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The Odonata of Iowa

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A Thesis
by
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PREFACE.

All aquatic forms of life are interesting because they are nearer to the beginnings of things than are their more highly specialized terrestrial relatives. Not only did all life arise in the water but the seas were the early battle grounds of hosts of evolving races. For ages before the barren lands were clothed with vegetation, myriads of armored animals swam to and fro in those waters, rending one another in a continuous carnal warfare and laying the foundations for the change to come. And so, not only do we read in the records of those times the chapters of life's story but our science and philosophy seize upon those forms which in the present day have arisen only to the lower levels of existence and make them contribute what they may possess to the opening lines of the book of life. They cannot be otherwise than interesting.

But if to this lower stage of existence an animal adds a transformation to the terrestrial or the aerial and all in one little life cycle shows us the primitive aquatic cell, the armored and predaceous monster of Paleozoic times and the best adjusted, swiftest and most beautiful aerial mechanism the world has ever known, our interest is more than doubled. This is true of the dragonflies.

During some years of observing and collecting these insect within the limits of our state, the writer has accumulated considerable material and data, the arranging of which in convenient and available form is the purpose of this paper. In scope it aims to cover, as far as possible, the following points:

1. A catalog of the species collected by the writer.

2. The records of Iowa species taken by other collectors. The earlier records of Say (1839), Hagen (1861), Morton J. Elrod (1898) and Charles...
B. Wilson (1909) are included.

3. Wherever possible ecological notes on the various species accompany the other data.

4. A list of the species for each county where collecting has been done is added in the hope of throwing some light upon faunal relations. Very little beyond a small beginning has here been accomplished.

5. A brief treatment of the physiography and faunal areas of the state is added in a separate chapter, hoping that it may be suggestive of further work.

To make the work of more use to those beginning a study of the Odonata the following are added:

1. Keys for the identification of the various forms.

2. Drawings of the most distinctive characters, some 123 figures in all.

3. Photographs of several species in life and of many habitats.

The drawings and photographs were made by the author.

It is not the intention to include descriptions or discussions of the nymphs or of the metamorphosis of the various species. Facilities and time have not been available for this important line of investigation. The best that can be done in this direction at present is to refer to Professor Needham's work on the "Aquatic Insects of the Adirondacks".

It is with pleasure that the writer acknowledges the constant direction and advice extended by Professor H.P. Wickham. Dr. Calvert has kindly furnished valuable papers and Mr. E.B. Williamson has sent specimens for comparison. Especial acknowledgement is due Mr. Richard A. Muttkowski for the identification of specimens, advice on troublesome questions of nomenclature and for literature. Two new species, a Gomphus and an Enallagma, have come to light during the examination of material. These he has also placed and named.

A great deal of help has been derived from the papers of Wilson, "Dragonflies of the Mississippi Valley," and Morton J. Elrod, "Iowan Odonata." Such
other monographs as Calvert's "Odonata of Philadelphia", Kellicott's "Dragonflies of Ohio", Williamson's "Dragon-flies of Indiana" and Muttkowski's "Dragon-flies of Wisconsin" have been indispensable. Kirby's "Synonymic Catalog of Neuroptera Odonata" and Nathan Banks' "Synopsis, Catalog, and Bibliography of the Neuroptoroid Insects of Temperate North America" have been constantly in use and Hagen's "Neuroptera of North America" has often proved of value. Numerous smaller papers by various authors have aided on particular subjects or species.

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State Normal School, Mankato, Minn.

May 6, 1912.
THE TOPOGRAPHY AND FAUNAL AREAS OF IOWA.

There is little excuse for offering here anything more than the briefest summary of our knowledge of the topography and geography of Iowa. The State Geological Survey Reports furnish detailed information regarding almost every county, and the various glacial drifts and other physiographic regions are very fully treated. Besides this, Dr. Samuel Calvin has contributed several general and special papers on the subject to the geological journals and Dr. Rudolph M. Anderson has touched upon the biological aspect of it in his "The Birds of Iowa".

It is then sufficient to say that the physiography of Iowa is of a very simple type. But a small part of the earth's forces have acted or are at present working upon this area and consequently but few and similar changes have taken place. The path of mountain-making forces has not crossed the state, vulcanism has not affected it and the sea has long since retreated from it. When it arose above the waters it did so without being crushed or folded, remaining a part of an immense plain which has since been moulded by external agents. In fact, since the seas crossed the southern boundary in their recession, the only struggle of great importance has been between glacial action and erosion. The ancient beds of limestones, sandstones and shales have been scored and planed or ground to powder by massive ice sheets, resulting in drift sheets which are now modified by weathering and flowing water.

Of the glacial drifts recent enough to affect the present topography, the Kansan is the oldest. It is exposed in general over the southern third and western fifth of the state and is characterized by its many streams and well developed valleys. There are no lakes here. Many of the valleys are thickly wooded.

Passing by the little strip of Illinoian lying between Scott and Lee Counties along the Mississippi River as unimportant, the Iowan drift should next be mentioned. It occupies the eastern two thirds of the northern half of the state, for the most part, and is yet but imperfectly drained.
The latest and least modified drift is the Wisconsin. It extends from Osceola to Winnebago along our northern boundary and reaches south to Dallas and Polk Counties. A half century ago the area was one of marshes and kettle-holes, separated by stretches of the flattest prairie; now much of this land has been reclaimed by artificial drainage. A large number of the rivers of Iowa rise here but few attain any size before passing into the Kansan or Iowan. The lakes all lie in the morainal boundaries on the eastern and western sides and are of the Kettle-hole type, none of them over eight or ten miles in length. Some of them, like Storm Lake in Buena Vista County, are great shallow ponds, while others, of which Okoboji might stand as the type, are very deep and beautiful bodies of water surrounded by high bluffs and hills. Small kettle-holes, teeming with aquatic life and frequented by hosts of other forms, are scattered in great numbers along the morains.

The Driftless area, a narrow belt on the Mississippi and including parts of Jackson, Dubuque, Clayton and Winneshiek Counties and all of Allamakee, deserves mention. Its original physiographic characters have not been obliterated by ice action. All of the streams of this region make their way from west to east through deep, entrenched meanders in the Ordovician and Cambrian rocks to the Mississippi, giving a wild ruggedness to the country unparalleled or even suggested elsewhere in the state.

Under the conditions set forth above little variation in elevation could be expected. The difference is not more than 1000 or 1200 feet between the south-eastern and north-western corners of the state, a water-shed traversing very irregularly the central region from Wayne to Dickinson County. The elevation at the south is about 500 feet. Thus the rivers tend to run either south-east to the Mississippi or south-west to the Missouri, these two rivers forming the eastern and western boundaries of Iowa.

Partly through geographical location and partly as a result of the physi-
ography of the state, its faunal areas are limited the Upper Austral over the
greater part and a narrow strip of Transitional in the extreme north. (See
map, Plate XI.) The faunas to be expected from this, however, are likely not
to be well defined as we are also on the intermediate ground between the eastern and western divisions of these zones.

Too little work has as yet been done upon the Odonate fauna, most of the
counties in the south-west and the north-east being untouched, to allow of de-
termining how far the species are segregated by these faunal lines. If the
markedly incomplete county lists offered in this paper (page 72) can be taken
as indicating anything, it is that the distribution is very general. And on
other grounds as well, little else can be foreseen. Differences in elevation
are too slight to prompt variation in species. The mature drainage of the
Kansan Drift as compared with the very young and swampy character of the Wis-
consin and Iowan Drifts might suggest differences, but a comparison of the
lists for Johnson and Dickinson Counties, notwithstanding the fact that one
lies in the Upper Austral Zone while the other is in the Transitional, does
not uphold these suppositions. Tetragonura cynosura and Lestes eurinus
in Dickinson might be distinctive but it is not yet proven that they are so.
The same may also be said of the faunas of Cherokee County, in the north-west-
ern extremity of the Kansan Drift, and Dickinson. It seems to be true from
the present lists that Johnson and Cherokee Counties, both in the Kansan, are
more like one another than either is like Dickinson, in the Wisconsin. The
former two are also in the Upper Austral Zone while the latter is in the
Transition Zone.

As the greater part of Missouri lies in the Upper Austral Zone and as
its topography is not unlike that of southern Iowa, nothing new can be look-
ed for from that side. The Lower Austral Zone comes no further north than
the southern portions of Illinois, Missouri and Kansas and could not affect
us.
There still remain two very limited regions in which almost no Odonata have been collected, or sought for, but from which we are justified in expecting forms not possible to the state generally. One of these is the Driftless Area, the ruggedness and zonal relations of which indicate it as the home of the Aeschnids, especially those of the Subfamilies Cordulegasterinae, Petalurinae and Gomphinae.

The other region is Lyon County in the extreme north-west. Here the more arid western division of the Upper Austral (the Upper Sonoran) should bring in the western species and varieties of the Dakotas. We have no records whatever from this section of the state.
Order ODONATA, The Dragon-flies.

This group of insects, formerly the Family Libellulidae of the old order Neuroptera, is made up of those possessing an aquatic nymphal or larval form and aerial winged imago. These stages not being separated by a definite pupal stage, the metamorphosis is incomplete. Both nymph and adult have large compound eyes, three-segmented antennae and mandibulate mouth parts; they are voracious in all stages. The four membranous, netted-veined wings of the adult usually possess a pterostigma on the costal, apical region of each. The tarsi are three-segmented. The abdomen is very long and slender and consists of ten distinct segments, exclusive of an anal segment ending in the dorsal or superior appendages. The males have inferior terminal appendages, also, and the opening of the testes are on the ninth and the accessory genital organs on the second segment. The females are without terminal inferior appendages and have the vulva at the sternal apex of the eighth segment. The order contains two suborders: the Zygoptera and the Anisoptera.

Suborder ZYGOPTERA, The Damsel-flies.

Usually small and slender species with the eyes widely separated, thorax weak, wings similar and usually laid together along the back when resting, males with paired superior and inferior abdominal appendages. Nymphs with three caudal tracheal gills.

A. More than two antecubitals--------------------------Family Calopterygidae.
B. Two antecubitals only-------------------------------Family Agrionidae.

Family CALOPTERYGIDAE.

Subfamily CALOPTERYGINAE.

A. Wings broadly spatulate, basilar space free--------Genus Calopteryx.
B. Wings narrower, basilar space with cross-veins-----Genus Hetaerina.
Genus CALOPTERYX, Leach.

A. Wings uniformly black.---------------------maculata.
B. Wings with apical third or fourth only black.---------------------aequabilis.

1. CALOPTERYX MACULATA, Beauvois.

Alta- August 8, 1910.
Audubon- June 20, 1908.
Cedar County (north of West Liberty)- July 17, 1908.
Cherokee- August 7, 15, 16 and 26, 1907.
Des Moines- July 1893. ("Common", Elrod)
Dows- August 4, 1909.
Dunreath- July 1897. ("A dozen specimens", Elrod)
Gladbrook- June 21 and 28, 1889. (Miss Sharp)
Iowa City- June 11, 1906; August 1, 1907; June 10 and 15, 1908; July 9, 1908;
July 12, 20 and 22, 1910. Becoming more common.
Iowa Falls- August 6, 1909.
Maxwell- July 20, 1901. (Hoag)
Wall Lake- June 22, 1908.
West Liberty- July 15, 1908.

This very conspicuous damsel-fly is to be found along the streams, generally the smaller ones, weakly fluttering over the ripples at the water's edge or perching on the vegetation within a foot or two of the surface. Not infrequently they rest among the taller grasses of shady flood-plains some distance from the water. Being very poor fliers they may be captured in numbers by sweeping the net back and forth as they arise from the vegetation by the stream. While sometimes frequenting ponds they are usually much less plentiful there. Heaps of drift-wood caught in some eddy and fallen, half-submerged trees attract them especially and here the eggs are laid. (Plate XXI.)
In pairing the male flits from position to position about the female un­
til a favorable opportunity allows him to seize his unwary mate, probably by the prothorax, and to carry her off. Dr. Kellicott remarks upon the battles fought by the males. Everyone who has watched maculata has also observed this re­peatedly, no doubt, and has wondered at the frequency of these "free fights", dur­ing which each male does his best to disable indiscriminately any or all of the rest of his kind in the gathering crowd. Apparently very few fatalities occur, probably due to the feebleness of the insects, but the stronger may tire out the weaker ones and then select the females. A whole group of quarrelsome males can be netted at once, so indifferent to all else are they.

This species was collected in greatest numbers along Clear Creek at Iowa City, on Wapsienonoc Creek at West Liberty and on Green's Creek (Plate XVIII) and Mill Creek at Cherokee. On Green's Creek they were especially fond of spots where the willows were overgrown by the wild cucumber.

Distinguishing characters:

General: Wings broadly spatulate, black; body bluish or metallic.

Male: Abdomen 37-38; hind wing 27-28; no pterostigma; appendages as in Plate I.

Female: Abdomen 36-38; hind wing 29-31; wings dull, pterostigma white.

Flight: June to September.

2 CALOPTERYX AEQUABILIS, Say.

Center Lake—July 13, 1909.

As recorded above a female specimen of this species was taken among the Calamus about a ditch leading from Center Lake to Lake Okoboji. Very little further is known of its distribution in the state. The habits of the species are reported to be the same as those of maculata, except that it is not fre­quently taken along streams.

Distinguishing characters:
General: Wings with apical portion black.

Male and female: Abdomen 36; hind wing 30.

Genus HETAERINA, Hagen.

A. Basilar space with 6 or more cross-veins, bases of wings red in $ and flavescent in $ americana.

B. Basilar space with 5 cross-veins, bases of hind wings brown in $ and whole wing flavescent in $ tricolor.

1. HETAERINA AMERICANA, Fabricius.

Alden- August 5, 1909.

