

The Great Lakes Entomologist

Volume 22
Number 4 - Winter 1989 *Number 4 - Winter*
1989

Article 1

December 1989

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McPherson, J. E. 1989. "An Overview of the Heteroptera of Illinois," *The Great Lakes Entomologist*, vol 22 (4)

DOI: <https://doi.org/10.22543/0090-0222.1683>

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AN OVERVIEW OF THE HETEROPTERA OF ILLINOIS

J. E. McPherson^{1,2}

ABSTRACT

A key to adults of all heteropteran families known to occur in Illinois is presented together with general information on the biologies of these families. Also included are general references on Heteroptera and on individual families, particularly if those references involve studies of fauna that were conducted in Illinois, adjacent states, or nearby parts of Canada.

The Heteroptera (true bugs) is a large insect order that occurs worldwide and is represented in America north of Mexico by about 45 families. Of these, 36 are known to occur in Illinois. The order is a well defined group characterized by (1) a segmented beak that arises from the front of the head and (2) wings that, when present and well developed, lie flat on the abdomen with the first pair usually leathery basally and membranous distally. In the closely related Homoptera (cicadas, leafhoppers, spittlebugs, aphids, scales, etc.), the segmented beak appears to arise ventrally from the rear of the head or from between the front coxae; the wings, when present and well developed, are usually held rooflike over the abdomen and the first pair is of uniform texture throughout.

Heteropterans occupy almost any habitat, both terrestrial and aquatic, the primary exception being the depths of the oceans. Terrestrial species occur in the soil, on grasses, bushes, and trees; aquatic species occur on or below water surfaces. The order also includes parasitic species such as bed bugs and bat bugs. Thus, the order is very diverse and abundant, appealing to those interested in biology and classification.

Heteropterans have a simple life cycle. Eggs are laid singly or in clusters and may be inserted in or on plants, including leaves, stems or bark; in the ground; or simply dropped at random on the substrate. The nymphs generally pass through 5 nymphal instars and, as they progressively increase in size, wing pads become increasingly well developed at the posterolateral angles of the mesonotum and, later, the metanotum. Nymphs resemble adults except for differences in body proportions (e.g., relative length of head versus remainder of body). Adults generally overwinter although some species overwinter as eggs and a few as nymphs.

Illinois presents an excellent opportunity for individuals interested in this group. The state extends from just above latitude 42° N southward to latitude 37° N, from a northern

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²Editor's Note: This manuscript originated as the written and expanded version of a talk presented 11 April 1987 at the Annual Meeting of the Illinois State Academy of Science, held that year in Charleston, on the campus of Eastern Illinois University. This talk was one of several given during a symposium on the "Invertebrates of Illinois and the Midwest." Although intended for a general audience, including non-entomologists, I have decided to publish the manuscript in its entirety because of the valuable information included therein. It provides the novice with a handy reference to Illinois Heteroptera, and will undoubtedly be useful for all entomologists within the Great Lakes region.

to a more southern climate, and, probably as a result, many of the families are represented by several species. Often species distributions within the state reflect their North American distributions (i.e., species with northern distributions occur in northern Illinois, those with more southern distributions in southern Illinois).

Although heteropteran diversity in Illinois is high, only a few groups have been investigated extensively in the state. These include the Pentatomoidea (stink bugs and their allies, Hart 1919, updated by McPherson 1982), Miridae (plant bugs, Knight 1941), and the aquatic bugs (Lauck 1959, unpublished M. S. thesis). Fortunately, general keys are available that, though not exclusively covering the Illinois fauna, treat many of the same species. For the beginning student unfamiliar with the order, Slater and Baranowski (1978) have prepared keys to adults of the more common genera. For more comprehensive coverage, Blatchley (1926) should be consulted. Family keys to nymphs can be found in Slater and Baranowski (1978), DeCoursey (1971), Herring and Ashlock (1971), and Lawson (1971).

To aid the reader of this paper, I have constructed a key to adults of all heteropteran families known to occur in Illinois. Included are general references on Heteroptera and on individual families, particularly if those references involve faunal studies conducted in Illinois, adjacent states, or nearby parts of Canada. Each family listing includes a short note on biology and, where available, references to studies of particular species conducted in Illinois. The recently published catalog by Henry and Froeschner (1988) of the Heteroptera of Canada and the Continental United States, a truly monumental work, should be consulted for the currently accepted names of the various taxa and their taxonomic history, species distributions, and additional references to keys and biology.

COLLECTING AND LABELLING TECHNIQUES

One of the best ways to learn about Heteroptera, or any group of insects for that matter, is to study them in their natural environment. To do this efficiently requires familiarity with the various taxa, and this can be obtained best by collecting and preserving specimens for future reference. Collecting requires only a few pieces of equipment, and preparing a useful collection requires only that a few basic rules be followed. Both are discussed in detail by many authors and thus are not discussed here. I suggest the beginning collector consult Steyskal et al. (1986) or Borror et al. (1989) for their general discussions of preservation and labelling, and Slater and Baranowski (1978) for discussions of the same topics in reference to Heteroptera. One word of caution: if you do not know what the insect is, *DO NOT PICK IT UP WITH YOUR FINGERS*. Use forceps. Many bugs can inflict a painful bite.

KEY TO THE ADULTS OF THE HETEROPTERAN FAMILIES OF ILLINOIS

1. Antennae rarely visible from above, shorter than head in lateral view (approaching subequal in Ochteridae), often hidden beneath eyes; primarily aquatic or living along shoreline 2
- 1'. Antennae visible from above, longer than head, not hidden beneath eyes; terrestrial or living on water surface 9
2. Ocelli present (Fig. 1). 3
- 2'. Ocelli absent 4
3. Beak short, hidden by front femora; front legs raptorial; eyes strongly protuberant (Fig. 1); body toadlike GELASTOCORIDAE
- 3'. Beak longer, extending to at least hind coxae; front legs not raptorial; eyes not strongly protuberant; body not toadlike OCHTERIDAE
4. Body with terminal, elongate, taillike respiratory filaments (Figs. 2-3) NEPIDAE

