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MICHIGAN AGRICULTURAL COLLEGE

EXPERIMENT STATION

KEY TO ORTHOPTERA


OF

MICHIGAN WITH ANNOTATIONS

BY

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MICHIGAN ORTHOPTERA.

The order Orthoptera consists of six families, five of which are found in Michigan. The Forficulidæ are considered as a separate order. The Mantidæ are more southern forms and do not winter in the north. The Blattidæ, Phasmidæ, Acrididæ, Locustidæ, and Gryllidæ are well represented in the fauna of the state, members of each family, at times, becoming numerous enough to be considered of economic importance.

The characters of the order are: Four wings, the first pair thickened and leathery; the second pair folded in longitudinal plaits. The mouth-parts are fitted for biting. The metamorphosis is incomplete.

KEY TO THE FAMILIES OF MICHIGAN ORTHOPTERA.

- A. Legs fitted for running. Hind femora but little longer and slightly thicker than the front and middle femora.
 - B. Body short, oblong, oval and depressed. Wings parchment-like and flat on top. Head withdrawn under the flat shield-shaped pronotum. Cerci jointed. *Blattidæ* (Cockroaches) page 5.
 - BB. Body long, cylindrical and very slender. Wings absent. Head almost horizontal. Pronotum short and cylindrical. Cerci not jointed. *Phasmidæ* (Walking-sticks) page 8.
- AA. Legs fitted for jumping. Hind femora much thicker and longer, in comparison, than the front or middle femora.
 - B. Antennæ shorter than the body. Tarsi with three segments. Ovipositor of four distinct, movable plates. *Acrididæ* (Grasshoppers) page 8.
 - BB. Antennæ usually longer than the body. Plates of ovipositor so united as to appear as one piece.
 - C. Body sub-cylindrical. Ovipositor compressed, sword-shaped. *Locustidæ* (Long-horned grasshoppers) page 32.
 - CC. Insect with a flattened dorsum. Ovipositor spear-shaped. *Gryllidæ* (Crickets). Page 38.
- AAA. Legs fitted for digging. Hind femora but slightly larger than the middle femora. Front tibiæ enlarged. Ovipositor not visible. Insect subterranean. *Gryllidæ* (Mole-cricket). Page 39.

BLATTIDÆ.

The Blattidæ, or "Cockroaches" as they are commonly called, are recognized as the oldest forms of insect life, evidence of them being found in the Silurian and Carboniferous ages. The native "roach" was an out-of-door creature, but several species are gradually taking up their abodes in

houses. The imported species are the ones of most economic importance, since they infest dwellings.

KEY TO THE GENERA OF MICHIGAN BLATTIDÆ.

- A. Last ventral segment of the female compressed beneath, forming a ridge. The tip of the supra-anal plate divided in both sexes.
- B. Tegmina surpassing the tip of the abdomen in both sexes. *Periplaneta*. Page 6.
- BB. Tegmina not surpassing the tip of the abdomen in either sex. *Blatta*. Page 6.
- AA. Last ventral segment not compressed into a ridge, the tip of the supra-anal plate broadly rounded.
- B. Tegmina covering the abdomen in both sexes. Pronotum with two longitudinal dark bands. *Blatella*. Page 7.
- BB. Neither tegmina nor wings of female well developed; the male with well developed tegmina and wings. Pronotum without the two longitudinal dark bands. *Ischnoptera*. Page 7.

PERIPLANETA (Burmeister).

Periplaneta has eyes which approach each other in front, and which are closer together than the pits of the antennæ. The tegmina extend beyond the tip of the abdomen in both sexes. The true wings are as long or longer than the wing-covers. The sub-anal plate does not extend as far back as the supra-anal. This genus has been introduced either from the American Tropics or from the Old World, and is now widely spread over the United States. *Periplaneta americana* (Linn). The "Big American Roach" is the only species recorded from the State. *Periplaneta australasiæ*, a very closely allied species, though a more southern form, has never been reported from the state but has doubtless found its way in many times through the agency of commerce. The two species can readily be separated by the following key:

- A. Pronotum surrounded by an irregular yellow band edged with brown.
- B. Color of tegmina uniform. *Periplaneta americana*.
- BB. A bright yellow streak along the costal margin of the tegmen. *Periplaneta australasiæ*.

BLATTA (Linn).

The eyes of *Blatta* are farther apart than the pits of the antennæ. The tegmina do not cover the abdomen in either sex. This genus is represented in Michigan by a single imported species, *Blatta orientalis* Linn. It is especially objectionable because of its peculiar, disagreeable odor and filthy food habits, although it is probably the most nearly carnivorous of the entire family of roaches, and is especially fond of bed bugs. The oriental roach is gregarious, the young and old living together in colonies, always in buildings and never out of doors. The adult is uniform brown in color, the legs being

a shade lighter. The tegmina are short in both sexes, those of the female covering about one-fourth of the abdomen, while those of the male cover about three-fourths. The true wings are wanting in the female, but well developed in the male. The supra-anal plate of the female is rounded, with a shallow notch, and that of the male is truncate.

BLATTELLA (Caudell).

In *Blattella* the tegmina and wings extend to, or beyond the tip of the abdomen. The ulnar vein of the true wing is not branched. This genus is represented in Michigan by one imported species, *Blattella germanica* Linn, best known in this country by the name "Croton bug." It is one of the smallest of the Michigan roaches, being only about three-fourths of an inch in length. The pronotum is conspicuously marked with two longitudinal dark bands which alternate with three yellow stripes.

Germanica is a native of southern Europe. It was first observed in this country in New York City when the Croton water-works were being installed. It is not so filthy in its habits as the "Oriental Roach," seeming to prefer starchy food and reveling in warm, damp places.

ISCHNOPTERA (Burmeister).

Our native "Roaches" were out of door species, and are represented by the single genus *Ischnoptera*. These native roaches are gradually finding their way into houses. There is a great deal of difference in the appearance of the males and females of these forms, the females in some cases not being known. The males are slender in form, with well developed tegmina and wings. The females have tegmina either small or wanting, body broadly oval in form, rather resembling the young of their kind. The eyes are nearly parallel, scarcely approaching one another in front. The sub-anal plate extends farther back than the supra-anal plate.

The following key will separate the Michigan species of *Ischnoptera*:

ISCHNOPTERA.

- A. Disk of pronotum dark, the margins lighter. Pronotum of the male narrowing toward the head. Female with the tegmina overlapping, well developed, covering from one-half to three-fourths of the length of the abdomen. Wings narrow, about half the length of the tegmina.
Ischnoptera pennsylvanica.
- AA. Pronotum uniform in color.
- B. Male with pronotum elliptical, without emarginations, narrowing toward the head. Sides somewhat deflexed, translucent. Female with tegmina abbreviated, their inner edges slightly overlapping,

covering less than half the abdomen. Wings short and narrow, covering only the first abdominal segment. *Ischnoptera uhleriana*.

- BB. Male with the lateral margins strongly deflexed, subcoriaceous. Female with tegmina reaching only to the second abdominal segment, their inner edges widely separated. Wings covering only the first abdominal segment. *Ischnoptera intricata*.*

Besides the seven species above described there are two others, which are sometimes imported into the state,—*Panchlora hyaline* Stahl, and *Nyctobora holosericea* Klug.

Panchlora hyaline is a slender, light-green insect, measuring about an inch in length. The first joint of the hind tarsi densely covered with bristles; the pulvillus bilobed and naked. *Nyctobora holosericea* is uniform dark brown in color and covered with fine hairs which give it a downy appearance. It is over an inch long and very broad.

PHASMIDÆ.

The family Phasmidæ is represented in Michigan by a single species, *Diapheromera femorata* Say. It feeds on the leaves of oak and wild cherry, though sometimes it attacks other forest trees. *D. femorata* takes advantage of its slender form, and when frightened it straightens out so as to closely resemble a dead twig. No wings are present, the legs are fitted for walking. The winter is passed in the egg stage, some of the eggs not hatching until the second season after they are laid.

ACRIDIDÆ

Key to Sub-families of *Acrididæ*.

- A. Pronotum not extending to the tip of the distal end of the abdomen. Pulvilli between the tarsal claws.

- B. Prosternal spine absent.

- C. Face oblique. (See figure) Antenna usually flattened at base. The median carina of the pronotum low, cut by not more than one sulcus, lateral carinæ usually distinct. Tegmina and wings often short. Disk of hind-wing transparent, never *brightly* colored.



Tryxalinæ. Page 9.

- CC. Face but slightly oblique. (See figure) Antenna not flattened at base except for first few segments. Lateral carinæ of pronotum usually wanting; median carina sometimes crested, usually cut by one or two sulci. Tegmina well developed, the disk of the wing often brightly colored. *Oedipodinæ*. Page 13.



- BB. Prosternal spine present.

- C. Median carina low and of nearly equal height throughout; lateral carinæ usually obsolete. *Acridinæ*. Page 19.

- AA. Pronotum prolonged, reaching to the tip of the distal end of the abdomen. Tegmina rudimentary, hind-wings usually well developed, sometimes wanting. Pulvilli between the tarsal claws wanting. Antenna short and slender. *Tettiginæ*. Page 27.

*The male of *I. intricata* has never been recorded as collected in Michigan. The above description of the male is taken from Blatchley's "Orthoptera of Indiana."

TRYXALINÆ.

