Vol. 6 APRIL, 1908 Nos. 1—2

BULLETIN

OF THE

WISCONSIN NATURAL HISTORY SOCIETY

EDITED BY THE SECRETARY

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MILWAUKEE, WISCONSIN.
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The Wisconsin Natural History Society,

MILWAUKEE, WISCONSIN.

ORGANIZED MAY 6, 1857.

OFFICERS AND DIRECTORS.

Edgar E. Teller, President.....165 27th Street, Milwaukee.
Henry L. Ward, Vice-President.....Public Museum, Milwaukee.
Charles T. Brues, General Secretary.....Public Museum, Milwaukee.
William Finger, Treasurer.....297 12th Street, Milwaukee.
Sigmund Graenicher.....551 7th Street, Milwaukee.

PUBLISHING COMMITTEE.

Henry L. Ward, Geo. W. Peckham,
Chas. E. Monroe.

REGULAR MEETINGS.

These are all held on the last Thursday of each month, except July and August, in the trustees' room in the Public Museum Building Milwaukee.

PUBLICATION.

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MEMBERSHIP DUES.

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BULLETIN

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WISCONSIN NATURAL HISTORY SOCIETY.

Vol. 6. **APRIL, 1908** **Nos. 1 and 2**

PROCEEDINGS.

Milwaukee, Oct. 10, 1907.

Meeting of the combined Sections.

President Teller in the chair and Mrs. Ruemmelin, Messrs. Brues, Colles, Edwards, Finger, Graenicher, Landau, Monroe, Russel and Ward present.

Mr. Colles exhibited some rocks and minerals from northern Ontario. Among them was a fine specimen of dentritic silver, probably deposited from solution: some cobalt bloom and some glaciated slate.

Mr. Monroe exhibited specimens of asters collected in September in the East. These included the following forms: *Aster divaicatus* L., and varieties; *A. Claytoni* Burg., *A. undulatus* L. and variety; *A. patens* L., and *A. acuminatus* Michx.?, all from western Massachusetts and Connecticut; *A. ericoides* L., from Western Connecticut, and *A. ericoides pilosus* (Willd) from northern Ohio. He also exhibited in connection with last two, specimens of *A. Faxoni* Porter, and *A. Pringlei* Gray; the former from northeastern Illinois, the latter from central Wisconsin. Mr. Monroe knew of no reason why the species above named should not all occur in Wisconsin, but he had never found the New England species in this State.

The members were very much interested in Mr. Monroe's exhibition, and there was a considerable amount of discussion concerning certain species.

The meeting then adjourned.

Milwaukee, Oct. 24, 1907.

Regular monthly meeting of the Society.

Vice-President Ward in the chair and 47 persons present.

The names of:

Mr. Charles B. Weil, 286 Knapp Street,
Dr. Geo. W. C. Meyer, Oconomowoc, Wis.,
Albert W. Martin, Jr., 3107 State Street and
Miss Alice Childs, East Side High School,

were proposed for active membership in the Society and they were elected at the directors' meeting following.

There being no further business, Mr. Howland Russel addressed the meeting on "A Visit to Linnaeus, a retrospection on the life, home and character of the great pioneer naturalist, gleaned from the writings of his contemporaries."

Mr. Russel gave a brief description of the personality of Linnæus, followed by a biography considering the more important epochs in his life, with his achievements during each. At the close he pointed out the immense amount of work accomplished by Linnaeus and its place as the basis of all present systematic botany and zoology.

After some discussion on the part of various members, the meeting adjourned.

Milwaukee, Nov. 14, 1907.

Meeting of the combined Sections.

President Teller in the chair and about fifty persons present.

Mr. Colles spoke on "The Origin and Deposition of the Principal Ores of Copper and its Extraction."

The speaker described the most important ores of copper, and classified them according to their chemical constitution. He described the manner in which ores are deposited, more particularly their relation to watery solutions, their geographical distributions and abundance. He also described the methods of extracting the metal from several of the more important types of ores. After he had finished, several of the members joined in a short discussion on certain points.

Mr. Brues then exhibited a series of plants collected by the Museum expedition into northern Wisconsin during the past summer. He also showed a number of lantern slides illustrating the general aspect of the localities examined by the expedition.

The meeting then adjourned.

Milwaukee, Nov. 21, 1907.

Regular monthly meeting of the Society.

President Teller in the chair and about sixty persons present.

Dr. Geo. W. Peckham spoke on "Recent Additions to Our Knowledge of the Habits of Wasps." The speaker described the wonderful stinging instincts of certain wasps and then showed the advancing steps in the evolution of such instincts as illustrated by living species in different families.

He was followed by Dr. S. Graenicher, who discussed the habits of bees from the standpoint of recent discoveries. He dealt particularly with the locality and direction senses so frequently attributed to certain Hymenoptera. The recent concensus of opinion seems to be that these instincts are largely built upon individual experience and visual memory of objects, whose position has to be learned by the bees.

The meeting then adjourned.

Milwaukee, Dec. 12, 1907.

Meeting of the combined Sections.

President Teller in the chair and twelve members present.

The minutes of the last Section meeting were read and approved.

Dr. S. Graenicher spoke on "Adaptational Structures in Flower-Visiting Coleoptera." He referred briefly to the great range of variation among the different orders of insects with reference to the extent to which some of their members are adapted to obtain nectar from flowers. He described in detail the elongation of the anterior parts of the body in the genus *Leptura* and its allies and showed how these were adaptations to visiting flowers, their extent being correlated with the habits of the different genera. He also exhibited a number of meloid beetles belonging to the genus *Nemognatha* and showed how their variously elongated mouthparts adapted them to different flowers. The group is of neotropical distribution, but a single species occurs as far north as Milwaukee, where it frequents the flowers of *Rudbeckia*, which has a tube length exactly equal to the length of the beetle's mouthparts.

Questioned by Dr. Graenicher, Mr. Brues stated that he had collected one of the Texan species of *Nemognatha* on the flowers of another composite plant belonging to the genus *Gaillardia*.

After some further discussion on the part of Mr. Mann and others the meeting adjourned.

Milwaukee, Dec. 26, 1907.

Regular monthly meeting of the Society.

President Teller in the chair and about fifty persons present.

The minutes of the last regular monthly meeting were read and approved.

The following persons were proposed for membership in the Society, and subsequently elected by the Board of Directors:

Mr. L. F. Crosby, 2406 Wells Street, proposed by Mr. Ward.

Dr. A. W. Akerly, National Soldiers' Home, and Wm. C. Klann, 2816 Chestnut Street, by Dr. Barth.

There being no further business, Miss Alice Dufour addressed the Society on "Guatemala, the Country and Its People." Miss Dufour described the character of the people, their customs,—some of them relics of the Sixteenth century—their progress in fine arts and literature, making especial reference to their love for lyric poetry and their skill in wood carving. Their industries are few, although their immense resources are very great and offer an opportunity for American enterprise. At present most of their imports come from Germany. Among internal improvements the speaker described their street car system, telegraph, telephone and electrical lighting plants. At present there are five railroads in Guatemala, the trans-continental line being the most important and one destined to play a part in the future partition of Central America.

Miss Dufour also mentioned the various enlightening forces at present active in the country, referring especially to the schools, one of which, the government school for girl's, had been in her own charge while she was in Guatemala.

The lecture was illustrated by a large series of stereopticon slides.

After expressing to Miss Dufour the thanks and appreciation of the Society, President Teller declared the meeting adjourned.

Milwaukee, Jan. 9, 1908.

Meeting of the combined Sections.

President Teller in the chair and about forty members present.

The minutes of the last section meeting were read and approved.

There being no further business, Mr. Wm. Segall spoke on, "Waters; Pure, Impure and Mineral." The speaker gave some facts concerning the general properties and distribution of water on the earth, its importance to life and other activities of matter. He also treated the question from the standpoint of drinking water, sanitation, etc., concluding with a consideration of some of the more important types of mineral waters.

Following this, Mr. H. L. Ward and C. T. Brues made some remarks concerning the recent Chicago meeting of the American Association for the Advancement of Science. They described the various activities of the numerous sections and affiliated societies and indicated the trend of work along different lines as exemplifying the present attitude of scientific research in particular fields.

The meeting then adjourned.

Milwaukee, Jan. 30, 1908.

Regular monthly meeting of the Society.

Vice-President Ward in the chair and about eighty persons present.

The names of:

Dr. Arthur J. Burgess, 1102 Grand Avenue,

Albert P. Puelicher, 137-139 Wisconsin Street, and

Dr. Patrick H. McGovern, 2036 Grand Avenue,

were proposed for active membership, and those of Miss Florence Buck and Miss Marion Murdock, for corresponding membership in the Society. These were later elected by the Board of Directors.

Mr. Charles E. Akeley of the Field Museum, Chicago, gave an account of his journey to, and a stay of fourteen months among the natives and wild animals of East Equatorial Africa; with experiences in the lion infested game fields of Athi Plaines, the home of the Buffalo and Rhinoceros in trans-tana country, and with elephants in the forests and bamboo jungles of snow-capped Mount Kenya.

Mr. Akeley's lecture was illustrated by a large series of excellent lantern slides made from negatives which he had made in Africa.

After he had finished, Mr. Ward expressed the thanks of the Society for the unusual opportunity given by Mr. Akeley of hearing at first hand of this remarkable part of the African continent.

The meeting then adjourned.

Milwaukee, Feb. 13, 1908.

There was no special section meeting of the Society, as the Natural History Society met in conjunction with the Wisconsin Academy of Sciences, Arts and Letters, the Wisconsin Archeological Society and the Wisconsin Mycological Society, in a general meeting at the Public Museum, on the evening usually devoted to the section meeting.

Milwaukee, Feb. 27, 1908.

Regular monthly meeting of the Society.

President Teller in the chair and about fifty persons present.

The names of:

Gustav J. A. Trostel, 555 Terrace Avenue,
G. Fred Bossert, 719 Franklin Place,
Dr. A. Ivans Comfort, National Soldiers' Home,
Geo. A. West, 97 Wisconsin Street, and
Alfred Cummings Burrill, Public Museum,

were proposed for membership and subsequently elected by the Board of Directors.

There being no further business, President Teller introduced Prof. C. O. Whitman of the University of Chicago, who spoke on "The Problem of Progressive Evolutions as Elucidated in the Color Patterns of Pigeons."

Prof. Whitman dealt principally with the possibilities of applying Mendelian principles to the changes in color produced by the hybridization of various kinds of pigeons.

The results obtained by him after very extensive breeding and crossing seemed to show that Mendel's law is not applicable to the inheritance of color patterns in pigeons. A number of colored figures of parent pigeons and their hybrid offspring were exhibited and the differences between the actual and expected Mendelian results pointed out. The speaker also exhibited a number of colored drawings which showed the apparent determinate trend of evolution of color patterns in certain pigeons.

After thanking Prof. Whitman on behalf of the Society, President Teller declared the meeting adjourned.

Milwaukee, March 12, 1908.

Meeting of the combined Sections.

President Teller in the chair and fourteen members present.

The minutes of the last meeting were omitted on account of the

fact that the Society had not held its last meeting individually, having met in combined session with the Wisconsin Academy of Arts, Sciences and Letters, and with other scientific societies.

Mr. Colles exhibited some rocks and fossils from Yellowstone Park and made some remarks concerning the general geological features of the region.

Mr. Burrill called the attention of the members to the spruce gall-louse and asked concerning the occurrence of spruce trees in this vicinity. Several members took part in the discussion which followed. Mr. Burrill spoke of the interest which attaches to the distribution of these insects and the members agreed to look for their occurrence in our locality.

Mr. Doerflinger called attention to certain prehistoric artifacts from France and Switzerland and the persistence of some types of manufacture very similar among primitive sections in France at the present day. The preservation of these wooden articles led to a discussion of the question as to how long wood could be preserved under natural conditions, particularly under water. After some discussion, the topic turned to the formation and preservation of deposits of peat and the way in which the size of these deposits could be utilized in measuring time, particularly the time between glacial epochs in the Northern Hemisphere.

The meeting then adjourned.

Milwaukee, March 26, 1908.

Regular monthly meeting of the Society.

President Teller in the chair and fifty persons present.

The minutes of the last regular monthly meeting were read and approved.

The name of Rev. Judson Titsworth, 216 Martin Street, Milwaukee, was proposed for active membership in the Society and he was later elected by the Board of Directors.

There being no further business, President Teller introduced Dr. Strong, of the University of Chicago, who spoke on "'The Brooding Habit in Birds," a discussion of the evolution of the brooding instinct in animals and its occurrence in various groups.

Dr. Strong's lecture was illustrated by a large series of slides made from original photographs.

At the close of the lecture, President Teller expressed the thanks of the Society to the speaker, after which the meeting adjourned.

SOME FOSSIL PLANTS FROM THE MIDDLE DEVONIAN OF MILWAUKEE, WISCONSIN.

By D. P. Penhallow, D. Sc., F. G. S. A.

On the 26th of January of the present year, I received from Prof. H. F. Cleland of Williams College, two photographs of specimens from the Hamilton Group at Milwaukee, Wisconsin. These were designated as being in all probability, a species of *Nematophycus* which had already been found in the Hamilton Group of New York, and a plant possibly related to *Zosterophyllum* from the Old Red Sandstones of Scotland.

Subsequently, the Director of the Milwaukee Museum, Mr. Henry L. Ward, to which institution the specimens belonged, forwarded the material for more thorough examination. From a critical study of these remains it has been possible to obtain more reliable data as now embodied in these notes, and to draw therefrom certain tentative conclusions as a basis for further study.

The specimens were designated as Nos. 1 and 2, and no details accompanied them beyond the simple statement that they were from the Hamilton Group of Milwaukee, Wisconsin.

Nematophycus milwaukeensis n. sp. (Plate I.)

The specimen No. 1, carrying the museum number 402, and designated as having been collected by C. E. Monroe, from the Hamilton Group of Berthelet, Milwaukee County, Wisconsin, measures 68 cm. in extreme length. It has been broken into three fragments, but when in place, these show a continuous stem. The upper end has a width of 5.5 cm., and a maximum thickness of 1.7 cm. These dimensions are maintained for a distance of 41 cm. when the stem expands, at first gradually and then somewhat rapidly, into a rather large base 12 cm. broad and 3.8 cm. thick.

These dimensions, however, probably do not represent the real base of the plant, since there is no evidence of a root system or of holdfasts. There is no evidence of branching at any part of the stem, although on the central fragment, on the side opposite that shown in the photograph, there is an apparent knot suggestive of a projecting organ of some sort. On closer examination, however, it is seen that this feature is completely covered by a prominent layer of coal derived from the carbonization of the superficial parts of the stem. Whatever its character may be, it is, therefore, clearly related to the interior structure and not to the surface parts.

The specimen shows several transverse joints. These are in no sense structural, but have been caused by displacement in the matrix and were subsequently filled with silica. Such joints are well known features of *Nematophycus*. Apart from them, there is no evidence of nodes, from which it may be concluded that the stem was of a very simple character such as may be met with in the stipes of the Laminariæ.

The interior of the specimen has been entirely occupied by silica which has so completely replaced all structure that no evidence of the nature of the plant from that source could be obtained. The only basis from which information could be secured, was found in the general form of the specimen and the occurrence of a very prominent layer of coal which originally extended over the entire surface, but which, owing to its very friable character, has been very largely removed. The side of the specimen shown in the photograph, indicates the almost complete removal of this layer, but on the opposite side it covers nearly half the specimen. The coaly layer has a maximum thickness of 2 mm., and gives abundant evidence of the former presence of plant structure.

In endeavoring to determine the possible nature of the plant represented, it may be recalled that there are only two genera of

plants from so low a horizon, with which it may be compared—*Cordaites* and *Nematophycus.*

With respect to the former, although at least four species are known to the Middle Devonian[1], there are none which may be directly compared with the present specimen, either in external appearance or in mode of preservation, and it is permissible to exclude the genus from further consideration, without hesitation.

Nematophycus crassus is known to the Hamilton Group of New York[2]. So far as the general mode of preservation may be taken as evidence, that presented by the Berthelet specimen is in exact accord with what is commonly found. Furthermore, the condition in which the plant is found, indicates clearly, that it was soft in texture and very susceptible to decay which had progressed extensively before infiltration.

The absence of hapteres and other portions of the anchorage system, cannot be adduced as evidence opposed to the view that this may have been a large alga, since such an objection would be equally valid as applied to *Cordaites.* All the evidence points with directness and force, to the idea that the plant is a species of *Nematophycus,* but which of the known species it is impossible to determine in the absence of internal structure.

So far as known, *N. crassus* is the only species found in the Hamilton Group, and it must have had a very extensive distribution in Middle Devonian time. It is, therefore, in a high degree probable that the New York specimens and those from Milwaukee represent the same species. It would seem better, however, to indicate the latter by a distinctive name derived from the locality, until such time as further and more complete material may enable

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[1] North American Species of Dadoxylon. Trans. R. S. C., VI, 1900, iv, 51-97.

[2] Ann. Bot., X, 1896, 47.
Proc. U. S. Nat. Mus., 929, 1893, 115-118.
Trans. R. S. C., VII, iv, 23.

us to determine its relation to known species in a more thorough and satisfactory manner. I therefore call it *Nematphycus milwaukeensis.*

Fucus bertheletensis n. sp. (Plate II.)

Specimen No. 2, bearing the museum number 399, presents the form of several strap-shaped organs lying in parallel positions, and representing probably, the subdivisions of one plant. When first examined by means of a photograph, showing the plant on a reduced scale, it was believed to be comparable with *Zosterophyllum myretonianum,* Penn.[1], from the Devonian of Scotland, but a later study of the actual specimen showed that such a comparison is in no sense justified.

As shown by the photograph, the plant is represented by a series of 16 linear members projected in a parallel manner. In three separate places it may be seen that the members subdivide by a regular dichotomy, and the conclusion is justified that such dichotomy is characteristic of the plant as a whole.

The plant has been carbonized, but instead of a very thin filmy layer of carbon as would be obtained from plants of the type of *Zostera,* the deposit is somewhat bulky, and, indeed, represents the entire structure. The organs are obviously thicker in the middle where there is evidence of a structure comparable with a midrib as presented by the medullary region of many of the Phæophyceæ. Individually, the various members are linear, 4-7 mm. broad and distinctly dichotomous, the largest fragments showing simple branches 18 cm. in length.

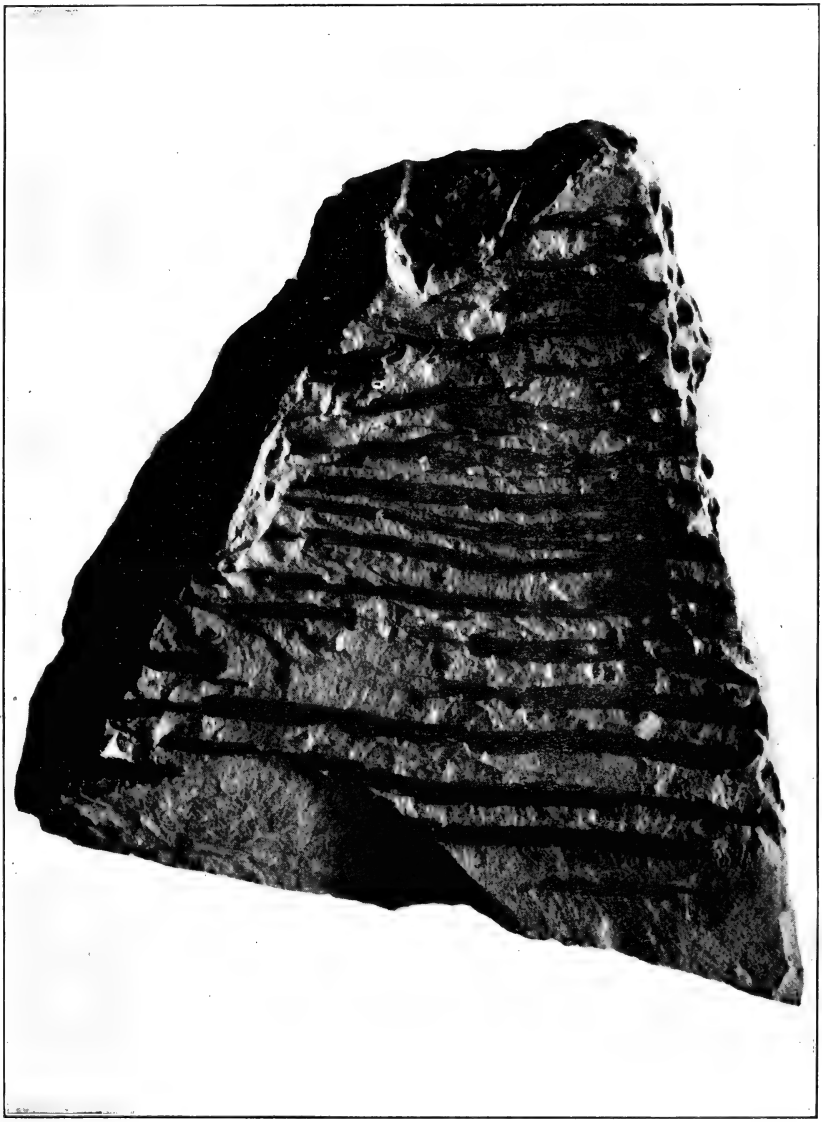
From these facts it is evident that the plant must have been possessed of rather thick and bulky parts, the structure of which was not only susceptible of somewhat ready decay, but which was entirely carbonized. Like *Nematophycus,* it was evidently of an aquatic habit. All of these considerations point with some force

[1] Can. Rec. Sc., 1892, 9.

to a comparison with rockweeds, the essential features of which it possesses in a large degree, although no fruit has been observed.

The genus *Fucus* is not on record for so low a horizon, but there is no valid reason why it should not be found in the Middle Devonian, as well as the laminarieæ. I designate it as *Fucus bertheletensis.*

NEMATOPHYCUS MILWAUKEENSIS PENHALLOW.



FUCUS BERTHELETENSIS PENHALLOW.

A PRELIMINARY LIST OF WISCONSIN MAMMALS.

By Hartley H. T. Jackson.

The present list of the mammals of Wisconsin is chiefly a result of the author's personal investigations in the state, supplemented somewhat by the studies of other mammalogists. The author is fully aware of the incompleteness of this paper and looks forward to the time when the working mammalogists of Wisconsin will, together, publish a list which will fully describe the distribution, habitats, and life histories of the mammals of the state. The eastern half of the state has been quite well covered by field study but there is room for much careful work in the western and northwestern sections, especially along the Mississippi bottomlands, and in the region adjacent to Lake Superior.

No list of the mammals of Wisconsin has appeared since Moses Strong published his "List of the Mammals of Wisconsin", in the Geology of Wisconsin (Survey of 1873-1879), Volume 1, Chapter X, pages 436 to 440. The list has served as a valuable guide to mammalogists, but many of Mr. Strong's records are not based upon actual examination of specimens, and are very doubtful. A few other papers of local and restricted character have been published.

Many species of mammals which have not yet been taken within the boundaries of the state may be expected in future collections. Particular effort has been made to secure specimens of *Microtus pinetorum scalopsoides* (Aud. & Bach.), *Synatomys cooperi Baird, Mephitis mesomelas avia* (Bangs.), *Putorius longicauda spadix* (Bangs), *Sorex fumeus Miller, Scalopus aquaticus machrinus* (Rafinesque), and others, whose geographical distribution it seems should include parts of Wisconsin. There are

certain other species which without doubt have occurred within the state in earlier days if they do not occur at the present time but of which we have no actual records; among these might be mentioned *Alces americanus Jardine, Bison bison* (Linnæus), *Felis concolor* Linnæus, *Gulo luscus* (Linnæus), and *Mustela pennanti* (Erxleben.)

There are two specimens of *Gulo luscus* in the Public Museum of the City of Milwaukee, labeled "Wisconsin", but as there are no other data we consider the record unsatisfactory. The writer has examined specimens from Wisconsin of all species recorded with the exception of *Sorex hoyi* Baird.

The author wishes to acknowledge his gratitude to all who have aided him in his studies of Wisconsin mammals. Acknowledgments are especially due to Dr. H. V. Ogden and to the officials of the Public Museum of the City of Milwaukee for the privilege of examining specimens in their respective collections; also to Dr. C. Hart Merriam, Mr. E. W. Nelson, Mr. Vernon Bailey, Mr. W. H. Osgood, and to others of the United States Biological Survey for identifying certain specimens and for substantiating identifications of many other specimens.

Didelphis virginiana Kerr.
Opossum.

Didelphis virginiana is occasionally captured in the south central portion of the state. One was taken in Green County, January 24, 1902, and again in the autumn of 1906 two more were taken near the same locality. Mr. Moses Strong reported it as found occasionally in the vicinity of Lake Michigan (1); but this has not been our experience as we find no records for this region.

Odocoileus americanus borealis Miller.
Northern Deer.

Deer are gradually diminishing in numbers wherever they are found. The cause of this decrease is not inefficient legislation, but

it is because of inefficient protection from wolves and law-breakers. Venison is the chief food of wolves during the winter months, and in the northern third of the state it is the principal meat of a large number of the rural population during the summer. With proper protection from these two evils, there is no reason why deer should materially decrease.

Deer are found rarely in the whole region west and north of the Wisconsin River, becoming gradually more plentiful towards the north. During very severe winters they occasionally wander to the southern tier of counties. East of the Wisconsin River they occur in Adams, Waushara and Outagamie Counties, thence northward.

Cervus canadensis (Erxleben.)
American Elk; Wapiti.

The elk is without doubt now extinct in Wisconsin, but cast-off antlers scattered throughout the lakes, marshes and woods of northern Wisconsin attest of its former occurrence there. I have examined antlers of *Cervus canadensis* found in Ashland and Iron Counties.

Sciurus carolinensis hypophæus Merriam.
Merriam's Squirrel.

The exact distribution of *Sciurus c. hypophæus* in the state has not yet been satisfactorily determined. In many localities it is quite common, being partial to heavy timber near water, often in company with *Sciurus c. leucotis.* It is found locally in a narrow rectangular stretch of country extending northwesterly from Racine and Waukesha Counties on the south to Dunn County on the north. This squirrel probably occurs in many other parts of the state but I know of no specimens taken outside of the area above described.

Sciurus carolinensis leucotis (Gapper).
Northern Gray Squirrel.

The relative abundance of the gray squirrel seems to vary with the abundance of hickory nuts. In years when nuts are plentiful

gray squirrels are common, and at such times seem to outnumber the other squirrels; then for a period of years they will be scarce, only to return when there is a crop of their favorite food.

Gray squirrels are sociable little fellows and if unmolested will make their homes in trees in the streets and parks of cities. Several towns throughout the southern part of the state have squirrels running about the streets, most notable of which is Fort Atkinson; here, at times, six or eight may be seen playing together The two forms *hypophæus* and *leucotis* both occur in Fort Atkinson; here, also, melanistic specimens were seen, the only black squirrels I have observed in southern Wisconsin.

Gray squirrels are reported from Forest County, but the most northern records I have are Adams and Dunn Counties.

Sciurus hudsonicus loquax Bangs.
Southern Red Squirrel; Chickaree.

Red squirrels are apt to make their appearance in any section of the state where conditions favor their welfare, but their true home is the north where they dwell chiefly along the streams, lakes and swamps at the edge of the woods. Chickarees prefer hemlock groves, but are not averse to mixed woods of pine, cedar, larch or birch. When they occur in the southern part of the state they are usually found in larch swamps or groves of bur oak. Red squirrels are erratic in occurrence, but not to such an extent as gray squirrels. They do not hesitate to swim across rivers, and I have frequently seen them swim through rapids which would baffle many aquatic animals. On one occasion I saw a red squirrel in North Pelican Lake swimming from one point of land to another fully ninety rods distant, and so skillful was he in his efforts that at a distance I mistook him for a mink.

Sciurus niger rufiventer Geoffrey.
Western Fox Squirrel.

Fox squirrels are not as abundant as formerly; even the past ten years have shown a decrease in their numbers in all the sections

of the state where they are to be found. It is reported by reliable authorities that in the days of the early settlers fox squirrels were so plentiful as to be a nuisance and that often in the autumn twelve or fifteen could be seen at one time carrying corn from the field to the woodland. They are at present regularly distributed over the southern half of the state, being more common in the central portion of this area and becoming less common along the shore of Lake Michigan and in the southern tier of counties.

Tamias striatus griseus Mearns.
Gray Chipmunk; Ground Squirrel.

Tamias s. griseus is found from the southern boundary of the state north at least to Oneida County, where I took an adult female August 20, 1907. This specimen was taken in a clearing among birch trees, and specimens of *Eutamias q. neglectus* were trapped in the same clearing. Old rail fences and second growth woods are the favorite habitats of the gray chipmunk and in such environments it is quite common north to about latitude 45°.

Chipmunks are particularly fond of berries, and during the month of July gooseberries and raspberries constitute their chief food; seeds of the linden tree also find favor in their eyes, and the smaller grains and grass seeds receive their due amount of attention.

Eutamias quadrivittatus neglectus (Allen).
Little Striped Chipmunk.

This, the eastern representative of the Rocky Mountain chipmunk, is confined in Wisconsin to the Canadian zone; here it lives in open woods and clearings. In the northern part of its range it confines itself almost entirely to rock piles, but in the southern part of its range it inhabits sand banks, stump piles, brush heaps, and nearly any conceivable location except dense woodlands and swamps.

No sooner is the camp made than these little chipmunks make

their appearance. At our camp on North Pelican Lake in the summer of 1906 no chipmunks were visible when we landed our boat-load of supplies, but within a few days they were present in dozens. They must investigate everything and one even entered my suitcase, left partly open, and remained there for several minutes. When we broke camp two of them entered the loaded boat. After the boat was launched they jumped into the water, though with considerable hesitation, and swam ashore.

Citellus franklini (Sabine).
Franklin's Spermophile; Gray Gopher.

Gray gophers are generally considered rare in all sections of the state but careful observation will prove them quite common west from Rock County to the Mississippi River and north to Pepin County. I have taken specimens in Rock County, and have observed the species in Green, Sauk and Jefferson Counties.

The habit Franklin's gopher has of dwelling in fields of growing grain and along old fence lines keeps the species in obscurity. As soon as the grain is cut in the fields this species takes up its abode in the taller grass along fences and in old pastures. It is a very shy mammal, and unless great caution is used it cannot be approached closely. These characteristics, together with its protective coloration, make it one of our most difficult rodents to study.

Citellus tridecemlineatus (Mitchell).
Striped Spermophile; Gopher.

This is one of our few Wisconsin mammals which has increased in numbers. There is scarcely a meadow, pasture, or roadside in the southern half of the state but what has its colony of gophers. Early in April or late in March they begin to awaken from their hibernation, and with the warm weather of May they commence their whistling which continues until the frosts of October drive them to their burrows for another winter. The latest

I have observed them out of their burrows in the autumn was November 1, 1903, at Milton.

Marmota monax (Linnæus).
Woodchuck; Ground Hog.

Marmota monax probably occurs over the whole of Wisconsin in favorable localities; it is most abundant in the southern counties and appears to be quite common as far north as Barron and Langlade Counties. It undoubtedly will be found less abundantly northward to Lake Superior, but we have seen no specimens from that region.

Sciuropterus sabrinus (Shaw).
Northern Flying Squirrel.

The large northern flying squirrel is found in the extreme northern counties of the State. It is probably not uncommon in favorable localities but it is seldom observed on account of its nocturnal habits. Specimens have been examined from Iron and Price Counties.

Scriuropterus volans (Linnæus).
Flying Squirrel.

The southern form of *Sciuropterus* is found wherever there is suitable hardwood timber in the state. During the day it remains concealed in a nest composed of grass, moss, plant down and fur, which is generally situated in a small cavity in an oak or poplar; cavities made by woodpeckers are preferred but sometimes natural cavities are chosen. Flying squirrels are nocturnal in habits and are seldom observed; however, a few sharp raps with a stick upon the trunk of the tree will usually bring them from their nest cavities if they are at home.

Castor canadensis Kuhl.
American Beaver.

Beavers at one time were not uncommon along many of the streams in northern Wisconsin; remnants of beaver dams and

lodges are quite frequently encountered, and some of them appear to have been quite recently built. There are a few beavers still remaining in some of the more secluded portions of the state, and it is hoped that sufficient protection will be given them to prevent their extermination.

There are two skulls of *Castor canadensis* in the collection of Dr. H. V. Ogden; one of these was taken in Sawyer County, November 3, 1899; the other was taken in Iron County, October 8, 1903.

Mus musculus Linnæus.
House Mouse.

House mice are common around dwellings and barns over the entire state. In the southern part of the state they are found in nearly every cornfield and grassy meadow, and I caught two specimens in traps set for shrews in a wet marsh. Apparently not increasing in abundance.

Mus norvegicus Erxleben.
Brown Rat.

This mammal is too well known to need discussion. Rats are found everywhere in the state, but are less abundant in the northern sections. I have observed them in the cornfields in Rock County; this is the only locality where I have found them any distance from buildings. Mr. J. N. Clark reports them occurring "to some extent in fields in summer and fall" in Dunn County.

Peromyscus canadensis (Miller).
Canadian Deer Mouse.

My specimens of *Peromyscus* from the pine regions of northern Wisconsin have been determined by Mr. W. H. Osgood to be *canadensis* and not the sub-species *umbrinus.* All the specimens that I have taken average slightly smaller than typical *canadensis* and in this respect approach *umbrinus,* but their color compares favorably with *canadensis.* Average measurements of three

males; Total length 151 mm.; tail vertebrae 67.3 mm.; hind foot 20.5 mm.; Average measurements of three females: Total length 174 mm.; tail vertebrae 91.6 mm.; hind foot 21 mm.

I have always found the Canadian white-footed mouse most abundant among alder *(Alnus)* bushes near pine forests, and particularly along gently sloping lake shores. Like other members of the genus they are nocturnal, and shortly after dusk they come from their holes to hunt for food. While sitting by the camp fire one evening I heard some mice not twenty-five feet from me. I baited a trap with walnut meat and set it among the alders; I reset it twice, and in less than twenty minutes I had taken three adult *Peromyscus canadensis.*

Peromyscus leucopus noveboracensis (Fischer).
Woodland Deer Mouse.

Peromyscus l. noveboracensis is quite abundant in deciduous woods, being apparently more abundant in the southeastern part of the state than elsewhere. Whether its range overlaps that of *P. canadensis* has not yet been determined.

Peromyscus michiganensis (Aud. & Bach).
Michigan Deer Mouse.

Peromyscus michiganensis is conspicuously absent in the vicinity of Lake Michigan, but in Walworth, Jefferson and Dodge Counties, and west to the Mississippi River it is quite abundant. Our knowledge of the northern extension of its range is not satisfactory.

The Michigan white-footed mouse inhabits the prairie regions, where it may be found in grassy meadows, in patches of weeds, or along old fences; occasionally it takes its abode in second growth timber and in brushwood. In the autumn this species frequently dwells in corn shocks in company with *Microtus ochrogaster,* and if undisturbed will remain there to rear its young the following spring. The young of *Peromyscus michiganensis* are

dark slate color dorsally, much different from adult specimens, and were formerly mistaken for a distant species, *Permomoyscus bairdii* (Hoy & Kennicott).

Evotomys gapperi (Vigors).
Red-backed Mouse.

This is the mouse frequently found in pine regions along the steep banks of streams and lakes and in sphagnum bogs and marshes; on a few occasions in Oneida County I have seen this species in hayfields, and one I saw in a deserted lumber camp. *Evotomys gapperi* is taken occasionally in southern Wisconsin along Lake Michigan, but in the interior of the state it is rarely seen south of Columbia County. The species is dichromatic, there being the ordinary red phase, and the brown phase. I have never seen specimens from Wisconsin in the brown pelage; Mr. Gerrit S. Miller reports such specimens from the north shore of Lake Superior (2).

Microtus pennsylvanicus (Ord).
Meadow Mouse; Meadow Vole.

This species occurs over the whole state in suitable locations. It is found principally in wet meadows, in hayfields and in cornfields, but it sometimes inhabits open woods and marshes. In the autumn *Microtus pennsylvanicus* leaves the lower lands for the sides of grassy hills; after the first snow falls it builds nests and makes runways on the surface of the ground beneath the snow, seeming to prefer the deeper snow and drifts for this purpose. When the snow melts in the spring, the majority of the animals again migrate to the lower lands, where they dwell during the summer months.

Meadow voles are quite diurnal in habits and may be seen frequently scampering through their runways at mid-day; more especially is this noticeable in the early spring.

I have known the species to become a pest in a house, but such cases are rare.

Microtus ochrogaster (Wagner).

Prairie Meadow Mouse.

Microtus ochrogaster is not so generally distributed as *Microtus pennsylvanicus*; our present knowledge limits its distribution in the state to the extreme southern and western counties, where it is locally common in upland grassy meadows and cornfields.

This species is often mistaken for the more common *Microtus pennsylvanicus*; in summer pelage the species are very similar, and a study of cranial characteristics is generally necessary; in winter pelage adult specimens of *ochrogaster* can always be distinguished from *pennsylvanicus* by the cinnamon color of the ventral portions of the former. Immature specimens are more difficult to determine.

Fiber zibethicus (Linnæus).

Muskrat.

Muskrats are distributed over the entire state wherever there are streams with clay or loam banks, and, more abundantly, around the lakes and the open swamps and marshes. The familiar muskrat houses are much more common in the southern part of the state than in the northern regions, but this does not necessarily indicate that the species is less plentiful in the northern sections; where sedge, rushes and flags are found the animals usually build houses in which to dwell, but where vegetation is lacking muskrats make their homes in holes in the banks of streams and lakes. It is generally believed that the large houses are used for winter headquarters, but from my own observations, and from what I can learn from old trappers, I am inclined to believe that these are chiefly summer houses, the smaller mud or sod houses being used for winter homes.

Zapus hudsonius (Zimmermann).
Jumping Mouse.

Zapus hudsonius occurs locally in many parts of the state, but it is nowhere common. The species appears to be most frequently found along creeks and brooks in the northern parts of the state; meadows and hayfields are haunts of this species in southern Wisconsin. I have taken only one specimen in the state; that one was taken August 9, 1907, near Crescent Lake in Oneida County.

Erethizon dorsatum (Linnæus).
Canadian Porcupine.

The porcupine is another of our mammals which is unable to withstand the approach of civilization, and as fast as the coniferous forests are cut away and the spruce and cedar swamps drained and cleared, this species disappears. It was formerly common in all the northern woods, but it is now becoming rare except in the wild and unsettled portions.

Geomys bursarius (Shaw).
Pocket Gopher.

Pocket gophers are common in some localities in the western part of the state near the Mississippi River, but we have no specimens or records from extreme southern Wisconsin. We have had frequent reports of pocket gophers but investigation has always proven the animal reported to be some other species. I have reliable reports of the occurrence of *Geomys bursarius* in Pepin and Pierce Counties; in the latter county it is reported quite common in some localities. Dr. C. Hart Merriam reports the species from Winnebago and Fond du Lac (3), and includes southern Wisconsin within its geographical range (4). The only specimen I have is a young male taken by Mr. J. N. Clark, October 21, 1901 at Meridian, Dunn County. Mr. Clark writes that pocket gophers are "common in sandy soil" in Dunn County.

Lepus americanus phæonotus Allen.
Minnesota Varying Hare.

Varying hares are not uncommon in most sections of northern Wisconsin, but owing to their retiring habits and to their excellent protective coloration they are not often seen. *Lepus americanus phæonotus* usually prefers to inhabit thin woods and brushland though occasionally it is found in the forests; during the day it remains hidden in the undergrowth, but early in the morning and in the evening it comes out into the old lumber roads and trails to nibble the green vegetation.

Five adult specimens, two males and three females, taken near Rhinelander, average as follows: Total length 457.4 mm.; tail vertebae 40.8 mm.; hind foot 134.1 mm.

Sylvilagus floridanus mearnsi (Allen).
Prairie Cotton-tail Rabbit.

The familiar cotton-tail rabbit is found over the southern half of the state north at least to Dunn and Outagamie Counties; it probably occurs farther north in the state, but more specimens and data are needed before the exact distribution of the species is known.

Lynx canadensis Kerr.
Canadian Lynx.

Lynx canadensis is taken occasionally in most of the northern counties but it is outnumbered in all localities by *Lynx ruffus.* I have examined specimens of *Lynx canadensis,* either skins or skulls, taken in Ashland, Bayfield, Iron, Oneida and Price Counties.

Lynx ruffus (Güldenstædt).
Wild Cat.

The wild cat, bob cat, bay lynx or catamount as it is variously called is comparatively common in the unsettled portions of northern and central Wisconsin, and specimens are occasionally taken

in the southern tier of counties. One was taken January 31, 1905, in the northwestern part of Rock County, and during the same winter another was killed in the western part of Green County. Wild cats are reported not uncommon in Adams County, but elsewhere south of latitude 44° the species seems to be rare.

Urocyon cinereoargenteus ocythous Bangs.
Wisconsin Gray Fox.

The type specimen of *Urocyon c. ocythous* was taken at Platteville, Grant County, Wisconsin (5), but the species appears to be common in only a few sections of the state, and principally in the western part. A male in the author's collection was taken by Mr. J. N. Clark, January 19, 1908, near Meridian in Dunn County. This specimen measured as follows: Total length, 1011 mm.; tail vertebrae, 378.3 mm.; hind foot, 104.4 mm.; ear, 68.5 mm. I have examined no other gray foxes from the state. Mr. Clark informs me that this species is "common in timbered sections" of Dunn County.

Vulpes fulvus (Desmarest).
Red Fox.

Vulpes fulvus is found in nearly all parts of the state, but the species is not constant in distribution and may be rare or entirely absent in a given locality for a period of years, then become quite common; or it may be plentiful in a certain section then suddenly become rare. The species is almost as erratic in this respect as some of our squirrels, but the periods of its sojourn in a given locality or of its absence from a locality seem to be of longer duration than in the case of squirrels. Previous to the autumn of 1903 red foxes were practically unknown in northern Rock County; since that time they have not been uncommon there. Mr. J. N. Clark informs me that this species is rather uncommon now in Dunn County, whereas a few years ago it was abundant.

Specimens have been examined from Ashland, Green, Oneida,

Rock and Vilas Counties. I have also seen the species in Jefferson and Kenosha Counties.

Canis griseus (Sabine).
Timber Wolf; Gray Wolf.

Timber wolves are quite common in the extreme northern counties, and it seems they are increasing in numbers. Gray wolves are very destructive to deer, and, also, domestic animals, particularly sheep. In most of the northern sections of the state sheep raising is impracticable, if not impossible, on account of the depredations of wolves. Experienced trappers and hunters inform me that if the leg bones of a sheep are burned in the air, the odor will attract wolves a distance of fifteen to twenty-five miles.

I have examined specimens, mostly skulls, taken in Ashland, Bayfield, Forest and Oneida Counties. This species is sometimes reported from southern Wisconsin, but we have seen no specimens; it may possibly occur there during severe winters.

Canis latrans Say.
Prairie Wolf; Coyote.

The prairie wolf occurs rarely in nearly all parts of southern Wisconsin, east nearly to Lake Michigan; it is reported quite common in certain localities near the Mississippi River. Mr. J. N. Clark writes me that this species is "not uncommon in small numbers" in Dunn County. The only specimens I have seen from the state were taken in Green County.

Lutra canadensis (Schreber).
Otter.

Otters are of regular occurrence in northern Wisconsin, and sometimes the species occurs in southern Wisconsin. There was an otter slide on the banks of Lake Koshkonong during the summer of 1901. Dr. H. V. Ogden has a skull taken in Racine

County. Specimens taken in Bayfield and Oneida Counties have also been examined.

Mephitis hudsonica (Richardson).
Northern Plains Skunk.

We have examined specimens of *Mephitis,* mostly skulls, from various parts of the state, and all have proven to be *hudsonica.* The species seems to be quite common in all parts of the state.

Taxidea taxus (Schreber).
American Badger.

The badger is found regularly in the sandy regions of the northern part of the state, but southward it becomes more uncommon. During the eighteen months from August, 1900 until February, 1902, badgers were quite common in certain sections of Rock County; between these two dates there were nine badgers captured within a radius of eight miles of Milton; one was shot in August, 1900, within the village limits. June 13, 1902, I obtained an adult male four miles east of Milton; this specimen weighed twenty-three pounds and six ounces, and measured as follows: Total length, 764.5 mm.; tail vertebrae, 131.8 mm.; hind foot, 103.4 mm.

Putorius vison (Schreber).
Northern Mink.

Putorius vison is found throughout the state wherever there are suitable streams, lakes or marshes; the species is quite common in nearly all sections, but it appears to be most abundant in the central parts of the state.

Putorius cicognanii (Bonaparte).
Bonaparte's Weasel.

Bonaparte's Weasel is taken occasionally in all parts of the state with the possible exception of the extreme southwest portion; it is most abundant in northern Wisconsin and in eastern

Wisconsin near Lake Michigan; in these parts of the state it outnumbers *Putorius noveboracensis.*

Putorius rixosus allegheniensis (Rhoads).
Alleghenian Least Weasel.

The single specimen of this rare weasel which has been taken within our boundaries has already been recorded by Mr. Henry L. Ward, (6); this specimen was taken November 26, 1906, near Burlington, Racine County. Specimens of typical *rixosus* have been taken in Minnesota, and additional collections and study may prove the two forms, *rixosus* and *allegheniensis,* to intergrade in central or northern Wisconsin.

Putorius noveboracensis Emmons.
New York Weasel.

Putoruis noveboracensis is the most common weasel in the southern and central parts of the state, westward to the Mississippi River; eastward, in the vicinity of Lake Michigan it does not appear to be so common.

Mustela americana Turton.
Pine Marten; American Sable.

The pine marten is now practically extinct in Wisconsin. I have seen only three specimens which have been taken in the state; one of these, a trapper's pelt, was taken in Vilas County in the winter of 1904-1905. Dr. H. V. Ogden has two skulls in his collection; one taken at Fisher Lake in Iron County from an animal killed in December, 1897; the other was taken near Drummond in Bayfield County.

Procyon lotor (Linnæus).
Raccoon.

Procyon lotor is distributed over the entire state, but it is most abundant in the western part; in the northern pine regions it becomes less common. Raccoons prefer oak woods in the vicinity

of lakes and rivers; here they may dwell in hollow trees or logs, but frequently they inhabit deserted buildings. Four were taken at one time from the loft of a deserted log house near Johnstown, Rock County. Two specimens examined, from Forest County, are abnormally dark.

Ursus americanus Pallas.
Black Bear.

Ten years ago the black bear was not uncommon in nearly all parts of northern Wisconsin, but it is now seldom taken except in the counties north and west of Oneida County; in the latter county it was quite common until about eight years ago. A few are still found in Forest County.

Sorex personatus I. Geoffrey.
Masked Shrew.

This little shrew has been taken in most parts of the state except in the southwestern portion, and careful collecting may possibly prove its presence there. It is not common in the southern half of the state, though of regular occurrence; in northern Wisconsin I found it very common, and I have taken specimens in wet swamps, on dry hillsides, along railroad tracks, and in fact, in almost every conceivable habitat except the dense pine forests. The species is evidently most abundant in sphagnum swamps and in grassy, second growth woodlands.

Sorex richardsonii Bachman.
Richardson's Shrew.