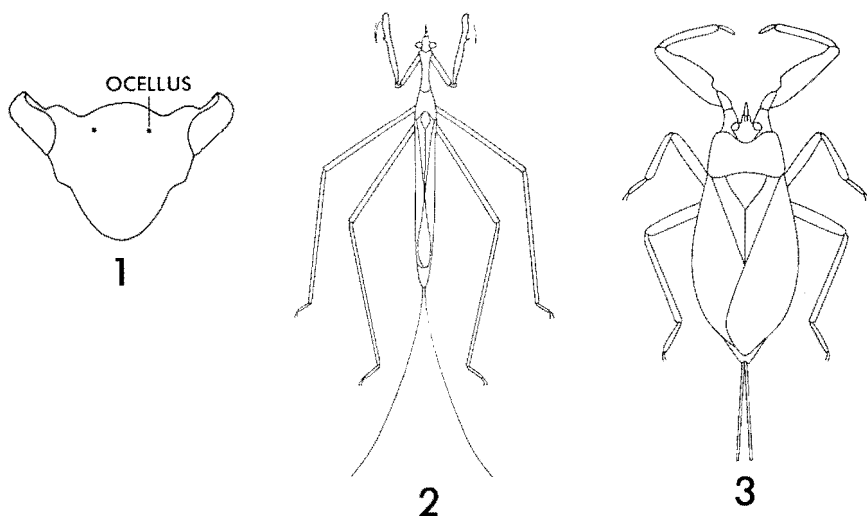
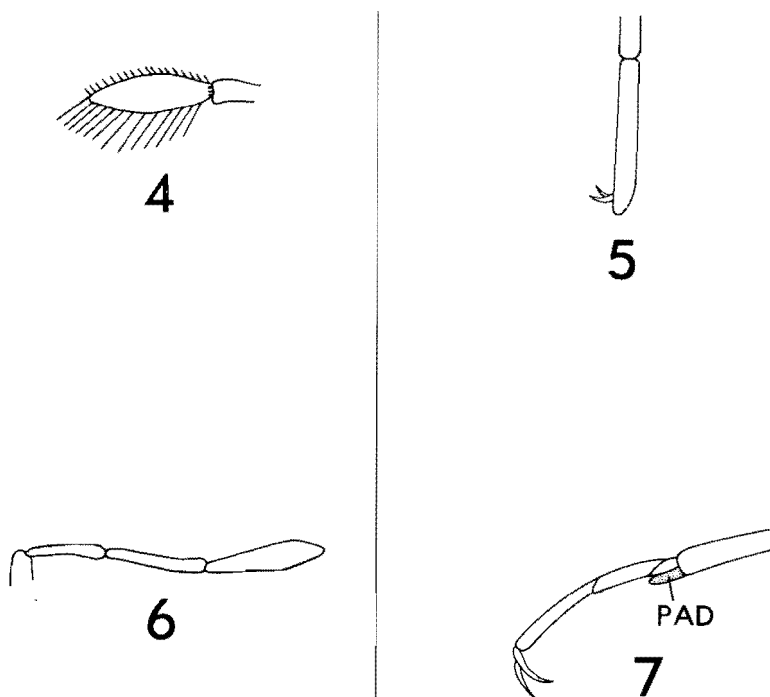


Fig. 1. Head, frontal view, *Gelastocoris oculatus* (Fab.).
 Fig. 2. General dorsal view, *Ranatra australis* Hungerford.
 Fig. 3. General dorsal view, *Nepa apiculata* Uhler.

- 4'. Body without terminal, elongate filaments, at most with very short straplike filaments 5
5. Front tarsi 1-segmented, usually distinctly scooplike (Fig. 4); beak short, broad, lacking distinct segmentation; dorsal surface of body, particularly thorax, often with transverse stripes. CORIXIDAE
- 5'. Front tarsi not as above; beak distinctly segmented; dorsal surface of body, including thorax, usually without transverse stripes. 6
6. Hind tarsi lacking claws; hind legs very long, oarlike; front legs not distinctly raptorial. NOTONECTIDAE
- 6'. Hind tarsi with pair of claws; hind legs not unusually long and oarlike; front legs often raptorial 7
7. Animals small, less than 3 mm in length; beetlelike, body strongly arched, yellowish brown to brown; front legs not raptorial. PLEIDAE
- 7'. Animals large, much longer than 3 mm; body flattened; front legs raptorial . . . 8
8. Membrane of front wings lacking veins; abdomen lacking terminal respiratory appendages; length less than 15 mm NAUCORIDAE
- 8'. Membrane of front wings with veins; abdomen with very short straplike appendages; length often more than 15 mm BELOSTOMATIDAE
9. Wings absent; body flattened, oval; ocelli absent; ectoparasites of birds and mammals. CIMICIDAE
- 9'. Wings present or absent but if absent, body not flattened and oval; ocelli present or absent 10
10. Body extremely elongate and narrow; head as long as thorax; legs very slender; aquatic or semiaquatic. HYDROMETRIDAE
- 10'. Body of various shapes but if elongate and narrow, then head much shorter than thorax 11
11. Claws of at least front tarsi arising well before apex (Fig. 5); front tarsi with tip of last segment cleft (difficult to see in some individuals); occurring on water surface. 12

Fig. 4. Front tarsus, female, *Hesperocorixa lucida* (Abbott).Fig. 5. Middle tarsus, *Gerris remigis* SayFig. 6. Antenna, *Phymata americana* Melin.Fig. 7. Middle tarsus, *Nabis americanoferus* Carayon.

- 11'. Claws arising at apex; front tarsi with tip of last segment not cleft.13
12. Middle legs arising much closer to hind legs than front legs; hind femora extending well beyond tip of abdomen.GERRIDAE
- 12'. Middle legs usually arising midway between front and hind legs; hind femora not or just slightly extending beyond tip of abdomenVELIIDAE
13. Antennae 4-segmented.14
- 13'. Antennae 5-segmented (or more)33
14. Prosternum with median striated groove; beak 3-segmented, its tip fitting into groove; front legs raptorial.15
- 14'. Prosternum without median striated groove; beak 3- or 4-segmented; front legs variable16
15. Antennae with last segment noticeably swollen (Fig. 6); front femora greatly swollen; front tarsi fitting into groove in tibiaePHYMATIDAE
- 15'. Antennae with last segment not swollen; front femora may be somewhat enlarged but not greatly swollen; front tarsi usually not fitting into groove in tibiaeREDUVIIDAE
16. Head elongate, constricted behind eyes and at base, thus divided into 2 separate lobes; length 5 mm or lessENICOCEPHALIDAE
- 16'. Head not divided into 2 separate lobes; length variable17

17. Front wings with cuneus (Fig. 8) or if not, hind femora enlarged and wings thickened and ovoid 18
- 17'. Front wings without cuneus or wings absent, hind femora sometimes enlarged but if so, wings not thickened and ovoid 20
18. Ocelli absent; if front wings with membrane, then also with 1–2 closed cells (Fig. 8) MIRIDAE
- 18'. Ocelli present 19
19. Labium 4-segmented (rare bugs) ISOMETOPIIDAE
- 19'. Labium 3-segmented ANTHOCORIDAE
20. Tips of front and middle tibiae with thick pad of hairs (Fig. 7) NABIDAE
- 20'. Tips of front and middle tibiae without thick pad of hairs 21
21. Front wings with numerous closed cells, often giving them lacy appearance . . 22
- 21'. Front wings variable (or wings absent) but not with numerous closed cells (although some closed cells may be present) and not having lacy appearance 23
22. Ocelli present PIESMATIDAE
- 22'. Ocelli absent TINGIDAE
23. Membrane of front wings with 4–5 elongate closed cells (Fig. 9) SALDIDAE
- 23'. Membrane of front wings with cells (but not as above) and veins, or lacking cells and veins, or wings absent 24
24. Length usually less than 4 mm; wings often absent but if present, then membrane of front pair lacking cells and veins; aquatic or semiaquatic 25
- 24'. Length usually much greater than 4 mm; wings present, membrane of front pair usually with cells and veins (which may be difficult to see); habitat variable. . . 26
25. Tarsi 2-segmented; base of beak lying within groove formed by bucculae; body covered with short velvety hairs; color variable but not yellowish green or green HEBRIDAE
- 25'. Tarsi 3-segmented; base of beak not lying within groove; body not covered with velvety hairs although short hairs present; color yellowish green or green MESOVELIIDAE
26. Tarsi 2-segmented; body very flat, usually gray, black or brown ARADIDAE
- 26'. Tarsi 3-segmented; body not very flat, color variable 27
27. Ocelli absent 28
- 27'. Ocelli present 29
28. Elongate, slender, subshiny to shiny black bugs, 8–10 mm in length, with yellowish to yellowish brown legs; membrane of front wings with 5 or fewer longitudinal veins (Fig. 10) (*Cnemodus mavortius* [Say]) LYGAEIDAE
- 28'. Elongate-oval gray to black bugs, 13–17 mm in length, with lateral margins of pronotum, corium, and abdomen and basal areas of femora yellow orange to red; membrane of front wings with 2 basal cells giving rise to 7–8 longitudinal veins (*Largus succinctus* [L.]) LARGIDAE
29. Body and appendages elongate and narrow, body 8 times or more as long as greatest width of pronotum; first segment of antennae elongate, last segment spindle-shaped BERYTIDAE
- 29'. Body shape variable but if slender, not exceeding 5 times greatest width of pronotum; antennae not as above 30
30. Membrane of front wings with 4–5 longitudinal veins (Fig. 10) LYGAEIDAE
- 30'. Membrane of front wings with many veins 31
31. Metathoracic scent gland opening absent or very reduced; ocelli well developed, tuberculate RHOPALIDAE
- 31'. Metathoracic scent gland opening large, conspicuous, located between middle and hind coxae; ocelli present but smaller, not tuberculate 32
32. Head across eyes 1/3 to 1/2 width of pronotum at base (Fig. 11); bucculae extending posteriorly beyond bases of antennae COREIDAE
- 32'. Head across eyes about as wide as pronotum at base (Fig. 12); bucculae not extending posteriorly beyond bases of antennae ALYDIDAE