The connecting links between the subfamilies Oedipodinae and Tryxalinae are so numerous that it is difficult, indeed, to say to which subfamily some genera belong. The following characters define the subfamily Tryxalinae:

The front of the head slopes obliquely, meeting the dorsum of the head, at the vertex, at an acute angle rather than in a curve. The antennae are often flattened at their bases and pointed at their tips. The disk of the pronotum narrows slightly toward the front, while the prozona is not shorter than the metazona. The median carina is never crested nor cut by more than one sulcus, the lateral carinae showing distinctly. The tegmina are more or less uniform in color, never banded in distinct patterns. The intercalary vein is generally wanting and many of the species possess both long and short winged forms. The wings are never brightly colored nor banded with black.

Key to the genera of *Tryxalinae*.

- A. Foveolæ of the vertex present, visible from above. Face slightly receding. Antennæ thread-like. (See figure)
- B. Lateral carinae of the pronotum distinct on the prozona. Vertex of the head with a median carina.
- C. Foveolæ of the vertex extending from the eye to the apex of the head. Tegmina either well developed or short. Insect slender, an inch or less in length.
- Stenobothrus*. Page 10
- CC. Foveolæ of the vertex small, mere triangles in front of the eyes, not extending to the vertex of the head. Tegmina well developed. Insect robust, about an inch in length. *Mecostethus*. Page 11
- BB. Lateral carinae indistinct on the front portion of the pronotum. Vertex of the head without a median carina. Foveolæ of the vertex each with its sides parallel. Hind tibia red, the lower apical spur on the inner side fully half as long again as the upper spur. Insect small, under an inch in length. *Ageneotettix*. Page 11
- AA. Foveolæ of the vertex absent, or if present not visible from above. Face decidedly receding. (See figure)
- B. Antennæ thread-like, slightly flattened at the base.
- C. Lateral carinae of the pronotum parallel; median carina cut behind the middle by the principal sulcus. Head with the lateral carinae of the vertex elevated; sulcate directly back of elevation, the dorsum convex. Median carina of the head absent. Eyes elongated ovals.
- Dichromorpha*. Page 11
- CC. Lateral carinae of the pronotum somewhat incurved, in front of the middle.
- D. Tegmina of the female seldom reaching to the tip of the abdomen. Head with the median carina indistinct; eyes oval. Median carina of the pronotum cut back of the middle by the principal sulcus. The hind tibiae with the inner apical spurs about equal.
- Chloealtis*. Page 11



DD. Tegmina in either sex extending at least to the tip of the abdomen. Foveolæ of the vertex sometimes present but never well developed nor visible from above.

E. Head with median carinæ indistinct; antennæ filiform. Eyes oval. Insect small, less than an inch in length. Color variable but usually a yellow line extends back of the eye and down the lateral carina of the pronotum, beneath this line is a dark bar.

Orphulella. Page 12

EE. Median carina of the head distinct. Antennæ slightly flattened, nearly uniform in width, pointed at tip. Eyes elongate, each one ending near the vertex in a point. Hind femora long, extending beyond the tip of the abdomen and the wings. Hind tibiæ each armed on the outer margin with not less than 19 spines. Tegmina well developed, exceeding the abdomen in length. Insect an inch or more in length.

Syrbula. Page 12

BB. Antennæ very much flattened at their bases. Lateral carinæ of the pronotum parallel.

C. Hind margin of the pronotum truncate in both sexes. Insect greyish-brown in color. Neither tegmina nor hind formora in either sex extend beyond the tip of the abdomen. Hind tibiæ each with not less than 15 spines on the outer margin. Eyes elongate, small, not prominent viewed from above.

Pseudopomala. Page 12

CC. Hind margin of pronotum angulate in the male, rounded in the female. Insect green or greenish-brown in color. Tegmina extending to the tip, and hind femora extending beyond the tip of the abdomen. Hind tibiæ each with less than 15 spines on the outer margin. Eyes oblong and prominent.

Tryxalis. Page 13

Chorthippus
~~STENOBOTHRUS~~ (Fischer)

Two species belonging to this genus are recorded from the state. *Stenobothrus curtippennis* Harr., is the common form. Head with foveolæ of the vertex visible from above, the sides of the foveolæ being parallel. Tegmina uniform in color, but variable in length. Males with the sides of the pronotum conspicuously banded, the upper portion black, the lower portion light. The markings on the pronotum together with the presence of the foveolæ of the vertex, separate the males of this species from those of *Chloecaltis conspersa*, which they very closely resemble.

Stenobothrus maculipennis is rare. The foveolæ of the vertex are very shallow, broader toward the eyes than at the apex. Tegmina with the sides green, each marked with a row of equidistant quadrate black spots along the middle. Dorsum rust red. Tegmina always well developed.

STETHOPHYMA
MECOSTETHUS (Fieber).

^{S.}
Mecostethus lineatus Scudder is the only species of this genus likely to be found in the state. Scudder records it as occurring on low swampy ground from New England to Northern Indiana and west to Iowa. It has never been reported as collected within the state, though doubtless a careful search would locate it in several places. It has been taken both from Northern Indiana and from Cedar Point, Ohio.

The color is somewhat variable. The costal margin of the tegmen is dark, and directly above the dark band is a yellow streak. A slender yellow line also extends from back of the eye along the lateral carina of the pronotum. The hind tibiae are yellow with black bands at the apices and at the bases. The bases of the spines are black.

AGENEOTETTIX (McNeill).

Ageneotettix scudderi Brun, is very common in the northern United States west of the Mississippi River, but is rare in the region east of it. It is common on high sandy soil. This species has never been recorded from the state, though it seems possible for it to exist within our boundaries.

The insect is of a uniform dirty-gray color, the tegmina flecked with black spots. The hind tibiae are red, each with a white band below a black knee.

DICHROMORPHA (Morse).

Dichromorpha viridis Scud., is recorded from the northeastern United States. It lives on coarse, heavy grass in the open. It has never been collected in Michigan, but it is probable that it exists in the southern part of the state.

The color of the insect is either a uniform bright green, or a dirty brown, a narrow black line extends back of the eye and along the lateral carina of the pronotum.

CHLOEALTIS (Harr.)

Chloealtis conspersa Harr., is common along the outskirts of open woods and streams bordered with undergrowth. The males very much resemble those of *Stenobothrus curtispennis*. The foveolæ of the vertex, however, are absent and the sides of the pronotum and the first two or three segments of the abdomen are solid black. The females are much larger than the males, and are dirty brown in color, mottled with light splotches scattered over the bodies and tegmina. The short-winged forms are sometimes designated as var. *prima*.

ORPHULELLA (Giglio-Tos).

Orphulella has a typical, receding, tryxaline face. The median carina of the pronotum is well defined. The lateral carinae are curved in, at, or just in front of the middle, giving the pronotum a flare at both the front and the back margins.

Orphulella speciosa Scudd. has been collected within the state. *Orphulella pelidna* Burm. has been taken in Lake County, Indiana. *O. speciosa* is usually found on dry pasture land and on hillsides. *O. pelidna* is recorded as occurring along sand bars on Lake fronts. The two species are readily separated by the following key:

- A. Antennae usually about as long as the head and pronotum taken together, somewhat flattened, the middle segments being about twice as long as broad. The hind margin of the pronotum but slightly wider than the front margin. Tegmina seldom surpassing the tip of the abdomen. Hind tibiae without a light band below the knee. *speciosa.*
- AA. Antennae longer than head and pronotum taken together, and but slightly depressed if at all, the middle segments being three or four times as long as broad. The hind margin of the pronotum much wider than the front margin. Tegmina surpassing the tips of the hind femora. Hind tibiae marked with light bands below the knees. *pelidna.*

SYRBULA (Stal.).

Syrbula admirabilis Uhler is the only species of this genus that is apt to be found in the state. The eyes are elongate, almost meeting at the vertex in a point. The median carina of the head is distinct. The males are much smaller than the females and both are very prettily marked. Dorsum of head and pronotum with a light brown bar extending down the median carina, bounded on each side by a darker band of the same color. Lateral carinae of the pronotum, each marked on the inner margin by a yellow line. Males usually light-brown in color, females pale green. It is very doubtful whether this species can endure our severe winters, although it is just possible that it will be found in the southern portion of the state.

PSEUDOPOMALA (Morse).

Pseudopomala brachyptera Scudd. the short-winged form is very common in the state, the long-winged form, var. *reversa*, being rare. It is a slender insect with a decidedly receding face. Eyes small and round. Antennae flattened at their bases, but tapering to points.

TRYXALIS (Fabr.).

Tryxalis brevicornis (Linn) has been collected just south of us and doubtless will be found in the state. The male is somewhat smaller than the female and very slender. The dorsum is pale-green with the sides uniform brown. The females are more variable in color. Some being bright green, mottled with brown, and others being gray-brown with a few splotches of brown on the wings.

ÆDIPODINÆ.

The Ædipodinæ may be separated from their near relatives the Tryxalinæ by the following characters: Head, when viewed from the side, with the dorsum meeting the front in a curve; front almost perpendicular; antennæ thread-like.

Pronotum much wider on the hind margin than on the front, the prozona shorter than the metazona; median carina often crested, entire, or cut by from one to three sulci; lateral carinæ often indistinct on the prozona. Tegmina often marked with bands, though sometimes of one color, intercalary vein usually present. Short-winged forms very rare. Disk of wings sometimes brightly colored, if so, always bordered with black, with the tips usually transparent.

Key to the genera of *Ædipodinæ*.