Burlington- August 3-6, 1907. (Wilson)

Cherokee- August 21, 23 and 26, 1907.

Des Moines- July 1893 and 1894; 1896. (Elrod)

Dows- August 4, 1909.

Iowa City- August 20-30, 1906; August 1908.

Hetaerina americana is often seen with H. tricolor and C. maculata along rippling brooks and even larger streams but never about ponds or lakes. It does not stray far from the shore and probably never gets out of sight of water unless by accident. Where found it is plentiful in numbers, especially over a stretch of rapid water where it alights upon protruding rocks.

Hetaerina sclerata, Walsh, pronounced by Dr. Calvert a variation of H. americana, has not been seen in Iowa, though collected in Illinois.

Distinguishing characters:

General: Basal wing spots, tips of wings clear, basilar space with 6 or more cross-veins; tibiae pale; abdominal appendages as in Plate I.

Male: Abdomen 34-36; hind wing 25-30; bases of wings bright red, pterostigma small and brown.
Female: Abdomen 31; hind wing 28; bases of wings and along proximal costal region yellowish brown, pterostigma white.

Flight - July to September.

2. HETAERINA TRICOLOR, Burmeister.

Cherokee - August 21, 23, 26, 1907; August 9, 1910.

Iowa City - August 8, 1908.

West Liberty - July 17, 1908.

When seen together in the field tricolor and americana may usually be separated by the darker color of the wings in the males of the former and by their habit of resting high in the trees, out of reach. Tricolor also tends to frequent larger streams than does americana. Plate XXIII illustrates the point on the Little Sioux River at Cherokee where the species was first taken in Iowa and gives a very good idea of the typical habitat. Americana is more plentiful than tricolor though possessing the same distribution.

Distinguishing characters:

General: Basal wing spots in males only, wing tips dark, basilar space with 5 cross-veins; tibiae dark; abdominal appendages as in Plate I.

Male: Abdomen 40-42; hind wing 29-30; bases of front wings red and of hind wings brown, pterostigma small and black.

Female: Abdomen 36-37; hind wing 30-31; wings entirely flavescent, pterostigma whitish.

Flight - Late July to September.

Family AGRIONIDAE.

Subfamily AGRIONINAE.

A. Radial sector and third media springing from the first media nearer the arculus than the nodus.-------------------------- Genus Lestes.
B. Radial sector and third media arising near nodus,

a. Spines of tibiae twice as long as the spaces separating them.-------------
----------------------------------------Genus Argia.

b. Spines of tibiae not twice as long as the spaces separating them.

a'. An apical spine on the sternum of segment 8 in ♀.
   a". Second media arising near fifth postcubital on front and
       fourth on hind wing; pterostigmas similar.------------------
       ------------------------------------------Genus Enallagma.
   b". Second media arising near fourth postcubital on front and
       third on hind wing; pterostigmas dissimilar.
       a'''. Pterostigmas touching costa.-------Genus Ischnura.
       b'''. Pterostigmas of front wings in ♀ removed from the
            costa.---------------------------Genus Anomalagrion.
   b'. No apical spine on the sternum of segment 8 in ♀.
       a". Very small and slender species.--------Genus Nehalennia.
       b". Larger and more robust species.--------Genus Coenagrion.
14.

Genus LESTES, Leach.

A. Inferior appendages longer than superiors; rear of head yellow. (inaequalis.)

B. Inferior appendages shorter than superiors.
   a. Inferiors less than half as long as superiors.
      a". Inferiors reaching slightly beyond basal tooth of superiors. ---
                       ................................................................. eurinus.
      b". Inferiors reaching the middle of median dilation on superiors--
                      ................................................................. (congener.)
   b. Inferiors more than half as long as superiors.
      a". Proximal tooth of superiors longer and more acute than distal one.
         a". Inferiors sigmoid; a yellow band from eye to eye in ♀----
                       ................................................................. unguiculatus.
         b". Inferiors short, with large, knob-like, in-turned dilation at
              apex; ♀ with basal half of segment 1 yellow. ------uncatus.
         c". Inferior appendages long, slender and straight; ♀ with
              segments 9 and 10 largely yellow. -------------vigilax.
         d". Inferiors slightly in-curved and dilated at tip; ♀ with
              humeral stripe wider below. ---------------------forcipatus.
      b". Distal tooth of superiors longer and more acute than proximal;
         ♀ with basal rings on segments 1-6 not interrupted, narrow.--
                       ................................................................. rectangularis.
   c". Proximal and distal teeth of superiors about equal, acute; ♀
       with rear of head and pterostigma blackish.---------disjunctus.
1. LESTES EURINUS, Say.

Miller's Bay, Lake Okoboji - June 19, 1909.

A male of this species was taken as it rested on the tall grasses in a hollow a few rods back from the shores of Miller's Bay, Lake Okoboji. Eurinus is nowhere recorded as common but is quite generally distributed from New York westward to Illinois and Iowa at least.

It is considerably larger than congener, which it resembles in its abdominal appendages, and has a slightly greater alar expanse than other American species, inequalis and vigilax approaching it. It is also very heavy bodied. The superior appendages have a strong sharp tooth on the inner side near the base and a broad serrated one at about the middle. The tip is strongly dilated and flattened dorsiventrally. The inferiors reach a very little beyond the basal tooth of the superiors and have their blunt apices turned inward and upward.

Distinguishing characters:

General: large size; wings uniformly flavescent.

Male: Abdomen 38; hind wing 27; abdominal appendages as in Plate II.

Female: Abdomen 34; hind wing 28.

2. LESTES UNGUICULATUS, Hagen.

Alden - August 5, 1909.

Cedar County (north of West Liberty) - July 17, 1908.

Cherokee - August 15, 16, 20, 1907; June 25, 1908; August 9, 1910.

Des Moines - July 1892; June 29, 1895; August 4, 1896; July 12, 1897. (Elrod)

Iowa City - August 7, 1907; June 10, 1908; July 9, 1908.

Miller's Bay, Lake Okoboji - July 13, 1909.

West Liberty - July 15, 1908.

This seems to be the commonest member of the genus, especially in the
western and northern sections of the state. It associates mostly with forci-
patus and uncati and with Enallagma hageni. On August 16, 1907 myriads of
individuals were found at Fountain House Lake, a small marshy pond grown up to
cat-tails, sedges and bulrushes, at Cherokee. (Plate XXXIII). The day was bright
but very windy and the insects were resting in copulating millions upon the
vegetation. Every bulrush stem was covered from earth to tip. A few sweeps
of the net would fill as though a swarm of bees had been scooped up, the collect-
or scarcely changing his position. As soon as the net was no longer used the
cloud of couples momentarily put to flight, resumed their places on the stems.

On this day an attempt was made to photograph these masses of damsel-flies
but the wind was far too strong to permit of success. On the day following,
which was again calm, I returned for another trial only to find that Lestes unguiculatus was a comparatively rare species. Neither did it reappear in num-
bers later. In all probability the insects were migrating from pond to pond
for they had not emerged from this one and had remained there but a day.

Distinguishing characters:
General: Blackish, thorax marked with yellow; occipital yellow band from eye to
eye.
Male: Abdomen 28; hind wing 19; metallic green; appendages as in Plate II.
Female: Abdomen 27; hind wing 21; mid-dorsal thoracic carina yellow.

Flight—June to October.

3. LESTES UNCATUS, Kirby.

Cherokee—June 24, 1908.

Iowa City—July 1, 1901; August 1, 1901; July 7, 1906; June 2, 9, 10, 1908.
West Liberty—July 15, 1908.

This brightly colored species is probably an inhabitant of all parts of
Iowa. While common it has never been observed to occur in great numbers.
It is not limited to the immediate vicinity of water.
Distinguishing characters:
General: Metallic green and yellow; body heavy.
Male: Abdomen 29; hind wing 21; Appendages as in Plate II.
Female: Abdomen 26; hind wing 23; basal half of segment 1 yellow.
Flight—June to September.

4. LESTES DISJUNCTUS, Selys.
Center Lake—July 3, 1909.
Spirit Lake—July 17, 1909.

Two females of disjunctus have been captured at the lakes listed above. The first in the sagittaria swamp shown in Plate XV; the second in an algae filled kettle-hole back of Templar's Point, Spirit Lake. (Plate XVI.) Neither of these localities was carefully worked as but a few hours were spent in each place, accounting perhaps for the failure to collect the male.

Distinguishing characters:
General: Dull brown; segments 3-6 with yellow basal ring interrupted.
Male: Abdomen 27-30; hind wing 18-20; appendages as in Plate II.
Female: Abdomen 26-29; hind wing 20-21; humeral stripe wider below.
Flight—July and August.

5. LESTES FORCIPATUS, Rambur.
Des Moines—July 1896. (Elrod)
Iowa City—June 13, 1900; August 1, 1901; May 9, June 3, 9, 10, 15, 1908; June 29, 1909.
Miller's Bay, Lake Okoboji—August 13, 1909.

Individuals of this species taken at Okoboji during July were copulating freely, while those found at Iowa City earlier in the season were very seldom pairing, in fact, only the males usually being discovered.
Distinguishing characters:

General: Brownish-black with sides of thorax yellowish below; humeral stripe broader below.

Male: Abdomen 32; hind wing 21; appendages as in Plate II.
Female: Abdomen 30; hind wing 24.

Flight - May to August.

6. LESTES RECTANGULARIS, Say.

Guttenburg - July 27, 1907. (Wilson)
Iowa City - June 8, 10, 1901; July 22, 1910.
West Liberty - July 15, 1908.

Wilson states that the specimens procured at Guttenburg were occupying a stretch of "flat, dry shore, raised considerably above the water and covered thickly with weeds". Those taken at Iowa City and West Liberty were found in shady places back from the streams, where deep grasses were abundant, and even in the woods.

Distinguishing characters:

General: Abdomen extremely long and slender, brownish-black.

Male: Abdomen 40; hind wing 21; Appendages as in Plate II.
Female: Abdomen 32; hind wing 22.

Flight - June to September.

7. LESTES VIGILAX, Selys.

Iowa City - June 3, 9, 1901; August 1, 1907.
Muscatine - August 1, 1907. (Wilson)
Spirit Lake - July 19, 1909.

Wilson's record is for "a single specimen taken in the thick woods".

The species is much like rectangularis in habits and distribution. Both sex-
es have been taken.

Distinguishing characters:

General: Slender; metallic green and yellow.

Male: Abdomen 37; hind wing 24; appendages as in Plate II.

Female: Abdomen 35; hind wing 26; segments 9 and 10 yellow.

Flight: July to September.

Genus ARGIA, Rambur.

A. Pterostigma covering more than one cell (Plate III). — putrida.

B. Pterostigma covering one cell only (Plate III).

a. Black markings on humeral and 1st lateral sutures not connected.

a'. Humeral suture anteriorly with a wide, short stripe or spot,
    posteriorly with a short narrow stripe; ♂ superiors with a
    ventral tooth. — apicalis.

b'. Narrow humeral and broad post-humeral stripes united anteriorly
    for fully half their length, the latter incomplete posteriorly.

a". Rear of head blackish; ♂ superiors simple, directed upwards.
    — tibialis.

b". Rear of head yellowish; ♂ superiors simple, directed
    downwards, apex acute, deflected. — violacea.

b. Black markings on humeral and 1st lateral sutures connected posteriorly by a band; ♂ inferiors bifid, lower branch slightly longer and more slender. — sedula.

1. ARGIA PUTRIDA, Hagen.

Burlington- August 3-6, 1907. (Wilson)

Iowa City- June 15, 1908.

Muscatine- August 1, 1907. (Wilson)
Argia putrida is very likely common along most of the rivers during July and August. Wilson's records are accompanied by the following notes: (Burrighton) — "Common on the western bank, but none could be found on the eastern side; prefers rocks and sand along the water's edge." (Muscatine) — "Common everywhere in the dry and open places on the banks." The largest number of individuals seen by the writer at a time were sunning upon the rocks bordering the river drives in the City Park at Iowa City. Here, on the afternoon of June 15th, 1908, putrida, tibialis, apicalis and violacea swarmed about the heaps of boulders and driftwood along the Iowa River. At the approach of the net they seemed to dissolve in the sunshine, so rapid were their motions, and at its retreat to again precipitate from the atmosphere upon the gray face of the rock. They appear to prefer rivers to creeks and are seldom seen about ponds.

Distinguishing characters:
General: Thorax with contrasty markings as shown in Plate III; large size.
Male: Abdomen 35; hind wing 25; appendages as in Plate III.
Female: Abdomen 33; hind wing 26; thorax with more blue than in $\sigma$'s.

Flight - June to August.

2. ARGIA VIOLACEA, Hagen.

Cherokee - August 20, 1907.
Iowa City - June 15, 1908.
Miller's Bay, Lake Okoboji - June 29, 1909.
Steamboat Rock - August 8, 1909.

These records indicate that violacea has a very general distribution. It usually keeps closer to the water and the vegetation than do most of the other species, except sedula, perhaps. The extensiveness of the bright violet in its coloration makes it a very attractive damsel-fly.

Distinguishing characters:
General: Predominating violet color, especially of the $\sigma$'s; thorax as in Plate III.
Male: Abdomen 26; hind wing 20; appendages as in Plate III.

Female: Abdomen 25; hind wing 21.

Flight—June to September.

3. ARGIA TIBIALIS, Rambur.

Burlington—August 1, 1907. (Wilson)
Cherokee—August 21, 1907.
Clinton—July 30, 31, 1907. (Wilson)
Iowa City—June 15, 1908; July 22, 1910.
Le Claire—July 30, 1907. (Wilson)
Muscatine—August 1, 1907. (Wilson)

So far as the writer has observed tibialis is less common than the other Argias. However, Wilson reports it common at points along the Mississippi River: "Found in company with A. moesta putrida, and about as common." This fact suggests that perhaps this form frequents only the larger streams.

