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THE TRUE BUGS, OR HETEROPTERA, OF
TENNESSEE.

These Bulletins will be sent upon application, free of charge, to any
Farmer in the State.

KNOXVILLE, TENNESSEE, U. S. A.

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THE TRUE BUGS, OR HETEROPTERA, OF TENNESSEE.

BY H. E. SUMMERS, CONSULTING ENTOMOLOGIST.

INTRODUCTION.

The greatest difficulty met with by the farmer in dealing with injurious insects grows out of his inability to determine the name of the insect that is doing the damage. Until this is known, it is impossible to find what remedies have been recommended for it in the Station Bulletins or Agricultural Reports; and this impossibility of using in such cases these publications often lessens their value in his eyes, even though they may contain information that would be of great value to him if he could find it. Neither has the busy farmer the time to make such an extended study of the structure of insects from the regular text-books as will enable him to understand the technical descriptions in the larger works on entomology. Yet *some* knowledge of the parts of an insect, and the names of these parts, is necessary in order to understand any description that is accurate enough to be of any use.

Some knowledge of the terms used in describing insects is also useful to the farmer in another way. Entomologists frequently receive letters of inquiry describing an injurious insect in such vague terms that no idea can be obtained as to what insect referred to is, and consequently no satisfactory reply can be given. A slight knowledge of terms would enable the sender to describe the insect intelligibly. In all cases, however, specimens of the insect are much preferable to even a good description, and should always be sent when possible.¹

¹ Insects may be sent by mail at one cent per ounce. If dead, pack in cotton in tin or wooden box. If possible, larvæ (i. e., caterpillars, grubs, maggots) should be sent alive, packed in a tight tin or wooden box, with a good supply of their natural food (leaves, etc.) *Do not punch holes in the box*; the tighter it is the better. Do not use paste-board boxes; they are crushed in the mails. Send also as full details as possible concerning the habits of the insect. Mark on outside of box the name of the sender.

This bulletin describes and names the more important parts of insects, and then takes up a single group, the Heteroptera, or True Bugs, and gives keys and descriptions which will enable any one, with careful study, to identify the majority of the species of this group which are of economic importance, or from peculiarities of habits or structure are likely to attract attention.

In all true insects (not including the spiders and millipeds) the body is divided into three sections, called the *head*, the *thorax*, and the *abdomen*. The *head* is usually quite distinct from the next division. It has, at each side, a large eye, which on examination with a lens, is seen to be compound, being made up of a large number of simple eyes. Between the compound eyes are very often two or three smaller simple eyes, called *ocelli*. The head also bears two many-jointed "horns," called *antennae*, and at the front end a number of parts, frequently very complicated, consisting of jaws, feelers, etc., known collectively as the *mouth* parts.

Two chief forms of mouth parts are found in insects; the one fitted for *biting*, the other for *sucking*. In the *biting mouth*, a good example of which may be seen in any grasshopper, there are present, among other parts, two pairs of jaws that work sideways (not up and down, as in the jaws of larger animals.) In the *sucking mouth*, a good example of which may be seen in a *cicada*, or "jar-fly," these jaws are absent, and the parts form a tube of greater or less length, through which liquids may be drawn. In the bees, wasps, and related insects, a combination of these two forms of mouth exists, there being one pair of jaws fitted for biting, the others being formed into a tube for sucking.

The *thorax* is the division of the body behind the head, which bears the wings and legs. In many insects, as the grasshopper for example, there is immediately behind the head a kind of collar which does not seem to be closely attached to the part bearing the wings. This is a part of the thorax, however, and is called the *pronotum*. As stated above, the thorax bears the legs which are six in number in all true insects. They are composed of several parts: First the *coxa*, usually quite small, attached to the body. Second, the *trochanter*, joined to the coxa, but usually so small that it can be found only by careful examination. Third, the *femur*, or thigh, generally the thickest and also the longest, or next to the longest division of the leg. Fourth, the *tibia*, commonly more slender, but often longer than the femur. Fifth and last, the *tarsus*, or foot, composed of from one to six joints, and usually furnished with two claws, which are commonly at the extreme tip, but may be at some distance back from it. (See plate V.)