- A. Disk of hind-wing opaque.
- B. Median carina of the pronotum never cut by more than one sulcus.
- C. Median carina of the pronotum variable, sometimes crested, entire, or but slightly indented by the principal sulcus; sometimes inconspicuous. Disk of hind-wing red or yellow, with a dark border, tip of wing somewhat transparent. Hind tibiæ dusky. *Body slender*, tegmina pepper and salt color. *Arphia*. Page 15
- CC. Median carina of the pronotum distinctly cut by the principal sulcus.
- D. Median carina of pronotum low, of equal height throughout. Disk of hind-wing red or orange, bordered with dark, leaving the tip transparent. Hind tibiæ yellow. *Body robust*; tegmina coarsely mottled. *Hippiscus*. Page 16

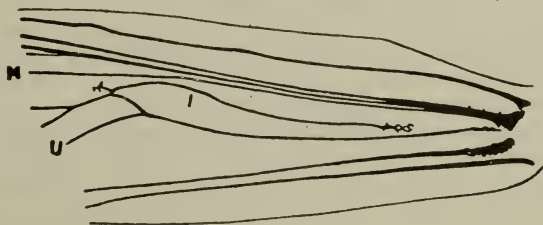


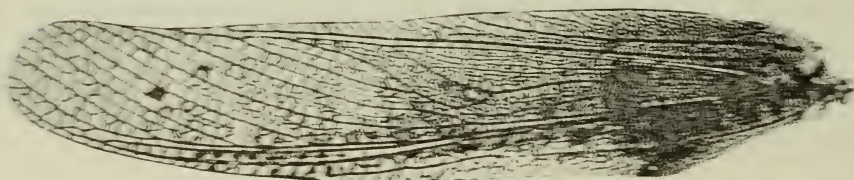
Diagram of tegmen,—i, intercalary vein; u, ulnar vein; m, median vein. Fig. 1.

- DD. Median carina of the pronotum crested. Body slender.
 E. Intercalary vein distinct, nearly intermediate between the median and ulnar veins. Hind wing black with a light border, tip transparent. Hind tibiae dusky. *Dissostoma*. Page 16



Dissostoma. Fig. 2.

- EE. Intercalary vein usually indistinct, nearer the median than the ulnar vein.
 F. Tegmina normal. Intercalary vein curved. Pronotum with



Spharagemon. Fig. 3.

the median carina crested, deeply notched by the principal sulcus. No secondary sulcus evident on the median carina. Disk of hind-wing lemon-yellow with dark border, tip transparent. Hind tibiae red or orange, knee dusky with a pale band beneath. *Spharagemon*. Page 16

- FF. Tegmina narrow. Intercalary vein straight and but faintly visible. Median carina of the pronotum low and of equal height throughout, intersected by the principal sulcus. Sometimes the suggestion of a secondary sulcus is discernable in front of the principal sulcus. *Scutellona*. Page 17

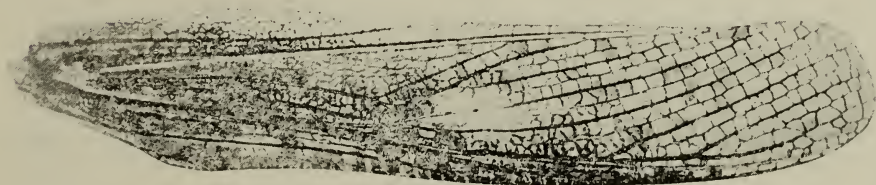
- BB. Median carina of the pronotum distinctly intersected twice by sulci. Disk of hind-wing vermillion-red (sometimes orange or yellow) bordered by a dark area, the wing having a transparent tip. Hind tibiae light, with three dark bands below the knee. *Peridonia*. Page 17

- AA. Disk of hind-wing transparent or translucent.
 B. Median carina of the pronotum cut by but one sulcus.
 C. Median carina of the pronotum low. Disk of pronotum flat. Disk of hind-wing transparent with dark veins. Facial carinae united at the apex of the vertex. Hind tibiae pale with dark tips. *Camulio*. Page 17

- CC. Pronotum with median carina distinct. Disk sloping at least on the prozona. Disk of hind-wing transparent or translucent with a dark tip. Facial carinae converging at the apex of the vertex, but not united. Hind tibiae black or dusky with light bands below the knees.
- D. Disk of pronotum flat on the metazona, sloping on the prozona. Facial carinae compressed in sharp ridges. Median carina of the pronotum cut about the middle by the principal sulcus. Insect granulated in appearance. *Encoptolophus*. Page 18
- DD. Disk of pronotum sloping on both the prozona and metazona. Facial carinae not compressed into sharp ridges. Median carina of the pronotum cut in front of the middle by the principal sulcus. In fresh or dried specimens a yellowish line is present passing lengthwise of the body through the upper part of the eye. Insect smooth in appearance. *Chortophaga*. Page 18
- BB. Median carina of the pronotum with two notches, the first being least prominent.
- C. Wing with the radiating veins of the anal field normal, not swollen. Antennae of male, as long or longer than hind femora. Insect light tan, mottled rather sparingly, with dark splotches. *Trimerotropis*. Page 19
- CC. Wing with the radiating veins of the anal field swollen. Antennae of the gray, mottled male much shorter than hind femora. Insect dark with black. Black often predominating. *Circotettix*. Page 19

ARPHIA. Stal.

Body compressed. Insect dark brown in color, tegmina densely spotted. Median carina of the pronotum usually compressed, entire or but slightly



Arphia. Fig. 4.

intersected by the principal sulcus. Disk of hind-wing brightly colored with a dark margin, tip somewhat lighter. Three species of this genus are recorded from the state. These are readily separated by the following key.

- A. Median carina of the pronotum cristate, arched. Foveolae of the vertex quadrate. Facial carinae with the sides nearly parallel. Disk of hind-wing orange. *xanthoptera*.

AA. Median carina of the pronotum distinct, but not arched or compressed.

- B. Facial carinae convergent above, meeting at the vertex. Foveolæ of the vertex broader than long. Anal margin of tegmen often marked part way with a light streak. Disk of hind-wing sulphur-yellow.



- BB. Facial carinae not convergent at vertex. Foveolæ of the vertex longer than broad. Disk of hind-wing red or orange-yellow.



HIPPISCUS. Saussure.

Insect large. Disk of pronotum flat and rugose, median carina low, but conspicuous. Tegmina with large spots. Disk of hind-wing brightly colored.

Hippiscus tuberculatus Pal. de Beauv. is dull grey-brown, with irregular splotches of dark brown. Prozona shorter than metazona. Pronotum terminates behind in an acute angle. Hind femora with upper and lower carinae prominent; hind tibiae yellow with dark spines. The disk of the hind-wing coral-red, rarely orange, with a darker border, the costal area being yellow and the tip transparent. This species passes the winter in the nymph stage, the adults appearing early in the spring, the young hatching in late summer or early fall. Found in dry sandy areas and very rare.

Hippiscus discoideus Stal. is also found in the state, it differs from *tuberculatus*, in that the hind margin of the pronotum forms a right or an obtuse angle. The prozona is nearly as long as the metazona. The apical portions of the tegmina being distinctly spotted. While this species is by no means general in the state, it occasionally occurs in colonies.

DISSOSTEIRA (Scudd).

The members of the genus *Dissosteira* have slender, compressed bodies. The head is prominent. The prozona slopes down from the median carina, the metazona being flat. The median carina is compressed and considerably arched behind, with a narrow deep notch in front of the middle. But one species of this genus has been found in the state. *Dissosteira carolina* Linn.

SPHARAGEMON (Scudd).

The members of the genus *Spharagemon* very closely resemble those of the genus *Dissosteira*. By some authors *Spharagemon* is considered but a sub-genus of *Dissosteira*, while others do not attempt to separate the two.

The intercalary vein is less distinct than in *Dissosteira*, also, it is nearer

to the median than to the ulnar vein. (Compare Fig. 3 and 2. The disk of the hind-wing is yellow bordered by a dark band, the tip usually being transparent. The hind tibiae have at least the apical portions red. Two species are recorded from the state:

A. Median carina of the pronotum with a vertical notch. Hind tibia with an intermediate black band. Apex coral-red and knee white.

AA. Median carina of the pronotum with an oblique notch. Hind tibia coral-red with knee lighter, black band wanting. *bolli.*
wyomingianum.—*Call*

SCIRTETICA (Saussure).

Scirtetica has the median carina of the pronotum low, of nearly equal height throughout. When viewed from the side, it does not appear deeply notched by the principal sulcus. Tegmen narrow with the intercalary vein straight. Hind tibia reddish or yellowish. This genus is represented in the state by a single species, *Scirtetica marmorata* Harr. It is brownish-grey in color, mottled with dark spots. The pronotum is suddenly narrowed in front of the middle. The median carina of the pronotum is more prominent on the prozona than on the metazona. The disk of the hind-wing is light yellow, with a dark border. The tip transparent, with two black spots. Hind tibia coral-red with a black band below the knee, followed by a white ring, apex black. Common in open spaces on vegetation near pine forests.

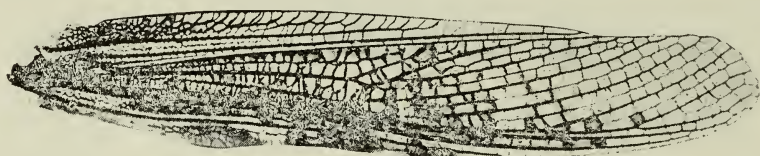
PSINIDIA (Stal).

Insect small, slender and compressed. Head prominent, eyes conspicuous, facial carinae compressed into distinct ridges, disk of head almost flat. Sides of pronotum much compressed in front of the middle, the median carina compressed and twice distinctly notched by sulci. Tegmina are long and narrow. Disk of hind-wing varying in color, usually orange-red, rarely pale yellow, occasionally semi-transparent, bordered by a black band, tip of wing transparent. *Psinidia fenestralis* Serv. is the only species of this genus found in the state. It is rare, found along sand bars and in dry, sandy places.