Distinguishing characters:

General: Color dark, thoracic markings as in Plate III.

Male: Abdomen 27-28; hind wing 22-23; blue or lilac; appendages as in Plate III.

Female: Abdomen 27; hind wing 23; segments 9 black and 10 yellow.

Flight—June and July.

4. ARGIA APICALIS, Say.

Burlington—August 3-6, 1907. (Wilson)
Cherokee—August 14, 21, 23, 1907.
Clinton—July 30, 31, 1907. (Wilson)
Des Moines—July 1897. (Elrod)
Iowa City—June 15, 1908; July 20, 1910.
Steamboat Rock—August 8, 1909.
In 1907 both sexes of this species were very common on the sand-bars of the Little Sioux River and along the roadsides east of the river to the bluffs, a half mile, at Cherokee. Elrod writes in his list of Iowa species (1898), "This is the only Argia taken in the several years over which these observations were made."

Distinguishing characters:
General: Head yellowish, inferior humeral spot black.
Male: Abdomen 26-28; hind wing 20-22; segments 8-10 blue; appendages as in Plate III.
Female: Abdomen 26-28; hind wing 20-23; brown in place of blue on male.
Flight- June to September.

Genus NEHALENNIA, Selys.
A. Thorax not striped above; a narrow occipital line----------------irene.
B. Thorax with antehumeral stripes; small postocular spots-------------posita.

1. NEHALENNIA IRENE, Hagen.
   Center Lake- July 13, 1909.
   Cedar County- July 17, 1908.
   Cherokee- June 24, 1908.
   Clinton- June 1897. (Taaborg)
   Des Moines- 1893. (Elrod)
   Iowa City- August 1, 1907.
   Maxwell- June 3, 1901. (Hoag)
   Nevada- June 2, 1901. (Hoag)
   West Liberty- July 15, 1908.
   West Okoboji- June 15, 1909.

In Dickinson County Nehalennia irene was quite plentiful about such marshy places as Gar Lakes and the kettle-holes of West Okoboji, where many
specimens were taken in company with several Enallagmas in the vegetation along the shore line, very close to the water. In other parts of the state but few individuals were observed at a time. Irene, the most beautiful of our two species, is much more plentiful than posita. Both are so delicate as to be almost invisible amongst the wind blown grasses.

Distinguishing characters:

General: Metallic green and blue, thorax plain dorsally; no postocular spots, a yellow occipital line.

Male: Abdomen 21; hind wing 13; apex of 8 and most of 9 and 10 blue.
Female: Abdomen 21; hind wing 14; apex of 9 and most of 10 blue.

Flight: May to August.

2. NEHALENIA POSITA, Hagen.

Iowa City - August 1, 1907.

Neither Elrod nor Wilson list this form and the writer has collected it in one locality only. However, no search has been made for it. Thus far it has not been found in Wisconsin but is a common species in Indiana and Ohio.

Distinguishing characters:

General: Metallic black; postocular spots round; antehumeral stripe interrupted; 2nd lateral suture with black line.

Male: Abdomen 18-20; hind wing 12-14; hind margin of prothorax entire.
Female: Abdomen 18-20; hind wing 13-15; hind margin of prothorax tri-lobed; antehumeral stripe sometimes not interrupted.

Flight: May to October (in Indiana).
Genus ENALLAGMA, Charpentier.

This genus is well represented in Iowa. The present list includes one new species, Enallagma lunifera, described by Mr. Richard A. Muttkowski.

A. Dorsum of segment 2 blue with an apical black spot.
   a. Dorsum of segments 3 - 5 largely black; a black spot on side of 2 --
      ---------------------------------------------geminatum.
   b. Dorsum of segments 3 - 5 at least one-third blue.
      a'. Segment 5 with blue and black about equal; appendages as in
         Plate IV.----------------------carunculatum.
      b'. Segment 5 more than one-half blue.
         a". Apical half of segment 6 black; appendages as in Plate IV.
            ------------------------------------------hageni.
         b" Apical two-thirds of segment 6 black.
            a"". Superior appendages with introduced tubercle be-
                 tween branches; branches equal. Plate IV---ebrium.
            b"". Superior appendages without introduced tubercle
                 between branches; appendages Plate IV.-----civile.

B. Dorsum of segment 2 blue with black crescent-shaped spot on distal
   half; appendages as in Plate IV.--------------------------lunifera.

C. Dorsum of segment 2 black (♂ and ♀); segment 10 blue or green in ♀.
   a. Thorax blue (or green) and black.
      a'. Face yellow or orange; appendages as in Plate IV.----antennatum.
   b. Thorax orange (or yellow) and black.
      a'. Segment 9 orange or yellow; appendages as Plate IV.---signatum.
      b'. Segment 9 blue, 1 - 8 black; appendages as Plate IV.--fischeri.
1. ENALLAGMA CARUNCULATUM, Morse.
   Cherokee- June 25, 1908; June 29, 1908.
   Miller's Bay, Okoboji- June 15, 1909.
   Spirit Lake- July 17, 1909.

   Several specimens of both sexes of this species, which is very similar to civile, have been taken. The males can be distinguished by their appendages but the only certain way of identifying the females is by taking them with the males. The species is is brightly colored, blue and black.

   Distinguishing characters:
   General: blue, marked with black.
   Male: Abdomen 24; hind wing 18; appendages as in Plate IV.
   Female: Abdomen 28; hind wing 20; not distinguishable from civile.
   Flight: June to August.

2. ENALLAGMA CIVILE, Hagen.
   Cherokee- June 25, 1908.
   Manning- June 21, 1908.

   Civile seems to have about the same distribution as carunculatum and to be present in equal numbers. All of the specimens collected are from the north-western part of the state.

   Distinguishing characters:
   General: Blue and black; dorsum of segment 6 two-thirds black; postocular spots connected.
   Male: Abdomen 25; hind wing 18; appendages as in Plate IV.
   Female: Abdomen 27; hind wing 20.
   Flight: May to August.

3. ENALLAGMA LUNIFERA, Muttkowski. sp. nov.
Correctionville- June 23, 1908.
Manning- June 21, 1908.

Mr. Richard A. Muttkowski has kindly named and described this new species for the writer. His description is quoted in full, though it is to be published separately, and his figures are given on Plate X.

"Male: Colors pale blue, black, metallic green and yellowish green.

Face pale blue, a fine line at base of the labrum, a broad band on the rhinarius, and the vertex, black. Occipital spots large, ovoid, pale blue; a fine line on the occiput between the spots, interrupted and blue. Eyes brown above, sides yellow with pale blue sprinkling.

Anterior lobe of the prothorax with a narrow line of blue at its posterior end. Side of the prothorax yellowish green.

Thorax black dorsally, an antehumeral line of blue equal in width to the black humeral. Sides blue, but tinged with greenish toward the venter. First and second lateral sutures with a fine black line arising below each wing and covering one-third of the suture; these sutural lines are connected by a fine transverse line of black, parallel to the base of the wings. Feet black above, greenish beneath; except the tibiae, which have an external line of greenish and lateral lines of black. Tarsi black.

Abdomen pale blue and metallic green, sides pale yellowish green on 3 to 7, otherwise pale blue. Segment 1- blue, a small spot of black on the basal third; a fine line at the side apically. Segment 2 entirely blue, except for lunulate spot on the apical third; this dark spot is narrow, and shaped exactly like a French circonflex. Apical two-thirds of 3, three-fourths of 4, four-fifths of 5, seven-eights of 6, and seven practically entirely, metallic dark bronzy green; the metallic green spot on each segment is tridentate, a median dorsal tooth and a lateral tooth tending toward the base of the segment; the median tooth is elongated on the median line on 6 and 7, interrupting the
basal ring of pale blue. Segments 8 and 9 entirely blue, 10 black dorsally.

Appendages black laterally, half as long as 10, the superiors thrice the length of the inferiors. The superiors with a large lobe, which bears an introduced tubercle; in dorsal view they appear as two superimposed tubercles. The inferiors are very short and broad, flat tubercles. The figures show the form of the appendages better than any description.

Length: abdomen 22 - 23 mm.; hind wings 16 mm.

Described from three males collected at Manning, Iowa, June 21 and 22, 1908, and at Correctionville, Iowa, June 23, 1908, by Mr. Arthur D. Whedon, from whom the specimens were received and to whom I am indebted for this opportunity to describe this interesting species. Holotype ♀ in the collection of the Milwaukee Public Museum, the two paratypes in Mr. Whedon's collection. The three specimens have been preserved in alcohol and their colors appear as fresh as when they were caught.

This species in its entire habitus recalls the genus Coenagrion, especially the species resolutum of which latter Mr. Whedon collected a fair number at the same localities and on the same dates. In the shades of blue and metallic green and especially in the delicate transitions from pale blue to yellow this species is akin to its prototype Coenagrion resolutum. For this reason I have placed a query relative to its identity as Enallagma.

As Coenagrion the species would be distinct from all other American species of Coenagrion in that it lacks the lateral lines of black on segment 2 which make the spot U-shaped in the other species. There is also no sign of a tendency toward the formation of an antehumeral !-point; the antehumeral is perfectly normal in this respect.

As Enallagma the species falls naturally in a group with carunculatum, civile and anna, i.e., those species of Enallagma in which the male superior appendages are supplied with an introduced tubercle. From either of these
it differs in that the colors of 3 to 5 are largely metallic green—more black in its relatives—and in the spot on segment 2. This spot takes the form of an orbicular in the other species; that of a French circonflex in lunifera, hence its name."

The following account of the capture of this species may be of interest:—

Manning is a small town on the West Nishnabotna River in the south-western part of Carroll County, Iowa. During a collecting trip through the central western and north-western parts of the state in 1908, two days, June 21 and 22, were spent there. A large part of the lowlands were under water; this threw what was regularly the marginal vegetation of the sloughs out into the water and hip-boots were brought into constant use. The weather was now bright, now cloudy, and always very warm.

Three localities were worked as carefully as time would allow—-a small creek near the town, a slough covering an acre at the Milwaukee Bridge and the "Great Western Lake", a large pond formed by a dam in the pleasure grounds of this railroad, a mile and a half south of the town.

The latter place was visited from 4 to 6 pm. on June 21st. Among the Zygoptera obtained in the grasses about the edge of the water were Ischnura verticalis, Lestes unguiculatus, Enallagma hageni, Enallagma antennatum, Coenagrion resolutum and the new Enallagma described above. Enallagma lunifera, Muttkowski, was taken as it flew rather close to the surface about the bases of tufts of grass a foot or two from the shore. Its short heavy body and bright blue and black coloration quickly attracted the collector's attention to it. No females were seen in company with the males.

A single male was also taken at Correctionville, in the north-eastern part of Woodbury County on June 23rd, this time about a ditch along the railroad.
4. ENALLAGMA HAGENI, Walsh.

Center Lake—July 13, 1909.
Cherokee—August 15, 16, 20, 1907; June 24, 25, 1908; June 29, 1909; August 1910.
Des Moines—1893. (Elrod)
Gar Lakes—July 14, 1909.
Guttenburg—July 27, 1907.
Iowa City—June 15, 1908.
Maxwell—May 28, 1901. (Hoag)
Spirit Lake—June 17, 1909.
West Okoboji—June 15, 1909.

This is undoubtedly the most plentiful damsel-fly in the state. During the whole summer it can be seen weaving back and forth over the ponds, large or small, close to the surface, so close the net must be wetted in capturing it. Masses of algae, sphagnum or other floating vegetation are dotted with its bright blue and black.

While working about the ponds in the Illinois Central gravel-pits at Cherokee (Plate XII), the writer repeatedly saw this species pairing and ovipositing. The ponds were very shallow, one to two feet deep, and the water was as clear as crystal. After copulation the pair came to rest upon some stick protruding from the water, when the female would start to descend slowly, the male meanwhile setting his wings in vibration and apparently trying to lift her again into the air. Sometimes he was dragged under with her, his wings in motion to the last, but usually he released his hold and left the female to proceed alone. She could be seen to go steadily on to a depth of eight or ten inches when her color so blended with that of the bottom as to conceal her. It was often many minutes before she returned to the surface.

The species was also very common at the Fountain House Lake (XXXIV).
Distinguishing characters:

General: Postocular spots not connected; mid-dorsal thoracic and humeral stripes black.

Male: Abdomen 23; hind wing 16; blue and black; appendages as in Plate IV.

Female: Abdomen 22; hind wing 17; green, dorsum black from segment 2 to 10.

Flight: May to August.

5. ENALLAGMA EBRIUM, Hagen.

Des Moines- June 29, 1893. (Elrod)

"About a dozen specimens!" (Elrod).

At Horseshoe Lake, opposite McGregor, Iowa, is also inhabited by this species according to Wilson--"The lily pads and rushes were tenanted by three species of Enallagma, hageni, ebrium and signatum, none of them at all numerous."

Distinguishing characters:

General: Similar to hageni.

Male: Abdomen 25; hind wing 17; appendages as in Plate IV.

Female: Abdomen 24; hind wing 18.

Flight: June and July.

6. ENALLAGMA FISCHERI, Kellicott.

Des Moines- 1897. (Elrod)

"Not common, a half dozen specimens being the entire number taken from Des Moines." (Elrod). This species has not been seen by the writer.

Distinguishing characters:

General: Thorax bronze-black with dorsal carina and humeral stripes bright orange.

Male: Abdomen 24; hind wing 17; segments 1-8 and 10 bronze-black, 9 blue; appendages as in Plate IV.

Female: Abdomen 24; hind wing 19; abdomen black dorsally; ventral spine on
7. ENALLAGMA SIGNATUM, Hagen.

