

Proceedings of the Iowa Academy of Science

Volume 22 | Annual Issue

Article 53

1915

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Recommended Citation

Stoner, Dayton (1915) "Notes on Iowa Pentatomoidea," *Proceedings of the Iowa Academy of Science*, 22(1), 347-354.

Available at: <https://scholarworks.uni.edu/pias/vol22/iss1/53>

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NOTES ON IOWA PENTATOMOIDEA.

DAYTON STONER.

The average person usually refers to almost any kind of insect as a "bug" but, employing the latter term in its proper sense, it represents the common name of an insect which belongs to one of the largest and best represented groups in North America. All bugs belong to the order Hemiptera which name is derived from the character of the fore wings though wings are not present in all members of the order. The group may be briefly diagnosed as follows:

Metamorphosis incomplete, i. e., there is no resting stage or period during which the insect does not take food in the course of its development after hatching. Mouth suctorial and of the same general form throughout all the stages; owing to the structure of the mouth parts these insects are able to take only liquid food. Wings developed outside the body except in a few apterous forms. Malpighian tubes few in number. Head set into pronotum.

This large order, comprising about 6,000 species in North America, is of great variety and of considerable economic importance. The noted entomologist David Sharp says that "If anything were to exterminate the enemies of Hemiptera, we ourselves should probably be starved in the course of a few months."

The Hemiptera are apparently not closely related to any other existing order of insects and Kirkaldy suggests that, without doubt, they have sprung from a Paleozoic or Archeozoic neuropteroid source. As a matter of fact the Hemiptera have sprung from neuropteroid forms but no true Hemiptera existed in the Archeozoic and it is not until Lower Permian that the first hemipteroid type is found; it is in that period that we find the first instances of typical hemipterous mouth parts.

The Hemiptera of Linneaus' time were practically the Hemiptera of the present day except that the family Thripidæ is now excluded. Some authors have employed the term Rhynchota or Rhyngota to designate the order but this seems to have sprung from Fabricius' use of the name in his "Systema Entomologiæ"

which was published in 1775. The name "Hemiptera" was used by Linnaeus in the 10th edition of his "Systema Naturæ" and in order to be consistent with the laws of priority we must adhere to this nomenclature.

The scope of the superfamily Pentatomoidea may be briefly summarized with the statement that the members are Gymnocerate Heteroptera having a short, broad, lozenge-shaped body and a very large scutellum. Antennæ usually of five segments. Labium with four segments.

WORK THAT HAS BEEN DONE ON IOWA PENTATOMOIDEA IN IOWA.

Practically nothing has been done on this group in Iowa outside the lists and a few notes by Professor Herbert Osborn now of Ohio State University. At the time of his work on Iowa Hemiptera (1888-1898), Osborn was associated with the Iowa State Agricultural College at Ames and his specimens are now in the collection of that institution. All of Osborn's notes on Iowa Pentatomids were published in the Proceedings of this Academy and the dates together with brief summaries of his papers now follow in chronological order so that the historical setting of this work may be brought to mind.

Proc. Ia. Acad. Sci., 1888, page 40, Herbert Osborn—"The Hemipterous Fauna of Iowa" (abstract). In this paper the number of families of Homoptera and Heteroptera occurring in the state is mentioned as well as the number of genera and species in each family. Twenty-one families are listed for the Heteroptera. Of the Pentatomoidea, the number of genera and species in each family is indicated as follows:

Scutelleridæ	2 genera	2 species
Thyreocoridae	1 genus	3 species
Cydnidæ	2 genera	2 species
Pentatomidæ	17 genera	26 species
Total	22 genera	33 species

Proc. Ia. Acad. Sci., Vol. I, Part II, 1890-1891, pages 120-131, Herbert Osborn—"Catalogue of the Hemiptera of Iowa". In this paper the number of species recorded from the state is raised to thirty-seven. They are distributed among the families as follows:

Scutelleridæ	2 species
Thyreocoridae	3 species
Cydnidæ	3 species
Pentatomidæ	29 species

Localities and abundance only are given.

Proc. Ia. Acad. Sci., Vol. I, Part IV, 1893, pages 120-123, Herbert Osborn—"Notes on the Distribution of Hemiptera". At this time an additional species (*Eurygaster alternatus* Say) was recorded for Iowa, thus raising the number of recorded Iowa species of Pentatomids to thirty-eight. Little more than locality records for this species and for other species before recorded are given. Twenty-nine species of Pentatomids are mentioned in the paper but most are listed from other states.

Proc. Ia. Acad. Sci., Vol. IV, 1896, pages 172-234, Herbert Osborn and E. D. Ball—"Contributions to the Hemipterous Fauna of Iowa". Here, locality records for a few species of Pentatomids are given.

Proc. Ia. Acad. Sci., Vol. V, 1897, pages 232-247, Herbert Osborn—"Additions to the List of Hemiptera of Iowa with Descriptions of New Species". In this paper eight additional species are listed along with one genus, *Geotomus* sp. of the family Cydnidæ.