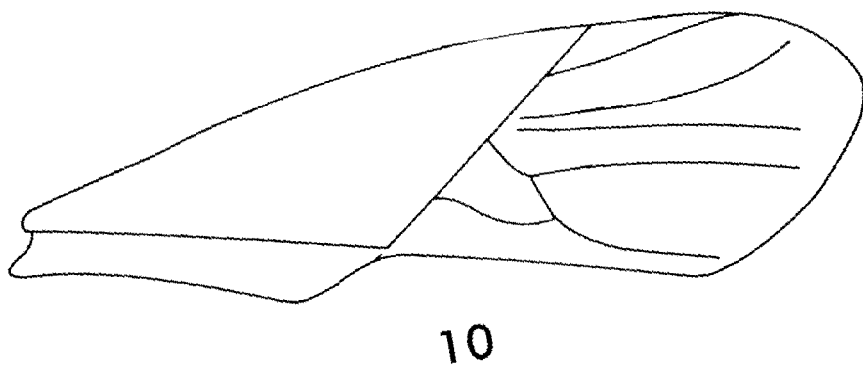
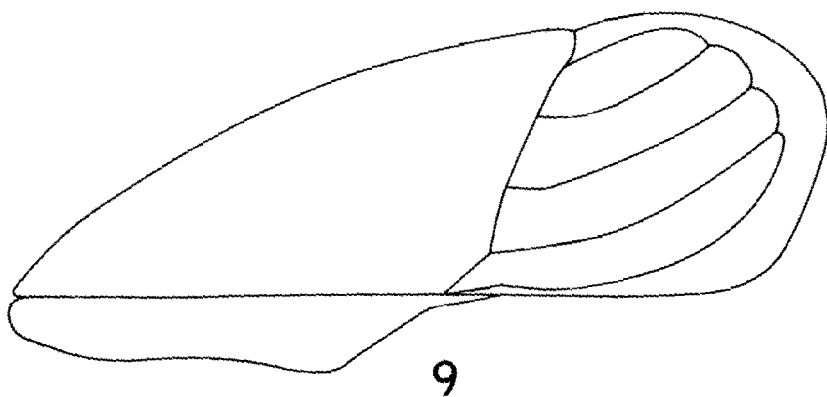
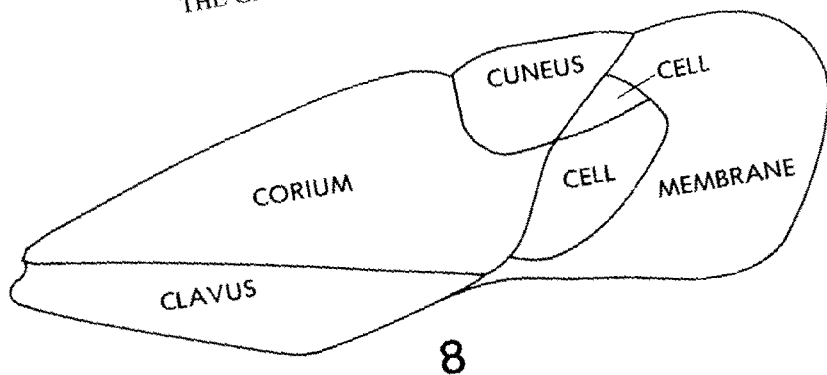
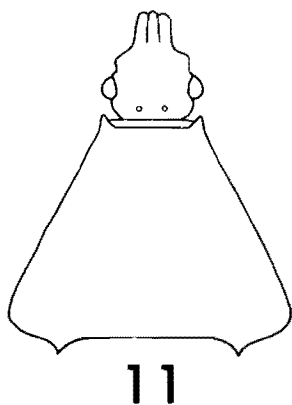
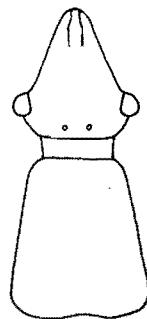


Fig. 8. Front wing, *Lygus lineolaris* (Palisot de Beauvois).
Fig. 9. Front wing, *Salda lugubris* (Say).
Fig. 10. Front wing, *Lygaeus kalmii* Stål.



11



12

Fig. 11. Head and prothorax, dorsal view, *Anasa tristis* (De Geer).Fig. 12. Head and prothorax, dorsal view, *Alydus eurinus* (Say).

33. Length 3 mm or less; front wings, if present, largely membranous; body covered with short velvety hairsHEBRIDAE
- 33'. Length greater than 4 mm; front wings not largely membranous; body not covered with short velvety hairs although hairs may be present.34
34. Prosternum with median striated groove; beak 3-segmented, its tip fitting into grooveREDUVIIDAE
- 34'. Prosternum without median striated groove; beak 4-segmented35
35. Tips of front and middle tibiae with thick pad of hairs (Fig. 7); scutellum only about 1/5 length of abdomenNABIDAE
- 35'. Tips of front and middle tibiae without thick pad of hairs; scutellum at least about 1/2 length of abdomen (Fig. 14).36
36. Scutellum large, U-shaped, covering most of abdomen (Fig. 13).37
- 36'. Scutellum usually much shorter than abdomen, subtriangular (Fig. 14); if scutellum large and U-shaped, then colors bright and contrasting or prominent tooth or process present at each anterolateral angle of pronotum38
37. Tibiae armed with 2 or more rows of strong spines (Fig. 15); color primarily shiny black.THYREOCORIDAE
- 37'. Tibiae without strong spines (Fig. 16); color variable but never shiny black.SCUTELLERIDAE
38. Tibiae armed with 2 or more rows of strong spines (Fig. 15); front legs fossorial; length usually less than 7 mmCYDNIDAE
- 38'. Tibiae without strong spines (Fig. 16); front legs not fossorial; length usually more than 7 mm39
39. Tarsi 2-segmented (Fig. 17); thoracic and abdominal sterna with well developed midventral longitudinal ridge.ACANTHOSOMATIDAE
- 39'. Tarsi 3-segmented (Fig. 16); thoracic and abdominal sterna without well developed midventral longitudinal ridgePENTATOMIDAE