CAMNULA (Stal).

Insect small, body slender, resembling *Hippiscus* in appearance, but much smaller. Disk of the hind-wing colored but transparent with dark veins. Pronotum with disk flat; lateral carinae entire and well developed; median carina low, of equal height throughout, but faintly notched by the principal sulcus. This genus is represented by a single species, *Camnula pellucida* Scudd. The color is tan or light brown, irregularly flecked with darker spots. Two splotches remain constant in all specimens; a triangular dark

spot back of the eye, and an oblong black mark on the front lateral portion of the pronotum. Tegmina more or less distinctly yellowish-brown, with



Camnula. Fig. 5.

dark spots. This species varies considerably in size and markings. It is common throughout the state.

ENCOPTOLOPHUS (Scudd).

Insect of medium size, body somewhat compressed, head slightly swollen. Pronotum with the metazona flattened, the prozona somewhat roughened; the median carina notched in the middle by the principal sulcus, nearly equal in height throughout, sometimes higher on the prozona than on the metazona. Lateral carina distinct only on the metazona. *Encoptolophus sordidus* Burm., the clouded-winged locust, is the only species of this genus found in the state. It is dirty dark-brown in color, irregularly mottled



Encoptolophus. Fig. 6.

with light spots. Disk of pronotum usually with a distinct dirty light x-shaped mark. Tegmen crossed by two transverse dirty white bars. Disk of wing transparent yellow, border smoked, tip darker. Hind femur with transverse bands. Hind tibia dusky with a lighter ring near the base.

CHORTOPHAGA (Saussure).

Body slender, compressed. Head small. Pronotum with sloping disk, median carina well developed, faintly notched in front of the middle by the principal sulcus. Lateral carinae distinct on the metazona. Two forms of this genus are found in the state, the green form, *C. viridifasciata*, De Geer, and the brown form which is known as var. *infuscata*.

Chortophaga viridifasciata has the head, pronotum, hind femora and the front margin of the tegmina grass green. That part of the tegmina showing on the dorsum varies in color from reddish-purple to brown. The disk of the wing is transparent or pale yellowish with a dusky border, the costa is marked with a short dark bar about one-fourth the length of the wing

from the apex. The hind tibia varies in color, but is usually a light-brown or a dull pale blue, with a white ring near the base. Throughout the season



Chortophaga. Fig. 7.

the green females and the brown males predominate. This insect passes the winter in the nymph stage, and is one of the earliest Orthoptera to appear in the spring.

TRIMEROTROPIS (Stal).

Body clothed with long hairs, compressed. Eyes prominent. Median carina of the pronotum with two broad notches in front of the middle. Tegmen long and narrow, tapering at the apex. *Trimerotropis maritima* Harr. is the only species of this genus found in the state. It is light-tan in color, sprinkled with irregular splotches of dark-brown or black. Hind tibia pale yellow, with dark tipped spines. Disk of wing semi-transparent or yellowish with a narrow black band, tip transparent. Insect found along sandy beaches.

CIRCOTETTIX (Scudd).

Body clothed with long hairs, compressed. Eyes prominent. Median carina of the pronotum broadly notched twice in front of the middle. Tegmen rather broad, blunt at tip. *Circotettix verruculatus* Kirby is the only species of this genus found in the state. It is dark-grey in color, densely mottled with black, often the black predominating. Disk of the hind-wing semi-transparent or yellowish, bordered by a narrow black band, apex usually transparent with a dark tip. Hind tibia yellowish with a black band at the knee, one at the apex, and a broad one just before the middle.

ACRIDINÆ.

The members of the sub-family Acridinæ are readily separated from other Acrididæ by the presence of a well developed prosternal spine. The genera differ widely in appearance and size. The face, with the exception of *Leptysma*, is nearly perpendicular. The pronotum is usually smooth, broadly rounded at the back, with the median carina low and of nearly equal height throughout; lateral carinæ often obsolete. Tegmina variable, sometimes wholly wanting; abbreviated and long-winged forms occurring in the same species. Disk of the wing never brightly colored, transparent. The most injurious of our Orthoptera belong to this sub-family.

Key to the Genera of *Acridinæ*.

- A. Face oblique. Antennæ much flattened at the base. *Leptysma*. Page 21
- AA. Face nearly vertical. Antennæ thread-like.
- B. The inner margins of the meso-sternal lobes straight. Sub-anal plate of male deeply notched at the apex. *Schistocerca*. Page 21



- BB. The inner margins of the mesosternal lobes curved; sub-anal plate of the male not deeply notched. *Melanopli*.

Key to Genera of *Melanopli*.

- A. Insect bright green in color.
- B. Tegmina well developed. Sub-anal plate of the male with a distinct sub-apical tubercle. *Hesperotettix*. Page 22
- BB. Tegmina wanting. The sub-anal plate often prolonged into a distinct apical conical tubercle involving the apical margin, the lateral margins but slightly swollen. *Podisma*. Page 22
- AA. Insect brownish-red or brownish-green in color.
- B. Males with the disk of the pronotum nearly always twice as long as the average width; the lateral carinæ parallel; each side of the prothorax with a broad black band just below the lateral carina. Antennæ usually as long or longer than hind femora; cerci long and spoon-shaped. *Paroxya*. Page 23
- BB. Male with the disk of the pronotum not twice as long as broad, usually only about one and one-half times as long as broad. Disk of the pronotum more or less constricted in the middle. Antennæ short, shorter than the hind femora. Sides of the pronotum usually without the black bar just below the lateral carina.
- C. Head not large in proportion to the pronotum, not prominent, but little longer than the prozona. Pronotum not flaring to receive the head. Cerci of male variable, but not styliform. *Melanoplus*. Page 23
- CC. Head large in proportion to the pronotum, especially on top, prominent, nearly half as long again as the prozona. Pronotum slightly expanded or flaring to receive the head. Cerci of male (styliform) long, slender and pointed, furcula small. Very rare in Michigan. *Phoetaliotes*. Page 27

LEPTYSTMA (Stal).

The members of the genus *Leptystma* very closely resemble the members of the sub-family Tryxalinae, but have been removed from this group because the prosternum is armed with a small blunt spine or tubercle. The vertex of the head projects horizontally in front of the eyes, the front is strongly sloping. The antennae are short, pointed and decidedly flattened at their bases. The members of this genus are considered as southern forms, one species, *Leptystma marginicollis* Serv. has been collected at Cedar Point, Ohio. It inhabits low, damp marshy places, and it is probable that it exists in some of our southern swamps. The body is very slender, much compressed. Tegmina either abbreviated or well developed, when well developed extending to or beyond the tip of the abdomen. Hind-wings transparent. The general color of the insect is grey-brown, marked more or less with darker spots. A dark streak extends from the lower border of each eye, along the sides of the pronotum and back to the hind leg. A light streak extends immediately below the dark streak for the entire distance.

very doubtful

SCHISTOCERCA (Stal).

The members of this genus are reddish-brown in color, relatively large in size, usually measuring two inches or more. Tegmina always well developed; the wings transparent. Pronotum with the median carina distinct, the lateral carinae wanting; the prozona convex, the metazona more or less flattened; the mesosternal lobes are longer than broad, their inner margins straight. The supra-anal plate of the male is deeply notched. The members of this genus usually are found in trees and underbrush. At least three species are recorded from the state, these may be separated by the following key.

- A. Insect reddish-brown in color. Tegmina with large distinct brown blotches on a light background. A yellow stripe is usually present, extending from the vertex of the head down the dorsum, part or all of the way over the closed tegmina. *americana.*
- AA. Color yellowish-brown. Tegmina usually uniform in color, or but faintly marked with darker splotches, background argillaceous (clay color).
- B. Insect a dirty brownish-yellow. A distinct pale yellow stripe extending from the vertex of the head down the dorsum, to at least two-thirds the length of the closed wings. *alutacea.*
- BB. Insect usually uniform rust-red in color. Dorsum without a yellow streak. *rubiginosa.*

2 forms of americana

MELANOPLI.

The Melanopli are small or medium sized Acridinæ. The prosternum is armed with a prominent conical spine; the inner margins of the mesosternal lobes being curved; the median carina of the pronotum is low, and the lateral carinæ usually wanting. The head is not greatly enlarged, the face being nearly vertical with the foveolæ of the vertex absent. The tegmina are variable, well developed or wanting. All tarsi bear pads between the claws. The Melanopli are confined practically to America in distribution, the largest number of species being from North America. The characters of the male pygidium are used almost exclusively in separating the species. The tip of the male abdomen is curved upward and the sub-anal plate is not tuberculate, the furcula is variable, but usually present; the cerci are also variable, being rarely longer than the supra-anal plate. The Melanopli of Michigan are represented by the following genera: *Hesperotettix*, *Podisma*, *Paroxya*, *Phoetaliotes* and *Melanoplus*. See page 20 for key to Genera of Melanopli.

HESPEROTETTIX (Scudd).

This genus is represented in the state by a single species, *Hesperotettix pratensis* Scudd. Blatchley records it from Lake Co., Indiana, and doubtless it exists in the dry pasture-lands of southern Michigan. This species is of a uniform, vivid, pale yellowish-green color, with a reddish-purple stripe extending down the median carina of the pronotum and the dorsal two-thirds of the closed tegmina. The antennæ are nearly the same color as the dorsal stripe. There is a short brownish bar below each eye, and one extending diagonally along the middle of the pronotum.

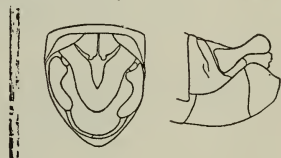
PODISMA (Latreille).