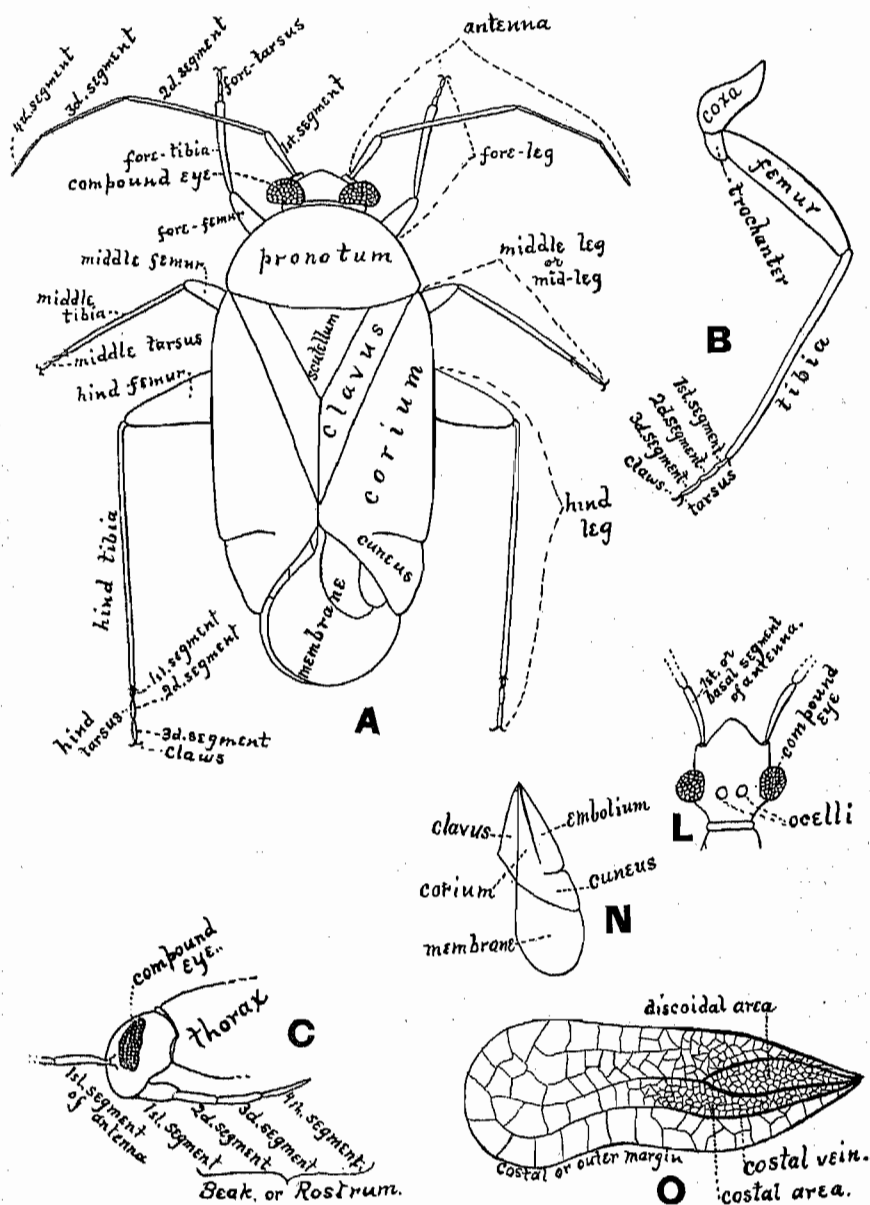


DIAGRAM OF BUG, SHOWING ALL THE PARTS NAMED.

The *wings* are also borne by the thorax. There are usually two pairs of these, although many insects, including one whole order, the true *flies* (Diptera), and many species of other orders, have only one pair. Furthermore both pairs are often absent. A wing consists of a frame work, made up of *veins*, supporting intervening thinner portions. The separate thin portions, each surrounded by veins, are known as *cells*. The form of the veins and cells, the general shape and texture of the wings, and the way they are folded when the insect is at rest, afford important characters in classification. The hind wings are of the same texture in most insects, being thin and transparent (*membranous*). In butterflies and moths, however, they, as well as the front wings, are covered with minute scales. The front wings may be membranous, or they may be more or less thickened, being then spoken of as *parchment-like*, *leathery*, or *horny*, according to the degree of thickening or hardening. In many insects there is a conspicuous piece (usually triangular) just behind the pronotum, between the front wings when they are at rest. This is called the *scutellum*.

The abdomen is the third and last of the three sections of the body. It is composed of several ring-like segments. The wings when at rest, in some orders, lie upon and often quite conceal its upper surface. The scutellum also often projects over it.

THE HETEROPTERA.

The *Heteroptera*, or True Bugs, form a well-defined group of insects, which is of much economic importance. The members of this group may be recognized by the following characters: Their mouth parts, collectively called a *beak*, are fitted for sucking, and consist of several parts contained within a jointed tube, which arises from the tip of the snout on the lower side, and when at rest is folded back along the lower surface of the head and thorax, between the legs; and further by the fact that the front wings, called *hemelytra*, when at rest overlap each other at their apices. Another group of insects, the *Homoptera*, have the mouth parts similar in form to the *Heteroptera*, but the tips of the front wings do not overlap each other when at rest. The *Heteroptera* usually, but not always, have the *hemelytra* composed of two distinct portions, a thickened basal part, and a thin membranous apical part. These parts of the *hemelytra* and their subdivisions receive special names, which are shown in figures A and D of plate V.

Table for Determining the Families of Heteroptera.¹

- Antennæ shorter than head and nearly or quite concealed in a cavity beneath the eyes.
 Hind-tarsi without claws.
 Fore-tarsi flattened, ciliated on edge, without claws: head overlapping prothorax **Corisidæ**
 Fore-tarsi normal, two-clawed; head inserted into prothorax **Notonectidæ**
 Hind-tarsi two-clawed.
 Abdomen with two caudal grooved filaments, forming together a respiratory tube which is not retractile **Nepidæ**

 Abdomen without respiratory tube.
 Legs natatorial; caudal end of abdomen with two strap-shaped retractile appendages **Belostomatidæ**
 Legs ambulatory; abdomen without strap-like caudal appendages.
 Ocelli absent **Naucoridæ**
 Ocelli present **Galgulidæ**
 Antennæ at least as long as the head, usually free, rarely (in *Phymatidæ*) lying in a groove along the side of the pronotum.
 Antennæ with their bases visible from above, usually consisting of four segments, rarely (some *Veliidæ*) of five (in neither case counting minute intermediate segments which are sometimes present). Scutellum less than half as long as abdomen.
 Beak consisting of three segments, sometimes of four, with basal segment very short and difficult to see.
 Body very slender; head as long as the three thoracic segments **Limnobatidæ**
 Body of various forms, but when very slender, with head shorter than the thorax.
 Distal segment of tarsi more or less bifid, with the claws inserted before the apex; lower surface of body shining-pubescent.
 Mid and hind legs extremely long and slender **Hydrobatidæ**

 Mid and hind legs not extremely long and slender .. **Veliidæ**

 Distal segment of tarsi entire; claws inserted at apex.
 Hemelytra usually well developed and in that case without cuneus. When hemelytra are rudimentary, ocelli are always present.
 Hind-tarsi, consisting of three segments.
 Beak long, slender, reaching to or beyond the middle coxæ **Saldidæ**
 Beak short, stout.
 Fore-coxæ elongated, at least four times as long as broad **Emesidæ**

¹ In the preparation of this and following tables, free use has been made of previous works. The most valued of these, and one which ought to be in the hands of every American interested in insects, is "An Introduction to Entomology," by Prof. John Henry Comstock; published by the author, Ithaca, N. Y., 1888.

Fore-coxæ never more than three times as long as broad.