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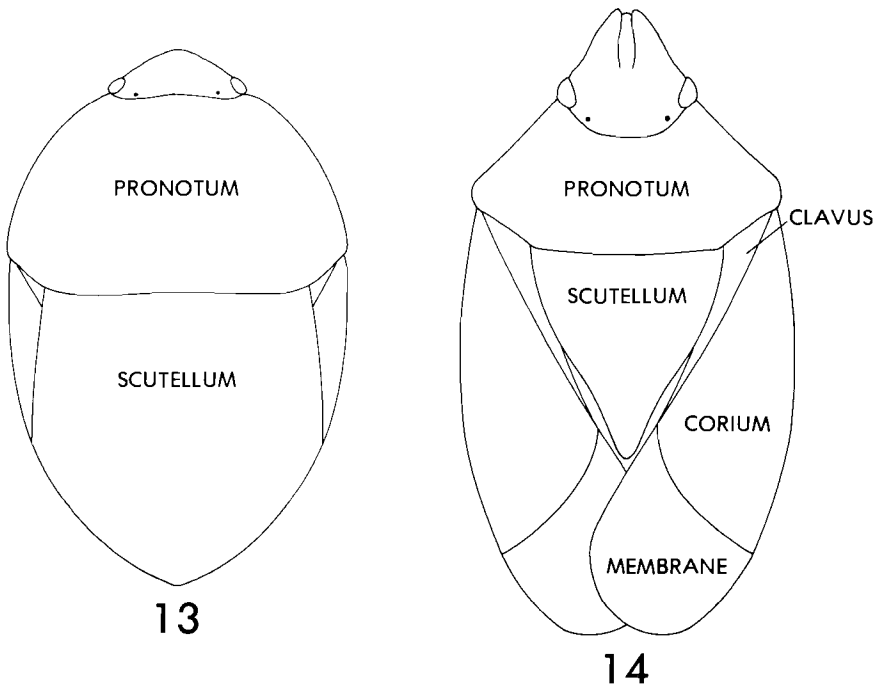


Fig. 13. General dorsal view, *Galgupha carinata* McAtee and Malloch.

Fig. 14. General dorsal view, *Chlorochroa saucia* (Say).

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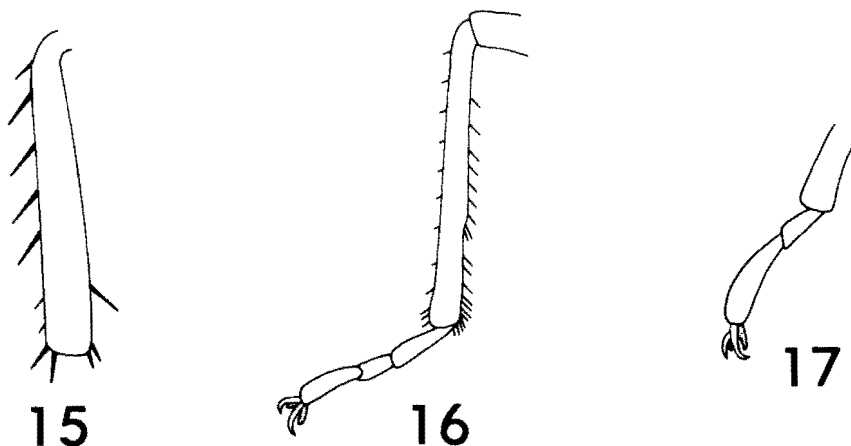


Fig. 15. Front tibia, *Galgupha denudata* (Uhler).

Fig. 16. Front tibia and tarsus, *Acrosternum hilare* (Say).

Fig. 17. Front tarsus, *Elasmostethus cruciatus* (Say).

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SPECIFIC FAMILIES

1. Leptopodomorpha

Saldidae (Shore Bugs)

Members of this small predaceous family are elongate-oval with protuberant eyes, and usually black and white or brown and white. They have 4 or 5 elongate closed cells in the membrane of the first pair of wings, 4-segmented antennae, and a 3-segmented beak. They often are common on sand and mud along the shores of salt marshes, ponds, streams, and even the ocean; and can be found on exposed surfaces of stones and rocks in rapid streams. They are very quick, fly readily, and often are difficult to catch. They feed on other insects.

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2. Gerromorpha

Hebridae (Velvet Water Bugs)

This small family is represented in Illinois by both North American genera, *Merragata* and *Hebrus*. It consists of small bugs (less than 3 mm in length) that possess 4- (*Merragata*) or 5- (*Hebrus*) segmented antennae, a 4-segmented beak, ocelli, and 2-segmented tarsi with apical claws. Velvet water bugs may possess fully developed or short wings, or lack wings. They occur on the surfaces of ponds and pools, often near the shore, or on damp soil along the shoreline; quite often they occur where there is much aquatic vegetation. They presumably are predaceous on small organisms.

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Mesoveliidae
(Water Treaders)

This small family of semiaquatic bugs consists of species that are usually less than 5 mm in length, usually greenish or yellowish green, have apical tarsal claws, and usually have ocelli in fully winged forms but greatly reduced or no ocelli in wingless individuals. Only one genus, *Mesovelia*, occurs in America north of Mexico. Water treaders occur on the surfaces of lakes and ponds, particularly where there is a heavy growth of surface vegetation, and presumably are predaceous on small insects.

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Hydrometridae
(Marsh Treaders, Water Measurers)

Members of this small aquatic family are easily recognized by their small size (about 8 mm in length), elongate slender body, threadlike legs and antennae, and elongate head with beadlike eyes located about midway between the tip and base of the head. Only one genus, *Hydrometra*, occurs in America north of Mexico. Marsh treaders usually occur on the surface of shallow standing water with much surface vegetation and are predaceous, feeding on small insects and ostracods.

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Veliidae
(Broad-Shouldered Water Striders, Riffle Bugs)

This predaceous aquatic family consists of small bugs (usually less than 6 mm in length) that live on the surfaces of both standing and flowing water or on the adjacent shore. They have anteapical claws as do the gerrids, but can be distinguished from them by the characters given in the key. They feed on small insects.

Smith, C. L. and J. T. Polhemus. 1978. The Veliidae (Heteroptera) of American north of Mexico—keys and check list. *Proc. Entomol. Soc. Washington* 80:56–68.

Gerridae
(Water Striders, Pond Skaters)

These common predaceous insects are probably the most familiar of the aquatic Heteroptera. They are long-legged and often seen running across the surfaces on both standing and flowing water. They have anteapical claws, a character shared only with the veliids, and 2-segmented tarsi. Both winged and wingless forms occur. The front legs are short and used in capturing insects that fall on the surface of the water.

- Calabrese, D. M. 1974. Keys to the adults and nymphs of the species of *Gerris* Fabricius occurring in Connecticut. 25th Anniv. Mem. Connecticut Entomol. Soc. 1974:227-266.
- Deay, H. O. and G. E. Gould. 1936. The Hemiptera of Indiana, 1. Family Gerridae. Amer. Midland Natur. 17:753-769.
- Drake, C. J. and H. M. Harris. 1934. III. The Gerrinae of the Western Hemisphere (Hemiptera). Ann. Carnegie Mus. 23:179-240.
- Hungerford, H. B. and R. Matsuda. 1960. Keys to subfamilies, tribes, genera and subgenera of the Gerridae of the world. Univ. Kansas Sci. Bull. 41:3-23.
- Kittle, P. D. 1977. The biology of water striders (Hemiptera:Gerridae) in northwestern Arkansas. Amer. Midland Natur. 97:400-410.
- Kittle, P. D. 1980. The water striders (Hemiptera:Gerridae) of Arkansas. Arkansas Acad. Sci. Proc. 34:68-71.
- Korsh, P. P., III. and J. E. McPherson. 1987. Life history and laboratory rearing of *Gerris argenticollis* (Hemiptera:Gerridae) with descriptions of immature stages. Great Lakes Entomol. 20:193-204.
- Sprague, I. B. 1967. Nymphs of the genus *Gerris* (Heteroptera:Gerridae) in New England. Ann. Entomol. Soc. Amer. 60:1038-1044.

