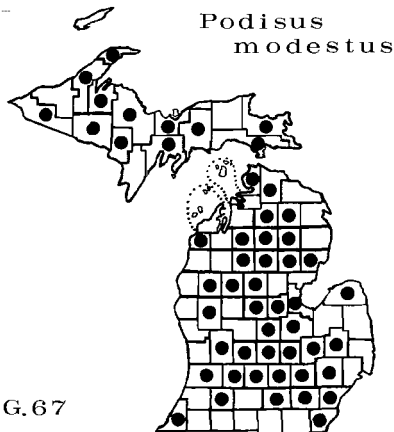


FIG. 67

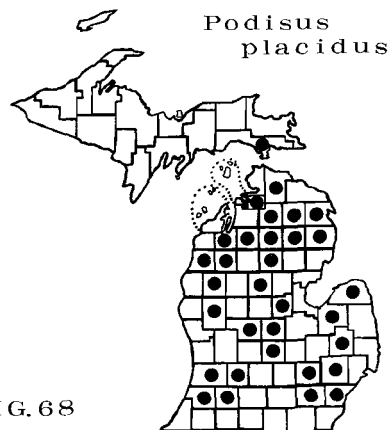


FIG. 68

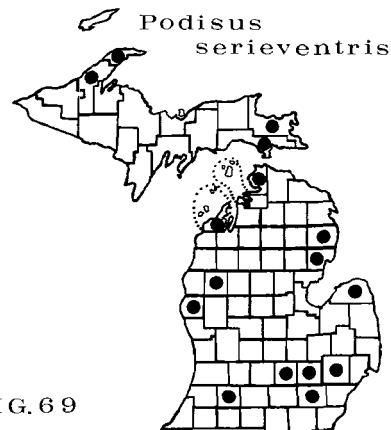


FIG. 69

Genus *ZICRONA* Amyot & Serville

caerulea (Linnaeus). (Fig. 70). Houghton Co., 29 May 1937 (MSU); Schoolcraft Co., 18 June 1922, S. Moore (UMMZ). This species presumably is predaceous (Torre-Bueno, 1939).

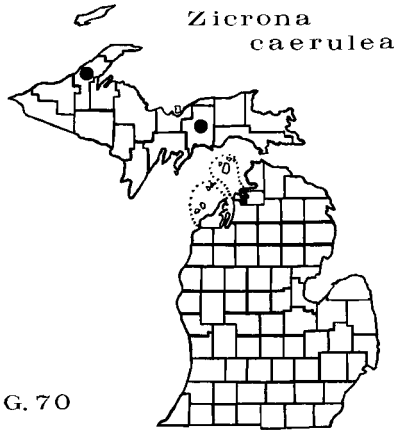


FIG. 70

SPECIES WHICH PROBABLY OCCUR IN MICHIGAN

Podisus fretus Olsen. This species has been collected on trees (Torre-Bueno, 1939) and from washup along Lake Michigan (Blatchley, 1926). It supposedly occurs in Michigan (Torre-Bueno, 1939) although I have seen no specimens which were collected in the state. It has been observed feeding on the pine sawfly, *Neodiprion excitans* Rohwer (Hetrick, 1959).

LITERATURE CITED

- Adams, A. L. & J. C. Gaines. 1950. Sunflower insect control. *J. Econ. Entomol.* 43:181-184.
- Allen, D. C., F. B. Knight & J. L. Foltz. 1970. Invertebrate predators of the jack-pine budworm, *Choristoneura pinus*, in Michigan. *Ann. Entomol. Soc. Amer.* 63:59-64.
- Balduf, W. V. 1945. Bionomic notes on *Meneclis insertus* (Say) (Hemiptera, Pentatomidae). *Bull. Brooklyn Entomol. Soc.* 40:61-65.
- Banks, N. 1912. At the *Ceanothus* in Virginia. *Entomol. News* 23: 102-110.
- Barber, H. G. & R. I. Sailer. 1953. A revision of the turtle bugs of North America (Hemiptera: Pentatomidae). *J. Washington Acad. Sci.* 43: 150-162.
- Bennett, S. E. 1961. The strawberry leaf roller complex in Tennessee. *J. Tennessee Acad. Sci.* 36:320-360.
- Blatchley, W. S. 1926. Heteroptera or true bugs of eastern North America with especial reference to the faunas of Indiana and Florida. Indianapolis.
- Chandler, S. C. & W. P. Flint. 1939. Controlling peach insects in Illinois. *Illinois Natur. Hist. Surv. Div. Circ.* 33:1-40.
- Coppel, H. C. & P. A. Jones. 1962. Bionomics of *Podisus* spp. associated with the introduced pine sawfly *Diprion similis* (Htg.) in Wisconsin. *Trans. Wisconsin Acad. Sci., Arts & Letters* 51: 31-56.
- DeCoursey, R. M. 1963. The life histories of *Banasa dimidiata* and *Banasa calva* (Hemiptera: Pentatomidae). *Ann. Entomol. Soc. Amer.* 56: 687-693.
- Esselbaugh, C. O. 1947. Some notes on the biology of *Hymenarcys aequalis* Say (Pentatomidae). *Bull. Brooklyn Entomol. Soc.* 42:25-30.