Podisma variegata Scudd. has been reported by the Michigan Biological Station as collected around Douglas Lake during the summer of 1910. We have not been able to obtain specimens of this species. The members of this genus are confined to high latitudes and to high altitudes. It is the one Melanoplid recorded from all over the globe. The tegmina are rudimentary or wanting. The pronotum is not constricted in the middle, somewhat wider in the rear than in the front; the median carina usually is indistinct, the lateral carinæ wanting. *Podisma variegata* Scudd. is olive green with a fuscous bar extending from back of the eye across the middle of the thorax, directly beneath which is a pinkish yellow bar. Males usually with a median, dorsal streak extending from the front part of the thorax down the dorsal two-thirds of the abdomen. The antennæ are longer than the hind femora. The sub-anal plate of the male is distinctly tuberculate; the furcula no longer than the segment from which it arises; cerci long, emarginate in the middle, slightly widened at the tip, and somewhat flattened.

PAROXYA (Scudd.).

The members of this genus resemble those of *Melanoplus* to which they are very closely related. They may be quite readily separated from them by the following characters: The antennæ are longer than the hind femora. The disk of the pronotum is twice as long as the average breadth, sides being parallel. The female has metasternal lobes as distant as the mesosternal lobes. The sub-anal plate of the male is short, transverse, of equal width throughout, and somewhat swollen. The cerci of male are short and slender. Specific characters are based on the pygidium of the male. All members of the genus have the thorax marked on each side with a distinct, colored bar. They inhabit low damp places. Three species are recorded from Michigan. These may be separated by the following key.

- A. Furcula well developed, flat, ~~attinent~~ for three-fourths their length, after which they bluntly round off into knobs. *scudderi*.

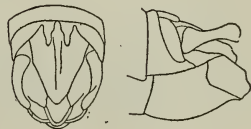


- AA. Furcula small, slender, pointed.

- B. Furcula attinent at base. *hoosieri*.



- BB. Furcula not attinent even at base. *atlantica*.



MELANOPLUS (Stal).

Body moderately stout, somewhat compressed. Tegmina always present, but variable in length, long and short-winged forms occurring in the same species. Tegmina when well developed, just equaling or but little surpassing the tips of the hind femora; the humeral vein straight, apically curved, nearly always ending either at or very near the apical margin and running for some distance almost parallel to the costal margin if not merging with it. In the short-winged forms the tegmina are usually about the length of the pronotum. It is to this genus that most of our *Acrididae* belong. Species are identified by the characters of the male. The following key is based on the male characters.

Key to species of *Melanoplus*.

- A. Wings short, not covering more than half the abdomen.
- B. Furcula well developed, extending over about one-third of the supra-anal plate. Cercus narrowing from base to tip, slightly curved in on the inner margin. Hind tibiae reddish-yellow. *dawsoni*.
- BB. Furcula small, not as long as the segment from which it arises.
- C. Cerci bowed inward on one side only.
- D. Apex of sub-anal plate entire.
- E. Apex of sub-anal plate slightly elevated. Cerci of male almost triangular. Hind tibiae blue. *islandicus*.
- EE. Apex of sub-anal plate rounded. Cerci of male short, bowed inward on upper edge. Hind tibiae yellowish-red. *amplectens*.
- DD. Apex of the sub-anal plate rounded with a slight depression in the center. Cerci of male long and stout, truncate at their apices with the upper margins bowed in. Hind tibiae reddish-yellow. *fasciatus*.
- CC. Cerci of male slender, the under margins bowed in, rounded at their tips. Apex of sub-anal plate produced into a slight tubercle. Hind tibiae blue. *viridipes*.
- BB. Both sides of cerci of male bowed in. Apex of sub-anal plate elevated. Furcula stout and shaped like an indian-club. Hind tibiae reddish. *blatchleyi*, *welshii*.
- AA. Wings well developed, covering at least three-fourths of the abdomen.
- B. Furcula absent or indistinct.
- C. Cerci with their apices entire, much expanded beyond the middle, the upper portion being more expanded than the lower. Hind tibiae reddish. *punctulatus*.
- CC. Cerci apically notched.
- D. Insect with decided yellow streaks, extending along the lateral carinae and back along the tegmina. Cerci broad, each with an indentation on the lower apical third. Hind tibiae red.* *femoratus*, *bivittatus*.

*(A southern species. *Melanoplus bivittatus*, much resembles *M. femoratus*. In *bivittatus* the hind tibiae are pale blue and the furcula is very indistinct, if present at all).

DD. Insect without the yellow streak along the lateral carina and the tegmen.

E. Cerci expanded apically, each with a slight indentation on the lower apical half. Hind tibiae yellow or orange-red.



differentialis.

EE. Cerci expanded apically, each deeply notched at tip, giving it a two-pronged appearance, the lower prong being somewhat the smaller. Hind tibiae deep orange-red.

collinus.

BB. Furcula distinct.

helleri lucidus.

C. Furcula well developed, extending over one-third or more of the supra-anal plate.

D. Cerci short, each bluntly rounded at tip, tapering from the base to the tip, and slightly incurved on the upper margin.

E. Tip of sub-anal plate without notch, Furcula somewhat flattened at base. Hind tibiae yellowish.

dawsoni.



EE. Tip of sub-anal plate with a distinct notch. Furcula sharply pointed. Cerci large. Hind tibiae reddish-yellow.

alaskanus.



DD. Cerci, each tapering from the base toward the tip, nearly pointed at apex, in-curved on both upper and lower margins.

E. Tegmina usually extending beyond the hind femora. Hind tibiae usually bright red. The distal ends of the cerci less than half the width of their bases. *femur-rubrum*.



EE. Tegmina usually not surpassing the hind femora. Hind tibiae reddish-yellow. Distal ends of male cerci more than half as wide as at their bases.

extremus borealis.

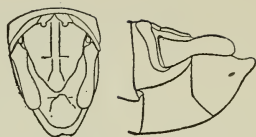


CC. Furcula small or wanting, extending over less than one-third the supra-anal plate.

D. Cerci of nearly equal width throughout.

E. Furcula very small, mere points.

Cerci long, extending beyond the tip of the supra-anal plate. Sub-anal plate slightly notched. Hind tibiae reddish-yellow. *fasciatus*.



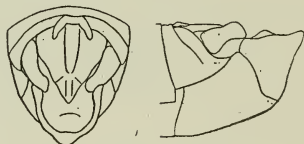
EE. Furcula about one-fourth the length of the supra-anal plate. Cerci short, not extending beyond the tip of the supra-anal plate. Narrowed slightly in the middle.

F. Cerci truncate at tips, in-curved on both margins. Apex of sub-anal plate notched. Hind tibiae blue. *angustipennis*.



FF. Cerci bluntly rounded at their tips.

G. Apex of sub-anal plate rounded. Hind tibiae reddish-yellow. Cerci slightly compressed in the middle, spoon-shaped at the tip.



GG. Apex of the sub-anal plate decidedly notched in the middle. Cerci in-curved on the upper margin only. Hind tibiae red. *foedus: Stonei*



DD. Cerci expanded apically. *atlantis: mix: Cenus*

E. Cerci with an apical notch. Furcula small, mere points; equaling in length the segment from which it arises.

F. Cercus with an incision on the apical portion, which gives it a forked appearance, the lower part being the smaller. Furcula blunt and short. Hind tibiae red. *luridus*.



FF. Cerci widened apically, with a slight indentation on the lower apical half. A distinct yellow stripe on each side extending along the lateral carina of the pronotum and back over the closed tegmina. Hind tibiae red. *femoratus: bivitatus*



- EE. Cerci expanded apically, each with a crescent-shaped notch on the lower margin. Furcula sharply pointed, nearly twice the length of the segment from which it arises. Hind tibiae either red or blue.



minor.

Confusus

PHOETALIOTES (Scudder).

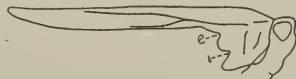
Phoetaliotes is represented by a single species, *Phoetaliotes nebrascensis* Thos. It resembles *Melanoplus* to which it is closely related. The head is somewhat swollen, especially on the dorsum. The pronotum flares slightly to receive the head. The abdomen of the male is compressed with the tip recurved; and the sub-anal plate is long and narrow, with the lateral margins swollen, especially at their bases; the tip of the sub-anal plate being pointed, but not elevated. The furcula is small, shorter than the segment from which it arises, and the cerci long and styliform. The tegmina vary somewhat, but when well developed the venation is quite distinctive. In the short-winged forms the tegmina are about the length of the pronotum; in the long-winged forms the tegmina surpass the hind femora; the humeral vein curves broadly, ending on the costal margin, at least as far before the apex as the breadth of the tegmen, nowhere running closely parallel to the costal margin nor merging into it.



TETTIGINÆ.

The members of this sub-family are distinguished from other Acrididæ by the following characters: The pronotum is prolonged over the abdomen to, or beyond the tip. The tarsi are without pads between the terminal claws. Tegmina are rudimentary, merely small scales at the bases of the wings, the wings are usually well developed, often reaching beyond the tip of the prolonged pronotum. The Tettiginæ are commonly known as the "Grouse locusts." They hibernate over winter in the adult stage, and, therefore, appear early in the spring. During an open winter or during a thaw it is quite common to find the adults in evidence. All members of this group are dark-grey or brown-grey in color; sometimes strikingly mottled. Two distinct groups of this sub-family are found in Michigan. They are easily separated by the following characters:

- A. Antennæ with 12 to 14 joints; front femora somewhat compressed and carinate above. *Tettigiæ*. Page 28
- AA. Antennæ with 16 to 22 joints; front femora distinctly and broadly sulcate above. *Batrachidæ*. Page 31



Pronotum and head of Tettigid; e, elytral sinus, l, lateral sinus.