3. Nepomorpha

Nepidae (Water Scorpions)

This predaceous aquatic family is represented in Illinois by two genera, *Ranatra* and *Nepa*. Water scorpions are easily recognized by the long caudal breathing tube. The front legs are raptorial; and the middle and hind legs are slender, not flattened, and lack swimming hairs. These insects occur in ponds and streams clinging to sticks and weeds (*Ranatra*) or in shallow muddy pools or slow shallow streams with little vegetation (*Nepa*). They feed primarily on aquatic insects but will also attack fish.

- Hungerford, H. B. 1922. The Nepidae of North America. Univ. Kansas Sci. Bull. 14:425-469.
- McPherson, J. E. and R. J. Packauskas. 1987. Life history and laboratory rearing of *Nepa apiculata* (Heteroptera:Nepidae), with descriptions of immature stages. Ann. Entomol. Soc. Amer. 80:680-685.
- Packauskas, R. J. and J. E. McPherson. 1986. Life history and laboratory rearing of *Ranatra fusca* (Hemiptera:Nepidae) with descriptions of immature stages. Ann. Entomol. Soc. Amer. 79:566-571.

Belostomatidae (Giant Water Bugs, Toe Biters)

This small aquatic family, which contains some of the largest insects in North America, is represented in Illinois by two genera, *Belostoma* and *Lethocerus* (including *Benacus*). All species are flattened, elongate-oval, nearly uniformly dull brown to yellowish, and possess raptorial front legs and flattened hind legs with long swimming hairs. They occur in ponds, lakes, and the quiet parts of streams where they feed on insects, snails, tadpoles, and small fish. They can be attracted to lights.

- Lauck, D. R. 1962. A monograph of the genus *Belostoma* (Hemiptera). Part I. Introduction and *B. dentatum* and *subspinosum* groups. Bull. Chicago Acad. Sci. 11:34-81.
- Lauck, D. R. 1963. A monograph of the genus *Belostoma* (Hemiptera). Part II. *B. aurivillianum*, *stollii*, *testaceopallidum*, *dilatatum*, and *discretum* groups. Bull. Chicago Acad. Sci. 11:82-101.
- Lauck, D. R. 1964. A monograph of the genus *Belostoma* (Hemiptera). Part III. *B. triangulum*, *bergi*, *minor*, *bifoveolatum* and *flumineum* groups. Bull. Chicago Acad. Sci. 11:102-154.

- McPherson, J. E. and R. J. Packauskas. 1986. Life history and laboratory rearing of *Belostoma lutarium* (Heteroptera:Belostomatidae) with descriptions of immature stages. J. New York Entomol. Soc. 94:154-162.
- Menke, A. S. 1963. A review of the genus *Lethocerus* in North and Central America, including the West Indies (Hemiptera:Belostomatidae). Ann. Entomol. Soc. Amer. 56:261-267.

Corixidae (Water Boatmen)

These bugs superficially resemble backswimmers but can be recognized by the transversely striped appearance of the dorsal surface of the body of many species; the more flattened appearance; the highly modified beak, which is unsegmented, broad, and conical; and the scooplike front tarsi. They occur most frequently near the shores of freshwater ponds and lakes although a few species occur in brackish water. Most species feed on algae and other minute organisms but a few are typically predaceous, feeding on midge and mosquito larvae and other small aquatic organisms. They often are attracted to lights.

- Hilsenhoff, W. L. 1970. Corixidae (water boatmen) of Wisconsin. Wisconsin Acad. Sci., Arts, and Letters 58:203-235.
- Hungerford, H. B. 1948. The Corixidae of the Western Hemisphere (Hemiptera). (including a monograph on the *Trichocorixa* by R. I. Sailer). Univ. Kansas Sci. Bull. 32:5-827.

Notonectidae (Backswimmers)

Members of this moderate-sized family of aquatic bugs are easily recognized by their habit as nymphs and adults of swimming upside down. Their long hind legs, which are equipped with long hairs, serve as oars for swimming. They are similar to water boatmen but the dorsal side of the body is more convex and often light-colored. Two genera occur in Illinois, *Notonecta* and *Buenoa*. Backswimmers are most abundant in ponds and lakes and slow parts of streams where they frequently rest at the surface (*Notonecta*); however, they can occur primarily in open water below the surface film (*Buenoa*). They are highly predaceous, feeding on insects, small crustaceans, tadpoles, and small fish.

- Hungerford, H. B. 1933. The genus *Notonecta* of the world (Notonectidae-Hemiptera). Univ. Kansas Sci. Bull. 21:5-195.
- Truxal, F. S. 1953. A revision of the genus *Buenoa* (Hemiptera, Notonectidae). Univ. Kansas Sci. Bull. 35:1351-1523.

Pleidae (Pigmy Backswimmers)

This small aquatic family of very small predaceous bugs (usually less than 2.5 mm in length) is represented in Illinois by only one species, *Neoplea striola* Fieber. Pigmy backswimmers are closely related to backswimmers but can be distinguished by the very convex dorsal surface of the body; hard elytra forming a shell over the back; and the lack of swimming hairs on the hind legs, which are not particularly oarlike. They feed on small crustaceans and, perhaps, small insects.

- Drake, C. J. and H. C. Chapman. 1953. Preliminary report on the Pleidae (Hemiptera) of the Americas. Proc. Biol. Soc. Washington 66:53-59.

- McPherson, J. E. 1986. Life history of *Neoplea striola* (Hemiptera:Pleidae). Great Lakes Entomol. 19:217-220.

Naucoridae (Creeping Water Bugs, Saucer Bugs)

This highly predaceous aquatic family is represented in Illinois by only one species, *Pelocoris femoratus* (Palisot de Beauvois). Creeping water bugs are medium-sized, broadly oval, somewhat flattened, and brownish. They have raptorial front legs with greatly enlarged front femora, lack ocelli, and lack veins in the membrane of the first pair of wings. They occur primarily in quiet water with dense vegetation, but some are adapted for living in rapid streams. They feed on small aquatic animals.

- La Rivers, I. 1971. Studies of Naucoridae (Hemiptera). Biol. Soc. Nevada Mem. II:1-120.
 La Rivers, I. 1974. Catalogue of taxa described in the family Naucoridae (Hemiptera) supplement No. 1: corrections, emendations and additions, with descriptions of new species. Biol. Soc. Nevada Occasional Papers 38:1-17.
 La Rivers, I. 1976. Supplement No. 2 to the catalogue of taxa described in the family Naucoridae (Hemiptera) with descriptions of new species. Biol. Soc. Nevada Occasional Papers 41:1-17.
 McPherson, J. E., R. J. Packauskas, and P. P. Korch, III. 1987. Life history and laboratory rearing of *Pelocoris femoratus* (Hemiptera:Naucoridae), with descriptions of immature stages. Proc. Entomol. Soc. Washington 89:288-295.
 Usinger, R. L. 1941. Key to the subfamilies of Naucoridae with a generic synopsis of the new subfamily Ambryinae (Hemiptera). Ann. Entomol. Soc. Amer. 34:5-16.

Gelastocoridae (Toad Bugs)

This small predaceous family is represented in Illinois by only one species, *Gelastocoris oculatus* (Fab.). Toad bugs are ovoid, flattened, dull-colored with bulging eyes, and superficially resemble toads in both appearance and hopping habits. They usually occur on mud and sand along the margins of ponds and streams where they feed on small insects and mites.

- Todd, E. L. 1955. A taxonomic revision of the family Gelastocoridae (Hemiptera). Univ. Kansas Sci. Bull. 37:277-475.
 Todd, E. L. 1961. A checklist of the Gelastocoridae (Hemiptera). Proc. Hawaiian Entomol. Soc. 17:461-476.