Hemelytra, when well developed, usually with membrane with three discal cells, from which veins diverge all around towards the margin. Beak with four segments, but with basal segment very short

..... **Nabidæ**

Membrane with discal cells, but without many veins diverging towards margin. Beak with three segments. ... **Reduviidæ**

Hind-tarsi consisting of two segments.

Ocelli present. Fore-femora greatly widened..

..... **Phymatidæ**

Ocelli wanting. Fore-femora not greatly widened

Hemelytra shorter than abdomen... **Aradidæ**

Hemelytra longer than abdomen .. **Tingitidæ**

Hemelytra, when well developed, with cuneus. When hemelytra are rudimentary, ocelli are absent....

..... **Acanthiidæ**

Beak consisting of four segments.

Hemelytra with cuneus. Membrane with one or two closed cells at base, otherwise without veins.. **Capsidæ**

Hemelytra without cuneus. Membrane with longitudinal veins, although these are sometimes very indistinct.

Membrane either with four or five simple longitudinal veins, in which case the ocelli are usually present; or with about eight forked veins, in which case ocelli are wanting.

Membrane with about eight forked longitudinal veins; ocelli wanting .. **Pyrrhocoridæ**

Membrane with four or five simple veins.

Head with transverse incision in front of ocelli, which are always present. **Berytidæ**

Head without transverse incision. Ocelli usually present, rarely wanting. **Lygaeidæ**

Membrane with many, usually forked, longitudinal veins, which are sometimes difficult to see.. **Coreidæ**

Antennæ with their bases not visible from above, consisting of five segments. Scutellum more than half as long as abdomen.

Scutellum nearly flat, attenuated behind.

Tibiæ unarmed or furnished with very fine short spines

..... **Pentatomidæ**

Tibiæ armed with strong spines in rows. **Cydnidæ**

Scutellum very convex, covering nearly the whole abdomen.

Lateral margins of scutellum with furrows in which the edges of the hemelytra fit when at rest

..... **Corimelaenidæ**

Lateral margins of scutellum without furrows

..... **Scutelleridæ**

Family I. CORISIDÆ. Water-boatmen.

But one genus, *Corisa*, in Tennessee.

Family II. NOTONECTIDÆ. Back-swimmers or Backswimming Water boatmen.

TABLE OF GENERA OF NOTONECTIDÆ.

Apices of hemelytra entire; the three pairs of legs similar in shape **Plea**

Apices of hemelytra notched; legs dissimilar.

Hemelytra usually much longer than abdomen; fourth segment of antennæ longer than third segment . . . **Anisops**

Hemelytra but little longer than abdomen; fourth segment of antennæ shorter than third segment **Notonecta**

The lower families of *Heteroptera* are, for the most part, aquatic, and the first two of these, the *Corisidæ* and *Notonectidæ*, being somewhat similar in appearance and habits, are partly described together. They may be found in almost any pool or slow stream, especially where water plants are abundant. Here they may often be seen resting with the tip of the abdomen and the ends of the legs at the surface, but ready to take alarm at the least disturbance and dart quickly away, propelling themselves by their long, flattened, oar-shaped hind legs. Their resemblance then to miniature boats driven by oars gives them their common name. Little has been said of their economic importance, but where they are abundant they must appreciably lessen the number of fish. The eggs and young of these last, with other insects, constitute their chief food. The back-swimmers are especially voracious, and will seize and destroy fishes many times their own size. Their offensive powers may be tested by taking one in the fingers rather carelessly, when, especially if slightly squeezed, it will quickly pierce the skin with its sharp beak, producing a pain little less acute than the sting of a honey bee. This must be sufficient to render completely helpless a fish of considerable size, after which its juices may be sucked out at leisure.

Aside from the technical characters given above, the *Corisidæ* and *Notonectidæ* may be readily distinguished by the fact that the body is considerably flattened, while in the latter it is nearly or quite as deep as broad. The latter are also distinguished from all other *Heteroptera* by their habit of swimming with their back low-ermost.

The *Corisidæ* are represented by a single genus, *Corisa*. The species of this genus are the most difficult of the *Heteroptera* to distinguish, and as the habits of all are, so far as known, precisely



FIG. 4.
Corisa interrupta.

the same, it will not be here attempted. They vary from one-sixth to nearly one-half inch (4 mm. to 11 mm.) in length.

There are three genera of *Notonectidae* in our fauna, *Plea*, *Anisops*, and *Notonecta*. *Plea striola*, our only species, is much the smallest insect of the family, being only one-twelfth inch (2 mm.) long, but quite broad in proportion. It is only rarely found, but is usually abundant in ponds where it occurs. *Anisops platycnemis*, also our only species of the genus, is much larger than *Plea*, being about five-sixteenths inch (7 mm.) long. It may be distinguished from the species of *Notonecta*, which it most closely resembles, by its more slender form, and usually by the *hemelytra* being much longer than the abdomen, although this last is a rather variable character. *Notonecta* has several species, the most common being *N. undulata*, which varies from forms that are almost entirely white above to those in which the upper surface is black, with only two or three irregular white patches on each side of the *hemelytra*. It is from three-eighths to one-half inch (9 to 12 mm.) in length. *Notonecta irrorata* is also rather a common species, which is usually slightly larger and more robust than the last, and is a dark brown, finely mottled with a lighter reddish brown above.



FIG. 5.

Notonecta glauca

Family III. NEPIDÆ. Water-scorpions.

TABLE OF GENERA.

Body elongated, more than five times as long as broad (not including respiratory filaments)	Ranatra
Body oval, less than three times as long as broad (not including respiratory filaments)	Nepa

Family IV. BELOSTOMATIDÆ. Giant Water-bugs.

TABLE OF GENERA.