TETTIGIÆ.

There are at least three genera of Tettigiæ found in the state. These may be separated by the following key:

- A. Vertex of the head, when viewed from the side, projecting beyond the eyes.
- B. Antennæ with 12 or 13 joints. Pronotum with the dorsum somewhat sloping down on the sides and prolonged in front over the disk of the head. Median carina arched. *Nomotettix*. Page 28
- BB. Antennæ with 13 or 14 joints. Pronotum with the dorsum somewhat flattened, not prolonged over the head, median carina low, but distinct. *Tettix*. Page 29
- AA. Vertex of the head when viewed from the side, not projecting in front of the eyes. *Paratettix*. Page 30

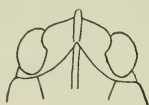
NOMOTETTIX (Morse).

Body small, somewhat compressed. Pronotum extending over the top of the head in a point; seldom extending backward beyond the tip of the abdomen, median carina arched longitudinally. Hind wings rudimentary. Specimens with wings and pronotum well developed are rare. (The following characters are based on Dr. Hancock's Key to Species of Nomotettix, "Tettigidæ of N. America, p. 54-55).

- A. Disk of head with elongate shallow grooves on either side of the median carina. Face decidedly receding. Insect very small. *parvus*. Morse.
- AA. Disk of the head with quite deep longitudinal grooves on either side of the median carina.
- B. Median carina of the pronotum strongly compressed. Body small.
- C. Median carina of the head when viewed from the side distinct above the eyes. *compressus*.



- CC. Median carina of the head when viewed from the side scarcely elevated above the eyes. *arcuatus*.



- BB. Median carina of the pronotum low but distinct, compressed, a slight depression on the mid-dorsal line when viewed from the side. Body larger. *cristatus*.



TETTIX (Charpentier).

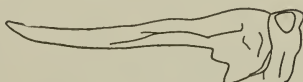
Vertex of the head when viewed from the side projecting in front of the eyes. Pronotum truncate on the anterior margin, or but slightly produced. Median carina low but distinct. Dorsum flat, granulate. The upper lateral sinus nearly, or quite as deep as the lower. Wings and pronotum usually well developed, extending to, or beyond the tip of the abdomen. Forms with abbreviated wings and pronotum are common. At least six distinct species with three varieties are recorded from the state.

Key to the Species of *Tettix*.

- A. Median carina of the pronotum well developed, the disk sloping.
 B. Head, when viewed from above with the frontal keel inconspicuous. Body slender. Dorsum of pronotum much prolonged.
 C. Wings well developed. *granulatus*.

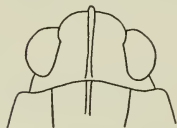


- CC. Same as above, but with wings and pronotum abbreviated. *granulatus* var. *variegatus*.
 BB. Head, when viewed from above, with the frontal keel prominent.
 C. Median carina of the pronotum with a depression just above the elytral sinus, arched in front of the sinus.
 D. Median carina distinctly compressed. Lateral carinae not well developed. Depression in the median carina quite distinct. *acadicus*.



- CC. Median carina of the pronotum without depressions in front of the lateral sinus.

- D. Dorsal surface of the head not excavated. Vertex of the head, when viewed from the side, projecting in front of the eyes in a knob-like prominence for nearly the width of the eye. Body stout.
- E. pronotum and wings extending beyond the tip of the hind femora. *hancocki*.



- EE. Pronotum and wings abbreviated. *hancocki abbreviatus*.
- DD. Dorsal surface of the head with depressions on either side of the median carina. Vertex of the head, when viewed from the side, projecting but slightly beyond the eyes. Body slender.
- E. Pronotum and wings extending beyond the tip of the hind femora. *ornatus*.



- EE. Pronotum and wings abbreviated. *ornatus triangularis*.
- AA. Median carina of the pronotum indistinct, scarcely or not at all developed. Disk flat.
- B. Body slender. Eyes conspicuous. The front portion of the head with the median carina distinct, deep depressions on either side of the median ridge. *arenosus*.



- BB. Body small, eyes small. The front portion of the head with the median carina distinct, a shallow depression on either side of the median ridge. *obscurus*.

PARATETTIX (Boliver).

The members of this genus are quite readily separated from the other genera of this sub-family by the following characters: The pronotum is truncate on the front margin, disk flat, median carina low. The vertex of the head does not extend in front of the large prominent eyes. The antennæ have 14 segments. But one species of this genus is recorded from the state: *Paratettix cucullatus* Burmeister. The vertex of the head is about the width of one eye. The head is withdrawn into the pronotum up to the eyes. This species is semi-aquatic, and not very common.



BATRACHIDEÆ.

TETTIGIDEA (Scudder).

Antennæ with 22 segments. Body robust. Front femora grooved along their upper margins. Disk of the head with small lobes which indent the eyes. Pronotum with the median carina low, disk sloping down from the middle, lateral carina present. Pronotum and wings usually well developed, but abbreviated forms common.

Key to the Species of *Tettigidea*.

A. Pronotum prolonged over the head in a distinct point.

B. Pronotum and wings well developed, surpassing the tip of the hind femora. *armata* Morse.



BB. Pronotum and wings aborted.

armata depressa Morse.

AA. Pronotum prolonged over the head, the anterior dorsal margin rounded.

B. Eyes not prominent. Wings and pronotum passing the hind femora.

parvipennis pennata Morse.

BB. Pronotum and wings aborted.

parvipennis Morse.



Tettigidea parvipennis pennata is the commonest species of this genus found in this state. The males are very strikingly marked. The lower part of the head and lower half of the side of the pronotum in front of the anterior foot are ivory white. Sometimes the side of the pronotum toward the apex is similarly marked. Two other species very closely related to *parvipennis pennata* are recorded from the state.

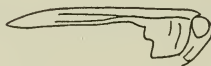
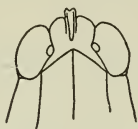
T. lateralis Scudder and *T. polymorpha* Scudder. Both are considered by authorities as southern forms and very closely allied to *parvipennis*. *T. lateralis* has the vertex of the head but little advanced in front of the eye. The front margin of the pronotum is broadly rounded. The eyes are



T. lateralis.

prominent. Wings and pronotum well developed. Males marked similarly

to those of *parvipennis pennata*. *T. polymorpha* is very similar to *T. lateralis*, but smaller, with wings and pronotum aborted.



T. polymorpha.

LOCUSTIDÆ.

Locustidæ have four jointed tarsi. The antennæ are very long, usually much longer than the body. The ovipositor is compressed and sword-shaped. The ocelli are usually wanting. The ear when present is located on the front tibia. The males are the only individuals that are capable of producing their characteristic sound. The tegmen has a small transparent area on the dorsal surface, in the upper tegmen this area is crossed by a vein with very small teeth on the lower surface. The sound is produced by rubbing these teeth on the upper side of the under wing-cover.

Key to the Genera of *Locustidæ*.

- A. Wingless usually.
 - B. Pronotum not extending over the meso and meta-notum. Tegmina absent. Wingless. *Ceuthophilus*. Page 33
 - BB. Pronotum covering meso and meta-notum, and part of the first segment of the abdomen. Tegmina of male covering about half the abdomen. Wing abbreviated or wanting. *Atlanticus*. Page 33
- AA. Winged.
 - B. Prosternal spines or tubercles present.
 - C. Tegmina longer than wings, much expanded in the middle, curled so as to be concave within. Pronotum crossed by two transverse sulci. Head rounded at vertex. Insect large. *Cyrtophyllus*. Page 34
 - CC. Tegmina surpassed at tip by wings, narrowed, or but slightly expanded in the middle. Pronotum entire, or crossed by but one sulcus. Head not rounded at the vertex.
 - D. Head oblique. Vertex bluntly tuberculated.
 - E. Insect small. Body slender. Vertex of head with rounded tubercle. Prosternal spines small. Tegmina narrow, straight and varying in length. Ovipositor narrow and usually straight. *Xiphidium*. Page 34
 - EE. Insect medium in size. Body stout. Prosternal spines well developed. Tegmina slender, the apical half narrowing. Ovipositor stout and broad, the apical portion curving upward. *Orchelimum*. Page 35
 - DD. Vertex of head prolonged into a large conical projection. *Conocephalus*. Page 36
 - BB. Prosternal spines or tubercles absent. Vertex of head blunt.

- C. Tegmina but slightly widened in the middle, long and narrow. Apex of the vertex blunt and narrow. Ovipositor short, broad and curved abruptly upward. Apical portion crenulate. Both sub-anal and supra-anal plates of the male prolonged into flat processes.

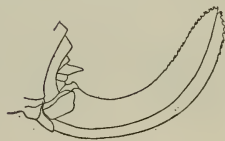
Scudderia. Page 37



- CC. Tegmina expanded in the middle, but not concave. Supra-anal plates of the male short and flattened.

- D. Ovipositor of medium size and curved gradually upward, strongly serrate on both edges. Supra-anal plates of the male short and truncate. Sub-anal plates of male prolonged; cerci strongly tapering.

Amblycorypha. Page 37



- DD. Ovipositor small and curved abruptly upward, finely serrate. Supra-anal plate of male, short and bluntly rounded. Sub-anal plates of male prolonged; cerci long, curved and slightly tapering.

Microcentrum. Page 38



CEUTHOPHILUS.