The only knowledge I have of the distribution of *Sorex richardsonii* in Wisconsin is based upon five specimens, two males and three females, taken in Oneida County; one of these specimens was taken August 25, 1906; the other four were taken during the summer of 1907. All of these were taken in a swamp overgrown with small conifers *(Larix, Picea* and *Juniperus)* just southeast

of Rhinelander. Average measurements of two males: Total length, 116 mm.; tail vertebrae, 39.5 mm.; hind foot, 14 mm.; Average measurements of three females: Total length, 114.5 mm.; tail vertebrae, 38 mm.; hind foot, 13.2 mm.

Sorex hoyi Baird.
Hoy's Shrew.

Baird's type of *Sorex hoyi* was a male collected at Racine, Wisconsin (7); two males, including the type, are recorded by Professor Baird from that locality (8). There is a shrew in the Milwaukee Public Museum collected in 1879 by Thure Kumlien in Jefferson County; this specimen, a female, bears the label *hoyi*, but I have been unable to examine it critically, and, being mounted with the skull inside, the species has not been positively determined by the author.

Neosorex palustris (Richardson). (Plate III.)
Marsh Shrew.

I secured four specimens of *Neosorex palustris* near Rhinelander in the swamp where I caught *Sorex richardsonii*. The four *Neosorex* were all trapped in the same runway, and, though the trap was in the runway over two weeks, no other species were captured there. The runway entered a mass of sphagnum which surrounded the roots of swamp laurel *(Kalmia glauca)*; within the sphagnum beneath the roots of the laurel was a dark, damp cavity, with a capacity of possibly one peck; the runway passed on through this cavity to the edge of a water hole, where I was unable to follow it further. Specimens of *Sorex richardsonii* and *Sorex personatus* were taken within a few yards of the place where the specimens of *Neosorex palustris* were obtained.

Two males of *Neosorex palustris* average in measurements: Total length, 147 mm.; tail vertebrae, 62 mm.; hind foot, 19.5 mm.; Two females average: Total length, 151 mm.; tail vertebrae, 62 mm.; hind foot, 19.5 mm.

There is a mounted shrew in the Public Museum of the City of Milwaukee, a male collected June 10, 1903, in Marinette County. The specimen is labeled *"Neosorex albibarbis"* but from external characteristics it appears to be *palustris.*

Blarina brevicauda (Say).
Short-tailed Shrew.

Blarina brevicauda is common in nearly all parts of Wisconsin, but it is more common in the southern half of the state than in the northern half. This species chooses principally grassy fence lines and patches of weeds for its habitat. It is not often seen during the summer months; during the winter it seems to acquire more diurnal habits, and it may frequently be observed in its runways, especially on warm cloudy days.

Condylura cristata (Linnæus).
Star-nosed Mole.

I have seen only two specimens of *Condylura cristata* from Wisconsin; one of these is in the collection of Dr. H. V. Ogden and was taken at Mercer, Iron County; the other specimen was taken near Stevens Point, Portage County. We can see no reason why this species should not occur frequently in northern Wisconsin but records have not established the fact.

Myotis lucifugus (Le Conte).
Little Brown Bat.

Our present knowledge of the distribution of *Chiroptera* in Wisconsin is far from satisfactory. *Myotis lucifugus* undoubtedly has a much wider distribution in the state than our records indicate; we have seen specimens from Dodge, Jefferson, Milwaukee, Rock and Waukesha Counties.

Lasionycteris noctivagans (Le Conte).
Silver-haired Bat.

This bat is found chiefly around lakes and water courses in

the southern part of the state; in most localities it is very common, but it is nearly everywhere outnumbered by *Lasiurus borealis.* I have seen no specimens of *Lasionycteris noctivagans* from northern Wisconsin.

Lasiurus borealis (Müller).
Red Bat.

Lasiurus borealis is found in nearly all parts of Wisconsin; it may not occur in certain sections of the northern part of the state. My experience has been that the red bat is our most common bat, and also that it is the bat most frequently seen in cities and towns. This species shows great color variation.

Lasiurus cinereus (Beauvois).
Hoary Bat.

I have examined only four specimens of this rare bat from Wisconsin. There is a male in the Milwaukee Public Museum, collected July 11, 1903, at Janesville, Rock County. A female, with two live young clinging to her, was brought to me on the evening of July 27, 1903; it was found dead in a yard on the east side of the public park in Milton, Rock County. The young were over one-third grown. Measurements of the adult female were as follows: Total length 149.6 mm.; tail vertebrae, 59 mm.; hind foot 13.8 mm.

REFERENCES.

1. Strong, Moses. List of the Mammals of Wisconsin. Geology of Wisconsin (Survey 1873-1879) Vol. 1. Chap. X. p. 440.
2. Miller, Gerrit S. Notes on the Mammals of Ontario. Proc. Bos. Soc. Nat. His. Vol. 28. No. 1. p. 16. (April, 1897).
3. Merriam, C. Hart. Monographic Revision of the Pocket Gophers. Family Geomyidae, (Exclusive of the species of Thomomys). U. S. Dept. Agr., Div. Biol. Sur. N. A. Fauna No. 8, p. 120. (Jan. 31, 1895).
4. Merriam, C. Hart, Loc. cit., p. 122.

5. Bangs, Outram. Proc. New Eng. Zool. Club. Vol. 1, p. 43. (June 5, 1889).
6. Ward, Henry L. A Weasel New to Wisconsin's Fauna. Bul. Wis. Nat. Hist. Soc. Vol. 5, No. 1, pp. 63-64 (Jan. 1907).
7. Baird, Spencer F. Mammals of North America, p. 32. (July 1857).
8. Baird, Spencer F. Loc. cit., p. 33.

HABITAT OF Neosorex palustris (RICHARDSON).

HABITAT OF Neosorex palustris (RICHARDSON).

FOSSIL CERCOPIDÆ (HOMOPTERA).

By T. D. A. Cockerell.

In the Miocene shales of Florissant, at Station 14, we found an excellent specimen of *Palaphrodes irregularis* Scudder, preserved in exactly the same position as Scudder's fig. 6, Pl. 21 (Tertiary Insects), and showing the characteristic form and markings. It is a little smaller than the typical size—not quite 10 mm. long. Curiously, however, the venation of the wings (hind wings) does not agree with Scudder's figures. Using the nomenclature set forth by Kirkaldy (Leaf-Hoppers and their Natural Enemies, 1906), Scudder's figure shows the cubitus apparently simple, but with a cross-vein (which may represent the lower branch of the cubitus), going to the first anal. (Fig. 1, lower figure). Our specimen, on the contrary, shows the cubitus evenly forked, with no cross-vein to the anal. When at Cambridge, I sought diligently in the Scudder collection for the original of his fig. 6, but failed to find it; and I do not know whether to consider the cross-vein an error of the artist's, or not. Scudder's description certainly agrees with his figure. I consulted Mr. Otto Heidemann on this point, and he very kindly wrote me at some length, also sending a series of Cercopidæ for comparison. Mr. Heidemann justly observes, that according to Scudder's description and figure, the venation of *Palaphrodes* does not accord with that of the Aphrophorinæ, to which it is assigned. My specimen, however, does so accord, and there is no doubt that the genus is very

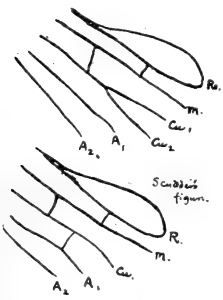


Fig. 1. *Palaphrodes irregularis* Scudder.

close to *Aphrophora,* that is, *Cercopis,* according to Horvath, Kirkaldy, etc. The principal distinctive character may be found in the shape of the head,—very obtuse and rounded in front, and distinctly narrower than the thorax. The pattern of the tegmina is perfectly typical of *Cercopis (Aphrophora)* or *Lepyronia*—these two having essentially the same pattern. The venation of the wings, at least in my specimen, is entirely that of *Cercopis (Aphrophora).* The recent species compared are *Cercopis saratogensis* (Fitch), *C. parallela* (Say) and *C. quadrinotata* (Say). In Ball's figure of the wing of *Aphrophora* in Pr. Iowa Acad. Sci. 1895, the cross-vein between the media and cubitus is omitted, but it is present in the specimens examined, and doubtless its omission was accidental.

We obtained *Palecphora communis* Scudder at Stations 14 *(W. P. Cockerell)* and 17 *(S. A. Rohwer),* and *P. prævalens* Scudder at Stations 13 *(T. D. A. Cockerell)* and 14 *(W. P. Cockerell, Geo. N. Rohwer).* This genus has longer and slenderer tegima than *Palaphrodes,* with the costa less arched. The pattern, as Scudder remarks, is distinctive, though it could be derived from that of *Cercopis* without any very great change. The venation of the tegmina, as figured by Scudder for *P. marvinei* Scudder, is in essential agreement with that of *Cercopis,* but is noteworthy for the rather numerous distinct nervures passing from the radius to the costal margin. The tegmina are rounded at the apex, not pointed. The hind wings, as well seen in our specimens of *P. communis,* are in general agreement with *Cercopis,* but offer a distinctive feature in the deflection downwards and bending of Cu_2 (see fig. 2). The relation of the radius to the media varies; it may be connected by a cross-vein as in *Cercopis,* or it may act-

Fig. 2. *Palecphora communis* Scudder.

ually join the media for a short distance—a condition approached in *Lepyronia.*

The variability of the venation of the wings of the *Cercopidæ* is undeniable, and it is of interest to note that the instability we find today existed as far back as the miocene. The color pattern of the tegmina really seems much more constant. In order to illustrate one more modification of the wing-venation, I give a diagram of the wing of a specimen of *Tomaspis bicincta* Say received from Mr. Heidemann. It will be seen that there are two little nervures leaving Cu_1, but breaking off without forming cross-nervures. It will also be noted in *T. bicincta* (and this is normal for the genus, being just the same in the large Central American *T. inca* Guér.) Cu_2 branches off from Cu_1 at a large angle, though it is not afterwards bent as it is in *Palecphora.* The figures accompanying this paper are pure diagrammatic, and are not intended to show specific minutiæ.

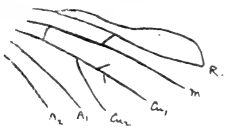


Fig. 3. *Tomaspis bicincta* Say.

Taking the North American genera of Cercopidæ, it is evident that as regards the venation *Cercopis (Aphrophora)* and *Lepyronia* stand at the foot of any phylogenetic tree, as being the most primitive. From *Aphrophora* or *Cercopis* we may readily derive *Philænus,* and from this we get two entirely diverse branches, one leading to *Clastoptera,* the other to *Monecphora* or *Tomaspis.* In *Tomaspis* we have a highly developed form, with the apical field of the tegmina densely reticulated and the color-pattern very different from that of *Cercopis,* namely two red or yellow cross-bars on a black ground. The beginnings of the *Tomaspis* pattern (with the divergence of the forks of the cubitus) are seen in the Florissant fossil *Prinecphora balteata* Scudder; while an almost typical *Tomaspis*-pattern is reached in the gigantic *Petrolystra gigantea* Scudder, the type of which I had the pleasure of examining in the Scudder collection.

Palaphrodes obviously is a relatively primitive Cercopid, near to *Cercopis*. *Palecphora* must be regarded as a branch of the same stem; not, so far as may be judged, in the line of evolution of any of the modern North American Cercopids; whether intimately related to any exotic genus, I cannot say. According to the conventional classification, *Palaphrodes* and *Palecphora* go in different sub-families, but they are doubtless more closely related than either is to *Clastoptera* on the one hand, or *Tomaspis* on the other.

THE PSEUDOSCORPIONS OF TEXAS.

By Nathan Banks.

Some time ago Mr. C. T. Brues sent me some pseudoscorpions from Texas. Most of them were taken near Austin, and several of them from ant-nests. Two of these prove to be new species. This induced me to examine and determine all my Texan material in this order. There are 10 species, six of these belong to one genus *Chelanops,* four of them being new. One of the species found in an ant's-nest occurs also near Washington, D. C., often under large stones. The most common Texan species is *Chelanops oblongus,* a species widely distributed in the United States east of the Rocky Mountains. The two species of *Chelifer* are found in many parts of the eastern United States, the *C. cancroides* usually in houses or other buildings. When more attention is paid to collecting these creatures, no doubt the Texan list will be double what it is now.

Chelifer cancroides Linn.

Brazos Co., New Braunfels.

Chelifer muricatus Say.

Austin, and Esperanza Ranch, Brownsville.

Chelanops oblongus Say.

Austin, in fungi; Brazos Co.; San Antonio; Brownsville; and Columbus.

Chelanops texanus Banks.

Brazos Co.

Chelanops unicolor n. sp.

Cephalothorax, palpi, and abdominal scutæ a uniform pale brownish yellow, rest whitish yellow. Cephalothorax nearly one and

one-half times as long as broad, narrowed and rounded in front, evenly and finely granulate, with two transverse furrows in the posterior part, the hind one indented in the middle; the hairs of cephalothorax are distinctly clavate, and on each of the dorsal scutæ are five strongly clavate hairs in a row. Palpi short and rather heavy, the hairs plainly clavate, except those on the fingers; the femur is scarcely as long as width of the cephalothorax; the tibia plainly shorter, very convex on inner basal part; the hand about twice as broad as femur, and as long as tibia, evenly convex each side, the fingers about the length of hand, stout and slightly curved. The hairs on under side of body are simple, but most of those on the basal joints of legs are clavate. Abdomen is about twice as long as broad, each side slightly convex. Length, 2 mm.

From nests of ants *(Eciton cœcum* and *Pachycondyla harpax)* at Austin Texas.

Chelanops tumimanus n. sp.

Cephalothorax, scutæ, and palpi dark red brown, almost black, fingers rather paler, posterior margin of cephalothorax, except a median square, is pale yellowish; legs brownish on femora, femora III. and IV. quite dark; all hard parts finely and evenly granulate. The cephalothorax is about one and one-quarter times as long as broad behind, much tapering in front, eye-spots indistinct, the surface with some scattered very distinctly clavate hairs; each dorsal scutum with a row of fine clavate hairs near posterior edge, and one on middle of lateral edge. Abdomen fully twice as long as broad, each side slightly convex. Palpi heavy and short, clothed with very strongly clavate hairs, except those on the outer side of hand and those from the fingers; femur not as long as width of cephalothorax, very much swollen on outer base; tibia but little shorter and barely, if any, wider than femur, rather evenly convex on both sides, the greatest inner convexity at the middle; hand very heavy, twice as wide as femur, but scarcely as long as tibia, very much swollen on inner base; the fingers shorter than the hand, very stout and slightly curved. Venter with a row of dark spots each side, the hairs simple, but those on femora and outer side of tibiæ clavate. Length 2.5 mm.

San Antonio, August.

Chelanops æqualis n. sp.

Cephalothorax and abdominal scutæ dark brown, palpi clear reddish brown, legs yellowish. Cephalothorax about one and one-quarter longer than broad behind, tapering and rounded in front, eye-spots indistinct, surface finely and evenly granulate, with short scattered thick hairs. Palpi large, trochanter with a swelling above and one behind; femur as long as width of cephalothorax, sides subparallel; tibiæ about as long as femur, slightly wider, the inner convexity is greatest before the middle; the hand is nearly as long as the tibia and about one and a half times wider, more strongly convex on inner than on the outer side; the fingers large, as long as hand, and only slightly curved; the hairs on the inner side of tibia, femur, and trochanter are almost clavate, the others are simple. The abdomen is about two and a half times as long as broad, the posterior edge of each scutem has from 9 to 11 simple hairs. Legs rather long and slender, with simple hairs; the hind femora not swollen. Length 3.3 mm.

From El Paso, Texas.

Chelanops pulchellus n. sp.

Cephalothorax dark brown, with an oblong silvery white spot in each posterior lateral corner; abdominal scutæ brown, the outer end of most of them with a silvery mark; palpi dark-red brown, almost black in the swollen parts, but the fingers are very much paler. Cephalothorax nearly one and a half times as long as broad behind, much tapering in front, with a few short, thick hairs. Palpi rather short; femur scarcely as long as width of cephalothorax, outer side evenly convex, inside slightly concave before tip; tibia scarcely as long as femur, but plainly wider, the greatest inner convexity at about the middle; hand heavy, about as long as tibia and one and a half times wider, both sides evenly convex; fingers stout, a little shorter than hand; the hairs on inner side of tibia, femur, and trochanter short, and almost clavate. Abdomen fully twice as long as broad, each scutum with about 8 very short hairs on posterior margin. Legs short, hind femora distinctly thickened; the hairs on outer side of femora and tibiæ short and thickened. Length 2.3 mm.

Esperanza Ranch, Brownsville, Texas.

The six species of *Chelanops* now known from Texas may be separated by the following table:

1. Many hairs on palpi distinctly clavate..... 2
   Hairs on palpi not plainly clavate..... 4
2. Fingers equal to hand, which is not very large, small species ..... **unicolor**
   Fingers shorter than hand..... 3
3. Hand very heavy, nearly twice as wide as tibiæ.....**tumimanus**
   Hand not heavy, but little wider than the tibia.....**texanus**
4. Fingers plainly paler than the hand, small species.....**pulchellus**
   Fingers as dark as hand, larger species..... 5
5. Fingers shorter than hand.....**oblongus**
   Fingers as long as hand.....**æqualis**

Ideobisium rufulum Banks.

From nest of *Camponotus sansabeanus,* Austin.

Olpium minutum n. sp.

Cephalothorax pale yellowish brown, darker in front, palpi yellowish brown, the fingers the darkest; abdominal scutæ yellowish, legs and venter whitish. Cephalothorax one and a-half times longer than broad, hind border rounded, but little narrowed in front, two distinct eyes each side close together. Palpi short: femur about as long as width of cephalothorax, a trifle wider at tip than near base, tibia nearly as long as femur and one and one-fourth times wider, the greatest inner convexity at middle, hand fully as long as tibia, one and one-fourth wider, sides but little convex; fingers stout, much shorter than the hand; hairs of palpi fine and uneven. Abdomen three and one-half times as long as wide, each scutum with 3 or 4 very fine hairs on posterior margin. Legs very short, hind femora slightly swollen, tarsi very short. Length 1.6 mm.

In nest of *Eciton cœcum,* Austin, Texas. Differs from *O. obsurum* in paler color, smaller size, longer abdomen, and more slender cephalothorax.

A RAPID MELANISTIC AND SUBSEQUENT PARTIAL ALBINISTIC CHANGE IN A CAGED ROBIN.*

By Henry L. Ward.

Early in November last I was told of a caged robin in the city that had suddenly turned black. On Nov. 6th I went to see this bird, which belongs to Mrs. T. J. Coughlin, and found a lively, pugnacious and apparently healthy robin with jet black plumage except for what appeared to be two small, white under-tail coverts. When viewed under strong illumination, and at a certain angle, the feathers of the breast were bordered with brownish black rather than being unicolor as otherwise they appeared. The eye-ring was not noticeable, the bill was nearly black and the anterior surfaces of the tarsi and upper surfaces of the toes were heavily suffused with black while their plantar surfaces were whitish flesh color. The tarsi are rather deeper, antero-posteriorly, than is normal, apparently due to excessive development of the scutes.

Its history as given me was that about four years previously it had been taken as an abandoned nestling by Mrs. Panton, a friend of Mrs. Coughlin, who had kept it in a cage in her kitchen. Thirteen months ago this friend died and the bird was transferred to Mrs. Coughlin's kitchen. For about the first three years of its life during its sojourn with Mrs. Panton the kitchen in which it was kept was used for cooking and washing. In Mrs. Coughlin's kitchen no washing and little cooking is done. The bird is in a large wire cage suspended by a pulley from the ceiling immediately in front of a south window. The room is perhaps eight

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* Read before the joint meeting of the Wis. Acad. of Sciences, Arts and Letters and the Wis. Natural History Society Feb. 13, 1908.

feet in height and the bird, when I have seen it, has been about five and a half feet above the floor.

Up to the latter part of last September the bird had exhibited rather bright normal coloration when it began to moult. This process, which resulted in the extreme melanistic phase in which I first saw it, occupied about three weeks and had been completed some two weeks before my visit. I was assured that the bird had been in uniformly good health and that its diet of ground hemp, grated carrot and cornmeal with an occasional piece of apple to pick at, a minute amount of scraped raw meat, perhaps once a week, and in spring occasional meals of angle worms has been maintained during its entire life.

On January 28th last, I again saw the robin. The pigmentation of the bill had almost entirely disappeared and it was bright yellow except for a dusky spot near the tip of the culmen. Mrs. Coughlin informed me that this change had occurred within the preceding four days. The eyelids were much lighter than at my previous visit, appearing whitish at a distance and greenish yellow on close inspection. The tarsi and feet were also lighter in color, the pigmentation of their anterior surfaces seeming to have concreted so as to produce a faintly maculated effect.

About a week previously, after having bathed and while its feathers were erected, it was for the first time noticed that there were various white feathers underlying its sable plumage. I could detect these on various parts of its body and neck and a faint suggestion of fine, white streaking was noticeable when looking directly at the breast of the bird, probably due to underlying white. A third inspection on the 10th inst., showed a farther fading of the dusky spot on the culmen, and apparently an addition of one or more white feathers to the original two white under-tail coverts. Whether or not the white underlying feathers on other parts of its body had increased was difficult of determination. As the bird

is lively and pugnacious and desires to face one it is a rather unsatisfactory subject for detailed examination.

The facts of the previous life of the robin, of its sudden and remarkably complete change from normal color to melanochroism and its subsequent albinistic tendencies have been vouched for by Dr. P. H. McGovern who has been personally familiar with it for more than three and a half years.

On account of the season of year it has been impossible to make any tests as to the comparative degree of heat and humidity of this room and that of the open air when these factors might influence its plumage.

In making a partial review of the literature of the subject I note the following: Mr. Ruthven Deane[1] has listed 134 species of birds exhibiting more or less complete albinism and melanism of which 126 belonged to the former group and but 8 showed the latter peculiarity. There is no doubt that a white bird is more conspicuous and consequently more liable to attract attention than a black one but it is probable that the latter pathological condition is the less common.

In the Bulletin of the Nuttall Ornithological Club and in The Auk, covering a period of 32 years, I find mentioned five cases of melanism in the robin. One, presumably a wild bird, is mentioned by Deane[2]. Another, a caged bird, was one of a nest of black robins taken at St. Johns of which Dr. Elliott Coues[3] wrote in 1878: "Mr. Boardman writes me later, under date of September 23rd, that he has been much interested in watching the moult of the black robin, and says: 'He acts as if he were going to be an albino. His new tail is about half grown out, and is nearly white, with a black stripe down each feather. His breast, head, neck and back are jet black, but very much out of feather.' "

In 1884 W. B. Barrows[4] called attention to a caged robin taken as a normal nestling (at Middletown, Conn.) about six years previously. At the fourth fall moult "a few white feathers were

noticed and here and there a black one." After the following fall moult the wings and tail were almost completely white while below he was clear black, except for a side patch of red unler each wing and the usual white belly. The next fall moult brought forth the normal robin plumage which a year later was replaced by the following coloration: "Above clear black; tail mostly white; interscapulars and most of the wing feathers white on outer webs; chin, throat, belly and under tail coverts normal. The upper breast shows a somewhat crescent-shaped patch of red, and almost as continuations of this on either side are red patches under the wings. A few red feathers down the middle of the breast imperfectly separate the black which would otherwise form a single large pectoral patch. The white about the eyes is normal."

Barrows in 1885[5] reports another robin taken at Middletown, Conn., as a normal nestling which retained its normal colors for two or three years. "Gradually the plumage became somewhat variegated with black and white, the black predominating above, though Mr. Leonard thinks the bird became ultimately almost white. There was no return to the normal plumage after the abnormal dress was once assumed." This bird died when about five years old.

Dr. Walter Faxon[6] in 1886 cites a robin "as dark as a European Blackbird", kept in an aviary the owner of which informed him that "Robins thus raised in confinement were often thus colored." Mr. Faxon pertinently asks: "Is not the melanism to be connected with the peculiar conditions to which the bird is exposed? The aviary is built like a greenhouse, with one side (glass) sloping to the south. It has no artificial heat yet keeps southern birds (as Cardinal Grosbeaks) in good condition."

In these accounts it will be noticed that albinism and melanism are not infrequently, in fact are usually associated together.

It has long been supposed that humidity was conducive to the deepening of colors in birds and the colors of lepidopterous insects

have experimentally been greatly modified by subjecting the larva to abnormally high temperature. Recently Mr. C. W. Beebe at the gardens of the New York Zoological Society has carried on some important and significant experiments on the effects produced on the colors of birds subjected to slightly supernormal temperature accompanied by increased humidity. In his "Summary of the Effects of Humidity"[7] on the Inca dove he states "Intrinsically the change is at first a segregation and intensification of the melanism, resulting in a clearing up and extension of the white or whitish areas. A period of equilibrium later ensues, until the increase of melanism is such that it begins to encroach upon the white areas, this continuing until all trace of white has disappeared."

In the Robins described by Barrows this sequence seems to have obtained: except that the one first reported became only incompletely melanistic while the second one as well as that described by Coues and our Milwaukee Robin have gone beyond this stage and developed a greater or less degree of albinism.

Beebe[8] says farther: "The sporadic appearance or artificial inducing of melanism *in a single individual* under humidity may be explained, and probably correctly, as merely the result of intensified action of the pigment-producing enzyme or unorganized ferment." Accepting this theory it is natural to suppose that a point will be reached when this abnormal production of melanisn will have exhausted the resources of the bird leaving it pigment-poor in which case albinism would succeed.

1. Bull. Nuttall Ornithological Club, Vol. I, pp. 20-24; Vol. IV, pp. 27-30; Vol. V, pp. 25-30.
2. Bull. Nuttall Ornithological Club, Vol. I, p. 24.
3. Bull. Nuttall Ornithological Club, Vol. III, p. 48.
4. The Auk, Vol. I, p. 90.
5. The Auk, Vol. II, p. 303.
6. The Auk, Vol. III, p. 284.
7. Zoologica, Vol. I, p. 30.
8. Zoologica, Vol. 1, p. 34.

NOTES AND DESCRIPTIONS OF NORTH AMERICAN PARASITIC HYMENOPTERA. VI.

By Charles T. Brues.

FAMILY BETHYLIDÆ.

Anisepyris rugosicollis sp. nov.

Female. Length 4.5 mm. Black, the head, mesonotum, and scutellum purplish; pronotum greenish; base of antennæ and posterior legs honey-yellow. Head as wide as long, opaque, finely shagreened, with small, very irregularly arranged punctures interspersed; cheeks much more coarsely sculptured; mandibles honey-yellow with broad tips and four small black teeth. Antennæ 12-jointed; scape, pedicel and base of first flagellar joint honey-yellow; scape rather slender, curved, as long as the following four joints together; pedicel two-thirds longer than the first flagellar joint; second as long as the first, but thicker, quadrate; following joints scarcely growing narrower, quadrate or transverse quadrate. Eyes elongate oval, separated by one-third their length on the vertex and by about the same distance from the base of the mandibles. Ocelli placed in a small equilateral triangle. Pronotum widened behind, where it is nearly twice as wide as long, abruptly declivous in front; its surface greenish, shining, coarsely longitudinally rugose, with a punctate frenum posteriorly; its lateral and posterior edges margined. Mesonotum as long as the pronotum, blue, with greenish reflections anteriorly on the middle lobe; its surface finely shagreened. Parapsidal furrows deep, convergent posteriorly; lateral furrows visible only behind. Scutellum purplish, subshining, with two foveæ connected by an impressed line basally and with several large punctures posteriorly. Metanotum with five longitudinal carinæ, besides the carinate lateral margins and posterior margin. Abdomen shining black. Legs black, the middle and posterior coxæ and trochanters brown; base of posterior femora ferruginous; middle tibiæ not spinous; tarsal claws with a single tooth. Wings brown with a hyaline band beneath the stigma and a pale apex. Venation normal, the marginal vein two and one-half times as long as the basal.

Described from a female specimen collected by Mr. Charles Schaeffer at Esperanza Ranch, Brownsville, Texas. Type in the Museum of the Brooklyn Institute of Arts and Sciences.

This species is similar to *A. fasciipennis* Kieffer from Nicaragua, from which it differs in the sculpture of the head and thorax, particularly the pronotum.

FAMILY SCELIONIDÆ.

Hoploteleia noveboracensis sp. nov.

Male. Length 4.25 mm. Black, very coarsely rugosely punctate; legs, except coxæ, honey-yellow; wings hyaline. Head large, twice as wide as thick anteroposteriorly. Occiput margined. Facial depression deep, margined, extending nearly to the anterior ocellus above, its surface transversely striate, although faintly so on the sides. Lateral ocelli separated from the eyes by less than their own diameter. Eyes ovate, bare, twice as long as the width of the cheeks. Mandibles black, tridentate. Antennæ 12-jointed, long and rather slender, black, the base and apex of the scape rufus; scape as long as the three following joints; pedicel small, triangular; first flagellar joint twice as long as the pedicel, and three times as long as thick; second slightly shorter; third shorter, a little over twice as long as thick; fourth and following about equal, but growing more slender, the fifth two and one-half times as long as thick, others three times; last joint one-third longer and pointed. Mesonotum with three furrows, less deeply impressed than in *H. floridana*, its surface shagreened, with fine scattered punctures and with distinct reticulate sculpture posteriorly. Scutellum coarsely rugoso-punctate, with a regular row of closely placed punctures along the posterior margin. Postscutellum bidentate medially. Metanotum very short, rugose. Pleuræ punctate-rugose, the mesopleuræ medially obliquely striate. Abdomen as long as the head and thorax; first segment and basal half of the second very coarsely striate or fluted; third the longest, faintly aciculate; fourth one-half as long as the third; fifth and sixth shorter, subequal. Legs, except coxæ, honey-yellow, the tarsi piceous. Venter faintly punctate. Wings hyaline, the marginal vein short, only three or four times as long as thick; postmarginal long, two-thirds as long as the submarginal;

stigmal long, straight, with a small knob at apex, about two-fifths as long as the postmarginal.

One specimen, sent by my friend Mr. J. R. de la Torre Bueno, collected at Van Cortlandt Park, New York City.

This species can be distinguished from *H. floridana* Ashmead, the only other one known from the United States, by its longer and more slender antennæ. It is the only species known to extend so far north in its range, most members of the genus belonging to the neotropical region.

FAMILY SCHNEUMONIDÆ.

SUBFAMILY TRYPHONINÆ.

TRIBE MESOLEPTINAE.

Oxytorus paludicola, sp. nov.

Male. Length 5—6 mm. Black; antennæ fuscous, most of legs and abdomen ferruginous. Head not quite twice as wide as thick, rather thickly hairy; subshining, the vertex, occiput, and cheeks faintly punctulate; face finely rugoso-punctate, distinctly produced below the base of the antennæ. Clypeus distinctly separated from the face, broad, its anterior margin truncate. Eyes elongate, very sparsely pilose, with not the slightest trace of an emargination between the antennæ. Antennæ stout and tapering, shortly pilose, 26-28 jointed, similar to those of certain Orthocentrine genera. Scape stout, oval; first flagellar joint distinctly longer than the second, which is twice as long as thick; following growing imperceptibly shorter and narrower, those near the tip quadrate. Mesonotum with the parapsidal furrows well marked, its surface punctulate on the sides, with the median lobe more coarsely punctate, especially behind, where it is confluently so. Scutellum with a wide deep fovea at the base divided by a median carina, apically convex and punctulate. Metathorax completely areolated, the lateral angles of the petiolar area produced as distinct teeth. Petiolar area transversely striate, the other areas rugose. Epomial carina of propleura distinct. Abdomen distinctly petiolate, smooth and shining, the petiole curved, more strongly so at the center; spiracles placed distinctly behind the center, where they give off lateral carinæ to the tip; two very strongly elevated median carinæ which

extend only to its posterior third; second and third segments subequal, each slightly broader than long. Legs moderately stout; anterior and middle pairs, except coxæ, fulvous; posterior pair, except coxæ in part, tarsi, tips of tibiæ, and tips of femora above, ferruginous. Clypeus and antennæ rufous, the former somewhat paler below. Palpi pale. Abdomen except the basal two-thirds of the petiole and extreme tip more or less ferruginous. Wings slightly infuscated; stigma elongate, piceous, veins piceous. Areolet very nearly regularly pentagonal; transverse median vein in hind wing broken just below the middle.

Described from two specimens collected by Professor T. D. A. Cockerell in a marsh at Florrissant, Colorado, July 26, 1908.

This species does not agree with the genus as characterized by Davis (Trans. Amer. Ent. Soc., Vol. 24, p. 322 (1897)), and *Mesoleptus facetus* Cress, which he refers to *Oxytorus* is evidently not congeneric with the present species, which however, agrees well with the characters given by Schmiedeknecht (Hym. Mitteleuropas, p. 621.)

TRIBE BASSINI.

Promethes rohweri, sp. nov.

Female. Length 4.25 mm. Black; face, underside of antennæ; marks on thorax and bands on abdomen, light yellow; legs light yellow and fulvous, to a slight extent variegated with black. Head about three times as wide as thick, smooth and polished, with faint indications of punctulation on the vertex and cheeks. Face smooth and highly polished, its central portion slightly elevated. Clypeus sharply separated from the face, rounded above, its lower margin deeply and broadly notched. Cheeks almost half the length of the eyes. Antennæ 22-jointed, distinctly shorter than the body; first flagellar joint as long as the scape; second two-thirds as long and about three times as long as thick; following gradually decreasing, the fifth twice as long as thick. Mesonotum shining, faintly punctulate, without trace of furrows. Scutellum shining, strongly convex. Metathorax incompletely areolated, the basal median, and first lateral areas indicated; second lateral area partly enclosed; petiolar absent. Mesopleuræ smooth and highly polished, pro and metapleuræ punctu-

late. First abdominal segment twice as long as wide at tip, the spiracular protuberances unusually large; lateral carinæ distinct, but no trace of any median ones. Second segment as long as the first and somewhat longer than wide at tip, the gastrocœli unusually large and deep; first and segment except the tip of the latter rugulose; following segments smooth and polished. Legs slender, four anterior ones yellow, their coxæ black basally and their femora with a short black stripe inwardly at the base. Posterior coxæ black, their tips and the trochanters yellow; femora pale ferruginous, with a black stripe inwardly at the base; tibiæ and tarsi pale ferruginous, the tibial spurs weak, only one-third the length of the metatarsus. Wings hyaline, stigma piceous with pale spot at base; veins piceous. Areolet open, indicated as a regular pentagon; transverse median vein in hind wing broken at the middle. Entire face, anterior orbits, mandibles except tips, palpi, underside of antennæ, lower part of cheeks, cuneiform marks on mesonotum, tegulæ, spot in front and below, large spot on mesopleura on anterior margin below, and line on posterior margin above, and bands on second to fourth abdominal segments more or less emarginate posteriorly, pale yellow.

Male. Differs by its more elongate form, 25-jointed antennæ and interrupted band on second abdominal segment. Length 6 mm.

Described from four specimens sent me by Mr. G. A. Rohmer of the University of Colorado, who collected them on flowers of *Ribes vallicola at* Florissant, Colo., June 11, 1907.

Zootrephes similis sp. nov.

Female. Length 5 mm. Black; abdomen, except base and apex, and legs ferruginous. Head three times as wide as thick, shining, the face finely punctate. Front and vertex polished, occiput and cheeks finely punctured; clypeus smooth and shining, its anterior edge subemarginate. Upper tooth of mandibles deeply divided. Eyes bare, separated on the front by a distance equal to their length. Antennæ black, 22-jointed; basal joint of flagellum one-half longer than the second; following growing shorter, those near the middle twice as long as thick. Pro and mesonotum finely punctulate, shining; no trace of parapsidal furrows. Depression at base of scutellum shallow, polished. Metathorax completely areolated, the carinæ very strong. Pleuræ shining, almost smooth. Abdomen subopaque, more shining

toward the tip; first segment one-third longer than broad at apex, its basal half with two very strong carinæ which become evanescent just beyond the middle, lateral carinæ strong and well away from the margin; its surface longitudinally rugose. Second segment as broad as long, third wider and shorter, both scabrous or finely rugulose; fourth punctulate at the base, apical ones smooth and shining. Legs ferruginous, the coxæ, particularly the posterior pair, black basally, their tips and the trochanters pale yellow; posterior tarsi piceous. Wings hyaline, the stigma and veins piceous black, the former pale basally; areolet open, its proximal shorter than its lower side; transverse median vein in hind wing broken at the middle. Clypeus, broad anterior orbits, two paired spots on face, mandibles except tips, spots at base of antennæ above, under side of pedicel, tegulæ, spot below and before; cuneiform spot on mesonotum, short line near anterior margin of mesopleura, spot at base of hind wing, and a large mark on scutellum, pale yellow. Second to fourth segments of abdomen ferruginous, the second and third yellowish at apex and the fourth darker at base; following segments with a rufous margin.

Beulah, New Mexico, Aug. 3, 1902, Prof. T. D. A. Cockerell.

This differs from *Z. saginatus* Prov. to which it is most closely related, by the black antennæ, the absence of any transverse line on the third segment, and the entirely black first abdominal segment. It is slightly larger.

Syrphoctonus lævis sp. nov.

Female. Length 6 mm. Black, legs, except tips of posterior tibiæ and tarsi which are ferruginous, pale yellow; spots on face and mesonotum pale yellow. Head two and one-half times as wide as thick, finely shagreened, with microscopic punctures intermixed. Face rather strongly depressed on the sides, between the eye-margin and the central convex portion. Clypeus strongly raised, its anterior margin rounded and deeply incised medially. Eyes not quite so long as the width of the face; bare. Antennæ 21-jointed; first flagellar joint one-third longer than the second, which is three times as long as thick and about as long as the scape; third and following growing shorter, the fifth about two times as long as thick. Mesonotum subshining, faintly punctulate; scutellum shagreened and punctulate. Metanotum punctulate or scabrous, without any indications of any areas. Pleuræ shin-

ing, very faintly punctulate and shagreened. Abdomen rather stout, the first segment, basal third of the second, and base of third, scabrous, remaining portions shining. First segment about one-half longer than wide, its lateral carinæ well-defined, sharp, no trace of central ones; second segment slightly shorter than its width at tip. Valves of ovipositor black, distinctly projecting. Venter shining black, the sutures of the basal segments whitish. Legs, including coxæ and trochanters, very pale ferruginous or honey-yellow. Tips of posterior tibiæ and posterior tarsi entirely, deep black; longer spur of hind tibia a little less than one-half the length of the metatarsus. Wings hyaline, stigma piceous, scarcely pale at the base; veins piceous; areolet open, its position indicated as a large almost regular pentagon. Transverse median nervure in hind wing broken considerably below the middle. Face with a median broad yellow stripe extending to the antennæ; clypeus and mandibles, except tips, yellow. Mesonotum with lateral cuneiform lines, tegulæ, spot at base of hind wing, continued as a narrow stripe between the meso and metapleuræ, and scutellum, except center, pale yellow.

Described from a female collected by Prof. T. D. A. Cockerell, at Beulah, New Mexico, during July.

This species is related to *pleuralis Cress.* and to *robustus* Davis. It is separable from the former, by its black pluræ and metathorax and fewer yellow markings, and from the latter by its much smoother body sculpture, and the absence of any central ridge on the abdomen.

Enizemum neomexicanum sp. nov.

Female. Length 6 mm. Black; legs, except posterior tibiæ and tarsi, bright ferruginous. Head about three times as wide as thick, subopaque and minutely punctulate. Occiput with a median groove or depression behind the median ocellus. Face shagreened, with fine punctures interspersed; at the upper edge of the clypeus with a pair of foveæ. Clypeus bilobed, with a median emargination. Eyes as long as the width of the face, subemarginate opposite the base of the antennæ. Antennæ 23-jointed, nearly as long as the body, the first flagellar joint very long, following gradually shorter to the tip, those near the middle about three times as long as thick. Mesonotum shining, finely punctulate, without any trace of parapsidal furrows;

scutellum with somewhat larger punctures. Metanotum finely rugose, the basal median area indicated, also the lateral carinæ, and very indistinctly the petiolar area. Pleuræ finely punctate, and metapleuræ more closely so. First abdominal segment a little longer than wide at apex, with two central carinæ which extend to the middle of the second segment, and with lateral carinæ which extend nearly to the apex of the second. First and second segments longitudinally rugose; third scabrous, apical ones nearly smooth. Legs entirely bright ferruginous, except the base of the anterior coxæ, and the posterior tibiæ and tarsi, which are deep black, the former with a white ring at the base. Spurs of posterior tibiæ long, the longer one one-half the length of the metatarsus. Wings nearly hyaline, the veins and stigma dark fuscous, latter pale at base. Areolet very small; transverse median vein in hind wing broken at the middle. Clypeus ferruginous; mandibles, except tips, yellow; small lateral mark on mesonotum, tegulæ, spot before and behind, spot at base of hind wing, and capillary lines behind scutellum and postscutellum white.

Beulah, New Mexico, Cockerell.

Differs from *Enizemum (Bassus) tibiale* Cress, by the black antennæ, scutellum and pleuræ, and partially areolated metanotum.

FAMILY BRACONIDÆ,

SUBFAMILY BLACINÆ.

Blacus gracilis sp. nov.

Female. Length 3 mm. Black; base of antennal flagellum, legs in part and venter yellowish. Head transverse, twice as broad as thick antero-posteriorly. Occiput and cheeks broadly rounded, the former impressed medially; surface punctulate, more or less shining, especially on the occiput. Face protuberant above the insertion of the antenæ. Front flattened and deeply concave centrally to accommodate the scape. Antennæ 28-jointed; scape very thick, rounded, a little longer than the second joint, following decreasing very gradually to the tip. The antennæ are pale brownish yellow on the basal half, except the scape, above which is black like the apical part of the flagellum. Clypeus and mouth parts honey-yellow. Face strongly raised medially, the elevation forming a sharp carina above; at the sides of the clypeus with a deep foveate impression. Thorax slender, delicately sculptured,

the parapsidal furrows sharp and deep, meeting far in front of the scutellum. Pleuræ subshining, finely rugulose; metanotum sculptured like the pleuræ, not areolate, with a single very poorly defined median carina, a transverse carina at the upper edge of the posterior slope, and a reflexed margin at its lower edge. Abdomen slender, shagreened at the base, smooth and shining posteriorly. First segment twice as wide as long, its tip less than twice as wide as its base; spiracles strongly protuberant, placed very near the base. Second segment quadrate, following growing shorter, the apical ones whitish at the sutures. Ovipositor slightly longer than the abdomen, pale, its sheaths black. Legs brownish-yellow; the hind coxæ blackish at the extreme base; hind femora and tibiæ dark at tips and their tarsi dusky. Wings hyaline, veins except the costal very pale. Marginal cell narrow, pointed, reaching only three-fifths the distance from the stigma to the wing tip; first and second sections of the radius almost perpendicular to each other. Submedian cell barely longer than the median; recurrent nervure and transverse cubitus interstitial. Discoidal and subdiscoidal nervures uniting in a curve. Stigma very narrow.

One female bred from insects in heads of clover at Minneapolis, Minn., sent me by Mr. A. G. Ruggles of the Minnesota Agricultural Experiment Station.

Public Museum, Milwaukee,
March 26, 1908.

REVIEW OF THE DRAGON-FLIES OF WISCONSIN.

By Richard A. Muttkowski.

The fauna of Wisconsin, especially that pertaining to the insects, has been but little explored. Except for Milwaukee County, which has been rather thoroughly canvassed by entomologists, there are probably only ten counties out of seventy-one where collections of dragon-flies have been made to any extent. To arouse the interest of entomologists in Wisconsin and to encourage the study of our most interesting fauna, this review has been prepared.

HISTORY OF THE ODONATA. In early times probably no other order had attributed to it pernicious qualities to such an extent as the Odonata. Such beliefs as their supposedly poisonous bite, the malevolent properties of the brown excretion, the fearsome consequences of their sting, were only too common. Thus is remained for Linnæus to glean whatever truth there was from the mass of contradictory superstitions. But one name stood out from the numerous appellations, the name of Water Nymph; at once Linnæus recognized the appropriateness of the name, and from that time our knowledge of the Odonata is dated. Among the first to comprehensively treat the group was Reaumur, who indicated the natural subdivisions of the Odonata, his suggestions being later utilized by Fabricus, who first proposed for the group the name Odonata. Following him, Leach, Say, Burmeister, Hagen, de Selys-Longchamps, and recent workers have increased our knowledge, until at the present time the Dragon-flies are fairly well-known.

The name Odonata signifies tooth and is characteristic in view of the greatly developed labial teeth of the nymph. Of common

names we have a series, such as damsel-flies, dragon-flies, horse-stingers, snake-feeders, spindlers, skimmers, for the whole order, and a few—amber-wing, white-face, dog-tail, marking the distinctive features of a species or genus. Of these names "damsel-flies" and "dragon-flies" are the most common, and considering the two types of Odonata, the dainty name of damsel-flies for the more timid, weaker types, and dragon-flies for the larger, formidable and predatory types are peculiarly appropriate.

CHARACTERS. The Odonata form one of the more primitive orders of insects and their characters may be summed up briefly thus: Wings four, sub-equal, net-veined, provided with a spot near the apex, the stigma, tarsi three-jointed, antennæ short, inconspicuous; metamorphosis incomplete.

LIFE HISTORY. From the time the egg hatches to the moment when the adult dragon-fly casts off its nymphal skin there is no well defined series of molts as among the higher orders of insects. The metamorphosis is incomplete since the larva has its later character indicated by the rudimentary wing-cases, the great eyes, and the big labial lobes. In all stages the insect is restive, never seeking complete quiet and solitude preparatory to emergence. The habits of the nymph are predatory, the methods applied when hunting for prey being three-fold; crawling, burrowing, and clinging. The last method is applied by the Agrionidæ, Aeschninæ and the greater number of Libellulinæ. Crawling is applied by the Macrominæ, Cordulegasterinæ, and the smaller part of the Libellulinæ; the nymphs sit among the rubbish at the bottom of ponds, rivers and slow bodies of water and aided by their protective resemblance to the surroundings, wait in greedy ambush for their unsuspecting prey. The representatives of the third group, comprising the Gomphinæ, burrow in the silt and sand of river-bottoms for their victims.

When the adult dragon-fly has cast off its skin, it usually rests

on some stone or stick near the water-level to unroll and dry the wings before flying. Different species have different habits in effecting this change. Some are indiscriminative in choice of locality and well satisfied to complete the transformation wherever they emerge; others seek the solitude of dark wash-outs in the river-banks; and again others climb into the shore-grass. The habits of the imago are varied; some are retiring, staying near their larval habitat, others seek open fields, while still others fly in the rush and roar of rapids and waterfalls. The females lay the eggs usually by flying near the water-level, and dipping the tip of the abdomen into the water while in flight to deposit an egg. In the case of some genera the males accompany the females. In quiet places the eggs remain clustered, while in more turbulent waters, they are scattered widely by the force of the currents.

Like the nymph, the adult dragon-fly is predatory, and the whole form of the imago is adapted to this form of life. The peculiarly unbalanced appearance of the body, the thorax sloping forward and behind, with the slanted wings on the rear slope, the position of the legs near the forward edge of the thorax, are all splendidly adapted for the seizure and holding of the prey.