Hind-tibiæ much broader than middle-tibiæ. Fore-coxæ little longer than broad.	
Ventral margin of fore-femora with a longitudinal groove in which the tibiæ lie when folded	Belostoma
Ventral margin of fore-femora convex, without a longitudinal groove	Benacus
Hind-tibiæ little, if any, broader than middle-tibiæ. Fore-coxæ at least twice as long as broad	Zaitha

The members of the families Nepidæ and Belostomatidæ, like those of the preceding families, are aquatic insects, but unlike them, they spend most of their time at the bottom of streams and

pools, crawling about among sticks and rubbish or the stems of water plants. The Belostomatidæ also swim freely, however, when they desire. They live upon fish, and other insects, which they dart upon and seize with their strong front legs.

Our common representatives of the Nepidæ belong to the genus *Ranatra*. These are insects with long slender body and legs; from the tip of the abdomen project two slender filaments, grooved on their adjacent surfaces, so that when applied to each other they form a tube. The tip of this tube the insect raises to the surface of the water to obtain air for breathing. From their stick-like form and dirty brown color, these insects are difficult to distinguish in the muddy water that they most frequent, and as they seldom fly from this, they are rarely seen. Our species are from $1\frac{1}{4}$ to $1\frac{5}{8}$ inches (32-40 mm.) long, not including the respiratory tube.

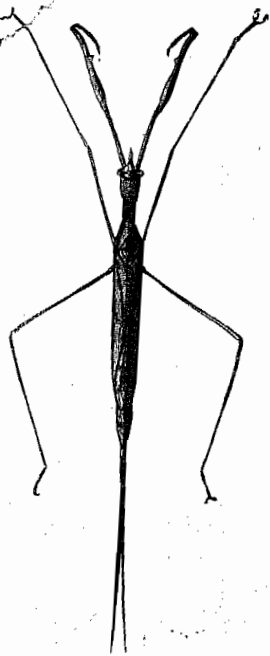


FIG. 6.

Ranatra fusca.

The family Belostomatidæ includes the largest of living bugs. We have a common species of each of the genera, *Belostoma* and *Benacus*, which so strongly resemble each other, except in the one important character given in the table of genera, that they are usually supposed to be the same species. They are known in many parts of the country as "electric-light bugs," from the fact that they are frequently seen flying about these lights at night. In some localities they are so abundant as to accumulate by hundreds beneath the lights. In some sections the absurd idea prevails that they have only appeared recently, as if they were in some way a product of the electric light. The form of the body is oval, about two and a half times as long as broad. Color brown, with irregular blackish marks. Length from $1\frac{1}{2}$ to $2\frac{1}{2}$ inches (38 to 63 mm.).

One species of *Zaitha* (*Z. fluminea*) is common. In the general form of its body and its color it resembles the above species, but it is a much smaller insect, being about 7-8 inches (22 mm.) long

Family V. NAUCORIDÆ.

One genus, *Pelocoris*, in Tennessee.

But a single species of this family, *Pelocoris femorata*, is found in the Eastern United States, and this is so rare as to be seldom seen. It is a rather broadly oval insect (1-3 inch or 9 mm. long), of a yellowish brown color, and lives, partly crawling and partly swimming, among the stems of plants beneath the surface of the water.

Family VI. GALGULIDÆ.

TABLE OF GENERA.¹

Fore-legs stout, fitted for grasping.

Anterior-tarsi with a single claw **Mononyx**

Anterior-tarsi with two claws **Galgulus**

Fore-legs slender, fitted for running **Pelogonus**

The only common representative of the family Galgulidæ in Tennessee is the *Galgulus oculatus*, which may often be found in considerable numbers on muddy banks of streams. It is a broadly oval insect with prominent eyes, its upper surface roughened, and varies in color to correspond with the color of the mud on which it lives, from a very light brown almost to black. It lives upon other insects, which it catches

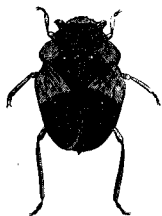


FIG. 4. by creeping slowly to within a short distance and then suddenly leaping upon and seizing them with its powerful front legs.

Family VII. SALDIDÆ.

But one genus, *Salda*, in America.

These insects live in similar situations to the Galgulidæ, but prefer banks with some weeds or grass, about the roots of which they may hide. They are also often found in the rocky beds of streams. They are most readily distinguished from the last family by their long slender antennæ. Their bodies are also longer and more graceful, and possess none of the roughness so characteristic of *Galgulus oculatus*. They also take flight quickly when disturbed. Otherwise their habits are much like those of the Galgulidæ. There are many common species.

Family VIII. VELIIDÆ.

This and the following family include those bugs that are so

¹ From Comstock's "Introduction to Entomology."

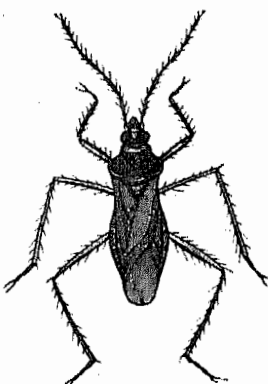


FIG. 8.

Mesovelia bisignata.

the present classification of them will long be recognized, that we give no table of genera.

Family IX. HYDROBATIDÆ. Water-striders.

TABLE OF GENERA.

Body oval, less than three times as long as broad; pronotum not longer than broad.

Second segment of antennæ longer than either third or fourth segment **Metrobates**

Second segment of antennæ shorter than either third or fourth segment **Stephania**

Body elongate, more than four times as long as broad; pronotum much longer than broad.

Antennæ longer than head and pronotum together; hind-tibiæ and tarsi together much longer than middle tibiæ **Limnopus**

Antennæ shorter than head and pronotum together; hind-tibiæ and tarsi together but little longer than middle tibiæ.

First segment of antennæ nearly the same length as fourth segment **Limnotrechus**

First segment of antennæ considerably longer than fourth segment **Hygrotrechus**

The habits of this family have been sufficiently referred to under the *Veliidæ*. The species of this, as well as the *Veliidæ*, are interesting, because of the existence of two forms of the adult insect, a winged form and an unwinged form. In some species the winged form is the more abundant, while in others it is comparatively rare.