Proc. Ia. Acad. Sci., Vol. VI, 1898, pages 36-39, Herbert Osborn—"Notes on the Hemiptera of Northwestern Iowa". Four additional species are listed at this time so that the total number of recorded species to this date was fifty-one. Brief notes on the abundance, occurrence, etc., of the four newly recorded species are given along with some similar data on other species of Hemiptera.

Proc. Ia. Acad. Sci., Vol. VI, 1898, pages 40-46, H. E. Summers—"A Generic Synopsis of the Nearctic Pentatomidæ". This work is largely a translation and rearrangement of the Nearctic genera and subfamilies as found in Stal's "Enumeratio Hemipterorum" and affords a convenient table for determining the Iowa genera.

Summing up, then, all the species of Pentatomoidea recorded by Osborn we find a total of fifty-one. His first list, which was also the first list for the state, gave a total of thirty-three species so that during the decade from 1888, the year of the appearance of the first list, to 1898, the year in which the last additions were made to this list, an increase of eighteen species is noted.

SCOPE OF THE PENTATOMOIDEA IN NORTH AMERICA AND IN IOWA.

Nathan Banks in his "Catalogue of the Nearctic Hemiptera-Heteroptera", (Am. Ent. Soc., 1910) lists 218 species in the group Pentatomoidea. The four families are represented by the following number of species:

Pentatomidæ	149 species
Scutelleridæ	25 species
Cydridæ	28 species
Thyreocoridæ	16 species

As the writer's collection now stands all but thirteen species of the fifty-one recorded from Iowa by Osborn are represented by Iowa specimens; of these thirteen recorded species, five are represented in the collection but these specimens are from nearby states and so can not be included in the list of Iowa species so far as this collection is concerned. Of the 218 species of Pentatomoidea recorded from North America, 113 species are now represented in the collection.

In addition to Osborn's list of fifty-one species, six species have been added to the state faunal list during the past two summers. One of these is the Harlequin Cabbage Bug (*Murgantia histrionica* Hahn) which is of great economic importance in the south but which seems to have reached its northern limits of distribution, at least in this longitude. But two specimens of the species have been found and, although the search has been continued in various supposedly favorable localities in the state, other specimens have not come to light.

Since most of the species still unrepresented in the collection have been recorded from the western part of the state it is likely that a summer's collecting in that region will yield the greater number of these as well as, perhaps, some new records. Geological and floral conditions in western Iowa begin to take on the characteristics of the Great Plains farther west so that this region in Iowa should show a hemipterous fauna at least approaching that of the plains across the Missouri river.

TIME AT WHICH THE WRITER'S WORK WAS BEGUN.

During the spring of 1913 the writer began assembling specimens of the group Pentatomoidea as a working basis for future investigations on the subject. About fifteen species donated by Professor Wickham and a few other species which the writer

already possessed served as a nucleus for the collection. Since that time, through the media of collecting, donations, exchanges and purchases, the collection has been considerably augmented as has been indicated above. Many locality records from the United States and a few from Canada and Mexico are included in the list.

OBJECT AND PLAN OF THE PROPOSED WORK.

Since, as before mentioned, little has been done on the Iowa species of the group Pentatomoidea, and that some time since, it was thought that some contribution might be made if data were collected on the following points—synonymy, descriptions, tables for determining species and genera, locality records, distribution and abundance of various species in detail, ecological notes, food habits and as complete a bibliography as possible.

During the progress of the work thus far it has been found that literature bearing on only Iowa species is widely scattered, must be obtained from many sources and some is quite inaccessible to many students on account of its cost or rarity. No single book or paper which the writer has seen has dealt with all these subjects for the group as a whole although some work of a similar nature has been done on a few of the genera. For this reason it was thought advisable to bring as much as possible of this matter together in one place and also to add any new material and information that might seem worth while. To accomplish this end much field observation and collecting will be necessary and this part of the work is only now fairly under way.

COLLECTING OF MATERIAL.

In work of this sort much material for comparison is needed; specimens of any given species from widely separated localities are desirable in order to determine the limits of distribution and the ecological status of the species; specimens of plant-feeding species from as many different plants as possible are desirable for a knowledge of food habits as to whether they are of limited or wide latitude; specimens of predaceous forms taken in the act of feeding are interesting and valuable from the economic standpoint; and specimens taken under other and varying conditions all help to complete one's working collection of a group. In order that the fauna of the state may be typical and representative in a collection, specimens must be secured in many localities presenting different geological, ecological, botanical and other conditions.

The studies of the writer have been greatly facilitated through another line of work that is being undertaken for the Iowa Geological Survey and, in conjunction with this investigation, practically every county in the state will be visited before the work is completed. It is largely through this kind of collecting that some additions to the locality records of Osborn will be made and the limits of distribution for the state be worked out more definitely.

Most of the Pentatomids are taken by beating vegetation with a sweep net. The Cydnids are found in or on the ground and something may be learned of the hibernating species in the other families by searching under sticks, leaves, rocks, etc., in winter, fall and early spring. A few species have been found in almost every month of the year.

