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BULLETIN
OF THE
WISCONSIN NATURAL HISTORY SOCIETY

CONTENTS.

MILWAUKEE, WISCONSIN.

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Directors of Sections.

ETHNOLOGY.

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GEOLOGY AND PALAEONTOLOGY.

E. E. Teller.....3303 Cedar St., Milwaukee

ZOOLOGY.

Chas. E. Brown—Entomology.....1214 Chestnut St., Milwaukee
Geo. Shrosbree—Ornithology.....2215 Wells St., Milwaukee

BOTANY.

Ernest Bruncken.....Mack Building, Milwaukee

MINERALOGY.

Louis Lotz.....615 Galena St., Milwaukee

PUBLISHING COMMITTEE.

Dr. G. W. Peckham, W. J. Bennetts, E. E. Teller, Philip Wells.

PLACE OF MEETING.

Lecture Room, Third Floor of Milwaukee Public Museum.

The Bulletin of the Wisconsin Natural History Society is published quarterly, and is distributed by the Milwaukee Public Museum.

An exchange with other publishing societies and institutions is solicited.

Proceedings of the Wisconsin Natural History Society.

March 8 to October 26, 1899.

Wednesday, March 8, 1899.

Called to order at the lecture room of the Public Library by the president, Dr. Geo. W. Peckham.

Chas. H. Doerflinger was elected secretary pro tem.

A letter was then read by Mr. Doerflinger, from Chas. E. Brown, president of the Milwaukee Natural Science Association, announcing that the latter association was disposed to join the Natural History Society, as a body—all its members wishing to become members of the Wisconsin Society. A motion passed to recommend to the board of directors that they be admitted as regular members and that their fees be fixed at $1.20 a year, for the first three years after admission.

Mr. Doerflinger then moved that the Natural History Society, in consideration of its inactivity during several years, amend its constitution by adding to article 6 the clause:

The board of directors are authorized to suspend, remit, or reduce, membership fees whenever in its judgment there are good reasons for such action.

The motion was seconded and carried.

Thursday, April 27, 1899.

In the lecture room of the Public Library, with Dr. Peckham in the chair.

The board of directors reported that the following members of the Milwaukee Natural Science Association, which had resolved

to unite with the Wisconsin Natural History Society, had been admitted to membership, this being the only constitutional means of uniting the two organizations, viz.: Chas. E. Brown, W. J. Bennetts, Robt. O. Wanvig, Paul H. Dernehl, H. Altschwager, Carl Boerner, Lee W. Whitney, Edw. W. Perkins, Armin Neitzke, Henry Roemheld, Geo. Shrosbree, Paul C. Rohde, Adolf Sontag, F. Kirchner and Frank H. Wallschlager.

The action of the board of directors was approved, and the union of the younger with the older society welcomed by the president.

The board of directors then reported the following resolutions for adoption:

Resolved, That the president and secretary request the board of trustees of the Public Museum to grant the use of the lecture room of that institution, free of charge, for the meetings of the Wisconsin Natural History Society and its sections, and also to grant those members of the society, who are interested in any branch of natural history or ethnology, the privileges accorded by such institutions, in all parts of the world, to students and investigators.

Resolved, That the society place its library, to be acquired by purchase, exchange, or donation, at the disposal of the museum as a loan collection.

Resolved, That the board of directors encourage and facilitate to the extent of the means of the society the organization of sections, which shall make it their object to stimulate study and research in the various branches of natural history.

Resolved, That each section thus formed shall have certain days of each month set aside for its section meetings.

Resolved, That every section shall be represented at the monthly meetings of the society, by its chairman or some other member selected by him, to report on the work and transactions of his section for the preceding month.

The above resolutions were unanimously adopted.

The president then appointed Messrs. Chas. H. Doerflinger, C. L. Mann and C. E. Brown, as a committee to nominate officers for the ensuing year. After a short recess the committee, through its chairman, C. H. Doerflinger, reported the following nominations:

For President—G. W. Peckham.
Recording Secretary—W. J. Bennetts.
Corresponding Secretary—Lee W. Whitney.
Treasurer—Ferdinand Meinecke.
Librarian—Paul H. Dernehl.

DIRECTORS OF SECTIONS:

Zoölogy—Sub-Section Entomology.....Chas. E. Brown
Zoölogy—Sub-Section Ornithology.....Geo. Shrosbree
Botany.....Henry Roemheld
Ethnology.....Chas. H. Doerflinger
Mineralogy.....Louis Lotz
Geology and Palæontology.....E. E. Teller

A motion to elect the nominees mentioned by acclamation was carried unanimously.

Chas. H. Doerflinger then read a paper and made remarks on his "Prehistoric Rambles in France," dwelling principally on the researches, discoveries and collections of his friend, Dr. François Daleau, of Bourg sur Gironde, made in the cave called Pair non Pair, and which he considered the most interesting and important of recent archeological finds. In it are found remains belonging to each of the four principal periods of the paleolithic age in France, viz., the Acheuléen, the Mousterien, the Solutréen and the Madelainien, which correspond to at least four great glacial periods and indicate an age estimated at from 30,000 to 90,000 years.

Mr. E. E. Teller then read a paper on the "Geology and Palæontology of the Region Around Milwaukee," a district he had personally investigated for many years, and in which he had made large and valuable collections. Several of the fossils described in the paper were stated to be new to science and hitherto undescribed.

THURSDAY, MAY 25, 1899.

This meeting was called to order by President Peckham in the lecture room of the Public Museum, eighteen members of the society being present.

The secretary read a report of the first field day of the united sections of the society. The excursion was made to the vicinity of the cement quarries on the upper Milwaukee river, and the report covered the ethnological, ornithological, botanical and entomological aspects of the trip.

Mr. E. E Teller then exhibited a number of fossils collected that day at the quarries, and explained their significance to the meeting. One specimen represented the chamber of habitation of an undescribed cephalopod. Among the others were scales of an undescribed fish, also gonotites, and a tooth of Paleomylus Greenei, named in honor of the late Thos. A. Greene, of Milwaukee.

Dr. Peckham then related some observations made during a recent trip to Georgia. He had found plant life there about a month ahead of that in Wisconsin, but insect life, on the contrary,

not correspondingly forward. Spiders and their webs were exceedingly scarce. A new fact in regard to the tortoise shell or Cassia beetle had there come to his notice. A specimen he had captured had changed immediately from yellow-gold to a yellow-red in color, in which state it almost exactly resembled the two-spotted lady bug, regaining its usual color when left undisturbed. As the lady bug is an insect, especially distasteful to birds and lizards, the doctor suggested that the above fact might be an instance of protective mimicry in the Cassia beetle.

Mr. C. E. Brown also mentioned an experience of his in which the same change of color had taken place immediately after they had died, when put in a cyanide bottle.

Mr. Phillip Wells read a paper describing an excursion made the previous Sunday through three miles of woodland, near Elm Grove, Wis., in search of morrels and mushrooms. About thirty species of flowers were mentioned as being observed on the trip. The event of the day was the finding of a flower of the showy *Orchis* (*Orchis spectabilis*)—a flower which Mr. Wells said was identical in structure with the orchid (*Orchis mascula*) figured by Chas. Darwin in his work, "The Fertilization of Orchids."

The following were elected to membership: Mr. Chas. E. Monroe, Mr. W. P. Caine and Mr. Herbert Clowse.

Mr. F. Rauterberg was transferred from the list of active members to the honorary list, and Prof. Marshall, of the University of Wisconsin, was made an honorary member of the society.

The question whether grooved stone axes were peculiar to Wisconsin was brought up by C. E. Brown, and both he and Mr. Ellsworth stated they had so far been unable to find any evidence to the contrary.

Thursday, June 22, 1899.

In the lecture room of Public Museum, Dr. Geo. W. Peckham in the chair, and twenty-five members present.

Mr. C. H. Doerflinger, the director of the ethnological section, read the report of a survey that had been made during the week, of the Indian mounds near the cement works, north of the city, and also exhibited photographs of the locality. Mr. Doerflinger stated that he had had access to the unpublished papers of the late Dr. Lapham, author of the "Antiquities of Wisconsin," but could find no evidence that the latter had ever known of the existence of these mounds. Later in the meeting a letter to the same effect from Miss Mary J. Lapham, of Oconomowoc, was read by Mr. E. E. Teller.

Mr. Doerflinger also gave notice that the members of his section would meet the following Sunday for the purpose of excavating a supposed burial mound that formed one of the group.

A paper on the winter habits of the great northern shrike (*Lanius borealis*), was read by Mr. W. J. Bennetts. The paper dwelt particularly on the little known musical ability of this bird and also on its habits as a bird of prey.

Mr. Chas. E. Brown as director of the entomological section read a list of lepidoptera, collected by members of his section during a trip taken to Larkin's tamarack swamp, near North Greenfield, following which he also gave an account of his investigations concerning the depredations of the cottony maple scale (*Pulvinaria innumerabilis*), in this city. He had found them to a greater or less extent in all sections of the city, but especially numerous in a district about a mile square on the West Side. The trees infested were principally the soft maple, the box elder, the balm of Gilead, and the elm, in about the order mentioned, and he had also found them on the grape vine. The life history of the insect was dwelt upon and remedies against its ravages suggested—the kerosene emulsion being the one most recommended.

The president next drew the attention of the society to the late Mr. F. S. Perkins' "Album of Antiquities," now in course of publication, and a motion, endorsing the work as a valuable contribution to archæological science was unanimously carried.

It was also decided that the proceedings of the society should be published at suitable intervals, and the president, the recording secretary and Mr. E. E. Teller were appointed a committee to gather information and report at the next meeting.

The following were elected members of the society: Dr. S. Graenicher, Mr. P. Wells, Mr. John A. Brandon, Mr. T. J. Pereles, Judge J. M. Pereles, Mr. Geo. Sutton, Mr. F. L. Horneffer, and Mr. Geo. G. Phillips.

It was decided to discontinue the meetings during the warm summer months and to hold the next regular meeting in September.

THURSDAY, SEPT. 28, 1899.

The meeting was held in the lecture room of the Public Museum, with Mr. E. E. Teller in the chair.

An interesting paper on "Indian Dialects of the Algonquins," was read by Mr. D. W. Fowler. It was explained that the term Algonquin related rather to a particular Indian language than to a group of tribes or nations. In the paper, many local names of Indian origin, such as Milwaukee, Wisconsin, Michigan, were traced back to their Chippewa derivation, and the peculiarities of

this language were described in detail. Among these are the exceedingly long words, ten or more syllables in length, the large proportion of verbs, comprising about nine-tenths of all the words in the language, the lack of any distinction for sex, and the great regularity of its grammar, there being only two irregular verbs in it.

The Dakotah tongue was also considered, and the statement made that the origin of all Indian languages was wrapt in complete mystery.

Mr. Paul H. Dernehl then read a paper relating his observations on the recent migrations of the milkweed butterfly (*Anosia plexippus.*) The main flight appears to have taken place on the night of Sept. 6th, as on the evening of that day the trees at Lake Park were weighted down by immense numbers of the insects, while on the following morning but few were to be seen.

In discussing this paper, Mr. Chas. E. Brown mentioned flights of this butterfly that had been reported from Pewaukee, Wis., and from Chicago, and also as having been seen crossing an arm of Lake Michigan near the Michigan shore.

Mr. E. Bruncken read a paper entitled, "Some Remarkable Trees in the Vicinity of Milwaukee." The largest tree in this locality was stated to be a soft maple twenty-one feet, eleven inches in circumference, growing on the west bank of the Menomonee River near the Soldiers' Home grounds. This was also, as far as he could discover, the largest soft maple on record.

E. E. Teller informed the society of the finding of an almost complete jaw of the fossil fish *Dinichthys pustulosus*, at the cement quarry, by Chas. E. Monroe.

The resignation of Chas. H. Doerflinger as director of the ethnology section was reluctantly accepted, and L. C. Whitney elected to succeed him.

A report from the treasurer, Mr. F. Meinicke, showed that there were $189.63 in the treasury.

Messrs. Geo. A. West, Otto Habhegger and Richard Raasch were elected to membership in the society.

Thursday, October, 12, 1899.

This was a joint meeting of the Botany and Ornithology sections, held for the purpose of deciding upon a program for the winter's work. Chas. E. Brown occupied the chair.

The object of the meeting was quite thoroughly discussed by those present, and it was the general opinion that, in addition to the special lines of research in which individual members were interested, considerable attention should be given to our local flora and avifauna.

Mr. P. Dernehl spoke on bird migration, and also described a recent visit to the Field Columbian Museum at Chicago.

Henry Roemheld signified his intention of resigning as director of the Botanical section, and a motion passed to recommend to the society the electing of Ernest Bruncken to the vacancy.

THURSDAY, OCTOBER 26, 1899.

The general meeting for October was held this day in the lecture room of the Public Museum. President Peckham occupied the chair, and eighteen persons were present.

The report of the committee on publications was read by the secretary.

It was voted that the report be adopted and that the selection of the members of the editing committee be left to the president.

Ernest Bruncken was elected director of the Botanical section in place of Henry Roemheld, resigned.

Mr. Bruncken then read a paper entitled "Notes on the Distribution of Some Trees and Shrubs in the Vicinity of Milwaukee." The paper dealt principally with the present distribution of the members of the birch, beech, poplar and willow families in Milwaukee county.

A suggestion of Mr. F. Meinecke that the society give one or more popular lectures on natural history during the coming winter, was favorably considered by the society, and the president and Ernest Bruncken were appointed to make the necessary arrangements.

President Peckham described some recent experiments made by a gentleman of Chicago, upon passenger pigeons, mud puppies and other animals, and which tended to prove that certain facts were not due to any defect in the vision of these creatures, but rather to their inability to recognize familiar objects when the latter were placed under unusual conditions.

Mr. Bruncken described a method of collecting data for a new list of plants of Milwaukee county, by the use of blank cards to be distributed among the active botanists of the locality, and the expenditure necessary for the printing of these cards was authorized by the society.

Messrs. Paul Jerome Waterous, A. W. Slocum and David Whitaker were elected to membership.

There being no further business to transact, the meeting was adjourned.

WILLIAM J. BENNETTS, Secretary.

ANCIENT WORKS
IN THE VICINITY OF
MILWAUKEE
WISCONSIN.

Surveyed in 1836 – 1852 by
I. A. Lapham.

SCALE 6600 ft to an inch

Report on the Teller Effigy Mounds in Milwaukee County, Wisconsin.

By C. H. DOERFLINGER and C. E. BROWN.

This interesting group of ancient works was first introduced to the notice of the Wisconsin Natural History Society in May, 1899, by Mr. Edgar E. Teller, a member, in whose honor the society has named them. It owes much of its present importance to the fact that Wisconsin's celebrated antiquarian, Dr. Increase A. Lapham, did not note and describe them in his immortal work on Wisconsin antiquities, although it is well known that he very frequently visited the vicinity and described other less extensive groups in the near neighborhood.

Writing to the society under date of June 1st, 1899, his daughter, Miss Mary J. Lapham, expresses her great surprise that her father should have overlooked such an extensive group of emblematic mounds in a locality with which he was so entirely familiar, but a most careful research among Dr. Lapham's published works and unpublished notes has thrown no light upon the matter under consideration, so that we may safely conclude that these ancient works were once so well hidden among the dense underbrush of the surrounding forest as to escape even the careful scrutiny of this great observer.

Of the many interesting prehistoric effigy and other mounds discovered and described by him and other explorers of Milwaukee County, nearly all have long since been effaced by the growth of the city and the cultivation of the outlying tracts, so that at the present time our group stands almost alone as a monument to the customs and works of prehistoric man in Milwaukee County, Wisconsin.*

A proposition to undertake a thorough exploration of this group of mounds was received with enthusiasm by the members of the Ethnological section. A preliminary excursion having been made to the grounds, and a favorable report presented at the following meeting, the director of the section was authorized to prepare a plan of operations and to engage Mr. F. W. Blodgett, an experienced civil engineer, to make an accurate survey of the mounds and their position relative to neighboring landmarks, the result of which is given here below and illustrated by the three accompanying plates.

* "It is claimed that within the limits of the city of Milwaukee stood some of these mounds even as late as 1855." H. L. Conrad's History of Milwaukee.

Location.

The Teller group is located in the northeast quarter of the southeast quarter of Section 5, Town 7 north, Range 22 east, in Milwaukee County, Wis., about one-third of a mile east of the Port Washington road, and about a quarter of a mile from the west bank of the Milwaukee River.

It is situated west of and close to the brink of a ravine, about 200 feet wide at the widest part, and through which a small, clear stream flows in the spring and early summer, being directly tributary to the Milwaukee River.

The general elevation of the tract of tree-covered pasture land surrounding the mounds is about 18 feet above the ravine, 36½ feet above the river and 17 feet lower than the Port Washington road. The elevation of the mounds themselves is from one-half foot to 2½ feet above the surrounding pasture land.

This group (Plate II.) comprises thirty-five large and small mounds and consists of:

First.—Five large effigy or animal forms, which belong to the so-called panther or lizard type.

Second.—One large mound of an elliptical shape, which was supposed to have been a burial mound or cache.

Third.—Twenty-seven smaller tumuli of approximately circular or oval outline, of which a group of three accompanies each of the five large effigies, the remaining twelve being located in other parts of the pasture grouped as follows: Six, two, two, one, one.

These smaller mounds are peculiar in their construction, and doubts were expressed during the discussion at meetings of the section, whether they represented the work of the aborigines or merely marked tree falls in the ancient forest. Careful comparison and consideration of these, however, has inclined us to the former opinion. They measure from 18x10 down to 2x6 feet in size, and have each a noticeable depression on either side opposite the transverse axis of the mound, whereas in the case of a tree-mound there would be but one such depression and that directly in the rear of the mound.

These depressions from their situation, give the impression that the mounds themselves were formed by simply scooping out the earth on either side of the mound and heaping it up in the middle. The original oval or circular shape of these smaller mounds appears to have undergone considerable modification in the course of time. It may be remarked that the soil composing these smaller barrows seems to be of a looser nature than that of the effigies.

Five of the larger mounds forming this group, viz., the supposed burial mound and four of the panther or lizard mounds, are quite close together. The supposed "burial mound" (No. 3) being surrounded by three of the effigies (Nos. 1, 2 and 4), while the fifth panther or lizard (No. 6) is isolated from the rest and lies at a distance of about 400 feet in a northerly direction from the remainder of the group. The latter is now somewhat mutilated, having had a considerable portion of its tail removed by the leveling of the ground and erection of a railway spur track directly to the north of it.

Upon this mound and its caudal extremity are to be seen growing three sturdy white oak trees of a circumference of 25, 52 and 36 inches, respectively, measured at breast height from the ground. None of them are probably more than 50 to 75 years old, which, however, is no indication of the age of these mounds, which were undoubtedly, like other mounds discovered in and near Milwaukee by early settlers more than half a century or nearly a century ago, in practically the same condition and of the same appearance when the embryos of those trees first sprouted. This mound measures now about 98 feet 6 inches in length, with an average width of about 7 feet in the tail and 18 feet at the legs.

Mound No. 1 is the largest of the group, with a general course of N. 60 deg. 2 min. W., and measures 162 feet in length, with an average diameter of 9½ feet across the tail and 27½ feet across the body. Its head is about 90 feet from the top of the ravine.

Panther or lizard mound No. 2, the most westerly mound of the group, has a general direction of N. 27 deg. 39 min. W., and is 122½ feet in length, with an average width of 10½ feet across the tail and 25 feet across the body at the limbs.

Upon its western side opposite the legs stands an oak tree 65 inches in circumference.

The distance from the tail end of No. 1 to the head of No. 2 is 40 feet.

Mound No. 3 is the supposed "burial" or elliptical mound. Its center lies about 70 feet north of the middle of the tail of No. 1, about 70 feet to the east of the fore leg of No. 2, and about 80 feet from the middle of the tail of No. 4. It is 55 feet long by 22 feet wide. Its general direction is N. 38 deg. 10 min. W.

Mound No. 4 is located to the northeast of No. 3, and is 119 feet long, with an average width of 9½ feet across the tail and 24 feet across the body. The general direction is N. 63 deg. 30 min. W.

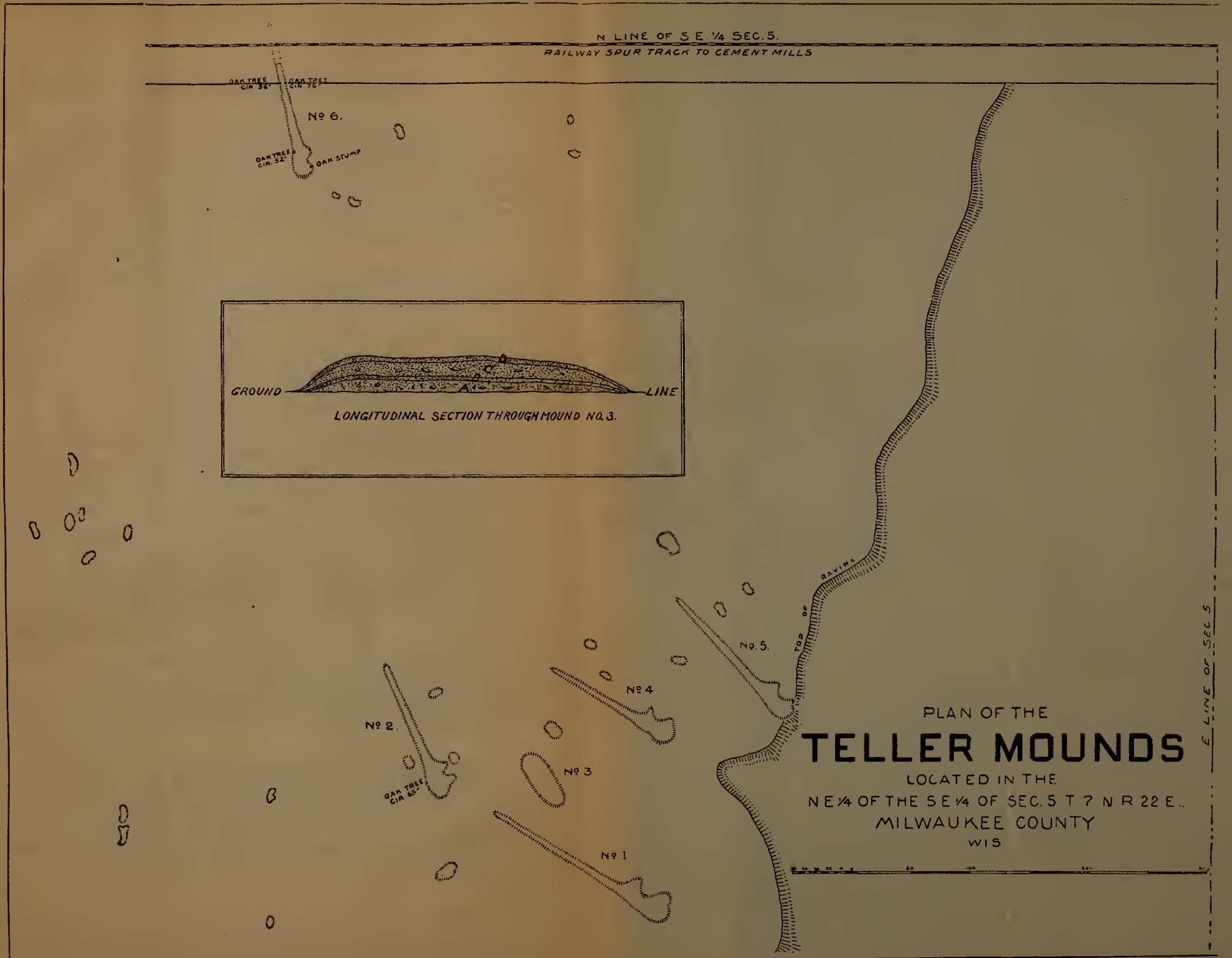
Mound No. 5 is located east by north of No. 4, their middles being about 110 feet apart. Its head projects slightly over the edge of the ravine. It measures 136 feet in length with an aver-

age width of 12 feet across the tail and 21 feet across the body, with a general direction of N. 44 deg. 26 min. W.

It is noticeable that all the effigies in this group have their heads directed to the southeast. We do not know what the direction given meant. It may have been a mere whim on the part of the builders or purely accidental; it may have been a sign for other members of the same tribe arriving at the place later, of the direction in which their kin had proceeded; possibly the different poses of the effigies had a meaning known only to the initiated and in this case the key to the picture ciphering will probably never be known. Certain it is that there are very marked variations in the attitudes of the heads and the relative positions of the legs of different specimens of the same species, for instance the so-called panther or lizard.