There are two sections of the family of very dissimilar appearance so far as the form of the body is concerned: one with short oval bodies,

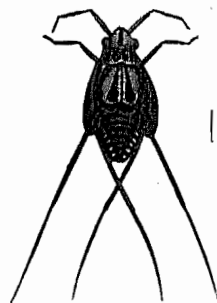


FIG. 9.

Stephania picta.

represented by *Stephania picta*, a beautifully marked, yellow and black species, and *Metrobates hesperius*, velvety black, with lead-colored markings; the other section with elongated bodies, represented by various species of *Limnotrechus* and *Hygrotrechus* in Tennessee, all of a prevailing dark brown color, with some markings of various other colors.

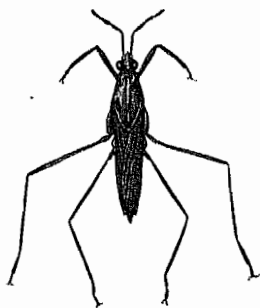


FIG. 10.

Hygrotrechus remigis.

Family X. LIMNOBATIDÆ.

But one species, *Limnobates lineata*, is found in the United States. This species, although not uncommon, is seldom seen on account of its small size and quiet habits. It is an exceedingly slender insect about 1-2 inch (12 mm.) long, of a dull brown color. It crawls about on the surface of the water or mud, or climbs upon water plants and sticks projecting from the water, seeming to prefer stagnant ponds to those which receive a large supply of spring water.

Family XI. EMESIDÆ.

TABLE OF GENERA.

Fore-tibiæ and fore-tarsi together not shorter than fore-femora.	
Eyes large, very prominent, when seen from the side occupying the whole side of the head	 <i>Luteva</i>
Eyes small, little prominent, when seen from the side occupying not more than half the side of the head	
	<i>Cerascopus</i>
Fore-tibiæ and fore-tarsi together shorter than fore-femora.	
Fore-tarsi one-clawed	 <i>Barce</i>
Fore-tarsi two-clawed	 <i>Emesa</i>

But one species of this family, *Emisa longipes*, seems to be at all common, and even this is found only in very limited localities. It is a dull brown insect, with elongated body and legs. It is most frequently seen in old stables and other outhouses, hanging from the rafters and roof by its very long front and hind legs, or crawling slowly about in search of flies or other insects, which it siezes with its front legs and then sucks their juices with its sharp pointed beak. Its length is about 1¼ inches (32 mm.).

Family XII. REDUVIIDÆ.

The many species of this family are often seen on account of their comparatively large size, although the number of individuals of any species is apparently not great. Among the more common forms are the following.

The masked bed-bug hunter (*Opicætus personatus*) is a black or dark brown insect, about 3-4 inch (18 mm.) in length, which is sometimes seen about houses, where it preys upon flies, bed-bugs, and other insects. Another species that resembles it somewhat is *Melanolestes picipes*, which is, however, usually somewhat smaller, of a deeper black, and of more importance, has the transverse depression on the prothorax *behind* the middle. The bite of both of these, as also of many other Reduviids, is exceedingly painful, and may even be dangerous.

Perhaps our most beautiful form is *Hammatocerus purcis*, a large species, over an inch (25-27 mm.) in length. It is black, with a broad yellowish white band across the bases of the hemelytra; and about one-half the length of the hind femora and a row of spots along the edge of each side of the abdomen, bright red.

Another beautiful form is *Sirthenia carinata*, which is much more slender than the preceeding, and a little less than an inch (22-24 mm.) in length. It is black, with bases of hemelytra, legs, sides of abdomen, and often a line along middle of abdomen beneath, red.

Family XIII. NABIDÆ.

TABLE OF GENERA.

Fore-coxal cavities far from front margin of prosternum.

Clavus and corium semi-transparent... . **Coriscus**

Fore-coxal cavities close to front margin of prosternum Clavus and corium opaque.

Second segment of beak longer than third segment; second segment reaching base of head.... . **Pagasa**

Second segment of beak shorter than third segment; second segment not reaching base of head **Nabis**

This family is closely allied to the Reduviidæ, and, like most of the latter, they live upon shrubs and herbs, where they catch and devour other insects.

Our only common representatives belong to the genus *Coriscus*. There are many species of this, but all found in Tennessee are very similar in appearance. They vary from a very light mottled gray to a dark brownish gray above, and from a light gray, often with darker longitudinal bands, to a dark brown beneath. Their length is from 1-4 to nearly 3-8 inch (6 to 9 mm.).

Family XIV. PHYMATIDÆ.

TABLE OF GENERA.¹

Scutellum short; head with a bifid prolongation above the insertion of the antennæ **Phymata**

¹ From "Comstock's Introduction to Entomology."

Scutellum very long, extending to the tip of the abdomen; head without bifid prolongation above antennæ... .. **Macrocephalus**

Our only common representative of this family is the *Phymata Wolffii*, mentioned usually in the Agricultural Reports under the name of *Phymata erosa*. It is a greenish or yellowish insect, marked with dark brown or black, the most conspicuous marking being a broad band across the abdomen. It lives in various flowers, being especially abundant in golden-rod (*Solidago*), where it lies in wait for the flies, bees and butterflies that visit the blossoms for honey; these it seizes and devours, overcoming insects many times its own size. Its length is from 1.3 to somewhat over 3.8 inch (8 to 10 mm.).

Family XV. ARADIDÆ.

TABLE OF GENERA.

- Beak reaching only about to base of head; ventral surface of thorax and abdomen not furnished with a fine mesal furrow. Fourth segment of antennæ much longer than third; scutellum transverse, broad caudad, caudal angle obtusely rounded **Aneurus**
- Fourth segment of antennæ not larger than third; scutellum scarcely transverse, triangular, caudal angle acute. **Brachyrhynchus**
- Beak reaching about to caudad margin of prosternum or beyond it; ventral surface of abdomen and thorax furnished with a fine mesal furrow **Aradus**

Under the bark of decaying logs, frequently in considerable numbers, and sometimes singly on the sunny side of trees or fences on bright spring days, may be found bugs of a dull, dark brown color, sometimes varied with lighter brown markings. To fit them for their life under bark, their bodies are very much depressed, usually being little thicker than a piece of thin cardboard. Although we have many species belonging to these different genera, their general naked-eye appearance differs little except in size; and as they are of no economic importance, no description will be here given of different species. The length of the more common species varies from 3-16 to nearly 5-16 inch (4 to 7 mm.).