Ochteridae (Velvety Shore Bugs)

Members of this very small family are small (less than 5 mm in length), oval-bodied, and dark brown to black; and have ocelli, 4-segmented antennae, a long beak that usually extends back between the hind coxae, and tarsi in which the first and second pair are 2-segmented and the hind pair 3-segmented (first segment very small on all tarsi). Only one genus, *Ochterus*, is known from America north of Mexico. Velvety shore bugs usually occur on mud or sand flats, or among weeds and grasses along the shores of ponds and streams, or in nearby wet areas. Although they are predaceous, feeding on small insects, the front legs are not raptorial.

- Drake, C. J. 1952. Concerning American Ochteridae (Hemiptera). Florida Entomol. 35:72-75.
 Schell, D. V. 1943. The Ochteridae (Hemiptera) of the Western Hemisphere. J. Kansas Entomol. Soc. 16:29-47.

4. Enicocephalomorpha**Enicocephalidae**
(Unique-Headed Bugs)

These small bugs (2–5 mm in length) are rather rare in North America. They can be easily recognized by the unusually shaped head, which is constricted just behind the eyes and at its base and somewhat swollen between these constrictions. The front wings are entirely membranous and the front legs raptorial. These insects usually are found under stones and leaves in wooded areas and under bark of dead trees. They are predaceous, feeding on various small insects.

Usinger, R. L. 1945. Classification of the Enicocephalidae (Hemiptera, Reduvioidea). *Ann. Entomol. Soc. Amer.* 38:321–342.

5. Cimicomorpha**Isometopidae**
(Jumping Tree Bugs)

This very small family (less than a dozen species north of Mexico) is usually treated as a subfamily of Miridae. Its members are small insects (less than 3 mm in length) that resemble mirids in having a cuneus and one or two cells in the membrane of the first pair of wings. They differ, however, in having ocelli. Little is known about their biology. They occur on bark and dead twigs and can jump quickly when disturbed. Some species are predaceous.

Eyles, A. C. 1971. List of Isometopidae (Heteroptera: Cimicoidea). *New Zealand J. Sci.* 14:940–944.

McAtee, W. L. and J. R. Malloch. 1924. Some annectant bugs of the superfamily Cimicoidea (Heteroptera). *Bull. Brooklyn Entomol. Soc.* 19:69–83.

Wheeler, A. G., Jr. and T. J. Henry. 1978. Isometopinae (Hemiptera:Miridae) in Pennsylvania: biology and descriptions of fifth instars, with observations of predation on obscure scale. *Ann. Entomol. Soc. Amer.* 71:607–614.

Wheeler, A. G., Jr., T. J. Henry, and T. L. Mason, Jr. 1983. An annotated list of the Miridae of West Virginia (Hemiptera-Heteroptera). *Trans. Amer. Entomol. Soc.* 109:127–159.

Miridae
(Plant Bugs, Leaf Bugs)

This family, the largest of the Heteroptera, is represented in North America by more than 1,900 species. Plant bugs can be recognized by the presence of a cuneus and one or two basal cells in the membrane of the first pair of wings, and lack of ocelli. They occur on a variety of plants, from grasses to trees, and most are plant feeders although some are predaceous on small insects. Some species are economically important, including the well known tarnished plant bug, *Lygus lineolaris* (Palisot de Beauvois).

Kelton, L. A. 1980. The insects and arachnids of Canada. Part 8. The plant bugs of the prairie provinces of Canada. *Heteroptera:Miridae*. *Agric. Can. Pub.* 1703:1–408.

Knight, H. H. 1941. The plant bugs, or Miridae, of Illinois. *Bull. Illinois Natur. Hist. Surv.* 22(1):1–234.

Wheeler, A. G., Jr., T. J. Henry, and T. L. Mason, Jr. 1983. An annotated list of the Miridae of West Virginia (Hemiptera-Heteroptera). *Trans. Amer. Entomol. Soc.* 109:127–159.

Anthocoridae
(Flower Bugs, Minute Pirate Bugs)

These small insects (2–5 mm in length) are elongate-oval, somewhat flattened; and have ocelli, a somewhat pointed head, an apparently 3-segmented beak, and a distinct cuneus in the first pair of wings. They occur on flowers, coniferous and deciduous trees; under loose bark; and in leaf litter, decaying fungi, and nests of birds and mammals. Most species are predaceous, feeding on small insects and insect eggs.

Kelton, L. A. 1978. The insects and arachnids of Canada. Part 4. The Anthocoridae of Canada and Alaska. Heteroptera:Anthocoridae. Can. Dep. Agric. Pub. 1639:1–101.

Cimicidae
(Bed Bugs)

This small family consists of bugs that are blood-sucking ectoparasites of mammals and birds; all species live away from the host in cracks, crevices, or nests except when feeding. These insects are 5–7 mm in length, flattened, oval, often reddish brown, and have the front wings reduced to small pads and hind wings absent. Although one species (i.e., *Oeciacus vicarius* Horvath) apparently can transmit an arbovirus to some birds, none has been implicated as a vector of any human disease. The common bed bug of man (*Cimex lectularius* L.) is a member of this family.

Eads, R. B., D. B. Francy, and G. C. Smith. 1980. The swallow bug, *Oeciacus vicarius* Horvath (Hemiptera:Cimicidae), a human household pest. Proc. Entomol. Soc. Washington 82:81–85.

Rush, W. A., D. B. Francy, G. C. Smith, and C. B. Cropp. 1980. Transmission of an arbovirus by a member of the Family Cimicidae. Ann. Entomol. Soc. Amer. 73:315–318.

Usinger, R. L. 1966. Monograph of Cimicidae (Hemiptera-Heteroptera). Thomas Say Found. 7:1–585.

Nabidae
(Damsel Bugs)

Members of this family are small to average-sized bugs that are relatively slender with the front femora slightly enlarged. The head is narrow and elongate, beak 4-segmented, and pronotum 2-lobed; and the first pair of wings, when present, has a series of short veins along the membrane margin. These predaceous bugs search actively for their prey, including aphids and caterpillars, on shrubs and weeds, and on the ground. They are important predators of pests on alfalfa, cotton, and other crops.

Harris, H. M. 1928. A monographic study of the hemipterous family Nabidae as it occurs in North America. Entomol. Amer. (N.S.) 9:1–97.

Reduviidae
(Assassin Bugs and Thread-Legged Bugs)

Members of this large family of bugs are easily recognized by the short 3-segmented beak that fits into a transversely-striated prosternal groove, and, usually, the lack of greatly swollen front femora. The body form (or habitus) can vary from stout and robust (assassin bugs) to elongate, slender, and long-legged (thread-legged bugs). Most species are predaceous on other insects, many of which are of economic importance. A few species, however, are blood suckers, feeding on various vertebrates including man. These blood suckers are known as “kissing bugs” because of their tendency to bite around the

mouth and have been shown to transmit a trypanosome disease of man known as Chagas' disease.

- Lent, H. and P. W. Wygodzinsky. 1979. Revision of the Triatominae (Hemiptera, Reduviidae), and their significance as vectors of Chagas' Disease. Bull. Amer. Mus. Natur. Hist. 163:123-520.
- Read, P. A. 1927. Studies on the biology of the Reduviidae of America north of Mexico. Univ. Kansas Sci. Bull. 17:5-291.
- Wygodzinsky, P. W. 1966. A monograph of the Emesinae (Reduviidae, Hemiptera). Bull. Amer. Mus. Natur. Hist. 133:1-614.