The Ceuthophilids are commonly known as "Stone-Crickets," or "Camel-Crickets." They are nocturnal in habit, hiding during the day in damp dark places. They may readily be separated from the other Locustidæ by the following characters: Wingless. The pronotum does not cover the meso and meta-notum. Body arched. Head projecting down and backward between the front legs. The antennæ are very long, two or three times the length of the body. The tarsi are without pulvilli. The hind tibiæ are furnished with two sizes of spines on the upper surfaces, long and short alternating; the under surface usually being smooth except in the middle where it sometimes has a few uniform spines. The tibiæ are considerably longer than the hind femora and equipped at their apices with four pairs of spines. At least one species is found in Michigan, doubtless many others exist, but since the species are very difficult to distinguish, they are not readily recognized. The species collected agree very well with the description of *Ceuthophilus lapidicolus* Burm.

ATLANTICUS (Scudd.).

The members of this genus are usually found on high, dry ground in pasture or on low shrubs. They live largely on vegetable matter, and obtain their food in day time. *Atlanticus* very much resembles a huge cricket in ap-

pearance. It is commonly known as the "Shield-back Grasshopper," because of the peculiar shield-shaped pronotum. The pronotum, which extends back over the first abdominal segment, is narrower in front than in the back; the dorsum is flat with the sides bending abruptly downward; the lateral carinæ are well developed. The prosternum is armed with a pair of erect spines. The tegmina of the males are well developed, sometimes projecting over half the abdomen. Those of the female are very rudimentary, and covered by the pronotum. Wings rudimentary or wanting in both sexes. Ovipositor nearly straight. One species of this genus has been recorded from the state, *Atlanticus pachymerus* Burm. It is almost uniform reddish-brown in color, usually sprinkled with small black dots, the tegmina and sides of the pronotum darker. The posterior angle of the pronotum is marked with a narrow curved yellow line, which, in the female is bordered with black. The pronotum is longer than half the length of the hind femur.

We have collected it at Long Lake, near Howell.

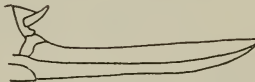
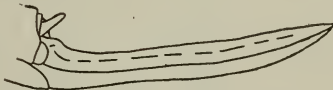
CYRTOPHYLLUS (Burm.).

The live insect is dark leaf-green in color. The tegmina are conspicuously veined, giving them a leaf-like appearance. They are broad, longer than the wings, with rounded tips, curved so that they may be wrapped about the body. Vertex of the head compressed into a small triangular spine which is grooved above. Antennæ much longer than the body. Eyes nearly round. Prosternum armed with two short spines. Pronotum cut by two transverse sulci. Ovipositor of the female saber-like, serrate on the lower apical margin. Sub-anal plate of the male leaf-like, hollowed out on the upper margin. Male cerci forked so that the lower prongs support the sub-anal plate. One species of this genus has been recorded from the state, *Cyrtophyllus concavus* Scudd. It is commonly known as the "True Katydid" or the "Broad-winged Katydid." The call of the male of this species is the loudest of all our "Katydids." They usually live in colonies and are seldom collected in large numbers since they congregate in the tree tops.

Conocephalus XIPHIDIUM (Serville).

The body is small, slender and compressed. The vertex of the head projects forward in a blunt tubercle, the front receding. Prosternal spines very small. Tegmina, even when well developed, seldom surpassing the tip of the abdomen. Wings usually shorter than the tegmina. Ovipositor narrow, straight, or but slightly curving upward, sometimes longer than the body. The members of the genus *Xiphidium* are the smallest of the winged Locustidæ. No other genus in this family presents any wider range of variation within a single species. Long or aborted tegmina, or green and brown insects of the same species occurring in the same locality. The following key will separate the Michigan *Xiphidia*: The characters being based on the structure of the females.


Key to the Species of *Xiphidium*. *Conocephalus*

- A. Ovipositor shorter than the body.
 B. Ovipositor straight.
 C. Tegmina surpassed by the wings at their tips; tegmina extending beyond the tip of the abdomen, often to the tip of the ovipositor. *fasciatum*

 CC. Tegmina surpassing the wings at the tip, but seldom reaching the tip of the ovipositor. *brevipennis*

 BB. Ovipositor slightly curved, very much like that of *Orchelimum*. Tegmina seldom covering more than half the abdomen. *nemorale*
 AA. Ovipositor as long or longer than the body.
 B. Ovipositor about half as long again as the hind femora.
 C. Sides of the body dull reddish-brown. Lower ridge of the hind femur armed on the outer side with at least three small black spines. *attenuatum*
 CC. Sides of the body greenish. Lower ridge of the hind femora without spines. *strictum*
 BB. Ovipositor equaling, or but little longer than the hind femora.
 C. Body slender, sides green. Tegmina covering about one-third the abdomen. *saltans*
 CC. Body stout, tegmina covering at least half the abdomen.
 D. Ovipositor longer than the body. Sides of the body dark. *nigropleurum*
 DD. Ovipositor about equaling the body in length. Sides of the body brownish-green. *ensiferum* ?

ORCHELIMUM (Serville).

Very similar to *Xiphidium*, but larger. Prosternal spines quite distinct. Tegmina well developed, extending beyond the tip of the abdomen. Wings usually surpassing tegmina in length. Ovipositor stout; the apical half curved upward, seldom straight. The Michigan species may be separated by the following key which is based on the characters of the females:

Key to the Species of *Orchelimum*.

- A. Hind femora armed on the under side with spines.
 B. Ovipositor curved on the upper and the lower margins. Tibiæ and tarsi dark. Insect green. *nigripes*.
 BB. Ovipositor nearly straight on the upper margin. Tibiæ and tarsi green. Insect brownish-green. *volantum*.


AA. Spines of the hind femora wanting.

- B. Median brown stripe extending down the front of the face. Ovipositor curved on the upper as well as on the lower margin.

indianense.



BB. Median brown stripe down the front of the face wanting.

- C. Ovipositor curved on upper margin as well as on the lower.

- D. Insect slender. Tegmina not expanded at their bases, almost equal with the wings in length. Insect often brownish-green.

campestre.



- DD. Insect stout. Tegmina expanded at the base (especially in the male).

- E. Tegmina and wings nearly equal in length, the wings slightly longer. Legs and ovipositor brownish-green.

vulgare.



EE. Tegmina shorter than wings. Insect green.

glaberrimum ~~vulgare~~

CC. Upper margin of ovipositor nearly straight.

- D. Insect green. Tegmina and wings equal in length, with the tegmina somewhat expanded in the middle (especially in the male). Ovipositor of the female thick and heavy.

gladiator.

- DD. Insect pale-green or light-brown. Wings longer than tegmina. Ovipositor slender and almost straight on top.

delicatum

NEOCONOCEPHALUS (Thunberg).

The body is large, slender and compressed. The vertex of the head projects forward in a distinct cone which bears a sharp tooth beneath, just in front of the eyes. Tegmina well developed, surpassing tip of abdomen, and longer than the wings. Ovipositor of the female sometimes very long, always well developed, narrow and nearly straight. Insect green in color or brown. Two species have been recorded from Michigan which can be distinguished by the following key:

- A. Cone of the vertex slender, extending three mm. or more in front of the eyes. Ovipositor longer than the hind tibiae. *ensiger* Harris.
- AA. Cone of the vertex stout, less than three mm. in length. Ovipositor shorter than the hind tibiae. *robustus* Scudd.

SCUDDERIA (Stal).

All members of this genus are medium sized Locustidæ, bright green in color and usually found on bushes or low vegetation in damp places. The fastigium of the vertex is acuminate, no broader than the first antennal segment. Tegmina long, narrow, of nearly equal width throughout. Wings exceeding tegmina in length. The ovipositor is short, curved abruptly upward, apex finely serrate on both margins. The species of this genus are most readily determined by the peculiar structure of the sub-anal and supra-anal plates, which are both prolonged. Four species occur in Michigan, these may be separated by the following key:

Key to the Species of *Scudderia*.

- A. The supra-anal plate of the male broadly hol-
lowed out, with a median process.

texensis Sauss.-Pict.



- AA. Supra-anal plate of the male notched, median process wanting.

- B. Supra-anal plate of the male deeply notched, the lateral processes
swollen.

furcata Brun.



- BB. Supra-anal plate of male but slightly notched, the
lateral processes not swollen.

- C. The notches in the supra-anal plate forming an obtuse
angle; the apexes of the lateral processes pointed.

pistillata curvicauda Deg.



- CC. The notch in the supra-anal plate more nearly forming a right
angle; the apexes of the lateral processes rounded.

pistillata Brun.
curvicauda



AMBLYCORYPHA (Stal).

The fastigium of the vertex much broader than the first segment of the antenna. Tegmina broadened in the middle, rounded at their tips. Wings longer than tegmina. Ovipositor flat, broad, of medium length, curving gradually upward, and rounded at the tip, the apical portion distinctly serrate on both edges. Supra and sub-anal plates of the male very short. Two species occur in the state, of these *oblongifolia* is the common form.

- A. Tegmina oblong oval in shape; surpassing the hind femora.
oblongifolia Deg.
- AA. Tegmina rounded oval in shape. Not surpassing hind femora.
rotundifolia Scudd.

MICROCENTRUM (Scudd.).

Fastigium of the vertex broader than the first antennal segment. Insect large. Tegmina decidedly widened in the middle, overlapping on the dorsum making a distinct angle with the flat sloping sides. Ovipositor short, curved abruptly upward, both upper and lower edges finely serrate. Anal plates of the male truncate. Hind femora about half the length of the tegmina. But one species of this genus is recorded from the state. *Microcentrum laurifolium* L., which is commonly known as the "Angular-winged Katydid."

GRYLLIDÆ.