RELATION TO LIFE ZONES. In Wisconsin the south-eastern and southwestern parts are comparatively low in altitude, and the character of its life temperate—Upper Austral. The southern part of the state in its middle portions is transitional in character, due to higher elevation, and the central part is occupied by a great basin lower than the south-eastern counties, but transitional in character. From this basin the state is gradually elevated north to the Penokee and Iron ranges, all this area occupied by transition forms. North of this natural water-shed the character of life assumes a boreal aspect, due to higher latitude and increased altitude. Thus the state is separated into three distinct life zones: temperate—Upper Austral, near-boreal (partly tem-

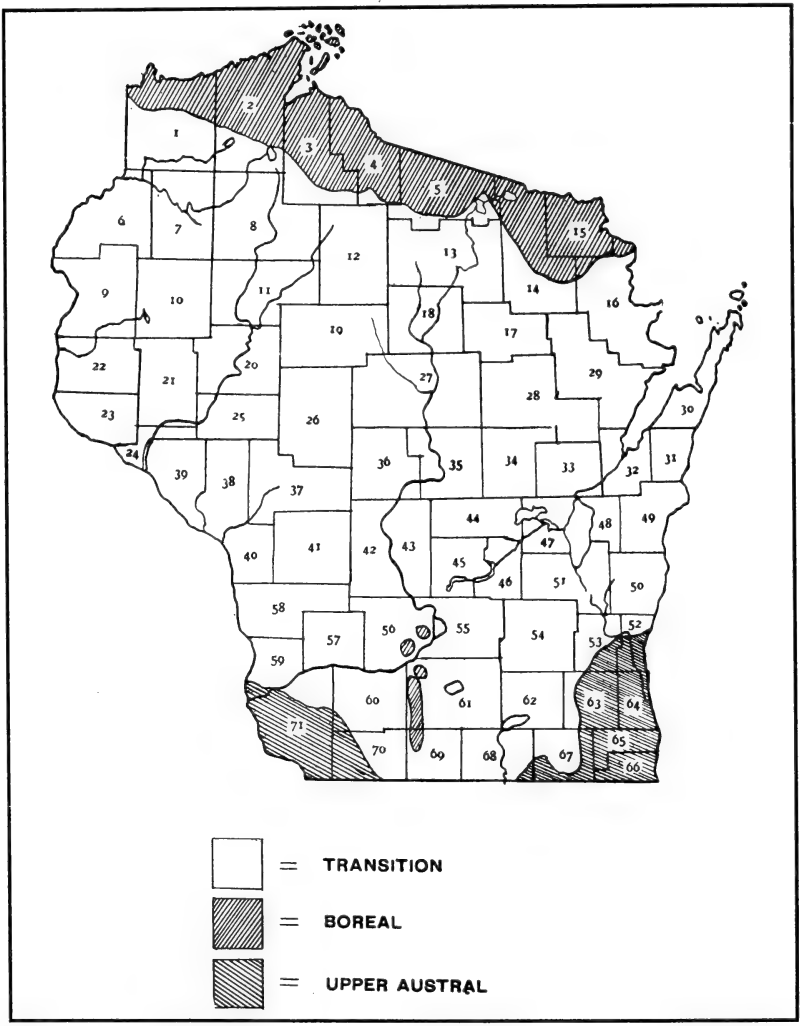
perate, partly boreal)—Transition, and arctic—Boreal. In Wisconsin latitude is of greater moment and altitude of only secondary importance, since the contour of the state is with few exceptions comparatively flat.

Due to the fact that dragon-flies are little influenced by considerations of food since they are omnivorous, their distribution exceeds that of the species of most orders of insects. Wherever there is water the dragon-flies of that respective life area are likely to occur. A very interesting illustration of the similarity of the Odonata throughout a life zone is the striking resemblance of the fauna of the White Mountains of New Hampshire and of Northern Wisconsin. The White Mountains are placed in the midst of a trans-austral region, and because of their altitude the character of their fauna and flora is boreal. Whatever records of insects we have from boreal Wisconsin are identical with the White Mountains records.

SEASONAL DISTRIBUTION. Imagos fly from April to November. But the great months for dragon-flies are June and July. Some species fly during the greater part of the season, while others are seen for but a very short time. The twilight hours of evening are the favorite hours of hunting and also of transformation. Species, however, chiefly of the Libellulinæ and Agrioninæ, fly also in the morning, but at the time their flight is stiff and slow, owing to the chill of the night.

It is doubtful whether the Odonata normally hibernate; but a specimen of *Anax junius* has come under my observation which was still alive in March when it was blown down from beneath the eaves of a building where it had passed the winter. Such cases are however very unusual.

FOOD HABITS AND ECONOMIC VALUE. Throughout all stages of its life the dragon-fly is carnivorous, and will eat anything that it is able to capture and hold. The creature is insatiate and with its predatory instinct it preys all the time, even



MAP ILLUSTRATING THE LIFE ZONES OF WISCONSIN

1 Douglas, 2 Bayfield (with Apostle Islands), 3 Ashland, 4 Iron, 5 Vilas, 6 Burnett, 7 Washburn, 8 Sawyer, 9 Polk, 10 Barron, 11 Gates, 12 Price, 13 Oneida, 14 Forest, 15 Florence, 16 Marinette, 17 Langlade, 18 Lincoln, 19 Taylor, 20 Chippewa, 21 Dunn, 22 St. Croix, 23 Pierce, 24 Pepin, 25 Eau Claire, 26 Clarke, 27 Marathon, 28 Shawano, 29 Oconto, 30 Door (with Islands), 31 Kewaunee, 32 Brown, 33 Outagamie, 34 Waupaca, 35 Portage, 36 Wood, 37 Jackson, 38 Trempealeau, 39 Buffalo, 40 La Crosse, 41 Monroe, 42 Juneau, 43 Adams, 44 Waushara, 45 Marquette, 46 Green Lake, 47 Winnebago, 48 Calumet, 49 Manitowoc, 50 Sheboygan, 51 Fond du Lac, 52, Ozaukee, 53, Washington, 54 Dodge, 55 Columbia, 56 Sauk, 57 Richland, 58 Vernon, 59 Crawford, 60 Iowa, 61 Dane, 62 Jefferson, 63 Waukesha, 64 Milwaukee, 65 Racine, 66 Kenosha, 67 Walworth, 68 Rock, 69 Green, 70 Lafayette, 71 Grant.

attacking its own kind, when nothing else offers. The nymph eats insects, small fish, tadpoles and other aquatic animals. The food of the imago is formed chiefly of insects, such as mosquitoes, flies, and occasionally moths. Undoubtedly the economic value of the adult dragon-fly is great, since myriads of harmful insects are destroyed by them. The nymph, too, partakes of this attribute though its economic value is less certain. In fact, at times nymphs may become a regular plague by over-population, to the detriment of other aquatic animals. Instances are known where large fish-ponds were completely depopulated by voracious odonate nymphs that infested them. For voracity these nymphs easily take the crown among insects.

COLLECTION AND PRESERVATION. In the capture of dragon-flies activity is the most necessary requirement. Their flight is usually so rapid that often they cannot be caught by pursuit, but must be met with according to their own tactics. Waiting till the dragon-fly alights which it usually does near its original resting-place, a rapid swoop with the net from behind will prove efficient. A sweep with the water-net along the bottom of shallow ponds and rivers will land many nymphs. Later in the season the rank growth on the bottoms prohibits the use of a net, when a rake is advisable.

For preservation the rapid drying process is the most adequate. A slit on each side of the thorax and in the venter of the basal abdominal segments, with exposure to the direct rays of the sun will complete drying within little more than an hour, and preserve the original colors. Thus prepared the insect should be placed in a dark cabinet. Alcohol is a commendable medium for the preservation of smaller species, since it retains the original coloration. This is well for exhibition purposes, but for collection series it is impracticable. There the drying process is likewise the best, though fading of colors is unavoidable; but since dragon-flies are usually common where they occur they are readily replaced.

BIBLIOGRAPHY. The following works will supply most of the information necessary for any more extensive study of our fauna.

HAGEN. Synopsis of the Neuroptera of North America. Smithsonian Miscellaneous collections, Washington, 1861.

KIRBY. A Synomymic Catalogue of Neuroptera Odonata or dragon flies. London, 1890, pp. 202.

BANKS. A Synopsis, catalogue, and biblography of the Neuropteroid insects of temperate North America. Trans. Am. Ent. Soc., 1892, pp. 328-373.

CALVERT. Catalogue of the Odonata (Dragon flies) of the vicinity of Philadelphia. Trans. Am. Ent. Soc. 1893, pp. 152-272, 2 pls.

KELLICOTT. The Odonata of Ohio. Ohio Acad. Sci., Special paper No. 2, 1899, pp. 114, 3 pls.

WILLIAMSON. The Dragon-flies of Indiana. Indiana Geolog. Rept. f. 1899 (1900), pp. 229-333, 7 pls.

NEEDHAM. Aquatic Insects of the Adirondacks, Odonata. Bull. New York State Mus., pp. 429-540 (1901). (Suborder Anisoptera.)

NEEDHAM. Idem, Bull. No. 68, pp. 218-279 (1903). (Suborder Zygoptera.)

NEEDHAM. A Genealogic Study of Dragon-fly wing venation, Proc. U. S. Nat. Museum, Vol. 26, pp. 703-764, 24 pls (1903).

MATERIAL STUDIED. The material used for the present paper is chiefly that contained in the Milwaukee Public Museum collections, in great part collected by Messrs. Charles E. Brown, Valentine Fernekes, Frederick Rauterberg, and others, from Milwaukee and Waukesha Counties, principally from 1900 to 1903; collections by expeditions from the Museum in Door County in 1905; in Vilas, Iron and Bayfield Counties in 1907; collections by Mr. Henry L. Ward from Washington County in 1907; and many single specimens from odd localities, chiefly from the counties mentioned. Lists of collections from Dane County were obtained through the kindness of Prof. Philip Calvert, of the University of Pennsylvania and of Prof. William S. Marshall, of the University of Wisconsin. Obligations are due to Mr. Charles T. Brues, un-

der whose direction this paper was prepared, for the many valuable suggestions offered and thankfully accepted. Local lists of Odonata from various parts of the United States and Canada, that appeared chiefly in the Entomological News and the Canadian Entomologist, the Ohio Naturalist and other periodicals, have furnished valuable data for the designation of a bounded life zone for each species.

Milwaukee Public Museum.

March 4, 1908.

ORDER ODONATA.

Even a perfunctory examination of a collection of Odonata will reveal two distinct types of dragon-flies, the one composed of small species with equal wings, folded in repose, and long, cylindrical abdomen, the other of larger species with unequal wings, extended horizontally in repose, the abdomen tapering, the segments of uneven girth. The former type includes timid species that flit gracefully among the weeds and rushes of woods and waters; this is the real damsel-fly. The other comprises bolder species that haunt the surface of the water, the lower flora of the ground as well as higher vegetation. Darting here and there with lightning speed, or rustling in the weeds in search of their food, they better merit the name of "dragon-fly" than the smaller, daintier damsel-fly. On the characteristics just stated is based the natural division into suborders:

1. Wings similar in shape, folded in repose; eyes wide apart..... Suborder **ZYGOPTERA** (Damsel-fly).
2. Wings dissimilar in shape, hind wings wider at the base, extended horizontally in repose, eyes touching or but little separated ..... Suborder **ANISOPTERA** (Dragon-fly).

The families are separated as follows:

1. Wings alike, eyes widely separated; a quadrangle on the basal third of the wings..... 2
   Wings dissimilar, eyes approaching or approximated, a triangle on the basal third of the wings..... 3
2. Quadrangle of wings crossed, more than two antecubitals..... **Calopterygidæ**
   Quadrangle of fore wings free, two antecubitals only.... **Agrionidæ**

3. Triangles of wings with the axis parallel to the wing; antecubitals of the first and second series not corresponding.... ..... **Aeschnidæ**
   Triangles of the fore wings with axis at right angles to the wing, of hind wings coinciding with wing.....**Libellulidæ**
   The sub-families are arranged similarly.
1. Eyes far apart..... 2
   Eyes approaching, or approximated..... 3
2. Wings with numerous antecubitals.....(1) **Calopteryginæ**
   Wings with two antecubitals.....(2) **Agrioninæ**
3. Antecubitals of the first and second series not corresponding.. 4
   Antecubitals of the first and second series mostly corresponding 7
4. Stigma with a brace vein at inner end in space below..... 5
   Stigma without brace vein.....(3) **Cordulegasterinæ**
5. Subtriangle of fore wing of one cell..... 6
   Subtriangle of fore wing of three cells.....(4) **Petalurinæ**
6. Eyes separated by a wedge-shaped occiput.....(5) **Gomphinæ**
   Eyes touching for some distance.....(6) **Aeschninæ**
7. Triangle of hind wing level with arculus, or before it..... 8
   Triangle of hind wing beyond the level of the arculus..... .....(7) **Macromiinæ**
8. Eyes tubercled behind.....(8) **Cordulinæ**
   Eyes not tuberculed.....(9) **Libellulinæ**

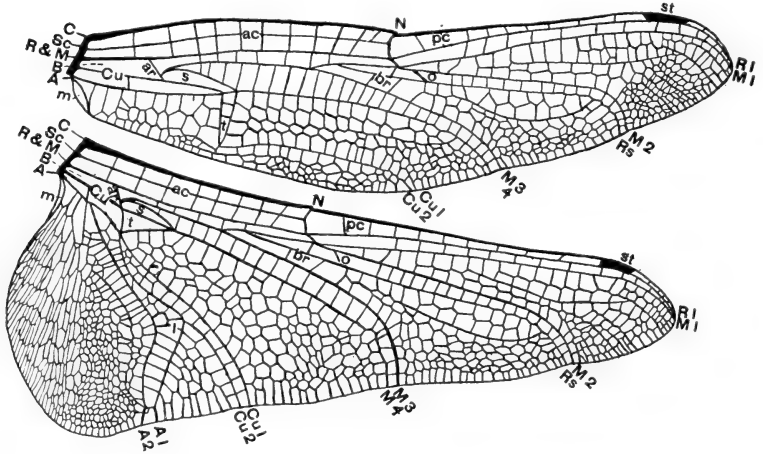
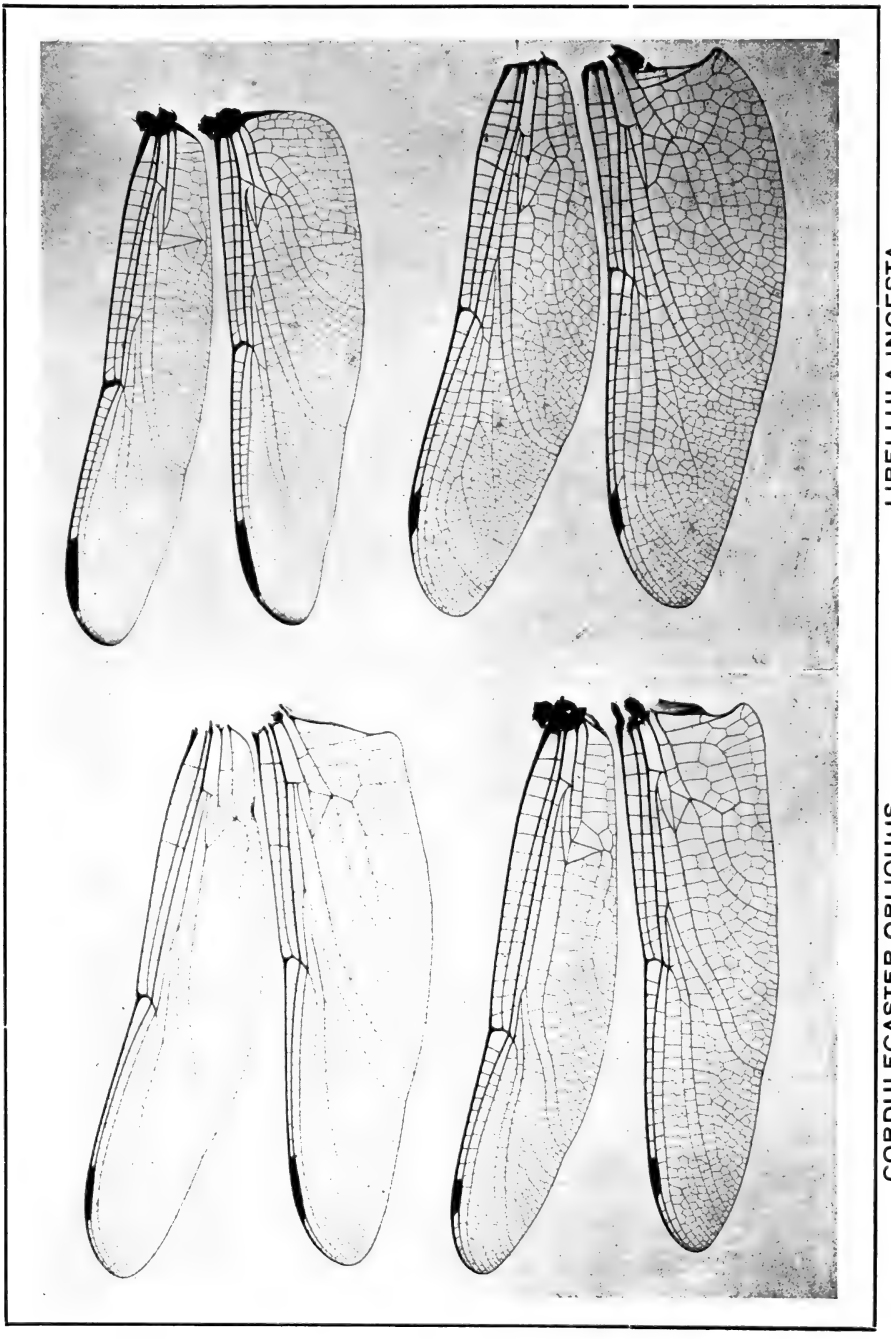


Fig. 1. WINGS OF *TRAMEA CAROLINA* (LIBELLULINÆ), SHOWING NOMENCLATURE.

GOMPHUS FRATERNUS.
TETRAGONEURIA SPINIGERA.

LESTES RECTANGULARIS.
ARGIA PUTRIDA.
HÆTERINA AMERICANA.



LIBELLULA INCESTA.
ÆSCHNA CONSTRICTA.

CORDULEGASTER OBLIQUUS.
MACROMIA ILLINOIENSIS.

For convenience the Comstock-Needham nomenclature and the other more commonly used by older writers are placed in juxtaposition, the recent system to the left.

C	Costa or costal vein.	
Sc	Subcosta or subcostal vein.	
R. & M	Radius & media	Median vein.
B	Basilar space.	
Cu	Cubitus	Submedian vein.
A	Anal vein	Postcosta.
R1	First radial vein	Median vein.
Rs	Radial sector	Subnodal sector.
M1	First media	Principal sector.
M2	Second media	Nodal sector.
M3	Third media	Median sector.
M4	Fourth media	Short sector.
Cu1	First cubital vein	Upper sector of the triangle.
Cu2	Second cubital vein	Lower sector of the triangle.
A1	First anal vein.	
A2	Second anal vein.	
N	Nodus.	
st	stigma or pterostigma.	
ac	antecubitals.	
pc	postcubitals.	
o	oblique vein.	
br	bridge.	
ar	arculus.	
s	supra-triangular space.	
t	triangle.	
l	anal loop (resembling a foot.)	
m	membranule.	

The spaces at the base of the wings below the costa, subcosta, media and the cubitus may be called, respectively,—costal, subcostal, median and cubital space.

SUB-ORDER ZYGOPTERA.

FAMILY CALOPTERYGIDÆ.

SUB-FAMILY CALOPTERYGINAE.

The sub-family includes two genera, Calopteryx and Hæterina. The species readily attract the attention of the observer by their metallic colors, bodies a beautiful blue and green, and wings clouded with brown or black. In general their habits are retiring. They frequent ponds, springs, and also strong, steadily flowing waters. The two genera are distinguished as follows:

Wings broad, basilar space free.....**Calopteryx**
Wings narrower, basilar space cross-veined.....**Hæterina**

CALOPTERYX Leach, Edin. Encyl. 9, p. 137, 1815; Needham, Proc. U. S. Nat. Mus., 26, p. 715, 745, 746, 1903 (Venation).

A genus of wide distribution, numbering about 18 species.

They vary in body colors from blue to green, the wings from yellow to black, the former color more common in the females. The males are without stigma on the wings, which is as often present as not in the females. Our northern species may be separated by the following table:

1. Wings narrow, front and hind margins sub-parallel..... 2
   Wings widening, the hind margin rounded..... 4
2. Wings uniformly colored, or clear..... 3
   Wings with the apical sixth black.....**dimidiata**
3. Wings clear.....**augustipennis**
   Wings yellowish .....**amata**
4. Wings uniformly black or brown.....**maculata**
   Wings with the base clear, the apical third black.....**æquabilis**

Calopteryx maculata Beauvois, Ins. Afr. Am., p. 25, 1805; Hagen, Syn. Neur. N. Am., p. 57, 1861; Needham, Bull. 68 N. Y. State Mus., p. 224, 1903 (Biobliography and desc. of nymph); Needham, Proc. U. S. Nat. Mus., 26, p. 745, 1903 (Venation).

Abdomen male 32—37, female 32—35, hind wing male 26—28, female 28—31.

Male.—Colors blue or green, with black markings. Thoracic carina, humerals, and legs black. Wings from light brown to black; costa blue or green. Abdomen black below except on the apical segments which are whitish. Appendages black, superiors forcipate, thickened apically, outwardly denticulated, an inner median tooth. Inferiors two-thirds as long.

Female.—Similar. Wings usually of light brown, the stigma white, if present. Abdomen brown, the three apical segments with a white-mid-dorsal stripe.

Life Zone: Transition, Upper and Lower Austral.

Wisconsin: Milwaukee Co., June 1899; June 1902, 1903; Waukesha Co., June 1902, 1903; Door Co., Jacksonport, June 25—30, 1906; Vilas Co., June 24—30, 1907; Washington Co., Little Cedar Lake, Aug. 1—15, 1907.

Time and Habitat—Over rippling streams from May to August.

Calopteryx æquabilis Say, Journ. Ac. Sci. Phila., 8, p. 33, 1839; Hagen, Syn. Neur. Am., p. 58, 1861; Needham, Bull. 68 N. Y. State Mus., p. 223, 1903 (Bibligraphy & Decs. of nymph).

Abd. male 38—40, female 37—38; h. w. male 30—32, female 32—33.

Male.—Metallic blue or green, resembling *maculata* in the white and black markings. The abdomen, however, is more slender and somewhat longer. Wings yellowish hyaline, darkened to black on the apical third or fourth.

Female.—Abdomen green, brown toward tip. Wings apically lighter. Pterostigma narrow, white, not reticulated.

Life Zone: Transition and Upper Austral.

Wisconsin: Milwaukee, Co.; Milwaukee River, July, 1899, July 8, 1902; Vilas Co., Divide, June 24-30, 1907; Washington Co., Little Cedar Lake, Aug. 1-15, 1907.

Time and Habitat—June to August at river shores.

Calopteryx dimidiata Burmeister, Handbuch der Ent., 2, p. 829, 1839; Idem. 2, p. 827, 1839 (*C. apicalis* Burm.); Hagen, Syn. Neur.

N. Am., p. 57, 1861; Needham, Bull. 68 N. Y. State Mus., p. 223, 1903 (Bibliography).

Abd. male 36, female 34; h. w. male 28, female 30.

Male.—Metallic green and blue. Thorax with black on the lateral sutures, yellow below. Rear of head with a tubercle each side. Wings yellowish hyaline, the apical fifth or sixth fuscous to black.

Female.—Similar. Apices of wings brown, fainter in the hind wings. Pterostigma varying in size, white, reticulated.

Life Zone: Upper and Lower Austral.

Wisconsin: Dane Co., June, 1890; Milwaukee Co., June 12, 1896; Washington Co., Little Cedar Lake, Aug. 1-15, 1907.

Time and Habitat—Over rippling waters June to August.

HÆTERINA Hagen, Syn. Cal., p. 30, 1853, Syn. Neur. N. Am., p. 58, 1861; Needham, Proc. U. S. Nat. Mus., 26, p. 745, 1903 (Venation).

The species of this genus have similar habits to those of the preceding. Like the species of *Calopteryx* they frequent the sunny ripples of quick-flowing streams. The fauna of Wisconsin contains but one species, though it is likely that a second may be found in the extreme southern parts of the state. Other species are found only in the south. The two northern species are separable by the following differential characters:

1. Males.—Base of all wings red; tibiæ yellow externally..**americana**
   Base of hind wings brown, apices dark; tibiæ black..
   ..... **tricolor**
2. Females.—Wings flavescent at base and along costa; tibiæ yellow externally .....**americana**
   Wings flavescent throughout; tibiæ entirely black..
   ..... **tricolor**

Hæterina americana Fabricius, Ent. Syst. Suppl., p. 287, 1798; Hagen, Syn. Neur. N. Am., p. 60, 1861; Needham, Bull. 68 N. Y. State Mus., p. 226, 1903 (Bibliography & Decs. of nymph).

Abd. male 34—38, female 32—33; h. w. male 28—30, female 30—31.

Male.—Is characterized by the color of the wings, bright red at the basal fourth, copper colored in young specimens, the coppery head and thorax, and dull green abdomen, with basal rings of white on each segment.

Female.—Wings flavescent basally and along costa, sometimes throughout the extent of the wing. Thorax and head green, abdomen green dorsally, with a linear mid-dorsal stripe and rings on the abdominal joints white. Body yellow beneath.

Life Zone: Transition, Upper and Lower Austral.

Wisconsin: Dane Co., July 1900; Milwaukee Co., Sept. 1, 1901, July 8, 1902, June 14, July 10-27, 1903; Waupaca, Aug. 15, 1902.

Time and Habitat—June to September near quick-flowing streams, and small rapids.

FAMILY AGRIONIDÆ.

SUB-FAMILY AGRIONINAE.

This group comprises eight genera for our northern life areas, including therein the smallest damsel-flies known to our fauna.

Tropical genera, however, show really gigantic forms, measuring in expanse of wing from 5—8 inches. The habits of our northern representatives are similar to those of the preceding subfamily. They seek the low sedges of river bottoms and beaches in search of food or unwary mates; for, small as they are, they are said to be cannibalistic to a great extent. Small, but graceful fliers, they are varied in color, some dull green, some a beautiful violet, others priding a mixture of red, green and orange.

1. Median and submedian sectors arising near the nodus..... 2
   Median and submedian sectors arising near the arculus.....**Lestes**
2. Spines of the tibiæ short..... 3
   Spines of the tibiæ twice as long as the spaces between them.. ..... **Argia**
3. No postocular spots..... 4
   Postocular spots present..... 5
4. Colors blue and black.....**Erythromma**
   Colors red and black.....**Amphiagrion**
5. Pterostigma of front and hind wings similar..... 6
   Pterostigma of front and hind wings dissimilar in color; an apical bifid process on dorsum of 10..... 7
6. Nodal sector arising near the fourth postcubital on fore wing, near the third on hind wing; abdomen about 20 mm..**Nehallennia**
   Nodal sector arising near the fifth postcubital on fore wing, near the fourth on hind wing; abdomen about 25 mm..**Enallagma**
7. Pterostigma of fore wings normal, darker than of hind wing.. ..... **Ischnura**
   Pterostigma of fore wings removed from costa, lighter than of hind wing.....**Anomalagrion**

The foregoing table accounts only for the generic characters of the males. The females, especially of the three last genera enumerated, are so vitally different from the males, even structurally, that it is well-nigh impossible to bring them under a uniform arrangement with the males. For that reason I have compiled a separate one for the females. *Lestes* and *Argia* are omitted, since the females of these genera distinguish themselves sufficiently from all others, *Lestes* by the venation, and *Argia* by the armature of the tibiæ.

1. Bristles of the tibiæ short; no apical spine on sternum of 8.... 2
   Bristles of the tibiæ short; an apical spine on sternum of 8.... 3
2. No postocular spots; colors blue and black; length of abdomen about 28 .....**Erythromma**
   Postocular spots present; colors bronzy green; slender species, length of abdomen about 20.....**Nehallennia**
3. Postocular spots present..... 4
   No postocular spots; colors red and black.....**Amphigrion**
4. Nodal sector arising near the fourth postcubital on the fore wing, near the third on the hind wing..... 5
   Nodal sector arising near the fifth postcubital on the fore wing, near the fourth on the hind wing.....**Enallagma**
5. Less than three basal segments of abdomen orange.....**Ischnura**
   Four basal segments orange or yellow.....**Anomalagrion**

LESTES Leach. Edin. Encyl., 9, p. 137, 1815; Needham, Broc. U. S. Nat. Mus., 26, p. 710, 717, 720, 1903 (Venation).

The species of this genus have their habitat usually near standing waters, though they are also met with in woods flying among the low foliage of bushes. Nine species inhabit the northern life areas, seven of which are resident in the state. It is possible that the two others may also be found in Wisconsin, but they have not been recorded thus far. The species group themselves naturally in three series according to the relative length of the superior and inferior appendages of the male.

A. Inferior appendages less than half the length of the superiors ..... **eurinus & congener**

B. Inferiors more than half the length of the superior appendages 1

1. Male inferior appendages straight, the apex dilated, or not so 2
   Male superior appendages sigmoid ..... **unguiculatus**
2. Thorax metallic green, carina and humerals, if yellow, very narrow 3
   Thorax brownish 4
3. Abdomen less than 34 mm. in length ..... **uncatus**
   Abdomen more than 34 mm. in length ..... **vigilax**
4. Abdomen very long and slender, about 40 mm .... **rectangularis**
   Abdomen shorter, brighter than thorax ..... **disjunctus & forcipatus**

C. Inferiors longer than superiors, incurved; rear of head in both sexes yellow ..... **inæqualis**

The females of group B may be separated, as follows:

1. Rear of head blackish 2
   Rear of head with a yellow band ..... **unguiculatus**
2. Thorax green 3
   Thorax brownish 4
3. Basal half of segment 1 of abdomen yellow ..... **uncatus**
   Segment 9 & 10 largely yellow ..... **vigilax**
4. Pterostigma black 5
   Pterostigma brown ..... **disjunctus**
5. Basal rings on 3—7 interrupted on dorsum ..... **forcipatus**
   Basal rings on 1—6 not interrupted on dorsum, narrow ..... **rectangularis**

Lestes eurinus Say, Journ. Acad. Sci. Phila., 8, p. 36, 1839; Hagen, Syn. Neur. N. Am., p. 70, 1861; Needham, Bull. 68, N. Y. State Mus., p. 233, 1903 (Bibliography & Desc. of nymph).

Abd. male and female 38; h. w. male 28, female 30.

Male.—Dark metallic green. Thoracic carina and humerals black, sides of thorax and beneath, sides of abdomen and basal rings on 3—7, yellow.

Female.—Mid-dorsal thoracic carina yellow. The species is readily distinguished from all others by its size and the slightly flavescent wings.

Life Zone: Transition and Upper Austral.

Wisconsin: Milwaukee Co., July 17, 1902; Western Wisconsin.

Time and Habitat—June to August about stagnant pools.

Lestes unguiculatus Hagen, Syn. Neur. N. Am., p. 70, 1861; Needham Bull. 68, N. Y. State Mus., p. 235, 1903 (Bibliography & Desc. of nymph).

Abd. male 30, female 28; h. w. male 20, female 21.

Male.—Color dull black, with a brown tinge, markings yellow. The body below yellow. Abdomen green, sides of 1—7 and narrow basal rings interrupted on the dorsum, yellow. Stigma brown, bounded at each end by a fine white line.

Female.—Humerals wider, and more yellow on sides of thorax and abdomen. Rear of head with a yellow band.

Life Zone: Transition and Upper Austral.

Wisconsin: Milwaukee Co., 1900; July 27, 1903.

Time and Habitat—July to October about lakes and ponds.

Lestes uncatus Kirby, Synonymic Catalogue, p. 160, 1890; Needham, Bull. 68 N. Y. State Mus., p. 234, 1903 (Bibliography & Desc. of nymph).

Abd. male 20, female 27; h. w. male 21, female 25.

Male.—Color metallic green, marked with yellow. Thorax green, with a narrow humeral line yellow. Abdomen with three apical segments black, narrow rings on 3—7 at the joints, and sides largely, yellow.

Female.—A mid-dorsal thoracic carina yellow. Abdominal rings interrupted on dorsum, basal half of segment 1 yellow.

Life Zone: Transition and Upper Austral.

Wisconsin: Dane Co., May 30, 1900; Milwaukee Co., Aug. 12, 1900; July 10-22, 1903.

Time and Habitat—July to September about small lakes and ponds.

Lestes disjunctus Selys, Bull. Ac. Belg. (2), 13, p. 302, 1862; Needham, Bull. 68, N. Y. State Mus., p. 233, 1903 (Bibliography).

Abd. male 29, female 27; h. w. male 20, female 21.

Male.—Color dull black, marked with yellow. Abdomen green or bronze, the three apical segments black. Sides of 1—7 yellow, 3—7 with narrow interrupted basal rings. Thoracic carina and narrow humerals, yellow.

Female.—Abdomen stouter, humerals wider than those of the male.

Life Zone: Transition and Upper Austral.

Wisconsin: Milwaukee Co., Aug. 22, 1899.

Time and Habitat—July to September about small lakes and rivers.

Lestes forcipatus Rambur, Ins. Nevr., p. 246, 1842; Hagen, Syn. Neur. N. Am., p. 70, 1861 (*L. hamata*); Needham, Bull. 68 N. Y. State Mus., 6. 235, 1903 (Bibliography & Desc. of nymph).

Abd. male 33, female 29—31; h. w. male 22, female 24.

The male and female of this species both resemble *disjunctus* very much. The male is distinguished by the wider humerals and apically wider inferior appendages, the female by her coloration and markings agreeing closely to those of the male and the black stigma.

Life Zone: Upper and Lower Austral.

Wisconsin: Milwaukee Co., July 9, 1899.

Time and Habitat—April to August about rivers and small lakes.

Lestes rectangularis Say, Journ. Ac. Sci. Phila., 8, p. 34, 1839; Hagen, Syn. Neur. N. Am., p. 66, 1861; Needham, Bull. 68 N. Y. State Mus., p. 235, 1903 (Bibliography & Decs. of nymph); Needham, Proc. U. S. Nat. Mus., 26, p. 762, 1903 (Venation).

Abd. male 39—41, female 32—34; h. w. male 21—25, female 23.

Male.—Dull brown, nearly black, marked with yellow or green.

Face and thoracic stripes yellow or green. Abdomen greatly attenuated, segments 1—5 light brown basally, black apically, the black forming distinct apical rings; 6—10 black; 1—7 with narrow rings at the joints.

Female.—Abdomen shorter, stout, bronze on dorsum, basal rings on 1—7.

Life Zone: Transition and Upper Austral.

Wisconsin: Milwaukee Co., July 17, 1900, Aug. 4, 1901, July 17-Aug. 24, 1903, Aug. 21, 1904, Aug. 3, 1907.

Time and Habitat—June to September near banks of rivers, in woods and swampy thickets.

Lestes vigilax Hagen, Bull. Ac. Belg. (2), 13, p. 306, 1862; Needham, Bull. 68 N. Y. State Mus., p. 235, 1903 (Bibliography).

Abd. male 40, female 26; h. w. male 25, female 26.

Male.—Color metallic green, marked with yellow. Thoracic stripes yellow or pale green. Abdomen green, apical segments dull, sides of 1—5, and part of 6 yellow. Basal segments with a narrow basal ring of yellow, and a subapical one of black. Stigma of both sexes yellow.

Female.—Like male. Humeral stripes wider, and segments 9—10 of abdomen largely yellow.

Life Zone: Upper and Lower Austral.

Wisconsin: Milwaukee Co., 1900, June 29-July 27, 1903; Nagowicka Lake, July 26, 1902; Waukesha, July 1902. Next to *rectangularis* our commonest species.

Time and Habitat—July to September about the marshy shores of lakes and ponds.

ARGIA Rambur, Ins. Nevr., p. 254, 1842; Calvert, Bull. Mus. Comp. Zool., 39:4, p. 105, 1902 (Bibliography); Needham, Proc. U. S. Nat. Mus., 26, p. 710, 727, 1903 (Venation).

A large genus of small species, numbering in all about 65, the majority of which are found in North and South America. The imagos frequent chiefly the rank vegetation of swamps and marshy places, but a few of them are sun-loving and fly in open places. Two species have thus far been taken in the state, but a third can be expected with some certainty. Species of the Upper Austral areas may be identified according to the following table:

MALES.

1. Stigma above more than a single cell..... 2
   Stigma above not more than a single cell..... 3
2. Apical segments of abdomen black.....**putrida**
   Apical segments 8—9 with the basal half blue.....**translata**
3. Wings clear, or faintly tinged at the apices..... 4
   Wings entirely smoky brown.....**fumipennis**
4. Segments 1—7 ringed with, and 8—10 entirely blue..... 5
   Segments 2—7 black, 9—10 blue.....**tibialis**
5. Abdominal segments 1—7 largely blue..... 6
   Abdominal segments 1—7 largely black..... 7
6. Thorax violet, humeral black, bifid above, not wider than the antehumeral .....**violacea**

Thorax deep blue, humeral black, not bifid above, wider than the antehumeral.....**bipunctulata**

7. Thorax deep blue, stripes heavy and broad.....**sedula**
   Thorax light blue, stripes slight, obscure.....**apicalis**

FEMALES.

1. Wings colored..... 2
   Wings clear..... 3
2. Wings flavescent.....**sedula**
   Wings smoky brown.....**fumipennis**
3. Segment 9 with some black..... 4
   Segment 9 entirely yellow or blue..... 5
4. Basal half of 9 black.....**apicalis**
   Segment 9 entirely black.....**tibialis**
5. Segment 7 dark, 8—10 yellow or blue; abdomen 25 mm....**violacea**
   Segment 8 dark, 9—10 yellow or blue; abdomen 32 mm....**putrida**

Argia putrida Hagen, Syn. Neur. N. Am., p. 96, 1861; Needham, Bull. 68 N. Y. State Mus., p. 240, 1903 (Bibliography & Decs. of nymph); Hagen & Calvert, Bull. Mus. Comp. Zool., 39, p. 122, 1902 (Bibliography & Figure).

Abd. male and female 32; h. w. male and female 25.

Male.—Color gray or blackish. Dorsum of thorax and a lateral stripe black. Abdomen black, 3—7 with light basal rings.

Female.—Brown and black. Abdomen brown above with a lateral black stripe on each segment. Stigma of both sexes covering more than one cell, that is, one cell and part of the next.

Life Zone: Transition, Upper and Lower Austral.

Wisconsin: Milwaukee Co.; June 3-16, 1899, July 6-Aug. 8, 1902, July 1-Aug. 18, 1901, July 7-Aug. 17, 1903.

Time and Habitat—Shores of lakes and rapid streams May to September.

Argia violacea Hagen, Syn. Neur. N. Am., p. 90, 1861; Hagen & Calvert, Bull. Mus. Comp. Zool. 39, p. 116, 1902 (Bibliography & Figure); Needham, Bull. 68 N. Y. State Mus., p. 242, 1903 (Bibliography & Decs. of nymph).

Abd. male and female 25—26; h. w. male 20, female 21.

Male.—Violet. Thoracic stripes black, the humeral bifid above. Abdomen violet, apical rings on 2—6, and 7 entirely, black; 8—10 blue.

Female.—Brown or dull violet. Abdomen brown, lateral spots extending upward, interrupted on dorsum.

Life Zone: Transition and Upper Austral.

Wisconsin: Nagawicka Lake, Aug. 29, 1901; Waupaca, Aug. 15, 1903; Milwaukee Co., July 1-6, 1902, July 1-15, 1903.

Time and Habitat—June to September about large ponds and slow streams.

Argia apicalis Say, Jour. Ac. Sci. Phila., 8, p. 40, 1839; Hagen, Syn. Neur. N. Am., p. 91, 1861; Hagen & Calvert, Bull. Mus. Comp. Zool. 39, p. 106, 1902 (Bibliography & Figure); Needham, Bull 68, N. Y. State Mus., p. 242, 1903 (Bibliography & Desc. of nymph).

Abd. male 29, female 28; h. w. male 21, female 23.

Male.—Color pale blue. Vertex, thoracic carina, humeral, suture

above and below, black. Abdomen dark brown or black, 3—7 with narrow pale basal rings, 8—10 blue.

Female.—Brown or blue. Abdomen with dorsum black, 10 and half of 9 blue.

Life Zone: Transition and Upper Austral.

Time and Habitat—June to September about shaded ponds and shores of streams.

NEHALLENNIA Selys, Revue Odonates d'Eur., p. 172, 1850; Needham, Proc. U. S. Nat. Mus., 26, 710, 727, 1903 (Venation).

Of this genus three species occur in the United States. They fly among the low sedge of river-banks, along sheltered brooks, often in thick masses. But one species, *irene,* has been taken in the State, though a second, *posita,* is known to occur westward as far as Missouri and is likely to be found in Wisconsin, probably in the western portion of the state. The species are separated by their colors and the form of the posterior lobe of the prothorax.

MALES.

1. Colors blue and green..... 2
   Colors bronze, black and yellow.....**posita**
2. Abdomen with 8—10 blue, with lateral green triangles.....**irene**
   Abdomen with 8—10 blue, with a black basal ring on 8....**gracilis**

FEMALES.

1. Posterior lobe of prothorax emarginate..... 2
   Posterior lobe of prothorax rounded, medially produced.....**posita**
2. Posterior lobe of prothorax notched once.....**gracilis**
   Posterior lobe of prothorax notched twice.....**irene**

Nehallennia irene Hagen, Syn. Neur. N. Am., p. 74, 1861; Needham, Bull. 68, N. Y. State Mus., p. 249, 1903 (Bibliography & Desc. of nymph); Needham, Proc. U. S. Nat. Mus., 26, p. 764, 1903 (Venation).

Abd. male and female 21; h. w. male 13, female 14.

Male.—Color green, marked with blue, yellow below. Abdomen with pale basal rings on 1—6, interrupted on dorsum of 3—6, basal half of 9 and apex of 8 blue, with lateral green tri- or rectangles. Inferior appendages longer than superiors.

Female.—Differs from the male by having the 8th segment green. The blue is limited to 10 and an apical spot on 9.

Life Zone: Upper Austral.

Wisconsin: Milwaukee Co., June 16, 1899, July 17, 1902, June 14, 1903.

Time and Habitat—May to July about quiet waters.

AMPHIAGRION Selys, Bull. Ac. Belg. (2) 41, p. 284, 1876.

A single species is found in Wisconsin.

Amphiagrion saucium Burmeister, Handbuch der Ent., 2, p. 819, 1839 *(discolor & saucium);* Hagen, Syn. Neur. N. Am., p. 79 & 85, 1861; Williamson, Ent. News, 11, p. 454, 1900 *(abbreviatum);* Needham, Bull, 68, N. Y. State Mus., p. 247, 1903 (Bibliography & Desc. of nymph).

Abd. male 20, female 21; h. w. male 14, female 15.

Male.—Thorax and apical segments of abdomen black, basal segments red. Abdomen with narrow basal pale rings on 1—7, and inter-

rupted sub-apical black rings till 6, plainest toward the apical segments; 7 mostly black, 8—10 black with narrow red rings and sometimes a mid-dorsal red stripe.

Female.—Thorax brown. Apical segments of abdomen brown or black with the mid-dorsal stripe more distinct.

Life Zone: Transition and Upper Austral.

Wisconsin: Waukesha Co., June 15, 1902; Milwaukee Co., June 22—July 6, 1902, June 14, 1903.

Time and Habitat—May to July in grasses of lakes and riverbanks.

ENALLAGMA Charpentier, Lib. Neur., p. 21, 1840; Needham, Proc. U. S. Nat. Mus., 26, p. 720, 1903 (Venation).

Most of our brightly colored damsel-flies flitting about the lakes, ponds and rivers in the early summer months belong to this genus. They are prettily colored, some blue, green and black, especially on the abdominal segments, others are mainly orange and yellow, varied with black, or blue on some segments of the abdomen. The considerable variation in color and extent of the markings make them quite difficult to determine. In the males, however, this difficulty is obviated by the sufficienlty characteristic abdominal appendages. But the females, because of the great similarity of the species, tax the student's ingenuity to the utmost, and even then, in cases like *carunculatum* and *civile,* there is no absolute certainty of specific values. Certainty in such cases can only be had when the female is caught with the male. The following table, based on colors, refers only to males.

1. Dorsum of segment 2 of abdomen blue with an apical spot black 2
   Dorsum of segment 2 black..... 14
2. Dorsum of segment 3—5 at least one third blue..... 3
   Dorsum of segment 3—5 mostly black..... 11
3. Segment 5 more than half blue..... 4
   Segment 5 with blue and black about equal.....**carunculatum**
4. Apical two thirds of 6 black..... 5
   Apical third of 6 black.....**hageni**
5. Superior appendages simple, cylindrical..... 6
   Superior appendages bifid..... 8
6. Inferiors longer than superiors..... 7
   Inferiors not longer than superiors, strongly upcurved.....**durum**
7. Superiors with an apical recurved lobe.....**annexum**
   Superiors with an apical tubercle.....**calverti**
8. Superiors with an introduced tubercle between the branches... 9
   Superiors without an introduced tubercle between the branches 10
9. Branches of the superior appendages equal.....**ebrium**
   Branches unequal, the upper shorter than the lower...**doubledayi**
10. Tubercle equal in size to the branches.....**civile**
    Tubercle reduced, much smaller than the branches.....**anna**
11. Sides of segment 2 blue..... 12
    Sides of segment 2 with a black spot.....**geminatum**

12. Segment 8 entirely blue..... 13
Segment 8 with a black basal spot.....**traviatum**
13. Segment 7 with a basal ring of black.....**aspersum**
Segment 7 entirely black.....**piscinarium**
14. Thorax green or blue, and black..... 15
Thorax orange or yellow, and black..... 17
15. Dorsum of 8 black..... 16
Dorsum of 8 blue.....**divagans**
16. Face green or blue.....**exsulans**
Face yellow or orange.....**antennatum**
17. Segment 9 yellow.....**signatum**
Segment 9 blue.....**pollutum**

A further table refers exclusively to the females of such species that have been taken in Wisconsin or are likely to be found. As supreme criterion I selected the form of the posterior lobe of the prothorax, which seems to be a quite constant character. Accordingly the species are divided into three groups, each group subdivided according to colors of the thorax and the abdomen. Even so the grouping is only tentative and may not be practical, since little latitude is permissable in a table as regards the darkened colors of aging specimens:

Group 1: *Prothorax with posterior lobe rounded.*

(a) Thorax yellowish green and black; dorsum of abdomen black.
Segments 3—7 with pale basal interrupted rings.....**civile**
(Not distinguishable from civile).....**carunculatum**

(b) Thorax yellowish green and black; dorsum of abdomen green basal rings on 2—7 pale.....**ebrium**

(c) Thorax blue and black; abdomen black.....
Segment 8 with a mid-dorsal black spot.....**calverti**
Segment 8 with a lateral blue spot.....**geminatum**

(d) Thorax green and black; abdomen black dorsally.
Segments 3—7 with pale basal rings.....**hageni**

(e) Thorax orange and green; dorsum of abdomen black, yellow or blue.
Segment 9 with black ascending to mid-dorsal apex..**signatum**
Segment 9 apically, 10 entirely yellow or blue.....**pollutum**

Group 2: *Prothorax with posterior lobe laterally sub-excised.*

(a) Thorax blue and black; dorsum of abdomen black.
Dorsal stripe narrowed on 7—8.....**aspersum**

Group 3: *Prothorax with a tubercle on the posterior lobe.*

(a) Thorax green and orange; dorsum of abdomen green.
Segment 10 and apex of 9 blue.....**exsulans**

(b) Thorax green and orange; dorsum of abdomen black, with yellow or blue.
Segment 10 mostly blue.....**antennatum**

Enallagma carunculatum Morse, Psyche, 7, p. 19, 1895; Needham, Bull. 68, N. Y. State Mus., p. 255, 1903 (Bibliography & Desc. of nymph). Abd. male 25, female 26; h. w. male 19, female 20.