Center Lake- July 13, 1909.
Cherokee- August 2, 1910.
Clinton- June 16, 1897. (J. S. Taaborg)
Gar Lakes- July 14, 1909.
Iowa City- June 15, 1908.
Miller's Bay, Lake Okoboji- June 29, July 13, 1909.

This species is to be found in company with antennatum and hageni and the Nehalennias among the vegetation. It was very plentiful at Center Lake.

Distinguishing characters:

General: Mid-dorsal thoracic and humeral stripes black or metallic brown; post-ocular spots connected.

Male: Abdomen 28; hind wing 17; orange; appendages as in Plate IV.

Female: Abdomen 27; hind wing 18; orange or bluish black.

Flight- June to August.

8. ENALLAGMA ANTENNATUM, Say.

Burlington- August 3-6, 1907. (Wilson)
Iowa City- June 15, 1908.
Manning- June 21, 1908.

"A single male secured in company with Ischnura." (Wilson).

This orange-faced Enallagma was quite common both at Iowa City and the ponds about Manning.

Distinguishing characters:

General: Face and under part of thorax orange, dark above.
Male: Abdomen 24; hind wing 17.

Female: Abdomen 24; hind wing 18.

Flight- June to August.

9. ENALAGMA GEMINATUM, Kellicott.

Muscatine- August 1, 1907. (Wilson)

"Rare; a few found in company with I. verticalis." (Wilson)

Distinguishing characters:

General: Blue; postocular spots not connected; black spot on side of segment 2.

Male: Abdomen 20; hind wing 14; appendages as in Plate IV.

Female: Abdomen 19; hind wing 15.

Genus COENAGRION,

1. COENAGRION RESOLUTUM, Hagen.

Cherokee- June 24, 1908.

Correctionville- June 22, 1908.

Iowa City- June 15, 1908.

Manning- June 21, 1908.

Several males and a few females of this brightly colored species have been taken in the above localities. It was found in company with Enallagma lunifera at Manning and both sexes were collected at Cherokee. (See Enallagma lunifera.)

Distinguishing characters:

General: Black or metallic green and blue, bright.

Male: Abdomen 24; hind wing 15; appendages as in Plate IV.

Female: Abdomen 23; hind wing 16;

Flight- Probably June to August.
Genus ISCHNURA, Charpentier.

1. ISCHNURA VERTICALIS, Say.

   Burlington—August 3-6, 1907. (Wilson)
   Center Lake—July 13, 1909.
   Cherokee—September 18, 1902; August 20, 1907; June 24, 1908; June 25, 1908; June 29, 1908.
   Des Moines—1897. (Elrod)
   Guttenburg—July 27, 1907. (Wilson)
   Iowa City—June 9, 10, 15, 1908.
   Manning—June 21, 22, 1908.
   Muscatine—August 1, 1907. (Wilson)
   Sabula—1897. (J.S. Taaborg)

   This very small and exceedingly abundant species is uniformly distributed over Iowa, having no marked habitat. The females are dimorphic, some blackish and others orange and bronze black. As far as noted these forms are about equally abundant.

   Distinguishing characters:
   General: Small size; black and green coloration.
   Male: Abdomen 20-21; hind wing 12-13; bright blue on segments 8 and 9; pterostigmas of front and hind wings dissimilar; appendages as in Plate III.
   Female: Abdomen 18-19; hind wing 12-13; black or orange individuals, the latter often largest.
   Flight—May to October.

Genus ANOMALAGRION, Selys.

1. ANOMALAGRION HASTATUM, Say.

   Des Moines—July 1896. (Elrod)

   Elrod states that in July 1896 he found a dozen specimens of this speci-
ies in the grass about a drained pond near Des Moines. Before this record the westward distribution of this form had been Bloomington, Ill.

Distinguishing characters:

Male: Abdomen 18-20; hind wing 10-13; pterostigma of front wings not touching the costa.

Female: Abdomen 18-21; hind wing 12-15; dimorphic, black or orange.


Usually larger and heavier bodied than the Zygoptera with the eyes touching or but slightly separated; thorax large and strong; front and hind wings unlike, the latter usually widest, and both held horizontally in repose; males with paired superior and single inferior abdominal appendages. Nymphs without caudal gills.

A. Triangle equally distant from the arculus in front and hind wings; antecubitals of the two series not corresponding throughout—Family AEschnidae.

B. Triangle of the hind wing much nearer the arculus than that of the front wing; antecubitals of the two series for the most part corresponding——

Family Libellulidae.

Of the four subfamilies but two are listed for the state.

A. Pterostigma with a brace vein at its inner end in space below it.

a. Subtriangle of fore wing of a single cell.

a'. Eyes widely separated by occiput—Subfamily Gomphinae.

b'. Eyes touching for some distance—Subfamily AEschninae.

b. Subtriangle of fore wing of three cells—(Subfamily Petalurinae.)

B. Pterostigma without a brace vein—(Subfamily Cordulegasterinae)
For various reasons no systematic search has been made for the Gomphinae of the state and as a result this list includes species from four genera only. Fully as many again can be expected when the territory is covered and for this reason a key including all of the possible genera is appended.

A. A sternal process on segment 1; basal subcostal cross vein present; legs very short.

B. No sternal process on segment 1; no basal subcostal cross vein; legs longer.

a. A distinct anal loop in hind wing.

b. No distinct anal loop in hind wing.

a'. Anal loop of three cells; triangle free~Genus Ophiogomphus.

b'. Anal loop of four cells; triangle crossed~Genus Hagenius.

a1. Triangle of front wing one third shorter than that of the hind wing.

b1. Triangle of front wing less than one fourth shorter than that of the hind wing.

a". Hind femora with short spines only~Genus Gomphus.

b". Hind femora with 5-7 long strong spines~Genus Dromogomphus.

Genus HAGENIUS,Selys.

1. HAGENIUS BREVISTYLUS,Selys.

Alden- August 5,1909.

Steamboat Rock- August 8,1909.

Two specimens of this large and showy gomphine were taken along the Iowa River in Hardin County on the dates given. As far as observed these insects spend most of their time patrolling the shores of large streams,
very swiftly but alighting frequently upon overhanging roots or stems. The specimens taken were captured with remarkable ease, considering the size and agility of the insect.

Professor Needham found this single American species in abundance at Saranac Inn and has written its life history.

Distinguishing characters:
General: Black, marked with bright yellow; face and eyes orange.
Male: Abdomen 60; hind wing 50; appendages as in Plate VI.
Female: Abdomen 63; hind wing 53; similar to ♂ in coloration.

Flight—July and August.

Genus GOMPHUS, Leach.

Among the eight species of this genus that may now be placed upon the Iowa list there is one new form. This has been described as quoted below under the name Gomphus whedoni, by Mr. Richard A. Muttkowski.

A. Face entirely yellow.
   a. Tibiae yellow externally; thoracic markings distinct; occiput without spine.
      a'. Abdominal segments 7-9 strongly dilated.
         a''. Outer tooth of superior appendages truncated; vulvar lamina short, broad and bifid.---------------graslinellus.
         b''. Outer tooth of superior appendages absent; vulvar lamina long, bifid, apices acute and divergent.------externus.
      a'. Abdominal segments 7-9 little dilated.
         a''. Segment 9 yellow; ground color brown; length 45 mm---
                      ----------------------------------------exilis.
   b. Tibiae black externally; thoracic markings distinct; occiput without spine.
      a'. Length over 50 mm; dorsum of 9 black.
a". Segment 10 and its appendages yellow.
   a'''. Segment 8 with yellow basal spot, 10 with yellow spot; superiors with internal branches long, produced inward and backward until their acute tips meet. ————(cornutus).
   b'''. Coloration as for cornutus; superiors with internal branches small and abruptly truncated. ————whedoni.

b". Segment 10 and its appendages black.
   a'''. Segments 7-9 greatly expanded. ————fratermus.
   b'''. Segments 7-9 not greatly expanded; superiors acute, outwardly truncated, inferior tooth directed downward; vulvar lamina bifid. ————descriptus.

B. Face yellow, transversely banded with black.
   a. Yellow thoracic stripes dilated anteriorly.
      a'. Sides of hind femora yellow. ————amnicola.
      b'. Sides of hind femora black; length about 54 mm; mid-lateral thoracic stripe interrupted; dorsum of 8 with yellow basal spot; 9 largely yellow. ————vastus.

The genus Gomphus has been subdivided by Needham into four subgenera.

The Iowa species are here distributed as follows:

Subgenus Gomphus— Descriptus, exilis, fratermus, externus and graslinellus.
Subgenus Arigomphus—Whedoni.
Subgenus Gomphurus—Amnicola and vastus.
Subgenus Stylurus—None.
1. **Gomphus Descriptus**, Banks.

Burlington—August 3-6, 1907. (Wilson)

Wilson records this species as follows: "A couple of females secured on the rocks near the river."

**Distinguishing characters:**
- **General:** Olive, marked with brown.
- **Male:** Abdomen 35; hind wing 30; segments 9 and 10 and appendages, black; appendages as in Plate VI.
- **Female:** Abdomen 35; hind wing 31; occiput slightly concave; vulvar lamina one third of 9, bifid apically, tip acute and divaricate; occiput as in Plate VI.


West Liberty—July 15, 1908.

A single female of exitus was collected about some small ponds in the pastures along the Wapsiencoc Creek on the outskirts of West Liberty.

**Distinguishing characters:**
- **General:** Slender; greenish and brown.
- **Male:** Abdomen 30; hind wing 24; appendages as in Plate V.
- **Female:** Abdomen 31; hind wing 25; vulvar lamina short, triangular and bifid; occiput as in Plate VI.


Alden—August 5, 1909.

Correctionville—June 23, 1908.

Iowa City—May 30, 1900; June 9, 1908; June 15, 1908.

Liscomb—August 9, 1909.

Steamboat Rock—August 8, 1909.

Wright County (near Dows)—August 4, 1909.
Most of these records were made along the Iowa River at places between Dows in Wright County and Iowa City in Johnson County. The species is very often taken in the pastures and even in the open woodlands back from the rivers.

While descending the Iowa River by canoe in August 1909 the writer captured many specimens, some of which were copulating, by laying the net upon the top of the pack in the boat. The insects seemed attracted to this white topped prominence on the sunlit water, and alighting upon it they were taken by a sudden reversal of the net. About the rapids at the high banks between Alden and Iowa Falls they were especially plentiful, darting here and there above the turbulent water, dashing in and out of the leafy arches between the islands and the shore or resting tightly flattened against the huge boulders in midstream.

Distinguishing characters:
General: Yellowish green, marked with brown.
Male: Abdomen 37-38; hind wing 30-31; appendages as in Plate V.
Female: Abdomen 38-39; hind wing 32-33; occiput with median spine as in Plate VI.
Flight: May to August.

4. GOMPHUS EXTERNUS, Hagen.
Clinton—July 30, 31, 1907. (Wilson)
Guttenburg—July 27, 1907. (Wilson)
Lansing—July 24, 1907. (Wilson)

The only records of this species are those of Wilson as given above.

Distinguishing characters:
General: Dark brown and yellow; humeral and antehumeral stripes not connected.
Male: Abdomen 37; hind wing 31-32; appendages as in Plate VI.
Female: Abdomen 38; hind wing 32-33; occiput variable but usually as in Plate VI.
5. *GOMPHUS GRASLINELLUS*, Walsh.

Iowa City - July 20, 1910.

A single female of *graslinellus* was taken on Clear Creek, near Coralville, on this date. It was photographed before being disturbed (see Plate XXIV). No observations were made upon the habits of the species.

**Distinguishing characters:**

General: Black, green and yellow.

Male: Abdomen 35; hind wing 31; appendages as in Plate V.

Female: Abdomen 36; hind wing 32; more green and yellow than ♀; occiput as in Plate VI.

6. *GOMPHUS WHEDONI*, Muttkowski. sp. nov.

Iowa City - June 9, 1908.

This new species has been described as follows by Mr. Richard A. Muttkowski:

"As this species resembles *Gomphus cornutus* very closely, I reproduce Tough's description of the latter, especially as the publication in which it originally appeared (Mem. Chicago Ent. Soc.) was so short-lived and is not available in many libraries.

'Length, ♀, 55-57 mm.; abdomen 40-42 mm.; hind wing 32-33 mm.

Yellowish green, with black and brown markings. Face and occiput yellowish green, eyes posteriorly black above, yellowish below, occiput distinctly convex, notched in center and fringed with black hairs, vertex and antennae black. Prothorax black, with a geminate spot in center and a patch on each side yellowish. Thorax yellowish green, except a narrow band, indistinct or absent anteriorly, on each side of the mid-dorsal carina, also except humeral and antehumeral bands, and margins of first and second lateral sutures, all of which are brown. Legs black, front femora yellowish green below. Wings hy-"
Aline with black veins, pterostigma yellowish, costa yellowish green. Abdomen of uniform thickness, black, a dorsal stripe or spot on segments 1–8, small and basal on 8, and a small quadrangular spot on 10, yellowish; dorsum of 9 entirely black.

'Appendages, $\varphi$, see Figure I, a and b. Superiors dull yellowish; seen from above, internal branches produced inward and backward until they meet, acute and spinose at tip; external branches short, rather broad, and tipped with a blunt spine. Inferior appendage, seen from above, slightly longer than superiors, spreading, the distance from tip to tip of outer extremities being more than twice the width of the 10th abdominal segment at base. From side view the lateral branches of the superiors are seen to bear a conical tooth about midway between base and apex; the inferior curving upward gradually and each branch bearing a curved spine at tip.'

A description of Gomphus whedoni would be practically identical with that just cited for G. cornutus. The only color difference that can be given is that the hastate dorsal marks on the abdominal segments are wider in G. whedoni.