The learned and indefatigable archæologist, Dr. S. D. Peet, asserts apodictically that our lamented Dr. Increase Allen Lapham was mistaken in calling the effigy that occurs most frequently in this region "lizard." With all due deference to the authority of Dr. Peet, who says it represents a "panther," attention is directed to some matters that may throw light on this question. The effigies in question present a striking resemblance in their proportions to a lizard. The tail is several times as long as the body from head to hind leg; moreover, the tail is like a lizard's, being broad near the leg and gradually tapering to the tip, while the tail of a panther (puma) is comparatively thin, nearly of equal thickness throughout, like a cat's, and is less than two-thirds as long as the body from head to hind leg. One of the Teller effigies carries its head and neck erect, precisely as a lizard does every time it stops after a run, to assume an attitude of attention and observation. While the mound builders may be supposed to have considered the fleet, agile, strong and blood-thirsty panther, their competitor in the hunt and the enemy of their game worthy of deification, it must not be overlooked that lizards, owing to their bright eyes, their speed, their mysterious action in appearing and disappearing like unto a "deus ex machina," and in some cases their rapid mutations of color, were regarded with superstitious awe by most peoples of all ages, whether savages, or more or less civilized, and they play an important role in folklore even at the present day. Nor should it be forgotten that Dr. Lapham was a calm and keen observer; and while no claim of infallibility of judgment is made for him here, we cannot set aside his opinion without conclusive proofs.

On the morning of the 25th of June, 1899, members and friends of the Wisconsin National History Society assembled at the mound field on the grounds of the Milwaukee Cement Com-


N LINE OF S E ¼ SEC. 5.
RAILWAY SPUR TRACK TO CEMENT MILLS
OAK TREE CIR 36"
OAK TREE CIR 76"
No 6.
OAK TREE CIR. 52"
OAK STUMP
GROUND
LINE
LONGITUDINAL SECTION THROUGH MOUND No. 3.
No. 5.
TOP OF RAVINE
No 4
No 2.
No 3
OAK TREE CIR 65"
No 1
PLAN OF THE
TELLER MOUNDS
LOCATED IN THE
NE¼ OF THE SE¼ OF SEC. 5 T 7 N R 22 E.
MILWAUKEE COUNTY
WIS
E LINE OF SEC 5

pany, for the purpose of excavating the supposed burial mound No. 3. Trenches from 3 to 4 feet in width, and extending down to the original surface of the ground, were carefully dug from end to end and side to side, but nothing of scientific interest or value was unearthed, the former contents, whatever their nature, had long succumbed to the moisture of the earth and absorbent root growths which have penetrated this mound on all sides. This negative result was anticipated as a possibility or probability, and was therefore no disappointment.

The original surface on which the mound has been erected, is composed of yellow, ochreous clay and gravel, covered with two or three inches of vegetable loam, presenting no appearance of having ever been disturbed. (See plate II.)

At (A) for a depth of about 12 inches is a layer of rich, black loam. At (B) is a layer, about 5 inches in depth, of very black soil of a rather hard consistency when first cut into, having much the appearance of being composed of a mixture of sand and charcoal, which, when exposed to the atmosphere, quickly turns to an ashy grey color, and readily loses its hard consistency. Overlying this at (C) is a layer of black, loamy soil similar to that at (A) and about 24 inches in thickness. The whole is surmounted by a layer of about 3 inches of recent loam. Mixed with the soil in the layers (A and C) were a number of angular fragments of yellow chert, none of them showing, however, the slightest indication of having ever been worked. The only relics that came to light during the excavation, were a small, triangular, incomplete, chipped arrow point of almost white chert, and a bone of about 12 square inches surface that was identified by a physician present as a human cheek bone. Both these objects were found very near the surface by persons not members of the exploring party and their condition gave color to the suspicion expressed as to their antiquity.

Dr. I. A. Lapham, in describing and picturing effigies similar in outline to those comprised in the present group from this and other localities in the state, characterized them as "lizard" mounds, a designation which has subjected him to frequent criticism, even during the period of his own life, and to which he briefly refers in his great work.

It will be noted in regard to the examples of this well-known type in our own and other groups formerly existing in this vicinity, that there is no distinct head visible, the head and fore limbs giving the appearance of having been moulded into one.

Whether this distortion be the work of intention or is merely due to the leveling influence of time and weather, we are only able

to conjecture, but the latter assumption seems to have more probability in its favor.

Having given our view on the lizard and panther question, we will quote also opposite holdings.

Dr. S. D. Peet in an article published some years ago in his *American Antiquarian and Oriental Journal,* offers the following kindly criticism of Dr. Lapham's identifications of effigies, which we take the liberty to quote in part:

"* * * Dr. I. A. Lapham published a work over thirty years ago in which animal effigies were shown in great numbers. This work is deserving of great praise as the surveying and plottings are in the main correct."

"He called panthers, lizards and birds, crosses. But other animals he did recognize and the work done by him is worthy of confidence."

There are numerous and weighty reasons why a correct identification of the animals is highly desirable, these have been so well outlined in other publications of note that we will not attempt to repeat them here.

(See *American Antiquarian and Oriental Journal,* pp. 126-199, Vol. VI.)

Suffice it to say that a proper recognition of the animals represented would clear up many disputed points and generally tend to increase the popular interest in the effigies themselves.

We further quote Dr. S. D. Peet as follows, (pp. 187-188, Vol. VI., *Am. Antiq. and Oriental Jour.*). "The (observer) will notice that the animals are represented mainly in motion and in the motion which would be peculiar to the animals inhabiting the different elements.

"1. The lizard and muskrat are represented as crawling or swimming, the birds as flying, and the fish as floating; the three classes corresponding to the three elements."

"These are the different methods of representing this.

"1. The land animals were universally represented with the legs on one side.

"2. The amphibious animals, such as the lizard, turtle and muskrat, are all represented with their legs on both sides, as if in the attitude of swimming.

"3. The birds, on the other hand, all have their wings extended as if in the act of flying.

"4. The fish is represented with the body alone, no particular part of the animal being present."

"The effigies are all good representations of the animal shapes; the attitudes of the animals are also natural, but the manner of

representing the different classes of animals is the most worthy of study.

"This is uniform—all the effigies which we have observed have the same characteristics, the manner of presenting the animals having become conventional and fixed."

When we stop to consider that these very birds, beasts and fishes which they so correctly, ably and artistically represented, played a prominent role in their daily life and environments, we need not wonder at their proficiency in depicting them. That they understood to a certain extent the division and classification of the animals they represented is most likely and not at all unnatural under the circumstances.

Such were their natural powers of observation and imitation, strengthened by an every-day association with their subjects, and so great the influence upon their savage nature that they readily became proficient in depicting them in their remarkable earth-works.

The prevalence of the panther type of effigy mound in the state of Wisconsin is well known. Other animals, the eagle, buffalo, wolf, otter and turtle occur frequently, but in point of numbers and relative interest the panther, as becomes his kingliness and strength, readily dominates over all.

Among the animal mounds of Milwaukee County this domination of the panther type over all others is particularly apparent.

Dr. I. A. Lapham alone describes and figures twenty-one of these out of a total of twenty-six animal mounds, the only other animal mounds in Milwaukee County described by him (so far as we are able to ascertain) being three bird, two turtle (one distorted) and one wolf mound.

Mr. Jas. S. Buck in his "History of Milwaukee," describes one other which Dr. Lapham does not seem to have noted, as located. "in Elizabeth Street, now National Avenue, about Twenty-fourth Avenue. This was a gigantic specimen 200 feet in length, and upon it stood oak trees, three feet in diameter."

Dr. Lapham has also spoken of a number of "lizard" and other mounds as having been once located at Walker's Point, on the south side of the Menomonee, near the junction of the Milwaukee and Menomonee Rivers, but does not inform us of their number. If to the twenty-one panther mounds heretofore mentioned we add the five comprised in the Teller group, we have a total of twenty-six panther or lizard mounds out of a total of thirty-one animal effigies described.

Of these nine were known to have been located in the vicinity of or along the Kinnickinnic, two near the Menomonee and twenty-one along the Milwaukee River.

It is a well-known fact, that in the state of Wisconsin, "certain effigies are generally found confined to certain localities, some representing panthers numerously, but other localities representing some other animal with the same prominence."

"A ruling divinity always presides over a locality."

"In one place it may be the eagle, in another the turtle, in another the wild goose, and in still another the racoon or wolf." (pp. 336, Vol. VI., *Am. Antiq. and Oriental Jour.*)

So it appears (if we undertake thus to interpret the hidden meaning of the effigies) that the different clans or gentes of a once great people had each its own particular symbol, which they built into the soil instead of portraying it on their tents, as was the Indian custom.

Totemism has been at some time or other common to the greater number of the wild tribes in all parts of the world, and in North America it once prevailed among the tribes east of the Rocky Mountains, and in Mexico and Central America.

Briefly defined it consists in the reverence or common faith of a body of men and women for an animal or mythological being by whose name they call themselves and from which they claim descent. This totem is common to the whole clan and passes by inheritance from one generation to another.—(*Ency. Britanica.*)

Dr. S. D. Peet in his extensive works and researches has plainly intimated to us that such a system of clan emblems did prevail among the emblematic mound builders, and he has given us many excellent reasons for so thinking.

He has pointed out to us, that where we find a certain region in which one effigy type outnumbers all others, we may rightly adjudge it to have been once the domain of a clan which had that particular effigy for its tribal totem.

By this means he has been able to say with ease and accuracy just what clans occupied a certain territory and the extent of their holdings by the effigies which have survived their downfall.

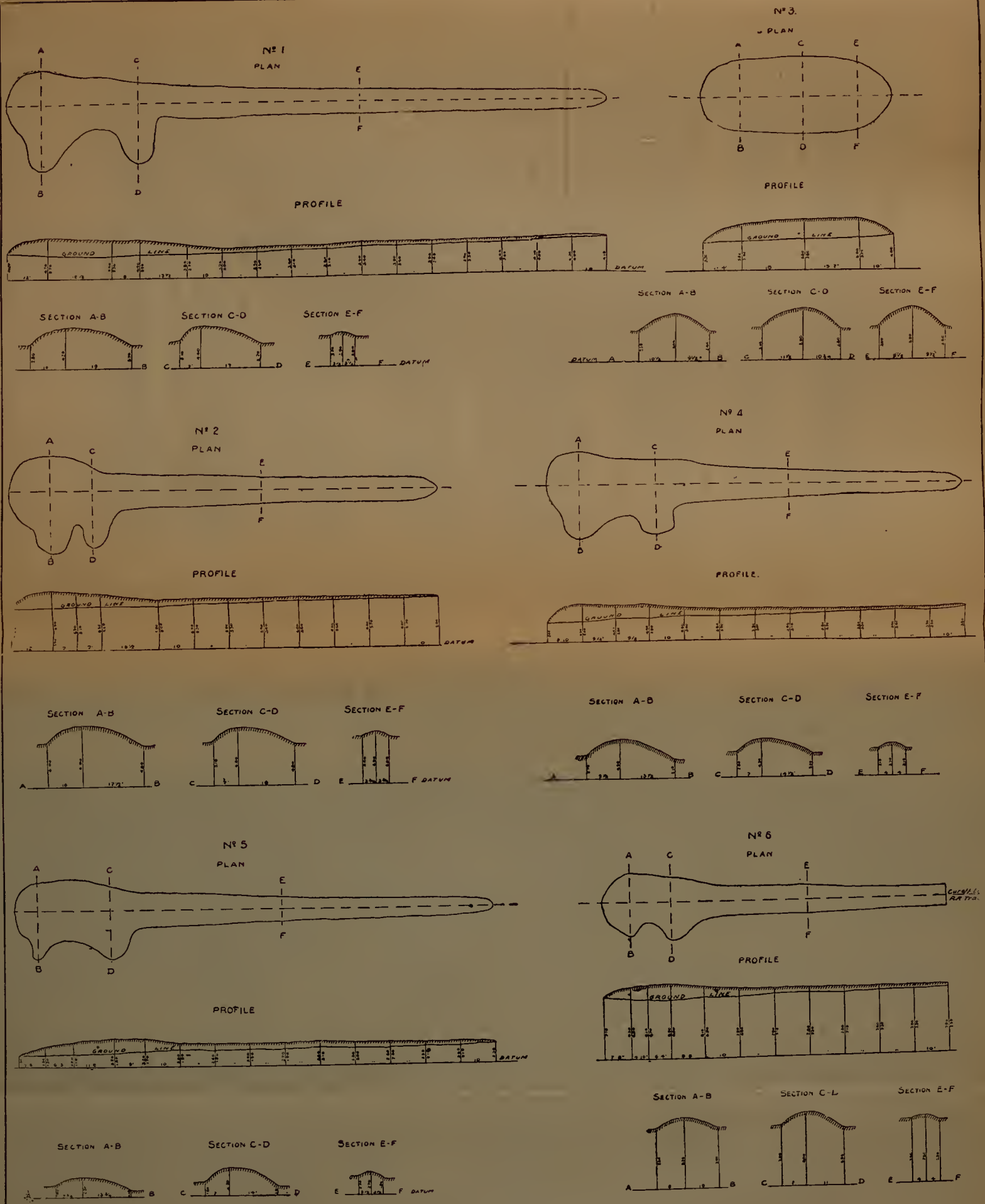
From him we learn that the turtle clan once occupied a strip of land extending along the Rock River, from Lake Koshkonong to Janesville, through Beloit and Rockford to the mouth of the Kishwaukee River, and possibly from Beloit to Geneva Lake.

The racoon clan he has located on the Sheboygan River.

The eagle clan extended from near Port Andrews all along the Wisconsin River to Sauk City, crossed over the watershed and finally ends in the region of the four Madison lakes.

The wolf clan he has recorded as occupying territory on the Milwaukee River, and the mink in Adams and Juneau counties.

The panther or lizard clan, one of the largest and strongest as his researches and our own incomplete local estimate will show,



DETAIL PLAN OF THE MOUNDS.

Datum Line - 315 Ft Above River

SCALES

FOR HORIZONTAL DIMENSIONS

10 5 0 10 20 30 40 50 Ft

FOR VERTICAL DIMENSIONS

5 4 3 2 1 0 5 10 15 20 Ft

occupied the greater part of the land along the three rivers, Milwaukee, Menomonee and Kinnickinnic, in Milwaukee County, and extended on to Racine, in Racine County and west to the Fox River to the great works at Great Bend, and on to Burlington, Wisconsin.

It often happens that two or more types of effigies are to be seen forming part of one group, where two domains overlap each other or where two or more clans occupied the same hunting ground.

This latter may be plainly seen by a glance at the game drive at Crawfordsville in Racine County, lying on the edge of a rice swamp several miles from the village site at Great Bend, of which it is generally conceded to be an out-work, in the territory of the panther clan, and first described by Dr. I. A. Lapham.

The effigies comprising this group are two of the panther, two turtle, three bird and one smaller effigy.

The runways themselves, through which the game is supposed to have been driven, are formed by nearly parallel location of the panther, turtle and oblong mounds, while the birds with wings wide-spread, nicely closed the embrasures at one end, forming a kind of game trap. And again the intermingling of two or more styles of effigies in one group may denote the removal of the original occupants from one point to another through the influence of war or stern necessity.

In either case the invading force might choose and probably did choose to indicate and commemorate its acquirement of new territory by erecting its own effigies near those of its late occupants and probably making them especially numerous and prominent.

What is more likely than that each should have its own clan center of government and population.

That of the panther clan appears to have been located at Great Bend on the Fox River, and others elsewhere. The wonderful works at Aztalan, we are informed, were a clan center or what is more likely by its extent, peculiar construction, centered trails and central location, the capital of a once great nation.

(See S. D. Peet's "Prehistoric America," Vol. II.)

"The attitudes of the animals will be seen not in a single group, but by studying various groups, as all the groups are characterized by the presence of a ruling divinity, one group furnishing one attitude and another another, the whole series giving a history of the divinity or show how varied his moods are."—(Prehistoric America, S. D. Peet, Vol. II.)

Of the many mounds of the panther or lizard type described by Dr. I. A. Lapham and others from this locality, all, with but one or two exceptions, of which we will speak later, are represented in

exactly the same general attitude, although the size varies considerably.

This is the most common attitude of the panther.

It has been argued that the prevalence of this type of effigy may indicate the abundance of the panther or mountain lion in this locality during prehistoric times, for though this animal is now rarely or never met with in Wisconsin, it is highly probable that it was once common here. Yet while the abundance of the type may indirectly indicate this, we can scarcely assign it as the only reason for their abundance.

Totemism has both its religious and its social aspect. Sometimes one survives the other.

Hence the religion of some tribes still shows lingering traces of a social system based on totemism, long after its disappearance, and on the other hand the social system often survives the other.

Clan totems have their limitation, being generally restricted to a certain fixed number.

The Seneca branch of the Iroquois tribe was divided into two phratries, each of which included four clans, viz., the bear, wolf, beaver and turtle, forming one phratry, and the deer, snipe, heron and hawk, the other.—(Morgan, p. 90.)

The Mohegans knew subdivision into the wolf phratry with clans, wolf, bear dog and opossum, and the turtle phratry, with clans little turtle, mud turtle, great turtle and yellow eel, and the turkey phratry with clans turkey, crane and chicken.—(Morgan, p. 174.)

Among the mound builders nearly every living class of animals was imitated, the birds of the air, the fishes in the streams and lakes, the beasts of the prairie and wood. The variety of the animals represented is too great for them to have been exclusively tribal signs. Let us then merely glance at the other side, that of the religious character and significance of the emblematic mounds.

These ancient peoples, like many other barbarous tribes and peoples the world over, were true nature and animal worshipers Animal and nature worship being but the earlier stages of idolatry.

What would be more likely or natural than that they, desirous of being ever under the power and protection of their divinities, should imitate them in connection with their villages, fortifications, game drives, places of council and burial, and along their trails, watercourses and other routes of travel.

It was this same pervading superstition that led them in many cases to erect their effigies upon the most prominent points of land, where they could lend their divine power to the entire country

about. It would seem that with them the various animals had each its especial rank and place in the religious firmament.

To them the panther with his wonderful strength and agility of body and limb, his courage and ferocity when angered, and his cunning in ambushing his prey, were the embodiment of kingliness and Godship.

The others typifying the minor gods, each possessing its own peculiar virtues and religious significance, were the minor divinities properly in attendance upon the greater.

In this case the panther is used simply as an illustration, the eagle or any other of the larger animals may have been equally highly reverenced by the aboriginal worshipers.

Neither is it altogether probable that the physical traits of the animal alone had to do with its preferment over all others.

Let us ask ourselves next what evidence have we that the Teller mounds may not have enclosed a mound builder village at one time?

Just previous to the occupation of this land by the white settlers and at the time when the United States government purchased this territory from the Indian tribes which inhabited it, the Menomonee Indians occupied the land along the east side of the Milwaukee River and the land on the west side was equally shared by the Pottawattomies, Sacs and Foxes. The country at the mouth of the river had been up to that time occupied in turn by these and other tribes of Indians.

It frequently happened that their villages were situated on the very sites upon which stood mounds of a prehistoric race.

Dr. I. A. Lapham has likewise informed us that the ancient earthworks in this state are usually situated in the very places selected more recently by the Indians for their villages.

Such was the similarity in their wants and habits. Howard Louis Conrad, in his "History of Milwaukee," says: "The rivers which now unite at the mouth of the Milwaukee, the deep bay into which they empty and the marshes surrounding their mouths, furnished the means of gratifying their tastes for hunting and fishing, and the neighborhood was well known to large numbers of them, before a white man knew of its existence."

Dr. Lapham had drawn our attention to the fact "that much time and labor were undoubtedly required for the completion of such large structures, and it would be necessary to accumulate the means of subsistence." "This would require more than a temporary residence," says Dr. S. D. Peet, "especially if we admit that the mounds were built with a view to their utility." The main source of identification of the villages of these emblematic mound builders, lies clearly in their situation.

Such villages, if we may accept the tales and descriptions given by early voyagers and travelers, had no stockades or visible means of defense beyond the natural barriers, ravines, swamps, bluffs and the fastnesses of the dense forest in which they reposed.

It will be noticed that the location of the Teller mounds is just such as would be chosen for the location of a village site.

Located in the midst of a once dense forest filled with game, protected on its eastern side by a ravine, on the north by a formerly-existing morass supplying wild rice, and a river replete with fish, on the south and west by the effigies themselves representing the power of the gods.

There were clear springs in the ravine and probably garden plats or cornfields in the near neighborhood, such as Dr. Lapham has described in connection with other groups he found here.

The location was an ideal one and the spot particularly attractive.

It is quite likely from the small amount of property enclosed (some 20 acres), that the village was not as large or important as some others in the state to which it bears many striking similarities.

Not only is it probable that there was formerly a mound builder village at this point, but it was one of a complete system of villages and their outworks which, if we examine Dr. I. A. Lapham's "Map of Works in the Vicinity of Milwaukee" (republished herewith), we shall find extended up the Milwaukee River Valley from its mouth through Milwaukee and Ozaukee Counties to above West Bend in Washington County.

A pretty good idea of this systematic arrangement of mounds along river systems may be had by glancing at the government archæologic maps of Wisconsin and other states, and noting especially the distribution of works along the Muskingum and other rivers in Ohio, Illinois and Indiana. Such a system would bring the clans into closer communication in war or trade.

It had been intended by this section that an attempt should be made by the society to preserve this last surviving memorial of prehistoric man in Milwaukee County, by recommending its purchase by the city for park purposes, but since the beginning of this publication, vandal hands and relic seekers have again and again dug into and disturbed the tranquility of the effigies, so that now such recommendation would not be acceptable.

Like the unique magnificent works at Aztalan and many other important monuments of the culture of a prehistoric race that once dominated the whilom Northwestern Territory, the Teller group of mounds in Milwaukee County is doomed to destruction and oblivion.

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H. L. Conrad's "History of Milwaukee."
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"Unnamed Wisconsin," Davidson.

List of Lepidoptera of the County of Milwaukee.

By F. RAUTERBERG.

The following is a list of diurnal lepidoptera collected by me in Wisconsin in the County of Milwaukee, with notes on the frequency of their occurrence. FR. RAUTERBERG.

[The numbers in the second column correspond with the Check List of Lepidoptera of Boreal America, by Prof. J. B. Smith.]

RHOPALOCERA—Family Nymphalidae.

Wis. No.	Amer. No.		
		EUPLOEINAE.	
		DANAIS. Latr.	
1	1		Archippus—Fab. Very common.
2	2		Berenice—Cram. Rare.
		NYMPHALINAE.	
		EUPTOIETA. Doub.	
3	10		Claudia—Cram. Rare.
		ARGYNNIS. Fabr.	
4	12		Idalia—Dru. Rare.
5	12	ab	Ashtaroth—Fisher. Very rare.
6	15		Leto—Behr. Common.
7	17		Cybele—Fabr. Common.
8	18		Aphrodite—Fabr. Common.
9	19		Cipris—Edw. Common.
10	20		Alcestis—Edw. Common.
11	53		Myrina—Cram. Common.
12	65		Bellona—Fabr. Common.
		MELITAEA. Fabr.	
13	67		Phæton—Dru. Very rare. . .
		PHYCIODES. Doub.	
14	104		Nycteis—Db. Hew. Common.
15	108		Tharos—Dru. Common.
		GRAPTA. Kirby.	
16	125		Interrogationis—Fabr. Common.
17	a		Fabricii—Edw. Common.
18	b		Umbrosa—Lint. Common.
19	135		Progne—Cram. Common.
20	136		J-Album—Bd. Lec. Rare.
		VANESSA. Fabr.	
21	137		Antiopa—Linn. Very common.
22	139		Milbertii—Gdt. Very rare.
		PYRAMEIS. Doub.	
23	140		Atalanta—Linn. Very common.
24	141		Huntera—Fabr. Very common.
25	142		Cardui—Linn. Common.

Wis. No.	Amer. No.	
		JUNONIA Doub.
26	144	Cœnia—Hbn. Rare.
		LIMENITIS. Fabr.
27	156	Ursula—Fabr. Common.
28	157	Arthemis—Dru. Common.
29	a	Lamina—Fabr. Common.
30	b	Proserpina—Edw. Common.
31	159	Disippus—Gdt. Common.
32	a	Floridensis—Strk. Common.

SATYRINAE.

		NEONYMPHA. Westw.
33	177	Canthus—Bd. Lec. Common.
34	181	Eurytris—Fabr. Very common.
		EREBIA Dalm.
35	198	Haydenii—Edw. Rare.
		SATYRUS. Westw.
36	208	Alope—Fabr. Common.
37	208 1-3 b	Texana—Edw. Very rare.
38	208¼	(*Form*) Nephele—Kirby. Rare.

LIBYTHEINAE.

		LIBYTHEA. Fabr.
39	233	Bachmani—Kirtl. Very rare.
40	234	Carinenta—Cram. Very rare.

LYCAENIDAE.

LEMONIINAE.

		CALEPHELIS. G. & R.
41	246	Nemesis—Edw. Rare.

LYCAENINAE.

		THECLA. Fabr.
42	252	M-Album—Bd. Lec. Very rare.
43	258 a	Acadica—Edw. Common.
44	263	Calanus—Hbn. Rare.
		CHRYSOPHANUS. Doub.
45	306	Thoe—Bd. Lec. Very common.
46	312	Hypophlæas—Bdv. Very common.
		LYCAENA. Fabr.
47	352 a	Lucia—Kirby. Common.
48	352 c	Violacea—Edw. Common.
49	352 g	Neglecta—Edw. Common.
50	354	Comyntas—Gdt. Rare.
51	359	Antibubastus—Hbn. Very rare.
52	364	Theonus—Luc. Rare.

PAPILIONIDAE.

PIERINAE.