Male.—Color blue, with black markings. Abdomen blue, an apical

spot on 2, apical third of 3, half of 4 and 5, apical two thirds of 6, most of 7 and 10 black. Appendages straight, cylindrical, the superiors with an introduced tubercle.

Female.—Resembles *civile* so closely that it is impossible to distinguish the two from each other.

Life Zone: Boreal to Upper Austral.

Wisconsin: Dane Co., 1900; Delafield, Aug. 1902; Cedar Lake, Aug. 12, 1902; Waupaca, Aug. 15, 1903.

Time and Habitat—June to September about lakes and streams.

Enallagma hageni Walsh, Proc. Ent. Soc. Phila., 2, p. 234, 1863; Needham, Bull. 68 N. Y. State Mus., p. 234, 1863 (Bibliography & Desc. of nymph).

Abd. male 23, female 22; h. w. male 16, female 17.

Male.—Color blue, with black markings. Thorax with a mid-dorsal and humeral stripes black. Abdomen blue, basal spot on 1, apical spot on 2, apical third of 3—5, half of 6, most of 7 and all of 10, black.

Female.—Green. Dorsum of abdomen black, 3—7 with pale basal rings.

Life Zone: Transition and Upper Austral.

Wisconsin: Dane Co., June 1890; Milwaukee Co., July 1900; July 22, 1902; Waupaca, Aug. 15, 1903; Door Co.: Plum Island, July 6, 1905; Portage Co., Aug. 26, 1905; Divide, June 24-30, 1907; Washington Co.: Little Cedar Lake, July 29, 1907.

Time and Habitat—May to August at shores of lakes and streams.

Enallagma calverti Morse, Psyche, 1895; Williamson, Ent. News, 11, p. 455, 1900.

Abd. male 23—26, female 24—26; h. w. male 19—21, female 20.

Male.—Color bright blue. Face blue. Occipital spots large. Carina, and humerals black. Below paler blue. Abdomen blue; a basal spot on 1, a sub-apical spot on 2, a fine basal ring on 3, larger apical rings on 3—5, two thirds of 6, 7 entirely but for a narrow basal area, black. In markings this species agrees with *annexum*, differing by the rounded superior appendages.

Female.—Blue, with a greenish lustre. Thorax with markings like the male dorsum of abdomen black, pale basal rings on 3—7, interrupted on 3, 8 pale with a median spot, the black narrowing on 9 and 10 to an apical point on 10.

Life Zone: Boreal and Transition.

Wisconsin: Milwaukee Co., June 22, 1902.

Time and Habitat—May to July in moist woods and along shaded streams.

Enallagma ebrium Hagen, Syn. Neur. N. Am., p. 89, 1861; Needham, Bull. 68 N. Y. State Mus., p. 255, 1903 (Bibliography).

Abd. male 25, female 24; h. w. male 17, female 18.

Male.—Color blue, markings much like *hageni* and *civile*. From these two it differs mainly in the form of the superior appendages. *Hageni* has a slight notch apically on the superiors, *ebrium* has two equal branches.

Female.—Abdomen entirely dark green, with pale basal rings on 2—7.

Life Zone: Transition and Upper Austral.

Wisconsin: Milwaukee Co., June 22, 1902.

Time and Habitat—June to August at shores of streams.

Enallagma civile Hagen, Syn. Neur. N. Am., p. 88, 1861; Needham. Bull. 68 N. Y. State Mus., p. 256, 1903 (Bibliograph).

Abd. male 25, female 27; h. w. male 18, female 20.

Male—Markings like *ebrium*. The superior appendages have an introduced tubercle.

Female.—Dull blue or yellowish green, dorsum of abdomen black, 3—7 with pale interrupted rings.

Life Zone: Boreal to Lower Austral.

Wisconsin: Near Southern Boundary.

Time and Habitat—May to September about lakes and ponds.

Enallagma aspersum Hagen, Syn. Neur. N. Am., p. 97, 1861; Needham, Bull. 68 N. Y. State Mus., p. 256, 1903 (Bibliography).

Abd. male 25, female 24—25; h. w. male and female 18.

Male.—Color blue, marked with black. Abdomen blue; a basal spot on 1, an apical spot on 2, apical two-thirds of 3, all of 4—6, basal half of 7, and 10 entirely, black. Segments 4—6 have narrow basal interrupted rings.

Female.—A trifle lighter, dorsum of abdomen black, interrupted rings on 3—7.

Life Zone: Upper Austral.

Time and Habitat—June to August about lakes and streams.

Enallagma exsulans Hagen, Syn. Neur. N. Am., p. 97, 1861; Needham, Bull. 68 N. Y. State Mus., p. 255, 1903 (Bibliography & Desc. of nymph).

Abd. male 27, female 26; h. w. male 18, female 19.

Male.—Color blue. Thorax with black mid-dorsal and humerals. Abdomen black, blue ringed; on 1 apically, basal and interrupted on 3—6; 10 and apex of 9 blue.

Female.—Dorsum of abdomen green, interrupted basal rings on 3—6; 10 and apex of 9 blue.

Life Zone: Upper Austral.

Wisconsin: Milwaukee Co., July 6-8, Aug. 8, 1902.

Time and Habitat—May to September at shores of lakes and streams.

Enallagma antennatum Say Journ. Ac. Sci. Phila. 8, p. 39, 1869; Hagen, Syn. Neur. N. Am., p. 73, 1861; Needham, Bull. 68 N. Y. State Mus., p. 257, 1903 (Bibliography & Desc. of nymph).

Abd. male 24, female 23; h. w. male 17, female 18.

Male.—Colors blue, marked with black, yellow and green. Thorax black, with carina and humerals yellow, sides yellow or pale blue to green. Dorsum of abdomen black, an apical ring on 1, narrow basal interrupted rings on 3—6, and 9 entirely, blue.

Female.—Thorax similar to male. Abdomen black, interrupted rings on 3—6, and most of 10 blue.

Life Zone: Upper Austral.

Wisconsin: Milwaukee Co., June 29, 1903; Nagowicka Lake, Aug. 8-20, 1901; Cedar Lake, Aug. 12, 1901.

Time and Habitat—May to September about lakes, ponds and streams.

Enallagma signatum Hagen, Syn. Neur. N. Am., p. 84, 1861; Needham, Bull. 68 N. Y. State Mus., p. 258, 1903 (Bibliography & Desc. of nymph).

Abd. male 28, female 27; h. w. male 17, female 18.

Male.—Color orange, marked with green and black. Thorax with black carina and humerals, also a stripe on the second lateral suture. Dorsum of abdomen black, an apical ring on 1, basal interrupted rings on 3—7, 9 and sides of 10 yellow.

Female.—Thorax orange and green. Abdomen like male. 10 entirely yellow.

Life Zone: Transition and Upper Austral.

Wisconsin: Little Cedar Lake, July 29, 1907.

Time and Habitat—June to September in reeds of lake shores.

Enallagma pollutum Hagen, Syn. Neur. N. Am., p. 83, 1861; Needham, Bull. 68 N. Y. State. Mus., p. 258, 1903 (Bibliography).

Abd. male and female 28; h. w. male 17—18, female 18.

Male.—Color bright yellow to orange. Thorax yellow, mid-dorsal stripe wide, green, humeral narrow, often indicated only by a spot on the suture above and below. Dorsum of abdomen green, darker apically on the segments. Pale interrupted basal rings on 3—7, 9 and 10 blue, the appendages yellow.

Female.—Dorsum of abdomen black, interrupted rings on 3—7, apex of 9 and 10 entirely yellow or blue.

Life Zone: Transition, Upper and Lower Austral.

Wisconsin: Little Cedar Lake, July 29-Aug. 15, 1907.

Time and Habitat—June to September in reeds of lake shores.

ISCHNURA Charpentier, Lib. Eur., p. 20, 1840.

A single species of this genus has been found in Wisconsin. The male imagoes resemble some of the Enallagma with their markings. The female is considered dimorphic, two distinct color types are found, often in the same brood.

Ischnura verticalis Say Journ. Ac. Phila., 8:37, 1839; Hagen, Syn. Neur. N. Am., p. 76 & 82, 1861; Kirby, Synonymic Cat., 1890; Needham, Bull 68 N. Y. State Mus., 261, 1903 (Bibliography & Desc. of nymph).

Abd. male 20, female: black 21, orange 22; h. w. male 13, female: black 14, orange 15.

Male.—Green, postocular spots blue. Mid-dorsal and humeral stripes wide and black. Dorsum of abdomen black, pale rings apically on 1, basally and interrupted on 3—7, 8 and 9 bright blue with black lateral stripes. Pterostigma of front wings black, of hind wings pale brown.

Black female.—Like males. Abdomen black, sides paler, segments darker apically. Pterostigma light brown or yellow on all wings.

Orange female.—Orange and black. Face and occipital spots orange, vertex black. Thorax with mid-dorsal stripe wide, black, the humeral narrow, linear. Abdomen with first three segments orange, segments 4—10 black. Segment 3 has a fine basal and a wider apical ring. The amount of black on the three orange segments is varied. Segment 1 often has a dorsal basal linear spot. Some specimens have also an apical spot on 2. The amount of black on the apex of segment 3 is quite variable, extending over one-fourth to one-half of the segment. A linear stripe is sometimes evident on the dorsum of the first three segments.

Life Zone: Transition, Upper and Lower Austral areas.

Wisconsin: Lake Nagowicka, Aug. 20, 1901; Delafield, Aug. 20, 1902; Waupaca, Aug. 15, 1903; Milwaukee Co., June 22, July 1, 17, Aug. 8, 1902, June 6, 14, 29, July 17, 1903.

Time and Habitat—May to October near water, in woods and open places.

SUB-ORDER ANISOPTERA.

FAMILY AESCHNIDÆ.

SUB-FAMILY CORDULEGASTERINAE.

A single genus is placed with this sub-family. Little is known of the habits of the species; they are said to frequent ravines, gulleys and gorges, and have been taken sparingly by collectors. Six species are found in the east, and a seventh is regional to the north-west.

CORDULEGASTER Leach, Edin. Encycl. 9, p. 136, 1815; Needham, Proc. U. S. Nat. Mus., 26, w. 719, 732, 750, 1903 (Venation).

The following tabella includes both males and females:

1. Abdomen with mid-dorsal spots 2
   Abdomen with lateral spot 3
   Abdomen with yellow half-rings on the segments 5
2. Spots bifid ..... **dorsalis**
   Spots hastate ..... **obliquus**
3. Length of abdomen less than 60 mm 4
   Length of abdomen more than 60 mm. (65) ..... **fasciatus**
4. A single lateral spot on each segment ..... **diastatops**
   A median and an apical lateral spot on the middle segments .. .. **maculatus**
5. Face yellow ..... **sayi**
   Face blackish ..... **erroneus**

Cordulegaster obliquus Say, Journ. Ac. Sci. Phila 8, p. 15, 1839; Hagen, Syn. Neur. N. Am., p. 116, 1861.

Abd. male 52, female 54; h. w. male 44, female 47.

Male and female.—Brown or yellow and black. Face yellow, a black band across the middle. Thorax black, two short yellow divergent stripes on the dorsum, and two longer yellow stripes each side of the thorax margined in black. Abdomen black, a spot on 1, a stripe on 2, hastate spots on 3—8, a small basal spot on 9, yellow. The spots decrease in size toward the apex.

Life Zone: Upper Austral.

Wisconsin: Waukesha, June 9, 1902.

Time and Habitat—May to August near lakes.

Cordulegaster sayi Selys, Mon. d'Odon. 19, p. 331; Hagen, Syn. Neur. N. Am., p. 115, 1861.

Abd. male and female 45; h. w. male and female 41.

Male and female.—Color black, marked with yellow. Face yellow, a black band across the middle. Thorax with two yellow divergent stripes on the dorsum, and two lateral stripes also yellow, but longer and wider. Abdomen black, the segments with yellow half-rings.

Life Zone: Transition and Upper Austral.

Upper Wisconsin.

Time and Habitat: June to August about lakes.

SUB-FAMILY PETALURINAE.

A single genus, *Tachopteryx,* is included in this sub-family. But few species are known, four in all, one of which is found in the Union. Its range is eastern and southern. The imagoes resemble the Gomphidæ, though they are readily distinguished from all other genera by the bifid median lobe of the labium. Also, the females of *Tachopteryx* have an ovipositor.

SUB-FAMILY GOMPHINAE.

The species of this group include many of our large bulky dragon-flies. They are strong fliers, but somewhat eccentric, though their wings are well able to bear them. The markings of the body consist of olive, yellow, and black stripes. They frequent flowing or clear water. The nymphs are predatory in habit; they burrow in the sand or mud in ambush, aided by their protective coloration, or hide among the reeds, till their prey appears. They attack by a sudden extension of the labium, seizing their victim with the claw-like lateral labial hooks. The following key comprises the genera found in temperate zone. *Herpetogomphus* has been eliminated, since its proper life zone is tropical. It has been found regionally in some parts of Arkansas and Texas, but never east of the Mississippi.

1. No basal cross-vein; legs long, hind femora passing base of segment 2 2
   Basal sub-costal cross-vein present; legs short, hind femora hardly reaching base of segment 1 ..... **Progomphus**
2. Hind wing with anal loop 3
   Hind wing without anal loop 4
3. Triangles free; anal loop of three cells; stigma broad with convex sides ..... **Ophiogomphus**
   Triangles crossed; anal loop of four cells; stigma narrow, with parallel sides ..... **Hagenius**
4. Triangle of fore wing less than one fourth shorter than of hind wing 5
   Triangle of fore wing one third shorter than of hind wing. **Lanthus**
5. Hind femora reaching to middle of segment 2, armed with numerous short spines ..... **Gomphus**
   Hind femora reaching to base of 3; armed with numerous short and a row of strong prominent spines ..... **Dromogomphus**

PROGOMPHUS Selys, Ac. Bull. Belg. 21 (2), p. 69, 1854.

A single species of this genus is fuond in temperate America, *P. obscurus.* The life Zone of this species appears to be the Upper Austral, and it can be expected in the Southern portions of Wisconsin.

HAGENIUS Selys, Bull. Ac. Belg. 21 (2), p. 1854.

A genus of two species, one from Tonkin, the other from the U. S. *H. brevistylus* is the type.

Hagenius brevistylus Selys, Bull. Ac. Belg. 21 (2), p. 82, 1854; Hagen, Syn. Neur. N. Am., p. 114, 1861; Kirby, Synonymic Cat., 1890; Needham, Bull. 47, N. Y. State Mus., 440, 1901 (Bibliography).

Abd. male 55, female 60; h. w. male 48, female 52.

Male.—Black and yellow. Face yellow, vertex and occiput black. Thorax black; carina, a curved line on either side, narrow humerals, and two broad stripes on the sides, yellow. Abdomen black, a mid-dorsal yellow band on 1—8, sides of 8 and 9 yellow. Appendages shorter than 10. Wings faintly flavescent, costa yellow, pterostigma long, orange or yellowish.

Female.—Like the male. Occiput with hind border twice tubercled. The last segments of the abdomen are expanded laterally. Appendages as long as 10; vulvar lamina one-fourth as long as 9, black, and apex excavated.

Life Zone: Listed from many regions through four faunal areas, Boreal, Transition, Upper and Lower Austral, and also the Gulf strip of the Lower Austral.

"Upper Wisconsin River" (Hagen).

Time and Habitat—June to September over rapid streams.

OPHIOGOMPHUS Selys, Bull. Ac. Belg. 21 (2), p. 39, 1854.

A small group of brightly colored and closely related species. The main distinguishing characters are those based on the markings of the legs and the form of the male abdominal appendages. A single species is known from the state.

Ophiogomphus rupinsulensis Walsh, Proc. Ac. Phila., p. 388, 1862; Selys, Bull. Ac. Belg. 46 (2), p. 434, 1878; Needham, Bull. 47 N. Y. State Mus., p. 437, 1901 (Bibliography).

Abd. male 39, female 38; h. w. male 31, female 32.

Male.—Green and brown. Head green. Thorax with humerals wider above, ante-humerals and a spot on the sides indistinct brown or obsolete. Abdomen brown marked with yellow on dorsum. Segment 1—9 with basal elongated spots, pointed apically, 1 & 2 and 7—9 laterally, and most of 10 greenish yellow. Segments 7—9 somewhat expanded. Wings with costa yellow or green, pterostigma brown.

Female.—Similar. Markings diffused.

Life Zone: Transition and Upper Austral areas.

Wisconsin: "Upper Wisconsin River" (Hagen).

Time and Habitat—Moist woods and marshes from May to July.

GOMPHUS Leach, Edin. Encycl. 9, p. 137, 1815; Needham, Proc. U. S. Nat. Mus., 26, 715, 718, 721, 732, 1903 (Venation).

One of our most interesting and widely extended groups. The habits of the species are varied, certain ones frequenting the shores of some stable body of water, others preferring the rapid movement of rushing streams, or the sun-shine of fields and open places. They are often very hard to capture, being the most cautious and wary of dragon-flies.

The climatic conditions in Wisconsin ought to be very favorable to the Gomphines. Every variety of aquatic habitat is offered, beginning with swamps and creeks to large lakes and rivers.

But, due probably to collecting restricted to very few localities, not many species have thus far been found. From the Museum records I find that collection in localities which otherwise would certainly have been attended by success was belated in regard to Gomphines.

The compilation of a table for identification purposes presents certain difficulties, especially in finding a constant factor for distinguishing the different species. In the male the distinctive character is the form of the superior abdominal appendage, a quite constant feature. In the females the form of the occiput has been accepted as distinctive. But in several cases considerable variety was proven among representatives of the same species. The following dichotomy comprises mostly Gomphines found in the Boreal, Transition and Upper Austral life Zones:

1. Face entirely yellow 2
   Face transversely banded with black 22
   Face blackish 28
2. Occiput concave, convex, or notched 3
   Occiput with a median, prominent spine ..... **villosipes**
3. Thoracic markings obsolete 4
   Thoracic markings distinct 5
4. Superior abdominal appendages shorter than inferiors ... **lentulus**
   Superior abdominal appendages longer than inferiors .... **pallidus**
5. Tibiæ yellow externally 6
   Tibiæ black externally 14
6. Abdominal segments 7—9 strongly dilated 7
   Abdominal segments 7—9 little dilated 8
7. Superior abdominal appendages of male with an outer truncate tooth; vulvar lamina short, broad, bifid ..... **graslinellus**
   Superior abdominal appendages without an outer tooth, the lateral margins parallel; vulvar lamina long, bifid, contiguous, the apices separating, acute ..... **externus**
8. Length of abdomen about 45 mm 11
   Length more than 45 mm 11
9. Segment 9 of abdomen yellow, length about 45 mm 10
   Segment 9 of abdomen brown, length about 41 mm ..... **cavillaris**
10. Ground color yellow, length about 45 mm ..... **intricatus**
    Ground color brown, length about 45 mm ..... **exilis**
11. Colors olive and fuscous 12
    Colors yellow, or brown, and fuscous 13
    Colors yellow and black; male superior appendages with a long inferior basal tooth; vulvar lamina very short, the apex excised ..... **minutus**
12. Male superior abdominal appendages with a sharp inferior tooth; vulvar lamina of two triangular lobes, one fourth the length of 9 ..... **spicatus**
    Male superior appendages with an inferior lobe; vulvar lamina of two rounded lobes, very short ..... **sordidus**

13. Yellow and dark-brown; superior appendages trigonate, externally truncate; vulvar lamina very short, the apex excised ..... **militaris**
Brown and fuscous; superior appendages trigonate; vulvar lamina oblong, bifid ..... **pilipes**
14. Length between 40 and 50 mm 15
Length over 50 mm 16
Length under 40 mm ..... **abbreviatus**
15. Abdominal segments 7—9 greatly dilated ..... **ventricosus**
Abdominal segments 7—9 little dilated ..... **quadricolor**
16. Dorsum of segment 9 yellow 17
Dorsum of segment 9 black 18
17. Segment 7—9 greatly dilated, vulvar lamina constricted at base ..... **crassus**
Segment 7—9 little dilated, vulvar, lamina short, broad, bifid ..... **olivaceus**
18. Segment 10 and appendages yellow 19
Segment 10 and appendages black 20
19. Segment 8 with a yellow basal spot, 10 with a yellow spot ..... **cornutus**
Segment 8 black, 10 largely yellow ..... **furcifer**
20. Segment 7—9 not expanded 21
Segment 7—9 greatly expanded ..... **fraternus**
21. Superior abdominal appendages acute, outwardly truncated, the inferior tooth directed downward; vulvar lamina bifid ..... **descriptus**
Superior abdominal appendages less acute, the inferior tooth directed far inward; vulvar lamina not so deeply bifid, less diverging ..... **borealis**
22. Yellow stripes on thorax dilated anteriorily 23
Yellow stripes on thorax narrow, isolated ..... **scudderi**
23. Sides of hind femora black 24
Sides of hind femora yellow ..... **amnicola**
24. One cell between veins A1 and A2 at their origin; length more than 45 mm 25
Two cells between veins A1 and A2 at their origin; length less than 45 mm ..... **brevis**
25. Mid-lateral thoracic stripe incomplete; length above 50 mm .. 26
Mid-lateral thoracic stripe complete; length less than 50 mm. ..... **adelphus**
26. Abdominal segments 8—9 with some yellow 27
Abdominal segments 8—9 black ..... **dilatatus**
27. Dorsum of 8 with a basal spot yellow; 9 largely black .... **notatus**
Dorsum of 8 with a basal spot yellow; 9 largely yellow .... **vastus**
28. Ground color brown; segment 9 about equal to 8 ..... **plagiatus**
Ground color black; segment 9 much longer than 8 ..... **spiniceps**

The species of *Gomphus* can be naturally sub-divided into several groups or sub-genera. Chief distintive characters are the presence of one or more cells between veins A1 and A2 of the anal angle, the sexual similarity or dissimilarity of the femora, the form of the posterior genital hamule of the male, and the

form—apically—of the eighth segment of the abdomen. Mr. Needham has accordingly grouped the species into four sub-genera, *Gomphus, Gomphurus, Stylurus* and *Arigomphus.* Grouping known species and such likely to be found within the state under these sub-generic names the result for Wisconsin is ten species of *Gomphus,* four of *Gomphurus,* one of *Stylurus,* and four of *Arigomphus.* For distinguishing the sub-genera the following table is appended:

1. Two cells between veins A1 and A2 at their origin..... 2
   One cell between veins A1 and A2 at their origin..... 3
2. Two cells; if one, elongated, the margin not thickened.
   Hind femora of sexes similar; posterior genital hamule of male generally vertical; segment 8 square at apex.....**Gomphus**
   Hind femora of sexes different, male hairy, female with many stout spines below; posterior genital hamule of male directed posteriorily; segment 8 oblique at apex.....**Arigomphus**
3. One cell, the border thickened.
   Abdominal segments 7—9 dilated; posterior genital hamule of male perpendicular.....**Gomphurus**
   Abdominal segments 7—9 not dilated; posterior genital hamule of male directed anteriorily.....**Stylurus**

Subgenus GOMPHUS.

The characters of this group, as indicated by the table, are prominent enough to constitute a separate group of species. Several species, three in number, form a class by themselves by the presence of only one cell between veins A1 and A2 of the hind wing.

1. Two cells between veins A1 and A2..... 2
   One cell between veins A1 and A2..... 6
2. Segment 9 longer than, or at least equal to 8..... 3
   Segment 9 shorter than 8.....**brevis**
3. Legs with some green or yellow..... 4
   Legs entirely black.....**quadricolor**
4. Tibiæ yellow externally..... 5
   Tibiæ black externally.....**descriptus & borealis**
5. Length about 52 mm.....**sordidus**
   Length about 43 mm.....**exilis**
6. Dorsum of 9 & 10 yellow..... 7
   Dorsum of 9 & 10 black.....**fraternus**
7. Ground color black, markings olive and yellow.....**graslinellus**
   Ground color dark brown, markings yellow.....**externus**

Gomphus brevis Hagen, Bull. Ac. Belg. (2) 46:464, 1878; Needham, Bull, 47 N. Y. State Mus., p. 449, 1901, (Bibliography, Description of nymph and imago).

Abd. male and female 31—33; h. w. 26—27.

Male.—Black and green. Face banded with black on all sutures, upper part of front and occiput olive. Thorax with a short mid-dorsal black line, not reaching the prothorax. The humeral and antehumeral stripes connected above. Legs entirely black. Abdomen black, yellow

as follows: a dorsal stripe on segments 1—2, a hastate spot covering the basal third of 3, a small basal triangular spot on 4—8, often obsolete. 9 and 10 are black. Sides of 1—3 largely yellow, margins of 7—9 slightly marked with yellow. These latter segments are somewhat expanded. Segment 10 is very short, hardly one-third the length of 9. Appendages widely separated, black. Wings hyaline, nervure black, costa black, the pterostigma brown.

Female.—Similar. Front femora green beneath. Segments 4—7 of abdomen with small basal lateral spots yellow.

Life Zone: Transition.

Wisconsin: Vilas Co., Divide, June 24-30, 1907.

Time and Habitat—May to July about lakes, ponds and creeks.

Gomphus quadricolor Walsh, Proc. Ent. Soc. Phila. 2, p. 248, 1863; Kirby, Synonymic Cat., 1890; Needham, Bull. 47 N. Y. State Mus., p. 452, 1903 (Bibliography).

Abd. male 32, female 33; h. w. male 26, female 27—28.

Male.—Olive and black. Dorsum of thorax with middle stripe short, widening in front, the humeral and antehumeral connected at both ends. Legs black. Abdomen black above, a stripe on 1—3, and small basal spots on 4—8 yellow. Sides greenish on 1—2, 8—9 yellow. Wings hyaline, costa yellowish, stigma brown.

Female.—Similar. Vulvar lamina short, emargine, the lobes rounded. A female in the Museum collection has the occiput of *vastus*, namely deeply excised, and its otherwise marked like *ventricosus*, segments 8—10 of the abdomen black on the dorsum. But from the latter it is readily distinguished by the presence of two cells between veins A1 and A2 at their origin, and likewise by the rounded lobes of the vulvar lamina, which are pointed in *ventricosus*. Also the sternum of 8 is produced in two lobes at the apex, so that the two pair of prominences appear superimposed.

Life Zone: Upper Austral.

Wisconsin: Milwaukee Co., Milwaukee River, June 2, 1902.

Time and Habitat—May and June about rapid streams.

Gomphus sordidus Hagen, Bull. Ac. Belg. 21 (2), p. 244, 1854; Syn. Neur. N. Am., p. 106, 1861; Needham, Bull. 47 N. Y. State Mus., p. 454, 1901 (Bibliography & Desc. of nymph).

Abd. male 38, female 37; h. w. male 32, female 33.

Male.—Olive, brown and black. Face and occiput olive, the occiput margined with black. Thorax with a broad mid-dorsal stripe not reaching the prothorax, wider in front. Humeral and antehumeral connected at both ends, enclosing a narrow olive stripe. Legs black, the fore femora olive below, all the tibiæ olive externally. Abdomen black, marked with olive. A mid-dorsal stripe on the basal segments, reduced to dashes on 4—9, 10 and the appendages usually yellow above or brown. Sides of 1—3 and 8—9 greenish yellow, basal spots on 3—7. Stigma of wings brown, costa olive. A specimen in the Museum collection has segment 10 of the abdomen and the appendages black, but the appendages have the same form as the typical *sordidus*.

Female. Similar. With more yellow on the abdomen and thorax. The vulvar lamina short, bifid. The female has great similarity to *spicatus* and *furcifer*. From the latter it is readily separated by its brown instead of black color, and also by the olive exterior surface of

the tibiæ; in *furcifer* they are black. From *spicatus* it is distinguished by the vulvar lamina and the occiput. *Spicatus* has a spine on the occiput, the vulvar lamina are about one-third the length of segment 9, deeply bifid, the apices well separated and acute.

Life Zone: Boreal, Transition, Upper Austral.

Wisconsin: Divide, June 24-30, 1907.

Time and Habitat—May to July about lakes and streams.

Gomphus descriptus Banks and **borealis** Needham greatly resemble *sordidus*. They differ by the black dorsum of segments 9—10 of the abdomen and the black appendages. The female has a narrow yellow stripe on 10, the vulvar lamina are one-third the length of 9, the apical half bifid, acute and divaricate. The male *descriptus* has an acute inferior tooth on the superior abdominal appendage, while *sordidus* has an inferior lobe. In *borealis* the inferior tooth is directed far inward. Both species have black tibiæ.

Gomphus exilis Selys, Bull. Ac. Belg. 21 (2), p. 55, 1854; Hagen, Syn. Neur. N. Am., p. 108, 1861; Needham. Bull. 47 N. Y. State Mus., p. 455, 1901 (Bibliography & Desc. of nymph); Needham & Hart, Bull. Ill. State Lab. 6, p. 82, 1901 (Desc. of nymph).

Abd. male 31—32, female 32—33; h. w. male 25—26, female 26—27.

Male.—Dark brown and greenish yellow. Face and occiput olive. Thorax with a mid-dorsal brown stripe, wider below, connected above with the antehumeral, separated by the green carina. Humeral and antehumeral and lateral sutures brown. Legs brown, the tibiæ olive externally. Wings with costa olive, pterostigma brown. Abdomen darker, dorsum with a yellow stripe on 1—8. Sides yellow, most of 9 yellow.

Female.—Like the male. Abdomen with more yellow on the sides, and the dorsum of 9—10 yellow. Legs paler, the fore and middle femora green below, hind femora luteous except at the apex, all the tibiæ green or yellow above, the feet black. Vulvar lamina one-fourth the length of 9, triangular, bifid, and apices rounded.

Life Zone: Transition and Upper Austral.

Wisconsin: Divide, June 24-30, 1907.

Time and Habitat—May to July about lakes and ponds.

Gomphus fraternus Say, Journ. Ac. Phila. 8, p. 16, 1839; Hagen, Syn. Neur. N. Am., p. 104, 1861; Calvert, Ent. News, 12, p. 71, 1901 (Differential Characters); Needham, Bull. 47 N. Y. State Mus., p. 451, 1901 (Bibliography & Desc. of nymph).

Abd. male 38, female 38—40; h. w. male 32, female 33.

Male.—Olive, yellow, dark brown, and black. Face and occiput olive, vertex black. Thorax olive, marked with dark brown. A mid-dorsal stripe not reaching the anterior edge of the thorax. A wide antehumeral and humeral connected at their lower edge, sometimes also above. Abdomen black, 1—7 with a mid-dorsal stripe, broad on 1—2, lanceolate on 3—7, interrupted at the apex of each segment, olive. The stripe ends with a triangular spot on the base of 8, rarely on 9. Sides yellow or yellowish green on 1—2 and 8—9, basal spots on 3—7. Appendages black. Segment 10 is about one-third the length of 9. Legs black, fore femora with some olive beneath. Costa of wings olive, pterostigma brown.

Female.—Similar. More yellow on the abdomen. The legs black,

the fore femora with olive below, the hind pair with an olive stripe on the outer surface. Vulvar lamina extending over two-fifths of 9, bifid, the apices diverging.

Life Zone: Upper Austral.

Wisconsin: Milwaukee County, June 1898, June 2-12, 1902, June 3-14, 1903.

Time and Habitat—May to July over rapid streams.

Gomphus externus Selys, Mon. Gomph., p. 411, 1857; Calvert, Ent. News, 12, p. 71, 1901 (Characters & Synonomy); Needham & Hart, Bull. Ill. State Lab., 6. p. 74, 1901.

Abd. male 37; h. w. male 31—32.

Male.—Dark brown and yellow. Occiput and face olive. Thorax yellow, a mid-dorsal brown stripe not reaching the anterior edge, divided by the carina. Humeral and antehumeral not connected, dark brown. Some brown on the lateral sutures. Legs black, all tibiæ with a yellow or green stripe. Wings hyaline, the costa yellowish green, pterostigma brown. Abdomen with brown and yellow. A mid-dorsal yellow stripe on 1—3, reduced to basal dashes on 4—10. Sides of 1—3 and 7—9 yellow.

Female.—Similar. The hind margin of the occiput is very variable in shape, some specimens having it almost straight, others with several convexities and a median notch. Vulvar lamina contiguous for the basal two-thirds, tips acute, separating, the lateral margins parallel.

Life Zone: Upper Austral.

Wisconsin: Southeastern part of the State.

Time and Habitat—May to July over rapid streams.

Gomphus graslinellus Walsh, Proc. Ac. Phila., p. 394, 1862 (Description); Kellicott, Dragonfield of Ohio, p. 62, 1899 (Description); Williamson, Dragonflies of Indiana, p. 290, 1900 (Description); Needham & Hart, Bull. Ill. State Lab. 6, p. 69, 1901 (Nymph); Williamson, Ent. News, 14, p. 253, 1903 (Structural Characters & Description).

Abd. male 35, female 36; h. w. male 31, female 32.

Male.—Black, green and yellow. Face and occiput green, vertex black. Thorax green, with dark-brown markings. A mid-dorsal stripe wider at the anterior edge, humeral and antehumeral as wide as the mid-dorsal stripe, always connected at both ends, enclosing a fine green stripe, which is sometimes obsolete. Legs black, fore femora green beneath, all tibiæ with an exterior green stripe. Costa green, pterostigma brown. Abdomen with a dorsal green stripe on all segments, becoming yellow on the apical segments. The stripe is broad on 1—2, twice constricted on 2, lanceolate on 3—7, interrupted at the apex of each segment, a basal triangular spot on 8, a broad streak on 9, fine and linear on 10. Sides with 1—3 and 8—10 yellow, basal spots on 1—7. Most of 10 and the appendages black.

Female.—Similar. More green and yellow on the abdomen. Segments with lateral streaks interrupted at the apex, Segment 10 largely yellow. Vulvar lamina short, broadly bifid.

Life Zone: Upper Austral.

Wisconsin: Milwaukee Co., Chicago road, July 26, 1902.

Time and Habitat—June to July in woods, and along streams.

A female taken with the male in Wisconsin has two cells between veins A1 and A2 at their origin, but otherwise it has the normal number of nine cells between the two veins.

Subgenus ARIGOMPHUS.

Like the preceding this group has two cells at the origin of veins A1 and A2. Distinctive characters are: the apex of abdominal segment 8 cut obliquely; the dissimilarity of the hind femora of the sexes, hairy in the male, spinose in the female; the posterior direction of the posterior male genital hamule. Four species belong to this subgenus.

1. Segment 10 and the abdominal appendages yellow..... 2
   Segment 10 and abdominal appendages black.....**spicatus**
2. Occiput even, segment 9 black..... 3
   Occiput with a prominent median spine, segment 9 yellow....
   .....**villosipes**
3. Male superior appendages seemingly bifurcate, segment 8 black, 10 largely yellow.....**furcifer**
   Male superior appendages bifurcate, segment 8 and 10 with yellow spot .....**cornutus**

Gomphus spicatus Hagen, Bull. Ac. Belg. 21 (2), p. 54, 1854; Syn. Neur. N. Am., p. 107, 1861; Needham, Bull. 47, N. Y. State Mus., p. 450, 1901 (Bibliography & Desc. of nymph); Needham & Hart, Bull. Ill. State Lab. 6, p. 77, 1901 (Description of nymph).

Abd. male 36—38, female 36; h. w. male 28—29, female 30.

Male.—Olive, brown and black. Face and occiput olive. Vertex black, hind margin paler. Thorax olive, marked with fuscous. A mid-dorsal stripe widened anteriorily. A humeral and antehumeral usually connected above. Lateral sutures marked. Legs black, fore femora green beneath, all tibiæ with an exterior stripe of yellowish green. Costa yellowish green, pterostigma light brown. Abdomen with a dorsal band yellow or greenish; broad on 1—2, twice constricted on 2, lanceolate, pointed apically, the spots not reaching the apex of segments 3—7, a basal triangular spot on 8; 9 and 10 black. Yellow or greenish on sides of 1—2, basal on 3, sides of 8—9. Basal spots sometimes present on 3—7. Appendages normally brown, becoming black with age.

Female.—Similar. The Female differs by having the fore femora entirely olive, and the hind femora olive with the apex darkened. Vulvar lamina one fourth the length of nine, bifid, separating at the top.

Life Zone: Transition and Upper Austral.

Wisconsin: Dane Co., May, 1900; Vilas Co., Divide, June 24-30, 1907; Door Co., Plum Island, July 6, 1905.

Time and Habitat—May to July about the shores of larger lakes and rapid streams.

A male *spicatus* from Door Co. has the inferior tooth of the superior appendage directed inward a trifle, so as to resemble *borealis* in a distant way. But from the latter it is easily separated by the vittate exterior surface of the tibiæ.

Gomphus villosipes Selys is readily distinguished from all other Gomphines by the median spine on the hind margin of the occiput. The ground color is olive with dark brown markings. Thorax with mid-dorsal stripes short, narrow; humeral wide, antehumeral short. Legs black, fore femora green beneath, all the tibiæ with a green stripe on the exterior surface. Costa of wings yellow, pterostigma light brown. Abdomen black, a dorsal stripe on 1—7, 8—9 brownish with green spots indistinct or obsolete, 10 and the appendages yellow. The

female has more yellow on the sides of the abdomen. Vulvar lamina short, bifid, the apices contiguous. The number of points on the occipital spine varies, sometimes as many as four points are present, other specimens have less, or the spine is simple. The range of this species covers two life zones, Transition and Upper Austral.

Gomphus furcifer Hagen. This species differs from the preceding mainly by the absence of the spine on the occiput. A minor difference is that the humeral and antehumeral stripes are often connected above. The appendages of the male are sufficiently distinct to separate it from villosipes. The vulvar lamina of the female are short, triangular, the apices separated (not contiguous) the lobes rounded. The life zone is similar to that of the preceding species.

Gomphus cornutus Tough, Occas. Mem. Chicago Ent. Soc. 1, p. 17, 1900 (Description & Figure).

Abd. male 40—42, h. w. male 32—33. (Female unknown).

Male.—Yellowish green, marked with black and brown. Face and occiput olive, the occiput margined with black, ciliated. Thorax olive. A mid-dorsal brown band on each side of the carina narrow, becoming obsolete at the anterior edge of the thorax. Humeral and antehumeral present. Legs black, fore femora olive beneath. Wings with costa olive, pterostigma light brown. Abdomen with a dorsal band of greenish yellow, the band reduced to lanceolate spots on the posterior segments, small and basal on 8. Dorsum of 9 black, 10 with a small spot, the appendages brown. The superiors are distinctly bifid, the external branch shorter, obtuse; the internal branch produced far inward, moving away from the exterior branch at an angle of more than 100°, slender, the apex acute.

Life Zone: Upper Austral and Transition. The designation of a limited life area for this species can be only tentative, since up to present year the species has been found in but two states, originally in Illinois.

Wisconsin: Dane Co., June 22, 1900 (Wm. S. Marshall).

Time and Habitat—June, about the shores of lakes.

Subgenus GOMPHURUS. The two following groups form a subdivision distinct from the preceding species. Both groups have in common the chief generic character, the presence of a single cell at the origin of veins A2 and A2, this cell with a thickened border, lending it such prominence as to form a distinct anal loop. Besides the anal loop the two groups resemble each other in the sexual similarity of the femora, and the square apex of the eighth abdominal segment. Points of difference for Gomphurus are: Abdominal segments 7—9 greatly dilated, the posterior genital hamule of the male perpendicular. Of the four species of this group none has as yet been found within the state, but from the fact that three have been taken in Iowa and Illinois and the fourth in the Upper Peninsula of Michigan we can conclude that they likewise inhabit the waters of Wisconsin.

1. Face banded with black..... 2
   Face entirely yellow.....**ventricosus**
2. Sides of hind femora black..... 3
.. Sides of hind femora yellow.....**amnicola**
3. Segments 3—10 of abdomen with basal rings and lateral spots; basal spots on dorsum of segments 8 & 9.....**scudderi**
   Segments 3—6 of abdomen with sides black, markings dorsal, no basal rings dorsum of 8 & 9 black.....**vastus**

Gomphus ventricosus Walsh. This species is very similar to *vastus* in color and markings. The chief specific difference is the entirely yellow or olive face. A minor distinction is that the black humeral and antehumeral are connected for some distance. The vulvar lamina of the female are bifid, the apices acute, more diverging than vastus. The life zone is the Upper Austral.

Gomphus amnicola Walsh. Colors yellow and black. Face with narrow black lines on the sutures, thorax black, marked with yellow: mesothoracic half-collar, two short oblique bars on the dorsum, a narrow, interrupted antehumeral, and nearly all of the sides, yellow. A broken line is found on the first lateral suture. Legs black, anterior femora beneath and hind femora with the exterior surface greenish yellow. Abdomen with a dorsal line on 1—2 yellow. A spot on 3 and 8, sides of 1—2 and 8—10 yellow. The vulvar lamina are contiguous at the apex. The species resembles *notatus*, from which it differs by its brighter color, the less complete thoracic markings, and the less divaricate male appendages. The vulvar lamina of *notatus* are short, the lobes separating, the apices rounded, conical. Life Zone: Upper Austral.

Gomphus scudderi Selys. Black, brown and greenish yellow. Face banded with black, thorax fuscous, marked with greenish yellow. Mid-thoracical and antehumeral stripes narrow. Abdomen black, segments 7—9 greatly dilated. Yellow basal rings on 3—10, the rings reduced on the posterior segments. Dorsum of 1 and 2 with a stripe of greenish yellow, 2 with a lateral spot. Faint yellow spots on sides of 4—6, prominent basal spots on 7—9. Dorsum of 8 and 9 with a small basal yellow spot. Segment 10, except for the linear basal ring, and the appendages black. Life Zone: Boreal.

Gomphus vastus Walsh. Face heavily banded with black. Thorax black, the markings greenish yellow. Dorsal stripes oblique, connected with the antehumeral above and the mesothoracic half-collar below, yellowish green. Abdomen black; segment 1—2 pale green; dorsum of 3—7 with an interrupted band of greenish yellow, ending in a triangular on the base of 7. Sides of 8 with a basal spot, and 9 largely bright yellow. Superior appendages black. Legs black, the anterior femora green beneath. The vulvar lamina of the female are more than half the length of 9, bifid at the apical third, the apices acute, the tips approaching each other.

Subgenus STYLURUS. In a disquisition on this subgenus Mr. Williamson has included five species in this group. Of these, however, Dr. Needham has diverted two, *amnicola* and *scudderi*, to the group *Gomphurus*, leaving *plagiatus*, *spiniceps*, and *notatus* to represent the group. *Stylurus* differs from *Gomphurus* mainly by the long, cylindrical (not dilated) abdomen, and the anterior direction of the posterior male genital hamule. The three species differ, as follows:

1. Abdomen black, marked with yellow or green..... 2
   Abdomen yellowish brown, marked with yellow or green; segment 9 much shorter than 7.....**plagiatus**
2. Face with distinct black bands; segment 9 shorter than 7...**notatus**
   Face suffused with black, no distinct markings; segment 7 and 9 about equal in length.....**spiniceps**

Either of these three species may be found within the state in the future, though as yet no specimen has been taken. But *G. plagiatus* can be expected with some assurace, since it is very common in Illinois.

Gomphus plagiatus Selys. Thorax brown, marked with yellow. Dorsal stripes divergent, two lateral stripes on each side of the thorax. Abdomen brown, segments 1—6 with an interrupted stripe of yellow or green. Life Zone: Upper Austral. Recorded also from the Gulf strip of the Lower Austral.

Because of its great similarity to the two species of this group the imagoes, especially the females, are easily confounded with each other. A short description of the sexual organs may serve to facilitate identification.

Male. Superior appendages widely divaricate, the lobes broad, subparallel, the apex with several minute inferior teeth, obliquely truncate to an external anteapical angle.....**plagiatus**
Female. Occiput straight, or slightly convex; vulvar lamina short, the apex emarginate, the tips acute.....**plagiatus**
Male. Superior appendages without well-marked anteapical angle .....**notatus**
Female. Occiput slightly concave; vulvar lamina exceedingly short, bifid, the branches divaricate, rounded.....**notatus**
Male. Superior appendages divaricate, the lateral external margins subparallel, the apex up-turned, with inferior minute teeth .....**spiniceps**
Female. Occiput with a slight median notch; vulvar lamina short rounded .....**spiniceps**

DROMOGOMPHUS Selys, Bull. Ac. Belg. 21 (2), p. 58, 1854.

A genus intimately related to *Gomphus*, from which it differs mainly by the anal loop of two cells, and likewise by the fact that vein A1 is strongly angulated near its origin and forming one side of the loop, thus apparently arising from the outer angle of the anal loop. A prominent distinction are the extremely long hind femora, with armature of five to eight long strong spines. The species do not love the rushing streams and rapids of their nearest relatives, the Gomphines, but frequent the more quiet waters of creeks and ponds.

Hind femora entirely black.....**spinosus**
Hind femora yellow, the apex darkened.....**spoliatus**

Dromogomphus spinosus Selys, Bull. Ac. Belg. 21 (2), p. 59, 1854; Hagen, Syn. Neur. N. Am., p. 102, 1861; Needham, Bull. 47, N. Y. State Mus., p. 461, 1901 (Bibliography & Desc. of nymph).

Abd. male 41, female 43; h. w. male 34, female 36.

Male.—Black or brown, marked with olive. Face and occiput yellowish, vertex black. Thorax above olive, humerals brown and wide, equal to the width of the dorsal green area. On the dorsum the brown gives off a stripe below, which curves upward parallel to mid-dorsal carina, disappearing above. The brown humeral is divided by a sinuous green antehumeral. Legs black, fore femora green beneath. Wings hyaline, costa and nervure black, pterostigma dark brown. Abdomen black, yellowish beneath. Dorsum with a green stripe, twice

constricted on each segment, near the base and the apex, interrupted apically on the segment, ending on segment 8 and 9 as basal triangular spots. Sides of the segments largely yellowish green. Appendages black.

Female.—Similar. An acute black spine on the vertex behind each lateral ocellus. Occiput with a median notch, from which arises an acute spine. Dorsum of segment 10 green.

Life Zone: This is widely extended. The species has been taken in the Transition, Upper and Lower Austral, and also in the Gulf strip of the Lower Austral areas.

Wisconsin: Door Co., Horseshoe Bay, July 13, 1905.

Time and Habitat—June to July about shores of lakes and shaded rivers.

Dromogomphus spoliatus Hagen, Mon. Gomph., p. 409, 1857; Syn. Neur. N. Am., p. 103, 1861; Kellicott, Dragon-flies of Ohio, p. 72, 1899; Williamson, Dragon-flies of Indiana, p. 297, 1900.

Abd. male 45—46, female 47; h. w. male 37, female 38.