The family Gryllidæ includes the crickets. They are readily separated from other Orthoptera by the following characters: The tarsi are three-jointed except in *Ecanthus*, the pulvilli are wanting between the tarsal claws. The antennæ are very long and slender, usually much longer than the body. The ovipositor is spear-shaped, often enlarged near the tip, but tapering to a point at the apex. Ocelli usually are present. The ear when present is located on the front tibia. The males alone produce the characteristic creaking "song", the sounding area of the tegmina being similar in structure to that in the Locustidæ, but much larger. The tegmina are flat on the dorsum, bending abruptly down on the sides, the wings being variable, seldom well developed.

Key to the Genera of Michigan *Gryllidæ*.

- A. Front tibiæ much expanded, fitted for digging. Ovipositor of the female not visible.
- B. Antennæ with many segments, but not as long as the body. Hind femora not fitted for jumping. *Gryllotalpa*. Page 39
- BB. Antenna with only 10 or 12 segments. Hind femora fitted for jumping.
- C. Hind tibiæ with a pair of short spine-like plates. Hind tarsi wholly wanting. *Ellipes*. Page 40
- CC. Hind tibiæ with more than one pair of spine-like plates. Hind tarsi one-jointed. *Tridactylus*. Page 39.
- AA. Front tibiæ not expanded at their tips.
- B. Hind femora elongated and thickened, fitted for jumping.
- C. The last joint of the maxillary palpi twice the length of the one preceding it. *Nemobius*. Page 40
- CC. The last joint of the maxillary palpi not twice the length of the one preceding it. Ear visible on both sides of the front tibia. *Gryllus*. Page 41

- BB. Hind femora slender, not well fitted for jumping. Wings of male flat on dorsum, wider than the body; wings of female fitted down close around the body. Ovipositor straight, blunt, slightly enlarged at the tip, shorter than the hind femora.
- C. The basal joint of the antenna armed on the underside with a short, blunt, apical spine. Wings nearly twice as long as tegmina.
Xabea. Page 43.
- CC. The basal joint of the antenna sometimes with a swelling on the inner front margin, but never with a spine. Wings but little, if any longer than tegmina.
Ecanthus. Page 41.

GRYLLOTALPA (Linn).

Gryllotalpa is commonly known as the mole-cricket. The front tibia of *Gryllotalpa* is much expanded and equipped at the tip with four claws, the two upper ones being much the larger. One species of this genus occurs in the state, *Gryllotalpa borealis* Burm. While relatively common it is seldom collected, since it is an underground form, and very shy. It is dark cinnamon brown in color, covered with fine hairs which give it a velvety appearance. It measures an inch or more in length. Tegmina and wings are variable in length, the short-winged forms predominating. The hind femur is but slightly enlarged, and the tarsi short. The ovipositor is not visible, but the sex is readily determined by the venation of the tegmina, since those of the male are equipped with sound-producing apparatus. Individuals are believed to live several years. This creature sometimes becomes an enemy to root crops, especially in low, wet, mucky situations.

TRIDACTYLUS (Olivier).

Tridactylus resembles the mole-cricket in general appearance, but is much smaller, being less than half an inch in length. It is a sand loving form occurring in great numbers on the sandy lake shores. It builds miniature tunnels and burrows similar to those of the mole-cricket. The hind femora are thickened, fitted for jumping. The tegmina of the males do not have sounding-boards, and the ovipositor of the female is not visible. One species, *Tridactylus apicalis* Say, is recorded from the state. The general color of this species is black, or dark brown with light patches. The wings extend beyond the tip of the abdomen. The tegmina are bony, not reaching to the tip of the abdomen. The front tibia is not broadly expanded, but three or four small spines are located at the apex; hind tibia with four pairs of slender spine-like plates. Hind tarsi each with two segments.

ELLIPES (Say).

Ellipes is very similar to *Tridactylus*, but can readily be separated from it by the fact that the hind tarsi are wholly wanting, and that the hind tibiae each has but a single pair of short plates. One species of this genus is found in the state, *Ellipes minuta*, Scudd. It may occur in the same locality as *Tridactylus apicalis*. Scudd.

NEMOBIUS (Serville).

The members of this genus are the most social of all our crickets, differing from the rest of the family in that they are day feeders. They are small in size, never more than half an inch in length. Color, dirty brown or grey. The last joint of the maxillary palpus is twice the length of the one preceding it. The tibiae are furnished with long flexible spines, and the tegmina of the female have the veins running lengthwise. Several species occur in Michigan, which may be separated by the following key:

Key to the Species of Michigan *Nemobius*.

- A. Ovipositor straight, longer than hind femora.
 - B. Wings reaching to the tip of the ovipositor. Tegmina of the female reaching to the tip of the abdomen, light in color. Head marked with four longitudinal black bars. Insect slender. *fasciatus*. Deg.
 - BB. Wings absent. Tegmina of the female covering nearly half the abdomen; of the male about three-fourths the abdomen.
 - C. Insect slender. Tegmina light with dark veins. Head sparsely plumose, marked with four longitudinal black bars.
 - fasciatus* var. *vittatus*. Harr.
 - CC. Insect robust. Uniform black in color. Head and thorax plumose.
 - bivittatus*. Harr.
- AA. Ovipositor somewhat curved, shorter than the hind femora.
 - B. Tegmina and legs usually light in color. Insect over one fourth of an inch long.
 - affinis*. Beut.
 - BB. Insect uniform black, less than a fourth of an inch in length.
 - palustris*. Bl.

Each of the above species has its own peculiar habitat. *Nemobius fasciatus* DeG. is the commonest of the three. It is found in meadows. *Nemobius affinis* Beut. occurs along the banks of streams. *Nemobius palustris* Bl. is found in tamarack swamps, in cranberry bogs and in sphagnum moss.

GRYLLUS (Linn).

The members of this genus are the commonest and the best known of the family, they are the common field crickets. They seldom feed out in the open during the day time, being for the most part nocturnal in habit. All members of this genus are large, robust creatures. The last joint of the maxillary palpus is but little, if any longer than the one preceding it. The hind tibia is armed with stout immovable spines. The ear is visible on both sides of the front tibia. The members of this genus are very difficult to separate into species, this being especially true of the males. The most satisfactory means of identifying the males being by collecting. Five species are recorded from Michigan. The following key is based on the characters of the female:

Key to the Species of Michigan *Gryllus*.

- A. Ovipositor less than half an inch in length.
 - B. Insect black. Tegmina of the female overlapping or attingent only at the base, usually covering about three-fourths of the abdomen. Ovipositor short, equaling, rarely exceeding the hind femora. *americana* Bl.
 - BB. Tegmina overlapping for their entire length. Ovipositor longer than the hind femora.
 - C. Insect straw-colored, with dark reddish-brown markings on the head and thorax. First antennal joint slightly projecting in front of the head. Found in houses. *domesticus*. Linn.
 - CC. Insects black with reddish-brown legs and wings. First antennal joint not projecting in front of the head. Found on sandy beaches. *arenaceus*. Bl.
- AA. Ovipositor more than half an inch long. Tegmina touching, or overlapping for their entire length.
 - B. Ovipositor about three-fourths of an inch long.
 - C. Tegmina of female covering about three-fourths of the abdomen. Wings shorter than the tegmina. Ovipositor equal to, or longer than the body, about one-half the length of the hind femora. *abbreviatus* Serville.
 - CC. Wings of the female nearly as long again as tegmina. *abbreviatus* var. *luctuosus*.
 - BB. Ovipositor about half an inch long, shorter than the body, slightly, if any longer than the hind femora. *pennsylvanicus* Burm.

Cell are merely forms of *domesticus*, except *domesticus*

ECANTHUS (Serville).

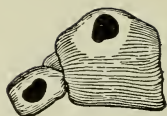
All members of the genus are pale-green or yellowish-green in color. The ovipositor is shorter than the hind femora. The tarsi are four segmented, the first joint being immovable. The tibiae are armed with small spines. The hind femora are slender. The tegmina and wings, of the female are folded down close around the body; those of the male are flattened above the abdomen, and broader than the body. The wings are but little, if any longer than the abdomen in either sex. Six species are recorded from the state.

Key to the Species of Michigan *Æcanthus*.*

A. The basal segment of the antenna with a swelling on the inner margin.

B. The first and second basal segments of the antennæ each marked with a round black spot.

niveus DeG.



BB. The first and second basal segments of the antennæ each with a single black bar.

C. The black bar club-shaped.

exclamationis Davis.



CC. The black bar the shape of the letter J.

angustipennis. Fitch.



AA. The basal segment of the antenna without a swelling on the inner margin.

B. The first and second basal segments of the antenna with two black marks, or entirely black.

C. The first joint of the antenna with a narrow black line along the edge and a black spot near the distal end. Body pale yellowish-green.

quadripunctatus. Bent.



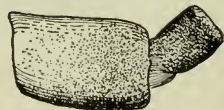
CC. The first joint of the antenna solid black or with the black bars very heavy, often merging into each other. Abdomen dark underneath.

fasciatus Fitch.
nigricornus



BB. The first and second basal segments of the antennæ unmarked with black.

latipennis Riley.



*Based on Technical Bulletin No. 42 of New York State Exp. Sta., by B. B. Fulton.

NE₀ XABEA (Walker).

This genus is very similar in general appearance to *Æcanthus*. It differs in that the members of *Xabea* have the antenna armed on the under side of the first segment with a blunt tooth. The wings are nearly twice as long as the tegmina. Hind tibia marked with four apical spines. Tarsi with but three joints. *Xabea bipunctata* DeG. will probably be found in the state, since it is recorded from the United States, east of the Great Plains. In color it is a pinkish-brown. The tegmina of the male are concolorous, while those of the female are conspicuously marked, each with two black spots, one in front of the other.



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