ECONOMIC STATUS OF THE GROUP.

Many of the species of the Pentatomoid group are of considerable economic importance from an agricultural standpoint. Some are beneficial and some are harmful but it is not often that any great damage is done by any of the Pentatomids except in the case of the Harlequin Cabbage Bug. This insect feeds on cabbage and other cultivated and wild Cruciferae and the loss each year in the southern states amounts to thousands of dollars. Great numbers of the bugs attacking a plant will cause it to wither and die due to the many punctures made by the insects' beaks and to their taking up of the plant juices. Often entire fields are devastated by this hardy and prolific insect.

At Ames, in the summer of 1913, we found that potatoes were attacked by the Negro Bug, *Thyreocoris pubicaria* Germar, and some of the plants, particularly young ones, were stunted in growth. Nothing of a serious nature was observed, however. Tobacco is often injured by these bugs but, of course, not to any appreciable extent in this state.

The genus *Euschistus*, which includes one of our most abundant and widely distributed species, *E. variolarius* Beauv., contains other species which are mainly plant feeders, though a few are predaceous to some extent and are beneficial for the most part since they destroy noxious insects. *Euschistus variolarius* is known to feed on Asparagus, Carduus, Thermopsis, Zea mays, broom corn, oats, rye, red clover, tomatoes, raspberries, mullein, peaches, tobacco and grasses. It is also said to feed on some

lepidopterous larvae as well as on plant juices. In Iowa we have found this insect most commonly in fields of clover and timothy.

Perhaps we are most familiar with the members of this family as a whole from the fact that when one of the bugs is disturbed a very ill-smelling odor is given off. And often when eating raspberries, blackberries or strawberries from the vines we have tasted something equally as bad. It is due to this propensity for crawling on berry vines coupled with the evil odor that many of the Pentatomids are known as "Stink Bugs" or "Berry Bugs". The odor emanates from an internal secretion which may be liberated at the will of the insect. In the adult, the fluid issues from a small opening on the episternum at either side of the mid-coxae. The shape and disposition of this opening is of considerable taxonomic importance.

The members of the old genus *Podisus* may, on the whole, be classed among our beneficial bugs since they destroy annually great numbers of noxious insects. This genus is represented in Iowa by five species. In the nymphal stages many of the bugs are plant feeders and in the adult stage some are predaceous and others are both predaceous and plant feeding, sometimes to an injurious extent. Among the insects attacked by the species of *Podisus* found in Iowa may be mentioned several species of leaf-feeding beetles (Chrysomelidae). In the eastern states the larvae of the Gypsy Moth and other noxious lepidopterous insects have been recorded as being preyed upon by various species of the genus.

COMPARISON OF THE WORK ALREADY DONE WITH THAT NOW IN PROGRESS.

As previously mentioned, in practically the only work done on Iowa Pentatomoidea, that of Osborn, little more than lists of the various species are given. In only a few instances are food plants included and his collecting was rather circumscribed in its scope, most of his locality records being from Ames and a few points in northwestern Iowa. This is not in criticism of Osborn's work for his studies in Iowa Homoptera were much more extensive and thorough. But the fact still remains that no other investigation of this group has been conducted since in the state.

Of the species *Neottiglossa undata* Say, Osborn says, "not common", and this is the only reference that has been made in any of the literature as to its status in Iowa. The writer has speci-

mens of this species from the following localities: Ames, Iowa City, Monticello, Centerville, Homestead, Dubuque, Waukon, Chariton, Des Moines, Indianola, Decorah, Robinson and West Union. It has been taken on mullein and grape. The following field note will give some idea of its abundance: "7 July, 1914, This species (*N. undata*) very common along roadsides and on grape just south of the West Side at Ames, Iowa. Collected thirty specimens and as many more could easily have been secured * * *."

Osborn says of the species *Hymenarcys aequalis* Say, "not common". More than fifty specimens are in our collection from the following localities: Iowa City, Bayfield, Monticello, Hampton, Indianola and Corydon. We have found the species in practically every month of the year.

The pretty green species *Thyanta custator* Fabr., is indicated as "not common" in Iowa and Osborn suggests that it has about reached its eastern limit for this latitude. However, we have found it in practically every one of the thirty-four counties visited in the state during the past summer. A considerable number of host plants are mentioned in our field notes.

Still other records might be cited but it will be seen from the above instances that conditions within the state have changed during the past fifteen years and it is not surprising that the work of more than a decade ago has become somewhat antiquated. It is due largely to this state of affairs that the field offers good opportunity for investigation.

The difficulties encountered in a problem of this kind, as may be expected, are numerous and oftentimes perplexing and complicated. Such matters as what system of nomenclature to employ, questions of synonymy, thorough collecting in certain localities, the ever-present question of what constitutes a species and many other and sometimes unforeseen hindrances confront one continually. It seems to the writer that if one can contribute one's small portion by assisting another who may, at some time, be working on a similar problem something will have been accomplished. If at least some of the way shall have been made a little easier for other workers in the field the effort will not have been in vain.

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