Male.—Yellow, or pale green, and brown. Face and occiput green, vertex dark brown. Thorax marked like spinosus. Legs yellowish, fore femora with a green stripe beneath. Wings hyaline, costa and nervure yellowish, pterostigma very pale yellow, nearly white. Abdomen dark brown, a stripe on the dorsum green, ending as a lanceolate basal spots on 8. Dorsum of 10 green. Sides of 1—2 yellowish, basal spots on 3—9. Appendages dark brown.

Female.—Similar. Abdomen with lighter brown and greenish on sides and dorsum. Occiput with an obtuse median prominence.

Life Zone: Transition, Upper Austral. This species seems less abundant than the preceding, since at present it is known from but three states, Texas, Ohio and Wisconsin.

Time and Habitat—June to July over fields and banks of lakes and streams.

Wisconsin: Door Co., Washington Island, July 7, 1907; Vilas Co., Divide, June 24-29, 1907.

There is some doubt as to the accuracy of the identification for a female from Washington Island. This specimen has the occiput with a median notch, from which arises a stout median spine. In this it resembles *spinosus*. Likewise it has a long acute spine behind each lateral ocellus on the vertex, but the spine is yellow instead of black. Also, the femora are largely yellow.

SUB-FAMILY AESCHNINAE.

The sub-family contains some of our largest and most voracious dragon-flies. In truth, of all the groups of Odonata they best merit the name of "dragon-flies", since in their nymphal stage there is hardly any animal they are able to capture upon which they do not prey. They are inclined to be cannibalistic, feeding upon their kind with great relish. The imagoes fly early and late in the season; that is, they are among the first to appear in the spring, and last to vanish in autumn. They frequent open places, mostly where some trees or bushes offer a ready hiding-place for

ambush. The species are widely distributed in all parts of the world. Genera found in the United States separate as follows:

1. Subnodal sector simple 2
   Subnodal sector furcate near the apical third 4
2. Triangle with several cross-veins, supra-triangular space veined. 3
   Triangle with one cross-vein, supra-triangular space free ..... **Gomphæschna**
3. Wings broad, basal space with cross-veins ..... **Boyeria**
   Wings narrow, basal space free ..... **Basiæschna**
4. Both sectors of the arculus arising not above its middle 5
   Both sectors of the arculus arising above its middle ..... **Anax**
5. One or two rows of cells between the subnodal and supplementary sectors 6
   Three or more rows of cells between the subnodal and supplementary sectors ..... **Æschna**
6. One row of cells between the subnodal and supplementary sectors ..... **Nasiæschna**
   Two rows of cells between the subnodal and supplementary sectors ..... **Epiæschna**

GOMPHÆSCHNA Selys, Trans. Ent. Soc. London, p. 413, 1871; Needham, Proc. U. S. Nat. Mus. 26, p. 718, 735, 737, 756, 762 (Venation).

This genus is represented by a single species found within the United States. Little is known of the habits, since it has rarely been captured. The present genus with the two following forms a separate group, the chief distinction of which is the simple subnodal sector, as shown by the table. As distinctive from its allies it might be well to mention several other features besides those furnished in the table. A prominent feature is the presence of but a single cross-vein under the stigma; also, the cubitus or the median space, as it is sometimes called, contains only two cross-veins, while the related genera boast of three or more. As a further distinction the wings are furnished but sparingly with cells, and these large, not fine and resembling the closely knitted net-like meshes of the other Aeschninæ. The single species, *G. furcillata* has been taken in the Upper Austral life Zone, but only in the more eastern states. The color of the species is brown, with the usual markings of the Aschninæ.

BOYERIA MacLachlan, Ann. Mag. Nat. Hist. 17 (6), p. 424, 1896; Needham, Proc. U. S. Nat. Mus. 26, p. 735-737, 1903 (Venation).

Two species of this genus are known from the states. In common with its nearest ally, *Basiæschna,* and distinctive from the preceding genus, *Boyeria* has several cross-veins under the pterostigma and three or more in the cubitus or median space. Both species of *Boyeria* occur in several life zones and are likely at any time to be discovered in the state.

Thorax with dorsal stripes narrow, each divided for some length; face suffused with brown.....**vinosa**
Thorax with dorsal stripes wider, continuous; face clear green...
grafiana

Boyeria vinosa Say, Journ. Ac. Phila. 8, p. 13, 1839; Hagen, Syn. Neur. N. Am., p. 130, 1861; Needham, Bull. 47 N. Y. State Mus., p. 465, 1901 (Bibliography & Desc. of nymph).

Abd. male and female 50; h. w. male 42, female 44.

Male.—Dark brown, marked with green and yellow. Face greenish, suffused with brown. Thorax brown, dorsum each side with a green stripe, each divided for part of their length; laterally the thorax with two bright yellow spots. Wings hyaline, brown at base, the apices sometimes suffused with brown. Abdomen constricted at segment 3, each segment with transverse carina. Dorsum of segment 2 with a basal spot and an apical one, 3—5 with a small apical spot, 3—8 with an obscure at the transverse carina, 9 at the apical half, and 9 and 10 entirely, yellow. All the spots on segments 2—8 are divided to twin spots by the longitudinal mid-dorsal carina. Sides of 4—8 with a small yellow spot. Superior appendages dark brown, inferiors yellow.

Female.—Similar; the dorsal stripes on the thorax are obscured. The hind wings differ from those of the male by the rounded anal angle.

Life Zone: Boreal, Transition and Upper Austral.

Time and Habitat: June to September, along shaded streams.

Boyeria grafiana Williamson, Ent. News, 18, p. 1, 1907 (Description).

Abd. male 48—51, female 46—47; h. w. male 40—43, female 43.

The markings of this species, which was long mistaken for vinosa, are similar to those of the related species. But while the ground color of the latter species is brown with yellow and green markings, grafiana is black and gray with chiefly blue markings, the color contrasts are sharper, the markings more clearly defined. The wings have a smaller number of cells than vinosa, the pterostigma is about 5 mm. shorter.

Life Zone: Thus far collected in the Boreal and Upper Austral.

Time and Habitat—June to August along streams.

BASIÆSCHNA Selys, Bull. Ac. Belg. 5 (3), p. 735, 1839; Needham, Proc. U. S. Nat. Mus. 26, p. 710 (Venation).

Basiæschna janata Say, Journ. Ac. Phila. 8, p. 13, 1839; Hagen, Syn. Neur. N. Am., p. 125, 1861; Needham, Bull. 47 N. Y. State Mus., p. 466, 1901 (Bibliography & Desc. of nymph); Needham, Proc. U. S. Nat. Mus. 26, p. 762, 1903 (Venation).

Abd. male 40—43, female 43; h. w. male 37—38, female 39.

Male.—Brown, marked with green and yellow. Face greenish, reddish in faded specimens, frons with a black T spot above. Thorax with a dorsal stripe green on each side of the carina, the stripes diverging at the anterior edge. Sides each with two yellow or white stripes margined with black. Legs brown. Wings hyaline, spotted at the base with dark brown, the nervure dark brown, costa and pterostigma yellow; the postnodal cells, especially those nearer to the stigma, are tinged with yellow. Abdomen marked with green rings and spots, the

segments becoming reddish brown with age. Appendages dark brown, the superiors as long as segment 9 and 10, the inferiors half as long.

Female.—Differs from the male by the straight appendages and the rounded anal angle of the hind wings. Both sexes have the membranule of all the wings white.

Life Zone: Transition and Upper Austral.

Wisconsin: Milwaukee Co., Milwaukee River, Spring 1899.

Time and Habitat—April to June along streams and ponds.

NASIÆSCHNA Selys. Foerster, Odonaton aus Neu-Guinea, 1900; Needham, Proc. U. S. Nat. Mus. 26, p. 718, 736, 755, 762, 1903 (Venation).

The present genus heads the second group of *Aeschninæ,* distinguished by the furcate subnodal sector. In common with two other genera, *Epiæschna* and *Aeschna,* it separates from the fourth genus, *Anax,* by the position of the sectors of the arculus at their origin, as indicated by the table. Distinguishing it from its allies, it is furnished with but a single row of cells between the subnodal and supplementary sectors. As a further distinction it might be mentioned that the principal and nodal sectors are sub-parallel opposite the stigma. The single species, *penthacantha,* was formerly placed in *Aeschna,* but in a paper for the year 1901 Dr. Needham gave it its proper position under *Nasiæschna.* The imago resemble *Aeschna constricta,* from which it is readily distinguished by the absence of a black spot on the frons above, and the venation. Although the species has been taken in Illinois, it is not likely to be found in Wisconsin. It appears to be regional in the Austral Life Zone.

EPIÆSCHNA Slys, Proc. Bost. Nat. Hist. Soc. 18. p. 36, 1875; Needham, Proc. U. S. Nat. Mus. 26, p. 718, 736, 755, 762, 1903 (Venation).

Besides the difference indicated in the table, *Epiæschna* is distinguished from *Nasiæschna* by the fact that the nodal sector approaches the principal sector opposite the stigma. One species is recorded from the United States.

Epiæschna heros Fabricius, Ent. Syst. Suppl., p. 185. 1798; Hagen, Syn. Neur. N. Am., p. 128, 1861; Needham, Bull. 47 N. Y. State Mus., p. 469, 1901 (Bibliography & Desc. of nymph).

Abd. male 62—66; female 67; h. w. male 54—56; female 59.

Male.—Brown, with green markings. Face brown and green, eyes blue. Thorax with two dorsal stripes of green, widened above to an inward angle. Sides each with two broad stripes of green. Legs black, the femora brown, darkened apically. Wings hyaline, the median area below the nodus tinged with yellow, nervure black, costa and stigma light brown. Abdomen brown, each segment crossed by a transverse carina at the basal third, marked with green transverse stripes or spots at the base, the apex and before the transverse carina. All stripes divided by the dorsal longitudinal carina. Sides with spot at the carina green. Superior appendages black, trigonal, as long as 9 and 10. Segment 10 with a middle acute prominence marking the end of the mid-dorsal carina.

Female.—Segment 10 with a triangular prominence beneath, denticulate at the apex. Vulvar lamina enclosed; longer than 9, curved, the apex bifid, acute, the points diverging and reaching into a groove in the prominence on the sternum of segment 10.

Life Zone: Common throughout the Transition and Austral areas.

Wisconsin: Milwaukee Co., Spring 1899, July 1900, June 8, 1906.

Time and Habitat—May to September, in woods and open places.

ÆSCHNA Fabricius, Syst. Ent., p. 424, 1775; Needham, Proc. U. S. Nat. Mus. 26, p. 732, 734-737, 1903 (Venation).

A genus of wide distribution, numbering above 50 species. Three species have been found within the state and it is possible that one or two others will be found. The species separate as follows:

1. Males.—Hind wings with the anal angle acute, containing an anal triangle 2
   Females.—Hind wings with anal angle rounded; no anal triangle 4
2. Anal triangle of two cells; three dorsal transverse spines on 10. 3
   Anal triangle of three cells; no dorsal spines on 10; appendages with an inferior apical spine ..... **constricta**
3. Superior longitudinal carina of the superior appendages even.. **verticalis**
   Superior longitudinal carina of the superior appendages denticulated ..... **clepsydra**
4. Genital valve strongly elevated at apex; vulvar lamina about 2 mm.; width of appendages 2—2½ mm. ..... **constricta**
   Genital valves not strongly elevated at apex; vulvar lamina about 1 mm.; width of appendages 1—1½ mm. ..... **verticalis**

Æschna constricta Say, Journ. Ac. Phila. 8, p. 11, 1839; Hagen, Syn. Neur. N. Am., p. 123, 1861.

Abd. male 55—59, female 53—54; h. w. male 46—49, female 44—47.

Male.—Brown, marked with bright and blue. Face green, rarely brown, frons with a black T spot above. Occiput white centrally. Thorax with two dorsal stripes green, each side with two greenish stripes, widest above. Legs dark brown. Wings hyaline, the nervure dark, costa light brown, stigma brown. Abdomen with apical spots on the dorsum and basal spots on the sides green and blue. Segment 10 above green or blue, appendages light brown.

Female.—The female has less blue than the male on the abdomen. The wings are often tinged with yellowish, the appendages are longer and leaf shaped.

Life Zone: Widely distributed through the Boreal, Transition and Upper Austral areas.

Wisconsin: Milwaukee Co., July 10, 12, Aug. 24, Sept. 6, 1902; July 27, 1903; Sept. 5, 1904; Dane Co., July 1900.

Time and Habitat—June to October along shores of lakes and streams.

Aeschna verticalis Hagen, Syn. Neur. N. Am., p. 122, 1861.

Abd. male 52, female 53—54; h. w. male 45—46, female 46—48.

Male.—Color reddish brown, marked much like *constricta*. Abdomen not so thick. The female has the sternum of segment 10 cov-

ered with numerous minute slender black spines, about twice the length of those found on *constricta*. Those of the latter are broad, triangular in shape, not so acute and about half as long.

Life Zone: Transition, Upper Austral.

Wisconsin: Milwaukee Co.: Aug. 24, 1902; June 26, July 1, 20, 26, Sept. 26, 1903; Aug. 8, 1905; Portage Co., Aug. 26, 1905; Milwaukee Co., Aug. 1, 1907.

Time and Habitat—June to October in woods, along streams.

Aeschna clepsydra Say, Journ. Ac. Phila. 8, p. 12, 1839; Calvert, Ent. News, 5, 13, 1894 (Bibliography & Synonomy); Kellicott, Dragonflies of Ohio, p. 84, 1899; Williamson, Dragonflies of Indiana, p. 304, 1900.

Abd. male 52—55, female 52; h. w. male 45—50, female 44.

Male.—Markings and coloration similar to *verticalis*. Differs by the denticulated superior carina of the superior abdominal appendages. The female is said to be indistinguishable.

Life Zone: Boreal and Transition. Also found in some spots of the Upper Austral area.

Wisconsin: Nagowicka Lake, Aug. 20, 1901; Milwaukee Co., June 8, 1906.

Time and Habitat—June to September in woods and about lakes.

ANAX Leach, Edinb. Encycl. 9, p. 137, 1815; Needham, Proc. U. S. Nat. Mus. 26, p. 714 ff., 1903 (Venation).

A genus distinct from all other Aeschnæid genera by the position of the sectors of the arculus above the middle of the arculus at their origin. Two species are found in the Transition and Austral zones. *A. junius* and *A. longpipes*. They are readily separated by the presence of a spot on the frons above in *junius*, absent in *longpipes*.

Anax junius Drury, Ill. Exot. Ent. 1, p. 112, 1770; Needham, Bull. 47, N. Y. State Mus., p. 470, 1901 (Bibliography & Desc. of nymph); Needham, Proc. U. S. Nat. Mus. 26, p. 710 ff., 1903 (Venation).

Abd. male 53—55, female 54; h. w. 49—51, female 49—52.

Male.—Bright green, marked with brown and blue. Face green, frons above with a black or brown spot surrounded by an olive and a blue ring. Thorax bright green, legs black, all the femora light brown. Wings hyaline, nervure black, costa and pterostigma yellow, the wings tinged with yellow about the base and the nodus and the middle area. Abdomen with segment 1 and base of 2 green, or 2 entirely green, the other segments blue with a dorsal longitudinal stripe brown. Segment 1 and 2 are greatly dilated, 3 constricted.

Female.—Like the male. The second segment of the abdomen entirely green, less often with blue at the apex. Abdomen darker, less constricted at segment 3. The occiput deeply emarginate. Wings with more yellow.

Life Zone: Common everywhere in North America.

Wisconsin: Dane Co., June 1900; Milwaukee Co., Aug 26, 1899; July 1900; Apr. 21, Aug. 8, 23, Sept. 10, 1902; Apr. 30, July 27, Aug. 26, 1903; Aug. 26, 1904; Aug. 24, 1907.

Time and Habitat—March to November under all conditions. A cosmopolite.

FAMILY LIBELLULIDÆ.

SUB-FAMILY MACROMIINAE.

Introducing the third family of dragon-flies, the Macromiinae are unique among Odonates by having the triangle of the hind wings placed far beyond the level of the arculus. In this peculiarity the nymphs also take part, possessing a horn, pyramidal in shape, on the front of the head. Together with the *Corduliniæ* the imagoes of the *Macromiinæ* have a tubercle on the eyes behind. The males further resemble the *Corduliinæ* by the auricles on the sides of segment 2 of the abdomen and by the excavated anal margin of the hind wings. The *Macromiinæ* are composed for the greater part of large species that expand from 80 to 110 mm. They fly in the vicinity of their aquatic homes and are rarely captured far from it. Their wings are strong, their flight is regular and well sustained. The two genera of the group separate, as follows:

Eyes barely touching; occiput larger than vertex; four to six cross-veins in the space above the bridge.....**Didymops**

Eyes touching for some distance; occiput smaller than vertex; two to four cross-veins in the space above the bridge.....**Macromia**

DIDYMOPS Rambur, Ins. Nevr., p. 142, 1842; Needham, Proc. U. S. Nat. Mus. 26, p. 756, 1903 (Venation).

The genus is represented by a single species confined to North America. At present it is not known to have been collected in Wisconsin, but from its occurrence in many parts of the Transition and Upper Austral life zones it may be inferred that the species is native also in Wisconsin.

Didymops transversa Say, Journ. Ac. Phila., 8, p. 19, 1839; Hagen, Syn. Neur. N. Am., p. 135, 1861; Needham, Bull. 47, N. Y. State Mus., p. 481, 1901 (Bibliography & Desc. of nymph); Needham, Proc. U. S. Nat. Mus. 26, p. 711, 763, 1903 (Venation).

Abd. male 37, female 39—40; h. w. male 33—35, female 37—38.

Male.—Color brown marked with pale yellow. Face brown with a transverse greenish stripe. Frons with a black spot above. Thorax brown, a narrow antehumeral and sides each with a large broad stripe yellowish or white. Legs brown, feet black, tibiæ yellowish above. Wings hyaline, brownish at base, nervure brown, costa yellow, pterostigma brown. Abdomen brown, segments 7—9 laterally expanded, the segments marked more or less with rings, 7 with a white ring at the base prominent, laterally a spot at the base of 8, 10 entirely yellowish. Appendages yellow, longer than 10.

Female.—Larger than the male. Wings with more brown at the base. The abdomen uniform, not expanded.

Life Zone: Transition, Upper and Lower Austral.

Time and Habitat—May to August about lakes.

MACROMIA Rambur, Ins. Nevr. U. S. Nat. Mus. 26, p. 740, 1903 (Venation).

Six or seven species are known from the United States, four have been found in the Upper Austral life zone. The species are recognized by their large size, 85-100 and more mm. and by the bright yellow transverse markings of the abdomen.

1. Antehumeral stripe present..... 2
   Antehumeral stripe absent; frons steel blue above.....**illinoiensis**
2. Antehumeral stripe complete..... 3
   Antehumeral stripe short; expanse above 110 mm.....**tæniolata**
3. Length of abdomen less than 50 mm.....**pacifica**
   Length of abdomen more than 50 mm.....**annulata**

Macromia illinoiensis Walsh, Proc. Sci. Phila., p. 397, 1862; Needham, Bull. 47, N. Y. State Mus., p. 483, 1901 (Bibliography).

Abd. male 48—50, female 50; h. w. male 44, female 46.

Male.—Colors brown black, metallic green, markings bright yellow. Face brown, labrum yellow, a transverse band below the frons yellow; frons blackish, changing to steel blue above; vertex and occiput black. Thorax metallic green, the crest above with a narrow yellow line; sides each with a long yellow stripe. Legs black, hind tibiæ below with a fine yellow stripe. Wings hyaline, nervure black, the base slightly tinged with fuscous, costa paler, pterostigma black. Abdomen black, a yellow spot each side of the mid-dorsum on 2—5, undivided and basal on 7, very slight on base of 8. Sides of 2 with diffused yellow. Segments 7—9 expanded, the expansion with a basal spot. Appendages black, lyre-shaped.

Female.—Similar. More yellow on the abdomen, wings with more fuscous at base.

Life Zone: Transition and Upper Austral.

Wisconsin: Milwaukee Cement Mills, July 25, 1903.

Time and Habitat—June to August along streams. Congregate in moist woods, resting on the underside of twigs. (Osborn.)

Macromia tæniolata Rambur, Ins. Nevr., p. 139, 1842; Hagen, Syn. Neur. N. Am., p. 132, 1861; Needham, Bull. 47, N. Y. State Mus., p. 484, 1901 (Bibliography).

Abd. male 58—60, female 61—62; h. w. male 52—54, female 58.

Male.—Colors like the preceding species. Thorax with a short antehumeral stripe below and a lateral band yellow. Legs black. Wings more or less tinged with yellow. Abdomen black, a transverse ring on 2, divided spots on 2—8, entire on 7, yellow.

Female.—Wings with more yellow. The spot on dorsum of segment 8 usually lacking.

Life Zone: Upper and Lower Austral.

Time and Habitat—Late May to July along streams and in damp woods.

Macromia pacifica Hagen, Syn. Neur. N. Am., p. 134, 1861; Williamson, Dragon-flies of Indiana, p. 309, 1900.

Abd. male 47, female 48; h. w. male 40, female 45.

Male.—Steel blue, black, fuscous, marked with bright yellow. Face fuscous, a yellow transverse band below the frons; frons brown, yellow above. Thorax metallic blue, the antehumeral stripes yellow, not quite reaching the yellow transverse stripe on the crest above. A lateral band between the wings encircling the entire thorax. Legs brown, the

feet black. Wings hyaline, yellow at the base, costa and pterostigma yellow. Abdomen black, segment 2 circled basally by a broad yellow band, divided on the dorsum. Segment 3—7 with dorsal divided spots, entire on 7 and 8.

Female.—Similar, larger, the wings sometimes yellow, more so at the base.

Life Zone: Upper and Lower Austral. The species has been found in but four States, Texas, California, Illinois and Wisconsin.

Wisconsin: Milwaukee, Cement Mills, July 2, 1902.

Time and Habitat—June, July, along streams.

SUBFAMILY CORDULINAE.

The present sub-family forms the connecting link between the two other sub-families of the most interesting group of dragonflies, the Libellulidæ. In common with the preceding sub-family this group has tubercled eyes, the males also with auricles on the sides of the second abdominal segment and excavated anal margins of the hind wings. To the Libellulinæ the group is related by the position of the triangle of the hind wings even with or before the level of the arculus. In habits they are related to the *Macromiinæ*, preferring the vicinity of their aquatic homes to the sunshine of fields and roadsides. The genera can be separated by the following table:

1. Fore wing with the short sector and the upper sector of the triangle approximated apically..... 2
   Fore wing with the short sector and the upper sector of the triangle parallel or divergent apically; all wings with dark spots at the base, the nodus and the apex.....**Neurocordulia**
2. Internal triangle present in the hind wing..... 3
   Internal triangle absent in the hind wing..... 5
3. Stigma normal, triangle of hind wings crossed..... 4
   Stigma diamond-shaped, triangle of hind wings free...**Helocordulia**
4. Wing clear, (triangles of hind wings rarely free)....**Somatochlora**
   Wings with dark markings at base, nodus and apex...**Epicordulia**
5. Triangles of fore wings crossed..... 6
   Triangles of fore wings free.....**Dorocordulia**
6. Wings with basal markings, hind wings with four antenodals .....**Tetragoneuria**
   Wings clear, more than four antenodals, male inferior abdominal appendages bifurcate.....**Cordulia**

NEUROCORDULIA Selys, Bull. Ac. Belg. 31 (2), p. 278, 1871.

Several species of this genus have been found in the Transition and Austra life areas, but it is hardly likely that more than one, *obsoleta*, is to be found within the state. *N. obsoleta* is known from Illinois and other places in the Austral regions. It is recognized from its dull brown color and obscure markings, which consist mainly in a short transverse line on each side of the dorsal

carina near the front edge, and a lateral spot of yellow. The appendages of the male are thickened at the apical half and without an inferior angle.

HELOCORDULIA Needham, Bull. 47, N. Y. State Mus., p. 495, 1901.

In the paper referred to Dr. Needham has discussed the characters upon which he based the separation of *Helocordulia* from the preceding genus, *Neurocordulia*. Besides the characters mentioned in the table, Dr. Needham has noted several others when comparing *Helocordulia* to its prototype, *Neurocordulia* and to its nearest ally, *Tetragoneuria*. Such differences are:

a. *HELOCORDULA*—Hind wings with six antenodals and free triangles, fore wings with a single cross-vein in the triangle.
NEUROCORDULIA—Hind wings with five antenodals and triangles crossed once, twice crossed in the fore wings.

b. *HELOCORDULIA*—Sub-triangle present, two cross-veins under the stigma, six antenodals in the hind wings.
TETRAGONEURIA—Sub-triangle absent in hind wings, a single cross-vein under the stigma, four antenodals in the hind wings.

The two species may be separated by their genitalia:

Male superior abdominal appendages with a distinct inferior tooth before the middle, the apex thickened, hairy; female vulvar lamina nearly one-half the length of 9, deeply bifid, divaricated ..... **selysii**

Male superior abdominal appendages without a distinct inferior tooth, the apex thickened, naked; female vulvar lamina less than one-third the length of 9, emarginate, the points widely divaricated, the lateral margins sub-parallel..... **uhleri**

Of these two species *Uhleri* alone has been taken as far west as Ontario, and there is some possibility of finding it in the middle portions of the State.

SOMATOCHLORA Selys, Bull. Ac. Belg. 31 (2), p. 279, 1871; Needham, Proc. U. S. Nat. Mus. 26, p. 741, 1903 (Venation).

About 40 species of this genus are known. Our American species inhabit chiefly the colder life areas, few species as yet being taken in regions warmer than the Upper Austral. For Wisconsin we have only a single record of a species by Hagen. But the remarkable similarity of the fauna of northern Wisconsin to that of the White Mts. of New Hampshire leads us to expect the presence of a similar number of species in the mountainous portions of our state. The different species are greatly alike in color and pattern of the markings. They are separated chiefly by the form of the superior abdominal appendages of the male. Accepting the superior appendages as criterion; the five New Hampshire species have the following points of difference:

tenebrosa—apical half abruptly incurved, directed downward, a superior tooth at the deflection; inferiors recurved, furcate.

cingulata—differing from the preceding by the superiors, inferiors similar.
albicincta—a basal tooth, an inferior median tooth.
walshii—an external obtuse prominence at the basal third.
elongata—apices upturned, an inferior basal tooth.

Somatochlora elongata Scudder, Proc. Bost. Soc. Nat. Hist. 10, p. 218, 186; Hagen, Proc. Bost. Soc. Nat. Hist. 18, p. 58, 1875 (Bibliography); Needham, Bull. 47 N. Y. State Mus. 499, 1901 (Description of nymph).

Abd. male and female 42—45; h. w. 36—38.

Male.—Metallic green and brown, marked with obscure yellow. Lower part of face brownish, frons and vertex dull green. Thorax metallic green, an obscure brown spot on each side of the dorsum near the anterior edge. Legs black, fore femore brownish above. Wings hyaline, stigma black. Abdomen blackish green, dilated at base, sharply constricted at 3, then gradually widening to 6, equal in width to the first segments. Segment 2 with a spot on either side of dorsum and sides, 3 with a basal spot, luteous or obscure yellow. Appendages black.

Female.—Similar. Abdominal segments 1 and 2 and base of 3 brownish. Wings sometimes with a smoky tinge about the nervures. Vulvar lamina as long as 9, forming a triangular trough at right angles to the sternum of 9.

Life Zone: Transition.

Wisconsin: "Upper Wisconsin River" (Hagen).

Time and Habitat—July to September along streams and about lakes.

EPICORDULIA Selys, Bull. Ac. Belg. 30 (2), p. 259, 1871.

The single species of this genus is easily recognized by its large size and the spots at the base, the nodus, and the apex of all the wings. In the markings of the wings it resembles certain Libellulinæ, such as Libellula pulchella, differing, however, from that species by the longer body and other characters referred to in the table. The imagoes, restive in flight, prowl about slow or standing waters.

Epicordulia princeps Hagen, Syn. Neur. N. Am., p. 134, 1861; Needham, Bull. 47 N. Y. Sate Mus., p. 488, 1901 (Bibliography & Desc. of nymph).

Abd. male 44, female 46; h. w. male 41, female 44.

Male.—Colors olive or brownish yellow, marked with yellow. Face olive. Thorax with gray or brownish hair. Sides with an obscure yellow stripe margined on the anterior side with fuscous. Legs black, the femora brown. Wings hyaline, nervure black, costa and stigma black, brown spots at the base, the nodus and apices of all wings, the spots larger on the hind wings. Abdomen dark brown, most of segment 1 and 2 and sides of 1—8 with yellow, segment 9 and appendages black. The superior appendages with two obtuse internal prominences, at the basal and the apical third.

Female.—Similar, vulvar lamina bifid, forcipate, nearly as long as the sternum of 9.

Life Zone: Transition and Upper Austral.

The species has been taken so near the boundary line of Illinois and Wisconsin, that it certainly can be expected in the State.

Time and Habitat—May to July about ponds and quiet waters.

DOROCORDULIA Needham, Bull. 47 N. Y. State Mus., p. 504, 1901 (Discussion of Characters).

The species of the present genus were separated from *Cordulia* chiefly because of differences in venation, such as open triangles and the presence of only two complete rows of cells beyond the triangles in the fore wings. Another point of difference is the entire (not furcate) inferior appendages of the male. The imagoes are small, with metallic colors, graceful in flight, though less rapid than the preceding species, but quite as restive. Three species are known:

1. Apex of abdomen (7—9) gradually and moderately dilated.... 2
   Apex of abdomen (7—9) suddenly and spatulately dilated..**libera**
2. Joints of abdomen yellowish.....**lepida**
   Joints of abdomen without yellow.....**lintneri**

Dorocordulia libera Selys, Bull. Ac. Belg. 31 (2), p. 263, 1871; Needham, Bull. 47, N. Y. State Mus., p. 504, 1901 (Description of nymph); Williamson, Dragon-flies of Indiana, p. 314, 1900 (Description of imago).

Abd. male 31, female 29; h. w. male 30, female 31.

Male.—Color metallic green, obscured on the thorax by brown hair. Mouth yellow, face green. Abdomen green, sides of 1—2 black with brownish spots, the posterior segments black. Legs black. Wings hyaline, nervure, costa and stigma black. The base of the wings marked sparingly with brown or yellow.

The female is similar.

Life Zone: Transition.

Wisconsin: Dane Co., June 1890; Door Co., Plum Island, July 6, 1905.

Time and Habitat—June and July about small lakes.

CORDULIA Leach, Edin. Encycl. 9, 1815.

The single species of this genus, *C. shurteffi* Scudder, is readily distinguished from its allies by the points specified in the table. In color and the few markings it resembles the preceding species *D. libera*, differing however, by having the abdomen more equal, not widely expanded at the apical segment. The species may be expected in Wisconsin, since it is found in Transitional regions.

TETRAGONEURIA Hagen, Syn. Neur. N. Am., p. 140, 1861; Needham, Proc. U. S. Nat. Mus. 26, p. 723-726, 1903.

Four species are referred to this genus.

1. Frons without a black T-spot above; if so, only faintly evident; triangle of hind wing generally crossed..... 2
   Frons with a black T-spot above distinct; triangle of hind wing generally free.....**spinigera**
2. Hind wings with four antenodals..... 3
   Hind wings with five antenodals.....**spinosa**

3. Hind wings with fuscous streaks restricted to space within the level of the first antenodal.....**cynosura**
Hind wings with the fuscous more distributed, not in isolated streaks, reaching beyond the level of the first, and generally to the fourth antenodal.....**semiaquea**

Taking the triangle of the hind wing, whether crossed or free, as a specific character, it is well to mention that this by no means is a constant factor for determination. In the collections of the Public Museum I have seen specimens of *cynosura* with the triangle free, and of *spinigera* with the triangle crossed.

Tetragoneuria spinigera Selys, Bull. Ac. Belg. 31 (2), p. 269, 1871; Needham, Bull. 47, N. Y. State Mus., p. 493, 1001 (Bibliography).

Abd. male 30—33, female 32; h. w. male 29—33, female 32—33.

Male.—Brown, marked with black and yellow. Face yellow, a greenish transverse band below the frons. Frons above with a prominent black T-spot. Thorax brown, dorsal stripes, meral and lateral sutures black. Generally these markings are hidden below the thick gray pile. Legs black, fore femora brown. Wings hyaline, nervure black, costa and stigma brown. Fore wings with the extreme base fuscous, hind wings with streaks along the median vein and the anal angle. Abdomen with segments 1, 2 and the base of 3 brown. Segment 2 is dilated, 3 slightly constricted, 4—9 flattened. Dorsum black, wider apically, lateral yellow spots on 2—9. Appendages black, the superiors with an inferior spine at the basal third.

The female is similar.

Life Zone: Transition and Upper Astral.

Wisconsin: Milwaukee County, June 1900; Dane County, May 1900; Vilas Co., Divide, June 24-30, 1907.

Time and Habitat—June to July about lakes and in forest clearings.

Tetragoneuria cynosura Say, Journ. Ac. Phila. 8, p. 30, 1839; Hagen, Syn. Neur. N. Am., p. 139, 1861; Needham, Bull. 47 N. Y. State Mus., p. 494, 1901 (Bibliography).

Abd. male 28—39, female 27; h. w. male 28, female 29.

Male.—Differs from the preceding species mainly by the absence of a T-spot on the frons and by its smaller size. The abdominal appendages are curved, touching at the middle the apices thickened.

The female is similar, the vulvar lamina exceeding the sternum of 9 in length, bifid.

Life Zone: Transition and Upper Austral.

Wisconsin: Milwaukee Co., June 4, 1899.

Time and Habitat—May to July about smaller waters (ponds and creeks).

Tetragoneuria semiaquea Burmeister, Handbuch der Entomologie, 2 p., 858, 1839; Hagen, Syn. Neur. N. Am., p. 140, 1861; Needham, Bull. 47 N. Y. State Mus., p. 494, 1901 (Bibliography).

Abd. male 26—27, female 28; h. w. male 26—28, female 29.

Male and female.—This species resembles *cynosura* greatly. The chief distinction is that the fuscous of the hind wings is more suffused, always extending at least beyond the second antecubital.

Life Zone: Transition and Upper Austral.

Wisconsin: Dane Co., June 2, 1900.

Time and Habitat—May to July about smaller waters.

SUB-FAMILY LIBELLULINAE.

This sub-family includes by far the largest number of dragonflies of any sub-family. The species, wherever found, are abundant, and are easily recognizable by the proportionately large wings and their short, stout, often flat bodies. They are familiar objects along the road-sides, often flying far from their aquatic homes. The thirteen North American genera separate as follows:

1. Hind wings narrow at the base; triangle of fore wing level with the apex of the triangle of the hind wing..... 2
   Hind wings very wide at the base; triangle of fore wing far beyond the level of the apex of hind triangle..... 12
2. Triangle of fore wing normal (three sides)..... 3
   Triangle of fore wing with four sides.....**Nannothemis**
3. Subtriangle of fore wing crossed; sides of triangle meeting at right angles (90°); hamules of male bifid..... 4
   Subtriangle of fore wing free; sides of triangle meeting at an obtuse angle (100°); hamules of male not bifid....**Perithemis**
4. Hind lobe of prothorax large, bilobed..... 5
   Hind lobe of prothorax small, entire..... 9
5. Sectors of the arculus pedicellate..... 6
   Sectors of the arculus contiguous or separate at their origin; wings generally with yellow or brown markings....**Celithemis**
6. Hind wings with the upper sector of the triangle departing from the hind angle..... 7
   Hind wing with the upper sector of the triangle departing above the hind angle on the outer side..... 8
7. Length of stigma more than three times the width; face yellowish .....**Sympetrum**
   Length of stigma hardly twice the width; face pure white....**Leucorhinia**
8. One cross-vein under the stigma, a large vacant space before it; hind tibiæ with two rows of about 10 small spines.....**Pachydiplax**
   Two cross-veins below the stigma, spaces before it normal; hind tibiæ with a row of 5—7 stout spines.....**Mesothemis**
9. Sectors of the arculus contiguous at their origin; hind wing with upper sector of the triangle arising from the hind angle 10
   Sectors of the arculus stalked; hind wing with the upper sector of the triangle arising above the hind angle....**Micrathyria**
10. Triangle of fore wing with two parallel cross-veins; subtriangle of 4—11 cells..... 11
    Triangle of forewing with a single-cross-vein; sub-triangle of three cells.....**Ladona**
11. Male without ventral hooks on segment 1 of abdomen; female tibiæ longer than hind femora; sexes with similar wing-markings* .....**Libellula**
    Male with ventral hooks on segment 1 of abdomen; female

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* The male of *L. pulchella* has ventral hooks on segment 1, but this species is placed with *Libellula* because of the other distinctions cited for the genus.

with hind tibiæ and femora equal in length; sexes with dissimilarly colored wings*.....**Plathemis**

12. Hind wings with a broad basal fuscous band, the cells within the colored area finely meshed.....**Tramea**
Hind wings not banded, the anal angle colored; the cells of the anal not small, normal in size.....**Pantala**

NANNOTHEMIS Brauer, Vern. zool.-bot. Gesellsch. Wien, p. 369, 726, 1868; Needham, Proc. U. S. Nat. Mus. 26, p. 740, 1903 (Venation).

Several species of this genus are known, but only a single one flies as far north as the Upper Austral and occasionally onto the Transition life area. If found, the species will be easily recognized from the foursided triangle. It flies in June around ponds and over marshes.

PERITHEMIS Hagen, Syn. Neur. N. Amer., p. 185, 1861; Needham, Bull. 47 N. Y. State Mus., p. 512, 1901 (Bibliography & Decs. of nymph); Needham, Proc. U. S. Nat. Mus., p. 718, 1903 (Venation).

Of the several species one is found in Wisconsin.

Perithemis domitia Drury, Ex. Ent. 2, p. 83, 1773; Needham, Bull. 47 N. Y. State Mus., p. 512, 1901 (Bibliography & Desc. of nymph); Needham, Proc. U. S. Nat. Mus. 26, p. 763, 1903 (Venation).

Abd. male 14—15, female 13—14; h. w. male 18, female 19.

Male.—Color yellowish brown. Face brown, a green band across the middle. Thorax laterally with two pale stripes on each side. Legs brown. Wings of uniform amber color, a brown spot at the end of the triangle on all wings. Hind wings with a basal streak of brown in the sub-costal space. Costa and stigma dark brown. Abdomen uniform brown, the sides a trifle lighter. Appendages yellow.

Female.—Body similar to the male in markings. Wings white, hyaline, yellowish along the costa, a fuscous blotch at the end of the triangle reaching to the sub-costal vein, a larger blotch between the nodus and the stigma. These markings are greatly variable in size and intensity, grading from insignificant blotches to bands reaching across the whole breadth of the wings.

Life Zone: Upper and Lower Austral.

Wisconsin: Kenosha Co., Paddock's Lake, July 6, 1900.

Time and Habitat—May to August about ponds and marshes. A timid, weak species, loving the sunshine.

CELITHEMIS Hagen, Syn. Neur. N. Am., p. 147, 1861; Needham, Proc. U. S. Nat. Mus. 26, p. 742, 1903 (Venation).

This genus includes but four species, numbering among the prettiest flyers of our odomate fauna. In general they prefer the lakes for their habitat, clinging to the deep swaying rushes of the shores, though occasionally they are also found along streams. The species are easily separated by the color-pattern of the wings, which, in contrast to the preceding species, varies but slightly in intensity and extent of the markings.

1. Wings hyaline, with markings at the apices..... 2
Wings yellow, without apical markings, a broad fuscous band traversing the wing just before the stigma.....**eponina**

2. Anal spots fuscous, divided by a yellow band.....**elisa**
Anal spots fuscous alone, not mixed with yellow.....**fasciata**

Celithemis eponina Drury, Ill. Ex. Ins. 2, p. 86, 1773; Hagen, Syn. Neur. N. Am., p. 147, 1861; Needham, Bull. 47 N. Y. State Mus., p. 514, 1901 (Bibliography & desc. of nymph).; Needham, Proc. U. S. Nat. Mus. 26, p. 763, 1903 (Venation).

Abd. male 26—27, female 24; h. w. male 33, female 32.

Male.—Colors fuscous and yellow. Thorax with a dorsal and two lateral stripes fuscous, or obsolete. Legs black, fore femora yellow beneath. Wings yellow, the nervure infuscated, stigma red, costa brown. Fore wings with basal spots; a spot filling the triangle, the supratriangular space and part of the sub-triangle; a series of spots on all antecubitals of the second series present or absent. Nodal spot, reaching from the sixth to seventh antecubital to the nodus and extending across the wing to near the hind margin. A further band from the fourth or fifth postcubital to the stigma reaching across the wing to the hind margin. The hind wing differs by having the spot of the triangle originating from the extreme base of the wing and a round spot in the anal angle. The spots vary in form, but are always present. Abdomen brown, the apical segments black. Yellow spots on dorsum of segments 1—7 and sides of 1—5. Segments 8—10 black. Appendages yellow.

Female.—Generally similar to the male. Usually the nodal spot is broken, the wings are more uniformly tinged with yellow, the veins are not infuscated, but are yellow within the fuscous areas.

Life Zone: Upper and Lower Austral, Transition.

Wisconsin: Dane Co., June 1890, June 7, 1900; Milwaukee Co., Sept. 9, 1898, June 4, 1899, July 28, 1901, July 6-17, 1902, Sept. 1, 1904; Delafield, Aug. 15, 1902; Washington Co., Cedar Lake, Aug. 1906, Little Cedar Lake, July 29-Aug. 15, 1907.

Time and habitat—June to early September about lakes and large ponds, occasionally near rivers.

Celithemis elisa Hagen, Syn. Neur. N. Am., p. 182, 1861; Needham, Bull. 47 N. Y. State Mus., p. 515, 1901 (Bibliography & desc. of nymph).

Abd. male 22—24, female 20; h. w. male 26—28, female 26.

Male.—Colors red or yellow, markings black and fuscous. Thorax above reddish, sides yellow. A mid-dorsal stripe and two lateral stripes brown or black. Legs of red specimens black, of yellow brown. Wings hyaline, nervure brown, costa yellow, stigma red or yellow. Fore wing with a spot at the upper end of the triangle, a second between the nodus and the stigma and a third spot filling the apices of the wings, fuscous. The ante- and post-cubitals of both series of all wings infuscated. Hind wings similar, an additional fuscous area nearly filling the entire anal angle from the base of the wing to the supratriangular space; this area is divided by a broad sinuous band of yellow. Abdomen black, dorsum of 3—7 and sides of 1—5 yellow or red. Yellow specimens have the base of the abdomen fuscous. Appendages yellow. The female is similar.

Life Zone: Transition and Upper Austral.

Wisconsin: Dane Co., July 7, 1900; Milwaukee Co., Aug. 1, 1900, July 28, 1901, July 6, 1902, July 1, 1903; Nagowicka Lake, Aug. 20, 1901.

Time and Habitat—June to early September about lakes.

Celithemis fasciata Kirby, Trans. Zool. Soc. London 12, p. 326, 1869; Williamson, Dragonflies of Indiana, p. 320, 1900.

Abd. male 22—23, female 21; h. w. male 28, female 27.

Male.—Fuscous, with yellow markings. Thorax with an antehumeral stripe and the sides yellow. Legs black. Fore wings with black or fuscous spot at the nodus, this spot reaching back to base of the wing in two forks. A second spot between the nodus and the stigma. The apices filled with black or fuscous. Hind wings similar, an additional anal round spot. Abdomen with an interrupted dorsal stripe and lateral spots yellow.

Female.—Similar. The female differs from the male by having a dark stripe just before the apex of the wing and the extreme apex clear.

Life Zone: Upper and Lower Austral.

Wisconsin: Milwaukee Co., 1900.

Time and Habitat—June to September about lakes and ponds.

SYMPETRUM Newman, Ent. Mag. 1, p. 511, 1833; Needham, Proc. U. S. Nat. Mus. 26, p. 720, 742, 1903 (Venation).

Numerically this genus is the largest of the Libellulinæ, comprising about 45 species. The imagos frequent the swampy shores of lakes and rivers, but seem to like moist woods and open prairies just as well, flying in great swarms wherever they occur. They are readily distinguished even in flight, from the yellow or reddish yellow tone of their colors. The following table includes the species of the Transition and Upper Austral life areas.

1. Triangle of fore wing crossed; sub-triangle of three cells.... 2
   Triangle of fore wing free; sub-triangle with a single cross-vein or entirely free.....**minusculum**
2. Three basal segments of the abdomen with a median transverse carina 4
   Four basal segments of abdomen with a median transverse carina .....**corruptum**
3. Male superior appendages with an inferior prominent median tooth, preceded by a number of denticles; female vulvar lamina bifid..... 4
   Male superior appendages with inferior denticles, no prominent tooth; female vulvar lamina emarginate or triangular, not bifid..... 9
4. Tibiæ and tarsi yellow externally; face without a black band before the eyes..... 5
   Tibiæ and tarsi entirely black; a black band before the eyes. 6
5. Abdomen with black markings.....**albifrons**
   Abdomen with brown and yellow markings.....**pallipes**
6. Wings with basal markings only..... 7
   Wings with basal half yellow.....**assimilatum**
7. Apical fourth, or less, of the genital hamule bifid, the fissure forming a rounded notch; yellow of wings restricted to extreme base..... 8

Apical third, or more, of the genital hamule bifid, the fissure oval in shape; yellow of wings reaching to or exceeding the first antecubital, vulvar lamina of two inflated lobes, the apices divergent.....**rubicundulum**

8. Branches of the genital hamule equally long, the exterior stout, triangular, the interior slender, curved; vulvar lamina bifid, triangular, the apices divergent.....**decisa**

Exterior branch of the genital hamule longer than the interior, the latter wider than the exterior; vulvar lamina bifid, the lobes conical contiguous to apex.....**obtrusum**

9. Yellow of wings restricted to extreme base..... 10

Yellow of wings reaching to the nodus.....**semicinctum**

10. Femora and tibiæ marked with black..... 11

Femora and tibiæ entirely yellow.....**vicinum**

11. Feet entirely black..... 12

Feet entirely yellow.....**costiferum**

12. Appendages black.....**scoticum**

Appendages yellow or red.....**atripes**

Of these species five have been taken in the state and two others will probably be found in the southern portions.

Sympetrum corruptum Hagen, Syn. Neur. N. Am., p. 171, 1861; Needham, Bull. 47 N. Y. State Mus., p. 525, 1901 (Bibliography).

Abd. male and female 28; h. w. male 29—31, female 30.

Male.—Face yellow, suffused with red in older specimens, an olive band below the frons. Thorax yellowish in young specimens, an antehumeral, humeral, and two lateral stripes whitish, the lateral stripes ending below in two bright yellow spots margined in black. In older specimens the stripes become obsolete, but the spots remain. Legs with yellow and black stripes, feet black. Wings hyaline, the nervure—especially toward the costa—bright red, stigma reddish fuscous, costa red. Abdomen yellowish or red, a series of bright yellow spots on the sides of each segment. Segments 8—9 marked with black on the sides and on dorsum. Appendages bright yellow, or reddish. Appendages cylindrical, thickened apically, several inferior denticles. Young specimens are chiefly yellow, older ones become red.

Female.—The female usually retains the yellow face in age instead of becoming red, while the appendages are less often of a reddish color. Vulvar lamina very short, broadly emarginate.

Life Zone: Upper Austral.

Wisconsin: Dane Co., July 10, 1900; Milwaukee Co., June 4, 1899, June 10-July 14, 1900, Aug. 1901, July 26, 1902, July 7-17, 1903.