Phymatidae (Ambush Bugs)

This small family contains medium-sized predaceous bugs that have well developed raptorial front legs; the tibiae are sickle-shaped and fit into a groove on the inner side of the femora, and the tarsi are reduced or absent. Ambush bugs are often cryptically colored and often wait motionlessly on flower heads for their prey, primarily flies, wasps, and bees.

- Kormilev, N. A. 1960. Revision of Phymatinae (Hemiptera, Phymatidae). Philippine J. Sci. 89(3-4):287-486.

Tingidae (Lace Bugs)

This is a large family of small (usually less than 5 mm in length) rather attractive insects. The common name, lace bug, refers to the lacy appearance in adults of the pronotum and first pair of wings. The insects lack ocelli, and have 4-segmented antennae and 2-segmented tarsi. They are all plant feeders, feeding on herbaceous plants, shrubs, and trees. Quite often, the species are host specific or limited to a group of closely related plants.

- Bailey, N. S. 1951. The Tingioidea of New England and their biology. Entomol. Amer. 31 (N.S.):1-140.
- Drake, C. J. and F. A. Ruhoff. 1960. Lace-bug genera of the world (Hemiptera:Tingidae). Proc. U. S. Nat. Mus. 112:1-105.
- Drake, C. J. and F. A. Ruhoff. 1965. Lacebugs of the world. A catalog (Hemiptera:Tingidae). Bull. U. S. Nat. Mus. 243:1-634.
- Hurd, M. P. 1946. Generic classification of North American Tingioidea (Hemiptera-Heteroptera). Iowa State Coll. J. Sci. 20:429-489.
- Sheeley, R. D. and T. R. Yonke. 1977. Biological notes on seven species of Missouri tingids (Hemiptera:Tingidae). J. Kansas Entomol. Soc. 50:342-356.
- Vogt, T. E. and J. E. McPherson. 1986. Life history and laboratory rearing of *Corythucha juglandis* (Hemiptera:Tingidae) with descriptions of immature stages. Great Lakes Entomol. 19:221-233.

6. Pentatomomorpha

Aradidae (Flat Bugs)

These small to average-sized bugs (3-11 mm in length) are dark brown to black and very flat. The body is usually elongate-oval and generally has a granular appearance. The antennae are 4-segmented, tarsi 2-segmented, and ocelli are lacking. These bugs usually are found on or under bark of decaying or dead trees where they feed on fungi.

- Kormilev, N. A. and R. C. Froeschner. 1987. Flat bugs of the world: a synonymic list (Heteroptera:Aradidae). Entomography 5:1-246.
- Matsuda, R. 1977. The insects and arachnids of Canada. Part 3. The Aradidae of Canada. Hemiptera:Aradidae. Can. Dep. Agric. Pub. 1634:1-116.
- Parshley, H. M. 1921. Essay on the American species of *Aradus* (Hemiptera). Trans. Amer. Entomol. Soc. 47:1-106.
- Usinger, R. L. and R. Matsuda. 1959. Classification of the Aradidae (Hemiptera-Heteroptera). British Mus. (Natur. Hist.), London. 410 pp.

Berytidae (Stilt Bugs)

These elongate slender bugs have long legs and antennae, giving them a thread-legged appearance. They are primarily plant feeders but occasionally are predaceous. Superficially they resemble the marsh treaders and thread-legged bugs. However, they never occur on the water surface (as do marsh treaders) nor do they have the front legs modified for grasping prey (as do thread-legged bugs).

- Harris, H. M. 1941. Concerning Neididae, with new species and new records for North America. Bull. Brooklyn Entomol. Soc. 36:105-109.
- McAtee, W. L. 1919. Key to the Nearctic genera and species of Berytidae (Heteroptera). J. New York Entomol. Soc. 27:79-92.
- Wheeler, A. G., Jr. and T. J. Henry. 1981. *Jalysus spinosus* and *J. wickhami*: taxonomic clarification, review of host plants and distribution, and keys to adults and 5th instars. Ann. Entomol. Soc. Amer. 74:606-615.

Piesmatidae (Ash-Gray Leaf Bugs)

These small bugs (less than 4 mm in length) can be recognized by the reticulated corium and clavus, juga that extend in front of the tylus, 5 longitudinal ridges on the pronotum, 2-segmented tarsi, and presence of ocelli. Only one genus, *Piesma*, occurs in North America. Ash-gray leaf bugs are plant feeders and attack several species, including pigweed (*Amaranthus*). They commonly can be collected in window traps.

- Drake, C. J. and N. T. Davis. 1958. The morphology and systematics of the Piesmatidae (Hemiptera), with keys to world genera and American species. Ann. Entomol. Soc. Amer. 51:567-581.
- McAtee, W. L. 1919. Key to the Nearctic species of Piesmidiae (Heteroptera). Bull. Brooklyn Entomol. Soc. 14:80-93.

Largidae (Largid Bugs)

This small family is closely related to the Lygaeidae. The 4-segmented beak, absence of ocelli, and presence in the membrane of the first pair of wings of 7 or 8 branching veins arising from 2 large basal cells distinguish this group. All members are plant feeders and are found on the ground or low vegetation. Some mimic ants. The family is represented in Illinois by only two genera, *Largus* and *Arhapha*. *Arhapha* is a recent addition to the state fauna, this based on two specimens of *A. carolina* Herrich-Schaeffer collected in 1966 but not reported until 1988; because the genus is represented only by these specimens, it is not included in the key.

- Bouseman, J. K. 1988. *Araphe (sic) carolina* in Illinois (Hemiptera:Largidae). Great Lakes Entomol. 21:117.
- Halstead, T. F. 1972. A review of the genus *Arhaphe* Herrich-Schäffer (Hemiptera:Largidae). Pan-Pacific Entomol. 48:1-7.
- Halstead, T. F. 1972. Notes and synonymy in *Largus* Hahn with a key to United States species (Hemiptera:Largidae). Pan-Pacific Entomol.48:246-248.

Lygaeidae (Seed Bugs)

Members of this large and diverse family have 4-segmented antennae, usually ocelli, a 4-segmented beak, and, in fully-winged forms, 4 or 5 distinct veins in the membranous part of the first pair of wings. They feed primarily on plants, particularly seeds, although several feed on sap and a few are predaceous on small insects. The infamous chinch bug, *Blissus leucopterus* (Say), belongs to this family.

- Slater, J. A. 1964. A catalogue of the Lygaeidae of the world. Vol. I:1-778; Vol. II:779-1168. Univ. of Connecticut Pub., Storrs.
- Sweet, M. H. 1960. The seed bugs: a contribution to the feeding habits of the Lygaeidae (Hemiptera:Heteroptera). Ann. Entomol. Soc. Amer. 53:317-321.
- Sweet, M. H. 1963. The biology and ecology of the Rhyparochrominae of New England (Heteroptera:Lygaeidae). Part. I. Entomol. Amer. 43 (N.S.):1-124. (1964).
- Sweet, M. H. 1964. The biology and ecology of the Rhyparochrominae of New England (Heteroptera:Lygaeidae). Part II. Entomol. Amer. 44 (N.S.):1-201.

Coreoidea (Scentless Plant Bugs, Broad-Headed Bugs, and Leaf-Footed Bugs)

- Hoffman, R. L. 1975. The insects of Virginia: No. 9. Squash, broad-headed, and scentless plant bugs of Virginia (Hemiptera: Coreoidea: Coreidae, Alydidae, Rhopalidae). Virginia Polytechnic Inst. and State Univ. Res. Div. Bull. 105:1-52.
- Schaefer, C. W. 1964. The morphology and higher classification of the Coreoidea (Hemiptera-Heteroptera): Parts I and II. Ann. Entomol. Soc. Amer. 57:670-684.
- Schaefer, C. W. 1965. The morphology and higher classification of the Coreoidea (Hemiptera-Heteroptera). Part III. The families Rhopalidae, Alydidae, and Coreidae. Misc. Pub. Entomol. Soc. Amer. 5:1-76.