As regards the genitalia, the difference is small as can be seen from a comparison of the figures (Plate X, Figures 5 and 6). The appendages, however, are so strongly different that I do not hesitate to name this species as new and as distinct by itself. Originally I supposed it to be a variety of G. cornutus, at best a subspecies; later comparison, however, with true specimens of the latter (specimens in the Milwaukee Public Museum) convinced me of its distinctness.

Viewed from above the main feature of G. cornutus is that the superior appendages have two angles, the inner processes being elongated and meeting on a level with the tips of the inferior appendages. In G. whedoni the superior appendage appears cut short with a small inner tubercle left in place of the long process of the other. This is very well shown in the figures (Plate X).
Described from a male collected at Iowa City, Iowa, June 9, 1908, by Mr. Arthur D. Whedon. Holotype in collection of the Milwaukee Public Museum.

The nearest relative of this new species is G. cornutus, Tough. I take great pleasure in dedicating this species to its discoverer, Mr. Arthur D. Whedon."

The spring of 1908 was extremely cold and rainy, interfering constantly with collecting. The dragon-flies had no chance to transform as the sloughs and ponds were abnormally flooded and the streams were roily torrents. especially was this true of the first week of June. On the 9th, however, the skies cleared, the sun came out and the insects again began to move.

About the middle of the forenoon on this date the writer took a little run out to the ponds along the C.R.I. & P. Railway a mile or so west of Iowa City. So cold was it that scarcely anything was on the wing until after 10:30, when a few benumbed libellulids were put to flight by sweeping the vegetation and a female of Gomphus fraternus was captured as she sunned herself on the short grass of the pasture adjoining the slough.

At 11 o'clock I crossed the railroad embankment to a small pond between steep hills covered with hazel brush and other shrubs. (Plate XXXV is a view of the pond taken about this time.) There was no wind here and the sun beat in warmly. Many Pulchellias were patrolling the shores, dashing around my net or rustling their wings in encounters with Lydia at the point of some little promontory. A few Ischnuras and Enallagmas skimmed the marginal waters.

Suddenly a medium sized Gomphus shot across the pond and appeared to dart without diminution of speed into a tall shrub near by. On an attempt to discover its position the insect darted out again and off up the valley. Thinking it lost, I turned my attention to some large snails which were creeping about over the leaves of the bush. While I was thus occupied the Gomphus returned and lit within easy reach of the net. No other Gomphi were seen on
this date.

7. GOMPHUS AMNICOLA, Walsh.

Cherokee- July 21, 1907; August 20, 21, 1907.

Des Moines- July -, 1892. (Elrod)

Muscatine- August 1, 1907.

A part of the specimens of this species taken in Cherokee County are
from Mill Creek some three or four miles north of Cherokee, where they were
quite plentiful, though very hard to capture, about the rapids shown in Plate
XVII. The remainder were obtained as they flew back and forth across a sand­
bar on the Little Sioux River, near the bridge to the east of the town. The
species is very swift and generally keeps well towards the middle of the stream.

"A single specimen (♂) collected in July 1892 at Des Moines." (Elrod)

"A single pair captured on the rocks at the water's edge." (Wilson)

Distinguishing characters:

General: Yellow and black; antehumeral line interrupted.

Male: Abdomen 36; hind wing 33; appendages as in Plate V.

Female: Similar in size and color.

Flight: June to August.

8. GOMPHUS VASTUS, Walsh.

Clinton- June -, 1897. (J. S. Taaborg) July 30, 31, 1907. (Wilson)

Lansing- July 24, 1907. (Wilson)

"Three specimens from Clinton, Iowa, taken in June 1897." (Elrod's list)

"Lansing. Only two species of Gomphus, vastus and externus, were seen at
this station or along the river above or below it." (Wilson)

Distinguishing characters:

General: Thorax black, marked with greenish yellow.
Male: Abdomen 38; hind wing 30; appendages as in Plate VI.

Female: Similar.

Flight- Probably June to August.

Genus DROMOGOMPHUS, Selys.

But one of the three species known to the United States is found in Iowa.

1. DROMOGOMPHUS SPOLIATUS, Hagen.

Cherokee- August 24, 1907.

A single female of this form was taken on Mill Creek, Cherokee County.

Distinguishing characters:

General: Yellow or greenish yellow marked with brown.

Male: Abdomen 46; hind wing 37; dorsum of 10 green.

Female: Abdomen 47; hind wing 38; occiput with median prominence as in Plate VI.

Subfamily AESCHNINAE.

Of the seven possible genera of this group the state can at present claim Boyeria, Anax, AESchna and Epiaeschna.

A. Radial sector not furcate.

a. Supratriangle veined; triangle with several cross veins.

a'. Wings narrow; basilar space free.----------(Genus Basiaeschna).

b'. Wings broad; basilar space crossed.----------(Genus Boyeria).

b. Supra-triangle free; triangle with one cross vein.----------------

-----------------------------------------------(Genus Comphaeschna).

B. Radial sector furcate.

a. Upper sector of arculus arising much nearer to 1st radial sector than does lower sector to cubitus.-----------------------(Genus Anax).
b. Upper and lower sectors of arculus arising about equally distant from 1st radial sector and cubitus.

a'. At least three rows of cells between radial sector and supplementary sectors.-----------------Genus Aechna.

b'. Two rows of cells as above.-----------------Genus Epiaechna.

c'. One row of cells as above.-----------------(Genus Nasiaechna.)

Genus BOYERIA, MacLachlan.

1. BOYERIA VINOSA, Say.

Cherokee- July 10, 1910.
Aldon- August 7, 1909.
Steamboat Rock- August 8, 1909.

For so large a dragon-fly this species is most inconspicuous, its dull brown color being invisible in the shadowy places it loves best. It usually keeps close to both the shore and the water, passing repeatedly over a beat of a few rods, pausing about projecting stumps or logs very much like a moth hovering momentarily about a flower. It has been frequently seen at the spot on Clear Creek near Iowa City shown in Plate XIX.

Distinguishing characters:

General: Brown; wings hyaline to brownish; two lateral yellow spots on each side of thorax.

Male: Abdomen 50; hind wing 42; appendages as in Plate VIII.

Female: Abdomen 50; hind wing 44.

Flight- Late June to early September.

Genus EPIAESCHNA, Selys.

1. EPIAESCHNA HEROS, Fabricius.

Iowa City- April 24, 1908; April 30, 1908; May 27, 1908.
All of the specimens recorded were picked up in a benumbed condition about the University buildings or the side walks of Iowa City. Buildings seem to have an attraction for this species: I have seen it hawking up and down the streets in the heart of the business section of Saint Louis as vigorously as though on its native streams.

Distinguishing characters:
General: Very large; dark brown and green; first and second media meeting opposite the pterostigma.

Male: Abdomen 65; hind wing 55.
Female: Abdomen 67; hind wing 58.

Flight- April to August.

Genus AESCHNA, Fabricius.

Of the fifty or more species of this genus, but three are recorded for the Mississippi Valley. Two of these are common throughout the state and the third has been taken a few times.

A. A prominent inferior distal spine on ♂ superior appendages (Plate VII); segment 10 with a dorsal spine; genital valve strongly elevated at the apex.---------------constricta.

B. No spine on ♂ superiors; genital valve not strongly elevated at apex.
   a. Longitudinal dorsal carina of ♂ superiors entire; segment 10 with three dorsal spines; ♂ as above, vulvar lamina about 1 mm long.---verticalis.
   b. Longitudinal dorsal carina of ♂ superiors with four to nine teeth; females not separable.-------------------clepsydra.

1. AESCHNA CONSTRUCTA, Say.

Cherokee- September 18, 1902; August 23, 26, 1907.

Iowa City- August -, 1908.
Miller's Bay, Lake Okoboji—July 22, 1909.

In the weedy pastures and the open groves in the neighborhood of streams this large and agile species is common. It darts along the paths, now and then stopping to rest on some weed stem, or mounts papilio-like among the trees, often alighting high up. Its flight is very swift and it is abroad at all times of day even to the dusk of evening.

Distinguishing characters:
General: Brown marked with green or bluish; frons with a black T spot; abdomen constricted at segment 3.
Male: Abdomen 56; hind wing 45; anal triangle of hind wing of three cells; appendages as in Plate VII.
Female: Abdomen 54; hind wing 45; appendages simple and leaf-like.

Flight—June to October, most numerous in late summer.

2. AESCHNA CLEPSYDRA, Say.

Burlington—August 3-6, 1907. (Wilson)
Cherokee—September 18, 30, 1902; October 10, 1902.
Miller's Bay, Lake Okoboji—July 22, 1909.

This form is a little more brightly colored than the last but the difference is not great enough to constitute a dependable character. Its habits are identical with those of constricta. About Miller's Bay it was usually found resting upon the weeds, largely Verbena stricta, on the bluffs near the Lakeside Laboratory. The frontispiece is a photograph of a male taken in this position.

Distinguishing characters:
General: Similar to constricta but slightly brighter colored.
Male: Abdomen 54; hind wing 48; denticles on superior appendages as in Plate VII.
Female: Not separable.

Flight: Similar to the other species.

3. AESCHNIA VERTICALIS, Hagen.

Cherokee- August 6, 1902.
Muscatine- August 8, 1907. (Wilson)

"Two specimens taken in the high bushes back from the shore." (Wilson)
One specimen of what at first impressed the writer as clepsydra, on closer examination appears to be verticalis; from Cherokee.

Distinguishing characters:

General: Similar to the other species but abdomen more slender.
Male: Abdomen 52; hind wing 45; dorsal carina of superior appendages smooth.
Female: Abdomen 53; hind wing 46; sternum of segment 10 covered with minute black spines about twice the length of those in constricta, and much more slender.

Genus ANAX, Leach.

But one of the two species known to this zone has been found.

1. ANAX JUNIUS, Drury.

Burlington- August 3-6, 1907. (Wilson)
Cherokee- August 16, 20, 21 and 23, 1907; August 10, 1909.
Clinton- ----. (Taaborg)
Dunreath- August 4, 1896. (Elrod)
Iowa City- April 25, 1907; April 19, 1908; May 3, 1909.
Manning- June 21, 1908.
Okoboji- June 15, 29, 1909.
Steamboat Rock- August 8, 1909.
Tama County- -----. (Miss Sharp)
Wall Lake—June 22, 1908.
West Liberty—July 17, 1908.

This is one of the earliest dragon-flies to emerge in the spring and has been found pairing during April even more frequently than in later months. At Iowa City egg-laying began commonly by April 10 or 15. While in copulation the pair often fly rapidly about over the pond, usually a shallow one, or settle upon a stick or weed stock near the ground. When ready to oviposite, they alight on a half submerged stem, the male retaining his hold on the female while she plunges the abdomen half its length into the water. Less frequently she drops the eggs as she flies, by dabbing the water after the manner of the Libellulas, the male always accompanying her, however. Later in the season she places the eggs in the stems of green plants. Needham states that the female sometimes descends beneath the water to oviposite but the writer has never observed this to happen.

The species also wanders away from the water to dwellings and lawns, where it is very common at dusk, or hawks over the corn-fields or along the edges of the woods.

Distinguishing characters:

General: Thorax uniform bright green; base of abdomen largely blue. See Plates XXV and XXVI.

Male: Abdomen 54; hind wing 50; appendages as in Plate VII.

Female: Abdomen 53; hind wing 50.

Flight—Early April to November.
Family LIBELLULIDAE.

A. Triangle of hind wing considerably beyond arculus; more than two cubito-anal cross veins.------------------(Subfamily Macromiinae.)

B. Triangle of hind wing on a level with the arculus or in front of it; one or two cubito-anal cross veins.
   a. Sectors of the arculus distinctly separate at their departure from the arculus; eyes tubercled behind.--------Subfamily Cordulinae.
   b. Sectors of the arculus close approximated or fused for some distance beyond the arculus; eyes not tubercled behind.------------------Subfamily Libellulinae.

Subfamily CORDULINAE.

A. Front wing with fourth media and first cubital veins (sectors of the triangle) parallel or apically divergent; all wings with dark spots at base, nodus and apex.------------------(Genus Neurocordulia.)

B. Front wing with fourth media and first cubital veins convergent apically.
   a. Hind wing possessing an internal triangle.
      a'. Triangle of hind wing free; pterostyigma diamond-shaped.------
                     -----------------------------------------------(Genus Helocordulia.)
      b'. Triangle of hind wing crossed; pterostigma normal.
         a". Wings with dark markings at base, nodus and apex.-------
                     -----------------------------------------------Genus Epicordulia.
         b". Wings without dark markings.--------(Genus Somatochlora.)
   b. Hind wing not possessing an internal triangle.
      a'. Front wings with triangles free.----------(Genus Dorocordulia.)
      b'. Front wings with triangles crossed.
         a". Hind wings with four antenodals; wings marked.-------
                     -----------------------------------------------Genus Tetragoneuria.
b". More than four antenodals; wings clear.—(Genus Cordulia.)

Genus EPICORDULIA, Selys.

1. EPICORDULIA PRINCEPS, Hagen.
   Guttenburg- July 27, 1907. (Wilson)
   Le Claire- July 30, 1907. (Wilson)
   Muscatine- August 1, 1907. (Wilson)

   According to the above records, Wilson observed or took this species several times. It seems to be a rare species, however. Needham states that in New York it is on the wing from May to August and that it frequents sluggish streams with muddy, reed-covered banks. It is rarely seen except in flight and is then very difficult to capture.

   Distinguishing characters:
   General: Very large; brownish or olive marked with green; all wings spotted.
   Male: Abdomen 44; hind wing 41.
   Female: Abdomen 46; hind wing 43;

Genus TETRAGONEURIA, Hagen.