Time and Habitat—Lakes, rivers and moist woods from June to September.

Sympetrum assimilatum Uhler, Proc. Acad. Nat. Sci. Phila., p. 88, 1857; Needham, Bull. 47 N. Y. State Mus., p. 524 (Bibliography).

Abd. male 25—28, female 23—27; h. w. male 28—30, female 26—29.

Male.—Colors in graded shades of yellow to reddish. Face olive to pink. Thorax reddish above, sides bright yellow. Legs black, fore femora greenish yellow beneath. Wings hyaline, nervure black, stigma reddish fuscous, costa yellow. Basal half of the wings to the nodus yellow. Abdomen yellow to red, sides with apical triangular spots on

segments 4—8, turning into an even band on 9—10. Appendages bright yellow or red.

Female.—Abdomen with the lateral spots continuous. Legs with all the femora olive beneath.

This species is usually considered as a variety of *rubicundulum*. In fact, the genital organs of both male and female of the two species are identical. Except for the yellow area of the wings there is no specific difference.

Life Zone: Transition and Upper Austral.

Wisconsin: Milwaukee Co., Aug. 1900, July 10-Aug. 8, 1902, July 7-Sept. 15, 1903.

Time and Habitat—July to September in marshes and woods.

Sympetrum rubicundulum Say, Journ. Ac. Phila. 8, p. 26, 1839; Hagen, Syn. Neur. N. Am., p. 176, 1861; Needham, Bull. 47 N. Y. State Mus., p. 524, 1901 (Bibliography).

Abd. male 28, female 24—26; h. w. male 30, female 26—28.

Male.—Color yellow in young specimens, adults red. Face pink or yellow, an olive band below the frons. Thorax reddish, covered with pile, legs black, fore femora green beneath. Wings hyaline, the base filled with bright yellow, nervure black, stigma reddish, costa yellow. Abdomen yellow to red, sides of 3—9 with black spots. Appendages yellow or reddish. Genital hamule bifid, the branches equal in length, the exterior slender, acute, the interior triangular.

Female.—Similar. Abdomen with more black on the sides, all femora yellow beneath. Vulvar lamina approximated at the base, the points divergent.

Life Zone: Transition and Upper Austral.

Wisconsin: Dane Co., June 1890; Milwaukee Co., June 6-Aug. 3, 1900, Aug. 3, 1901, June 22-July 22, 1902, July 10-27, 1903, Aug. 27, 1904, July 15-Sept. 1, 1907.

Time and Habitat—June to September in woods and moist places.

Sympetrum obtrusum Hagen, Stettiner Ent. Zeit. 28, p. 95, 1867; Needham, Bull. 47 N. Y. State Mus., p. 525, 1901 (Bibliography).

Abd. male 24—27, female 23—24; h. w. male 25—26, female 24—25.

Male.—Yellow to red. Face of young specimens olive, of adults whitish. Thorax and body yellow to red, marked similar to *rubicundulum*. Legs black, fore femora yellow beneath. The yellow area of the wings is smaller than that of its ally. The genital organs are decidedly different from *rubicundulum*, as indicated by the tabella.

Female.—Usually of an olive brown color with a reddish tinge. This olive color separates it from *rubicundulum*, which it resembles, by the form of the vulvar lamina.

Life Zone: Transition and Upper Austral.

Wisconsin: Milwaukee Co., June-July, 1899, June-July, 1900, Aug. 3, 1901, June 22, 1902, July 21-27, 1903, July 15, 1905.

Time and Habitat—Lakes and rivers June to October.

Sympetrum semicinctum Say.

Marked like other species in colors ranging from yellow to red. In the yellow of the wings it resembles *assimilatum*, but it is much smaller, the abdomen measuring but 20 mm. and the hind wing 23 mm. The genital organs of the male resemble those of *vicinum*, but the female differs by having the vulvar lamina short, broad, with a straight

front margin, while *vicinum* has a triangularly formed lamina The range of the species is the Transition and Upper Austral, and it probably will be found in parts of the state by collectors.

Sympetrum vicinum Hagen, Syn. Neur. N. Am., p. 175, 1861; Needham, Bull. 47 N. Y. State Mus., p. 522, 1901 (Bibliography).

Abd. male 21—24, female 22—23; h. w. male 24—25, female 23—24.

Male.—Colors as usual, ranging from yellow to red. Face yellow or red, a broad olive band below the frons. Sides of thorax of younger specimens bright yellow. Legs entirely yellow, the claws of the feet blackish. Wings hyaline, nervure brownish, costa fuscous, stigma reddish. Abdomen yellow to red, sides marked with brown spots. Appendages lighter, cylindrical, with numerous inferior denticles. The color of the legs and the small size are distinctive.

Female.—Similar. More brown on sides of abdomen. Vulvar lamina entire, forming a right-angled triangle with angle directed outward.

Life Zone: Transition and Upper Austral.

Wisconsin: Waukesha Co., Nagowicka Lake, Aug. 20, 1900; Milwaukee Co., June 4-July 1, 1900.

Time and Habitat—Marshy ponds from August to early November.

Sympetrum costiferum Hagen.

This species has as yet been found only in the Transition area. The imago is a trifle larger than *vicinum*, which it resembles, but is easily distinguished by the legs marked with yellow and black stripes and the yellow feet. The genital is distinct by having the anterior lobe with its apex bent inward. The female vulvar lamina is short, entire, somewhat rounded, the middle third emarginate. It is possible that this species will be found in the state.

Sympetrum scoticum Donovan.

The present species is more Boreal in its range. It has been taken in the Northern Peninsula of Michigan and is probably to be found in some of our northern counties along the boundary. The points indicated in the table will suffice to distinguish it from its allies.

LEUCORHINIA Brittinger, SB. Akad. Wiss. Wien 4, p. 333, 1850; Needham, Proc. U. S. Nat. Mus. 26, p. 763, 1903 (Venation).

Hagen places 11 species in this genus, of which six inhabit North America, while the rest are found in Europe, and in part in Northern Asia. Because of their one prominent color-feature folk-lore has given them the name of "Whiteface". Like the preceding genus they love the deep reeds of the marshy shores of lakes and ponds, but are rarely seen any considerable distance from the water. The generic character mentioned in the table, that the upper sector of the triangle of the hind wing departs from the lower angle is really not quite valid as a distinctive feature. Specimens of both sexes taken in Wisconsin have come to my notice, in which the upper sector is migrated a trifle upward from the lower angle of the triangle. Still, the difficulties that this inconstancy might cause are obviated in view

of the pronounced white color of the face and the short thick stigma upon the wings of the imagoes.

1. Subtriangle of fore wings free; small species, hind wings 20—23 mm. 2
   Subtriangle of fore wings usually of three cells; larger species, hind wing 24—30 mm..... 3

Males.

2. Basal segments pruinose, 6 and 7 with a narrow basal line...**frigida**
   Segments 2—7 with hastate spots, interrupted apically...**hudsonica**
3. Segment 7 with a dorsal spot..... 4
   Segment 7 without a dorsal spot.....**glacialis**
4. Segment 8 black on dorsum..... 5
   Segment 8 with a prominent dorsal spot.....**borealis**
5. Segment 7 with a prominent red spot on dorsum.....**intacta**
   Segment 7 with a faint yellow line on dorsum.....**proxima**

Females.

2. Segment 2 with a prominent dorsal spot, 4—7 with spots decreased to narrow bands posteriorily.....**frigida**
   Segments 2—7 with hastate spots, interrupted apically...**hudsonica**
3. Dorsum of 8 black..... 4
   Dorsum of 8 with a prominent red spot.....**borealis**
4. Markings on dorsum of 4—7 linear..... 5
   Markings on dorsum of 4—7 reduced (or obsolete) to small basal triangles.....**glacialis**
5. Dorsal band interrupted at the apex, ending in a basal triangle on 7.....**intacta**
   Dorsal band hardly covering the basal half of the segments....**proxima**

Leucorhinia hudsonica Selys, Revue des Odonates, p. 53, 1850; Hagen, Syn. Neur. N. Am., p. 180, 1861; Hagen, Trans. Am. Ent. Soc., 17, p. 233, 1890.

Abd. male 20—21, female 19—20; h. w. male 20—23, female 21—22.

Male.—Colors yellow and black. Labium black, labrum creamy white. Face milky white. Thorax yellow, a broad mid-dorsal stripe divided by the yellow carina, humeral and lateral sutural marks, all of irregular shape, black or fuscous. Wings hyaline, nervure fuscous, the antecubitals of all wings yellow, stigma short, fuscous, costa yellow. Fore wings with a small area within the subcostal and the median space fuscous or black. The hind wings have the fuscous in the subcostal and median space extending farther, that of the latter reaching to the anal margin of the wing, thereby forming a quite regular triangle. Legs black. Abdomen black, yellow on sides of 1 and 2, a basal point on 3; dorsum with a continuous band of hastate spots on 2—7, interrupted apically, ending in a basal triangular spot on 7. Appendages black, the superiors cylindrical, thicker at the apex, the inferiors widening apically, with a broad shallow notch.

Female.—Similar. Labium with the sides white, labrum entirely black. The band or dorsum of abdomen wider, stigma of wings a trifle longer. Vulvar lamina short, approximated, or divergent and the apices obtuse.

Life Zone: Boreal. Occasionally the imago flies into Transitional regions.

Wisconsin: Vilas Co., Divide, June 24—29, 1907.

Time and Habitat—June to August about marshy places.

Leucorhinia glacialis Hagen, Proc. Bost. Soc. Nat. Hist., 18, p. 79, 1875; Hagen, Trans. Am. Ent. Soc., 17, p. 234, 1890.

Abd. male 24—26, female 23—24; h. w. male 25—28, female 25—27.

Male.—Colors yellow and black. Labium black, a white spot at the sides, labrum creamy white, face milk white. Thorax yellowish brown, a broad mid-dorsal irregular stripe of black, divided by the yellow carina, a humeral and lateral irregular markings black. Legs black. Wings hyaline, nervure black, stigma short, fuscous to black, a yellow spot at each end in younger specimens, disappearing in fully developed imagoes. The costa at the apex yellow above, in front entirely yellow. Abdomen black, segment 2 and 3 to median transverse carina yellow, a yellow spot on the dorsum and the sides just beyond. Appendages black, the superiors cylindrical, thickened at the apex, with about seven small denticles below. Inferiors two-thirds as long, the apex with a shallow angular notch. Genital hamules bifid, the anterior branch slender, recurved, the posterior shorter, thicker, armed with bristles.

Female.—Differs from the male by the entirely black labium and labrum, the yellow thorax, the yellow spots on segments 5—7 of the abdomen, and the yellow surrounding the fuscous area of the wings. Like the male the triangular anal spot is emarginate just below the median space. The abdomen has the venter pruinose, while on the male the blue extends over the dorsum also to about the eighth segment. Vulvar lamina short, widely separated by a quadrangular notch. There seems to be some variety in regard to the vulvar scale. A female from Divide, Wis., has the laminæ approximated, and the round lobes widely divergent.

Life Zone: Boreal. Possibly also Transition.

Wisconsin: Vilas Co., Divide, June 24-30, 1907.

Time and Habitat—June to August along marshy shores of lakes.

Leucorhinia proxima Hagen.

Because of the remarkable similarity of the fauna of the White Mountains of New Hahpshire to that of Northern Wisconsin, as mentioned before in this paper, I feel justified in including this in the list of our Wisconsin species, as it is quite probable that it occurs within the borders of the state. The species is distinguished by the markings stated in the table. The male has the anterior branch of the genital hamule bent strongly backward, the posterior is curved inward, both branches are without bristles. The vulvar lamina of the female consist of two very short, approximated tubercules. It is possible that the one female *glacialis* referred to in the description of that species really belongs to *proxima*, but this I doubt, for the markings of the abdomen are decidedly different.

Leucorhinia intacta Hagen, Syn. Neur. N. Am., p. 179, 1861; Hagen, Trans. Am. Ent. Soc., 17, p. 235, 1890; Needham, Bull. 47, N. Y. State Mus., p. 517, 1901 (Bibliography & Desc. of nymph); Needham, Proc. U. S. Nat. Mus. 26, p. 763, 1903 (Venation).

Abd. male 20—24, female 19—21; h. w. male 25—28, female 24—26.

Male.—Black, marked with yellow. Labium black, sometimes with a yellowish brown spot at the sides, labrum creamy white, face milky white. Thorax yellowish brown, an irregular mid-dorsal stripe divided by a yellow carina, antehumeral, and the lateral sutures, black. Legs black. Wings hyaline, nervure black, stigma fuscous, costa brown. Abdomen black, the first segments chiefly yellow or orange, becoming blackened in older specimens, dorsal marks at the base of 4—7, obsolete in adults, but the round spot on 7 is always prominent and of a bright red or orange. Appendages black, the superiors cylindrical, the inferiors shorter, bifurcate.

Female.—Usually greenish yellow or bright orange, rarely black like the male. The labrum black only in the middle, the labium yellow, face whitish. Thorax brighter yellow than the male, the black markings more regular. The wings with the fuscous spots of the base surrounded by yellow, nervure fuscous. Abdomen with segments 1—3 largely yellow or orange, 4—7 with dorsal hastate spots. Vulvar lamina short, the two lobes widely separated, slender, the apices acute.

Life Zone: Boreal and Transition. Also found in parts of the Upper Austral.

Wisconsin: Dane Co., June 1890, May 25, 1902; Milwaukee Co., June 14, July 20, 1903; June 8-18, 1906; Door Co., Jacksonport, June 26, 1905.

Time and Habitat—Lakes and marshes June to July.

PACHYDIPLAX Brauer, Verh. Zool. Bot. Gesellsch. Wien, 18, p. 368, 722, 1868; Needham, Proc. U. S. Nat. Mus. 26, p. 716, 726, 727, 1903 (Venation).

A genus of a single species possessing in part the attributes of *Leucorhinia,* such as the white face. It differs, however, in other respects, the longer stigma of the wings, and the base of the wings free of black markings.

Pachydiplax longipennis Burmeister, Handbuch der Ent. 2, p. 850, 1839; Needham, Proc. U. S. Nat. Mus. 26, 763, 1903 (Venation).

Abd. male 24—26, female 23—25; h. w. male 29—30, female 31.

Male.—Mouths parts creamy white, face milk-white. Frons above and vertex steel blue. Thorax fuscous, antehumerals, humerals and three lateral stripes olive. Legs black, fore femora green beneath. Wings hyaline, nervure black, pterostigma fuscous, costa black. Wings yellow at base, the hind wings with a larger area of darker yellow at the anal margin. Hind wings of other specimens with a fuscous streak in the sub-costal and median spaces. Abdomen black, a yellow or green stripe on each side of the dorsum of 2—7, sides 1—3 largely yellow, 4—5 with a basal streak. Appendages black. Adult males usually become pruinose between the wings on the sutures, on the dorsum of the abdomen to the fifth segment inclusive and on the venter to the apex. Such specimens may also have the postnodal area of the wings dusky.

Female.—Similar to the fully colored male. Rarely pruinose. The females have less yellow at the base of the wings and no basal fuscous streaks. The vulvar lamina consist of two short, rounded, widely divergent lobes.

Life Zone: Upper and Lower Austral.

Wisconsin: Milwaukee river, June 1899; July 6, Aug. 1, 1900; July 7, Aug. 10, 1903.

Time and Habitat—Lakes and marshes May to August.

MESOTHEMIS Hagen, Syn. Neur. N. Am., p. 170, 1861; Needham, Proc. U. S. Nat. Mus. 26, p. 718, 719, 1903 (Venation).

Two species are referred to this genus.

1. Males 2
   Females 3
2. Superior appendages yellow ..... **simplicicollis**
   Superior appendages black ..... **collocata**
3. Apical black spots on segments 4—10 linear, or wanting.. **collocata**
   Apical black spots on segments 4—10 quadrangular.. **simplicicollis**

Mesothemis simplicicollis Say, Acad. Nat. Sci. Phila. 8, p. 28, 1839; Hagen, Syn. Neur. N. Am., p. 170, 1861; Needham, Bull. 47, N. Y. State Mus., p. 527, 1901 (Bibliography & desc. of nymph); Needham, Proc. U. S. Nat. Mus. 26, p. 763, 1903 (Venation).

Abd. male 29—32, female 27—32; h. w. male 32—34, female 31—35.

Male.—Olive or green, marked with black. Face olive, thorax of the same shade, the lateral sutures with isolated black or brown marks. Legs black, fore femora green beneath, hind femora with six and tibiæ with about ten long spines laid in two rows. Wings hyaline, clear, stigma light brown, costa olive. Abdomen olive or greenish yellow, all the sutures ringed with black, black spots on the apical half of segments 4—9. This description applies to young males only. As the imagoes grow older the yellow of the abdomen is overshadowed with black beginning with the apical segments. Full grown specimens become blue pruinose over the whole body, except for the apical segments of the abdomen which remain black and the yellow appendages.

Female.—Fore femora entirely olive or yellow and with an external black stripe. All other femora olive externally. Abdomen with more yellow. Vulvar lamina triangular, erect, seen as a nearly perpendicular process from the venter.

Life Zone: Upper and Lower Austral. Also in tropical regions.

Wisconsin: Dane Co., July 10, 1901, Aug. 20, 1900; Town Franklin and Milwaukee river, July 17, 1902, Aug. 10, 1903.

Time and Habitat—June to September in open places along water.

MICRATHYRIA Kirby, Trans. Zool. Soc. London, 12, p. 303, 1889.

This genus includes five or six species, of which a single one is found outside of the tropical zones. *Micrathyria berenice* has been taken in Austral regions, chiefly along the Atlantic coast, and but rarely westward from the ocean strip. The imago resembles the preceding species, the adults are black or pruionse, and if not, the markings are yellowish brown on a black background.

LADONA Needham, Can. Ent. 29, p. 144-146, 1897.

Three species are referred to this genus by Prof. Needham. The genus *Ladona* was separated from *Libellula* and erected with *exusta* as the type. *Deplanata* belongs to the southern fauna, the

two other species have been taken in the state. The genus differs from *Mesothemis* by the stouter body and the dilated basal segments of the abdomen, from *Libellula* by the short stigma and other characters mentioned in the table.

1. Dorsum of thorax with two black humerals; anal fuscous spot not including the triangle.....**julia**
   Dorsum of thorax with two white antehumerals; anal fuscous spot including the triangle.....**exusta**

Ladona julia Uhler, Acad. Nat. Sci. Phila., p. 88, 1857; Hagen, Syn. Neur. N. Am., p. 153, 1861; Needham, Bull. 47, N. Y. State Mus., p. 530, 1901 (Bibliography & desc. of nymph).

Abd. male and female 22; h. w. male 33—34, female 33.

Male.—Frons and mouth-parts bright yellow. Thorax brown, two black humeral stripes preceded each by a white antehumeral. Legs dark brown, all femora luteous. Wings hyaline, nervure, costa, and stigma brown, fore wings with two streaks in the basal and sub-costal space, hind wings with yellow between the streaks and a triangular anal spot. Abdomen with the basal segments dilated, largely yellow, a dorsal spot on each side of the mid-dorsal carina on each segment. Older specimens have hardly any markings, becoming pruinose on the thorax and the four basal segments of the abdomen. Appendages yellow.

Female.—The face without yellow. Thorax above whitish to the humerals. Abdomen with yellow, blackening with age, rarely pruinose.

Life Zone: Transition and Upper Austral.

Wisconsin: Milwaukee Co., June 1900. "Inhabits Wisconsin" Hagen.

Time and Habitat—June and July about marshy ponds and lakes.

Ladona exusta Say, Journ. Ac. Sci. Phila., 8, p. 29, 1839; Hagen, Syn. Neur. N. Am., p. 155, 1861; Needham, Can. Ent. 29, p. 146, 1897; Needham, Bull. 47, N. Y. State Mus., p. 529, 1901 (Discussion of characters).

Abd. male 25, female 23; h. w. male 31—33, female 30—31.

Male.—Dark brown. Similar to the preceding species. Thorax brown, two antehumerals of white. Legs brown, the femora lighter. Wings hyaline, nervure black, stigma and costa brown, fuscous streaks in the sub-costal and basal space, hind wing the anal triangular spot covering the triangle. Some yellow about the streaks. Abdomen with a dorsal band of black and lateral spots, disappearing in adults. Appendages yellow. The anterior branch of the genital hamule, according to Prof. Needham, is bent toward the rear, on line with the abdomen, not sideways as *julia*.

Female.—Similar. More yellow on the abdomen.

Life Zone: Transition and Upper Austral.

Wisconsin: "Racine" (Hagen); Dane Co., June 1890.

Time and Habitat—Lakes and ponds in June and July.

LIBELLULA Linne, Syst. Nat. 1, p. 543, 1758; Needham, Proc. U. S. Nat. Mus. 26, p. 721, 742, 1903 (Venation).

The present genus contains many of our finest and most daring dragon-flies. From early June to late September they can be seen near the reeds and bushes of lake shores and rivers, or in moist woods, flying along with a jaunty swaggering air, or dart-

ing with flashy speed after a prospective victim. They are a fearless tribe; *L. pulchella* especially is very reckless, not in the least afraid of human beings and fairly tempting the collector by its audacity.

1. Wings without a nodal spot 2
   Wings with a small nodal spot on the outer side 10
   Wings with a large nodal spot surrounding the nodus 12
2. Wings with a broad basal band 3
   Wings with basal streaks only 4
3. Front brown, or black banded with brown ..... **basalis**
   Front entirely black ..... **odiosa**
4. Stigma bicolored 5
   Stigma uniformly colored 7
5. Stigma yellow, fuscous at outer end 6
   Stigma white, dark brown at the outer end ..... **cyanea**
6. A yellow spot on the vertex; sub-costal space faintly yellow or not ..... **comanche***
   No yellow spot on vertex; sub-costal space distinctly yellow ..... **flavida***
7. Stigma long 8
   Stigma short, fulvous ..... **saturata**
8. Stigma black 9
   Stigma red or yellow ..... **auripennis**
9. Apices of wings infuscated ..... **incesta**
   Apices of wings clear ..... **composita**
10. Wings with basal streak and an anal triangular patch, black 11
    Wings without a basal streak and an anal triangular patch ..... **vibrans**
11. Costal area filled with yellow ..... **quadrimaculata**
    Costal area clear, spots alternating with white ..... **nodisticta**
12. Spots on all wings dark brown, or fuscous, no anal triangular patch 13
    Spots on all wings fulvous, costal area filled with yellow, an anal triangular patch ..... **semifasciata**
13. Apices of all wings infuscated ..... **pulchella**
    Apices of all wings clear ..... **forensis**

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*) To make clear the specific validity of *L. flavida* Hagen, *flavida* Rambur, *plumbea* Uhler, *cyanea* Fabricius and *quadrupla* Say, Prof. Calvert undertook the trouble of examining the types of the different species and of otherwise studying them thoroughly. (Ent. News, Vol. 18, p. 201-204, 1907). The results, it may be said, are final. After thorough investigation Prof. Calvert concluded that, first, *flavida* Hagen was a valid species, and, secondly, *flavida* Rambur was identical with *plumbea* Uhler, and also *cyanea* Fabr. with *quadrupla* Say. Thus we have three species: *flavida* Hagen, *flavida* Rambur *(plumbea* Uhler), and *cyanea* Fabr. *(quadrupla* Say.) The second species, hitherto called *plumbea* Uhler had to receive the name of *flavida* Ramb. because of the priority of the latter and Prof. Calvert proposed the name *comanche* for *flavida* Hagen. Thus the final result is:

comanche Calvert = *flavida* Hagen.
flavida Rambur = *plumbea* Uhler.
cyanea Fabr. = *quadrupla* Say.

Libellula basalis Say, Journ. Acad. Nat. Sci. Phila. 8, p. 23, 1839; Needham, Bull. 47, N. Y. State Mus., p. 532, 1901 (Biblography & desc. of nymph).

Abd. male 28—32, female 28; h. w. male 39—42, female 37—29.

Male.—Color dark brown. Face black, a brown band below the frons. Thorax reddish, lighter at the mid-dorsal carina, a black humeral and lateral irregular marks on the sutures. Sides tinged with yellow. Legs black. Wings with the basal half or third fuscous, lighter at the base, milk-white beyond the fuscous area to the nodus. Stigma and costa black. Abdomen with a black mid-dorsal band flanked on each side by a yellow stripe which is blackened in older specimens.

Female.—Face light brown. Thorax brown above, a mid-dorsal stripe of yellow, humerals and lateral sutures irregularly marked with fuscous. Sides largely yellow. Legs dark brown, fore femora yellow beneath. Wings with a smaller fuscous area than the male, the apices of all wings infuscated. No white area beyond the fuscous. Abdomen flattened, dilated, yellow, a fuscous mid-dorsal stripe flanked by yellow stripes which in turn are bounded by fuscous stripes.

Life Zone: Transition and Upper Austral.

Wisconsin: Waukesha Co., Nagowicka Lake, June 1898; Milwaukee Co., July 1, 1900, July 10, Aug. 10, 1903; Dane Co., June 7, 1900; June 1890; Washington Co., Cedar Lake, Aug. 15, 1906.

Time and Habitat—Lake shores June to September.

Libellula incesta Hagen; Syn. Neur. N. Am., p. 185, 1861; Needham, Bull. 47, N. Y. State Mus., p. 533, 1901 (Bibliography).

Abd. male 36—39, female 32—34; h. w. male 40—44, female 39—40.

Male.—Color reddish brown, overlaid with purple in older specimens. Face black, a luteous band below the 20, mouth parts yellow. Thorax with a light mid-dorsal stripe, sides largely yellow, irregularly marked with black near the legs. Legs black, coxa and trochanters yellowish, anterior femora yellow beneath. Wings hyaline, clear, the apices infuscated, nervure and costa black, stigma dark brown. The nodus of the wings faintly tinged with fuscous. Abdomen with the basal segments largely brown or luteous, a mid-dorsal band of black flanked by two yellow stripes. The appendages black. These markings disappear in older specimens, which become pruinose.

Female.—Usually with more yellow than the male, the markings at least translucent through the black of age. Rarely pruinose.

Life Zone: Occurs everywhere in the Transition and Austral areas.

Wisconsin: Milwaukee Co., June 1900.

Time and Habitat—Lake shores June to September.

Libellula vibrans Fabricius, Ent. Syst. 2, p. 380, 1793; Needham, Bull. 47, N. Y. State Mus., p. 533, 1901 (Bibliography).

Abd. male 42, female 41; h. w. male 48, female 49—50.

Male.—Colors yellow and brown. Face olive, the mouth parts yellow, margined with black. Thorax above brown, black at the anterior edge, a mid-dorsal stripe of yellow, a black band on the upper half of the humeral suture, sides yellow, black near the legs. Legs black, the femora brown at the base. Wings hyaline, nervure, costa and stigma black, the sub-costal space up to the third antecubital, a small spot on the outer side of the nodus and the extreme apex of the

wings, fuscous. Abdomen with a mid-dorsal stripe of black, sides yellow. Appendages brown. Adults have the markings darkened with age, obsolete, or become pruinose.

Female.—The female retains most of the yellow markings even when old, the abdomen with more yellow, the infuscated area at the apices of the wings larger, enveloping the farther end of the stigma.

Life Zone: Upper and Lower Austral.

Wisconsin: Milwaukee Co., June 1900.

Time and Habitat—Lakes and ponds June to September.

Libellula quadrimaculata Linné, Syst. Nat. 1, p. 543, 1759; Hagen, Syn. Neur. N. Am., p. 150, 1861; Needham, Bull. 47, N. Y. State Mus., p. 534, 1901 (Bibliography & desc. of nymph).

Abdomen, male and female 29—20; h. w. male 34—37, female 36.

Male.—Face olive, mouth parts yellow margined with black. Prothorax black, thorax olive or yellowish, covered with pile, the humeral and second lateral suture marked irregularly with black. Nervure and stigma black, costa lighter, costal area more or less yellow, the yellow more distinct toward the base. Fore wings with a fuscous dot at the outer side of the nodus, hind wings with an additional triangular spot from the cubital space to half of the anal margin. At its outer end the spot sends off a branch to fill the triangle and the supra-triangular space. Sometimes, but this rarely, there is a smoky patch below the stigma. Abdomen conical, the basal segments dilated, the apical segments very narrow. The color is olive or yellowish, a black band on 6—10, increasing in extent toward the apex, the sides with spots of bright yellow. Appendages black. This is the most robust of our species, stout in body, small of wing.

Female.—Differs from the male by the stouter body and wider wings.

Life Zone: Transition and Upper Austral.

Wisconsin: Dane Co.: June 1890; June 2, 1900; Milwaukee Co.: June 4, July, 1899; Aug. 1, 1900; May 22—June 21, 1902; June 4, July 27, 1903; July 1907; Door Co.: Jacksonport: June 26, 1905; Vilas Co.: Divide, June 24-30, 1907.

Time and Habitat—Lakes, rivers and moist woods May to August.

Libellula semifasciata Burmeister, Handbuch der Ent., 2, p. 862, 1839; Hagen, Syn. Neur. N. Am., p. 151, 1861; Needham, Bull. 47, N. Y. Mus., p. 535, 1901 (Bibliography).

Abd. male 26—30, female 28; h. w. male 33—37, female 35—36.

Male.—Yellowish, marked with white and black, older specimens reddish. Face of tenerals yellow, adults blood-red. Thorax yellowish brown, sides with two white stripes. Legs brown, femora green beneath. Wings hyaline, of a yellow tinge, nervure and stigma red, the base of the wings, a spot surrounding the nodus, the apices of the wings including the stigma reddish brown. In addition the hind wings have a vague triangular patch at the anal margin separated from the basal streak. Abdomen yellowish, black on the dorsum of the apical segments, banded on the sides by yellow spots, which become red in older specimens. Appendages yellow.

Female.—Differs by the wider abdomen and the transparent apices of the wings. The only female I have seen has the markings of the wings of a decided brown color, darker than the male. At the stigma

a brown band crosses the wing, while the extreme apices are hyaline and yellow. Also the wings are wider than those of the male.

Life Zone: Transition and Upper Austral.

Wisconsin: Milwaukee Co., July 7, 1902; July 20, 1903.

Time and Habitat—May to early August near creeks and roadsides and in moist woods.

Libellula pulchella Drury, Ill. Exot. 1, p. 115, 1770; Hagen, Syn. Neur. N. Am., p. 153, 1861; Needham, Bull. 47, N. Y. State Mus. 26, p. 763, 536, 1901 (Bibliography & desc. of nymph); Needham Proc. U. S. Nat. Mus. 26, p. 763, 1903 (Venation).

Abd. male 32—35, female 32—33; h. w. male 42—45, female 42—43.

Male.—Brown, yellow and fuscous. Face light brown to black, a band below the frons lighter. Thorax above pale, humerals broad, fuscous, two lateral stripes of bright yellow, reduced to inferior spots in older individuals. Legs black, the base of the femora lighter. Wings hyaline, nervure brown or black, stigma black, costa lighter. All wings with a basal streak, a large nodal spot, and infuscated apices, black to fuscous, alternating with milk-white spots. The hind wings also with a white anal spot. In the fore wings the basal streak is bounded by the sub-costal vein above, by the cubital below; on the outer side the fuscous area extends to a little beyond the triangle, which is usually fuscous in the upper half. The nodal spot reaches across two thirds of the width of the wings. The hind wings differ slightly, the basal streak being broader at the base. Abdomen light brown, a yellow stripe on each side of the dorsum. Appendages dark brown to black. Adults are blackened or pruinose, the markings obscured.

Female.—Differs from the male by the more inflated abdomen and the absence of the white spots on the wings.

Life Zone: Transition and Austral zones. Distribution encompassing entire North America.

Wisconsin: Dane Co., June 1890; June 7, 1901; Milwaukee Co., June 4, 1899; July 1-10, 1900; July 1-8, 1901; July 10, Sept. 30, 1903; Aug. 1-15, 1907. This is our commonest Libellula, and occurs practically in all parts of the State.

Time and Habitat—June to August along rivers, creeks and roadsides, in woods, fields and open places.

PLATHEMIS Hagen, Syn. Neur. N. Am., p. 149, 1861.

A single species is known.

Plathemis lydia Drury, Ill. Exot. Ent. 1, p. 112, 1770; Hagen. Syn. Neur. N. Am., p. 149, 1861; Needham, Bull. 47, N. Y. State Mus., p. 536, 1901 (Bibliography & desc. of nymph).

Abd. male 27—28, female 25—26; h. w. male and female 33.

Male.—Color brown. Face brown, mouth parts lighter. Thorax above pale, some irregular humeral spots of brown, sides with two white stripes ending in bright yellow below. Wings hyaline, nervure, costa and stigma black. The fore wings with a fuscous basal streak bounded above and below by the sub-costal and cubital space, reaching to the base of the triangle, the latter clear. A broad fuscous band beginning a little distance before the nodus and extending to the middle of the stigma crossing the wing to the posterior margin. Hind wings similar, but the basal streak envelops the triangle and is followed by a milk-white anal spot. Apices of all wings clear. Legs brown, femora

lighter. Abdomen light brown or yellowish, oblique triangular spots on each side of the dorsum.

Female.—With similar body markings. Wings with the basal streaks like the male, leaving the triangle of the fore wing clear, and filling that of the hind wing. A large nodal spot and the apices of all wings fuscous. The imago in flight resembles puchella greatly, but is distinguished by the smaller size and the oblique white spots on the abdominal segments.

Life Zone: Found everywhere in the Transition and Austral areas.

Wisconsin: Dane Co., June 1890; July 10, 1901; Milwaukee Co., Aug. 12, 1898; June 10, 1899; July 1-6, 1900; July 1, 1900; June 15, 1902; June 7, July 10, 1903. Very common.

Time and Habitat—Ponds, marshy woods and open places from May to August.

TRAMEA Hagen, Syn. Neur. N. Am., p. 143, 1861; Needham, Proc. U. S. Nat. Mus. 26, p. 728, 742, 752, 1903 (Venation).

A genus of over thirty species, of which four occur in the Austral life areas. The imagoes are strong and rapid fliers, due to the large expanse of wing. They are distinguished from all other Odonata by the very broad hind wings, from one-third to nearly one-half as wide as long at the base, and the large fuscous or black spot at the anal angle. Wherever they occur they are not at all rare, but are very difficult to capture because of their great wariness and the rapidity of their flight. In their habits they are much like other Libellulinæ, showing no preference for any particular habitage, but frequenting lakes and ponds with the same fond assurance that carries them triumphantly over fields and along wooded roadsides.

1. Color of body and anal blotch brown or reddish..... 2
   Color of body and blotch black; stigma black.....**lacerata**
2. Anal blotch not attaining the costa, divided by the clear basilar space; stigma fuscous..... 3
   Anal blotch entire, reaching the costa; stigma red or orange .....**carolina**
3. Anal spot yellowish; stigma small.....**chinensis**
   Anal spot fuscous, stigma long.....**onusta**

Tramea lacerata Hagen, Syn. Neur. N. Am., p. 145, 1861; Needham, Bull. 47, N. Y. State Mus., p. 539, 1901 (Bibliography & desc. of nymph).

Abd. male 35—36, female 35—37; h. w. male 45—47, female 44; width at base 19.

Male.—Adults black mixed with brown. Face brown, banded with black. Frons above and vertex metallic dark blue or purple. Thorax black above, lighter on the sides, lateral sutures marked with black. Legs black. Wings hyaline, nervure black, brown toward the costa, stigma short, blackish. Fore wings with a short streak and a small triangular spot at the extreme base. Hind wings widening toward the base, a large spot at the basal fourth black or fuscous, leaving the basilar space clear, and with a deep incision at the middle of the anal margin. Abdomen blackish brown, darkest at the apices of the seg-

ments, appendages black; the superiors as long as the two apical segments, cylindrical, the apical half denticulated inferiorily. Hamule longer than the genital lobe.

Female.—Similar. The face yellowish, the frons above metallic blue, the vertex yellow. Femora brown, abdomen with yellow dorsal spots, vulvar lamina bilobed, the lobes widening apically, one half the length of 9, appendages as long as 8 and 9.

Life Zone: Upper and Lower Austral.

Wisconsin: Milwaukee Co., June 1900.

Time and Habitat—June to September. About ponds, lakes and open places.

Tramea carolina Linneé, Cent. Ins., p. 28, 1763; Hagen, Syn. Neur. N. Am., p. 143, 1861; Needham, Bull. 47, N. Y. State Mus., p. 538, 1901 (Bibliography & desc. of nymph).

Abd. male 33, female 35; h. w. male 43—45, female 43; width at base 17—18.

Male.—Color brown. Face yellow, frons above and vertex metallic blue. Thorax legs, abdomen and anal spot on the wings brown. The species has some resemblance to *lacerata*. A marked distinctive feature is that the hyaline anal incision into the brown spot on the hind wings enters only one-fourth of the width of the brown band, not two-thirds as *lacerata*. The latter moreover has the outer side of the fuscous area twice strongly angulated, the upper, smaller angulation on the upper sector of the triangle, the other larger angle on the cubital vein. *Carolina* is angulated strongly only on the upper sector of the triangle. The stigma is shorter, yellow or orange, the veins toward the costa reddish yellow. Superior appendages longer than 9 and 10, the genital lobe and hamule equal in length.

Female.—Similar. The appendages longer than 8 and 9, vulvar lamina a triffle shorter than 9.

Life Zone: Upper and Lower Austral.

Wisconsin: Milwaukee Co., May 22, 1902; Aug. 1, 1903.

Time and Habitat—May to September about lakes, ponds, in woods and open places.

PANTALA Hagen, Syn. Neur. N. Am., p. 141, 1861; Needham, Proc. U. S. Nat. Mus. 26, p. 721, 1903 (Venation).

Like their allies of the preceding genus the two species of *Pantala* are restive fliers and not easily captured, winging themselves along at great speed, often at a considerable distance above the ground. They are not discriminative in choice of their surroundings, imitating their relatives in this respect also. From *Tramea* they are distinguished by the clear wings of one species and the diminutive anal spot of the other. The imagoes are less abundant than their relatives of *Tramea*.

1. Anal margin flavescent, no anal spot.....**flavenscens**
   Anal margin with a distinct fuscous spot.....**hymenea**

Pantala flavenscens Fabricius, Ent. Syst. Suppl., p. 285, 1798; Hagen, Syn. Neur. N. Am., p. 142, 1861; Needham, Bull. 47, N. Y. State Msu., p. 539, 1901 (Bibliography & desc. of nymph); Needham, Proc. U. S. Nat. Mus. 26, p. 764, 1903 (Venation).

Abd. male 32—33, female 35; h. w. male 41—42, female 42, width at base 16—17.

Male.—Colors yellow and olive, markings black. Face bright yellow, adults suffused with red. Thorax olive, covered with short hair. Legs black, anterior femora yellow beneath. Wings hyaline, nervure reddish, the costa and stigma bright red. Extreme apices of all wings and the anal margin of the hind wings flavescent. Abdomen olive in tenerals, adults bright yellow basally, darkened on the apical segments, a faint black line on the dorsum of 1—4, developed into broader angular spots on 5—10. Appendages black, yellow at the base.

Female.—Face olive, wings with the apices hardly tinged, stigma and costa yellow.

Life Zone: Upper and Lower Austral.

Wisconsin: Milwaukee Co., July 1899; Aug. 24, 1904.

Time and Habitat—July to September near rivers, lakes, ponds, in woods and open places. A cosmopolite.

Pantala hymenea Say, Journ. Ac. Sci. Phila. 8, p. 18, 1839; Hagen, Syn. Neur. N. Am., p. 142, 1861; Calvert, Proc. Cal. Ac. Sci. 4, p. 512, 1895; Kellicott, Dragon-flies of Ohio, p. 93, 1899; Williamson, Dragonflies of Indiana, p. 315, 1900.

Abd. male 32, female 31; h. w. male 42, female 41—42.

Male.—Color reddish brown. Front red, mouth parts fuscous. Thorax brown, legs fuscous, all femora yellow externally, anterior tibæ with an external line of yellow. Wings hyaline, nervure brown, costa and stigma brown. Hind wings with a round anal spot fuscous. Abdomen brown, the apical segments with angular dorsal spots fuscous. Appendages yellowish.

Female.—Similar. Stigma of the wings lighter.

Life Zone: Upper and Lower Austral.

Wisconsin: Milwaukee Co., July 12, 1898.

Time and Habitat—Fields, woods, lakes, July to September.

AN ADDITION TO THE AVIFAUNA OF WISCONSIN.

By Henry L. Ward.

The Dovekie, *Alle alle*, is properly a bird of the Atlantic coast, breeding from latitude 69° northward; in winter coming south, occasionally to Long Island and New Jersey. It has been reported from Pennsylvania and Virginia on the south and from the Detroit River, Michigan, on the west as accidental occurrences.

Early in February last Dr. C. W. Beemer, of Port Washington, Wis., informed me that he had a devekie which was killed on Jan. 11th, 1908 by some boys hunting along the ice fringe of Lake Michigan at that point, and who had brought the bird to him for determination. Dr. Beemer had given it to a local taxidermist to be mounted. A few weeks later he presented the specimen to the Public Museum of the City of Milwaukee.

The sex was not determined by the taxidermist. The specimen appears to be an adult in ordinary winter plumage.

While this accidental occurrence increases the known western range of this species and adds one more to the birds recorded from Wisconsin yet it has no special significance. However, it adds another to our list of such freaks, showing how far a bird may wander from its proper habitat, as instanced previously by the Man-o'-War Bird taken in 1880 in the Milwaukee River near the city and now preserved in this museum, and of Clarke's Nutcracker taken on the edge of the city in 1875 and preserved for some years by Dr. Peckham. In these instances we have birds belonging to the Atlantic and to the Pacific coast regions and from the tropics meeting at this locality.

INDEX TO REVIEW OF DRAGON-FLIES.

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"The Wisconsin Archeologist," Vol. I, No. 1, Oct., 1901; Vol. I, No. 2, Jan., 1902; Vol. I, No. 3, Apr., 1902; Vol. I, No. 4, July, 1902; Vol. II, No. 1, Oct., 1902, each..... 25 cents

This publication is now issued by the Wisconsin Archeological Society of Milwaukee, from whom the later volumes may be obtained.

Vol. 6 OCTOBER, 1908 Nos. 3—4

BULLETIN

OF THE

Wisconsin Natural History Society

PUBLISHED WITH THE
COOPERATION OF THE

Public Museum of the City of Milwaukee

EDITED BY CHARLES T. BRUES

CONTENTS:

MILWAUKEE, WISCONSIN.
THE EDW. KEOGH PRESS.

Entered as second-class matter, Oct. 24, 1906, at the post-office, Milwaukee, Wis., under Act of Congress of July 16, 1894. (Issued quarterly.)

The Wisconsin Natural History Society,

MILWAUKEE, WISCONSIN.

ORGANIZED MAY 6, 1857.

OFFICERS AND DIRECTORS.

Edgar E. Teller, President.....165 27th Street, Milwaukee.
Henry L. Ward, Vice-President.....Public Museum, Milwaukee.
Charles T. Brues, General Secretary.....Public Museum, Milwaukee.
William Finger, Treasurer.....297 12th Street, Milwaukee.
Sigmund Graenicher.....551 7th Street, Milwaukee.

PUBLISHING COMMITTEE.

Henry L. Ward, **Geo. W. Peckham,**
Chas. E. Monroe.

MEETINGS.

Regular meetings are held on the last Thursday of each month, except July and August, in the trustees' room in the Public Museum Building, Milwaukee, and meetings of the combined sections on the second Thursday of each month, at the same place.

PUBLICATION.

The "Bulletin of the Wisconsin Natural History Society."

MEMBERSHIP DUES.

Active Members, $3.00 per annum; Corresponding Members, $2.00 per annum; Life Members, one payment of fifty dollars.

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Published with the cooperation of the

Public Museum of the City of Milwaukee

VOLUME VI

(NEW SERIES)

WITH NINE PLATES

EDITED BY CHARLES T. BRUES

MILWAUKEE, WISCONSIN

1908

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New species and new names are indicated by an asterisk.

BULLETIN

OF THE

WISCONSIN NATURAL HISTORY SOCIETY.

Vol. 6. **OCTOBER, 1908** **Nos. 3 and 4**

PROCEEDINGS.

Milwaukee, April 9, 1908.

Meeting of the combined sections.

President Teller in the chair and ten members present.

The minutes of the last section meeting were read and approved.

Mr. Ward mentioned that during the winter a Dovekie (*Alle alle*) had been taken at Port Washington, which was, he believed, the most western record of the bird in the United States and the first record for Wisconsin. The bird had been presented to and was now in the Public Museum. The occurence was of course accidental, as the species is normally confined to the Atlantic sea-coast. A note regarding the occurrence has appeard in the Auk.

M. Finger presented for discussion the suggestion that the society undertake to form a list of the plants of the state. The feasibility of obtaining the requisite data was discussed by Messrs. Graenicher, Russel, Ogden and Ward. The question was asked whether the museum would afford facilities for the storage and study of these specimens, it being understood that those acquired by the society should become the property of the museum. Mr. Ward replied that while such matters rested with the trustees he felt assured that the museum would afford all possible facilities for such work as it would be a direct benefit to it.

It was moved by Dr. Ogden and seconded by Mr. Monroe that the sections recommend to the next meeting that the president appoint a committee of four with power to add to their numbers, to take charge of and organize the work in connection with preparing a check list of the flora of Wisconsin. The motion was carried. After further informal discussion the meeting adjourned.

Milwaukee, April 30, 1908.

Regular monthly meeting of the society.

President Teller in the chair and fifty persons present.

The minutes of the regular March meeting and those of the section meeting in April were read and approved. There being no opposition, the chair appointed Messrs. Finger, Monroe, Russel, and Graenicher as a committee to take charge of and organize the work in connection with preparing a check list of the flora of Wisconsin in accordance with the recommendations of the sections.

The name of Dr. Rudolph C. Gruettner, 271, 22nd Ave., City was presented by Dr. Barth for membership and subsequently was favorably acted upon by the directors.

President Teller then introduced the speaker of the evening, Professor W. L. Tower of the University of Chicago, who spoke on "Variation, the Basic Phenomenon in Organic Evolution." Professor Tower gave a short sketch of the history of evolution, the attitude of religion and philosophy to this doctrine and its passage from a deductive to an inductive study. Variation was early recognized as being the important factor in evolution and Bacon first recognized that there were two kinds of variation. an ordinary or fluctuating one and an extreme or saltatory variation producing mutants.

The speaker made the distinction between somatic and germinal variation or that which is tranmitted to offspring. Under this latter class came certain experiments of his in which he found in breeding 200,000 or more beetles of the genus *Leptinotarsus* that the offspring belonged to one series only and not to a Mendelian group; and another in which A crossed with C produced only A and C or A or C only. He called attention to the fact that what sometimes appears to be the inheritance of disease is in reality due to intrauterine infection.

He explained the peculiarities of oviposition of *Leptinotarsus* in lying a mass of eggs at one time, followed by a period during which no eggs are laid, a phenomenon repeated several times and which is convenient for the experimentor as it enables him to select any one or more of these egg-lying periods for subjecting the female to stimuli of temperature and humidity, reserving the products of other periods as checks upon the results.