- . 1948. Notes on the binomics of some midwestern Pentatomidae. *Entomologica Americana* 28:1-73.
- Forbes, S. A. 1905. A monograph of insects injurious to Indian corn. Twenty - third Rep. State Entomol. Illinois. Part II, 38: 1-273.
- Froeschner, R. C. 1941. Contributions to a synopsis of the Hemiptera of Missouri. Part 1, Scutelleridae, Podopidae, Pentatomidae, Cydnidae, Thyreocoridae. *Amer. Midland Natur.* 26: 122-146.
- . 1960. Cydnidae of the western hemisphere. *Proc. U. S. Nat. Mus.* 111:337-680.
- Frost, S. W. & V. R. Haber. 1944. A case of parental care in the Heteroptera. *Ann. Entomol. Soc. Amer.* 37: 161-166.
- Gilbert, B. L., S. J. Barras & D. M. Norris. 1967. Bionomics of *Tetyra bipunctata* (Hemiptera: Pentatomidae: Scutellerinae) as associated with *Pinus banksiana* in Wisconsin. *Ann. Entomol. Soc. Amer.* 60:698-701.
- Gould, G. E. 1943. Insect pests of cucurbit crops in Indiana. *Proc. Indiana Acad. Sci.* 53: 165-171.
- Harris, H. M. & F. Andre. 1934. Notes on the biology of *Acantholoma denticulata* Stal (Hemiptera, Scutelleridae). *Ann. Entomol. Soc. Amer.* 27:5-15.
- Harris, R. H. & L. D. Sibbitt. 1941. The effect of the green grain bug upon the milling and baking quality of wheat. *North Dakota Agr. Exp. Sta. Bimonthly Bull.* 3(5): 10-14.
- Hart, C. A. 1919. The Pentatomoidea of Illinois with keys to the nearctic genera. *Illinois Natur. Hist. Surv. Bull.* 13:157-223.
- Hendrickson, G. O. 1930. Studies on the insect fauna of Iowa prairies. *Iowa State Coll. J. Sci.* 4:49-179.
- Hetrick, L. A. 1959. Ecology of the pine sawfly, *Neodiprion excitans* (Rohwer) (Hymenoptera, Diprionidae). *Florida Entomol.* 42: 159-162.
- Hussey, R. F. 1922. Hemiptera from Berrien County, Michigan. *Occasional Papers Mus. Zool. Univ. Mich.* 118:1-39.
- Ives, W. G. H. 1967. Relations between invertebrate predators and prey associated with larch sawfly eggs and larvae on tamarack. *Canad. Entomol.* 99:607-622.
- Jewett, H. H. 1955. Controlling tobacco insects. *Kentucky Agr. Ext. Service Cir.* 525:1-38.
- Jones, P. A. & H. C. Coppel. 1963. Immature stages and biology of *Apateticus cynicus* (Say) (Hemiptera: Pentatomidae). *Canad. Entomol.* 95: 770-779.
- Keen, F. P. 1958. Cone and seed insects of western forest trees. *U. S. D. A. Tech. Bull.* 1169: 1-168.
- Kirkland, A. H. 1897. Notes on the life history and habits of certain predaceous Heteroptera. *Rep. Mass. State Board Agr. on extermination of gypsy moths. Append.*, 51-63.
- Knight, H. H. 1952. Review of the genus *Perillus* with description of a new species (Hemiptera, Pentatomidae). *Ann. Entomol. Soc. Amer.* 45: 229-232.
- Knowlton, G. F. 1932. Notes on Utah Hemiptera. *Canad. Entomol.* 64: 166-167.
- Kretovich, V. L. 1944. Biochemistry of the damage to grain by the wheat-bug. *Cereal Chem.* 21: 1-16.
- Landis, B. J. 1937. Insect hosts and nymphal development of *Podisus maculiventris* Say and *Perillus bioculatus* F. (Hemiptera, Pentatomidae). *Ohio J. Sci.* 37:252-259.
- Linsley, E. G. & J. W. MacSwain. 1959. Ethology of some *Ranunculus* insects with emphasis on competition for pollen. *Univ. California Pub. Entomol.* 16: 1-46.
- McAtee, W. L. & J. R. Malloch. 1933. Revision of the subfamily Thyreocorinae of the Pentatomidae (Hemiptera - Heteroptera). *Ann. Carnegie Mus.* 21: 191-411.
- McDonald, F. J. D. 1968a. Some observations on *Shirus cinctus* (Palisot de Beauvois) (Heteroptera: Cydnidae). *Canad. J. Zool.* 46: 855-858.
- . 1968b. The life history of *Cosmopepla bimaculata* (Thomas) (Heteroptera: Pentatomidae) in Alberta. *Quaest. Entomol.* 4:35-38.
- Metcalf, C. L., W. P. Flint & R. L. Metcalf. 1962. *Destructive and useful insects: their habits and control.* New York.
- Morrill, A. W. 1910. Plant bugs injurious to cotton bolls. *U.S.D.A. Bur. Entomol. Bull.* 86: 1-110.
- Mukerji, M. K. & E. J. LeRoux. 1969a. The effect of predator age on the functional