Wis. No.	Amer. No.		
		PIERIS. Schrank.	
53	375		Protodice—Bd. Lec. Very common.
54	376	g	Virginiensis—Edw. Very common.
55	378		Rapæ—Linn. Very common.
56	378	b	Immaculata—Sk. & Aar. Rare.
57	378	e	Nov-Angliae—Scud. Rare.
		NATHALIS. Bdv.	
58	379	a	Irene—Fitch. Very rare.
		MEGANOSTOMA. Reak.	
59	403		Cæsonia—Stoll. Common.*
		COLIAS. Fabr.	
60	408		Eurytheme—Bdv. Common.
61	408	a	Ariadne—Edw. Rare.
62	408	b	Keewaydin—Edw. Common.
63	408	c	Eriphyle—Edw. Very rare.
		TERIAS. Swains.	
64	431		Lisa—Bd. Lec. Common.

PAPILIONINAE.

		PAPILIO. Linn.	
65	439		Ajax—Linn. Rare.*
66	443		Turnus—Linn. Rare.
67	443	a	♀ Glaucus—Linn. Rare.
68	446		Thoas—Linn. Very rare.
69	456		Asterias—Fabr. Very common.

HESPERIDAE.

		ANCYLOXYPHA. Feld.	
70	466		Numitor—Fabr. Common.
		THYMELICUS. Speyer.	
71	473		Poweschiek—Park. Common.
		PAMPHILA. Fabr.	
72	475		Zabulon—Bd. Lec. Very common.
73	476		Hobomok—Harr. Common.
74	484		Manitoba—Scud. Rare.
75	501		Leonardus—Harr. Rare.
76	504		Nemorum—Bdv. Common.
76	517	a	Egeremet—Scud. Rare.
77	518		Peckius—Kirby. Common.
78	519		Mystic—Scud. Rare.
79	524		Manataaqua—Scud. Common.
80	526		Vestris—Bdv. Common.
81	551		Delaware—Edw. Rare.
		AMBLYSCIRTES. Speyer.	
82	565		Samoset—Scud. Common.
		NISONIADES. Speyer.	
83	584		Icelus—Lint. Rare.
		EUDAMUS. Swains.	
84	616		Pylades—Scud. Common.
85	617		Nevada—Scud. Rare.
86	623		Lycidas—S. & A. Common.
87	627		Tityrus—Fabr. Common.

HETEROCERA.

SPHINGIDAE — Macroglossinae.

Wis. No.	Amer. No.	
		HEMARIS. Dalm.
88	645	Tenuis—Grt. Common.
89	646	Diffinis—Bdv. Common.
90	647	Axillaris—G. & R. Common.
91	649	Thysbe—Fabr. Common.

CHOEROCAMPINAE.

		DEILEPHILA. Ochs.
92	664	Gallii—Rott. Rare.
93	665	Lineata—Fabr. Very common.
		ARGEUS. Hbn.
	667	Labruscæ—Linn. Very rare.
		PHILAMPELUS. Harr.
94	671	Pandorus—Hbn. Rare.
95	672	Achemon—Dru. Common.
		AMPELOPHAGA. Brem & Gray.
96	674	Choerilus—Cram. Very rare.
97	675	Myron—Cram. Common.

SPHINGINAE.

		PROTOPARCE. Burm.
98	688	Celeus—Hbn. Common.
99	689	Carolina—Linn. Common.
100	691	Cingulata—Fabr. Very rare.
		SPHINX. Linn.
101	692	Kalmiæ—S. & A. Very Rare.
102	693	Drupiferarum—S. & A. Rare.
103	698	Libocedrus—Hy. Edw. Very rare.
104	699	Chersis—Hbn. Common.
		CERATOMIA. Harr.
105	714	Amyntor—Hbn. Rare.
106	715	Undulosa—Walk. Common.

SMERINTHINAE.

		TRIPTOGON. Brem.
107	722	Modesta—Harr. Rare.
		SMERINTHUS. Latr.
108	723	Geminatus—Say. Rare.
109	724	Cerisyi—Kirby. Common.
110	724 (2)	(*Form*)—Ophthalmicus—Bdv. Rare.
		PAONIAS. Hbn.
111	725	Excæcatus—S. & A. Common.
112	726	Myops—S. & A. Common.
		CRESSONIA. G. & R.
113	728	Juglandis—S. & A. Rare.
		ARCTONOTUS. Bdv.
114	729	Lucidus—Bdv. Rare.

SESIIDAE.

Wis. No.	Amer. No.	
		SESIA. Fabr.
115	792	Acerni—Clem. Common.
116	794	Tipuliformis—Linn. Very common.

AGARISTIDAE.

		ALYPIA. Hbn.
117	881	Octomaculata—Hbn. Very common.
		COPIDRYAS. Grt.
118	897	Gloveri—G. & R. Rare.
		EUDRYAS. Bdv.
119	898 a	Brevipennis—Stretch. Common.
120	899	Grata—Fabr. Rare.

SYNTOMIDAE.

		LYCOMORPHA. Harr.
121	912	Pholus—Dru. Rare.

CTENUCHIDAE.

		SCEPSIS. Walk.
122	932	Fulvicollis—Hbn. Common.

PERICOPIDAE.

		MELANCHROIA. Hbn.
123	952	Cephise—Cram. Very Rare.

NYCTEOLIDAE.

		SARROTHRIPA. Curtis.
124	962	Lintneriana—Speyer. Rare.

LITHOSIIDAE.

		NOLA. Leach.
125	966	Fuscula—Grt. Rare.
		CLEMENSIA. Pack.
126	973	Albata—Pack. Rare.
		CRAMBIDIA. Pack.
127	976	Pallida—Pack. Common.
		HYPOPREPIA. Hbn.
128	977	Fucosa—Hbn. Common.
		LITHOSIA. Fabr.
129	986	Bicolor—Grt. Rare.
130	987	Cephalica—G. & R. Rare.
		EUPHANESSA. Pack.
131	996	Mendica—Walk. Common.
		AMERIA. Walk.
132	998	Unicolor—Rob. Common.

ARCTIIDAE.

ARCTIINAE.

Wis. No.	Amer. No.		
		CROCOTA. Hbn.	
133	1008		Ferruginosa—Walk. Rare.
134	1017	(1)	*Treatii*—Grt. Common.
		UTETHEISA. Hbn.	
135	1020		Bella—Linn. Common.
136	1020	a	Hybrida—Butl. Rare.
137	1020	b	Pura—Butl. Rare.
		CALLIMORPHA. Latr.	
138	1024	a	Militaris—Harr. Common.
		ARCTIA. Schrank.	
139	1034		Virgo—Linn. Common.
140	1038		Rectilinea—French. Common.
141	1058		Decorata—Saund. Very rare.
142	1059		Nais—Dru. Common.
143	1059	a	Phalerata—Harr. Common.
144	1060		Anna—Grt. Common.
145	1060	a	Persephone—Grt. Common.
146	1061		Virguncula—Kirby. Common.
147	1065	a	Dione—S. & A. Common.
		PYRRHARCTIA. Pack.	
148	1079		Isabella—S. & A. Very common.
		PHRAGMATOBIA. Steph.	
149	1080		Rubricosa—Harr. Common.
		LEUCARCTIA. Pack.	
150	1089		Acræa—Dru. Very common.
		SPILOSOMA. Steph.	
151	1091		Virginica—Fabr. Very common.
152	1093		Vestalis—Pack. Rare.
		HYPHANTRIA. Harr.	
153	1096		Cunea—Dru. Common.
154	1096		Punctatissima—S. & A. Very Rare.
		EUCHAETES. Harr.	
155	1113		Collaris—Fitch. Common.
		HALISIDOTA. Hbn.	
156	1126		Tessellata—S. & A. Common.
157	1128		Caryæ—Harr. Rare.
158	1129		Maculata—Harr. Rare.
159	1129	(2)	*Agassizii*—Pack. Rare.

LIPARIDAE.

		ORGYIA. Ochs.	
160	1153		Difinita—Pack. Very common.
161	1154		Leucosigma—S. & A. Very common.

LIMACODIDAE.

		ADONETA. Clem.	
162	1182		Spinuloides—H. S. Rare.
		PACKARDIA. G. & R.	
163	1204		Fusca—Pack. Common.
164	1206	(1)	*Ocellata*—Grt. Very rare.

Wis. No.	Amer. No.		
		PSYCHIDAE.	
		PEROPHORA. Harr.	
165	1225		Melsheimerii—Harr. Rare.
		NOTODONTIDAE.	
		ICHTHYURA. Hbn.	
166	1227		Inclusa. Hbn. Common.
	1227	a	Palla—French.
167	1230		Inversa—Pack. Rare.
168	1232		Ornata—G. & R. Common.
		BELLURA. Walk.	
169	1244		Gortynoides—Walk. Common.
		DATANA. Walk.	
170	1246		Ministra—Dru. Common.
171	1254		Contracta—Walk. Common.
172	1255		Perspicua—G. & R. Rare.
		NADATA. Walk.	
173	1257		Gibbosa—S. & A. Common.
174	1258		Doubledayi—Pack. Rare.
175	1259	(1)	*Vubripennis.* Very rare.
		GLUPHISIA. Bdv.	
176	1264		Trilineata—Pack. Common.
177	1264	(1)	*Septentrionalis*—Walk. Common.
		NOTODONTA. Ochs.	
178	1274		Stragula—Grt. Rare.
		LOPHODONTA. Pack.	
179	1281		Angulosa—S. & A. Rare.
		PHEOSIA. Hbn.	
180	1284		Rimosa—Pack. Rare.
		EDEMA. Walk.	
181	1289		Albifrons—S. & A. Common.
		SEIRODONTA. G. & R.	
182	1297		Bilineata—Pack. Common.
		OEDEMASIA. Pack.	
183	1300		Eximia—Grt. Rare.
184	1301		Nitida—Pack. Rare.
185	1303		Salicis—Hy. Edw. Rare.
		SCHIZURA. Doub.	
186	1307	a	Cinereofrons—Pack. Rare.
187	1310		Unicornis—S. & A. Rare.
		IANASSA. Walk.	
188	1315		Lignicolor—Walk. Rare.
		HETEROCAMPA. Doub.	
189	1322		Marthesia—Cram. Rare.
190	1324		Biundata—Walk. Very rare.
191	1326		Cinerea—Pack. Common.
192	1329		Manteo—Doub. Common.
193	1329	(1)	*Subalbicans*—Grt. Rare.
		CERURA. Schrank.	
194	1343		Cinerea—Walk. Common.
		PLATYPTERYGIDAE.	
		PLATYPTERYX. Lasp.	
195	1347		Arcuata—Walk. Very rare.
		PRIONIA. Hbn.	
196	1350		Bilineata—Pack. Very rare.
		DRYOPTERIS. Grt.	
197	1352		Rosea—Walk. Rare.

SATURNIIDAE.

Wis. No.	Amer. No.		
		ATTACINAE.	
		ATTACUS. Linn.	
198	1358		Promethea—Dru. Common.
199	1361		Gloveri—Strk. Very rare.
200	1363		Cecropia—Linn. Common.
		ACTIAS. Leach.	
201	1364		Luna—Linn. Rare.
202	1364	a	Dictynna—Walk. Very rare.
		TELEA. Hbn.	
203	1365		Polyphemus—Cram. Common.
		SATURNIA. Schrank.	
204	1366		Galbina—Clem. Rare.
205	1368		Io—Fabr. Rare.

CERATOCAMPIDAE.

		EACLES. Hbn.	
206	1373		Imperialis—Dru. Very rare.
207	1373	a	Didyma—De. B. Very rare.
		CITHERONIA. Hbn.	
208	1374		Regalis—Fabr. Rare.
		ANISOTA. Hbn.	
209	1385		Virginiensis—Dru. Rare.
		DRYOCAMPA. Harr.	
210	1386		Rubicunda—Fabr. Common.

BOMBYCIDAE.

		HEMILEUCA—Walk.	
211	1389		Maia—Dru. Common.
212	1389	a	Nevadensis—Stretch. Common.
		CLISIOCAMPA. Curtis.	
213	1405		Americana—Harr. Common.
214	1406		Disstria—Hbn. Common.
		TOLYPE. Hbn.	
215	1409		Velleda—Stoll. Common.
216	1411		Laricis—Fitch. Common.
		GASTROPACHA. Ochs.	
217	1414		Americana—Harr. Common.
218	1415		Ferruginea—Pack. Rare.

COSSIDAE.

		PRIONOXYSTUS. Grt.	
219	1435		Robiniæ—Peck. Common.

HEPIALIDAE.

		HEPIALUS. Fabr.	
220	1455		Gracilis—Grt. Rare.

(To be Continued.)

Notes on the Distribution of Some Trees and Shrubs in the Vicinity of Milwaukee.

By ERNEST BRUNCKEN.

The territory covered by the observations herein recorded embraces all of Milwaukee County except the two southern and the northwestern townships. Its elevation above Lake Michigan ranges from nothing to more than two hundred feet. The soil is mostly a marly clay, with more or less admixture of siliceous and calcareous sands, gravel and larger boulders.

This territory has some interesting characteristics from a phytogeographic point of view. At least one tree, the beech, here reaches its western limit, as far as this latitude is concerned. One shrub, *Cephalanthus occidentalis,* has not, to my knowledge, been reported from any station farther north in this state. But aside from such facts as these there are certain peculiarities in the distribution of trees and other woody plants in this neighborhood which make a study of it of more than local interest.

We will first consider a number of groups of trees and shrubs separately, and then append a few remarks of a more general nature.

THE BIRCHES.

There are found, within the limits above detailed, three species of the genus *Betula,* each of which presents certain peculiarities. These are *Betula papyracea, B. lutea* and *B. glandulosa.*

B. papyracea occurs exclusively on the east side of the Milwaukee river and southward along the immediate vicinity of Lake Michigan. At the same time cultivated specimens seem to thrive well in gardens in other parts of the territory. This species never grows to large size here. Where it occurs at all, it is plentiful, in a few localities even forming the dominant forest growth.

B. lutea, yellow birch, has not been heretofore recorded from this county. I have found it, however, in two places, both of which are in the Town of Wauwatosa, west of the city, and several miles from the lake shore. In neither case is it associated with the paper birch, although it is possible that it may still be found in the territory occupied by that species. The first locality is just outside of the city limits, between State and Chestnut Streets.

Here a number of old individuals stand in a northerly exposure on the slope towards the St. Paul railway tracks. There are no seedlings or young trees, but this is easily accounted for by the fact that the grove in which they stand has been deprived of the greater part of its underbrush, that the crown cover is much broken and grass has occupied the soil.

It may be stated here that these particular trees have all the typical characteristics of the species, except that the bark is very rough and does not easily roll up in clean, lateral strips. This is undoubtedly due to the great age of the individuals. I may state here that however distinct the two species of *B. lutea* and *B. lenta* may be in the east, they shade off into each other very much in Wisconsin. In the fall of 1897, in company with Prof. Filibert Roth or Cornell University, I found a grove of birches at Miller's Lake, in Langlade County, where this fact was illustrated to perfection. From trees with dark and rough bark, which should have been *B. lenta,* we gathered fruit catkins bearing scales with narrow, almost parallel lobes; from trees on which the bark was silvery, thin, and stripping off easily, we got scales with lobes spreading almost at right angles; and we even picked catkins with both forms of scales from the same trees; the same confusion prevailed with regard to the inside color and the aroma of the bark.

The second observed station of *B. lutea* is in a small wood, at the crossing of two roads in Section 31, Town of Wauwatosa. The grove is not more than three acres in extent, and apparently a remnant of the large swamp formerly extending for several miles in a northwest to southeast direction in this region. Approaching the wood from the west, it still looks like a tamarack swamp. But entering it one finds that the tamarack trees are dying or dead. The ground is strewn with the tamarack trunks and branches, and vigorous trees are seen only on the western margin, where the vicinity of the ditch along the bordering road seems to have kept the moisture conditions more favorable. Elsewhere the soil appears to be rapidly drying and losing its swampy character. No young tamaracks at all can be seen. (1) In place of the larches, hardwoods of various kind have come up, all vigorous young trees. Among these the black ash is conspicuous for its greater size and age, as if it had arrived at an earlier time, when the conditions were not yet ripe for the other species. Among these young, broad-leaved trees grow numerous specimens of the yellow-birch, all young and apparently thriving.

1. This is the condition of practically all tamarack swamps in Milwaukee County and the adjoining territory, notably the former large swamp west of Calhoun in Waukesha County. At the latter place, the tamarack is not even spreading on the wet lands surrounding the forest.

Their average diameter is about 8 inches breast high, the largest measured by me having 11 inches diameter. There are also many small saplings and some seedlings.

The third species of birch occurring in this region is reported by Wheeler as *Betula pumila,* with a note that it occurs in Larkin's tamarack swamp, in the Town of Greenfield. I have not been able to verify this station. But in a thicket in the Menomonee Valley, at the foot of the bluff below the electric car track, I find numerous specimens of a form apparently intermediate between *B. pumila* and *B. glandulosa.* The glandular warts on the twigs are quite distinct, but the shrubs are quite tall, and the branches pubescent. They are here associated with *Alnus incana,* several kinds of willows, and some other species.

THE BEECH.

The occurrence of *Fagus atropunicea, Sudw.,* in this neighborhood presents several very interesting peculiarities. In Prof. Chamberlain's map of vegetation zones of Eastern Wisconsin (Atlas of Wisconsin Geological Survey), about two-thirds of the county is assigned to the maple group, the southwestern corner being assigned to the oak group. The northwestern third of the county, including all east of the Milwaukee River and a narrow strip on the west side of this stream, is given to the maple and beech group. This map is approximately correct as to the occurrence of beech. This tree is found in Wisconsin only in that territory lying, roughly speaking, to the northeast of a line drawn from Milwaukee in a northwesterly direction to about the east line of Dodge County, or where it strikes the western escarpment of the Niagara formation. It is characteristic of Chamberlain's maple and beech, and hardwood and conifer groups, reaching its finest development on the Kettle Range in Washington and Sheboygan Counties, where in many places it forms almost pure growths, and reaches great size. In contrast to the birches which are distinctly northern trees, the range of the beech is mostly to the south of us. In the woods of Indiana and Ohio it is becoming the dominant tree, largely because other species, which are of greater commercial value, have been removed without regard to their reproduction. It is somewhat remarkable, therefore, that the beeches of Milwaukee are of much smaller growth than those immediately northwest of us. Old trees in this vicinity rarely have a greater height than sixty feet, and a diameter of eighteen inches.

The beech is probably present in every reasonably large piece of woodland to the east of the Milwaukee River. It also extends along the immediate vicinity of Lake Michigan, at least as far

south as the north line of the Town of Oak Creek, and possibly farther. West of the river its occurrence is scattered. In one timber lot there may be many, and another half a mile away may show not one. This is not likely to be due to the action of man, as there is no incentive to cull beeches from among other trees. One of the finest stands of beech is on Section 19, in the Town of Milwaukee. Here are the largest trees I have seen in this neighborhood, one of them having a diameter of 20 inches breast high, something very unusual for this locality. There are many young saplings and seedlings, and there would be more if it were not for the cattle that wander at will in these woods. The old trees are all badly rotten and attacked by fungi. A few have the lower parts so thoroughly decayed that one may look through the hollow, and the trees appear to be standing on stilts. Yet they still put forth leaves and new shoots. Other places on the west side where beeches are found are Perrigo Park, where there are a few young trees; and the same grove on State Street in the Town of Wauwatosa, where the yellow birches have been observed. On the South Side, away from the lake shore, there is a single old beech tree by the roadway on Section 35, Town of Greenfield, just above the western bank of the little lake. It stands in a thicket of aspen saplings and is dying fast.

Many years ago the peculiar distribution of the beech in Wisconsin was referred by the late I. A. Lapham to the influence of Lake Michigan on the moisture conditions. This hypothesis may be correct, but its detailed proof is still wanting. A first step in that direction must be an exact knowledge of the facts, and the above observations may be a beginning to that end.

THE POPLARS.

The two aspens, *P. tremuloides* and *P. grandidentata,* occur scatteringly all over the region. At least I have not been able to detect any special characteristics of their distribution. One finds them of all ages, from seedlings and saplings to mature trees, sixty feet high and twelve inches in diameter, which is about the largest size attained by these species in Wisconsin. They are nowhere particularly numerous.

Populus deltoides, the cottonwood, offers many interesting points. Old and large specimens of this tree are rare, except where planted by the hand of man. It is possible that this species did not occur in the region before settlement; but in the Menomonee Valley (e. g., below the electric line viaduct), there are several groups of them which may be spontaneous growth. At any rate one would look for them in localities such as this, if anywhere.

However that may be, young cottonwood trees are now quite common along the Menomonee River and in other similar situations. In addition to the neighborhood of the rivers and creeks, many seedlings and saplings are found scattered over the uplands, and even on sunbaked banks of clay. Whether these will grow into mature trees under conditions so very different from their ordinary habitat, is perhaps very doubtful. Here and there in similar localities as the cottonwood, and sometimes associated with it, seedlings and root suckers of the silver poplar, *Populus alba*, are met with, and thus that beautiful tree seems to be establishing itself away from cultivation.

In one place, and only there, as far as known, can be found the balsam poplar, *Populus balsamifera*, like the birches a distinctively northern tree. The station is on the lake shore at Fox Point, in a ravine through which a little brook finds its way from the upland down to the lake. The largest specimen I have seen there measures 20 inches in breast-high diameter. There are many young trees of various ages, and the colony seems to be prosperous.

THE WILLOWS.

W. M. Wheeler, in his "Flora of Milwaukee County," published in 1888, enumerates but three species of *Salix*, besides two cultivated varieties, remarking, however, that "there are undoubtedly several other species in the county." In a supplementary list published the following year, he adds one more, *S. lucida*. The species named by Wheeler are *S. tristis, S. longifolia, Muhl.*, and *S. myrtilloides*, and the cultivated *S. alba* and *S. viminalis*. Following is the list of species of willows found by me in that part of the county covered by this paper:

S. nigra, S. nigra falcata, S. amygdaloides, S. fluviatilis (=*S. longifolia Muhl.*), *S. discolor, S. cordata, S. Bebbiana Sarg.* (=*S. rostrata*), *S. lucida*, and *S. myrtilloides*. *S. tristis*, which is said by Wheeler to occur along the Kinnickinnic River, I have not found myself, but have no reason to doubt the correctness of the prior observation. There are, accordingly, ten species of willows growing wild in this neighborhood, besides several apparent local varieties or hybrids. Occasionally also a specimen of *S. alba*, which species is very commonly planted as a shade tree, is found escaped from cultivation.

There is hardly any situation in which one may not occasionally find a willow; like the cottonwood they even invade the parched clay banks. But there are three types of localities, where willows form a conspicuous and often dominant vegetation, giving character to the landscape. These types are the banks of the three

larger rivers, the Milwaukee, Menomonee and Kinnickinnic, with the islands lying in them. Secondly, the numerous small water courses, and thirdly, the swampy depressions so common on the uplands, especially in the Town of Wauwatosa.

In several places along the rivers the willows form dense thickets in which the oldest and largest trees and shrubs almost invariably stand farthest away from the river bank; in some places, where the river has during recent years shifted its current, a regular gradation in the age of the willows can be noticed, from the line of comparatively old trees at the landward edge to last year's seedlings, dipping their young shoots into the water. These willow thickets, or *saliceta,* are all of recent development, to judge from the size of the composing trees and shrubs. In the case of one of them, in the Menomonee Valley, I personally recollect that twenty years ago it was but just beginning to form. The most conspicuous of these river *saliceta* are that below Helm's mill, on the Milwaukee River, and that which stretches in a somewhat interrupted line along the Menomonee from the neighborhood of the Milwaukee & St. Paul Railway shops to a little above the Monarch quarry. The latter I have studied more thoroughly than I have the others, and will treat it somewhat more fully in this place.

The thing first to attract one's attention in the Menomonee *salicetum* is the large number of species composing it. *S. nigra, amygdaloides* and *fluviatilis* are found in approximately equal numbers; *S. lucida, cordata, bebbiana* and *discolor* sparingly in comparison. But besides these well-defined types, there are so many intermediate forms, whether varieties or hybrids, that they may well drive the taxonomist to despair. *Salix fluviatilis* is most frequent on the islands, and nearest the water's edge; *nigra* and *amygdaloides* on the mainland and farther landward.(2)

Willows are not the only trees and shrubs occurring in the Menomonee Valley *saliceta.* There is an occasional dogwood,

2. It has the appearance as if *S. fluviatilis* had a tendency to be the first on the ground, but was later crowded out by the more vigorous growth of the other species, which grow taller and overshadow the *fluviatilis.* The conditions of these islands are peculiar. They are composed of coarse gravel and shingle, coming from the calcareous rock of the neighborhood, mixed with more or less sand and fine mud. They are dry during the summer, but more or less covered with water in winter, and occasionally during freshets. The shingle allows the water falling on it to percolate almost immediately, and has hardly any power of raising water from the lower strata by capillarity. Consequently the islands, notwithstanding the river flows all around them, are of exceedingly arid character during the vegetation period of plants. This is reflected in the xerophytic character of the species which first colonize these islands. In the summer of 1899 the most conspicuous plant on these shingle flats was the wild mustard, with its very deep tap-root and rough leaves. Next in frequency was the sweet clover (*Melilotus alba*), which reduces transpiration by having comparatively few and small leaves (at least in the upper portions of the plant). I am inclined to think that the narrow leaves of *S. fluviatilis* are likewise a xerophytic adaptation. This species, wherever it occurs, tends to occupy situations in which the conditions are very similar to those of the Menomonee Valley shingle islands.

and a few young elms and cottonwoods. On the southerly side of the river, above Gettelmann's brewery, where the thicket borders on a large meadow, there is on its edge a fringe of other shrubs, containing the following species in about equal numbers: *Ptelea trifoliata* (3), *Xanthoxylum Americanun, Cornus stolonifera, Corylus Americana, Crataegus coccinea, Sambucus nigra.* These same shrubs are springing up in clumps all over the adjacent meadow, and if they are left undisturbed will probably in time convert it into a brushwood. There are a few herbaceous plants so characteristic of this *salicetum* that they deserve mention. These are *Calystegia Sepium, Lespideza repens,* and especially *Echinocystis lobata.* This species is not found anywhere, in this neighborhood, except in *saliceta,* such as those in the Menomonee Valley and at Helm's mill. But there it is very common, and with its pretty, climbing shoots, conspicuous flowers and queer fruit is a very attractive feature of the landscape, sometimes covering large shrubs almost entirely out of sight.