The beetles if subjected to stimuli of temperature and humidity at ordinary times develop certain definite characters that are not transmissible; but if these stimuli are applied at the time of the fertilization of the ova, the resulting variation is then inherited, continuing without change for many generations. The speaker referred to experiments made by MacDougal on plants. In these he injected salts of Zinc, Cal-

cium etc. and solutions of cane sugar directly into the ovaries of many kinds of plants before fertilization has taken place. Many of these die, but in others variations are produced even in the external characters of the seeds that they develop, and these plants when bred for four or five generations continue to exhibit the variations as first produced.

Professor Tower described various of his experiments, in one of which he removed one species from within a few feet of the sea-level in Vera Cruz to an altitude of 8500 feet, thereby producing various changes in appearance and habits. Crosses of the parent form with a certain third species produced hybrids of small size which lay few eggs and these produced a predominance of males. The new variety produced from the parent form by transplanting to an increased altitude when crossed with the same third species gave large offspring laying many eggs that develop about an equal number of males and females, continuing this for many generations, thus showing that the changed environment had produced an inheritable and transmissible effect. His experiments showed that temperature, moisture and atmospheric pressure were the most important factors in producing these changes. The speaker stated that the determination of the causes of variation will be the determination of the causes of evolution. Three large cases of mounted specimens of species of *Leptinotarsus* so arranged as to graphically illustrate the results produced by altered environment and by crosses were exhibited and explained by the speaker after which they were passed among the audience for examination.

After a five minute intermission for the withdrawal of non-members, the annual meeting was called with Mr. Teller in the chair. The report of the treasurer was read and after motion was received. The president announced that owing to the absence of the secretary, his report would necessarily be omitted and that next in order would be the election of officers. Mr. Russel moved that the acting secretary be instructed to cast one ballot for all the present officers. Dr. Peckham having seconded this motion, it was put and carried, whereupon the acting secretary cast one ballot for E. E. Teller, president, Henry L. Ward, vice president, William Finger, treasurer, Charles T. Brues, general secretary and Sigmund Graenicher director.

Upon motion the meeting adjourned.

Milwaukee, May 13, 1908.

Meeting of the combined sections.

President Teller in the chair and 12 members present.

The minutes of the last section meeting were read and approved.

Mr. Russel spoke on the classification of the genus *Antennaria.* He referred to the splitting up of the group into a considerable number of species of doubtful validity, many of which he considered must be surely rated as subspecies or varieties when the forms and their geographical distribution were better known. He exhibited fresh specimens of two of the more sharply defined types showing in detail the characters which are used for their separation.

Dr. Graenicher followed with a consideration of the insect visitors of the same plants in this vicinity and those observed in Europe. This was followed by a more general discussion of the types if insect visitors which pollinate various Compositae in our region.

Milwaukee, May 27, 1908.

Regular monthly meeting of the society.

President Teller in the chair and about 60 persons present.

The minutes of the last regular monthly meeting were read and approved.

The names of J. F. Wm. Inbusch, Henry A. Koch, Bernhard S. Scheftels, and Max Griebsch were proposed for membership and subsequently passed upon by the board of directors.

Mrs. H. A. J. Upham then read a paper on the geology and topography of the Dells of the Wisconsin River.

She described the topography of the country immediately surrounding this very interesting region and showed the relation of this driftless area to the surrounding glaciated country. The form of the two quartzite ranges near Kilbourn City and the way in which they have affected the drainage in the vicinity was next considered in addition to a description of several of the more interesting parts of the Dells proper. The second part of the paper was devoted to a discussion of the probable origin of the sandstone rocks, their partial metamorphosis into quartzite and subsequent weathering with final capping by more recent limestone and sandstone. The paper concluded with an explanation of the origin of this driftless area and the probable change in the course of the Wisconsin River due to the deposits of glacial drift in its former course.

The lecture was illustrated by a number of large photographs of the region.

Milwaukee, June 11, 1908.

Meeting of the combined sections.

President Teller in the chair and fifteen members present.

The minutes of the last section meeting were read and approved.

Dr. A. Ivans Comfort exhibited a number of articles made by the North American Plains Indians which he had accumulated many years ago while stationed at various military posts in the middle west. He related a number of his experiences as exemplifying certain traits of the Indians and spoke particularly of their verbal and sign languages.

Mr. Colles exhibited some specimens of rocks from southwestern Wisconsin near Prairie du Chien and referred to the stratigraphy of the vicinity. This led to a discussion and a comparison with the stratigraphy of the Milwaukee region in which Mr. Teller and several other members joined.

The meeting then adjourned.

Milwaukee, June 26, 1908.

Meeting of the combined sections.

President Teller in the chair and seven members present.

The minutes of the last regular monthly meeting were read and approved.

Mr. Russel exhibited two species of plants new to Milwaukee county.

Mr. Brues exhibited part of a collection of arctic plants from Grinnell Land, Lat. 79°, part of Ellesmere Island. With them Mr. Ward showed a series of photographs of the region and its Eskimo inhabitants. Some of the photographs showed some of the plants in bloom.

After a general examination and discussion of the plants, the meeting adjourned.

Milwaukee, July 9, 1908.

Meeting of the combined sections.

President Teller in the chair and 10 persons present.

Dr. Barth exhibited some Syrphid flies and Crabronidae, the latter selected to show the different groups into which they are divided according to Fox. He stated that about 20 species are found about Milwaukee. He described the making of their nests, manner of stinging their prey, laying of eggs, feeding of young, spinning of their cocoon and their metamorphoses.

He called attention to specimens of *Condidea lata* Coquillett, and *Spilomyia hamifera* Loew, which had not previously been reported from Milwaukee County.

Dr. Graenicher exhibited specimens of a Yellow Flax, *Linum sulcatum*, new to the flora of the county. He also reported having found *Aster Drummondi* blooming on July 1st, which from the condition of the flowers, he judged must have come out about June 25th, or about a month earlier than usual.

The meeting then adjourned.

Milwaukee, August 13, 1908.

Meeting of the combined sections.

Vice-president Ward in the chair and ten persons present.

Dr. Geo. P. Barth exhibited plaster casts of wasps nests he had made recently at Cedar Lake, Wis., and described the habits of some of the fossorial species shown. *Anacrabro ocellatus* which builds at the foot of a tuft of grass, a weed, stone, etc. in sand banks, preferably with sparse vegetation is unique in its digging methods. It flies along a sand bank in short arcs so as to strike the bank every few inches, and bite the ground, as if testing its workable quality. When it has found a suitable place, it sets to work, not in the usual way by picking out the earth grains, but by picking them up one at a time and flying with the load clutched between the forelegs and the depressed head to drop the load some ten inches away. Thus there is often a sand trail of such dropped particles leading towards the nest. It goes into its hole by diving into it on the wing, but usually has to make a few preliminary jerky dives as if to locate the hole it seeks to enter. Three casts of its irregular holes were shown also one cast of a hole of *Bembex spinolæ* whose general direction of the nest is 45° from the vertical; one of the great Golden Digger, *Proterosphex ichneumonea*, with its several cells leading off at right angles at or near the base of the main passage; and one of *Philanthus*, whose boring enters the bank directly.

Ichneumonea stores its nest with as many as 12 grasshoppers, in amplification of Dr. Peckham's published accounts. The finest dental plaster in twice its bulk of water was used these casts, and poured into holes of nests with a small bottle fitted with glass tubes like the chemist's wash bottle.

Mr. Ward exhibited some vegetable balls, probably the alga *Pithophora* rounded like flattened spheres, capsules and egg-shapes, formed apparently by wave action at Fox Lake, Wisconsin.

Mr. Burrill read a lecture entitled "The Home Making Work of the Federal Government," recently written by Mr. C. J. Blanchard of the U. S. Reclamation service and illustrated by about one hundred

slides beautifully colored, also loaned by the service. The subject matter reviewed the need of irrigation in the west, the government work to date, a description of the leading irrigation projects undertaken by the government, and the astonishing results in those regions already irrigated last year.

After discussion, the meeting adjourned.

Milwaukee, September 24, 1908.

Regular monthly meeting of the society.

President Teller in the chair and about fifty persons present.

The minutes of the last regular monthly meeting were read and approved.

President Teller mentioned the needs of the society in the direction of enlarging its membership list and asked that the meeting discuss the matter.

Dr. Barth moved that a committee be appointed to look into this matter, to prepare a circular letter and mail it to persons who might be prospective members, stating the aims, needs and privileges of the society. After some discussion the motion was carried and the chair appointed Messrs. Barth, Ward, and Russel to serve on this committee.

Dr. Barth then proposed the following resolution. "Be it resolved that a committee of three members be appointed by the chair to confer with the Board of Trustees of the Public Museum relative to contributing a sum of money to assist in defraying the expense of publishing the bulletin of the society. Mr. Russel moved that the resolution be adopted; seconded.

Mr. Ward said that he thought the Board of Trustees would be glad to confer with such a committee and that he thought they might quite probably regard favorably such an arrangement. After some further discussion the motion was passed.

The names of Mr. R. A. Muttkowski of the Public Museum and Dr. Oscar Chrysler of the National Soldiers' Home were proposed for membership and subsequently elected by the board of directors.

There being no further business Mr. Alfred C. Burrill gave an illustrated talk on the Indians of Our Southwest, at the same time calling attention to the kind of lantern slide collection which the Public Museum is organizing as a stock series for public lectures. He

showed views illustrating the manners, customs and rain worship of the Pueblo indians, the Apaches and neighboring tribes with a digression to the Huichol indians of Mexico. He combatted the common opinion that the indian is naturally lazy, showing the indians of these tribes to be very thrifty and hard workers; going "back to the blanket" did not betoken indolence, but rather the adaption of the white man's education to the indian customs and civilization.

The meeting then adjourned.

NOTES ON WISCONSIN MAMMALS.

By N. Hollister.

The following fragmentary notes on Wisconsin mammals are intended as supplementary to the excellent and conservative list recently published by Hartley H. T. Jackson.[1]

One of the important objects of such a paper as Jackson's preliminary list is to induce others to publish any additional information they may have, that it may become available to the local workers. In determining the geographic and zonal distribution of mammals it is important to have records from as many localities as possible, even for the most common and generally distributed species. Many previously unthought-of factors regulating the distribution of a form within the state may be disclosed by a carefully prepared map of the range of the species, based upon authentic records.

Thanks are due Dr. C. Hart Merriam, Chief of the Biological Survey, for permission to publish this paper and to include records of specimens in the Survey collection.

Didelphis virginiana Kerr.

Opossum.

At least three oppossums have been killed in Walworth County during the past fifteen years, two of which I saw in the flesh. A fine male, killed at Delavan, October 19, 1902, is in the collection of the Biological Survey.

Cervus canadensis Erxleben.

Canadian Wapiti.

Elk formerly ranged throughout southern as well as northern Wisconsin. Sections of antlers are still occasionally found in Walworth County, most frequently under marshy ground. A fine pair was taken from Delavan Lake some years ago.

Theodore Roosevelt says the elk disappeared from the region south of the Great Lakes and between the Alleghanies and the Mississippi River about the beginning of the nineteenth century

1) Bull. Wis. Nat. Hist. Soc., VI, 1-2, pp. 13-34, Apr., 1908.

but existed much longer in northern Wisconsin, northern Michigan, and Minnesota.[1] There are several reliable records for Illinois at about this period, and John Dean Caton states that the last account of their presence in northern Illinois known to him was in the year 1820 or thereabouts.[2] Dr. P. R. Hoy records their occurrence on the Hay River, Wisconsin, in 1863,[3] and there is no reason to doubt this statement as it is well known that the animals were not infrequently killed in both Michigan and Minnesota at a still later period.

Alce americanus (Clinton).
Eastern Moose.

I see no good reason for excluding the moose from a list of Wisconsin mammals. It is a well known fact that the species was formerly common in the northern part of the state, and it is not entirely an impossibility that a few will still be found there, as they are fairly plentiful in parts of Minnesota and have been killed within the past ten years in the upper peninsula of Michigan where they still occur in a number of counties. Hoy states that one was killed "near the line of the Wisconsin Central Railroad" in December, 1877.[4]

Bison bison (Linnæus).
American Buffalo.

I consider that the buffalo, like the elk and other exterminated species, is entitled to a place in a list of Wisconsin mammals. The former range has been carefully worked out and mapped by the historians of the species, notably Allen and Hornaday, and it is well known that it formerly ranged over much of the western half of the state. Furthermore, Wisconsin is now generally credited with the last buffalo east of the Mississippi River, near the St. Croix River in 1832 or 1833.[5]

Sciurus hudsonicus minnesota Allen.
Minnesota Red Squirrel.

A careful review of the red squirrels of this region proves the validity of this race, to which all the Wisconsin animals belong. True *hudsonicus* apparently does not occur on the south-

1) The Deer Family, p. 132, 1903.
2) The Antelope and Deer of America, p. 80, 1877.
3) Trans. Wis. Acad. Sciences, Arts, and Letters, V, p. 256, 1882.
4) Trans. Wis. Acad. Sciences, Arts, and Letters, V, p. 256, 1882.
5) Lapham, Trans. Wis. State Agric. Soc., 1852, p. 340, 1853; Hoy, Trans. Wis. Acad. Sciences, Arts, and Letters, V, p. 256, 1882; Hornaday, Report U. S. Nat. Mus., 1886-7, map, etc., 1889.

ern shore of Lake Superior, though it reaches northern Minnesota, as attested by a specimen from Two Harbors, north of Duluth. In this connection I have examined specimens from extreme northern Wisconsin, near the line of the upper peninsula of Michigan, the western and south-central part, and the extreme southeastern corner. A speciman from Hebron, Jefferson County, is the nearest approach to *Sciurus h. loquax* but from its large size and light color is easily referable to *minnesota,* the range of which form, as defined by Dr. Allen in his original description, extends to northern Indiana.[1]

Eutamias borealis neglectus Allen.
Lake Superior Chipmunk.

Although apparently restricted at the present time to the most northern counties this chipmunk formerly occurred in the central portions of the state. Moses Barrett gives some interesting notes on the two species of chipmunks in central Wisconsin in the early fifties.[2] In the National Museum are four specimens of *neglectus* collected by Dr. E. A. Mearns at Camp Douglas, Juneau County, in 1890 and 1891.

Citellus franklini (Sabine).
Franklin Spermophile.

This species is common in isolated colonies in various parts of Walworth County. I have collected many specimens near Delavan. The largest colonies here are located on Ridge Prairie, just west of town, and on the border of the Big Marsh, seven miles north of Delavan on the Whitewater road. In the former place the "gray gophers" do considerable damage in the grain fields and have greatly increased in numbers in recent years. On the Big Marsh I once shot one from a considerable height in a tamarack tree, mistaking it for a gray squirrel.

The Biological Survey also has records of this species from Janesville, Kansasville, Madison, Plover, Racine, Ripon, and Whitewater.

Castor canadensis Kuhl.
Beaver.

The beaver was not always confined to the northern counties but occurred in the early days over much of the state. Lapham states that "the last beaver killed, in the southern part of Wisconsin, was in 1819, on Sugar Creek, Walworth County, a very large one."[3]

1) Am. Naturalist, XXXIII, p. 640, Aug., 1899.
2) Am. Naturalist, VII, p. 693, Nov., 1873.
3) Trans. Wis. State Agric. Soc., 1852, p. 339, 1853.

Peromyscus bairdi (Hoy & Kennicott).
Michigan White-footed Mouse.

This mouse is found in the vicinity of Lake Michigan north at least to Racine, where Vernon Bailey captured two specimens April 20, 1898. These are now in the Biological Survey collection. In Walworth County it is abundant and I have collected many specimens at Delavan.

Zapus hudsonius (Zimmermann).
Jumping Mouse.

Additional records for *Zapus* are furnished by specimens from Racine and Delavan. The Racine specimen is in the National Museum and has been previously recorded by Preble.[1] A Delavan specimen, in the Biological Survey collection, was taken by myself October 9, 1908. While hunting for a wounded mallard in the marsh at the upper end of Lake Como, near Delavan, I started the mouse from a grassy bog. He seemed somewhat dazed by the bright sunlight and I managed to capture him by a lucky stroke with my hunting cap. Another specimen was also collected near Delavan by Charles Besecker of that place and I believe one was captured a number of years ago at Milton by R. W. Clarke.

Urocyon cinereoargenteus ocythous Bangs.
Wisconsin Gray Fox.

Two typical specimens of this fine fox, collected by myself at Delavan, are in the collection of the Biological Survey. Both are males; they were killed January 13, 1900 and November 15, 1903.

Vulpes fulvus (Desmarest).
Red Fox.

In the Biological Survey collection are specimens of the eastern red fox from Eagle River, Vilas County; and Delavan, Walworth County. The Eagle River specimen was killed February 9, 1908, and the Delavan specimens, a male and female, were captured January 24, 1899 and November 28, 1903.

1) N. A. Fauna, No. 15, p. 17, 1899.

Canis latrans Say.
Coyote.

The range of the prairie wolf extends northward to the northern border of the state. The Biological Survey collection contains three skulls collected near Eagle River, Vilas County, March 10, October 5, and November 2, 1907. In the southern part of the state, notably in Walworth County, it is probably increasing in numbers and several litters of young are taken each year. A fine male, skin and skull, from Delavan, December 12, 1898, is also in the collection.

Felis couguar Kerr.
Panther.

In the absence of any recent accounts of an animal which undoubtedly occurred in Wisconsin in the early days I see no good reason why Dr. Hoy's record should not be prepetuated in any Wisconsin list. He states that Benjamin Bones of Racine shot one on the headwaters of Black River, December, 1863.[1]

Mephitis mesomelas avia Bangs
Illinois Skunk.

In the Biological Survey collection are three specimens of this species from Delavan, a female, December 6, 1902; male, January 28, 1903; and male, January 6, 1904. The species occurs here with *Mephitis hudsonica* but is not common like that species. Out of twenty-eight skunks collected near Delavan, twenty-five are *hudsonica* and only three *avia*. All have been determined by A. H. Howell.

Taxidea taxus (Schreber).
Badger.

Several badgers have been recently captured in Walworth County. The Biological Survey collection contains a fine specimen killed at Delavan, January 4, 1904.

Gulo luscus (Linnæus).
Wolverine.

As in the case of the panther the only specific account of a capture of this animal in the state that I am aware of is that given by Hoy. He writes that wolverines are occasionally taken in the

1) Trans. Wis. Acad. of Sciences, Arts, and Letters, V, p. 256, 1882.

timber and that one was captured in La Crosse County in 1870. These records are certainly worthy of mention in any general account of Wisconsin mammals.

Sorex fumeus Miller.
Smoky Shrew.

A specimen of this species from Racine is in the National Museum collection. It has already been recorded by Miller.[1] Persistent trapping will undoubtedly produce other specimens from northern localities within the state.

Scalopus aquaticus machrinus (Rafinesque).
Large-nosed Mole.

A specimen of this species was collected at Camp Douglas, Juneau County, Wisconsin, by Dr. E. A. Mearns, U. S. A. It was examined by Dr. F. W. True in connection with his work on the American moles and recorded in his revision of the group.[2]

Myotis subulatus (Say.)
Say Bat.

In the United States National Museum collection is an alcoholic specimen of this species collected by J. W. Milner at Bayfield, Wisconsin, which has already been recorded by Miller.[3] While ordinarily not so abundant as *Myotis lucifugus* this bat doubtless regularly occurs in Wisconsin, as this region is in the center of its area of distribution and it has been captured on all sides of the state, as notably at Elk River, Minnesota; Chicago, Illinois;[4] and Porcupine Mountains, Michigan.[5]

Lasiurus cinereus (Beauvois).
Hoary Bat.

An additional record for this bat in the state is furnished by a female specimen in the Biological Survey collection collected by myself at Delavan, July 6, 1901. It is rare here at that season, usually arriving from the north in September.

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1) N. A. Fauna, No. 10, pp. 38 and 50, 1895.
2) Proc. U. S. Nat. Mus., XIX, pp. 26 and 31, 1896.
3) N. A. Fauna, No. 13, p. 76, 1897.
4) Miller, N. A. Fauna, No. 13, p. 76, 1897.
5) Adams, Ecological Survey in Northern Michigan, p. 131, 1906.

THE LAST RECORDS OF DEER IN WALWORTH COUNTY, WISCONSIN.

By N. Hollister.

Authentic accounts of any of the larger mammals in central or southern Wisconsin are of great value and must be collected soon if they are to be preserved with accuracy as to dates and circumstances. Many species are already gone from the entire state and of some of these there is not a local specimen in existence nor a specific record in literature. Even in the extreme northern counties conspicuous species are now rapidly disappearing and each record of their occurrence or capture is worthy of note.

Wild deer were exterminated in southeastern Wisconsin nearly sixty years ago. During various visits at home in the past few years I have been collecting from some of the older residents data relating to their occurrence in the vicinity of Delavan, Walworth County, and believe that the information thus gathered will prove of interest.

Deer were formerly abundant in Walworth County and in the early forties plenty still remained. The late Silas Bowker of Delavan told me of often seeing numbers of them between Delavan Lake and Geneva Lake, which locality he claimed was the best deer country in Walworth County. Others tell of many in the northwestern part of the county, and it seems probable that though deer were generally distributed throughout the county the vicinities of Delavan Lake and Richmond were their favorite resorts. I. P. Larnard, of Delavan, tells me that Wm. Hollister, deceased, saw about fifty in one herd on the edge of the Big Marsh, between Delavan and Whitewater, in 1842.

After this date the deer rapidly decreased. Mr. Larnard states that they soon left the lake woods and Richmond, and never returned in any numbers. In September, 1846, Mr. Larnard shot one from a bunch of five or six in what is now Isham's Grove, on the outskirts of Delavan. After killing this one he rapidly loaded his rifle and snapped three caps in an endeavor to shoot a fine buck which came out and stood in plain sight during the whole performance but trotted off, to his great disgust, before he could find a cap which would explode. This, Mr. Larnard believes, was

the last deer killed in the vicinity of Delavan, though a few were seen from time to time during the next few years. Mr. Larnard was a keen sportsman in those days and probably kept better account of such matters in that region than any man now living.

In 1849 or 1850, my father, K. N. Hollister, and his brother, U. S. Hollister, saw three deer in the Big Woods, five miles west of Delavan, and a year or two later saw two more crossing Rock Prairie and taking to the woods near the same place. A. B. Hare, of Delavan, last saw deer at Lake Nine, Richmond, as nearly as he can figure, in 1852; and Jas. H. Camp, also of Delavan, says that two deer were seen in the park at Elkhorn one morning in 1852 by a Mr. Bradley, who was then postmaster at that place and is still living. The park was much larger then and, of course, in a wilder state.

From all accounts, then, 1846 may be taken as the date for the last deer killed and 1852 for the last deer seen in the vicinity of Delavan.

THE AMERICAN ELK IN SOUTHERN WISCONSIN.

By Henry L. Ward.

This, the most stately American representative of the deer family, has within the present generation of men given way before the changes wrought by an increasing population and exploitation and has presumably become quite exterminated from Wisconsin's soil although from the fact that some are reputed to still exist in Minnesota it would not be altogether surprising should a straggler now and then cross the boundary.

The tempermental qualities of the animal which deter it from, at the first suspicion of danger, seeking safety in flight but cause it to linger until assured that its life is really menaced has rendered it less fit in the struggle for existence than is its smaller, more nervous, relative of this region, the white-tailed or Virginian deer; and thus its numbers and range have been more rapidly restricted.

In 1881 Judge Caton (1) wrote of it: "But few quadrupeds in our country have occupied a wider range than the American Elk. He was found in every part of the present United States and in northern Mexico; and was abundant in both Upper and Lower Canada, and in Labrador. In the interior, he was found as far north as the fifty-sixth or fifty-seventh degree of north latitude; but I can not find any evidence that he ever went so far north on either coast. The last account I get of their presence in northern Illinois was in the year 1820 or thereabouts. Till comparatively recent times they were found in northern Iowa, and in 1877 I saw several accounts of them having been killed in the northern part of the lower peninsula of Michigan, also in Minnesota."

In 1882 Dr. P. R. Hoy (2) wrote: "Elk, *Cervus canadensis,* were on Hay River in 1863, and I have but little doubt that a few still linger with us. The next to follow the buffalo, antelope and reindeer."

Moses Strong (3) in 1883 wrote of the elk: "Occurs very rarely in northern and central Wisconsin. It was formerly quite numerous, but is now almost extinct."

Mr. Hartley H. T. Jackson (4) writes: "The elk is without doubt now extinct in Wisconsin, but cast-off antlers scattered throughout the lakes, marshes and woods of northern Wisconsin attests of its former occurrence there. I have examined antlers of *Cervus canadensis* found in Ashland and Iron Counties."

Presumably antlers and other remains of this deer have been found in many parts of southern and central Wisconsin, but their occurrence seems not to have been noted in publications which zoologists would naturally consult, therefore I have thought it desirable to here put on record two occurrences from the southern part of the state.

In or before 1889 the museum received from Mr. Fred. Miller a portion of an antler, probobly cast, that was dug up four feet below the surface at Miller's Brewery in Wauwatosa a few miles west of this city.

In 1899 Mr. Frank Clark plowed up on his farm in Pewaukee, near the river, a pair of cast antlers. These were recently presented by his widow, to Mr. Stanley G. Haskins who has since given them to the Public Museum. The antlers were originally of good size but are now considerably reduced by complete loss of some of the tines and the loss of the ends of all but one of the others and the cutting off of the distal half of one antler, probably by the plow that brought it to the surface. Their loss of animal matter seems to have progressed as far as is common to mastodon bones recovered from eastern marshes; carrying conviction that the antlers have lain buried many years. Minute root plants have penetrated the cellular tissues exposed by the removal of the ends of the tines.

It would be of interest should some one, having the requisite time at their disposal, collect the credible references to the occurrence of the elk living in Wisconsin that presumably are embodied in many historical works, narratives of early voyages, settlers, etc. The work might be fraught with some difficulty as this as well as the buck of the white-tailed deer have frequently been called Stag.

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1. The Antelope and Deer of America, John Dean Caton, pps. 78—80.

2. Dr. P. R. Hoy. The Larger Wild Animals That Have Become Extinct in Wisconsin, Trans. Wisconsin Acad. Sciences, Arts and Letters, Vol. V, p. 256.

3. List of the Mammals of Wisconsin by Moses Strong in Geology of Wisconsin, Vol. 1, p. 437.

4. A Preliminary List of Wisconsin Mammals, Hartley H. T. Jackson, Bull. Wisconsin Nat. Hist. Soc., Vol. 6, p. 15. (Apr. 1908.)

THE NESTING OF ANACRABRO OCELLATUS PACK.

By George P. Barth.

This little wasp, from six to seven and one half millimeters or about one-quarter inch in length, is very common on the umbelliferous and composite flowers about Milwaukee during the month of July, August and early September. It is easily recognized by its compact form, rather rough, granulated exterior, sharply pointed abdomen concave below and convex above, with five sharply pointed triangular yellow spots on each side, and a line of yellow on the metanotum.

Although very numerous the nesting site of the insect seems to be hard to find as very diligent search has thus far failed to reveal any nests in the immediate vicinity of the city. It was my good fortune however, to have my attention called to a considerable colony in a sand bank near the shore of Cedar Lake, Washington Co., Wis.,—about thirty miles from Milwaukee—and here the notes following were taken.

Anacrabro begins nesting labors about the middle of July but does not begin storing until a week or two later, as several nests dug up before July 22nd showed no cell formation or storing. After that date nidification is in full swing.

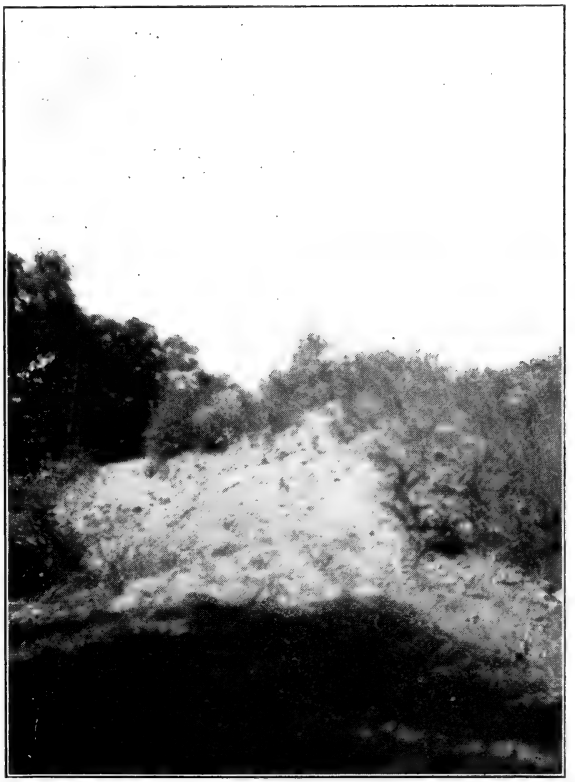
The first illustration shows what is evidently the typical nesting site of this wasp—a moderately large sand bank sparsely covered with tufts of grass and flowering plants and fully exposed to the heat of the sun's rays.

Such banks usually are literally alive with a host of insects, generally digger wasps, eagerly, nay fiercely active on hot bright days in their efforts to obey nature's mandate: to provide for the perpetuation of their species by the building and storing of nests. To a nature lover the sight presented gives the keenest enjoyment and abundant opportunity to indulge in that speculative philosophy which holds him enthralled for evermore when once his interest is awakened.

Among the busy workers Anacrabro is easily recognized by certain peculiarities or characteristic actions which mark her advent upon the scene. Unlike most fossores she does not alight and furiously attack the sand by scratching and gnawing but in a gentile, dainty manner approaches the bank on the wing and alights just long enough to give a discrete 'peck' and mayhap, the

place being unsuited to her taste, flies along the bank in arcs testing in like manner every few inches until her fastidiousness is satisfied as to the character of the soil. Usually the spot chosen is at the base of a tussock of vegetation though she is not averse to a level expanse of sand, the edge of a small stone or the base of a four inch cliff.

Having decided on a location the wasp begins the actual labor of excavation and herein again lies a peculiarity which, as far as I have observed, is characteristic of Anacrabro as opposed to other digger wasps of this region. She bites off a piece of earth and flying backwards from six to eighteen inches, drops it and dives forwards again for more, this to and fro flight taking place very rapidly and with great regularity without the insect turning about in its excursion—in other words, the insect always faces the nest, the backward flight being started by a backward jump from the ground and is not accompanied by an audible hum. The ground is not thrown but dropped, the momentum of the flight and its sudden termination being sufficient to transfer it in parabolic curve to some distance from the nest, in one case showers of sand falling over my book as I wrote though fully three feet from the nest. In no case was the insect seen to assist in the loosening of earth by scratching. Having penetrated to some distance the method of approach, or rather the rythm, is altered in that it at times becomes jerky in character. One, two or even three momentary halts, each one nearer the entrance may be made before the wasp disappears within. The purpose of this manoeuvre appears to be to assure an accurate entrance into the nest as in no case was the wasp seen to alight and enter by crawling. In one case in which the nest was located at the foot of a cliff and the entrance gallery almost paralleled its base, the insect repeatedly struck the side just within the door, often with such force as to send her rolling down the bank. Again and again she flew back to renew the attempt each failure being accompanied by an angry buzz and with every appearance of great annoyance. Discouraged at last by the frequent repetition of this mishap she abandoned the nest after tunnelling about one inch, the intelligence of the insect evidently being not great enough to overcome the difficulty. That this method of entering the nest is instinctive was shown in practically all cases. Especially evident did it become on one rather windy day. The wasps were repeatedly blown from the straight path to the nest generally missing the opening by a very short distance. It certainly would have been far easier to alight and walk into the nest, always less than half



NESTING SITE OF ANACRABRO OCELLATUS PACK.
AT CEDAR LAKE, WASHINGTON CO., WIS.

an inch away. But true to instinct the entire process of entry must be repeated until the wasp disappeared directly through the door—certainly a waste of time and energy. To ascertain whether there is a definite rythm in this halting forward flight a large number of observations were made on different individuals, two of which will be considered sufficient here, the figure one indicating direct flight into the nest, two, one halt on the way, three, two halts. *Wasp No.* 1. 1, 2, 2, 3, 3, 1, 2, 2, 1, 1, 1, 1, 1, little or no wind.

Wasp No. 2. (Day quite windy) 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 2, 1, 1, 1, 1, 1, 1, 1, 2, 1, 2, 1, 1, 2, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 2 (missed the entrance and flew back for a new start) 1, 1, 1, 1, 1, 2, 1, 3, 1, 1, 1, 1, 1, 1, 1, 2 (back for new start) 1, 1, 1, 1, 2, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 2 (back for a new start). 1, 1, 1, (wind blew her back on the sand and when she finally entered she remained in the nest for twenty-three and one-half minutes, probably resting, as she then came out and resumed digging). She had as yet formed no cells. These figures show that no rythm is followed, the momentary halt being merely to gauge a more accurate arrival at a desired point. Nor is the flight made undulating by the halt but continues in a straight line.

The method of carrying a load also differs somewhat hereafter. She now backs out and instead of merely flexing the head to hold the sand she brings an 'armful' of material—if one may so designate it—and holds it in place by flexing the head over it just as one would flex the chin over a heaping armful to prevent it from topling off.

The number of loads which the wasp carries out in a given time is quite large. Occasionally she flies off, probably to feed or rest, but her absences during the process of construction are never very long.

A few figures on one wasp will serve to illustrate the rapidity and amount of work done. as all others practically agree with these:—

Between 10 A. M. and 10:6 she carried 19 loads (6 min.)
Between 10:6 A. M. and 10:9:30 she carried 13 loads (3½ min.)

Remained in nest until 10:37:30 then flew off returning at 10:42:50.

From 10:43	to 10:45	—— 4	loads	(2 min.)
10:58	to 11:1:30	—— 16	loads	(3½ min.)
11:1:30	to 11:6	—— 21	loads	(4½ min.)
11:6	to 11:11	—— 23	loads	(5 min.)
11:11	to 11:16	—— 22	loads	(5 min.)

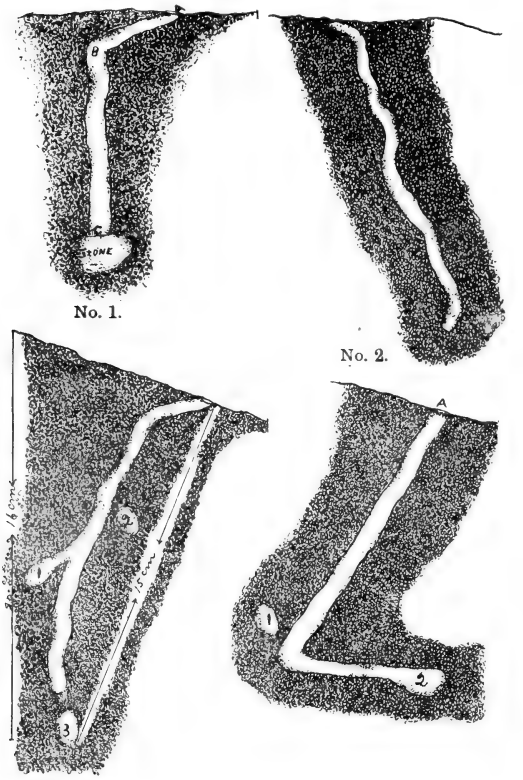
One hundred and eighteen loads in twenty-nine and one-half minutes or over four to the minute! Certainly very rapid work considering that she covers from one to three feet in flight with each load! And this number in but twenty-nine minutes of a working day of over nine hours! (I have seen Anacrabro still working at 7:45 P. M.). During her prolonged stays in the nest she probably brings the excavated material nearer the door although this could not be determined. While she was still in view each load was carried out as soon as loosened, the mandibles only being used to dig. The backward and forward path of flight rarely varies more than a few inches in lateral direction, and its limit is from four to eighteen inches. In one case a ridge of sand could be traced beginning two inches from the nest and extending over two feet. Anacrabro is quite lazy as far as early morning hours are concerned, rarely beginning work before ten o'clock though the sun be bright and hot and shine directly on the nest. She compensates however by working well into twilight.

In all but one of the twenty-odd nests examined the entrance proceeded from two to six centimeters slightly inclined and shallowly underneath the surface and then took a rather abrupt bend down into the sand. In the exception the nest entered a bluff of a mixture of clay and sand and maintained a curved course from the beginning. The first or horizontal portion was usually fairly straight, about six millimeters in diameter but the descending gallery often pursued so tortuous a course as it proceeded between and around stones and obstructions that it would have been well-nigh impossible to follow it without assistance obtained by first filling the nest with plaster of Paris cream. This part varied from four to seven millimeters in diameter, the normal evidently being six as this was maintained where no obstruction was met. The number of cells in a nest is proportionate with its age. The terminal portion of the gallery is fashioned into a cell, stored and walled off. The further enlargement of the nest takes place in one of two ways. Either a short portion of the gallery above this cell is filled in and the tunneling continued in a new direction beyond it (vide Nest 4) or short tunnels are built laterally from the main gallery and proximal to the end cell, the ends of these again being formed into cells, stored and closed off. (vide Nest 3). This would agree in general with the usual plan of the nests of other members of the Crabro family except that in none of the Anacrabro nests was there a row of cells, a very common occurrence with other members of the family. The cells average seven by thirteen millimeters in size, elongate—oval in

No. 5.

No. 6.

PLASTER FILLED NESTS OF ANACRABRO OCELLATUS PACK., SHOWN IN THEIR NATURAL LOCATION.



No. 1. No. 2.

No. 3. No. 4.

EXPLANATION OF FIGURES.

Nest No. 1—An unfinished nest which stopped abruptly at the stone. A to B—2 c. m. B to C—4 c. m. Diam at B—5 mm.

Nest No. 2.—An unfinished nest ⅓ natural size.

Nest No. 3.—Cell 1 contained four *Lygus pratensis* Linn. but was not closed off. Evidently not completely stored; cell 2 contained four bugs and was closed off; no egg; cell 3 contained 7 bugs and an egg. ⅓ natural size.

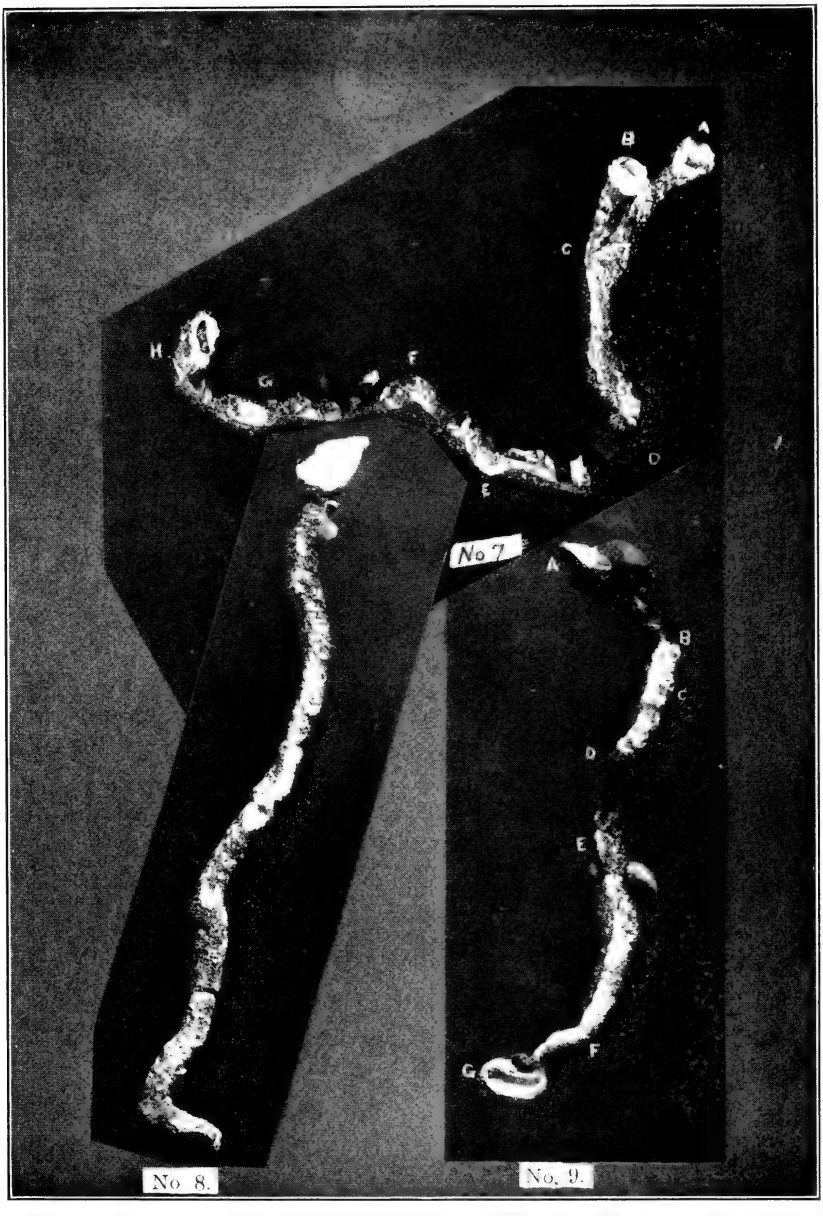
Nest No. 4—Cell 1 contained a number of the Lygus which were being eaten by ants of the genus Monomorium. Cell 2, a terminal cell 7x13 mm. ⅓ natural size.

shape and are stored with from four to seven adult *Lygus pratensis* Linn. In one of the nests (No. 7) the peculiarity of two entrances was offered, they being about two centimeters apart, the gallery of the one two and a half, of the other, three and a half centimeters long. They then met and continued as one gallery for the remainder of the nest. I can offer no explanation of this unless it happened by accident as no stone or other obstruction existed between the two entrances. Long and careful watching showed that but one insect occupied the nest. In her work of excavation this insect always entered through the longer gallery and always came out through the shorter with her load. Possibly the original entrance to the nest was closed by a disturbance of the sand about it and the returning wasp, not finding the door where she knew it ought to be, started a new nest in the immediate vicinity and, guided by a nest odor, dug in the direction of the old gallery till a connection with the old nest was formed. Her activities in the nest may then have caused the barrier in the old door to cave in and, consequently, a re-opening of the original entrance. In a number of cases where the nest had been filled with the plaster cream but not immediately dug out, the owner of the nest at once started a new tunnel beside the rather large cap of hardened plaster which is formed on the surface after the nest is full, which tunnel proceeded directly in line and close beside the plaster cast of the old gallery.

The time which the wasp takes to capture and return with its very common prey is comparatively short, as could be expected since it is found abundantly on almost any of the flowering plants. The following observations will serve as an example of the duration of the hunting expeditions:—

Left at 10:37. Returned at 10:39:10 with prey (2 min. 10 sec.)
Left at 2:48. Returned at 3:4 with prey (16 min.)
Left at 3:5:40. Returned at 3:14:30 with prey (8 min. 50 sec.)
Left at 3:16. Returned at 3:28:10 with prey (12 min. 10 sec.)
Left at 3:30:20. Returned at 3:38 with prey (7 min. 40 sec.)

The bug is firmly pressed into the concavity of the abdomen and against the thorax by the middle and hind legs, the abdomen being curved down over it. This makes it rather difficult to decide whether she is carrying or not. Without halt she darts directly into the entrance giving the impression of a tumbling down the gallery. Whether the prey is shifted was not determined as her disappearance into the nest was too rapid for such obervation. In this she very much resembles *Crabro errans*, also a ground digger belonging to the Crabronidæ. None of the cap-



Nest No. 7 A curious nest having two entrances about ¾ in. apart. A to D—6 cm. D to E—3 cm. E to F—2 cm. F to G—4 cm. G to H—3 cm. A to C 3½ cm. B to C—2½ cm. B to D—5 cm. Terminal cell at H contained several Lygus pratensis. Nest was on the slightly inclined open expanse of sand.

Nest No. 8.—Plaster filled nest which had no stored cells. Anacrabro was digging.

Nest No. 9.—Has one cell (terminal) at G. A to B—3 cm. B to C.—1½ cm. C to D—1½ cm. D to E—1½ cm. E to F—3 cm. F to G—2½ cm. A to G in direct line 10 cm. Diam. at D 5 mm. at F 6 mm.

tured insects responded to stimulation so presumably they were stung to death. The bugs seemed to be arranged more or less accurately with the head toward the end of the cell, from four to seven being found in the fully stored chamber. The egg is laid on the thorax of the Lygus beginning at the neck and extending somewhat obliquely to the long diameter of the prey.

The entrance of the nest was not closed when she absented herself either during the digging or on hunting expeditions or at night.

None of the wasps were seen to make a locality study beyond a circle or two (and this in only two cases) either during excavation or before beginning to bring in prey, probably the wasps having so thoroughly familiarized themselves with the locality before nidification that no special study was required.

As is usual with digger wasps numbers of parasitic flies hovered about the nests and entered whether the wasp was present or not. In one instance the returning wasp fiercely attacked a tachina fly which was within the entrance of its nest and both rolled over and over down the bank the wasp tightly clasping the fly but whether she tried to use her sting on her opponent could not be seen in the flurry . Both kept up a furious buzzing in their progress to the foot of the bank. The wasp then released the fly and entered the nest while the tachina immediately took its station directly beside the entrance evidently none the worse for nor discouraged by the assault upon her. The wasp had not started to store the nest and was not carrying prey at the time so it may be that her failure to disable the fly by stinging was owing to the fact that her hunting instinct was still in abeyance.

NOTES AND DESCRIPTIONS OF NORTH AMERICAN PARASITIC HYMENOPTERA. VII.

By Charles T. Brues.

FAMILY BETHYLIDÆ.

Cephalonomia utahensis sp. nov.

Female. Length 2mm. Black, except the tip of the antennal pedicel and the basal two joints of the tarsi which are honey yellow. Head oblong, with parallel sides, not quite twice as long as wide. Eyes oval, one-third as long as the head, exclusive of the projecting mandibles; ocelli in a very small triangle. Surface of head shining, very minutely shagreened or punctulate. Face between the antennæ with a small raised prominence with parallel sides and truncate tip, bounded on each side by a large depression. Antennæ 12-jointed, about as long as the head; scape oblanceolate, about two and one-half times as long as thick; pedicel as long as the first and second flagellar joints together; joints of the flagellum about quadrate, increasing in size to the sixth, then becomming slightly smaller; apical joint two times as long as the penultimate. Thorax one-half longer than the head; propleura finely longitudinally striated; pronotum faintly shagreened with sparse microscopic punctures intermixed, nearly three times as long as the mesonotum which is nearly four times as wide as long and sculptured like the pronotum; with two very faintly indicated and widely separated parapsidal furrows. Scutellum with a prominent impressed line at the base; mesopleura with a large round fovea anteriorly and a smaller one centrally. Metanotum with a delicate median carina and raised lateral margins; the entire metathorax much more coarsely punctulate than the rest of the thorax. Legs as usual, only moderately stout; entirely black, except the basal two joints of the tarsi. Wings quite distinctly infuscated; submarginal cell only one-fourth the length of the wing; ending in a prominent black stigma which is distinctly separated from the margin. Just beyond is a much smaller, secondary stigma which is continous with the margin. Edge of the wing ciliated, more prominently so along the submarginal cell and just beyond the apex.

Described from one complete specimen and a part of another.

Type in the collections of Cornell University, cotype in the Milwaukee Public Museum.

This is a slender species conspicuous by its black legs with distinctly pale base to the tarsi. It was reared from cedar berries at Milford, Utah and sent me for identification by Mr. C. R. Crosby of Cornell University.

FAMILY PROCTOTRYPIDÆ.

Proctotrypes longiusculus sp. nov.