Family XVI. TINGITIDÆ.

TABLE OF GENERA.

- Pronotum with an angulated process caudal, commonly covering scutellum.

Discoidal¹ and costal¹ areas of hemelytra rarely jointly elevated; when so elevated the lateral margins of pronotum never broadly foliaceous, nor with the narrow foliaceous parts (when they are present) produced cephaled.

Rostral sulcus of the sternum not interrupted by a transverse ridge (between the mesosternum and metasternum).

Costal area of hemelytra furnished with a regular, single or double series of cells.

Costal area with a single series of cells... **Teleonemia**

Costal area with a double series of cells ... **Tingis**

Costal area of hemelytra at least in part, furnished with a triple or multiple, sometimes confused, series of cells.

First segment of antennæ not twice as long as second segment.

Pronotum with a single longitudinal mesal ridge (carinæ); third segment of antennæ not at all slender ... **Loptoypa**

Pronotum with three parallel longitudinal ridges (carinæ); third segment of antennæ slender ... **Physatochila**

First segment of antennæ at least twice as long as second segment.

Oblong; anal margins of hemelytra somewhat concave ... **Leptostyla**

Oval; anal margins of hemelytra convex **Acalypta**

Rostral sulcus of the sternum interrupted between the mesosternum and metasternum by a transverse ridge... **Gargaphia**

Discoidal and costal areas of hemelytra jointly elevated lateral margins of pronotum broadly foliaceous, produced cephaled ... **Corythuca**

Pronotum not covering scutellum; truncated, not furnished with an angulated process caudal ... **Piesma**

The insects of this order are among the most delicate of the *Heteroptera*. They may be recognized at once by their gauze-like wings, usually of the same thickness throughout, divided into quite regular cells by a network of veinlets. Any *Heteroptera* with wings of this appearance may be safely referred to this family. They are all of small size. They live upon, usually upon the under side of, the leaves of various plants, more commonly trees, and frequently become so abundant that the nourishment that they abstract from the plant seriously weakens it.

Fortunately but few of the many species live upon the more valuable cultivated plants.

Perhaps the commonest species is the Sycamore Tingid, *Cory-*

¹ See Fig. o, of plate V.

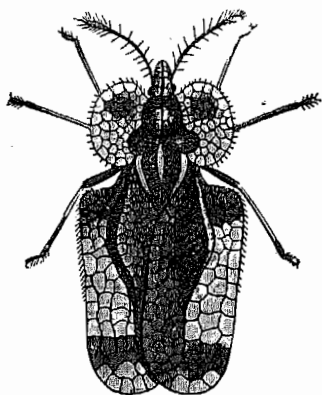


FIG. II.
Corythuca arcuata.

thuca ciliati, which may often be found in countless numbers on the leaves of this tree. It may also be found in winter beneath the loose outer bark. Its thorax and hemelytra are of a beautiful transparent white, with one brown spot near the base of each hemelytron.

Another species, which often becomes so abundant on the young leaves and flowers of the grape as to do considerable damage, is the ash-gray leaf-bug, *Piesma cinerea*. It is a small and more slender insect than the former, and differs from all our other Tingids by the presence of a distinct clavus to the hemelytra.

Family XVII. ACANTHIIDÆ.

The best known representative of this family is the bed-bug, which it is not necessary to describe here. Besides this the family includes a number of insects all of very small size, known as the flower-bugs. The only very common species of these is *Triphleps insidiosus*, a minute form only 1-12 inch (2 mm.) in length. It is often found in the flower of golden-rod and the ox-eye daisy. It is recorded as preying upon two very injurious insects, the grape phylloxera (leaf-form) and the chinch bug.

Family XVIII. CAPSIDÆ.

This family contains the largest number of species and individuals of any of the Heteroptera. Some of them prey upon other injurious insects, and are consequently beneficial to man, but the majority are plant feeders. Most of them are general feeders, and for this reason they are less noticed than those insects that confine themselves to one or a few species of plants; but the damage they do is none the less real, and their countless numbers in meadows must often seriously diminish the grass crop.

Perhaps our commonest species is the Tarnished Plant-bug, *Lygus pratensis*. Comstock ("Introduction to Entomology") describes this bug as follows: "It is exceedingly variable in color and markings. It ranges from a dull dark brown to a greenish or dirty yellowish brown. In the more typical forms the prothorax has a yellowish margin and several longitudinal yellowish lines; there is a V shaped yellowish mark on the scutellum; the distal

end of the corium is dark, and the cuneus is pale, with a black point at the apex. This species has been reported as injuriously infesting the young leaves of the expanding buds of the pear, and also the unopened buds. Sometimes a whole branch will be affected, and will die as the result of the injury." This insect is usually, however, found in meadows, where it abounds. Length 1-5 inch (5 mm.).

There are several other species that resemble the last so strongly that they would be mistaken for them without careful study. Then there is a large series of narrower, more elongate forms, some of which are almost as abundant as the species described above.

One of these often seen is *Calocoris rapidus*, an insect with head and thorax yellow, except a brown spot on each side of thorax behind, the two sometimes uniting to form a line. Hemelytra dull brown, with a stripe along outer margin yellow. Length about 5-16 inch (8 mm.).

Somewhat between the two above named species in form is the Glassy-winged Soldier-bug (*Hyaliodes vitripennis*) which is fully described and illustrated on page thirty-two. It is one of the comparatively few useful Capsids, and is commonly found devouring the leaf-hoppers on grape vines, although it also occurs on other plants.

Family XIX. PYRMOCORIDÆ.