Cuscuta Gronovii frequently preys upon the willows. The insect enemies of the latter are very numerous, and during the later part of the season it is practically impossible to find a bough most of the leaves of which are not more less insect-eaten. Conspicuous on account of the strange effect on the branches attacked is *Cecidomyia salicis-triticoides Walsh.*

The second type of willow stations is along the banks of the small streams, many of them barely a couple of feet wide, and often dry during a portion of the summer, which are so plentiful, especially to the west and south of the city. Along these runs, particularly where they flow through meadows and pastures, individual willows, either as trees or shrubs, are met with usually at short distances, but in no such locality that I know of is there anything approaching a thicket. The species to be met with here are in their order of frequency, *S. amygdaloides, nigra, discolor, Bebbiana* and *cordata. Fluviatilis* is absent. The reason why they are confined to individuals occurring singly or in very small groups is, hardly without a doubt, that the moisture supplied by these little streams is not sufficient to affect the soil for more than a few feet along their margins, and there is consequently no room for regular *saliceta.*

A third and most interesting type is formed by the *saliceta* developed in the swamps filling depressions in the uplands, especially in the Town of Wauwatosa. These swamps are sometimes without visible outlets; sometimes they give rise to the small streams

3. It is peculiar that this handsome shrub seems to occur nowhere in this region except in the central part of the Menomonee Valley and the adjacent slopes. In these localities it is very numerous and reproducing finely.

referred to in the preceding paragraph. Many are surrounded by woodland of greater or less density, in other cases they lie in the midst of open fields or pastures. They are all characterized by the fact that open water stands in them during the spring and early summer, but disappears almost entirely after the middle of July. The duration of the open water period depends very largely on the amount of precipitation during the summer months. The soil is a black, deep muck, sometimes peaty. As soon as the water has disappeared, it covers itself with a rank, herbaceous vegetation, in which many species of *Cyperaceae,* especially *Carex,* are prevalent, but a large number of other flowering plants are likewise found. This herbaceous vegetation covers every inch of ground not occupied by woody plants, among which the willows are often dominant.

The various localities of this kind differ somewhat in floristic detail, but the swamp found on section 34, in the large wood just west of the Soldiers' Home and north of the railway track, is perhaps the most characteristic, and has been least disturbed by human action. This swamp is surrounded by vigorous hardwood forest, very mixed in species, but with *Acer barbatum* and *Quercus alba* strongly predominating. Along the edge of the swamp are many vigorous trees of *Fraxinus sambucifolia,* together with a few young specimens of *Acer rubrum,* a rare tree in this neighborhood. About two-thirds of the surface of swamp itself is covered with shrubs. The majority of these belong to the several species of *Salix* enumerated below. Besides these, there occur *Cornus stolonifera, Viburnum acerifolium, V. opulus, Spiraea salicifolia,* and perhaps others. The number of shrubs of the genus *Salix* and the other species is about as three to one. Among *Salix,* again, *Salix amygdaloides* is far more frequent than any of the others.(4)

The habitus of the willows found in localities such as these is strikingly different from those along the rivers. In the willow thickets described above, the roots of the trees and shrubs can rarely be seen. In these swamps, however, stout, horizontal roots invariably lie on the surface of the soil The same peculiarity is noticeable with other trees and shrubs grown in very wet places. But still more striking is the prevailing narrowness of the leaves in *S. amygdaloides;* they often approach almost the dimensions of *S. fluviatilis.* The other species do not seem to be affected that way. It will be interesting to observe the difference in conditions

4. In September, 1899, the leaves of *S. amygdaloides* in this swamp were almost entirely covered with some mildew, probably *Uncinula Salicis Winter.* The other species seem to be immune. But the entire thicket, from a distance, looked as if white-washed in consequence; which shows how much *S. amygdaloides* predominates.

of growing between the swamps and river margins. Both are under water at certain periods of the year. But along the rivers, this period is considerably shorter; the water covering the soil is running, and well mixed with air; the soil itself is a mixture of fine mud, sand and coarse gravel. On the other hand, in the swamps the water is shallow, stagnant and grows very warm during the spring and early summer. The soil is either a very fine muck or a mass consisting of imperfectly decomposed vegetable matter. Such soil is known to be very poorly aerated. The chief defect, therefore, of a positon in a swamp as compared with one along the river shore, seems to lie in the direction of air supply. This may account for the narrow leaves. In the absence of a sufficient supply of oxygen to the roots, the plant is compelled to reduce the vigor of its life processes. This is done by reducing the leaf area, through which these processes are carried on. Another striking peculiarity of all swamp-growing willows seems to point in the same direction. While the river willows are either trees or shrubs composed of a few stout shoots(5), the swamp willows of all species have a very large number of slender shoots, and are never trees. The advantage of this form of growth may lie in the increase of bark surface, through the lenticels of which oxygen is taken in.

There is one more station for willows in this region which deserves mention. That is the shore of Lake Michigan. As far as I am aware the two species so characteristic of places along the coast where dunes are found (*S. adenophylla* and *S. glaucophylla*) are not found within the limits covered by this article. But more or less vigorous specimens of *S. fluviatilis* are found in many places along the sandy beach. In some places also *S. nigra* is seen, but seems to be apt to take places where clay from the steep bank(6) has been washed down on the sand, especially in spots where a spring keeps the ground wet. In similar places there are also a few specimens of *S. lucida* and *S. discolor,* and I have found one *S. alba.* All willows along the lake shore are young individuals. This must be either because a change has recently occurred which gives them a chance to occupy a field from which they were formerly excluded, or because the conditions are so unfavorable that all invaders perish before they have become old and large. I am unable to say which reason is the true one.

5. The willows aptly illustrate the difficulty of defining a tree. One of the commonest forms is one where two or three stout, ascending shoots, each several inches in diameter, rise to a height of twenty feet or more. According to the rule adopted in Sargent's *Silva*, these would have to be called shrubs; but who has the heart to refuse them the name of trees?

6. The shore of Lake Michigan in this locality is formed by a steep clay bank rising to a height of one hundred feet in some places. Between this and the water's edge there is a beech of more or less breadth, composed sometimes of coarse gravel or even boulders, but more generally of sand.

The only place where I have found *S. myrtilloides* is in the same ravine at Fox Point where the balsam poplar grows. Wheeler mentions it as occurring in Larkins' tamarack swamp.

A word should be said of the relative frequency of shrubby and tree-like forms of willows. The only species which in this region ever assume the tree form are *S. nigra* and *amygdaloides*. Except in the swamps, of which we have spoken, the tendency of these species seems to be to become trees in all cases; where we find them as shrubs, we may be reasonably sure that they are quite young. The largest willows I know of in the region (aside from *S. alba* in cultivation) are in a group of three on the road to Elm Grove, about half way between the County Poor Farm and the Waukesha line. The largest of these has an estimated height of sixty feet, the others are slightly lower. Their breast-high diameters are 23, 25 and 29 inches, respectively. Their trunks seem to be sound, and they are remarkable for the fact that they have no branches until a considerable height above the ground. Most willows divide almost immediately above the ground, if they do not come out of the root in divided shoots. Trees of a size approximating these three are very rare in this vicinity.

As to the relative numbers of the various species, *S. amygdaloides* is by far the most common; next come *S. nigra* and *fluviatilis;* the others are comparatively infrequent, although in the localities where they occur at all, they are not usually solitary.

General Remarks on Distribution.

In the map illustrating the distribution of plants in Eastern Wisconsin(7) a narrow strip of what is there called the Hardwood and Conifer Group, stretches southward along Lake Michigan to the vicinity of Port Washington. This group is characterized by the presence among the hardwood forests of the pines, hemlocks and other conifers native to this state, in more or less great numbers. The group is one with essentially northern character, as compared to the Maple and Maple and Beech Groups, lying to the southwest of it, and the regions still further southwest where the oaks predominate.

Now the fact is remarkable that quite a number of northern trees are found in limited localities in the region under discussion, such as one would be more apt to look for in the Hardwood and Conifer Group. The yellow birch has already been mentioned, so has the balsam poplar and the white birch. To these should be added the white pine, which at the time of the first settlement

7. Atlas of Wisconsin Geological Survey.

is said to have been numerous on the east side of the Milwaukee river, and of which some individuals survived to within a few years on the river bank, about a mile above Lindwurm's. In the ravines leading from the upland to the lake beach, down the high clay banks at Whitefish Bay and Fox Point, is the only place in this region where the dwarf juniper (*Juniperus communis var. alpina*) is found, a shrub very characteristic of the lake shore farther north, and especially on the Door County peninsula. Here also the Arbor Vitae is represented by a few scattering individuals. It may be significant, perhaps, that the stag horn sumach (*Rhus hirta*) is nowhere so abundant and vigorous as in this same locality. Although this species flourishes far to the South, its greatest development is reached in the North. If the search for characteristically northern plants were extended to the herbaceous vegetation, it is very probable that many more species would be found in the region. Another peculiarity is the rarity of white oaks in the immediate vicinity of the lake. Here *Quercus rubra* is almost the only oak, while in the other parts of our district the several species of white oak are far more frequent than *Qu. rubra*. In the northern part of the state, the latter species alone occurs of all the oaks.

With the single exception of the yellow birch, all the northern plants mentioned occur only in the vicinity of the lake, some, like the juniper, only on its immediate shore. The conclusion appears therefore obvious that the influence of the lake has something to do with giving a favorable station to these species which are excluded from the surrounding country. Just how this influence is exerted, remains to be explained by exact observations. In a general way, it may be said that the local climate, so far as it affects vegetation, is modified in a two-fold manner: First, the maximum temperatures during the summer months are kept down; secondly, the amount of evaporation is reduced. Hand in hand with this remarkable occurrence of northern species on the lake shore there goes a phenomenon which makes the situation still more interesting.

The map prepared by the Biological Survey of the U. S. Agricultural Department places nearly the whole of Wisconsin within the Transition or Alleghanian life zone. But a strip along the lake shore, stretching to about the latitude of Milwaukee, is placed within the Upper Austral, or Carolinian, zone. These zones are arranged according to faunal rather than floral characteristics, but if they are approximately correctly mapped, the faunal and floral zones should very nearly coincide. We find that interesting phenomenon, therefore, that along the lake shore are mingled both Northern and Southern life forms which do not occur in this lati-

tude farther inland. Of plants occurring in Milwaukee County, which properly belong farther south, the button bush (*Cephalanthus occidentalis*) has already been mentioned(8). Possibly the beech should be counted in this category. I have little doubt that numerous species of this kind can be found if the attention of collectors is directed to it.

It may be worth while to state in this place the law of temperature influence on distribution of life forms as formulated by the Biological Survey Division(9).

According to this formula, the northward distribution of terrestrial animals and plants is governed by the sum of positive temperatures for the entire season of growth and reproduction; the southward distribution is governed by the mean temperature of the six hottest weeks of the year. This accords exactly with the observations regarding Northern species along the lake shore; for it is precisely the heat of summer which is reduced by its influence. But it does not seem to tally so well with the occurrence of Southern forms, for the sum of temperatures during the growing period is certainly not increased by the lake influence. Perhaps modifications of the moisture relations have something to do with this. At any rate, a wide field for interesting and profitable study is here opened.

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8. This occurs, however, several miles away from the Lake shore.
9. National Geographic Magazine, Vol. VI., page 229. Merriam, Life Zones and Crop Zones, Bulletin 10, Div. Biol. Survey.

Some Remarkable Trees in the Vicinity of Milwaukee.

By ERNEST BRUNCKEN.

This part of the country is not one, at present, where one can reasonably expect to find trees remarkable for their size. The heavy forest with which most of Milwaukee county was covered but fifty years ago is not favorable to the development of great diameter in boles or wide spread of crown. On the other hand, few trees, comparatively speaking, have survived half a century of clearing and culling. Most of the trees in this vicinity, therefore, are of second growth, so-called; in other words, they are at best not much over half a century old.

Notwithstanding these facts, there are some individual trees of considerable interest on account of size, age or form. Probably the largest tree in this neighborhood is a specimen of soft maple (*Acer saccharinum,* or *A. dasycarpum,* according to the older nomenclature). It stands near the west bank of the Menomonee River, just east of the northeast corner of the Soldiers' Home grounds. This tree has a circumference of 21 feet 11 inches one foot from the ground. At this height it branches into three main divisions; the south division diverges at an angle of about 45, the north and east divisions at 55 degrees. The south division has a diameter of 36 inches at breast height. A trifle farther up it divides again, and at this point there is a strong swelling, bringing the diameter of the main stem to 47 inches. The north division has 49 inches diameter just below the point where it forks into four branches, six feet above the ground. The east division is 29 inches in diameter, breast-high, and badly rotten on the west side. There is the remnant of a former central division, 16 inches in diameter, and somewhat rotted away. The appearance of this giant suggests that its present large main divisions are stool shoots from the ruins of the main trunk, which was destroyed in youth. If this were true, it would be somewhat remarkable, as stool shoots rarely attain such great size and age. The estimated height of this tree is 70 feet. It is beginning to grow stag-headed, and is evidently past its prime.

The largest soft maple tree on record so far is one growing near Northampton, Mass. It was mentioned in Emerson's "Trees of Massachusetts" (page 489), in 1837, and then had a circum-

ference of 12 feet 6 inches at 3½ feet from the ground. In 1889 Prof. Sargent found its circumference increased to 17 feet 4 inches. It was then hollow and much decayed. (Silva, 4, 104, n.). This tree does not divide till a considerable height, which perhaps makes its size more impressive than that of the Milwaukee tree. This mighty tree is surrounded by a number of soft maples also far above the common size. The next largest is 10 feet 7 inches in circumference, breast high, just below the fork. There is also in this group of giants an American elm of 11 feet 6 inches in circumference at 3 feet from the ground, just below where it divides into three main branches. There are no young trees in the neighborhood, a fact which is not surprising as the group stands in a meadow where the thick sward of grass makes it difficult for seedlings to sprout. If any did come up, they would soon fall victims to the haymaker or browsing cattle. The only soft maple seedling I have found in this vicinity stands on the opposite bank of the creek in the midst of the dense willow thicket. It is a vigorous youngster about four years old. There is another pretty large soft maple tree in the Menomonee Valley, near Grand Avenue, which may or may not be of spontaneous growth. Outside of these I know of no specimen of *Acer dasycarpum* growing spontaneously in the vicinity of Milwaukee at present. Undoubtedly this species was formerly common in the Menomonee Valley, but very few of the original forest trees still survive in that locality.

Next to the individual mentioned above, the finest elm I know of in this neighborhood, stands at the west end of a bridge over a small creek on the town line between Wauwatosa and Granville. Two main stems, diverging but very little from each other, and grown as straight as two masts, divide at two feet from the ground. At breast-height the diameters of these divisions are 26 and 28 inches. The two divisions do not branch again until a height of about sixty feet is reached, when they form one of those globular crowns, characteristic of individuals that have grown in crowded condition during youth, and have afterwards been set free.

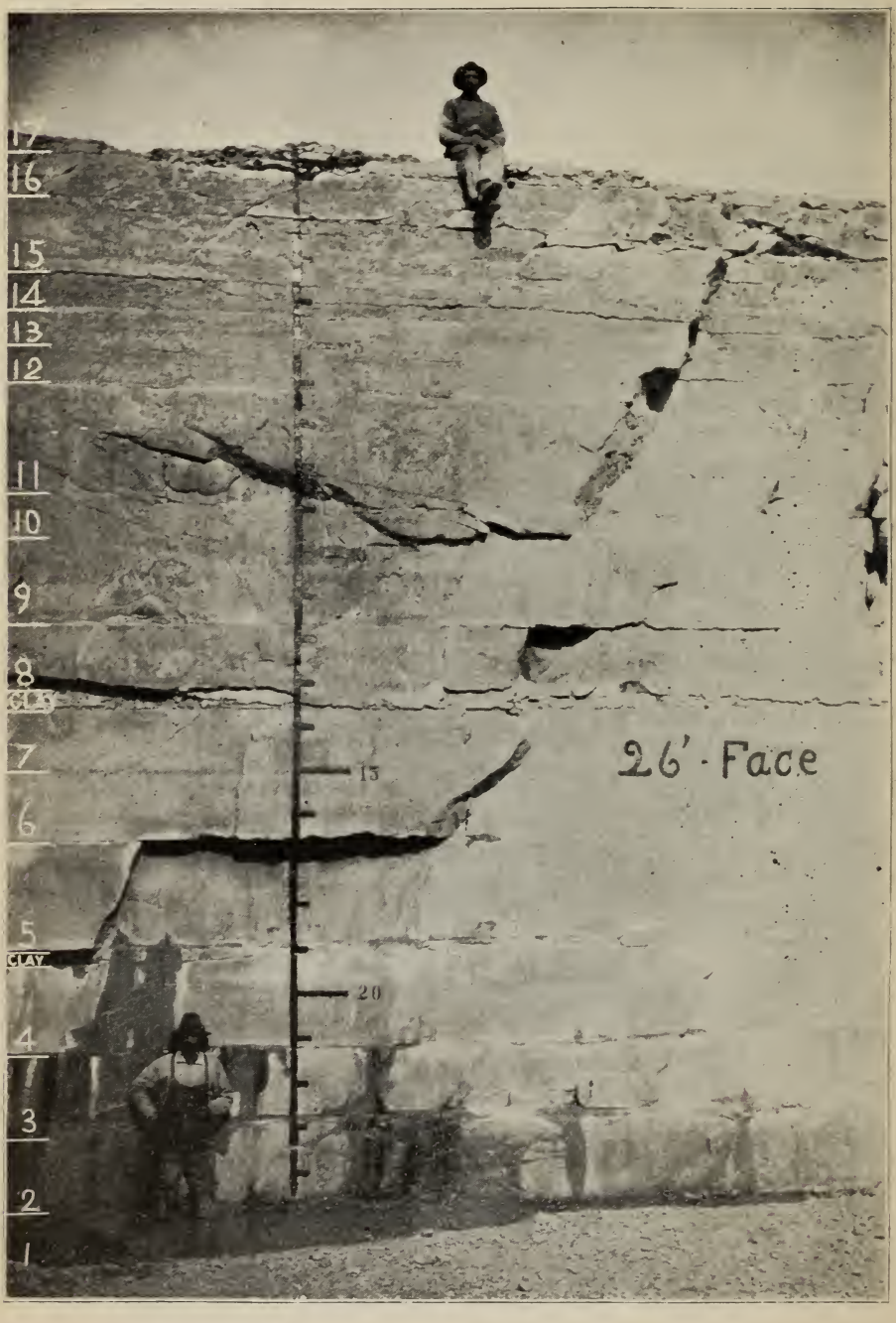
This form of the elm is rather more common among the older elms of spontaneous growth in this vicinity, than is the vase-like form usually seen among planted trees along city streets. This is not surprising, as all our older elms during youth must have grown in close forests. Some very fine specimens of this form can be seen in the Soldiers' Home grounds. The celebrated large elms of New England mostly have a third form, in which the stem forks very close to the ground and the divisions diverge at a more or less obtuse angle, similarly to the growth of the soft maple above described. The large elm standing near the latter is excep-

tional in this vicinity by showing a form that looks like a modification of the New England type. It divides rather close to the ground, but the forks are decurrent at a pretty acute angle, and the secondary branches assume still more nearly vertical positions. An exception is made by a single stout branch which comes out, at a height of about ten feet from the ground, horizontally towards the west. This branch is about 6 inches in diameter, 20 feet long, and, like most horizontal branches in elms, very much of a zigzag growth. The peculiarities of form in this tree must probably be explained as follows:

The seedling grew up in a rather open position, which caused it to fork early. By the time the main divisions were ready to branch, a dense growth of shrubs, possibly willows or dogwood, had grown up around it, taking away the lateral rays of light and forcing the new shoots of the elm to grow upward, almost perpendicularly. The shrubs formed the edge of a sun-lit glade, and in one place there was a break through which the light reached the shoot from which the horizontal branch was developed by growing in the direction from which the sun's rays reached it.

Of oaks, all the large specimens I have seen belong to the tall, slender-shafted, small-crowned forest type. One specimen, however, of the swamp white oak, which grows on Barnekow Avenue, in the Town of Wauwatosa, half a mile south of the Blue Mound road, is of the type with wide-spreading crown. It is a comparatively young tree, and if it is not prematurely destroyed may develop into a very fine individual, similar to some of the great oaks of Massachusetts, described by Henry Brooks in "Typical Elms and Other Trees of Massachusetts." Last August (1899) it was about 50 feet high, with a trunk diameter of 23 inches at breast-height. The lowest branches were not more than eight feet from the ground, and the diameter of the spread of its crown was sixty-six feet as measured by pacing.

Of course there may be other large or otherwise remarkable trees in the vicinity of Milwaukee which I have never seen; and it would be well if a record of them was made by people interested in fine trees.



HAMILTON FORMATION—QUARRIES OF MILWAUKEE CEMENT CO.

The Hamilton Formation at Milwaukee, Wisconsin.

By EDGAR E. TELLER.

The geological formation displayed at the quarries of the Milwaukee Cement Company, belongs to that period known as the Hamilton, and is a part of the Devonian Age, so named by Murchison from the exposures in North and South Devon, England, for all of the strata which intervene between the upper silurian and the carboniferous rocks. The Age has been identified over a wide geographical extent of the earth's surface, being known to extend to the Continent of Europe; it is found in Russia, at the Cape of Good Hope, in China, and on the American continent, where is found the best development of the Age, as well as the most perfectly preserved organic remains; also the greatest variety both in genera and species.

The group name is that given by Vanuxem from its exposures at Hamilton, Madison County, New York. Of its organic remains he says: "It abounds in fossils, such as shells, corals, trilobites, fucoids, and a few plant remains resembling those of terrene origin. In organic remains it is the most prolific of all the New York rocks."

The late James Hall, then the geologist of the State of Wisconsin, in his report on the geological survey of the state, 1861, considers what he refers to the Upper Helderberg and the Hamilton groups, in one article. He says "we find a compact fossiliferous limestone and above it some shaly beds, likewise with fossils. These calcareous and shaly beds are clearly identified by their fossils, belonging to the age of the Upper Helderberg and Hamilton groups of New York." Referring to the organic remains he says: "The fossil remains of these beds are chiefly *Spirifer, Strophcodonta, Orthis* and *Atrypa,* a few *Lamellibranchiate* shells have been observed, a single species of *Gyroceras,* and one of *Gomphoceras.*" Inasmuch as in the preceding article he had referred what is now recognized as the Lower Helderberg Group of Wisconsin, to the western extension of the Onondaga, Salt group of New York state, it would probably be natural that he should look among the succeeding formations for the equivalent of the Upper Helderberg, and as that formation in New York is exceedingly rich in organic remains of those genera noted in Wisconsin, on a cursory examination it is probably not strange

that he should have drawn the conclusions he did, and, as at the time of his investigations, the formation was considered of no special commercial importance and was therefore not worked, and as the exposure was of a slight geographical area, being known at that time only from a very limited exposure near what was then the Village of Humboldt and a short distance above it on the Milwaukee River, as well as of an exceedingly slight geological horizon, the exposure at that time being but a few feet vertically, not exceeding more than three or four feet at most, for a very short distance along the margin of the river, where they are very deeply overlaid by the drift, there was probably a reasonable excuse for the conclusions drawn. In writing of the state of preservation of the organic remains he, however, says: "The upper limestone and shales which imperfectly represent the Upper Helderberg and a part of the Hamilton groups, through nearly all of the rocks of this age there is much iron pyrites and, owing to the decomposition of this mineral, the shells are mostly destroyed, leaving only casts of the interior." While this is the case with many of the fossils collected throughout the formation, in this locality the specimens from the upper layers are quite generally in a very perfect state of preservation in most cases not only the shells, but the very fine and delicate markings peculiar to each species being perfectly preserved. In the list of fossils given in the same report described from the various formations in the state, or identified with species described from other states, only four species are given from the formation, these are simply referred to the Devonian, no reference being made to the group, and no species whatever being given as from the Helderberg.