Rhopalidae (Scentless Plant Bugs)

This family is closely related to the Coreidae but can be recognized by the very small thoracic scent glands (well developed in Alydidae and Coreidae) and the large tuberculate ocelli. Some species are similar to the Lygaeidae but have numerous veins in the membranous part of the first pair of wings. All species are plant feeders, and usually can be found in weedy fields. An exception is the box elder bug, *Boisea trivittata* (Say), which, quite logically, occurs on box elder.

- Chopra, N. P. 1967. The higher classification of the family Rhopalidae (Hemiptera). Trans. Roy. Entomol. Soc. London 119:363-399.
- Chopra, N. P. 1968. A revision of the genus *Arhyssus* Stål. Ann. Entomol. Soc. Amer. 61:629-655.
- Göllner-Scheiding, U. 1983. General-Katalog der Familie Rhopalidae (Heteroptera). Mitt. Zool. Mus. Berlin 59(1):37-189.
- Hoebcke, E. R. and A. G. Wheeler, Jr. 1982. *Rhopalus (Brachycarenum) tigrinus*, recently

established in North America, with a key to the genera and species of Rhopalidae in eastern North America (Hemiptera:Heteroptera). Proc. Entomol. Soc. Washington 84:213-224.
Paskewitz, S. M. and J. E. McPherson. 1983. Life history and laboratory rearing of *Arhyssus lateralis* (Hemiptera:Rhopalidae) with descriptions of immature stages. Ann. Entomol. Soc. Amer. 76:477-482.

Alydidae
(Broad-Headed Bugs)

This family is closely related to the Coreidae and the various species superficially resemble coreids. However, the head is broad and nearly as long as the pronotum. These plant feeders occur on flowers and foliage of various weeds and on grasses, frequently along roadsides. Nymphs of some species very much resemble ants.

Fracker, S. B. 1918. The Alydinae of the United States. Ann. Entomol. Soc. Amer. 11:255-282.

Coreidae
(Leaf-Footed Bugs)

These insects are generally medium-sized to large, elongate, and dark colored bugs with the head narrower and shorter than the pronotum. The membrane of the first pair of wings has numerous veins and, often, the hind tibiae are expanded and leaflike. Most species are plant feeders, and some are serious pests (e.g., the squash bug, *Anasa tristis* [De Geer]). However, a few species apparently are predaceous.

Baranowski, R. M. and J. A. Slater. 1986. Arthropods of Florida and neighboring land areas. Volume 12. Coreidae of Florida (Hemiptera:Heteroptera). Florida Dep. Agric. Consumer Services, Bur. Entomol., Contrib. No. 630, 82 pp.

Pentatomoidea
(Negro Bugs, Burrower Bugs, Shield-backed Bugs, Stink Bugs, and
Acanthosomatid Bugs)

These insects, in Illinois, all have 5-segmented antennae and well developed ocelli.

Hart, C. A. 1919. The Pentatomoidea of Illinois with keys to the Nearctic genera. Illinois Natur. Hist. Surv. Bull. 13:157-223.

McPherson, J. E. 1982. The Pentatomoidea (Hemiptera) of northeastern North America with emphasis on the fauna of Illinois. Southern Illinois Univ. Press, Carbondale and Edwardsville. 240 pp.

Thyreocoridae (= Corimelaenidae)
(Negro Bugs)

These small bugs (less than 6 mm in length) are oval, strongly convex, shiny black, and appear beetlelike. The tibiae are spined but the front tibiae are not flattened for digging as they are in the Cydnidae. The scutellum is well developed and covers the entire abdomen. These bugs are usually found on grasses and weeds in open fields and on berries.

Biehler, J. A. and J. E. McPherson. 1982. Life history and laboratory rearing of *Galgupha ovalis* (Hemiptera:Corimelaenidae), with descriptions of immature stages. Ann. Entomol. Soc. Amer. 75:465-470.

McAtee, W. L. and J. R. Malloch. 1933. Revision of the subfamily Thyreocorinae of the Pentatomidae (Hemiptera-Heteroptera). Ann. Carnegie Mus. 21:191-411.

Cydnidae (Burrower Bugs)

These bugs are generally black or reddish brown and less than 8 mm in length. They have spined tibiae, and the front tibiae are flattened and modified for digging. They are usually found in sand and soil where they apparently feed on plant roots. An exception is *Sehirus cinctus* (Palisot de Beauvois) in which nymphs are found in the soil but adults often climb up on plants and can be collected by sweeping; both the nymphs and adults of this species feed on seeds of the mint *Lamium purpureum*.

Froeschner, R. C. 1960. Cydnidae of the Western Hemisphere. Proc. U. S. Nat. Mus. 111:337-680.
Sites, R. W. and J. E. McPherson. 1982. Life history and laboratory rearing of *Sehirus cinctus cinctus* (Hemiptera:Cydnidae), with descriptions of immature stages. Ann. Entomol. Soc. Amer. 75:210-215.

Scutelleridae (Shieldbacked bugs)

These insects are small to large bugs that look much like stink bugs but have a well developed scutellum that covers the abdomen. They are generally rarer than stink bugs and generally not of economic importance. These plant feeders attack grasses, sedges, and seeds.

Lattin, J. D. 1964. The Scutellerinae of America north of Mexico (Hemiptera:Heteroptera: Pentatomidae). Ph. D. Diss., Univ. California, Berkeley. 350 pp.

Pentatomidae (Stink Bugs)

This large group of small to large insects is easily recognized by the 5-segmented antennae, shieldlike, triangularly shaped scutellum, and head that usually is tapering and much narrower than the maximum width of the pronotum. Most species are plant feeders, attacking a wide range of host plants above ground including grasses, bushes, and trees. One subfamily is predaceous, and several of its species attack destructive insects.

Furth, D. G. 1974. The stink bugs of Ohio (Hemiptera: Pentatomidae). Bull. Ohio Biol. Surv. (N.S.) 5(1):1-60.

Acanthosomatidae (Acanthosomatid Bugs)

Members of this small family can be recognized easily by the 5-segmented antennae, triangularly shaped scutellum, and 2-segmented tarsi (members of the other pentatomoid families have 3-segmented tarsi). They are greenish yellow to reddish yellow and occur on various kinds of vegetation, including trees such as birch and beech. They are plant feeders, although some reports have suggested they may also be predaceous. Only two genera, *Elasmucha* and *Elasmostethus*, occur in America north of Mexico; both have been collected in Illinois but are rare.

Kumar, R. 1974. A revision of world Acanthosomatidae (Heteroptera:Pentatomidae); keys to and descriptions of subfamilies, tribes and genera, with designation of types. Australian J. Zool. (Suppl. Ser. 34):1-60.

ACKNOWLEDGMENTS

I thank R. A. Brandon, Department of Zoology, Southern Illinois University at Carbondale, for his critical review of a portion of this manuscript; and S. L. Keffer and P. P. Korch, for spot-checking the taxonomic keys for accuracy. I am grateful to C. W. Schaefer, Department of Ecology and Evolutionary Biology, University of Connecticut, Storrs; and A. G. Wheeler, Jr., Bureau of Plant Industry, Pennsylvania Department of Agriculture, Harrisburg; for their critical reviews of the manuscript.