But one species, and its subspecies, from this genus is as yet known to inhabit the state. For the latest and most complete work on the genus reference should be made to Muttkowski's "Studies in Tetragoneuria", Bulletin of the Wisconsin Natural History Society, Volume IX, No. 3.

1. TETRAGONEURIA CYNOSURA, Say.
   Le Claire- July 30, 1907. (Wilson)
   Miller's Bay, Lake Okoboji- June 25, 29, 1909; July 2, 3, 1909.

   In 1909 the writer reached Okoboji about June 15th. For some days following this species was not seen but on the 25th a number of individuals were
noticed flying over the lawns about the Laboratory. They were twenty to thirty feet up in the air, far out of reach of the net, and flying to and fro very swiftly. Their actions reminded one somewhat of Aeschna constricta as they hovered about the oak trees or alighted upon the upper branches. Several hour's labor resulted in the capture of one or two specimens.

About July 1st they became still more numerous and were present in numbers over the bay, though too agile to be taken from the boat. Soon, however, they began patrolling the shores of the sand spit across the bay (Plate XIII) and here came within occasional reach. Thus several more specimens were acquired but as collecting was still slow, the collector turned sportsman and "bagged" a few by shooting them while on the wing with a thirty-two caliber collecting gun.

During July the waters about this sand-spit were searched for the egg masses of Tetragonuria but none could be discovered. Along one side of the spit the water was very shallow and the bottom of clean sand and gravel, the shore line occupied by a thick growth of bulrushes and sedges. Hundreds of sunfishes were guarding their basin-like "nests" and so indifferent to danger as to allow themselves to be scooped up in a landing or insect net by any passer-by. The fish may have accounted for the lack of insect eggs. Either the eggs were not laid before August 1st, when the writer left the lakes, or else they were destroyed by the fishes.

Distinguishing characters:

General: Brown, marked with black and yellow; wings hyaline, marked with brown at extreme bases, not exceeding base of triangle in hind wing; no T-spot on frons.

Male: Abdomen 28; hind wing 28; appendages as in Plate VIII.

Female: Abdomen 27; hind wing 29.

Flight June to August.
TETRAGONEURIA CYNOSURA SEMIAQUEA, Burmeister.

Burlington- August 3-6, 1907. (Wilson)
Miller's Bay, Lake Okoboji- June 28, 1909; July 12, 1909.

Although assigned to the rank of a distinct species by Muttkowski, this form is listed here as a subspecies. Needham has given some thought to this question and suggests that a study of the nymphs and metamorphosis will prove semiaquea to be merely a subspecies.

This form differs from cynosura proper by the fact that the fuscus of the wings extends beyond the second antecubital.

Subfamily LIBELLULINAE.

A. Hind wings wide at base, pointed at apex; triangle of front wing placed beyond level of apex of triangle of hind wing.
   a. Radial sector regularly curved; hind wings with broad basal band.--------------------- Genus Tramea.
   b. Radial sector undulate; hind wings yellowish or with small spot on anal angle.--------------------- Genus Pantala.

B. Hind wings not especially wide at base; triangle of front wings about on a level with that on hind wings.
   a. Sectors of the arculus in front wing fused (usually completely) for a short distance from the arculus.
      a'. First cubital vein of hind wing springing from hind angle of triangle.
         a". Wings spotted with brownish.-------- Genus Celethemis.
         b". Wings not spotted.
            a"'. Face white; pterostigma short and wide.--------------------- Genus Leucorhinia.
b''''. Face yellowish or reddish (rarely whitish); pterostigma more than three times as long as wide. ------
---------------------------------Genus Sympetrum.

b'. First cubital vein of hind wing springing from the hind angle of the triangle on its outer side and a little above the apex.

a". A single cross vein under the pterostigma, preceded by a long vacant space. ----------------------Genus Pachydiplax.

b". Two cross veins under the pterostigma.

a'''. A single row of cells between second media and radial sector. ------------------------Genus Mesothemis.

b''''. Two rows of cells as above. -------(Genus Micrathyria.)

b. Sectors of the arculus not at all or very incompletely fused beyond arculus in front wing.

a'. Triangle of front wing with two parallel cross veins; sub-triangle with four to eleven cells.

a". Ventral hooks on segment 1 in $; $ with hind tibiae and femora equal in length. ----------------Genus Plathemis.

b". No ventral hooks on segment 1 in $ (except in pulchella); $ with hind tibiae longer than femora. --------------------------------Genus Libellula.

b'. Triangle of front wing with one cross vein; sub-triangle of three cells. ------------------------Genus Ladona.

Genus CELETHEMIS, Hagen.

A. Wings with a brown band at nodus. -----------------eponina.

B. Wings with a rounded brown spot at nodus. -----------------elisa.
1. **CELETHEMIS EPONINA**, Drury.

    Clinton- 1897. (J.S. Taaborg)

    This record of a single female specimen is all we have for the state; it is found in the Elrod list.

    **Distinguishing characters:**

    **General:** Wings yellow, hyaline apically and with a broad band of brown in front of pterostigma; a spot covering triangle.

    Male: Abdomen 26; hind wing 33.

    Female: Abdomen 24; hind wing 32.

2. **CELETHEMIS ELISA**, Hagen.

    Moscow- July 24, 1909. (M.P. Somes)

    Many individuals of this species were seen and several were taken by Mr. M.P. Somes about dry sandy areas near Moscow, in Muscatine County.

    **Distinguishing characters:**

    **General:** Colors more reddish and markings of black or brown; anal angle filled by a large spot divided by a broad, sinuous yellow band.

    Male: Abdomen 24; hind wing 27.

    Female: Abdomen 20; hind wing 26.

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**Genus PERITHEMIS**, Hagen.

1. **PERITHEMIS DOMITIA**, Drury.

    Burlington- August 3-6, 1907. (Wilson)

    Center Lake- July 13, 1909.

    Gar Lakes- July 14, 1909.

    Guttenburg- July 27, 1907. (Wilson)

    Le Claire- July 30, 1907. (Wilson)

    Muscatine- August 1, 1907. (Wilson)
The writer first collected a female of this quiet little species in the Sagittaria Marsh south of Center Lake (Plate XV). A day later several pairs were taken on the swampy eastern shore of Gar Lakes. Though looked for at other times, the species was found abroad only during the sunniest times of day, even then keeping close to the sheltering sagittaria leaves and following the little canals between them. Females seen ovipositing were not attended by the males.

Distinguishing characters:
General: Brown to yellowish; small, short and thick set.
Male: Abdomen 14; hind wing 18; wings usually uniform amber color.
Female: Abdomen 13; hind wing 19; wings hyaline, spotted with brown.

Flight—June to August.

Genus LEUCORHINIA, Brittinger.

But one of the several American species of this genus can at present be recorded for Iowa. Wisconsin has three and probably four species.

1. LEUCORHINIA INTACTA, Hagen.
Cedar County—July 17, 1908
Center Lake—July 13, 1909.
Cherokee—June 20, 24, 25, 1908.
Gar Lakes—July 14, 1909.
Iowa City—June 10, 1908.
Maxwell—June 10, 1901. (Hoag)
Nevada—June 4, 1901. (Hoag)
Sabula—1897. (J.S. Taaborg)

While very generally distributed, this species is more abundant in the northern counties. At Fountain House Lake at Cherokee on June 24 and 25, 1908
there were thousand of them on the wing in company with Pachydiplax, Sympetrum and Libellula. Usually they are very alert and agile, floating before the collector like a host of jet black, ivory-centered balls. When resting, the wings are thrown forward, the abdomen held high in the air and the head is kept turning watchfully from side to side. A very quick thrust of the net is necessary to capture them. Ponds are their favorite habitat.

Distinguishing characters:
General: Black, marked with yellow; a conspicuous round yellow or orange spot on dorsum of segment 7.
Male: Abdomen 23; hind wing 27; appendages and genitalia as in Plate IX.
Female: Abdomen 20; hind wing 25; duller than σ

Flight—June and July.

Genus SYMPETRUM, Newman.

The members of this genus are to be found almost everywhere from reedy swamps to meadows or roadsides. They all possess the same general coloration, yellow to red depending upon age, and are much the same size. Some representative of the group is on the wing from April 1st to November 15th, usually rubicundulum first and vicinum latest. Mimusculum is retained here although often placed in a separate genus.

A. Triangle of front wing crossed; sub-triangle of three cells; sectors of triangle of hind wing joined or but slightly separated at origin.
   a. Three basal segments of abdomen with a median transverse carina.
      a'. Superior appendages of σ with a prominent median ventral tooth; vulvar lamina bifid or incised.
         a". Internal hamular branch equal to or longer than the external.--------------------------rubicundulum.
      b". Internal hamular branch small and shorter than the external.--------------------------obtrusum.
b'. Superior appendages of ♀ denticulate beneath and without median tooth; vulvar lamina entire.

a". Yellow reaching nodus in hind wing. ————-emicinctum.

b". Yellow at base only. ————-vicinum.

b. Four basal segments of abdomen with a median transverse carina. ————-corruptum.

B. Triangle of front wing free; sub-triangle of one or two cells; sectors of triangle of hind wing separate at origin. ————-mimusculum.

1. SYMPETRUM RUBICUNDULUM, Say.

Burlington- August 3-6,1907. (Wilson)
Center Lake- July 13,1909.
Cherokee- September -,1902; July 15,1907; August 7,14,15,16,20,26,1907; June 24,1908.
Des Moines- August -,1892. (Elrod)
Gar Lakes- July 14,1909.
Hardin County- August 5,1909.
Iowa City- August 8,1907; June 9,10,15,1908; July 9,1908.
Miller's Bay, Lake Okoboji- June 25,29,30,1909; July 1,2,12,13,1909.
Nevada- July 11,22,1901. (Hoag)
Spirit Lake (Templar's Lodge)- July 17,1909.
Tama County- July 12,15,1889. (Miss Sharp).

This is an exceedingly abundant species. It is out at all times of the day and in sort of collecting grounds. The fresher specimens are yellowish and during cool wet weather they seem to remain thus for some time. During the first half of June 1908 scarcely an individual was seem with the red coloration. While in copulation the pair usually rest among the grasses unless disturbed, as shown in Plate XXXI.

Distinguishing characters:
Male: Abdomen 28; hind wing 30; appendages as in Plate IX.

Female: Abdomen 25; hind wing 27; vulvar lamina bifid, points divergent.

Flight- May to September.

SYMPETRUM RUBICUNDULUM ASSIMILATUM, Uhler.

Iowa City- August 6, 1907; June 10, 1908.

This variety of rubicundulum is very common.

Distinguishing characters:
General: Wings with basal half yellow. Perhaps a trifle smaller than rubicundulum.

2. SYMPETRUM OBTRUSUM, Hagen.

Clinton- No date. (J.S. Taaborg)

Iowa City- October 27, 1900; August 1, 1908.

This species is likely quite rare as it has been sought for with little success.

Distinguishing characters:
General: Face whitish (sometimes olive in younger specimens).
Male: Abdomen 23; hind wing 23; appendages as in Plate IX.
Female: Same size as male.

Flight- Probably July to October or November.

3. SYMPETRUM VICINUM, Hagen.

Des Moines- August 1, 1893. (Elrod)

Iowa City- October 2, 20, 27, 1900.

Muscatine- August 1, 1907. (Wilson)

This little species is especially plentiful in late October and early November about weedy ponds and road-sides. It has often been remarked,
ever, that most of these later individuals are males. In October 1900 some fifty specimens were collected about a certain pond and all were males, though search was made for the other sex.

Distinguishing characters:

General: Face red, with an olive band beneath frons; wings hyaline.

Male: Abdomen 22; hind wing 24; appendages as in Plate IX.

Female: Abdomen 22; hind wing 23; vulvar lamina entire, forming a right-angled triangle with apex posterior.

Flight: August to November.

4. SYMPETRUM SENICINCTUM, Say.

Cherokee- August 14, 20, 26, 1907; August 10, 1910.

Hundreds of individuals of this species were found among the low shrubs and brush at the margins of the woods along the hills across the Little Sioux River, east from Cherokee, on the above dates. They are usually found in similar locations.

Distinguishing characters:

General: Basal half of wings yellow or brownish, darker near nodus.

Male: Abdomen 20; hind wing 23; appendages as in Plate IX.

Female: Same size as male; vulvar lamina short, margin entire.

5. SYMPETRUM CORRUPTUM, Hagen.

Cherokee- June 30, 1901; September 15, 1902; August 19, 1907; August 24, 1907; June 25, 26, 1908.

Dunroth- August 4, 1896. (Elrod)

Miller's Bay, Lake Okoboji- July 12, 1909.

Spirit Lake- July 17, 1909.

Along the roads and railroads this is a very common late summer and fall
species. It is the largest and most agile Sympetrum we have. Plate XXX is a photograph from a living specimen, about natural size.

Distinguishing characters:
General: Large size; additional carina on fourth segment.
Male: Abdomen 28; hind wing 30; appendages as in Plate IX.
Female: Abdomen 28; hind wing 30; vulvar lamina very short and emarginate.
Flight: July to September.

6. SYMPETRUM MIMUSCULUM, Rambur.

Cedar County (just north of West Liberty) - July 17, 1908.

The only specimen of this rare species obtained was a badly damaged male, at a little pond on the southern border of Cedar County, on the above date.

Distinguishing characters:
General: Yellow, becoming very dark with age; wings hyaline with extreme base yellow; abdomen yellow with three stripes and apex, black.
Male and female of same size: abdomen 18; hind wing 19. See Plate II.

Genus MESOTHEMIS, Hagen.