- response of *Podisus maculiventris* to the prey size of *Galleria mellonella*. *Canad. Entomol.* 101: 314-327.
- . 1969b. A quantitative study of food consumption and growth of *Podisus maculiventris* (Hemiptera: Pentatomidae). *Canad. Entomol.* 101: 387-403.
- . 1969c. A study on energetics of *Podisus maculiventris* (Hemiptera: Pentatomidae). *Canad. Entomol.* 101: 449-460.
- Muldrew, J. A. 1955. Parasites and insect predators of the larch sawfly. *Canad. Entomol.* 87: 117-120.
- Mundinger, F. G. & P. J. Chapman. 1932. Plant bugs as pests of pear and other fruits in the Hudson Valley. *J. Econ. Entomol.* 25: 655-658.
- Nelson, G. H. 1955. A revision of the genus *Dendrocoris* and its generic relationships. *Proc. Entomol. Soc. Washington* 57: 49-67.
- Olsen, C. E. 1912. Contribution to an annotated list of Long Island insects. *J. New York Entomol. Soc.* 20: 48-58.
- Pack, H. J. & G. F. Knowlton. 1930. Notes on Utah Hemiptera. *Canad. Entomol.* 62: 248-250.
- Parish, H. E. 1934. Biology of *Euschistus variolarius* P. de B. (Family Pentatomidae, Order Hemiptera). *Ann. Entomol. Soc. Amer.* 27: 50-54.
- Parshley, H. M. 1923. Family Cydnidae, family Scutelleridae. In Britton, W. E. Guide to the insects of Connecticut. Part 4, The Hemiptera or sucking insects of Connecticut. *Bull. Conn. Geol. Natur. Hist. Surv.* 34:1-807.
- Prebble, M. L. 1933. The biology of *Podisus serieiventris* Uhler, in Cape Breton, Nova Scotia. *Canad. J. Res.* 9:1-30.
- Rings, R. W. 1957. Types and seasonal incidence of stink bug injury to peaches. *J. Econ. Entomol.* 50: 599-604.
- Ruckes, H. 1937. An annotated list of some pentatomids (Heteroptera) from New Mexico. *Bull. Brooklyn Entomol. Soc.* 32: 32-36.
- . 1938. Additions to an annotated list of pentatomids (Heteroptera) of New Mexico. *Bull. Brooklyn Entomol. Soc.* 33: 10-13.
- . 1946. Notes and keys on the genus *Brochymena* (Pentatomidae, Heteroptera). *Entomologica Americana* 26: 143-238.
- . 1957. The taxonomic status and distribution of *Thyanta custator* (Fabricius) and *Thyanta pallido-virens* (Stal) (Heteroptera, Pentatomidae). *Amer. Mus. Novitates* 1824: 1-23.
- Smith, J. B. 1910. A report on the insects of New Jersey (Hemiptera). *Ann. Rep. New Jersey State Mus.* 1909: 131-170.
- Smith, J. M. 1959. Notes on insects, especially *Gymnaetron* spp. (Coleoptera: Curculionidae), associated with toadflax, *Linaria vulgaris* Mill. (Scropulariaceae), in North America. *Canad. Entomol.* 91: 116-121.
- Stone, P. C. 1939. Notes on the predaceous stink bug, *Apateticus cynicus* Say. *Trans. Illinois Acad. Sci.* 32: 228.
- Stoner, D. 1920. The Scutelleroidea of Iowa. *Univ. Iowa Stud. Natur. Hist.* 8: 1-140.
- . 1922. The Scutelleroidea of the Douglas Lake region. *Univ. Iowa Stud. Natur. Hist.* 10: 45-65.
- Torre-Bueno, J. R. de la. 1939. A synopsis of the Hemiptera - Heteroptera of America north of Mexico. Part 1, Families Scutelleridae, Cydnidae, Pentatomidae, Aradidae, Dysodiidae and Temitaphididae. *Entomologica Americana* 19: 141-304.
- Walster, H. L. 1942. The battle against insects. *North Dakota Agri. Exp. Sta. Bimonthly Bull.* 4 (4): 6-10.
- Whitmarsh, R. D. 1916. Life-history notes on *Apateticus cynicus* & *maculiventris*. *J. Econ. Entomol.* 9: 51-53.
- Woodside, A.M. 1947. Weed hosts of bugs which cause cat-facing of peaches in Virginia. *J. Econ. Entomol.* 40: 231-233.
- . 1949. Tests of insecticides for control of cat-facing on peaches. *J. Econ. Entomol.* 42: 335-338.

NOTES