The late I. A. Lapham in his "Report of Progress and Results" for the year 1874, made but a very slight reference to the Devonian formation, and none whatever to the group. Dr. O. M. Wright, who was the chief geologist of the State of Wisconsin during the year 1875, in his annual report for that year discussed to a considerable extent the formations that had previously been recognized as Upper Helderberg and Hamilton, and dissenting from all previous views on the subject, principally on account of the non-representation of formations that are wanting in this locality, as well as on erroneous identification of the organic remains and, as he says, chiefly on stratigraphical evidence, maintains that the formation under consideration is the water-lime group of the Lower Helderberg, of the organic remains collected near Humboldt by himself, he quotes *Orthis plicata*, now *Spirifer Vanuxami*, *Avicula rugosa*, and a species of *Tentaculites*, he also says that *Leperditia alta*, a still more important characteristic fossil, has also

been found. On what he based his identifications it is difficult to say as none of the species quoted have ever been found at the locality. The *Orthis* and *Avicula* are characteristic species of the *Tentaculite* limestone of the water-lime group of New York, a formation that very clearly has no representation in this state. *Leperditia alta* is a characteristic species of the Lower Helderberg, no portion of which formation was then exposed at the locality, while *Tentaculites,* which is found in the water-lime group, is also a very common genus in the Hamilton, being fairly abundant at Humboldt in the upper layers, while in New York it forms almost a compact mass in some of the Hamilton shales.

A collection of the fossils of the locality was made by Prof. T. C. Chamberlain, then an assistant on the survey; these were submitted to Prof. R. P. Whitfield, of New York, a recognized authority on such subjects, who pronounced them to be characteristic Hamilton forms, and that no water-lime forms were contained in the collection, although, as he says, "there were among them forms characteristic of the corniferous," a formation lower than the Hamilton, yet still above the water-lime, "as well as a few forms which have their position defined as belonging to the Chemung," a still higher formation than the Hamilton. Prof. Chamberlain, geologist of the state, in his report, "Geology of Wisconsin," Vol. II., Part II., 1872, discusses very fully the Devonian Age and the Hamilton group, the only representative of the age in this state. As recognized the formation has comparatively a very limited geographical area, lying adjacent to Lake Michigan, immediately north of the city limits of Milwaukee, it has been traced for a distance of about six miles north along the lake shore, and extending about the same distance into the state, it rests in part upon the laminated shales of the Lower Helderberg, and partly upon the Niagara limestones; it has a thickness, as far as known, of about twenty-six feet, and dips slightly to the southeast. The most extensive outcrop is that at the quarries of the Milwaukee Cement Company, where it rests upon the non-fossiliferous shales of the Lower Helderberg, which latter formation has no exposures at the locality, but forms the sole of the quarries as the cement rock is removed. This locality is regarded as the typical exposure of the Hamilton group in this state, and is the locality from which has been collected all of the type specimens of fossils, except three(1), that have been described from the formation in the state. Other exposures are found in Section 11, Town of Granville, in the railway cut immediately south of the station of Brown Deer, where are exposed about three feet of the formation; this is the typical

1. For a list of the species of the formation see The Fauna of the Devonian Formation at Milwaukee, Wis., in Journal of Geology, Vol. VII. No. 3, 1899.

locality of the fish *Rhynchodus excavatus.* In Sections 9 and 10 of the same township occurs the most northwesterly known outcrop, where it has a very slight exposure and rests upon the limestones of the Niagara formation. On the lake shore, north of the village of Whitefish Bay, and about six miles north of Milwaukee, there is a very limited exposure of the upper layers of the group. This is the typical locality of the *Cephalopod Gyroceras eryx.*(2)

In sinking the shaft and tunneling for the present water supply of the city, clays and so-called shales of the formation were encountered for the greater part of the distance, the fossils found being identical with those from the upper portion of the formation at the other localities.

Exactly how far along the lake shore, or into the state the formation may have originally extended will probably never be known, as its area has undoubtedly been greatly reduced by the eroding agencies of the drift. This is confirmed by the fossils of the group having been found at Racine, Wis., twenty-five miles south of the most southerly known exposure of the formation.

The formation as shown at its different outcrops, in its lithological character, consists of a blueish-gray or ash-colored impure dolomite, which weathers on exposure to a yellowish or buff color, due to the oxidization of the iron which constitutes one of its ingredients. Its known impurities consist of silica and alumina, and it also carries considerable magnesia. In texture it varies considerably, being quite homogeneous in some layers and quite irregular and lumpy in others, while between each of the layers there is generally a more or less well-defined layer of a semi-hard clay, being barely traceable between some layers but ranging up to about five inches in thickness between others. In degree of induration it ranges from rather soft to moderately hard, except in four of the layers, which are more or less exceedingly hard, due to the mineral matter that they contain. The minerals found are calcite, iron pyrite, zinc-blende, nickel and bitumen. The chemical composition is well illustrated by an average analysis of the layers number two to eleven, which gives:

Carbonate of lime	45.11
Carbonate of magnesia	30.89
Silica	16.61
Alumina	4.09
Oxide of iron	3.25
	99.95 (3)

2. The third species, that of the Crinoid, Melocrinus nodosus, was described from a specimen collected from the drift. Geol. of Wis. 1861.

3. Geology of Wisconsin, Vol. 1, Page 202.

Frequent reference has been made to the shaly character of some of the upper layers. This character, while very apparent at certain points in some of the layers, cannot be considered as general throughout any layer, as but a short distance from where the shaly character is clearly observed, the layer becomes either angular or lumpy in its breakage. Neither are there in any of the layers any certain lines of cleavage, for on being broken with the hammer, they are just as liable to break across the plane of bedding as with it. Even where there has been extensive weathering, and it apparently shows a shaly character, this feature of breakage is as constant. Some of the heavy layers at times have the appearance of being made up of a number of layers, which, however, on being traced for a short distance entirely disappear and the layer becomes solid and the character lost.

The plate shown herewith is a reproduction of a photograph taken by Mr. Wm. Berthelett, one of the officers of the Cement Company. It shows a vertical face of a portion of the workings in the quarries on the west side of the river, and exhibits the first good display of joint structure that has been noted at the locality, the plate unfortunately not having range enough to show the adjoining jointure, although it shows most accurately almost the full thickness of the formation, the lower layer being partially covered by water, while a portion of the upper layer has been denuded. The numbers to the left indicate the layers referred to in this paper. The layers vary from a few inches to about three feet in thickness, the most of them being heavy in their bedding and all of them very uniform in their thickness throughout the workings. For quarry purposes they are locally known as numbers one to fourteen, beginning at the top, but as all geological formations are investigated from the lower layer upwards, for the purpose of this paper these local numbers are reversed, while three of the upper layers for palæontological reasons have been divided, adding three extra layers, making seventeen; we therefore begin with number one at the base of the formation.

Numbers one and two are rather heavy-bedded being each about 18 inches thick. They have a tendency towards being granular in their structure, are not very hard, and contain but few organic remains, those found being in the form of impressions in rather an indifferent state of preservation, and none but what have been recognized in the layers above them.

Number three is 20 inches thick; it is not as granular as numbers one and two and is considerably harder, it contains almost innumerable specimens of the genera *Stropheodonta*, and a few plant remains, few other forms being found. The *Stropheodonta* are always in the form of impressions of either the exterior or interior

of single valves, and are so numerous that it may properly be called the lower *Strophcodonta* layer. The plant remains are always in a carbonized form and may be considered in a good state of preservation.

Number four is 28 inches in thickness, it is not as hard as the preceding layers, although it is more compact and not as granular; it carries casts of single valves of several genera of *Brachiopods,* and is the one layer in which the greatest number of specimens and variety of species of fish remains have been found, these being always in the form of the exterior bony plates of the teeth and are generally well preserved, although much broken up, the effect of the high explosives used in quarrying. These remains are not confined to this layer but have been found in all of the layers of the formations above, but as yet not observed below it.

Overlying number four is found a layer about three inches thick of a semi-hard clay; when first broken into it is compact and firm, but on a limited exposure it readily disintegrates, assumes rather a shaly character, and quickly becomes an impure clay. This layer contains a few organic remains of the same species as are found throughout the group, generally those of *Brachiopods.*

Number five is 28 inches in thickness, it is rather soft and has much the same character as number four; it carries only a few fossils, generally *Brachiopods,* not differing from the layers below.

Number six is 18 inches thick, not very hard, differing very little, if any, from number five, and has but few fossils.

Number seven is 18 inches in thickness and is an exact counterpart of number six in its character and organic contents.

Above number seven is found a five-inch layer of semi-hard clay, having all of the characters of that found above number four.

Number eight is 20 inches thick, a little harder than any of the layers below as more or less well defined crystals of calcite begin to appear; in its organic remains it is almost a counterpart of number three, and were it not that fossils of the genus *Strophcodonta* are fairly common in some of the upper layers it could very properly be termed the upper *Strophcodonta* layer, fossils of but few other forms are found in it.

Number nine, one of the heavy layers of the group, is 21 inches thick, slightly harder than number eight, and a little more granular. The fossils begin to assume the form of internal casts, while the variety becomes larger but still not numerous in specimens, and a few forms not observed in the lower layers begin to appear.

Number ten is about 12 inches thick; it is much harder than number nine having more calcite and iron pyrite, the fossils are more numerous in specimens with a slight increase in species.

Number eleven is the one layer in the formation that has probably the strongest characteristics; it is the heaviest-bedded layer, being 33 inches in thickness and is exceedingly hard as it contains a large quantity of calcite and pyrite, with occasionally a little zinc blende. The organic remains have been very numerous, many of them probably corals, having been absorbed and the cavities filled with the minerals mentioned. Fossils of the *Cephalopod* order prevail, large forms of *Gyroceras* and *Gomphoceras* are abundant, while of *Brachiopods* the *Spirifer, Orthothetes* and *Atrypa* are common. *Lamellibranchs* of several species make their appearance. Almost all of the above are in the form of internal casts, very few of the fossils preserve any of their external markings, while fish remains are at times to be found, being probably more numerous than in any layer above number four.

Number twelve may properly be termed the rotten layer, it is about 10 inches thick, very earthy in character and readily goes to pieces; the fossils are less numerous than in number eleven, although of the same general species, while *Orthoceras* are more numerous than in any other layer.

Numbers thirteen and fourteen are each about 10 inches thick, and while slightly different in aspect are generally about the same. They are harder than number twelve with a tendency to split up into a number of minor layers, the fossil contents are numerous; a few new forms appear, while of the large *Cephalopods, Gyroceras* and *Gomphoceras* have disappeared. Many of the fossils have their shells replaced with iron which is much oxided and therefore poorly preserved, while many others on weathering are found in a very good condition; many of the corals have been absorbed and replaced with calcite with which are at times associated a little nickel in the form of Millerite. A few impressions of plant remains are found; most of the *Gastropods* of the formation are confined to these layers, none having been noted in the lower ones, while the *Blastoids* begin and end their existence in them as far as noted.

Number fifteen has much of the characters of the two below it, is probably a little more oxided, has the same tendency of breaking into minor layers, being at times either angular or lumpy in its breakage. It also has the feature of becoming shaly but is not continuous; it is rather earthy, has less organic remains than the two layers below it, the same species being found while a few new ones appear, the most characteristic of which are the *Terebratula.*

Number sixteen is about 10 inches thick, is more compact than number fifteen, has the same tendency of minor layers and of lumpy and angular breakage, but contains not so much iron or

iron oxide, while the organic remains are much more numerous. Several new forms appear among them, the *Crinoids,* which, while not numerous, being mostly confined to this layer, and *Phacops ranu,* which has been sparingly observed through the group, becoming more numerous.

Number seventeen is estimated at about 12 inches thick. It is more compact than number 16, with the same character of breaking into minor layers, some of which are more oxided than others and rather earthy. Others are very hard, due to not only the calcite they carry but also to the immense number of calcareous fossils contained therein. In some parts it is almost a compact mass of the *Brachiopods* of the group, while the disks of crinoid stems are almost innumerable, though with the exception of a small form of *Taxocrinus* almost no other species of crinoid has been found. Many corals are observed, *Phacops* becomes more common, while a species of *Proetus* is confined to it. Another portion is almost a compact mass of *Chonetes,* while *Tantaculites* is not rare. Overlaying the formation at various points are found beds of clay derived from now unknown layers that have been resolved or decomposed. These contain well-preserved specimens of all the species found in the upper layers, especially of those found in number seventeen, many of which are very abundant, the most numerous being those of *Atrypa, Cyrtina* and *Chonetes.*

While the formation may be said to have three main subdivisions, the lower being the layers numbers one to seven inclusive, which possess much the same general character; the fossils are in almost all cases in the form of impressions. The central subdivision, or the layers numbers eight to eleven, is of a distinctly different feature in all of its characters, being very much harder in structure, and the fossils in almost all cases being casts of the interior; while the upper subdivision consisting of the layers numbers twelve to seventeen and the clays overlaying them, possess many of the characters of both of the lower subdivisions. We find the fossils here in much the best state of preservation, yet there are very few species found in one subdivision but what can be found in the others. The greatest number of specimens, however, are found in the upper portion.

While the number of species found is very large for so limited an area, the total being over two hundred, the casual visitor to the locality will undoubtedly meet with much disappointment, as it is only by persistent collecting that anything like a fair representation of the fauna of the locality can be secured.

The observations presented herein have been gathered during a period of about twenty years of steady collecting at the locality, and while probably not infallible they are as the formation and its

organic contents have been studied. Criticism by future writers on the subject is to be expected and is desired, as it is only by such criticism that a perfect knowledge of the formation at the locality can be secured.

The *Crinoids* and *Blastoids* of the locality have been described and figured by Mr. Stuart Weller, of the University of Chicago, while the fish remains, of which no less than sixteen species have been recognized, have been identified or described and illustrated in three separate articles by Dr. C R. Eastman, of the Cambridge Museum of Comparative Zoölogy, and who still has many of the best specimens for further study and description in future publications.

Since the publication of the list of the fauna of the locality a few new and interesting forms have been discovered.

The thanks of the writer are due to the late Thomas A. Greene, also to Mr. F. L. Horniffer and Chas. E. Monroe, local collectors, for specimens and several of the observations presented herein.

For the illustrations and descriptions of the types described from the locality, and of many of the species there found, the reader is referred to the works cited in the bibliography herewith.

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Edgar E. Teller.

Milwaukee, Wis., Dec. 11, 1899.

The F. S. Perkins Album of Antiquities.

A Descriptive Notice of this Important Contribution to American Archaeology.

By CHAS. H. DOERFLINGER.

The researches of the nineteenth century in anthropology, taking this term in its broad sense to include beside other branches of science the history, anatomy, physiology, psychology, education and civilization of man, have, under the leadership of foremost minds, developed as never before in the history of the human race, the comparative methods of study. Psycho-physiology, one of the youngest daughters of universal science, which is rapidly taking the place of the old-time "mental philosophy," teaches us that the development of the individual human soul as well as the individual human body takes places in the same general stage that characterized the evolution of the human race, and that our method of education, to be productive of the happiest results, must accommodate itself to the same law of nature and follow the same, the natural channels, which are the channels of least resistance.

The work to which attention is here invited, while it will be of general scientific interest, will be of especial merit as an auxiliary for comparative studies in archæology, and the accompanying text by Professor Frederick Starr, who is in charge of the Department of Anthropology of the University of Chicago, will be a valuable contribution to the branch of science it treats of.

Of the Perkins' collection of American relics, President C. K. Adams, of the University of Wisconsin, at Madison, says:

"I suppose, without doubt, this collection is the finest of its kind in the world. It is doubtful whether it can under any circumstances ever be equaled."

Dr. Geo. W. Peckham, of the Milwaukee Public Library, says:

"The Perkins album is a most important contribution to science. It is a magnificant work and full of interest for all people of intelligence. I hope that you will be able to carry it through, and I have reason to believe that you will."

Requested to say a few words about the enterprise, Professor Starr, the editor of the Album, wrote as follows:

"In some respects the Perkins 'Album of Antiquities' is unique. Among features worthy of notice are the following:

"1. It is probable that no attempt has ever been made to publish a work on prehistoric archæology in which all the specimens illustrated were reproduced in color fac-simile. Works with colored plates have indeed been published, but the illustrations could not be called fac-similes.

"2. Mr. Perkins was a trained artist of high talent. He spent a fortune in money and a quarter of a century in time in forming his archæological collection of nearly fifty thousand specimens. He devoted thirteen years of constant and conscientious work to painting, in aquarelle, representations of more than twelve hundred of the choicest specimens in this great series. These superb paintings exactly reproduce the objects themselves in size, form, markings and delicate variations in color.

"3. Mr. Perkins was an acknowledged authority upon the rare and interesting copper implements of Wisconsin and adjacent states. Probably more specimens of these were in his possession at different times than are to be found in any public museum or private collection in the world. Every specimen of this sort that he ever owned is represented in the Album."

Because of the value of this beautiful Album for comparative studies, some members of the Wisconsin Natural History Society, many years ago, proposed that the work should be published by the society. So great were the financial and other responsibilities of the publication, that the enterprise was abandoned. In 1897, however, Mr. Perkins induced Mr. Charles H. Doerflinger, who has been a member of this society for thirty-five years, and who was at one time in the book business, to undertake the publication of the work.

It is proposed that the Album shall contain one hundred and thirty-five large plates, measuring about 16 by 22 inches. These will be exact copies of Mr. Perkins' paintings and represent beautiful and typical aboriginal relics in copper, stone, bone, clay, etc. These paintings are wonderfully accurate representations. Prof. Adolph Ceuleneer, of Ghent University in Belgium, an eminent authority, made a visit to Burlington, Wisconsin, to see Mr. Perkins' collection and Album. After carefully examining both he stated that for himself and for purposes of study, he would prefer to have the Album, or a fac-simile of it, than the collection itself. Especially notable in the plates are the representations of the copper implements—several hundred in number. Practically every type of American copper implements is illustrated.

Inter-leaves of fine, strong, but thin, paper, will accompany the plates. They will bear the field notes of Mr. Perkins regarding the specimens represented on the accompanying plates and such additional matter, by the editor, as may seem necessary to a full understanding of the illustrations.

There will be a text of at least one hundred pages. In this text will be presented a sketch of the archæological work so far done in Wisconsin—a state fortunate in having had in its population such workers as Increase Allen Lapham and Frederick Stan-

ton Perkins—a study of the relation of the archæology of the state to that of the United States at large, comparison of American and European prehistoric archæology and a critical study of the Perkins collection.

An elegant and substantial all-leather cover for binding will be supplied with each copy of the work. The Album will be issued in twenty-seven parts. These parts will average five plates with inter-leaves. The text and binding-cover will accompany the final part.

The parts are to appear at monthly intervals. They will cost ten dollars each and will be sent by express C. O. D. Thus the cost, *to subscribers,* will be two hundred and seventy dollars. Upon completion of the work the price will be raised to four hundred dollars. The "Walter's Album of Keramics," containing one hundred and sixteen plates, is sold at five hundred dollars a copy; the Perkins Album of equal beauty, execution and interest, costs but two hundred and seventy!

Part I will soon be placed in the hands of the artists. The following parts will not be issued until the number of subscriptions warrants publication. Four hundred subscriptions will be necessary to cover the first cost of the work, which four hundred copies will amount to, at least, one hundred thousand dollars. It is hoped that there will be no interruption of the work after the second part appears, because the 1,200 water color paintings are all ready.

The work is to be dedicated to Dr. Increase Allen Lapham, long an honorary member of this society, and known throughout the world by his momumental work, "*The Antiquities of Wisconsin.*" His influence upon the advancement of science and education needs, here, no comment. He was director of the first geological survey of this state and was the successful instigator of the establishment of the United States Signal Service, with its system of Daily Weather Reports. In this dedication the work itself is honored. The Lapham family heartily approve the plan of publishing the Album, and of the dedication, and have supplied some unpublished drawings and maps, made by Dr. Lapham in his last years, which will be printed in the work.

The Museum of the Wisconsin Natural History Society, founded in 1857 and donated to the City of Milwaukee in 1882, contained some of the first copper implements, recognized as such by Prof. Peter Engelmann, Mr. Perkins and Dr. Lapham. The idea of publishing the Perkins Album originated in the society and, in promoting its appearance by this notice, it performs a labor of parental love.

NATURAL HISTORY NOTES.

On the Occurrence of the Mocking Bird in Milwaukee County.

The northern limit of the range of the mocking bird *Mimus polyglottus,* is stated to be the forty-second parallel of latitude, which is approximately that of Chicago. The following is offered as evidence that this limit should be extended at least one degree or to the latitude of Milwaukee.

In McIllwraith's "Birds of Ontario," is recorded a well-authenticated case of a pair of these birds nesting one year near the city of Hamilton, Ontario, which is in latitude 43 deg. 15 min. As Hamilton is at the extreme north of an arm of the Carolinian Faunal area—as outlined by the United States Biological Survey in 1897—that extends into Canada, and as Milwaukee is near the north end of a similar arm that enters Wisconsin, we might expect to hear occasional reports of their presence near the latter city.

That the mocking bird was at one time not uncommon in this locality would appear probable from the following extract from a paper published by this society in 1885, and written by the late Dr. P. R. Hoy, of Racine—a city twenty miles south of Milwaukee. He writes: "Mocking birds nested freely in the near vicinity of Racine previous to 1856. I obtained three nests and knew of several that I would not molest and of three others broken up by boys. This matchless songster was continually heard among the thorn thickets and witch-hazel bushes. The ax and plow have destroyed the haunts of this interesting bird; none have been seen for fifteen or twenty years."

During the past five years, however, the following instances of their occurrence in Milwaukee County have come to our notice:

On the evening of June 29th, 1894, we found a bird of this species in full song in a tree on the banks of Oak Creek, about half a mile from its outlet. As we had but lately come from a two years' sojourn in the Gulf states, where we had frequent opportunity to become acquainted with the mocking bird, it is not likely that a mistake was made in identification.

Mr. John W. Dunlop has also reported the fact of a pair nesting near the same locality a few years ago.

Mr. Robert O. Wanvig, a member of this society, has a mocking bird's nest and eggs in his collection, which he found in 1897 in a thicket just west of the city. The locality is a small sheltered grove, abundant in underbrush, the owner of which prevents all trespassing on the property, and for several years past Mr. Wanvig has found several of the birds frequenting the spot each summer, and has been in the habit of visiting the place evenings and at night to hear their song.

Thus it would seem that there are a few secluded spots in the vicinity of Milwaukee which the mocking bird visits regularly each year, and there raises its young. Possibly a few may pass on to still more northern points in Wisconsin, but if so it has not, as far as we can learn, been as yet reported.

Is it not then highly probable that Milwaukee is the most northern point in the United States visited regularly by the mocking bird? W. J. Bennetts.

Bird Tragedies.

The death of every wild creature is a tragic one, asserts Earnest Seaton Thompson, and probably few of our birds live out the possible span of of their existence. Disease and old age are seldom permitted to run their usual course, for soon after the resulting feebleness or lack of vigilance manifests itself, the watchful hawk, owl, or fox, interferes, and the end is still a tragedy. Storms and scarcity of food, the accidents of migration, birds and beasts of prey, and man, are some of the agencies of bird destruction.

Two cases have been brought to our attention recently that are somewhat removed from the common. Mr. F. Kerchner, a member of the Wisconsin Natural History Society, has described to us the finding of the body of a golden-crowned kinglet, *Regulus satrapa,* in a cluster of burrs in a plant of the common burdock, *Arctium minus Schk.* Late in the fall the heads or burrs of this plant may be found bunched or tangled together near the extremities of the branches, and against one of these the kinglet had evidently involuntarily flown, only to be seized by the minute hooks with which the burrs are provided; its subsequent struggles to escape only entangling it more securely.

Had this occurred to a larger bird, the latter would doubtless have escaped, carrying a number of the burrs with it and thus have been the agent of that method of seed dispersion which *Arctium minus* has so successfully evolved.

The second instance illustrates how a habit or instinct misdirected frequently ends disastrously. Mr. Geo. G. Phillips also a member of the Wisconsin Natural History Society relates that for several days in December last he observed a downy woodpecker, *Picus pubescens,* busily engaged enlarging a small hole in the side of a stable on his premises. Finally the hole appeared to be completed and a few days afterwards, upon entering the stable in the morning he observed a bird fluttering feebly on the floor. It was easily captured and upon being set down again put its head beneath its wing and appeared to sleep, but when Mr. Phillips returned shortly after with some food, it had fallen over and was dead. Evidently it had entered the building through the hole it had made and being unable to find any exit had perished for lack of suitable food and from the extreme cold that prevailed at the time.

In the woods in winter time may easily be found numerous dead trees and stumps containing freshly made woodpecker holes that go inwards for a few inches and then downwards for eight inches or a foot. These, at least many of them, are the work of the downy woodpecker, and are probably used as sleeping places and as a retreat during storms.

The particular bird mentioned had perhaps thought it had discovered a tree or stub of unusual dimensions, and its error had resulted in the way described. W. J. Bennetts.

The Wild Animal Life of a Large City.