1. MESOTHEMIS SIMPLICICOLLIS, Say.

Burlington - August 3-6, 1907. (Wilson)
Cherokee - June 15, 1901; August 15, 24, 1907; June 24, 1908.
Iowa City - September 8, 1900; July 1, 1901; August 14, 24, 1901; August 1, 1910.
Muscatine - August 1, 1907. (Wilson)
Sabula - June -, 1897. (J.S. Taaborg)

This common and universally distributed dragon-fly occupies the shores of ponds, lakes and even streams, perching upon weed-stems or flattening itself
against a path, a dock or an old boat. Its voracious appetite keeps it continually active. In age the males especially become very dark and pruinose.

Distinguishing characters:

Male: Green when young, with markings of black: dark blue pruinose when old.

Abdomen 30; hind wing 33; appendages as in Plate IX.

Female: Like young male in coloration, green and brown; vulvar lamina elevated, triangular and entire.

Flight—June to September.

Genus PACHYDIPLAX, Brauer.

A genus of a single species, confined to North America.

1. PACHYDIPLAX LONGIPENNIS, Burmeister.

Burlington—August 3-6, 1907. (Wilson)

Cedar County—July 17, 1908.

Clinton—June 18, 1897. (J.S. Taaborg)

Dunreath—August 4, 1896. (Elrod)

Iowa City—September 8, 1900; June 9, 10, 1908.

Manning—June 21, 1908.

Muscatine—August 1, 1907. (Wilson)

Pachydiplax longipennis is usually found with Leucorhinia in reedy swamps and bogs or about small ponds. In actions the two are much alike, the former being a trifle less agile. Also to the casual observer they look alike though Pachydiplax is the larger and generally lighter colored.

This species has been taken most abundantly at Iowa City and at Cherokee, at Fountain House Lake.

Distinguishing characters:

General: Blackish; face white, vertex metallic blue; thorax with three brownish stripes on green ground color.
Male: Abdomen 24; hind wing 29; wings yellowish at base, with two brown longitudinal streaks, a cloudy spot between pterostigma and nodus and apices smoky. See Plate IX.

Female: Abdomen 22; hind wing 28; wings yellowish at base, with no markings.

Flight—June to September.

Genus PLATHEMIS, Hagen.

Another genus of a single species.

1. PLATHEMIS LYDIA, Drury.

Burlington—August 3–6, 1907. (Wilson)

Cherokee—June 25, 29, 1906.

Correctionville—June 23, 1908.

Des Moines—1897. (Elrod)

Iowa City—May 25, 1901; June 8, 1901; May 26, 31, 1908; June 2, 9, 15, 1908; July 9, 1908.

Maxwell—June 3, 1901. (Hoag)

Tama County—June 28, 1889; July 29, 1889. (Miss Sharp)

West Liberty—July 15, 1908.

This species and Libellula pulchella are constant inhabitants of our ponds and are common about streams. They race up and down the banks, now and then meeting with a rustle of wings. Toward the collector both species show considerable curiosity. If on the wing they shorten their beat in order to dash past him more frequently; if resting their heads are kept turning from side to side, their wings flattening closer on the slightest suspicion of danger. If a bold stroke of the net is made they usually escape it. On the other hand, if the net or a stick is moved gently to and fro before them, at first quite distant, then closer and closer, they can be easily taken or even knocked over. This would indicate that the dragon-fly eye, as keen as it is, cannot...
clearly judge distances. The female of lydia is often confused with pulchella.

Distinguishing characters:

Male: Abdomen 28; hind wing 33; wings with a basal spot and a broad, complete transverse band between pterostigma and nodus, black or brownish black; very pruinose in age. See Plate XXVII.

Female: Abdomen 24; hind wing 33; wings like pulchella but with triangle of front wings entirely hyaline.

Flight- May to September.

Genus LIBELLULA, Linne.

Of this large genus but three species can here be recorded but several more should come to light on further collecting. For a key to the species likely to occur in the state, reference should be made to Muttkowski's "Dragon-flies of Wisconsin." Our three forms may be separated as follows:

A. Wings with a broad basal band. -------------------------------basalis.

B. Wings with a small nodal spot and basal streaks; pterostigma uniformly colored; costal area yellow. -------------------------------quadrimaculata.

C. Wings with a large nodal spot; all wing spots dark brown; no patch on anal area; apices of wings fuscous. -------------------------------pulchella.

1. LIBELLULA BASALIS, Say.

Cherokee- August 15,16,20,26,1907; June 24,25,29,1908.

Clinton- 1897. (Elrod)

Des Moines-1897. (Elrod).

Guttenburg- July 27,1907. (Wilson)

Iowa City- May 30,1900.

Maxwell- June 10,1901. (Hoag)

Muscatine- August 1,1907. (Wilson)

Lake Okoboji- July 2,1909.
This very common form associates with pulchella and Plathemis lydia but is a little less common. See Plate XXIX.

Distinguishing characters:
Male: Abdomen 31; hind wing 39; basal third or half of wings black.
Female: Abdomen 28, hind wing 38; basal band of wings shorter.

Flight—May to August or later.

2. LIBELLULA QUADRIMACULATA, Linné.
Maxwell—May 19, 1901; May 28, 1901. (Hoag)
Lake Okoboji—July 12, 1909.
Sabula—June —, 1897. (J.S. Taaborg)

The only place in which the writer has found this species is about Lake Okoboji. Among the elder and blackberry bushes in a hollow close to the bay and not very far from the Lakeside Laboratory, a number of individuals were seen on July 12th and a few of these were captured after scrambling over the brush under a very hot sun for an hour or more. They did not seem as wild as many other species but constantly sailed out over the little valley just as the collector felt certain that he had them.

Two female specimens have been received from Mr. Hoag in Story County and the Elrod list contains a record of two others. It is probably a rare species in the state.

Male and female: Abdomen 30; hind wing 35; characters of key.

3. LIBELLULA PULCHELLA, Drury.
Burlington—August 3-6, 1907. (Wilson)
Cherokee—August 16, 20, 1907; June 24, 25, 29, 1908.
Correctionville—June 23, 1908.
Clinton—1897. (J.S. Taaborg)
Dunreath- August 4, 1896. (Elrod)
Gar Lakes- July 14, 1909.
Iowa City- June 8, 13, 1901; August 12, 13, 1901; July 7, 1906; June 9, 10, 15, 25, 1908; July 9, 1908.
Manning- June 21, 1908.
Maxwell- May 28, 1901. (Hoag)
Muscatine- August 1, 1907. (Wilson)
Nevada- June 6, 1901. (Hoag)
Lake Okoboji- June 22, 1909; July 2, 3, 12, 1909.
Tama County- July 29, 1897. (Miss Sharp)
Wall Lake- June 22, 1908.
West Liberty- July 15, 17, 1908.

This is by far the commonest of our dragon-flies. It is to be as much expected about every pond and stream as is the usual vegetation. Being large and active it attracts everyone's attention. It feeds quite constantly upon Diptera and must consume hosts of small and medium-sized flies. On capturing the prey the dragon-fly kills it by piercing it with the mandibles; then it is rolled over and over by means of the feet, while the jaws are kept busy clipping and crushing until only an unrecognizable ball remains. This is rapidly devoured and the insect is again alert for another victim.

Distinguishing characters:

General: All wings with a basal streak, a large nodal spot and fuscous tips; triangle of front wings blackish or brownish.

Male: Abdomen 34; hind wing 42; wings with white spots. See Plates XXVII and XXVIII.

Female: Abdomen 32; hind wing 42; wings without white spots; abdomen stout.

Flight- May to September.
Genus TRAMEA, Hagen.

Three of the four possible species of this genus occur in Iowa. None of them are abundant but all are generally distributed.

A. Bases of wings black in mature imago. ------------------------------------Lacerata.

B. Bases of wings reddish or brown in mature imago.
   a. Basal band usually reaching costa and extending along it to or near to the fourth antecubital; pterostigma red or orange. -------carolina.
   b. Basal band not usually reaching costa and extending only to or a little beyond the second antecubital; basilar space and space just above super-triangle, hyaline; pterostigma long. -------------onusta.

1. TRAMEA LACERATA, Hagen.

Audubon—June 20, 1908.

Cherokee—August 2-10, 1907.

Clinton—May --, 1896. (J.S. Taaborg)

A specimen of this species was taken along a small creek in Audubon and several others were captured, from the many seen, at the gravel-pit ponds along the Illinois Central tracks at Cherokee (Plate XII). It has also been seen but not taken at Iowa City.

While much like the rest of the Trameas, it is probably the most powerful and can be distinguished with some certainty while on the wing by its darker color. All of the species are continually on the wing and must be taken by a sudden, and lucky, stroke of the net. On cloudy days or at morning or evening, they sometimes rest on the weeds as does Libellula pulchella.

Distinguishing characters:

General: Dark color.

Male: Abdomen 36; hind wing 46; color pattern of wings and the genitalia as in Plate VIII.

Female: Abdomen 36; hind wing 44.
Flight- May to August.

2. TRAMEA CAROLINA, Linné.

Cherokee- June 25, 1908.

A single male of this form was taken along with lacerata at the gravel-pit ponds at Cherokee.

Distinguishing characters:
General: Reddish brown.
Male: Abdomen 33; hind wing 43; wing markings as in key; see Plate VIII.
Female: Similar to male in size and color.

3. TRAMEA ONUSTA, Hagen.

Iowa City- October 4, 1908.

West Liberty- July 15, 1908.

Two males of this species, one from each of the above localities, have been collected.

Distinguishing characters:
General: Reddish brown; wing markings as in key and on Plate VIII.
Male: Abdomen 31; hind wing 40.
Female: Abdomen 33; hind wing 42.

Flight- Probably May to September.

Genus PANTALA, Hagen.

Both the species of this genus inhabit Iowa. They are closely related to the Trameas and are to be found in the same habitats. Of the two places where they have been taken in Iowa, they were most plentiful about the gravel-pit ponds at Cherokee.

A. An anal spot present-----------------------------hymenaea.
B. No anal spot.-----------------------------flavescens.

1. PANTALA FLAVESCENS, Fabricius.
   Cherokee- August 20, 1907.
   Iowa City- August -, 1908.

   Plate XXXII shows a freshly emerged specimen of the present species, taken at the gravel-pits at Cherokee. The nymphs seemed to leave the water at any time of day and were seen to crawl across several feet of gravel to reach the low willows which skirted the pond. So far as noted the transformation was slow, the insects remaining in a weak, flightless condition for a day or two. Even after some days, as far as could be told, they were very inferior to the Trameas in flight.

   Distinguishing characters:
   General: Yellowish; hind wings with anal margin yellowish.
   Male and female: Abdomen 33; hind wing 40.

2. PANTALA HYMENAEA, Say.
   Cherokee- August 20, 23, 1907.
   Iowa City- August 23, 1901.

   This species is identical with flavescens in habits. At Iowa City both species were found on Clear Creek.

   Distinguishing characters:
   General: Color more brownish than flavescens; hind wings with a round anal fuscous spot.
   Male and female: Abdomen 32; hind wing 42.
A LIST OF THE IOWA SPECIES.

The list here presented is the result of combining the records of such earlier workers as Thomas Say (1839), Hermann Hagen (1861), Morton J. Elrod (1898) and Charles B. Wilson (1909) with those of the writer. It includes sixty-eight species and two sub-species; forty-one of which are already listed for the state. Of the remainder twenty-five are new records of known species, two are new records of known sub-species, and two are new species—twenty-nine new records in all. For convenience in reference the names of species recorded for the first time are starred and those of new species are doubly starred.

Calopteryx maculata, Beauvois.
Calopteryx aequibilis, Say. *
Hetaerina americana, Fab.
Hetaerina tricolor, Burm. *
Lestes urinus, Say. *
Lestes unguiculatus, Hagen.
Lestes uncatus, Kirby. *
Lestes disjunctus, Selys. *
Lestes forcipatus, Rambur.
Lestes rectangularis, Say.
Lestes vigilax, Selys.
Argia putrida, Hagen.
Argia violacea, Hagen. *
Argia tibialis, Rambur.
Argia apicalis, Say.
Nehalennia irene, Hagen.
Nehalennia posita, Hagen. *
Enallagma carunculatum, Morse. *

Enallagma civile, Hagen. *
Enallagma lunifera, Muttkowski. **
Enallagma hagieni, Walsh.
Enallagma ovarium, Hagen.
Enallagma fischeri, Kellicott.
Enallagma signatum, Hagen.
Enallagma antennatum, Say.
Enallagma geminatum, Kellicott.
Coenagrion resolutum, Hagen. *
Ischnura verticalis, Say.
Anomalagrion hastatum, Say.
Hagenius brevistylus, Selys. *
Gomphus descriptus, Banks.
Gomphus exilis, Selys. *
Gomphus fraternus, Say. *
Gomphus externus, Hagen.
Gomphus graslinellus, Walsh. *
Gomphus whedoni, Muttkowski. **
Gomphus amnicola, Walsh.
Gomphus vastus, Walsh.
Dromogomphus apolius, Hagen. *
Boyeria vinosa, Say. *
Epiaoschna heros, Fab. *
Aeschna consticta, Say. *
Aeschna clepsydra, Say.
Aeschna verticalis, Hagen.
Anax jenius, Drury.
Epicordulia princeps, Hagen.
Tetragoneuria cynosura, Say.
Tetragoneuria cynosura var. semiaquea, Burm. *
Celethemis eponina, Drury.
Celethemis elisa, Hagen. *
Perithemis domitia, Drury.
Leucoorhina intacta, Hagen.
Sympetrum rubicundulum, Say.
Sympetrum rubicundulum var. assimilatum, Uhler. *
Sympetrum obtrusum, Hagen.
Sympetrum vicinum, Hagen.
Sympetrum semicinctum, Say. *
Sympetrum corruptum, Hagen.
Sympetrum mimusculum, Rambur. *
Mesothemis simplicicornis, Say.
Pachydiplax longipennis, Burm.
Plathemis lydia, Drury.
Libellula basalis, Say.
Libellula quadriraculata, L.
Libellula pulchella, Drury.
Tramea lacerata, Hagen.
Tramea carolina, L. *
Tramea onusta, Hagen. *
Pantala flavescens, Fab. *
Pantala hymenaea, Say. *
LISTS OF SPECIES BY COUNTIES.