The only common member of this family is the Red-bug or Cotton-stainer (*Dysdercus suturellus*) of the Southern States. This is a robust insect, varying in length from 2-5 to nearly 2-3 inch (10 to 16 mm.). It is red, with scutellum and a stripe on prothorax behind pale brown. Hemelytra pale brown, with several slender stripes yellow. This insect is well known to the planter of the Southern States, on account of the great damage it does, especially by staining, with its excrement, cotton in the opening boll.

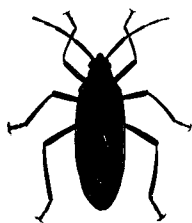


FIG. 12.
Dysdercus suturellus.

Family XX. LYGAEIDÆ.

The family Lygaeidæ embraces a great variety of forms, most of them, however, of rather robust build. It is here that the Chinch bug, so well known in our Western States, is placed. The great damage done by this insect has long made it notorious, but it has recently come prominently to the notice of entomologists from the fact that it is upon it there have been made the first practically successful experiments in the destruction of insects by

the transmission of a contagious disease to the bugs in the field. These experiments have been carried on in several States, but chiefly in Kansas, where bugs that had been inoculated with the disease in the laboratory were turned loose into infested fields, and the disease being communicated to the bugs there; they were destroyed in vast numbers.

Considerably larger, and of a more elongate form than the Chinch bug, is perhaps our most abundant Lygæid, *Pamera longula*. It is a little more than 1-4 inch (7 mm.) in length, of a dark brown color, with the hind half and often most of the front half of the prothorax above, the hemelytra except a short stripe on inner angle of corium, and minute dots over rest of surface, legs, and some other less conspicuous marks on various parts of body, light brown. It is a general plant-feeder, being found mostly in meadows. Several other species of *Pamera*, closely resembling this, are also found.

A still larger insect is the *Myodocha serripes*, striking on account of the exceeding long neck which supports the conical head. It is black, with margins of abdomen, tip of scutellum and legs, except a black band near end of front femora, pale yellow; some other smaller yellow markings also occur. Length nearly 3-8 inch (9 mm.) It inhabits meadows, and open woods, but is more frequently seen flying to the light at night.

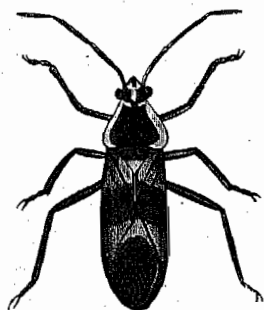


FIG. 13.
Lygæus fasciatus.

Our largest and most beautiful Lygæid is *Oncopeltus fasciatus*, which is about 2-3 inch (16 mm.) in length. Upper surface orange, with most of head, prothorax, except lateral margins, scutellum except tip, a broad band middle of hemelytra, and the membrane, black. It is found on milkweed. Several other beautiful red and black species, somewhat smaller in size, belonging to the genera *Lygæus* and *Melanycoryphus*, also occur.

Family XXI. BERYTIDÆ.

The only representative of this family in Tennessee is *Jalysus spinosus*. This insect, in the extreme slenderness of the body and legs, somewhat resembles the *Limobates lineata*, described above, but it is entirely dissimilar otherwise. It is of a light yellowish brown color, with a paler longitudinal line along the middle, and one on each side, of the upper surface of the prothorax. The last joint of antennæ, tarsi and usually tips of tibiæ, a point at tip of corium, are black, and the lower surface of abdomen usually has four darker longitudinal lines. Length 1-3 inch (8 mm.).

Family XXII. COREIDÆ.

Some of the largest of the land Hemelytra belong to this group, while others are small and inconspicuous. Among the larger forms are the following:

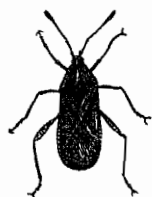


FIG. 14.

Anasa Tristis. 3-5 to 2-3 inches (14 to 17 mm.).

The Squash bug, *Anasa tristis*, a well known insect of a general dark brown color above, with a narrow stripe along each side of prothorax, one along middle of head, often extending upon thorax also, and a row of spots along each side of abdomen, yellow; membrane black; lower surface dirty yellow. Length

Another still larger species, *Metapodius femoratus*, is also often found on squash, although it is more commonly known as the Pumpkin bug in Tennessee. It is a very dark brown insect, coarsely granulated above. The hind femora are thickened and armed with knobs and spines. The hind-tibiæ have a plate-like expansion. The length varies from 15-16 to 1½ inch (22 to 28 mm.)

Family XXIII. PENTATOMIDÆ.

With this family we begin a series of forms that are usually broader and more rounded than those of the preceding families, although there are some exceptions to this rule. The most important, economically, of our species is the Harlequin cabbage bug, *Murgantia histrionica*. This is a beautifully marked black and orange insect, which is one of the worst cabbage pests in the Southern States, although fortunately it does not usually become abundant so far north as Tennessee until early cabbage is well advanced or even matured.

Perhaps the most common species of the group is *Ebalus pugnax*, although it rarely attracts attention because of its meadow-feeding habits. It is the narrowest of our Pentatomids, being a little less than one-half as broad as long, measured between the prominent spines that project forwards from the shoulders. It is yellow, appearing more or less dirty from the presence of numerous black points. Length about 2-5 inch (10-11 mm.). It lives upon various species of grass.

Family XXIV. CYDNIDÆ.

TABLE OF GENERA.

Vertex of head and disk of pronotum without bristles.	
Beak short, not reaching abdomen	 Canthophorus
Beak long, reaching middle of abdomen	 Lobonotus
Vertex of head and disk of pronotum with bristles.	

Scutellum with sides and base sub-equal.....	Amnestus
Scutellum with sides longer than base.	
Hind-tibiæ cylindrical.	
Pronotum with an impressed line near and parallel to the front margin	Pangaeus
Pronotum without an impressed line near front margin ..	Melanæthus
Hind-tibiæ flattened.....	Cyrtomenus

This and the following families contain insects that are comparatively rare and of no economic importance. The commonest species of the present family is *Canthoporus cinctus*, a shiny, blue-black insect, with a slender line along each edge of prothorax, and along outer edge of hemelytra, and some bands on the legs, yellowish white. Length 1.5 inch (5 mm.).