Even in our crowded city, a few of our native wild animals manage to exist and to hold their own. The cotton tail rabbit, *Lepus sylvaticus,* is present among us in greater numbers than is generally supposed. In our parks they may be seen on moonlight nights; and after a fall of snow their tracks are easily to be found in many quarters of the city. The lumber yards and certain willow thickets near our rivers are their favorite haunts, but even in the resident quarter of the city they are not absent. On the East Side we have happened upon one during a dense fog one Sunday morning in early winter, and shortly afterwards found one that had been freshly killed by a Northwestern train near the North Avenue crossing.

A red fox, *Vulpes vulgaris,* was captured in October of this year in a chicken pen at Wells and Twenty-fifth Streets, which is a thickly peopled district; and as poultry owners in that locality

had been suffering losses for a month or more, Reynard had no doubt been at large in that district during all that time.

A mink, *Putorius vison*, was lately captured behind a refrigerator in a saloon on Ninth Street, having been discovered there by a dog that entered the saloon along with a customer.

W. J. Bennetts.

Swarming of the Milkweed Butterfly, Danais Archippus.

During the summer months—June, July and August—these butterflies are present in large numbers, though I have never seen them flying in companies of more than two or three. During the early part of September, however, I have noticed for the past six or seven years that they gathered in large migratory swarms. The motive of these migrations, I believe, is the impossibility of finding food and to avoid the cold of the winter months. The insects are naturally forced to seek milder climes and localities where plant life is more abundant. The question arises in my mind, however, what then might induce these insects to subject themselves to the dangers and trials of a northward journey in the spring of the year. The milkweeds are well represented in the south and plant life in general is more abundant than in our latitude, so that we cannot attribute their northward migration to be due to the lack of food or to cold. I believe that these annual migrations can be likened to those of birds of passage, and that the same instinct which governs these birds in their migration is also the cause of the same habit in *Danais archippus*.

In September 9 to 11, 1898, I noticed small swarms of *D. A.* in different places in the city, containing some forty or fifty individuals, some flying, others busily engaged in sipping the horse brine in the street; this they seemed particularly to relish. It is interesting to note how closely the given dates correspond with the following: From Aug. 29 to Sept. 6, 1899, their gatherings came to my notice in various parts of the city. A daily increase in their numbers was noticeable, particularly so at Lake Park, which it appeared was chosen as their place of rendezvous. Toward Sept. 6, I was unable to note any of the smaller swarms throughout the city, but found immense swarms at Lake Park, where they were present in thousands. The females outnumbered the males considerably. Several pairs were found in copulation. A strange fact which came to my notice was that these insects would sit very closely together, one upon each adjoining leaf, and thus several branches on one tree were covered with them, while the rest of the tree would be deserted.

In these gatherings I found that the butterflies preferred elm trees to any other for resting purposes. It is true I noticed a few on oak, maple and basswood trees. The reason that the elm trees received the preference is due, in my opinion, to the fact that its leaves offer the insect a firmer hold than do the leaves of the other trees. The elm leaf at this time of the year turns slightly up at the edges, thus giving the butterflies an opportunity to clasp the edges of the leaf, while in the leaves of the bass, oak and maple they are compelled to hold to the flat surface. In resting, these insects always chose the upper side of the leaf, and sit with their heads pointing towards the trunk of the tree or upwards, i. e., in a direction opposite to the growth of the branch. I am unable to state whether the migratory flights are undertaken during the night or day, never having been fortunate enough to be an eye-witness. Mr. F. Rauterberg has informed me that he at one time saw a flock of these butterflies start, from the same locality where my notes were made, and choose a southeasterly course across Lake Michigan. This was at dusk, so we may feel positive that that flock migrated under the cover of night; other observers too have noted nocturnal flights of these insects.

P. H. DERNEHL.

On the Occurrence of the Hawk Moth Argeus Labruscae in Wisconsin.

Although at home in Japan this insect has found its way to the United States, either by means of transportation, or possibly employing its extremely enduring powers of flight, it has managed to find its way hither unassisted. It is occasionally met with in the more southerly regions of the United States. In Wisconsin it is very rarely seen. I can enumerate but two specimens captured in this state. One was taken in Sheboygan in 1893 and is now in the possession of Mr. F. Rauterberg.

The writer was fortunate in capturing a second individual Sept. 5th, 1899. When taken it was very intent upon visiting the blossoms of various species of gourds, seemingly prefering these to all other flowers, of which there was a great variety in the same garden. It was 7:30 P. M. when captured and quite dark.

P. H. DERNEHL.

Depredations of the Cottony Maple Scale.

The cottony maple scale, *Pulvinaria innumerabilis, Rathv.*, whose annual presence by reason of its comparatively small numbers has gone almost unnoticed for several seasons past, made its

appearance in late May and early June of this year, despite the severely cold weather of the past winter, in such unusually large numbers on our shade and ornamental trees, as to cause serious apprehension among property holders.

At about the same time it also appeared in destructive numbers in Chicago, Evanston, Lake Forest, Waukegan and nearly all of the lake shore towns between Milwaukee and Chicago.

In and about the City of Milwaukee are many small nurseries from which large numbers of young maples are annually sold and shipped to the neighboring villages and towns and there again transplanted.

Several such nurseries examined this fall have the small limbs quite covered with the minute and inconspicuous brown overwintering scales. This may in some measure account for their unusually large numbers and wide distribution during the past year in this territory. As usual the soft maples suffered most severely from this attack, but many specimens were also observed on hard maple, box elder and ash, while others were taken on elm trees, the grape vine and currant bushes. The limbs of some small maples on Chestnut Street, between Thirteenth and Fourteenth streets, were so badly infested as to give them the appearance of having been sprinkled with whitewash. One such small limb showed forty-one of these destructive egg-laden insects reposing on its surface, within a compass of six inches.

When noticed these trees had already lost much of their foliage and later observations proved that several of them had been killed outright.

As a general thing, however, these attacks only weakened the vitality of the trees, making way for tree diseases and the ravages of the Tussock moth caterpillar, *Orgyia leucostigma Sm. and Abb.*, and like insects, which followed soon after.

A thorough canvass of the city by the entomological members of the society, showed the most badly-infested portion to be a district on the West Side, bounded by Tenth Street on the east, Twentieth Street on the west, Grand Avenue on the south and Chestnut Street on the north, a tract ten by five blocks square.

Thousands of the young scales appeared upon the leaves in early August, but at least 50 per cent. of these had the appearance of being badly parasitized.

By early October the most of the healthy scales had transferred themselves to the limbs where they now repose in considerable numbers. We have counted as many as 200 upon a single small branch, fifteen inches long and less than one-eighth inch in diam-

eter. Some of these healthy scales lingered upon the leaves until their falling (as late as November 1st).

When this insect pest appeared the attention of our citizens was called to its destructive methods by this society. Through the kindly medium of the newspapers remedies were recommended, the employment of which by many of our property holders, together with the prevalence of its natural enemies, will, we trust, do much toward holding the insect in check in the coming year.

C. E. Brown.

Fruit Feeding Habit of the Cotton Worm Moth.

The cotton worm moth *Alctia argillacea, Huebn.,* widely known in the southern states by reason of its destructive habits, has been repeatedly observed for several seasons past, in quite large numbers, puncturing ripened grapes in early October, in small vineyards in and about Milwaukee, Wis.

Often as many as five or six of these moths were observed at night feeding upon a single bunch, and often nearly every second bunch was thus beset with insect depredators, the damage to the yield (in bruised fruit) being anything but slight.

At such times the insects did not appear to mind the light of a dark lantern and were quite approachable, enabling one to tumble them into a cyanide jar with ease.

After settling upon and piercing a grape they would generally remain in that position for several minutes and then fly away or shift to a neighboring grape.

The fruit-feeding habit of the adult moth is well known, and is especially marked in the south; the curious arming of the hanstellum enabling it to pierce fruit easily. Dr. L. O. Howard, entomologist of the United States Agricultural Department, says that he is not aware that this habit of the moth has ever been observed before as far north as Milwaukee, Wis.

C. E. Brown.

The Balsam Apple Vine as an Insect Trap.

A rather unusual occurrence which created some little interest among local entomologists and others in August of the present year was the ensnaring of a large green dragon fly *Anax junius, Drury,* by a tendril of wild balsam apple, *Micrampeles lobata, Green.*

It is conjectured that the insect had settled upon the vine and becoming somewhat benumbed by the cool of evening, was easily entrapped by the outreaching tendril, which had wound itself quite tightly, twice about the insect's body, near the joint of the seventh and eighth abdominal regments.

The prisoner remained quite lively for several days, often flying out to the length of its vegetable rope, until it finally perished at the hands of a careless observer.

After our attention had been drawn to this curiosity, several instances of the entrapping of smaller species of the order *Odonata* by vine tendrils were also noted. In these cases the insects had been made prisoner by the tendrils entwining itself about their limbs.

C. E. Brown.

Vol. 1. (NEW SERIES) APRIL, 1900. No. 2.

BULLETIN

OF THE

WISCONSIN NATURAL HISTORY SOCIETY

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PLACE OF MEETING.

LECTURE ROOM, Third Floor of Milwaukee Public Museum.

[The Bulletin of the Wisconsin Natural History Society is published quarterly and distributed by the Milwaukee Public Museum, an exchange with other publishing societies and institutions is solicited.]

BULLETIN

OF THE

WISCONSIN NATURAL HISTORY SOCIETY.

Vol. 1, New Series. **APRIL, 1900.** **No. 2.**

Proceedings of the Wisconsin Natural History Society.

November 24, 1899 to January 25, 1900.

THURSDAY, NOVEMBER 24, 1899.

This meeting was devoted to an illustrated lecture by W. H. Dudley, of Platteville Normal School, on the colors of flowers. Fifty-four persons were present. After the meeting the board of directors elected the following to membership: Messrs. E. C. Case and Henry G. Ruenzel, and Dr. Chas. D. Stanhope.

THURSDAY, DECEMBER 28, 1899.

Held in the museum lecture room with President Peckham in the chair and twenty-six persons present.

After the minutes of the previous two meetings had been read by the secretary, Director Bruncken of the section of botany reported that prices had been obtained upon the cards and printing for the proposed plant census of Milwaukee County, and that the expenditure would not exceed ten dollars.

A list of those publications of the society that are represented in the library of the public museum was handed in by P. H. Dernehl. These publications consist of (1) annual reports for the years 1870 to 1889, inclusive—those up to 1880 being published in German; (2) six numbers of "Occasional Papers;" (3) seven numbers of separate lectures; twenty-eight publications in all. Of these, several are represented by only one copy, while of the others there are from two copies to five hundred remaining.

The president informed the meeting that the first quarterly bulletin of the society was then in the hands of the printer and that the manner of its distribution remained to be decided upon.

The museum board had agreed to attend to the distributing, and to pay the postage, but required a list of the societies and institutions to which it should be sent. The recording secretary was then instructed to prepare a mailing list for that purpose.

Chas. E. Brown pointed out that the want of a blackboard was frequently felt at the meetings, and a motion was made by Dr. Dorner that the corresponding secretary communicate with the museum board in regard to supplying the lecture room with a wall blackboard at the east end. The motion was seconded and carried.

Dr. S. Graenicher then read a paper of much interest, entitled, "Our early wild flowers and their insect visitors." *Trillium nivale, Erigenia bulbosa* and *Salix discolor,* which blossom in this vicinity in the order named, were the plants chiefly considered. *Trillium nivale* he had found in bloom as early as March 26th, but had never observed any insects visiting it, and had concluded that like the majority of the Trilliads, it was self-fertilized. Upon *Erigenia bulbosa* he had taken ten species of insects and upon *Salix discolor* eighty-four. The paper was illustrated by specimens of the plants and insects mentioned and a considerable portion of the paper was devoted to a consideration of the relation of the insects to one another and to the plants visited.

It was announced that at the next monthly meeting Dr. H. Dorner would read a paper upon the giant cuttlefish, of which the museum possesses a papier-maché cast.

THURSDAY, JANUARY 25, 1900.

Held in the museum lecture room. President Peckham occupied the chair and sixty persons were present.

After the usual opening business had been transacted, Mr. George Shrosbree, taxidermist of the Milwaukee Public Museum, read an instructive and practical paper, entitled, "Modern Taxidermy."

Mr. Shrosbree contrasted the present methods of the art with the old-time methods of *stuffing* specimens, and gave credit to the South Kensington Museum, London, and to the American Museum, New York, for inaugurating the change. A successful taxidermist, it was stated, should primarily be endowed with a love of nature and with a good perception of form and color. He should be a constant student and accurate observer of the habits and haunts of animals, should have a knowledge of their myology and osteology in as far as it affects their surface and outline, and should have considerable artistic skill in modelling and coloring. He should also be familiar with the use of the principal tools employed in the different artisan trades.

The applications of taxidermy intended for the instruction and entertainment of the public were considered. Among those mentioned were the making of elaborate *groups* of animals in which their natural surroundings were accurately reproduced, of *sets* illustrating the life histories of birds or other creatures and of series of familiar animals, such as dogs, domestic fowls or pigeons.

The methods of preparing skins for the purpose of the student and scientist were described, and the care of museum specimens discussed.

Thorough poisoning, daylight, and frequent handling will prevent insect depredation. For specimens, however, that had become infected, Mr. Shrosbree had found that spraying with turpentine and then placing the specimens in an air-tight box for twenty-four hours was most efficacious in destroying the larvae of *Dermestes,* while for moths and *Dermestes* in the beetle form he recommended naphtha.

Dr. H. Dorner followed with an exceedingly interesting and lengthy paper on "The Giant Squid and its Allies." The structure of this largest and least known of the members of the Cephalopod family was described in detail and illustrated by charts picturing in colors the form and anatomy of the creature. The habits of other members of the squid or decapod group were described, and then Dr. Dorner gave the results of his observations upon members of the octopod or cuttlefish group, whose habits he had had many opportunities of studying, during four years' connection with the Hamburg museum. The color changes of these animals were described and had been found to depend upon the temperature of the water and the animal's vitality. The holding power of the suckers on the arms of the cuttlefish he had found to be comparatively weak, at least while it was in captivity. A criticism of Victor Hugo's description of the devilfish, and remarks on the utility of these creatures and the part played by them in nature closed the paper.

At this meeting Mr. Hugo Lutz and Mr. Herman Pereles were made ordinary members of the society, and Mr. F. M. Benedict, of Waupaca, a corresponding member.

W. J. BENNETTS, Secretary.

The Fertilization and Insect Visitors of our Earliest Entomophilous Flowers.

By Dr. S. GRAENICHER.

Among the first plants appearing in our neighborhood in early spring, only those species will receive our attention whose flowers rely more or less on the co-operation of insects to secure fertilization, and which for this reason are called entomophilous flowers. The few species of anemophilous or wind-pollinated plants, blooming at the same time of the year, as for example our species of *Alnus* (alder) and *Corylus* (hazelnut), will, therefore, not come within the reach of these considerations.

In a small piece of open woods along the banks of the Menomonee River and opposite the grounds of the County Insane Asylum, two small plants may be observed together, one of them—*Trillium nivale*, Riddell (dwarf white trillium)—opening its flowers two or three days in advance of the other—*Erigenia bulbosa*, Nutt, whose popular name, harbinger-of-spring, has been selected in accordance with its early arrival. Under extremely favorable circumstances, the first flowers of both species may be expected towards the end of March. The spring of 1898 was remarkable in this respect, as it presented us with the first flowers of *Trillium nivale* on March 26th, and with those of *Erigenia bulbosa* on March 29th. When spring puts in a late appearance, however, the opening of these flowers may be delayed as late as the second week in April. This was the case last year (1899), when the first flowers of *Trillium nivale* were not observed previous to the 11th of April and those of *Erigenia bulbosa* on April 12th.

Both plants occupy the same position in the soil, and bloom synchronously. The families to which they belong, produce, as a rule, entomophilous species, and for this reason the question arises, whether these two species enter into competition with each other for the visits of any of the anthophilous (flower visiting) insects, flying at this early period.

The plant of *Trillium nivale*, Riddell, a member of the Lily family *(Liliaceae)*, usually attains a height of 5 cm. and bears, as is characteristic of the genus *Trillium*, a single terminal flower, arising from a whorl of three leaves. The flower of our species holds an erect position on a pedicel of 8 mm. length, and has a corolla of three white, recurving petals, giving the flower a diameter of 15 mm. There are two rows of stamens surrounding

the pistil, the three anthers of the outer row being longer than those of the inner row, and shedding their pollen in advance of the latter. The stigmas of the three slender styles are situated about 3 mm. above the long anthers of the outer row, and become receptive at the same time that the anthers of the inner row begin to empty their pollen.

During the last three years I have repeatedly watched the flowers of *Trillium nivale* in favorable weather, and have never seen a single insect visit them, or even take the slightest notice of them, although insect visitors were not lacking on the flowers of *Erigenia bulbosa,* near at hand. There is nothing astonishing about this, as the flowers of *Trillium nivale* have no fragrance, are devoid of nectar, and offer nothing but pollen to attract insects; besides, it is a noteworthy fact, that our other species of *Trillium,* appearing later in the season, seem to have very little attraction for insect visitors and that even the large, conspicuous flowers of *Trillium grandiflorum,* Salisb. (wake-robin), with their fair supply of nectar, receive comparatively few visits in our neighborhood.

From the foregoing we must conclude that *Trillium nivale* is not visited by insects, and is, therefore, not cross-fertilized. In view of the erect position of the flower, and the elevated situation of the stigmas, there is no possibility of self-fertilization being effected through the falling of pollen on the stigmas. The only way open to spontaneous self-fertilization under these circumstances, is by the recurving of the style to such an extent as to bring the stigmatic surface in contact with pollen of a dehiscent anther. This is in fact the course adopted by the flower to insure self-fertilization, and is, so far as I have been able to observe, the only method of fertilization adopted at all.

According to Gray's Manual of Botany, the range of *Trillium nivale* is from western Pennsylvania and Kentucky to Minnesota and Iowa; whether this plant resorts to the same mode of pollination exclusively in other parts of the country, as it does in our locality, can not be stated, as up to the present time no account of the fertilization of this species has been published.

With *Erigenia bulbosa* Nutt. the case is altogether different. In 1882, A. F. Foerste (1) gave an account of the floral structure of this small, umbelliferous plant, and called attention to the proterogyny of the flowers, in other words, he made known the fact that the stigmas are receptive before the anthers of the same flower discharge their pollen. This announcement was received with much surprise among biologists, as up to that time, the Um-

(1) A. F. Foerste. Dichogamy of Umbelliferae. Bot. Gazette, Vol. VII (1882), pp. 70–71.

belliferae (Parsley family) had been regarded as a family producing without exception species with proterandrous flowers, flowers emptying their supply of pollen before the corresponding stigmas become receptive.

In 1888, Chas. Robertson (2) published a paper on "Proterogynous Umbelliferae," in which he confirmed Foerste's views on *Erigenia bulbosa* and added the four following species of this country to the list of proterogynous Umbelliferae: *Sanicula marylandica*, L., *Zizia aurea*, Koch., *Pimpinella integerrima*, Benth. & Hook. and *Polytaenia Nuttallii*, D. C. In 1891, Kirchner (3) discovered in the vicinity of Venice, in Italy, a proterogynous species (*Echinophora spinosa*, L.) among the European Umbelliferae. From all this it is evident that to *Erigenia bulbosa* belongs the distinction of being the first umbelliferous plant in which proterogyny was recognized and reported.

In the locality where my observations have been made, the plants of *Erigenia bulbosa* rise 12 to 18 cm. above the ground and grow together in small patches. In the first or female stage, the two styles bearing the receptive stigmas at their summit protrude from the little white, purplish-tinged flower, but none of the anthers are shedding pollen. The five erect petals enclose the stamens, and the latter are incurved in such a manner as to partly conceal the nectar-glands from view and afford them protection. Nectar is secreted in abundance on the greenish disc on top of the ovary. Later on the petals and also the styles become divergent, the stamens assume an erect position, and one by one the anthers burst open and expose their pollen; in this way the flower enters into the second or male stage.

Pollination takes place in the female stage, when an insect, arriving from another flower in the more advanced male stage, and having grains of pollen attached to different parts of its body, comes in contact with the receptive stigmas. In *Erigenia bulbosa* we have a well marked case of proterogyny, the stigmas being receptive long before the anthers of the same flower dehisce, and such a contrivance generally results in securing cross-fertilization, and, on the other hand, in preventing self-fertilization.

Although the flowers of our first representative of the Umbelliferae appear so early in spring that very few insects might be expected to render their services as cross-fertilizers, yet observation shows that even in our surroundings, with prevailing cool weather at that time of the year, the flowers are visited sufficiently to obtain favorable results. Under adverse circumstances, the in-

(2) C. Robertson. Proterogynous Umbelliferae. Bot Gazette. Vol. XIII (1888) p. 193.

(3) O. Kirchner. Die Blueten der Umbelliferen. Jahresh. d. Ver. f. Vaterland. Naturk. in Wuerttemberg. 1892, pp. 89-91.

sects may not appear at all for a whole day, or even for a few days in succession. But an hour of sunshine and calm weather is generally all that is needed to arouse individuals of the more hardy species from their lethargy and bring them to the flowers.

Within the first two weeks of the blooming period of *Erigenia bulbosa,* that is, within the time usually elapsing between the appearance of the first flowers of this plant and those of our earliest willow—*Salix discolor* Muhl., I have taken the following ten species of insects, visiting the flowers of *Erigenia bulbosa:*

A. Hymenoptera.

Bees—Apidae: (1) *Apis mellifica,* L. ♀ ; Andrenidae: (2) *Halictus similis,* Sm. ♀ ; (3) *Halictus confusus,* Sm. ♀ —all sucking.

B. Diptera (Flies).

Tachinidae: (4) *Gonia capitata, De G.;* (5) *Siphona geniculata, De G.;* Muscidae: (6) *Lucilia caesar,* L.; (7) *Lucilia cornicina, Fabr.;* (8) *Pollenia rudis, Fabr.;* Scatomyzidae: (9) *Scatophaga squalida, Meig.;* Sapromyzidae: (10) *Lonchaea polita, Say*—all sucking or feeding on pollen.

Of these, the three bees, and among the flies the two species belonging to the family of the Tachinidae are anthophilous (flower-loving) insects in the strict sense of the term, as they depend on floral diet for their own subsistence, and, so far as the bees are concerned, for the subsistence of their offspring besides. The five remaining visitors are flies, living, as a rule, on decomposing organic matter, and visiting flowers occasionally to feed on nectar and pollen. The flies belonging to this latter group are the first to appear on the flowers; they are hardy species, very able to withstand the effects of cold weather, and may be observed towards spring on sunny days and in sheltered spots long before the umbels of *Erigenia* make their appearance above the dry leaves. This is especially true of the dungfly *(Scatophaga squalida, Mg.)* and the two species of *Lucilia,* well known under the popular name blue-bottle flies. Speaking of *Pollenia rudis,* Fabr., Williston (4) remarks, that numbers of these flies may be observed on mild days of winter, crawling over the snow. In the locality where the visitors of *Erigenia bulbosa* were taken, numerous specimens of the different species referred to above were noticed a few days ahead of the first flowers of *Erigenia,* eagerly sucking the sap escaping from the injured stems of maples. From these facts it is evident that the very first flowers of *Erigenia* have an opportunity of being thoroughly and successfully visited, and in addition to this we see that the first visitors

(4) S. W. Williston. Manual of N. Am. Diptera, 2d Edition, p. 141.

are flies, which do not depend on floral diet exclusively and are not to be regarded as anthophilous insects.

The two remaining species of Diptera (*Gonia capitata,* De G. and *Siphona geniculata,* De G.) belong to the Tachinidae, a family well known from the fact that the larvae of all of the species live parasitically on other insects, while the adult flies generally obtain their food from flowers.

After the blooming period of *Erigenia* has fairly begun, the bees appear among the other visitors. The honey bee is frequently observed on the flowers, and the remaining two bees on the list are species of *Halictus,* a very important genus belonging to the Andrenidae, a family comprising all of our short-tongued or less specialized bees.

In Southern Illinois, where *Erigenia bulbosa* seems to be more abundant, and where, on the first warm days of spring, the climatic conditions seem to bring out a more numerous set of visiting insects than in our vicinity, Robertson (5) has taken a larger percentage of bees on this species, than on any of the other species of Umbelliferae observed by him.

By reviewing the results obtained, we are led to the conclusion that *Trillium nivale,* Riddell, and *Erigenia bulbosa,* Nutt. do not interfere with each other as regards their mode of pollination, *Trillium nivale* not relying on the visits of insects, but resorting to spontaneous self-pollination, *Erigenia bulbosa* on the contrary furnishing a well-defined case of proterogyny and securing cross-pollination through insect agency.

The small size of both plants is remarkable, when compared with that of near related forms. The position of the flowers in close proximity to the ground and among fallen leaves and dry grass, undoubtedly affords protection from the ill effects of frosty weather, and reminds one of the small sized species growing in high altitudes and having to endure low temperatures even during the nights of summer, as for example Alpine plants, Rocky Mountain plants, etc. Both our species occur in open woodlands, as is the rule with our vernal species of herbaceous plants. Blooming so early in the season, as they do, their small size is of no disadvantage to them; later on, plants of such dwarf-like appearance could not inhabit the same locality, without being concealed beneath a luxuriant growth of other herbaceous plants of greater size.