In order to make a beginning in the determination of faunal relations for different sections of the state, the following lists of species collected in various counties are brought together. Undoubtedly they are in all cases incomplete but they will at least offer a foundation for further records.

Allamakee County.

Gomphus externus.
Calopteryx maculata.
Calopteryx maculata.
Enallagma civile.
Enallagma lunifera.
Enallagma antennatum.
Coenagrion resolutum.
Ischnura verticalis.

Audubon County.

Lestes unguiculatus.
Nehalennia irene.

Buena Vista County.

Lestes unguiculatus.

Carroll County.

Calopteryx maculata.
Enallagma civile.
Enallagma lunifera.
Enallagma antennatum.
Coenagrion resolutum.
Ischnura verticalis.

Cedar County.

Calopteryx maculata.
Lestes unguiculatus.
Nehalennia irene.

Cherokee County.

Calopteryx maculata.
Hetaerina americana.
Hetaerina tricolor.
Lestes unguiculatus.
Lestes uncatus.
Argia violacea.

Anax junius.
Pachydiplax longipennis.
Plathemis lydia.
Libellula pulchella.
Tramea lacerata.
Leucorhinia intacta.
Sympetrum mimusculum.
Pachydiplax longipennis.
Argia tibialis.
Argia apicalis.
Nehalennia irene.
Enallagma carunculatum.
Enallagma civile.
Enallagma hageni.
Enallagma signatum.
Coenagrion resolutum.
Ischnura verticalis.
Gomphus amnicola.
Dromogomphus spoliatus.
Boyeria vinosa.
AEschna constricta.
AEschna clepsydra.
AEschna vertivalis.
Anax junius.
Leucorhinia intacta.

Enallagma hageni.
Gomphus externus.

Argia tibialis.
Argia apicalis.
Nehalennia irene.
Enallagma signatum.
Gomphus externus.
Gomphus vastus.
Anax junius.

Hetaerina americana.
Argia putrida.
Argia tibialis.
Argia apicalis.
Enallagma antennatum.

Sympetrum rubicundulum.
Sympetrum semicinctum.
Sympetrum corruptum.
Mesothemis simplicicollis.
Flathemis lydia.
Libellula basalis.
Libellula pulchella.
Tramea carolina.
Tramea lacerata.
Pantala flavescens.
Pantala hymenaea.

Clayton County.

Epicordulia princeps. (observed)
Perithemis domitia. (observed)

Clinton County.

Celothemis eponina.
Sympetrum obtusum.
Mesothemis simplicicollis.
Pachydiplax longipennis.
Libellula basalis.
Libellula pulchella.
Tramea lacerata.

Des Moines County.

Ischnura verticalis.
Gomphus descriptus.
AEschna clepsydra.
Anax junius.
Tetragoneuria cynosurica var.

semiaquea.
Perithemis domitia.
Sympetrum rubicundulum.
Sympetrum corruptum.

Dickinson County:
Calopteryx aequilibilis.
Hetaerina americana.
Lestes eurinus.
Lestes unguiculatus.
Lestes disjunctus.
Lestes forcipatus.
Argia violacea.
Nehalennia irene.
Enallagma carunculatum.
Enallagma hageni.
Enallagma signatum.
Ischnura verticalis.

Pachydiplax longipennis.
Plathemis lydia.
Libellula pulchella.

Aeschna constricta.
Aeschna clepsydra.
Anax jinius.
Tetragoneuria cynosura.
Tetragoneuria cynosura var. semiaquea.

Perithemis domitia.
Leucorhinia intacta.
Sympetrum rubicundulum.
Sympetrum corruptum.
Libellula basalis.
Libellula quadrimaculata.
Libellula pulchella.

Hardin County:
Calopteryx maculata.
Hetaerina americana.
Argia violacea.
Argia apicalis.
Hagenius brevistylus.

Gomphus fraternus.
Boyeria vinosa.
Anax jinius.
Sympetrum rubicundulum.

Ischnura verticalis.
Leucorhinia intacta.

Jackson County:
Mesothemis simplicicollis.
Libellula quadrimaculata.
Johnson County.

Calopteryx maculata.
Hetaerina americana.
Hetaerina tricolor.
Lestes unguiculatus.
Lestes uncatus.
Lestes forcipatus.
Lestes rectangularis.
Lestes vigilax.
Argia putrida.
Argia violacea.
Argia tibialis.
Argia apicalis.
Nehalennia irene.
Nehalennia posita.
Enallagma hageni.
Enallagma signatum.
Enallagma antennatum.
Coenagrion resolutum.

Ischnura verticalis.
Gomphus graslinellus.
Gomphus whedoni.
Epiaeschna heros.
AEschna consticta.
Anax junius.
Leucorhinia intacta.
Sympetrum rubicundulum.
Sympetrum obtrusum.
Sympetrum vicinum.
Mesothemis simplicicollis.
Pachydiplax longipennis.
Plathemis lydia.
Libellula basalis.
Libellula pulchella.
Tramea onusta.
Pantala flavescens.
Pantala hymenæa.

Marshall County.

Gomphus fraternus.

Muscatine County.

Calopteryx maculata.
Hetaerina tricolor.
Lestes unguiculatus.
Lestes uncatus.
Lestes rectangularis.
Lestes vigilax.
Argia putrida.
Argia tibialis.
Nehalennia irene.
Enallagma geminatum.
Ischnura verticalis.
Gomphus exilis.
Gomphus amnicola.
Aeschna verticalis.
Anax junius.
Perithemis domitia.
Sympetrum vicinum.
Mesothemis simplicicollis.

Polk County.
Calopteryx maculata.
Hetaerina americana.
Lestes unguiculatus.
Lestes forcipatus.
Lestes rectangularis.
Argia apicalis.
Nehalennia irene.
Enallagma hageni.
Enallagma ebrium.
Ischnura verticalis.
Anomalagrion hastatum.

Sac County.
Ischnura verticalis.
Anax junius.
Sympetrum rubicundulum.

Scott County.
Argia tibialis.
Epicordulia princeps.

Story County.
Calopteryx maculata.
Nehalennia irene.

Pachydiplax longipennis.
Plathemis lydia.
Libellula pulchella.
Libellula luctuosa.
Tramea onusta.

Gomphus amnicola.
Anax junius.
Epicordulia princeps.
Perithemis domitia.
Sympetrum rubicundulum.
Sympetrum vicinum.
Pachydiplax longipennis.
Plathemis lydia.
Libellula basalis.
Libellula pulchella.
Libellula luctuosa.

Libellula pulchella.
Tramea lacerata. (observed)

Tetragonouria cynosura.
Perithemis domitia.

Enallagma hageni.
Leucorhinia intacta.
Sympetrum rubicundulum.  
Plathemis lydia.  
Libellula basalis.  

Libellula quadrimaculata.  
Libellula pulchella.  

Tama County.

Calopteryx maculata.  
Anax junius.  
Sympetrum rubicundulum.

Woodbury County.

Enallagma lunifera.  
Coenagrion resolutum.  
Gomphus fraternus.

Wright County.

Calopteryx maculata.  
Hetaerina americana.  

Lestes unguiculatus.  
Gomphus fraternus.
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Plate I.

Calopteryx and Hetaerina.
Plate II.

Lestes and Sympetrum.
Plate II.

Lestes and Sympetrum.

Lateral and dorsal views of the male abdominal appendages:

1,2. Lestes eurinus.

3,6. " unguiculatus.

4,5. " forcipatus.

7,8. " uncatus.

9. " disjunctus. (after Calvert)

10,11. " rectangularis.

13,14. " vigilax.

Wing venation:

12. Basal half of wing of Lestes uncatus, showing positions of Radial Sector and Third Media.

Genitalia:

15. Sympetrum mimusculum, lateral view.
Plate III.

Argia and Ischnura.
Plate III.

Argia and Ischnura.

Lateral view of thorax showing color pattern:

1. Argia putrida.
4. " apicalis.
7. " tibialis.
10. " violacea.

Lateral views of male abdominal appendages:

5. " apicalis. 15. " kellicotti.
8. " tibialis.
11. " violacea.

Region of the pterostigma:

3. Argia putrida.

6. " apicalis. Represents the position in all species but A. putrida.
Plate IV.

Enallagma and Coenagrion.
Plate IV.

Enallagma.

Lateral and dorsal views of the male abdominal appendages:

1,2. Enallagma antennatum.

3,4. " lunifera.

5,6. " signatum.

7,8. " geminatum. (after Williamson.)

9,10. " civile.

11,12. " ebrium. (after Williamson.)

13,14. " hageni.

15. " fischeri. (after Kellicott.)

17,18. " carunculatum.

19,20. Coenagrion resolutum.

Lateral view of second segment:

16. Enallagma lunifera, showing color markings.
Plate V.

Gomphus.
Plate V.

Gomphus.

Lateral and dorsal views of the male abdominal appendages:

1,2. *Gomphus fraternus*.

4,5. " " *amnicola*.

7,8. " " *graslinellus* (after Williamson.)

10,11. " " *exilis*.

Genitalia of the 2nd segment:

3. *Gomphus fraternus*.

6. " " *amnicola*.

9. " " *graslinellus*.

12. " " *exilis*. 
Plate VI.

Gomphus and Hagenius.
Plate VI.

Gomphus and Hagenius.

Lateral and dorsal views of male abdominal appendages:

1. Gomphus descriptus. (after Williamson."

2. " vastus. ( " " )

3. " externus. ( " " )

4,5. Hagenius brevistylus.

Occipita of females:


7. Gomphus fraternus.

8. " graslinellus.


10. " vastus.

11. " externus.

12. " exilis.
Plate VII.

*Aeschna, Epiaeschna, Boyeria and Anax.*
Plate VII.

A{\textit{E}}schna, E{\textit{P}}iaeschna, B{\textit{O}}yeria and Anax.

Lateral and dorsal views of the male abdominal appendages:

1,2. A{\textit{E}}schna clepsydra.

3,4. " constricta.

5,6. E{\textit{P}}iaeschna heros.

7,8. Boyeria vinosa.

9,10. Anax junius.
Plate VIII.

Tramea, Boyeria and Tetragonesuria.
Tramea, Boyeria and Tetragoneuria.

Bases of wings showing coloration:

1. Tramea lacerata.
3. " carolina.
5. " onusta.

Genitalia:

2. Tramea lacerata.
4. " carolina.
8. Tetragoneuria cynosura.

Lateral view of abdominal appendages, male:

7. Tetragoneuria cynosura.

Auricles of 2nd abdominal segment of male:

Plate IX.

Sympetrum, Mesothemis, Pachydiplax and Leucorhina.
Plate IX.

Sympetrum, Mesothemis, Pachydiplax and Leucorhinia.

Lateral views of male abdominal appendages:

1. Mesothemis simplicicollis.

4. Pachydiplax longipennis.

7. Leucorhinia intacta.

Genitalia:

2. Mesothemis simplicicollis.


11. " corruptum.

5. Pachydiplax longipennis.

8. Leucorhinia intacta.
Plate X.

Appendages of New Species.

Gomphus and Enallagma.
Appendages of New Species.

Dorsal views of male abdominal appendages:

1. Gomphus cornutus.

2. Gomphus whedoni.

7. Enallagma lunifera.

Lateral views of male abdominal appendages:


8. Enallagma lunifera.

Genitalia:

5. Gomphus cornutus.


The drawings of this plate were traced from photographs of Mr. Muttkov original figures.
Plate XI.

A Map of Iowa.
Plate XI.
A Map of Iowa.

The counties are numbered on the map and the names listed below. The solid blue line indicates the boundary between the Upper Austral (south) and Transition (north) Faunal Zones. The broken blue lines mark off the limit of the glacial drift sheets.

4. Emmet. 24. Humboldt. 44. Crawford. 64. Johnson. 84. Lucas.
Plate XII.

Gravel Pits, Cherokee.
Plate XIII.

Sand-spit in Miller's Bay, Lake Okoboji.
Plate XIV.

Center Lake.
Plate XV.

Sagittaria Swamp south of Center Lake.
Plate XVI.

Spirit Lake from Templar’s Lodge.
Plate XVII.

Rapids on Mill Creek, Cherokee.
Plate XVIII.

Green's Creek, Cherokee.
Plate XIX.

Clear Creek, Iowa City.
Plate XX.

The Iowa River at Dows.
Plate XXI.

The Iowa River a few miles below Dows.
Plate XXII.

The Iowa River above Alden.
Plate XXIII.

The Little Sioux River at Cherokee.
Plate XXIV.

Gomphus graslinellus, ♂.
Plate XXV.

Anax junius, ♀.
Plate XXVI.

Anax juniqus, showing protective action.
Plato XXVII.

Plathemis lydia, ♂. (at left)

Libellula pulchella, ♂. (at right)
Plate XXVIII.

Libellula pulchella on lookout perch.
Plate XXIX.

Libellula basalis.
Plate XXX.

Sympetrum corruptum.
Plate XXXI.

Sympetrum rubicundulum in copulation.
Plate XXXII.

Pantala flavescens, just emerged.

Anax junius, teneral.
Plate XXXIII.

Calopteryx maculata.
Plate XXXIV.

Fountain House Lake, Cherokee.
Plate XXXV.

Pond at Iowa City

where Gomphus whedoni was collected.