Male. Length 10 mm. Black; legs, except the coxæ, and abdomen except extreme base, ferruginous. Head transverse, two times as wide as thick, strongly contracted behind the eyes and sharply margined behind. Eyes bare. Clypeus broad, its anterior margins straight; broadly truncate. Front, vertex, occiput and cheeks shining, minutely punctulate. Clypeus deeply sparsely punctate and with a large fovea on each side. Mandibles dark rufous with black tips. Antennæ entirely black, slender, strongly pubescent, scape two times as long as broad at tip; flagellar joints elongate; first to tenth gradually growing shorter, the penultimate about three-fourths the length of the first. Thorax very elongate; collar finely transversely aciculate above, and

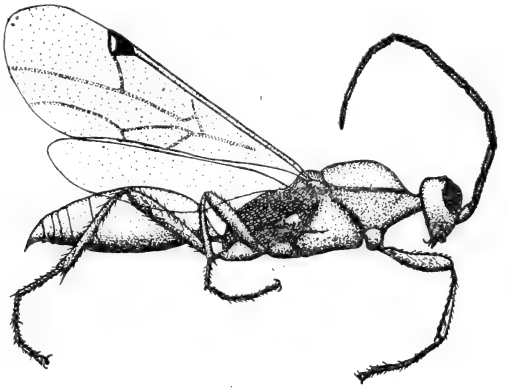


Fig. 1. *Proctotrypes longiusculus* sp. nov. Male.

faintly obliquely so on the sides below. Mesonotum shining, faintly punctulate, one and three-fourths times as long as wide. Scutelluf normal, sculptured like mesonotum; methathorax very slightly arched above, as long as the mesonotum, regularly rugose reticulate, the reticulations forming quite distinct longitudinal series, but without median longitudinal carina. Plura shining, and faintly shagreened, the meso and metapleura each with a large convex, perfectly smooth area. Abdomen ferruginous, infuscated apically and black at the extreme base of the second segment and the petiole. The latter broader than long and coarsely rugose, extreme base of second segment with six short diverging carinæ. Legs slender, ferruginous; coxæ, trochanters except tips, and tarsi black. Longer spur of hind tibia less than one-third the length of the metatarsus; tarsal claws simple. Wings quite distinctly infuscated; stigma, submarginal and radial veins fuscous; remaining veins distinctly indicated in pale brownish yellow; radial cell one-third as long as high and a trifle more than one-third as long as the stigma.

This species differs from *P. caudatus* by its longer antennæ, less arched metathorax and generally much more slender form.

The head is strongly contracted behind while in *caudatus* it is very faintly so.

Described from one specimen from Harrisburg, Pa., sent me by Professor H. A. Surface. I have later seen a second collected by Mr. P. R. Meyers at Enola, Pa., Oct. 3, 1908, under a stone.

FAMILY SCELIONIDÆ.

Aphanomerus americanus sp. nov.

Female. Length 1 mm. Black, the antennæ except the club and the legs except the coxæ yellow. Head slightly more than twice as wide as thick anteroposteriorly, the vertex very sharply rounded above and quite acute. Ocelli in a triangle, the lateral ones removed from the eye margin by about their own diameter. Antennæ 7-jointed, the club large and unjointed except for a trace of sutures indicating four club joints; club as long or a trifle longer than the funicle; scape stout, thickened apically, but little longer than the club; pedicel as long as the first three joints of the funicle taken together; first funicle joint longer than broad, remaining ones very short, but becoming broader; club large, ovate. Eyes bare. Surface of head shagreened. Thorax oval, pronotum visible from above, especially on the sides where it is quite broad. Mesonotum much narrowed anteriorly where it is fitted into the posteriorly excavated pronotum; with complete parapsidal furrows, its surface shagreened and thinly short whitish pubescent. Scutellum shagreened, rounded behind and provided with a marginal line. Metathorax very short, with two short, approximated strongly raised median carinae near the base, forming a sort of tooth when seen in profile. Abdomen as long as the thorax, widest near the apex of the second segment; subsessile, the first segment small, finely longitudinally fluted. Second occupying most of the surface of the abdomen, about one-fourth longer then wide and coarsely striated along the entire base; following segments very short. Legs stout, the femora strongly thickened, the tibiæ however only very slightly clavate; tarsal claws about equal. Coxæ piceous, remainder of legs yellow. Wings nearly hyaline, with a slight yellowish tinge, veinless except for a clavate pale brown submarginal vein well separated from the costal margin and reaching two-fifths the length of the wing.

Described from a large number of specimens bred by Dr. George P. Barth from the cocoons of a species of *Crabro*. Type in the collections of the Milwaukee Public Museum.

This is the first time this genus has been found in America. It was first described by Perkins from Queensland, Australia* where it is represented by a number of species parasitic on the eggs of certain leaf-hoppers. That the present species attacks the *Crabro* directly seems probable, although it may of course be a hyperparasite. That it can be an egg-parasite however, appears to be extremely unlikely.

* Bull. Hawaiian Sugar Planters' Expt. Sta., No. 1, part 6, p. 200 (1905).

FAMILY PLATYGASTERIDÆ.

Rosneta, New Genus.

Related to *Fidiobia* Ashmead and *Anopedius* Foerster. Antennæ nine-jointed, the funicle four-jointed; club three jointed; scape clavate, long and stout; pedicel large; ocelli three, in a triangle, the lateral ones almost contiguous with the eye-margin; eyes bare. Mesonotum with deep, sulcate, parapsidal furrows on its posterior half. Scutellum flat, broad and short. Abdomen nearly one-half longer than the head and thorax together, narrowly sessile; second segment very long; tip of abdomen broadly rounded. Wings scarcely pubescent, not ciliate on the margins.

Type: *R. tritici* sp. nov.

Rosneta tritici sp. nov.

Female. Length 0.6 mm. Black, the legs including coxæ and antennæ except club, rather light yellow. Head twice as wide as thick, its occipital margins slightly concave; surface punctulate; ocelli in a broad triangle, the lateral ones removed by less than their own diameter from the eye-margins. Antennæ 9-jointed, short and stout, the scape two-thirds as long as all the following joints together, strongly incrassated; pedicel large, stouter and fully twice as long as the first flagellar joint, which is slightly longer than wide; second to fourth flagellar joints very small, quadrate, about as wide as the first; following three forming a very large stout oval club, the first two joints of which are quadrate and the apical one a trifle longer and conic. Eyes bare, Prothorax and mesonotum roughly punctulate, the scutellum smooth and shinning; parapsidal furrows indicated only on the posterior one-half of the mesonotum, but very deep and broad, in the form of deep sulci which have a polished smooth surface. Scutellun broad and short, fully twice as broad as long, at its extreme sides with a longitudinal groove which is farther from the median line then the parapsidal furrow. Metanotum very short and sharply truncate behind; above with two widely separated median longitudinal carinæ just outside the postscutellum, and with the lateral margins less distinctly carinated. Abdomen oval, rounded at the tip, almost sessile at the base; first segment short, second long, fully three times as long as the following together which decrease rapidly in length to the tip. Legs stout, the femora strongly and the tibiæ more weakly clavate. Wings veinless, hyaline, not ciliate and only very weakly pubescent on the surface.

Described from six specimens reared from wheat stubble collected at Middleport, N. Y. and sent me by Mr. C. R. Crosby of Cornell University.

Anopedius error Fitch has also been reared from *Diplosis tritici* affecting wheat, but I do not believe it could possibly be this species, even though Fitch's original account is rather too indefinite to place his species very accurately.

FAMILY EURYTOMIDÆ.

Bephratoides New Genus.

Related to *Bephrata* Cameron, but differing in the form of the anterior femora which are greatly swollen, as large as the posterior ones, grooved beneath for the reception of the tibiae and denticulate below for their entire length. Head and thorax coarsely punctate; metanotum short, abruptly declivous, with a deep median sulcus; pronotum as long as the scutellum and slightly contracted posteriorly. Antennæ inserted above the middle of the face, 11-jointed, with one ring joint; joints of flagellum long, cylindrical, the first two-thirds the length of the scape. Abdomen oval as long as the thorax, greatly compressed, in side view higher than the thorax, but seen from above it is only about one-third as broad as the pronotum; eighth segment reduced into a small stylus or aculeus. Wings with marginal, stigmal and postmarginal veins long.

Type species.—*B. maculatus,* sp. nov.

Bephratoides maculatus sp. nov.

Length 5 mm. Black, marked with yellow; legs mostly yellow; head transverse, a little more than two times as broad as thick and somewhat broader than high. Occiput deeply arcuately emarginate between the eyes, the emargination extending halfway to the front of the head; ocelli in a curved line, close to the emargination of the occiput, equidistant from each other and the eye-margin. Antennæ filiform, 11-jointed, black except the basal three-fourths of the scape and the tip of the pedicel; first flagellar joint three times as long as thick, second two-thirds as long as the first, following growing shorter gradually to the club-joints which decrease rapidly. Eyes ovate, nearly circular, bare; but little longer than the cheeks; front above the antennæ with a deep groove for the reception of the antennal scapes. Face nearly flat, coarsely confluently punctate and sparsely clothed with stiff white hairs. Malar groove present. Head behind with raised margin which however does not extend to the occiput. Mandibles stout, obliquely truncate at the tip, with two faintly indicated teeth at the apex. Palpi slender, short; front and vertex sculptured like the face; occiput smooth or faintly vertically aciculated. Prothorax two-thirds as wide as the head, one-half broader than long and quite distinctly narrowed posteriorly, its surface coarsely punctured, most roughly so along the median line, the punctures growing smaller laterally and on the pleuræ, near the coxæ giving place to fine transverse aciculations. Mesonotum evenly punctate, its punctures the size of those along the sides of the pronotum, a little shorter than the pronotum and one-fourth broader than the pronotum behind where it is much widened. Scutellum and axillæ punctate like the

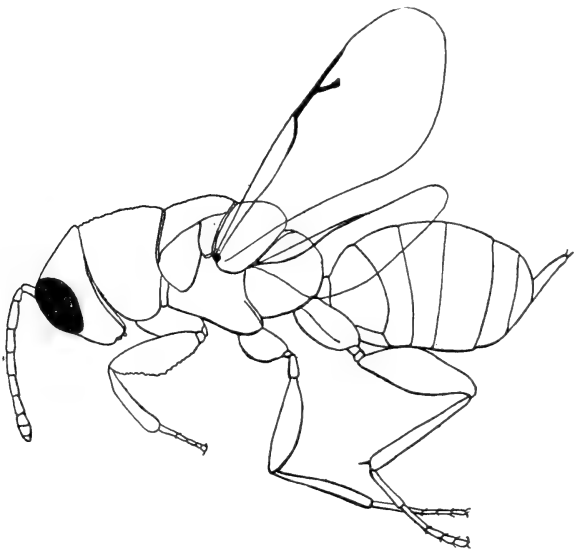


Fig. 2. *Bephratoides maculatus* sp. nov. Female.

mesonotum, the scutellum more coarsely so, rounded behind and as long as the pronotum. Metathorax punctate with a deep smooth longitudinal sulcus. Abdomen oval, very sharp above, as long as the thorax. First segment very small, following four segments of nearly equal length, sixth and seventh much shorter, the latter punctulate, eight forming an aculeus about as long as one of the basal segments. Legs stout, especially the anterior and posterior femora; anterior femora with an obtuse lobe below toward the apex and denticulate for its entire length; posterior femora as large as the anterior ones and faintly denticulate below medially; posterior tibia with two short spurs. Wings hyaline, veins yellow; marginal vein one-forth the length of the submarginal; stigmal one-half as long as the marginal, knobbed; postmarginal one-fourth longer than the marginal. Head black on the vertex and occiput, elsewhere yellow; prothorax yellow except the dorsum and a fine marginal line posteriorly on the pleurae; mesothorax except tegulae, and metathorax entirely black; abdomen yellow, with the extreme base, a dorsal line to near the tip, lower basal one-half and an irregular subapical spot black, aculeus black. Legs yellow, all femora and tibiæ with abbreviated black lines exteriorly.

One specimen, Brownsville, Texas, sent me by Mr. Charles Schaeffer. This is a most interesting insect, of undoubted tropical affinities and I believe generically distinct from *Bephrata* Cameron.

FAMILY PTEROMALIDÆ.

Asaphes rufipes sp. nov.

Female. Length 1.4—1.6 mm. Greenish aeneous black with the legs except coxæ reddish or brownish yellow. Head seen from above a little wider than the thorax at the base of the wings; about twice as wide as thick. Occiput concave, but not strongly excavated, its edge finely margined. Vertex finely punctulate. Eyes bare; ocelli in a triangle the lateral ones as far from the median one as from the eye margin. Front strongly excavated medially below the ocelli, its surface shining and sparsely hairy. Cheeks about two-thirds as long as the eye-height; mandibles fuscous. Malar furrow wanting. Antennæ 13-jointed, gradually clavate; scape two-fifths the length of the flagellum, rather slender and nearly straight; pedicel one-third as long as the scape, obovate; two ring joints; funicle joints increasing a very little in length, but considerably in width, the first a trifle longer than thick and the last fully one-half wider than long; joints of club consolidated, together as long as the three preceding taken together and little broader than the last funicular joint. Pronotum long, nearly as long as the mesonotum, considerably narrowed anteriorly. Mesonotum with deep, very distinct, strongly convergent parapsidal furrows, its surface and that of the pronotum shagreened. Axillæ extending in as far as the parapsidal furrows. Scutellum shagreened on its basal half, posteriorly smooth and polished; at the apical third with a cross furrow made by confluent punctures. Metathorax microscopically rugose above; below on the pleuræ smooth; the pleuræ above with a longitudinal elevation which is sparsely clothed with long fine white hairs. Petiole of abdomen coarsely fluted and finely rugulose on the surface, shorter than the second segment and distinctly longer than wide. Body of abdomen triangular in lateral view, fully three-fourths as high as it is long on the dorsum; second and third segments of equal length; fourth one-half as long and the fifth only one-half as long as the fourth; apex of abdomen produced as a very short stylus. Wings hyaline, veins pale brown, the marginal vein five or six times as long as thick; stigmal about one-third longer, slender, knobbed at the tip postmarginal about one-fourth longer than the marginal. Legs slender, pale reddish brown, the posterior femora somewhat infuscated.

Described from four specimens bred from a species of *Aphis* (probably *A. atriplicis* Linn.) on *Chenopodium album* at Forest Hills, Mass., October 30, 1908 by Mr. Paul Hayhurst of the Bussey Institution. Type in the collections of the Public Museum of the City of Milwaukee.

FAMILY EULOPHIDÆ.

Chrysocharis aeneus sp. nov.

Female. Length 1.5 mm. Shining greenish black, the antennal scape and pedicel and most of the legs except sometimes the anterior femora, yellow. Head very flat, attached to the thorax near its upper side; viewed from the front it is one-third higher than broad. Front with a deep longitudinal depression above the insertion of the antennæ which is however, markedly narrowed above the middle of the front. Antennæ inserted close to the clypeus; 9-jointed, with one ring-joint; scape stout, reaching one-half way from its insertion to the vertex; pedicel one-third as long as the scape, contracted basally; ring-joint so small as to be scarcely discernible; funicle joints three, about equal, nearly quadrate or slightly moniliform when seen in side view; seen in another plane they grow thicker apically the third being nearly twice as broad as long and as wide as the first joint of the ovate club; second club-joint much narrowed apically, third extremely small, pointed and appearing as an appendage of the second. Eyes small, oval, bare; separated by three-fourths their length from the base of the mandibles. Thorax elongate, smooth; pronotum as long as wide at the base, anteriorly narrowed, mesonotum with sharply defined furrows which converge posteriorly where they are very nearly continuous with two parallel grooves on the scutellum, metanotum with a delicate median carina which forks at the extreme tip, curving outward and forward to form a lateral divergent carina which terminates basally near the lateral margin of the scutellum. Abdomen sessile, as long or but little longer than the thorax and slightly flattened; first five segments of about equal length, slightly increasing in width to the fourth; apex rounded, ovipositor not projecting. Legs slender, yellow, except the coxae which are black, and the anterior femora which are piceous, except at the tip; posterior tibiæ with a single spur about three-fourths the length of the first tarsal joint. Tarsi four jointed. Wings hyaline, marginal vein about one-fourth longer than the submarginal; stigmal clavate, one-fourth the length of the marginal; postmarginal faintly indicated but extending for a considerable distance.

Described from a large number of females bred by Dr. George P. Barth at Milwaukee, Wisconsin, from the cocoon of a species of *Crabro*.

Nesomyia cimbicis sp. nov.

Female. Length 1.25—1.5 mm. Metallic green, head more bluish; spots on the axillae and the occiput below, and the face, more or less cupreous. Head transverse, about three times as long as thick. Face above the insertion of the antennæ finely rugose punctate, above on the vertex shagreened. Ocelli large, in a small triangle. Eyes pubescent. Vertex and front with a few stiff white erect hairs. Mandibles small, acute, bidentate; cheeks short, about one-eighth the eye-height; malar furrow present. Antennæ 9-jointed; scape, pedicel, one ring joint, three funicle joints and a three jointed club, the club with only two distinct joints, the apical one being very small and slender, styluslike; funicle joints each about two times as wide as long; first club joint slightly shorter and thicker; second as long as the first, tapering; all the antennal joints rather hairy; mesonotum and scutellum scaly punctate, the parapsidal furrows indicated posteriorly as depressions, obsolete anteriorly; scutellum nearly as long as the mesonotum, acutely rounded behind, with a long bristle on each side near the middle; postscutellum very short, very broadly angled medially at the tip. Metanotum very short, finely rugulose. Abdomen sessile, almost orbicular, with obtusely pointed apex; segment two the longest; three to six shorter, nearly equal, the last small, triangular. Wings hyaline, pubescent, with short marginal cilia; submarginal vein one-half as long as the pale marginal; stigmal short, clavate; postmarginal nearly two times as long as the marginal. Legs slender, pale yellow, almost white, their coxae æneous black except at the extreme apices.

Three specimens, bred from eggs of *Cimbex americana* Leach, collected at Milwaukee, Wisconsin. Type in the Milwaukee Public Museum. They were brought to me for identification by Mr. Henry Severin of the University of Ohio.

FAMILY BRACONIDÆ.

Cosmophorus hypothememi sp. nov.

Female. Length 1 mm. Piceous black; face and first three joints of antennæ yellowish brown; legs fuscous, trochanters, knees, base and tips of tibiæ and base of tarsi yellowish or testaceous. Head one and three-fourths times as wide as thick, much excavated on the occiput. Front with a deep excavation above the insertion of the antennæ, the median ocellus placed on its upper margin. Antennæ inserted on a projecting ledge which bears two approximated teeth at the insertion of the antennæ. Antennæ 14-jointed, filiform, the scape stout and

short, almost globose; first joint of flagellum longer, but much more slender than the pedicel; second joint subequal, stouter; following gradually becoming shorter to the tip, all however more than twice as long as thick. Face below the antennæ rugose; clypeus short and broad, punctate. Mandibles broad, leaving a broad opening when closed. Eyes small, oval; sparsely pubescent. Surface of head smooth and highly polished. Thorax short, mesonotum without furrows, smooth and shining, at the base of the scutellum with a transverse groove, scutellum rather long, rounded off on the sides and behind. Metanotum finely rugose, incompletely areolated; two very closely approximated median longitudinal carinæ, a lateral carina on each side and a transverse V-shaped one across the upper edge of the posterior slope. Pleuræ irregularly rugose-punctate. Abdomen petiolate, the petiole longer than the metathorax and equalling the remainder of the abdomen, its surface above finely longitudinally rugose, two and one-half times as long as broad at tip and but slightly widened behind. Body of abdomen globose, the second segment occupying most of its surface. Ovipositor almost as long as the abdomen. Wings hyaline, stigma and nervures pale brownish piceous, the extreme base of the stigma pale. Stigma large, ovate nearly as long as the radial cell; first discoidal and first cubital cells confluent; second discoidal cell open.

One specimen, bred by Professor H. A. Surface from a species of *Hypothenemus,* thought by Dr. A. D. Hopkins to be undescribed.

Ashmead has already described one American representative of this genus, differing from the present species by its much larger size, different antennæ, etc.

Public Museum, Milwaukee, Wis.
March 1, 1909.

A SUMMER'S INSECT COLLECTING.

By Richard A. Muttkowski.

To entomologists in Milwaukee County the collecting season of 1908 will always be memorable; not so much for the results of their labors, as for the various factors that worked to introduce a season replete with surprises. Foremost was the belated beginning. A winter full of severe storms, with frosts extending far into May, precipitated a remarkably short spring. Trees that had begun to bud during April, but had ceased to develop in the following cold weather, now burst into full bloom. Fauna and flora, retarded so long, renewed their life.

The results of this belated spring were immediately manifest: botanists noted a general jumble in the early flower-months, May, June and July. May flowers blossomed together with those of June and early July. Thus Early Meadow Rue flowered simultaneously with Tall Meadow Rue. Goldenrod made its appearance several weeks earlier than usual.

The early appearance of some food-plants may have hastened that of the insects. In support I may cite a difference of several weeks in the dates of attaining maturity among the Lepidoptera, Neuroptera, and Hymenoptera. Dr. Graenicher reports a seasonal disturbance among bees also, the May and July types appearing together at the end of June. Among Neuroptera this disturbance was less marked, though perceptible; thus *Chauliodes pectinicornis* and *C. rastricornis* appeared in late June.

The Lepidoptera, however, show a number of striking accelerations, among them that of a whole group, the *Catocalinae*, which appeared a full month earlier than in previous years. With these accelerations came other results, specially noticeable in the *Catocalæ*, such as increase or decrease of size, intensification of colors, widening or narrowing of bands. As instances of increased size *Archips rosaceana* and other *Tortricidæ* may be mentioned. *Calpe canadensis* (in part), *Apatela brumosa, Catocala lucinda*, show the opposite condition. *Catocala cara, ilia, concumbens, lucinda, cerogama*, showed a general darkening of the fore wings and a greater brilliance of the colored bands of the hind wings. The latter effect was especially prominent in *C. cara*, while all captured specimens of *C. cerogama* show a distinct de-

crease in the width of the yellow band of the hind wing. Other species again show a distinct brightening of their markings. Of a specimen of *Apatela hasta* Dr. J. B. Smith writes: "It has the markings of *hasta,* but is brighter than any specimen I have ever seen." At another place he writes: "It is a puzzle and I am almost inclined to suspect a foreigner.————————it is unlike any specimen in my collection'". Of *Ap. brumosa* he says: "A very small example for a female and yet it resembles nothing else so much".

Collecting in general, as will be seen by the list, was prolific in numbers of species obtained, yet not in numbers of specimens; but prolific only during part of the summer. Climatic conditions served to make the latter part of summer a void as to collection of interesting Lepidoptera. The last rainfall of July 15th marked the beginning of a drouth and a season of forest fires, cold and general inclemency, such as Wisconsin has rarely seen. After the 1st of August little of value was captured. Smoke hung over the woods in a heavy pall during the two following months, the drouth dried up the creeks and various swamps and ponds, parching the ground till it split open in inch-wide fissures. The flower-season was thus quickly ended.

Not until the first week of October did the relieving rains fall and extinguish the fires in upper Wisconsin and clear the air of the dense smoke. A few successful nights marked October. But the latter part of the month again brought on the forest fires, this time upon Milwaukee. West Allis and its surrounding forests, including Johnson's Woods, were visited by the fires, the whole underbrush of the latter swept away; with what results the coming season will show.

Collections were obtained chiefly from Johnson's Woods and Layton Park by the author, and from the Milwaukee River by Mr. Fernekes. North and East Milwaukee, Whitefish Bay, Wauwatosa, and the County Line were visited intermittently.

Note. (F), (J), and (B) after the names of species refer to Mr. V. Fernekes, Mr. H. Bower, and Mr. John Jacobs, respectively; and species so marked should be credited to these collectors.

ODONATA.

Little time was devoted to the collection of insects of this group. The few records obtained result from desultory captures during the collection of Lepidoptera. However, a few interesting specimens were received from Dr. Was of Oostburg, Sheboygan Co. As the collections of the Museum already contain species of that region collected by Mr. Henry L. Ward, but at a much later date than the 1908 species, Dr. Was' donations serve to complete the seasonal series from Eastern Wisconsin, Transitional region.

Calopteryx maculata Beauv. Milwaukee, June 13. On shady river banks, in high grass. Also from Oostburg, Wis., June 13—July 16.

Calopteryx æquabilis Say. Loc. et die citato.

Hetærina americana Say. Loc. et die cit.

Lestes eurinus Say. Milwaukee, June 13. On stones in river, near rapids Oostburg, July 9.

Lestes unguiculatus Hagen. June 13. Milwaukee River, in high grass on bank. Johnson's woods, July 26, in marsh. Oostburg, July 20.

Lestes uncatus Kirby. Milwaukee, loc. et dieb. cit. Oostburg, July 8.

Lestes disjunctus Selys, Oostburg, June 11. From marsh.

Lestes rectangularis Say. Milwaukee, Aug. 3, Milwaukee River. High grass on banks.

Ischnura verticalis Say. Milwaukee River, June 13. In high grass in sunny spots.

Enallagma hageni Walsh. Milwaukee, June 13. High grass on river bank. Oostburg, July 8.

Enallagma calverti Morse. Oostburg, July 26.

Enallagma exsulans Hagan. Milwaukee River, June 13. High grass on river bank.

Gomphus fraternus Say. Milwaukee River, June 13. Open sunny and shaded places on river bank.

Anax junius Drury. Milwaukee. July and August. On streets, in building near river, and in woods.

Æschna tuberculifera E. Walker. July 16. Oostburg. The Museum collection of *Aeschnæ* was sent to Prof. E. M. Walker of Toronto, who is at present monographing this genus. The data for the present and following species are given by Prof. Walker in a letter.

Æschna canadensis E. Walker. Milwaukee, June 14, from woods in East Milwaukee and Wauwatosa. Oostburg, July 4, 1908.

Æschna verticalis Hagan. Milwaukee, in woods, June 14.

Æschna constricta Say. August.

Æschna umbrosa E. Walker.

Epiæschna heros Fabr. Oostburg, June 16.

Epicordulia princeps Hagen. Oostburg, June 15. The first record from Wisconsin.

Sympetrum vicinum Hagen. East Milwaukee, July 24. In woods near marsh.

Sympetrum obtrusum Hagen. July 24—Sept. in marshy woods. This species was very abundant. Mr. Burrill reported a night in mid-August on which the species flew in such large swarms in the vicinity of Lake Park and Wonderland that it was impossible for people to remain outside.

Sympetrum rubicundulum Say. Johnson's woods, July 26, in marsh.

Sympetrum sp. A very interesting male obtained from Fox Lake,

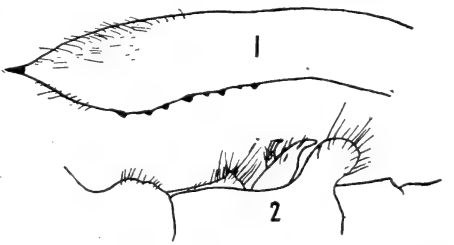


Fig. 1. *Sympetrum* sp. Superior appendage and genitalia.

Douglas Co., by Mr. H. L. Ward. Apparently it is *S. costiferum*, on comparison of the genitalia, which are nearly identical. It differs, however, in the unusual number of eight denticles inferiorly of the superior appendages, while *S. costiferum* is known to have four or five The specimens is still in teneral stage, but bears unmistakable indications of the markings of a fully developed specimen. The markings are identical with those of *S. costiferum*, save that the tarsi are entirely black, and not only ringed apically on the joints.

Leucorhinia intacta Hagen. Milwaukee, July and August, on roadsides, in fields. Oostburg, July 8. A female from Oostburg presents an abnormality by having rather more than the usually flavescent area at the base of the wings fuscous (blackish) halfway to the nodus.

Pachydiplax longipennis Burm. July 10, Oostburg.

Libellula quadrimaculata Linn. Oostburg , July 10. Milwaukee, June to August, abundant in woods.

Libellula semifasciata Burm. Oostburg June 16.

Libellula pulchella Drury. Oostburg and Milwaukee, June to Aug. In woods and fields.

Libellula basalis Say. Oostburg, June 26.

Plathemis lydia Drury. Oostburg, June 9.

Pantala flavescens Fabr. Sunny river bank, Milwaukee, Sept. 16.

Other Neuroptera captured by the author are:

Chauliodes pectinicornis Linn. et **rastricornis** Ramb., both species on sugar the latter part of June.

Chrysopa rufilabris Burm. **oculata** Say. et **nigricornis** Burm. On sugar in marshy woods.

Panorpa rufescens Ramb. June, Johnson's woods.

Bittacus strigosus Hagen. County Line, July 9.

Phryganea vestita Walker. On oak in Wauwatosa, West Allis and East Milwaukee, June and July.

Neuronia postica Walker. On oak and sugar in marshy woods. Johnson's woods, Wauwatosa, June to August.

Limnephilus indivisus Walker. On sugar in marshy woods. Johnson's woods, June to September.

Colpotaulius medialis Banks. On sugar in marshy woods. Johnson's woods July 10.

Hydropsyche scalaris Hagen, **Kansensis** Banks, **morosa** Banks, **analis** Banks. Milwaukee, June 5—Aug. 15, at light near Milwaukee river.

Limnephilus submonilifer Walker.

Hexagenia bilineata Say.

Ephemera simulans Walk.

Cænis hilaris Hagen.

Cleon vicina Hagen.
Siphlonurus aridus Say.
Heptagenia flaveola Pict. (?)
Heptagenia terminata Walsh.

Correction: Among the material collected by the Museum Expedition in Vilas Co., Wis., June 24-30, 1907, I found upon comparison one male *Tetragoncuria spinosa* Hagen. This record, added to the three other species of *Tetragoneuria* known from Wisconsin, completes the series of Northern species of *Tetragoneuria* for the state. *T. spinosa* is known from few localities and these chiefly Eastern. The occurrence of this species both in the White Mts. of N. Hampshire and in Northern Wisconsin is but another instance of the noted resemblance of the fauna of these two widely separate localities. (Bull. Wis. Nat. Hist. Soc. 6, pp. 60, 101, 1908.)

Public Museum, Milwaukee, Wis.
March 1, 1909.

A NEW FOSSIL GRASS FROM THE MIOCENE OF FLORISSANT, COLORADO.

By Charles T. and Beirne B. Brues.

The occurrence of fossil Gramineæ in the Miocene shales of Florissant was first noted by Cockerell* who described *Stipa laminarum* from these deposits.

In the present note we have the pleasure of describing a second species, referable to the genus *Melica*, also collected by Professor T. D. A. Cockerell and very kindly loaned to us by him for study. Through the efforts of Lesquereux, Cockerell and others the fossil flora of the wonderfully rich deposits of this region have been quite thoroughly worked out and many species have been described, but so far only two species of grasses have been brought to light.

Like *Stipa*, the genus to which the new form belongs is at the present time widely distributed throughout temperate and subtropical regions where it is represented by a considerable number of species.

Melica primæva sp. nov.

The specimen shows a detached pair of secund spikelest viewed from the inner, or side nearest the rachis. The spikelet which is

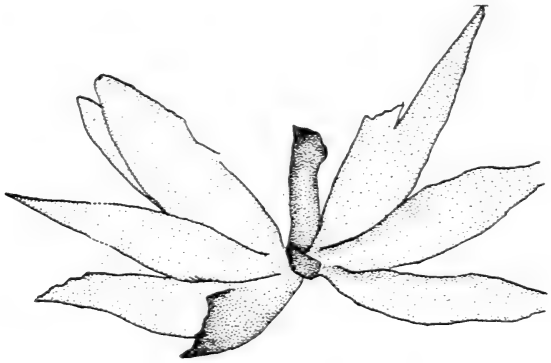


Fig. 1. *Melica primæva* sp. nov. Shaded portions indicate lower laminæ of the shale.

best preserved is about 12 millimeters long and shows five glumes; the lower of these, presumably one of the empty glumes is visible only at the base, its apical portion extending under the shale be-

* Bull. Amer. Mus. Nat. His., Vol. 24, p. 79 (1908).

neath the lowest flowering glume. The latter is not well preserved at the tip, but the second is visible for its entire length. It is 10 mm. long and about 2 mm. wide, broadly lanceolate in outline, with acutely pointed but unawned apex. Between the second and third flowering glumes can be seen the apex of the second empty glume. The spikelet thus appears to be three flowered, which also appears to be true of the second one, which shows three flowering glumes in a position symmetrical to those of the first and bears an empty glume partly hidden in the shale in almost the same position as the upper empty glume of the first spikelet. The lower empty glume of this spikelet probably lies beneath the first flowering glume in the shale.

Described from one specimen collected at Florissant, Colorado by Prof. T. D. A. Cockerell in the Miocene shales at station 14.

The present species appears to belong quite properly to *Melica* with which it agrees in all essential particulars. The secund insertion of the two spikelets as shown in the type, their large size and the form of the glumes, and the apparently very short joints of the rachilla seem to determine its location here with but little doubt. A superficially similar arrangement of the spikelets occurs in certain Hordeae, but other characters exclude it from a place in this trible.

THE GENERIC NAME ROOSEVELTIA.

I find that *Rooseveltia* proposed by me for a genus of *Attidæ* from Borneo, Trans. Wisconsin Acad. Sciences, Arts and Letters, Vol. XV, pt. II, p. 164 (1907) is preoccupied in Jordan and Seale's Fishes of Samoa, Dept. Comm. Lab. Bur. Fish., No. 25 (1906). I propose in its place *Ogdenia* after Dr. H. V. Ogden of Milwaukee.

Geo. W. Peckham.

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ACTUAL DATE OF PUBLICATION, APRIL 20, 1909.

PLANT FAMILY REFERENCE LIST.

By Herbert Clowes.

An alphabetically arranged double list of English names of plant families and their Latin equivalents, for the use of such as are not working exclusively or continuously on herbarium reference work, and who are therefore apt not to have the synonymous terms thoroughly memorized. The area embraced in the United States is from Maine to Virginia and Kentucky, west to Kansas and Nebraska inclusive.

The family suffix, (aceæ), for convenience, is abbreviated to [a]; and thus Taxaceæ (Yew) is rendered Tax[a].

I have found this compilation to materially facilitate herbarium reference work, having used it for years; and find it also a time-saver for quickly comparing synonyms. For use as a ready reference list *in general*, I have included Gramineae, Labiatae, etc. which, though not truly consistent for a *family* list, it seemed advisable to include.

LATIN.	ENGLISH.
ACANTH[a]	Acanthus
ACER[a]	Maple
ADOX[a]	Moschatel
AIZO[a]	Carpetweed
ALISM[a]	Waterplantain
AMARANTH[a]	Amaranth
AMARYLLID[a]	Amaryllis
AMBROSI[a]	Ragweed
AMMI[a]	Carrot
ANACARDI[a]	Sumac
ANON[a]	Custard Apple
APOCYN[a]	Dogbane
AR[a]	Arum
ARALI[a]	Ginseng
ARISTOLOCHI[a]	Birthwort
ASCLEPIAD[a]	Milkweed
BALSAMIN[a]	Jewelweed
BERBERID[a]	Barberry
BETUL[a]	Birch
BIGNONI[a]	Trumpet-creeper
BORAGIN[a]	Borage
BROMELI[a]	Pineapple
BUX[a]	Box
BURMANNI[a]	Burmannia
CACT[a]	Cactus
CAESALPINI[a]	Senna
CALLITRICH[a]	Water-starwort
CALYCANTH[a]	Strawberry-shrub
CAMPANUL[a]	Bell-flower
CAPPARID[a]	Caper
CAPPRIFOLI[a]	Honeysuckle
CARDU[a]	Thistle
CARYOPHYLL[a]	Pink
CELASTR[a]	Staff-tree
CERATOPHYLL[a]	Hornwort
CHENOPODI[a]	Goosefoot
CICHORI[a]	Chicory
CIST[a]	Rock-rose
CLETHR[a]	White-alder
COMMELIN[a]	Spider-wort
COMPOSITÆ	Thistle
CONVALLARI[a]	Lily of the Valley
CONVOLVUL[a]	Morning-glory
CORN[a]	Dogwood
CRASSUL[a]	Orpine
CRUCIFERAE	Mustard
CUCURBIT[a]	Gourd
CUSCUT[a]	Dodder
CYPER[a]	Sedge
CYRILL[a]	Cyrilla
DIAPENSI[a]	Diapensia
DIOSCORE[a]	Yam
DIPS[a]	Teasel
DROSER[a]	Sundew
DRUP[a]	Plum
EBEN[a]	Ebony
ELAEAGN[a]	Oleaster
ELATIN[a]	Water-wort
EMPETR[a]	Crowberry
EQUISET[a]	Horse-tail
ERIC[a]	Heath
ERIOCAUL[a]	Pipewort
EUPHORBI[a]	Spurge
FAG[a]	Beech
FUMARI[a]	Poppy
GENTIAN[a]	Gentian
GERANI[a]	Geranium
GRAMINEÆ	Grass
GROSSULARI[a]	Gooseberry
HÆMODOR[a]	Bloodwort
HALORAGID[a]	Water-milfoil
HAMEMELID[a]	Witch-hazel
HIPPOCASTAN[a]	Buckeye
HYDROPHYLL[a]	Water-leaf
HYMENOPHYLL[a]	Fern
HYPERIC[a]	St. Johns-wort
ILIC[a]	Holly
IRID[a]	Iris
ISOET[a]	Quillwort
ITE[a]	Virginia Willow
JUGLAND[a]	Walnut
JUNC[a]	Rush
KRAMERI[a]	Krameria
LABIATÆ	Mint
LAMI[a]	Mint

ENGLISH.	LATIN.
ACANTHUS	Acanth[a]
ADDERS-TONGUE	Ophioglossa
AILANTHUS	Simaruba
AMARANTH	Amaranth[a]
AMARYLLIS	Amaryllid[a]
APPLE	Pom[a]
ARROW-GRASS	Scheuchzeria
ARROW ROOT	Maranta
ARUM	Ara
ASTER	Compositae
BARBERRY	Berberid[a]
BAYBERRY	Myric[a]
BEECH	Fag[a]
BELL-FLOWER	Campanul[a]
BIRCH	Betul[a]
BIRTHWORT	Aristolochi[a]
BLADDERNUT	Staphyle[a]
BLADDERWORT	Lentibulari[a]
BLOODWORT	Haemodor[a]
BORAGE	Boragin[a]
BOX	Bux[a]
BROOMRAPE	Orobanch[a]
BUCKBEAN	Menyanth[a]
BUCKEYE	Hippocastan[a]
BUCKTHORN	Rhamn[a]
BUCKWHEAT	Polygon[a]
BUNCH FLOWER	Melanth[a]
BUR-REED	Spargani[a]
BURMANNIA	Burmanni[a]
CACTUS	Cact[a]
CALTROP	Zygophyll[a]
CAPER	Capparid[a]
CARPET-WEED	Aizo[a]
CARROT	Umbelliferae
CAT TAIL	Typh[a]
CHICORY	Cichori[a]
CLUB-MOSS	Lycopodi[a]
COWBERRY	Empetr[a]
CROWFOOT	Ranuncul[a]
CUSTARD-APPLE	Anon[a]
CYRILLA	Cyrill[a]
DIAPENSIA	Diapensi[a]
DODDER	Cuscut[a]
DOGBANE	Apocyn[a]
DOGWOOD	Corn[a]
DUCKWEED	Lemn[a]
EBONY	Eben[a]
ELM	Ulm[a]
EVENING PRIMROSE	Onagr[a]
FALSE MERMAID	Limnanth[a]
FERN	Polypodi[a]
" CLIMBING	Schizae[a]
" FILMY	Hymenophyll[a]
" ROYAL	Osmund[a]
FIGWORT	Scrophulari[a]
FLAX	Lin[a]
FOUR-O-CLOCK	Nyctagin[a]
GENTIAN	Gentian[a]
GERANIUM	Gerani[a]
GINSENG	Aralia
GOOSEBERRY	Grossulari[a]
GOOSEFOOT	Chenopodi[a]
GOURD	Cucurbit[a]
GRAPE	Vit[a]
GRASS	Gramineae
GRASS OF PARNASSUS	Parnassi[a]
HEATH	Eric[a]
HOLLY	Ilic[a]
HONEYSUCKLE	Caprifoli[a]
HORNWORT	Ceratophyll[a]
HORSETAIL	Equiset[a]
HUCKLEBERRY	Vaccini[a]
HYDRANGEA	Hydrange[a]
INDIAN PIPE	Monotrop[a]
IRIS	Irid[a]
JEWELWEED	Balsamin[a]
KRAMERIA	Krameri[a]
LAUREL	Laur[a]
LILY	Lili[a]
LILY OF THE VALLEY	Convallari[a]
LINDEN	Teli[a]
LIZARDS-TAIL	Saurur[a]
LOASA	Loas[a]
LOGANIA	Logani[a]
LOOSESTRIFE	Lythr[a]

LATIN.	ENGLISH.
LAURa	Laurel
LEITNERIa	Corkwood
LEMNa	Duckweed
LENTIBULARIa	Bladderwort
LILIa	Lily
LIMNANTHa	False Mermaid
LINa	Flax
LOASa	Loasa
LOGANIa	Logania
LORANTHa	Mistletoe
LYCOPODIa	Club-moss
LYTHRa	Loose-strife
MAGNOLIa	Magnolia
MALVa	Mallow
MARANTa	Arrowroot
MARSILEa	Marsilea
MARTYNIa	Unicorn-plant
MAYACa	Mayaca
MELANTHa	Bunch flower
MELASTOMa	Meadow-beauty
MENISPERMa	Moonseed
MENYANTHa	Buckbean
MIMOSa	Mimosa
MONOTROPa	Indian-pipe
MORa	Mulberry
MYRICa	Bayberry
NAIADa	Pondweed
NYCTAGINa	Four-o-clock
NYMPHÆa	Water-lily
OLEa	Olive
ONAGRa	Evening-primrose
OPHIOGLOSSa	Adders-tongue
ORCHIDa	Orchid
ORONBANCHa	Broom-rape
OSMUNDa	Fern
OXALIDa	Wood Sorrel
PAPAVERa	Poppy
PAPILIONa	Pea
PARNASSIa	Grass-of-Parnassus
PASSIFLORa	Passion Flower
PHASEOLa	Pea
PENTHORa	Stonecrop
PHRYMa	Lopseed
PHYTOLACCa	Pokeweed
PINa	Pine
PLANTAGINa	Plantain
PLATANa	Plane-tree
PLUMBAGINa	Plumbago
PODOSTEMa	River-weed
POLEMONIa	Phlox
POLYGALa	Milkwort
POLYGONa	Buckwheat
POLYPODIa	Fern
POMa	Apple
PONTEDERIa	Pickerel-weed
PORTULACa	Purslane
PRIMULa	Primerose
PYROLa	Pyrola
RANUNCULa	Crowfoot
RESEDa	Mignonette
RHAMNa	Buckthorn
ROSa	Rose
RUBIa	Madder
RUTa	Rue
SALICa	Willow
SALVINIa	Salvinia
SANTALa	Sandalwood
SAPINDa	Soapberry
SAPOTa	Sapodilla
SARRACENIa	Pitcher-Plant
SAURURa	Lizards-tail
SAXIFRAGa	Saxifrage
SCHEUCHZERIa	Arrowgrass
SCHIZÆa	Fern
SCROPHULARIa	Figwort
SELAGINELLa	Selaginella
SIMARUBa	Ailanthus
SMILa	Smilax
SOLANa	Potato
SPARGANIa	Bur-reed
SPHAGNa	Bog-moss
STAPHYLEa	Bladdernut
STYRACa	Storax
SYMPLOCa	Sweet-leaf
TAXa	Yew
THEa	Tea
THYMELEa	Mezereon
TILIa	Linden
TRAPa	Water-nut
TYPHa	Cat-tail
ULMa	Elm
UMBELLIFERÆ	Carrot
URTICa	Nettle
VACCINIa	Huckleberry
VALERIANa	Valerian
VALLISNERIa	Tape grass
VERBENa	Vervain
VIOLa	Violet
VITa	Grape
XYRIDa	Yellow-eyed grass
ZYGOPHYLLa	Caltrop

ENGLISH.	LATIN.
LOPSEED	Phrym a
MADDER	Rubia
MAGNOLIA	Magnolia
MALLOW	Malva
MAPLE	Acera
MARSILEA	Marsilea
MAYACA	Mayaca
MEADOW BEAUTY	Melastoma
MEZEREON	Thymelea
MIGNONETTE	Reseda
MILKWEED	Asclepiada
MILKWORT	Polygala
MIMOSA	Mimosa
MINT	Labiatae
MISTLETOE	Loranth a
MOONSEED	Menisperm a
MORNING GLORY	Convolvul a
MOSCHATEL	Adoxa
MOSS BOG	Sphagn a
" CLUB	Lycopodia
" FLORIDA	Bromelia
" FLOWERING	Diapensia
MULBERRY	Mora
MUSTARD	Cruciferae
NETTLE	Urtica
OLEASTER	Elaeagn a
OLIVE	Olea
ORCHID	Orchida
ORPINE	Crassula
PASSION FLOWER	Passiflora
PEA	Papilion a
PHLOX	Polemonia
PICKEREL-WEED	Pontederia
PINE	Pina
PINE APPLE	Bromelia
PINK	Caryophyll a
PIPEWORT	Eriocaula
PITCHER PLANT	Sarracenia
PLANE TREE	Platan a
PLANTAIN	Plantagin a
PLUM	Drupa
PLUMBAGO	Plumbagin a
POKEWEED	Phytolacca
PONDWEED	Naiada
POPPY	Papaver a
POTATO	Solan a
PRIMROSE	Primula
PURSLANE	Portulac a
QUILLWORT	Isoet a
RAGWEED	Ambrosia
RIVERWEED	Podostem a
ROCKROSE	Cista
ROSE	Rosa
RUE	Ruta
RUSH	Junc a
ST. JOHNS-WORT	Hyperic a
SALVINIA	Salvinia
SANDALWOOD	Santal a
SAPODILLA	Sapota
SAXIFRAGE	Saxifrag a
SEDGE	Cyper a
SELAGINELLA	Selaginell a
SENNA	Caesalpinia
SMILAX	Smila
SOAPBERRY	Sapinda
SPIDERWORT	Commelina
SPURGE	Euphorbia
STAFF-TREE	Celastra
STONE CROP	Penthora
STORAX	Styrac a
STRAWBERRY SHRUB	Calycanth a
SUMAC	Anacardia
SUNDEW	Drosera
SWEET-LEAF	Symploca
TAPE-GRASS	Vallisneria
TEA	Thea
TEASEL	Dipsa
THISTLE	Compositae
TRUMPET CREEPER	Bignonia
UNICORN PLANT	Martynia
VALERIAN	Valerian a
VERVAIN	Verbena
VIOLET	Viola
VIRGINIA WILLOW	Itea
WALNUT	Juglandia
WATER-LEAF	Hydrophyll a
" LILY	Nymphaea
" MILFOIL	Haloragida
" NUT	Trapa
" PLANTAIN	Alisma
" STARWORT	Callitrich a
WATERWORT	Elatina
WHITE ALDER	Clethra
WILLOW	Salica
" VIRGINIA	Itea
WINTERGREEN	Pyrola
WITCH HAZEL	Hamamelida
WOOD SORREL	Oxalida
YAM	Dioscorea
YELLOW-EYED GRASS	Xyrida
YEW	Taxa

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