The first open flowers on the catkins of our willow species—*Salix discolor,* Muhl., appear in the second or third week in April,

(5) C Robertson. Flowers and Insects. Umbelliferae. Trans. Acad. Sc. St. Louis, Vol. V, pp. 450-451.

or even later. In the early spring of 1898, *Salix discolor* began its blooming period on April 12th, seventeen days later than *Trillium nivale* and exactly two weeks later than *Erigenia bulbosa*. The spring of 1899 was preceded by a prolonged period of unusually cold weather in the month of February, and accordingly our first vernal flowers were slow in making their appearance. But after the opening of the flowers of *Trillium nivale* on April 11th, and those of *Erigenia bulbosa* on the following day, April 12th, the season progressed very rapidly and brought out the first flowers of *Salix discolor* on April 17th, only five days later than *Erigenia bulbosa*.

The appearance of the first willow catkins, covered with blossoms, is an event of no small importance to the anthophilous insects, whose time of flight corresponds with the blooming period of our willows. One of the most important features of the willow-blossoms is the presence of catkins bearing only male or staminate flowers on one plant, and catkins with only female or pistillate flowers on a different plant. This distribution of the two sexes on two different plants is called dioecism, and is a contrivance by which cross-fertilization is made a necessity.

The willow family (Salicaceae) comprises the species, belonging either to the genus *Salix* (the willows) or to the genus *Populus* (the poplars, aspens), and the members of this family are without exception dioecious. The species of *Populus* are anemophilous. They depend on the currents of air to transport their pollen from the male flowers to the stigmas of the female flowers. Their flowers are neither fragrant, nor do they secrete nectar. They possess practically nothing attractive to insects, except, perhaps, the dry, smooth-coated pollen of the male flowers, which is not appreciated by insect visitors. The latter may be observed in exceptional cases on the male flowers of poplars, feeding on pollen, but their visits are of no advantage to the flowers, as the same insects never pay any attention to the female flowers.

The other members of the family, the species of *Salix* (the willows), have adopted entirely different methods to insure cross-fertilization. They rely for this purpose on the aid of insects. They are decidedly entomophilous. Owing to the abundant production of nectar and the fragrance of their flowers, they secure an ample set of visitors, and in addition to this their male flowers offer a full supply of damp, adherent pollen, which is a further source of attraction to pollen-collecting and pollen-eating insects. The flowers of our earliest willow, *Salix discolor*, Muhl., are well provided in this respect, and attract numerous visitors, belonging to widely separated orders of insects. These flowers are of a very

simple structure, bearing no perianth, and being arranged in oblong cylindrical catkins. In this species the male or staminate flower consists merely of two stamens, arising from the base of a scale, and is furnished with a nectar-gland at the base. The female or pistillate flower is constructed exactly on the same plan, having a pistil instead of the two stamens. It is an easy task for any flower-visiting insect to gain access to the entirely exposed pollen, as well as to the nectaries of these simple flowers, and this fact, together with the rich supply of pollen and nectar in the numerous flowers, explains the frequency with which they are visited. Another point of advantage in attracting insects to the flowers, is the opening of the flowers of *Salix discolor* and of a few other early species of *Salix* before the green leaves of the stem appear. It is evident that the catkins of such a species are more conspicuous than those of a species producing the green leaves in advance of the flowers.

According to Kerner's (6) statements, the majority of dioecious plants are proterogynous. In referring to willows, this author mentions four European species, in which proterogyny has been observed, the pistillate flowers appearing from one to three days earlier than the staminate flowers. This condition of affairs favors, in the opinion of Kerner, the production of hybrids, as the very first pistillate flowers of such a species can not, during the first two or three days of their existence, be supplied with pollen of the same species, but may be fertilized by pollen from another species, whose staminate flowers are blooming at that time. From observations on *Salix discolor* during the last three years, I am satisfied that this species is proterogynous, the female flowers opening at least one day, and, as a rule, two days in advance of the male. In this species proterogyny can have nothing to do with the production of hybrids, as *Salix discolor* is our earliest willow, and, therefore, no staminate flowers of any other species are on hand during the proterogynous period of this plant.

As has been stated previously, the flowers of this willow are abundantly visited by a great variety of insects, and, on looking over the following list of visitors of *Salix discolor*, we come across the majority of anthophilous insects flying in early spring.

A. HYMENOPTERA.

Apidae: (1) *Apis mellifica*, L. ☿ s. and c. p. *; (2) *Bombus Edwardsii*, Cr. ♀, s.; (3) *B. Virginicus*, Oliv. ♀, s.; (4) *B. separatus*, Cr. ♀, s.; (5) *Osmia lignaria*, Cr. ♂♀, s.; (6) *O. atriventris*, Cr. ♀, s.; (7) *Nomada integerrima*, DT. ♂, s.; Andrenidae: (8)

(6) A. Kerner von Marilaun. Pflanzenleben, Vol. II, pp. 311-313.

*☿ Worker; ♂ Male; ♀ Female; s Sucking; c p Collecting Pollen; f p Feeding on Pollen.

Halictus similis, Sm. ♀, s.; (9) *H. fasciatus,* Nyl. ♀, s.; (10) *H. confusus,* Sm. ♀, s.; (11) *H. connexus,* Cr. ♀, s.; (12) *H. Pattonii,* Ashm. (M.S.) ♀, s.; (13) *Halictus sp.* ♀, s.; (14) *Andrena mariae,* Rob. ♂♀, s. and c. p.; (15) *A. illinoensis,* Rob. ♂♀, s. and c. p.; (16) *A. crythrogastra,* Ashm. ♂♀, s. and c. p.; (17) *A. vicina,* Sm. ♂♀, s.; (18) *A. bipunctata,* Cr. ♂♀, s.; (19) *A. erigeniae,* Rob. ♀, s.; (20) *A. Forbesii,* Rob. ♀, s.; (21) *A. rugosa,* Rob. ♂♀, s.; (22) *A. mandibularis,* Rob. ♂, s.; (23) *Parandrena andrenoides,* Cr. ♂♀, s. and c. p.; (24) *Colletes inaequalis,* Say. ♂♀, s.; (25) *Sphecodes dichroa,* Sm. ♀, s.; Vespidae: (26) *Polistes pallipes,* Lep. s.; Ichneumonidae: (27) *Ephialtes irritator,* F. s.; (28) *Glypta varipes,* Cr. s.; (29) *Glypta sp.,* s.; (30) *Meniscus parvus,* Cr. s.; (31) *Pimpla indagatrix,* Walsh., s.; (32) *Amblyteles sp.,* s.; Braconidae: (33) *Apanteles cupitheciae,* Ashm., s.; Tenthredinidae: (34) *Dolerus unicolor,* Beauv., s.; (35) *D. arvensis,* Say., s.; (36) *D. sericeus,* Say., s.; (37-38) *Pontania spp.,* s.

B. DIPTERA.

Syrphidae: (39) *Melanostoma obscurum,* Say.; (40) *M. mellinum,* L.; (41) *Syrphus americanus,* Wied.; (42) *S. ribesii,* L.; (43) *Mesograpta geminata,* Say.; (44) *M. parvula,* Loew.; (45) *Eristalis aeneus,* F.; (46) *E. tenax,* L.; (47) *E. Dimidiatus,* Wied.; (48) *E. meigenii,* Wied.; (49) *Helophilus similis,* Macq.; (50) *Crioprora cyanogaster,* Loew.; (51) *Syritta pipiens,* L.—all s. or f. p.; Conopidae: (52) *Myopa pilosa,* Will., s.; Phoridae: (53) *Phora femorata,* Meig.; (54) *P. rufipes,* Meig.; Tachinidae: (55) *Gonia capitata,* DeG.; (56) *Siphona geniculata,* DeG.; (57) *Tachina robusta,* Towns.; Muscidae: (58) *Calliphora crythrocephala,* Meig.; (59) *Lucilia caesar,* L.; (60) *L. cornicina,* Fabr.; (61) *Pollenia rudis,* Fabr.; Sarcophagidae: (62) *Sarcophaga sarraceniae,* Riley; Anthomyidae: (63) *Hyetodesia parsura,* Gig.-Tos.; (64) *Leucomelina garrula,* Gig.-Tos.; (65) *Phorbia fusciceps,* Zett.; (66-69) *Phorbia spp.;* Oscinidae: (70) *Mosillus aeneus,* Fallen.; (71) *Elachyptera nigriceps,* Loew.; Ephydridae: (72) *Ochthera mantis,* DeG.; Sepsidae: (73) *Sepsis violacea,* Meig.; (74) *Prochyliza xanthostoma,* Walk.; Sapromyzidae: (75) *Lonchaea polita,* Say.; Scatomyzidae: (76) *Scatophaga squalida,* Meig.—all s. or f. p.

C. LEPIDOPTERA.

Phopalocera: (77) *Vanessa atalanta,* L., s.; (78) *V. milbertii,* Gdt., s.

☿ Worker; ♂ Male; ♀ Female; s Sucking; c p Collecting Pollen; f p Feeding on Pollen.

D. COLEOPTERA.

Coccinellidae: (79) *Adalia 2-punctata,* L.; Chrysomelidae: (80) *Diabrotica vittata,* S.; Curculionidae: (81) *Smicronyx corniculatus,* F.—all s.

E. HEMIPTERA.

Capsidae: (82) *Lygus pratensis,* L.; Pyrrhocoridae: (83) *Dysdercus, sp.;* Lygaeidae: (84) sp.—all s.

The vast majority of the visitors is made up of the hymenopterous insects (mostly bees) and flies taken together, the hymenoptera being represented by thirty-eight species, as are also the flies by thirty-eight; these two orders together giving a total of seventy-six species, and leaving only eight species to be distributed among the remaining three orders in the following proportion, two butterflies (Lepidoptera), three beetles (Coleoptera), and three bugs (Hemiptera).

Among the bees we notice seven species of the highly specialized or long-tongued bees of the family Apidae, and most prominent among these are three species of *Bombus* (bumble-bee), which, at this early period, are present in the female sex only, the workers and males appearing much later in the season. The honey-bee *(Apis mellifica,* L.) is a frequent visitor, especially on the staminate catkins, sucking honey and collecting pollen, but is in our part of the country never present in such numbers as to monopolize the staminate catkins and drive off most of the other visitors from the staminate flowers, as has been observed by Robertson (7) in Southern Illinois on *Salix humilis,* Marsh., an early flowering willow. The three remaining species of the higher bees are two species of *Osmia,* bees having the pollen-collecting apparatus on the lower surface of their abdomen and one species of *Nomada.*

Of all the insects frequenting the willow-blossoms, none attain such an importance as the less-specialized bees—the Andrenidae. Eighteen species are credited to this family, the majority of them belonging to the genera *Andrena* and *Halictus* and leaving only one species to each of the remaining genera—*Parandrena, Sphecodes* and *Colletes.* Many species of *Andrena* have their time of flight during the spring months, and depend to a great extent on the flowers of the different willow-species for their supply of honey and pollen. A few species of *Andrena* and our single species of *Parandrena* rely even exclusively on willow-blossoms for their supply of pollen, and are never observed collecting pollen on any other plant than on certain species of *Salix,* although they resort to other flowers for nectar. A bee obtaining

(7) C. Robertson. Flowers and Insects. XV. Bot. Gazette, Vol. XXI (1896) p 78.

pollen from one plant-species exclusively, or from a limited number of closely related species, has been called by Loew (8) an oligotropic bee, and for a bee that collects pollen on an extended number of species, belonging to different families the same author has selected the name polytropic. Robertson (9), in a paper on the visits of oligotropic bees refers to five oligotropic bees taken on four species of *Salix* in Macoupin County in Southern Illinois, and four of these I have observed on the flowers of *Salix discolor,* where they appear as regular and frequent visitors. Their names are *Andrena mariae,* Rob., *Andrena illinoensis,* Rob., *Andrena erythrogastra,* Ashm. and *Parandrena andrenoides,* Cr., and they may be seen on the flowers in both sexes, the females paying more attention to the staminate catkins in search of pollen and nectar, and the males visiting both staminate and pistillate catkins for nectar only.

The willows which furnish pollen to these oligotropic bees are of vital importance in the economy of these bees, the latter utilizing the pollen mixed with honey as food for their offspring, and depending strictly on the pollen produced by willows for their purposes. On the other hand, the existence of these bees is of great advantage to the willows, furnishing them a set of regular visitors, which need an ample amount of pollen, as well as of nectar, and which for this reason can be relied upon to visit both staminate and pistillate flowers, thereby rendering excellent services as cross-fertilizers.

In favorable weather the Andrenidae visit the catkins of *Salix discolor* in great numbers, and they, together with members of the most important family of anthophilous flies—the Syrphidae—represent a high percentage of the visitors. Wherever observations have been made, in this country as well as in different localities of Europe, the results always point to the Andrenidae and Syrphidae, as being the most prominent agents in effecting cross-pollination in the willows. Of the eighty-four insects making up the list for *Salix discolor,* thirty-one belong to these two families, amounting to 37 per cent. of the visitors. A comparison of these figures with those obtained by Robertson (10) in Southern Illinois, by Herman Mueller (11) in Germany, and by MacLeod (12) in Flanders on several early species of *Salix,* gives the following results:

(8) E. Loew. Beobachtungen ueber den Blumenbesuch von Insecten an Freilandpflanzen. Jahresb. d Bot. Gart. Berlin, Vol. III, 1884.

(9) C. Robertson. Flowers and Insects. XIX. Bot. Gazette, Vol. XXVIII (1899) p. 36.

(10) C. Robertson. Flowers and Insects. XV. Bot. Gazette, Vol. XXI (1896) pp. 76-78.

(11) H. Mueller. Die Befruchtung der Blumen durch Inseckten. 1873. pp. 149-150. Weitere Beobachtungen Vol. Ii, 1879, p. 210.

(12) Mac Leod. Over de bevruchting der bloemen in het kempisch gedselte van Vlaunderen. Bot. Jaarboek 6, pp. 129-133.

	Locality.	Visitors.	Andrenidae + Sysphidae.	Per Cent.
Salix Cordata, Muhl	Southern Illinois	87	49 =	56
Salix Humilis, Marsh	Southern Illinois	51	27 =	53
Three Early Species	Germany	113	61 =	54
Early Species	Flanders	43	15 =	35
Salix Discolor, Muhl	Milwaukee, Wis.	84	31 =	37

Several species of Syrphidae are in attendance on the willow-flowers most of the time in pleasant weather, and this is especially true of two very common species—*Eristalis dimidiatus,* Wied. and *Helophilus similis,* Macq., which are occasionally so numerous on the flowers that they surpass the rest of the visitors, as far as the number of individuals is concerned. On April 23d, 1897, I saw plants of *Salix discolor,* growing near the city limits in Bay View, literally swarming with flies, belonging to these two species of Syrphidae. Although the Syrphidae take such a prominent part in the pollination of the willow-flowers, yet there are no close mutual relations existing between these flies and the willows, as we have seen to exist between these plants and the Andrenidae.

Having considered the more important groups of visitors of *Salix discolor,* it remains for us to turn our attention to the other visitors on the list. The only wasp observed on the flowers is a female of our social wasp, *Polistes pallipes,* Lep.; none of our other species of wasps appear so early in the season, the solitary wasps notably coming out much later. The remaining hymenopterous insects of the list are made up of seven parasitic Hymenoptera, chiefly Ichneumonidae and five Tenthredinidae (saw-flies). The visitors belonging to these families are of little importance, compared with the other Hymenoptera, and are only occasionally taken on the flowers.

Among the flies we have in *Myopa pilosa,* Will., a single species of the Conopidae, a family ranking as high as the Syrphidae, as regards the adaptation of its members to flowers, but having comparatively few representatives in our region.

Of the three species of Tachinidae, we have already come across two *(Gonia capitata,* DeG. and *Siphona geniculata,* DeG.) among the earliest Diptera, visiting *Erigenia bulbosa,* and the third *(Tachina robusta,* Towns.) is a good-sized fly, which appears regularly, though in small numbers, on the flowers of *Salix discolor.*

The remaining species of Diptera are scattered among different families, none of which produce anthophilous species in the strict sense of the word. These species do not depend on floral diet, although some of them, as for example those belonging to

the Muscidae, Anthomyidae and Scatomyzidae are frequently observed on the willow-catkins, and most certainly contribute their modest share of work in effecting pollination. The smaller flies of the families Phoridae, Sepsidae, Oscinidae and others visit the flowers in search of nectar, but can not be relied upon to render efficient services, as, on account of their small size, they can crawl down to the nectarglands, without necessarily coming in contact with either the anthers or the stigmas.

This same consideration applies to the small-sized species of beetles and bugs, while the large species of these orders, as well as the butterflies, may be expected to carry pollen to the stigmas, if they visit the flowers in the appropriate order; that is, if they visit the staminate catkins in advance of the pistillate. The staminate catkins, with their numerous yellow anthers, are undoubtedly more conspicuous than the pistillate and, besides, they offer both pollen and nectar to the visitors and may, for these reasons, be expected to be more attractive to insects than the pistillate catkins, which are provided with nectar only. Observations establish the fact that insects are more numerous on the male (staminate) flowers than on the female, and there is a probability of the visitors paying their attention to the male flowers before visiting the female.

Before closing these remarks on *Salix discolor* and the throng of insects feasting on the sweets of its flowers, it remains for me to state, that the latest flowers of this species may be observed in the first week of May, and that, during its blooming period, several other entomophilous flowers make their appearance, as for example additional species of *Salix,* two species of *Hepatica,* two species of *Erythronium, Dirca palustris,* L., *Sanguinaria canadensis,* L., *Claytonia virginica,* L. and *Isopyrum biternatum,* T. & G. Although, as the season advances, anthophilous insects become more numerous, yet competition among the gradually increasing number of entomophilous plants becomes more severe, and accordingly the blossoms of *Salix discolor* are not visited so abundantly towards the end as during the first and second week of its blooming period.

Additional Observations on the Instincts and Habits of the Solitary Wasps.

By G. W. and E. G. PECKHAM.

Chlorion coeruleum Linn.

C. coeruleum is an old friend of ours and we have given some account of its habits in an earlier work,* but we were anxious to learn more about it, and when, one morning in the middle of August, we saw a female running along with a cricket in her mouth, we were only too happy to drop our dignity and run after her. She led us a rough race down a steep declivity at one side of the island to her nest, which was entirely hidden from view by long grass, there being nothing whatever to indicate its presence. The cricket was deposited and the wasp flew away without circling, but it seemed that we were not the only ones who were interested in her actions, for immediately after we saw a little dark colored wasp come slipping along through the grass and into the nest. All remained quiet until, at the end of half an hour, *coeruleum* returned with a cricket. We had pushed the grass back to get a view of the entrance and this disconcerted her, for she ran about for some time seeming doubtful about the place, but she finally entered, head first, carrying the cricket with her. A moment later there was a commotion down below, and the inquiline came out shaking her wings in a flippant way as though she cared nothing for an encounter with the big blue *Chlorion*. We tried to catch her, but she ran off under the grass. Twenty-five minutes passed, and we began to think that the little wasp had wounded the big one, when *coeruleum* appeared. She stood in the doorway turning her head now to this side and now to that, as though listening, and now we became conscious of the fact that a cricket was chirping loudly near by. Perhaps she was getting the direction from which the sound came, for after a little she flew to the top of a tall weed, then dropped and entered a hole below, from which she issued a moment later with a very limp specimen of *Gryllus abbreviatus*. An ant, that indiscreetly showed some interest in her proceedings, was chased away with great vindictiveness, and then the cricket was laid upon its back and scraped, four or five times, from head to tail, with her mandibles. She then picked it up and carried it toward the nest, but laid it down on the way, and repeated the scraping operation, before taking it in. When it had been stored, and we had seen her run hunting up

* Instincts anI Habits of Solitary Wasps, Madison, 1898.

the hillside, we left her, but an afternoon visit, on the same day, found her still working industriously, storing from two to three crickets an hour.

As we had had some acquaintance with this wasp, and knew that the larva needed only five crickets to carry it through, it became evident that the one we were watching was provisioning several cells. Our curiosity in the matter being aroused we took up our station beside the nest early on the following morning. Madam *Chlorion* was still asleep down in one of her lower galleries, while the upper tunnel was occupied by an unsuspecting cricket that had crept into this shelter to pass the night, all ignorant of the proximity of its deadliest enemy. When the wasp came up from below it scrambled out and scuttled off through the grass in a great hurry. It was probably quite safe, however, for *coeruleum* does not sting a cricket unless she has gone through the preliminary act of hunting for it. A little later in the day we provided one for her and put it down into the hole when we saw her approaching, but instead of making use of it she brought it out, carried it to some distance, and set it free, quite unharmed.

On this morning she came out of her nest at fifteen minutes before nine, made a careful survey, on foot, of the surrounding grass, weeds, sticks and stones, and then flew away. Half an hour later she came back without a load and made another study of the locality. Then she began her day's hunting, running up the side of the hill and poking her head into every hole and tangle that might afford shelter to a cricket. From twenty minutes after nine until fifteen minutes after one she worked very industriously, taking one rest of half an hour in the middle of the morning, and in that period of four hours she brought in sixteen crickets. The length of time occupied in capturing and storing each one may be reckoned from the hours at which she returned to the nest, these being as follows: 9:27, 9:45, 10:10, 10:18, 10:35, 10:40 (she must have spent this hour rather easily), 10:55, 11:00 (here she passed half an hour in her nest), 11:45, 11:55, 12:10, 12:20, 12:40, 12:55, 1:05, 1:15. At the end of this stretch of work she flew away and had not returned at two o'clock, when we took our departure.

Only once did we see this wasp deliver her sting. When she started on her hunting expeditions she usually began close by, going either up or down the hillside, running over the ground or making short flights, so that we were able to keep track of her for some little time. On one of these occasions we saw her dislodge a cricket which tried to escape by hiding under some brush. She pursued, there was a slight scrimmage in which the sting was

doubtless used, for when she pulled it out it was quite limp and helpless. She held it in her mandibles with its back up and gave it a very prolonged sting under the neck, before carrying it home. While carrying another cricket toward her nest she paused by the way, and clasping its neck in her mandibles, gave it one long tight squeeze.

In coming home this wasp almost invariably approached the nest by one particular path. She would alight upon a stump some eight or ten feet distant, and would then descend into the long grass and follow the runway which passed through it, her progress from the stump into the hole being entirely screened from any but a very observant eye. The other wasp of this species which we had watched, had a nest on a bare spot of ground with no protection of any sort, and made it even more conspicuous by leaving unscattered the heap of earth pellets which she had carried out. The difference may be partly accounted for by the fact that the grass-grown nest was evidently in a large natural cavity which ran deep into the ground, so that whatever excavation was necessary could be carried on out of sight.

It is evident from these observations that *Chlorion* does not make a new nest for each egg, but that, like *Cerceris, Philanthus* and others, she provisions a number of cells leading from one main gallery.

Pompilus atrox Dhalb.

While we were working on the island, one morning late in July, we saw a large wasp enter a natural crevice in the hillside. She was new to us, and although she came out and flew away almost immediately, we resolved to watch the spot in the hope that she had something more than a momentary interest in it. After a wait of two hours she appeared again and made another brief visit to the hole, showing that she had, in all probability, selected it for a nesting place. This second visit took place at noon, and we saw no more of the wasp that day, although we remained on guard until four o'clock. On the following day she visited the spot three times before two o'clock, when a heavy rain came on, and drove us to shelter. The next morning found us on hand early, for we thought that the storing of the nest could not be delayed much longer. At nine o'clock the wasp paid the place a short visit, and again at half past ten we saw her approaching, this time with even more than the usual signs of excitement. She was a really beautiful creature, instinct with vitality and the impersonation of grace and energy, the red spots on her body flashing and the steel-blue wings quivering in the sunlight. After a brief inspection she ran to the edge of the grass eight feet away,

and, going backward, dragged out a large spider, which was held by the under and hind part of the cephalothorax. She took her victim into the nest, and remained within for half an hour. When she came out we captured her, but, although we dug up the place, we failed to find the spider.

Sphex ichneumonea Linn.

This great *Sphex* is so striking in appearance that we never see her without a pleasurable excitement, and this feeling is intensified when we find her actually engaged upon the serious business of life. In the summer of 1896 we had seen her dig out her nest, but three years had passed without a similar experience, when, on a sunny August morning, we found a large, suggestive looking hole which bore the marks of recent labor, a pile of fresh earth being heaped to one side of it. A whirr of wings and a flash of yellow soon announced the arrival of the big *Sphex,* who at once resumed her task with a great show of energy, and kept at it persistently for an hour and a half. It was half past eleven o'clock when she departed in search of her prey, and she did not return with it until fifteen minutes before one, when she appeared on foot carrying her big meadow grasshopper over the bushes and weeds. The burden was laid down at the doorway while the wasp ran into the nest, out again, then off to a little distance and back, finally seizing it by an antenna and dragging it within. All this we had seen before, but at this point, in our former observation, we had interrupted the natural course of events by opening the tunnel and carrying off the grasshopper with the egg of the wasp upon it. We now proposed to see the final closure of the nest, but to our surprise the wasp took in only a little earth—enough to fill the opening of a single cell—and leaving the main entrance wide open, departed with a comfortable air of "duty performed." We had supposed that each nest of *Sphex* served as the repository of a single egg, but this conduct suggested that several cells might be made, on successive days, leading from the main passage-way, each cell being stored with a grasshopper, and this proved to be true. On the following day, August tenth, we found our wasp at work upon a second cell, but did not wait to see it filled. On August eleventh the rain fell heavily excepting for an hour or two in the middle of the day, and we did not visit the nest. On the morning of the twelfth we found her working, presumably at a third cell. She stored a grasshopper at a little before twelve o'clock, and then filled the tunnel up solidly, evidently having concluded operations in this locality.