Family XXV. CORIMELÆNIDÆ.

But one genus of this family, *Corimelæna*, containing, however, many species, occurs in the United States. Our species are all small, shiny black insects, often with inconspicuous white or reddish markings. As in the next family, the scutellum is very convex, and covers nearly the whole abdomen; the hemelytra are in consequence not easily seen.

Corimelæna pulicaria appears to be our commonest species. In this nearly all the visible part of hemelytra is white. Its length is only 1.8 inch (3 mm.).

Family XXVI. SCUTELLERIDÆ.

The general form of the body in this family resembles that of the *Corimelæna*, but the colors are usually much more conspicuous.

Our species are all very rare, and are not likely to be seen, except by one especially interested in collecting insects.

REMEDIES.

Only general principles for the destruction of the bugs can be here discussed. To the structure of the mouth parts, and in consequence of their mode of feeding, is due the greatest difficulty in dealing with them. Unlike the most other destructive insects, as larvæ of butterflies, moths, and beetles (grubs, caterpillars, etc.), and grasshoppers, adult beetles, etc., all of which have biting mouths, and consequently gnaw their food, the true bugs only suck the juices of the plant or animal they attack, inserting their beak, for this purpose, into the substance of the food. This renders useless the use of the much-used solid poisonous insecticides

(such as Paris Green, London Purple, etc.), which cling in solid particles to the outside of the leaves, etc., and are eaten by the insect with its food. And we are forced to use means of destruction other than poisons to be eaten. One of the most generally applicable is an insecticide that kills by contact with the body of the insect. Perhaps for most purposes the best is *kerosene emulsion*, of which the following is an approved

FORMULA.

Make soap emulsion by boiling one-half pound ($\frac{1}{2}$ lb.) of common hard soap in one gallon of water until the soap is dissolved.

Take of

Kerosene 2 gallons.

Soap solution 1 gallon.

Add the soap solution, boiling hot, to the kerosene, and agitate it violently with a force pump until the two combine into a creamy liquid, which thickens upon cooling, without the separation of any oily drops on the surface. The pump that is used to spray plants or trees may be used for agitating, passing the liquid through the pump back into the same vessel from which it is drawn. Five to ten minutes pumping is necessary.

To use, add one part of the kerosene emulsion, made as above, to from nine to twelve parts of water, mixing thoroughly. The weaker solution is used for very delicate plants.

This is best applied by some kind of spraying pump, as the success of the application depends largely on its touching every part of every insect to be killed. The addresses of some firms are given below; from them full descriptions and prices may be obtained. The best form of pump of course depends on the particular purpose for which it is desired. For the majority of crops affected by the Heteroptera, some form of knapsack pump is probably preferable.

Makers of Spraying Apparatus.

M. J. Caswell, Box 17, Sandusky, Ohio.

Field Force Pump Co., Lockport, New York.

Goulds Manufacturing Co., Seneca Falls, New York.

P. C. Lewis, Catskill, New York.

Nixon Nozzle & Machine Co., Dayton, Ohio.

Wm. Stahl, Quincy, Illinois.

Hot water is another insecticide useful for some bugs. It must be applied as hot as is possible without injury to the plants.

Pyrethrum is also a substance that kills by contact, and may be found useful in many cases.

Many bugs winter in the adult state, often under rubbish of various kinds. A thorough winter cleaning-up, burning all rubbish collected, will be useful against these. The Harlequin cabbage-bug and Chinch bug are among the insects which may be

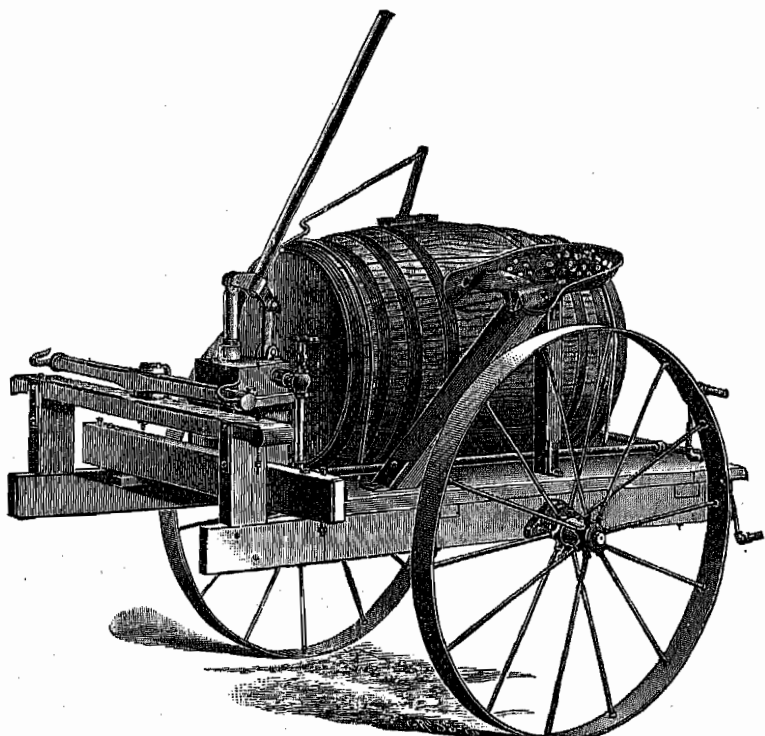


FIG. 14.

The Orchard and Vineyard Barrel Pump, made by the Nixon Nozzle & Machine Co.

thus destroyed. As many feed upon various weeds, along fences, etc., as upon cultivated crops, keeping the former well cut away, especially early in the season, will materially lessen the number of some species later upon the useful plants.

Another class of remedies, the artificial propagation of contagious diseases, has already been referred to when speaking of the Chinch bug. While this promises to be of great use in the future, the details are not yet sufficiently easy of manipulation as to allow of its use by the practical farmer.