We did not open this nest until the eighteenth of August, when we found only two of the cells, one of these containing a

freshly spun pupa, and the other a larva that was still eating. This one was well grown and had probably hatched from the egg laid on the eleventh.

Tachysphex tarsata Say.

On the afternoon of the twenty-first of July we saw this little red wasp on the *Bembex* field of the island. She had a very worried air and was running about wildly and rapidly, holding a small grasshopper with the third pair of legs. She let it drop four or five times and when she picked it up again she seemed to sting it, but of this we were not quite certain. At last she left it and began to rush about investigating the *Bembex* holes, entering one of them, and perhaps throwing out a little dirt, as though she intended to use it, and then hurrying off to another. We have no doubt that her confusion was the result of her having lost track of the hole that she had made, or selected, as was the case with *P. quinquenotatus* in one of our earlier observations.* The *Pompilus,* after a long search, resigned herself to the necessities of the case and made a new nest, but this little wasp could not adjust herself to a break in the system of her instinctive activities, and at last deserted her prey and disappeared. We waited for an hour, and then, as she did not return, we took possession of the grasshopper. It gave no response to stimulation, and never revived, a very careful and thorough examination later on showing that it was quite dead.

On the next morning we again saw this wasp on the *Bembex* field. She was looking for a nesting place, and presently selected one and began to work. The weather was warm and sunny so that the Bembecids were in the full swing of their obstreperous activity, and, perhaps, resenting the presence of the little red wasp as an intrusion, or perhaps in a spirit of teasing, they kept snatching her up and carrying her off to a distance of two or three feet. She took these interruptions with the most philosophic composure, hurrying back to her work as soon as she was released without any display of resentment. When the nest was finished she made a careful locality study, both on foot and on the wing, and then flew away. Twenty minutes later she came back, apparently to refresh her memory, for she again made careful notes of all the points that could help her to identify the place. She dug a little more, and then again departed, to return five minutes later on foot, with a grasshopper. In spite of all the precautions she had taken, at this exciting moment she was unable to remember just where her nest was, and spent some time in running wildly about, but when she did find it she went in without any delay. We

* Instincts and Habits of Solitary Wasps, p. 135.

caught her as she came out, and then dug out the grasshopper, but found no egg, so that she would probably have brought in a second victim had we let her go. The tunnel ran in obliquely for an inch and a half, the pocket at the end being two inches below the surface.

Cerceris fumi-pennis Say.

While working on the island on July twenty-third we noticed a large, open nest in a very bare, exposed position. The hole was surrounded by the heaped up earth that had been removed, giving it the characteristic appearance of *Cerceris*. We spent several hours in the vicinity, both on this day and the next, but caught no glimpse of the owner. On the morning of the twenty-fifth we were at work early, and saw her open the nest at half past nine. At ten she flew away, leaving the hole open, and forty-five minutes later she returned with a large beetle, *Chrysobothris 4-impressa*, which, while on the wing, she carried in her falces, supporting it by all the legs. When she alighted she let down the second and third pairs of legs. We caught her and took the beetle, which was quite dead, since we tested it closely during the next twenty-four hours without getting the slightest response to stimulation.

Ammophila polita Cresson.

This species, which we have never seen at Pine Lake, is very common in the sandy fields to the south of Milwaukee. Our observations upon it were made on the tenth of September, in bright, clear weather. Half a dozen individuals were working within a few rods of each other, their method being similar to that of *A. yarrowii*, described by Dr. Williston, and having an especial interest as it shows a transition stage between the wasps that provide the store of food for the larva all at once, and those that feed their young all through the larval period. *A. urnaria* rarely flies with her prey, but this wasp, although her caterpillars are not very much smaller, and she herself is no larger, carries her booty lightly on the wing, only occasionally alighting to run a few steps. She has to do more work than *urnaria*, taking five or six caterpillars instead of two, and this method of progression has the advantage of rapidity.

The first wasp that we saw was just alighting, with a medium-sized green caterpillar, near a partly closed nest. When disturbed she flew away, but soon returned, dropped her prey half an inch from the nest, proceeded to clear the opening, ran inside to see that all was right, and then backed in with the caterpillar. Emerging after a few minutes she placed a small pebble in the doorway, which was thus partly closed, and flew away. She brought three

more caterpillars at intervals of about thirty minutes, and then, after wedging a pebble into the neck of the opening, she began to fill it in solidly, scratching in dirt and packing in lumps of earth which were brought in her mandibles. We did not allow her to complete this operation, as it would have made excavation more difficult, but caught her and dug out the nest. The tunnel ran down obliquely for five inches, being two inches below the surface at the pocket. In it we found a wasp-larva which was at least three days old, and the four caterpillars. There were no signs of the banqueting that must have already taken place. We carried this larva home with us and it ate the caterpillars up clean, finishing with a fifth which we supplied from another nest, and going into its cocoon on September sixteenth. The additional food would probably have been brought by the mother had we not interfered. The caterpillars all wriggled about upon the slightest stimulation, and remained in this lively state until they were eaten. They belonged to four different species.

In a second nest to which food was being carried, we found four caterpillars and a larva about three days old, all the conditions being like those in the other example. Evidently the larva had been fed from day to day, since four or five days must have elapsed since the making of the nest.

Odynerus capra Sauss.

We had often seen this wasp gathering earth on the very hard clay and gravel path that leads to our boat house, but had always failed in our efforts to follow her to the nesting place. Even when we called in our auxiliary force of children and stationed them with the greatest care as to their positions, she baffled our pursuit, disappearing among the foliage of the thickly wooded ravine at one side of the path. However, her fearlessness and her tendency to utilize any convenient crevice at last betrayed her.

One of our neighbors in the country keeps a large tin horn hanging under the porch. One day when she wished to use it no amount of blowing would bring forth a sound, and when she unscrewed the mouth piece to investigate the matter, out tumbled several small green caterpillars and a quantity of dry mud. When we heard of this incident we begged that, if it should be repeated, the nest and its contents might be saved for us, and on the second of September we received the mouth piece of the horn with a message to the effect that a wasp had been working at it for some days and had just closed it up. Examination showed that there were three cells, each containing larva and a supply of caterpillars, of which there were ten in the cell most lately formed, and only one left uneaten in the oldest. The caterpillars, all of them being

alive, together with the wasp larva, were transferred to a place in which they could be conveniently watched. None of the caterpillars died until they were attacked. The larva ate all the food that was provided, the oldest one cocooning on the fourth, and the second one on the seventh of September. Of the third we have no record, excepting that the caterpillars had all been eaten on September eighth.

We happened to be passing through our neighbor's grounds at nine o'clock on the morning of September fifth, and calling to ask whether there had been any more visits from the wasp, we learned that an *Odynerus* had been seen making a mud partition in the horn on the day before. While we were speaking she arrived and entered the mouth piece, where she remained for about ten minutes. When she departed we found that she had laid her egg, which we carried away with us, wishing to determine the length of the egg stage. This proved to be longer than that of any wasp that we had heretofore known, for not until the morning of September ninth did the larva make its appearance, and then the hatching was accomplished in a manner new to us, the egg-skin bursting and leaving its tenant free to crawl away. As a usual thing the egg changes into a larva imperceptibly, there being no sloughing off of the skin.

Odynerus capra, then, first finds a suitable crevice and builds an earthen partition across the inner end, the earth being scratched up from some dry, bare spot and moistened in her mouth. In this her habits seem to be identical with *O. nidulator,* which is described by Fabre as building in natural crevices or in those excavated in the stems of plants by bees. She then lays her egg, very probably suspending it by a filament of web, as is done by *O. nidulator* * and *O. reniformis,* † as well as by *Eumenes.* ‡ Not until this is done does she gather the ten or twelve small caterpillars which are to serve as food for her young. One cell being provisioned, others follow until the crevice is filled. The caterpillars are not killed, nor even reduced to a state of decent immobility, since we were obliged to press wads of cotton into the tubes in which they were kept to prevent their wriggling out of reach of the wasp-larvae. In the case of *O. nidulator* the caterpillars, according to Fabre, are so severely stung that they are reduced to absolute immobility. Not the slightest response is given to stimulation, and had the observer only this test to depend upon they would be pronounced dead. In *O. reniformis,* on the other hand, and to a somewhat lesser extent in *Eumenes,* the con-

(*) Fabre, Souveners Entomologiques, Quatrieme Serie, 1891, p. 179.
(†) Id. Nouveaux Souveners Entomologiques, 1882, p. 89.
(‡) Id., ibid, p. 74.

dition of the caterpillars is like that which we find in *O. capra.* Fabre, in discussing the theory of natural selection, considers it a fact of immense importance that in these species the egg and young larva are so placed as not to be imperilled by the wriggling of the caterpillars. He thinks that if the egg, so delicate that the least pressure would crush it, were placed among the mass of caterpillars, nothing could save it from destruction. Certainly the adaptation does seem to be a peculiarly beautiful one, but where is the necessity of it in the case of *nidulator,* whose caterpillars never move at all? And is it, after all, so important in the case of the other species? The caterpillars of *capra* were in the same threateningly active state that was found in those of *reniformis,* and yet the wasp-larvae which we dropped in among them, even the youngest, which could not have been more than a day old, were not in the least harmed by their contortions. The egg stage of *capra,* like that of *nidulator,* is four days, and the larval stage is probably six or seven.

Physiographical Field Notes in the Town of Wauwatosa.

By ERNEST BRUNCKEN.

1.—Boulder Clay and Lacustrine Deposits.

On one of the maps accompanying the first geological survey of Wisconsin there is indicated between the main body of the boulder clay and the lower red clay, in Milwaukee County, a strip of clay deposit of lacustrine origin, but differentiated from the red clay by its physical and chemical properties, and especially the greater abundance of pebbles. The map does not purport to show local details. But it would be a mistake to imagine that within the territory assigned to this deposit the lacustrine clay occupies the entire surface. The fact is, that areas of lacustrine clay, and areas of boulder clay, alternate very frequently everywhere in the Town of Wauwatosa, to which these notes principally relate, as well as on the West Side of the City of Milwaukee.

A complete mapping of the relations of these two formations, if it were worth while, would be impracticable for the reason that grading and filling operations have in many places radically changed the character of the surface. But from observations which can be made without mapping the following facts can be learned:

Generally speaking, the northeastern portion of the territory under discussion is a gently rolling plateau, dissected by the valley of the Menomonee. The southeastern portion, without being in bold relief, is yet much more broken. The hills are mostly drumloid in character, but the typical drumlin form is often modified in a particular manner to be indicated forthwith. The presence of drumloids is not surprising in this locality. This form of glacial accumulation is usually found near the outer rim of a glacial lobe, and the outer rim of the Michigan glacier, as indicated by the moraine dividing the Michigan and Green Bay lobes, is but a few miles to the west. The longer axis of the hills is generally from northeast to southwest, in accordance with the flow of the glacial ice in this locality. As far as I know there is but one place within the town where the hills are of a different character. This is in the grounds of the Soldiers' Home, where they are of kame-like appearance.

All these hills are without doubt of glacial origin. Their surfaces are covered with boulders, mostly crystalline. Where cuts and other exposures have been made sufficient to show the internal structure, the aspect is always the same. There is an irregular accumulation of clay, sand, gravel and boulders of varying size. But surrounding these hills, filling the depressions between them and ascending their sides, there is the deposit of grayish clay (1), with comparatively few pebbles and only an occasional boulder, which is indicated on the map. This deposit shows a fairly distinct stratification, but considerable exposures of it are infrequent. The largest are those made by the brick yards in the Menomonee Valley. About the aquatic origin of this deposit there can be no doubt, nor about the fact that it is younger than the boulder clay. This being so, the interesting feature is that all the highest places of this neighborhood show the boulder clay as their surface deposit. In some cases, the lower hills may have a lacustrine clay surface like the depressions. I have noticed no exposures showing this, but have suspected it from the scarcity of boulders. But without question all the higher hill tops are boulder clay.

The obvious conclusion to be drawn from this circumstance is, that at the time when the lacustrine clay was deposited, the boulder clay hill tops were islands, and the lower hills with a lacustrine clay surface, if such there are, were shoals. This fact explains the greater quantity of pebbles and the relatively large number of boulders in this formation, compared with the red clay to the eastward. The latter was deposited in open and deep water, while the former was laid down in narrow seas, where there was a great deal of material washed down from the land, both by direct erosion and with the help of ice rafts. In some places, notably the ravines on the north side of the Menomonee Valley, there appears to be a stratum of boulder clay overlying the lacustrine. This is easily explained by material rolling down the sides of the hill, either while the lower deposit was still forming or, more probably, after it had become dry land.

The existence of an archipelago of boulder clay islands on the west side of Milwaukee and in the town of Wauwatosa during Champlain times is still further evidenced by the existence of another formation, occupying a middle ground between the boulder clay and the lacustrine clay. In a large number of places, but invariably on the side of one of the hills, there are large accumulations of sand and gravel, which are now often used as gravel pits. These accumulations have the evident ear-marks of

(1) The term "clay" is used in this paper in its popular rather than its technical sense, meaning a fine-grained, cohesive earth. I do not know whether pure aluminous clay occurs in this neighborhood. Most of the clay, so-called is decidedly marly.

being beach deposits. They are very distinctly stratified, but show the cross-bedding characteristic of beaches. The material is usually composed of alternating strata of sand, varying in fineness up to the size of a pea, and gravel consisting of flat, well-worn pebbles. The fact that these deposits occur on all sides of hills, and that their strike and dip is in all sorts of directions, preclude the idea that they indicate a continuous coast line. For the same reason they cannot be identified with the various beach formations indicated along the present shore of Lake Michigan by the Geological Survey. The only alternative seems to be that they were formed around islands, while the clay was deposited in the deeper portions of the straits throughout the archipelago.

Some caution is necessary in identifying quaternary deposits in this region. As a general rule, we may classify all formations showing distinct stratification as Champlain rather than Glacial. But this does not always hold true. It is well known that the Till not rarely shows limited areas of pure clay, without pebbles or boulders, or of sand and gravel. Not rarely, also, there is an imperfect stratification visible. Where the exposure is large, mistakes are not likely to happen because such areas are usually small and surrounded on all sides by unmistakeable boulder clay. But in small exposures it is sometimes impossible to come to a positive conclusion. Among the tests must be, aside from the general topographical relation of the area, the character of the pebbles, which in the Till are subangular, but in the beach deposit worn more or less flat. In the lacustrine clay, the pebbles may be of either kind, according to their history. The stratification within the Till is usually irregular, often crumpled, while the strata of the lacustrine clay are regular and approximately horizontal.

These accumulations on the sides of the boulder clay hills have of course materially changed the outlines of the latter. It is noticeable that the farther southwest one goes within the township the more distinctly drumloid the hills appear. In the eastern portion they are often broad, while towards the west they are often elongated beyond the typical drumloid form. The western half of the township offers less favorable opportunities for studying the quaternary formations, because there are not so many cuts and other artificial exposures as in the portions nearer the city. It is not at present practicable to say precisely how far west the archipelago extended. The mainland must, of course, be held to have begun where the boulder clay commences to be the continuous surface deposit of the hills as well as the depressions, which, according to the map, is somewhere near the county line.

2.—Quaternary Deposits and Bedrock.

As is well known, natural exposures of the Niagara limestone are very rare in the neighborhood of Milwaukee. In fact I believe there are only two to be found in the county: One is in the Menomonee River bed, just below the Wauwatosa Sanitarium; the other is the little cliff which projects in the shape of a triangle in a northeasterly direction from one of the bluffs in the Soldiers' Home grounds into the flats of the Menomonee Valley. The rock here forms the base of a rounded gravel hill which crowns it like a dome. This gravel hill is the outermost of a group of similar hillocks, which within these grounds form an area of the nature of kames, as far as I know the only occurrence of such a structure in this vicinity.

How did this little exposure take its origin? The theory which suggests itself first of all is, that it is an ancient sea-cliff. It stands on the edge of a circular valley, surrounded on all sides, except the east, where it connects with the plain of the present Menomonee River, by bluffs of considerable steepness. The fact that there is a narrow terrace on the inside of this semi-circle of bluffs, several feet higher than the general level of the valley, adds rather than detracts from the plausibility of the suggestion, for such terraces are a common shore form.

But a closer inspection of the rock itself quickly refutes this theory. As stated above, the exposure has the shape of a V, with the apex towards the northeast. The easterly face might possibly be shaped by the action of waves, for it is almost vertical as sea cliffs, formed by undercutting, usually are. But the other face presents smooth planes, slanting back at an angle of about 45 degrees. These planes are roughened by weathering. They could not possibly have been formed by wave action. What, then, is their origin?

Observations on some phenomena in another place in the vicinity may suggest the true explanation. Less than half a mile to the north from this cliff is the quarry of Story Bros. It is located at the base of the bluff forming the west bank of the Menomonee Valley. A portion of the discrete of which this bluff is composed has been removed, laying bare the surface of the bedrock. This surface is elevated in the neighborhood of twenty feet above the general level of the valley. The quarry itself constitutes a deep hole, sunk far below that level. Evidently the bedrock formed a low hill, the eastern portion of which has been cut away in making the quarry. This leaves the line of contact between the glacial deposits and the bedrock plainly visible on the west side of

the quarry. Tracing this line one notices first of all that the surface strata are very sound. There is hardly a trace of weathering, no layer of "rotten" stone. Furthermore, the line is very even, forming a low, vertical curve, highest in the center and descending gently to north and south. The bedrock, therefore, seems to have formed in this place a low dome, worn smooth on its surface, in other words, a huge *roche moutonnee.* On the top of this the boulder clay was deposited. There is nothing to indicate, in the present condition of the exposure, whether the abrasion of the surface took place during an earlier stage of the same glacial invasion which deposited the Till, or had been completed before the last invasion began. It is generally admitted that the Till of this neighborhood, in its present arrangement, belongs to the youngest or Wisconsin epoch of the ice age. If more of the surface of this *roche moutonnee* should be uncovered, an examination should be made to ascertain whether any weathering had taken place. If none at all could be found, it would indicate that there was no interval of exposure between the abrasion and the deposit of Till. If there has been weathering, the amount of it may throw some light on the mooted question of the length of time elapsing between the successive glacial deposits.

The existence of the *roche moutonnee* at Story's quarry suggests that the peculiar configuration of the cliff at the Soldiers' Home is caused by its being the somewhat irregular edge of a similar ice-worn dome. As to whether the existence of the kame-like group of hillocks at this place has a causal connection with the surface configuration of the bedrock, I am not able to form an opinion.

Botanical Notes from the Green Bay Peninsula.

By ERNEST BRUNCKEN.

The shores of Lake Michigan, meaning thereby the beach and the zone immediately behind it, be it cliff, terrace or ridge, constitutes one of the most distinctly defined biological districts of this state. Its study has hardly been begun, but will richly repay the student of ecological and biogeographical phenomena. The following random notes may be of use for this purpose.

The western or Green Bay side of the Door County peninsula, north of Sturgeon Bay, is well known for its picturesque limestone cliffs, which in some cases descend directly into the water, while in others there is an interval of from a rod to a third of a mile of foreland between the water's edge and the cliff. This foreland is composed of fragments of stone, coming evidently from the cliff talus, together with beach sand and soil formed since vegetation has clothed it. This material is heaped up, in many places, in one or more beach ridges. The uplands, above the limestone cliffs, show the usual glacial drift formations. A characteristic of the region is the fjord-like incisions into the shore lines, which have often been described.

The entire peninsula was, before settlement, heavily wooded. But there is a very striking contrast between the vegetation of the main body of the district and the foreland on the Green Bay side. The upland forest was principally of hardwood, with hard maple and beech predominating. Swamps in the depressions are occasionally found, covered with black spruce or tamarack. On a ridge following the east shore for some six miles north of Sturgeon Bay, there was pinery, composed of white and Norway pine. This is now mostly cut and burned over, and presents the usual aspect of a young growth of aspen, together with underbrush composed of fire cherry, *Amelanchier,* etc. In the shade of these weeds, young pine is coming up everywhere, and will soon overtop the aspen.

In contrast to these formations, typical foreland localities, such as may be found, e. g., at Egg Harbor and Fish Creek, are conspicuous, first of all by the almost total absence of broad-leaved trees. *Thuja occidentalis,* the arbor vitae, is by far the most numerous tree in these places. It grows both in dry and

moist places, reaches considerable height, and individuals a foot and more in diameter are common. The next tree in order of frequency is *Abies balsamea,* which seems to reach greater dimensions here than elsewhere in the state. Hemlock and black spruce are common, but not by any means as much so as the two species first named. Of the hemlock, many vigorous young trees were noticed, in contrast to many places farther in the interior of the state. Tamarack is occasionally found in swampy places. Of hardwoods, there are occasional specimens of the paper birch, and of three kinds of poplar, *Populus tremuloides, balsamifera* and *grandidentata.* Of underbrush there was noticed, at Egg Harbor, *Amelanchier canadensis, Ribes cynosbati, Rhus hirta, Rosa sp., Salix sp.* All of these are rather sparse; the latter was found only on the double spit projutting from the southwest side of the mouth of the bay.

Among non-arborescent species found in bloom on May 29, 1897, at Egg Harbor, I may mention: *Cypripedium pubescens,* sparingly on the ridge; *Trillium grandiflorum, Antennaria plantaginifolia, Clintonia borealis, Viola pubescens;* on the beach proper, near the spit, and growing invariably under the protection of sticks of drift wood, there was *Primula mistassinica;* in the same locality, as well as throughout the wooded portion, were many patches of some species of violet, one of those into which the old *Viola cucullata* has lately been split up. It was noticeable that all these violets were almost wholly glabrous. In the same locality, but higher up and within at least partial shade, *Iris lacustris* was copious.

The original forest on these forelands has in the neighborhood of the villages been largely removed and wide, grass-grown pastures have taken its place. On these pastures there are, at Egg Harbor, and still more conspicuously at Fish Creek, frequent clumps of *Juniperus communis var. alpina,* which is so characteristic of many places along the lake shore.

The hardwood forest of the uplands is extending its sway upon these forelands, using as channels of invasion the breaks in the cliff afforded by the fjord-valleys and an occasional smaller ravine. At the northeast side of Egg Harbor, the interval between the cliff and the water's edge is of more than ordinary breadth. Here a swamp is found between the cliff-talus and the beach-ridge. In this swamp, *Fraxinus nigra* occupies the center, being surrounded by a very dense ring of arbor vitae. A little farther up *Tilia Americana* and *Acer barbatum,* typical upland trees, make their appearance. They are accompanied by upland herbs, such as *Aralia nudicaulis.* Two herbs which are very con-

spicuous in the maple and beech woods of the uplands were not, at the time stated, found anywhere, either on the foreland proper, nor in this transition locality. These species are *Podophyllum peltatum* and *Anemone nemorosa.*

In conclusion, I may note that in the upland woods around Egg Harbor was found *Viola rostrata,* which I believe has not heretofore been credited to Wisconsin.

Notes on the Food of the Ruffed Grouse.

By W. J. BENNETTS.

Facts bearing on the relation of animals to their food supply are interesting to the student of natural history, as they assist in solving many of the problems connected with animal distribution, and help in determining the influence which a species has upon the existence of other species with which it comes in contact. The search for food is one of the principal activities in an animal's existence, occupying no inconsiderable part of its entire life, and being intimately connected with its general habits and frequently with its structure and external form. Hence investigations concerning an animal's food, generally also reveal and explain many interesting facts concerning its life history, and its morphology.

In the case of birds, the necessity for food and the habits resulting therefrom, have given rise to influences that reach out in many directions. The usual result is to reduce the number of individuals in the animal and plant world. To counteract this effect among animals, the interesting phenomena classed as mimicry and protective coloration have been evolved, while plants have accomplished the same end by greatly increasing their seed-bearing capacity and by special methods of propagation. The food habits of birds have also the opposite effect on plant life—of tending to increase the number of individuals. Fruit eating birds, for example, are agents of seed dispersion, while honey feeders are employed to effect the cross-fertilization of flowers.

The food supply of man may also be affected by birds, often prejudicially in the case of predaceous and fish or fruit-eating ones, while in the case of insectivorous and seed-eating birds the result may be beneficial.

The food habits of the species to be considered in this paper—the ruffed grouse, *Bonasa umbellus*—are especially interesting, as it is a resident or non-migratory species, and the character of its aliment must necessarily vary according to the season, and be characterized by a variety greater than is that of most migratory birds. With the latter, a radical change of diet is avoided in the fall, by joining in the southward migration, while the spring or northward migration is so timed that a species finds its customary

food ready for it upon or soon after its arrival. The ruffed grouse and its allies, however, avoid a change of station by a change of food.

The geographical distribution of the typical species and its three sub-species covers the entire United States and the Dominion of Canada, with the exception of the extreme south and southwestern portions of the former and the northeastern portion of the latter, so that with so wide a range the character of the food must depend in a considerable degree upon the locality. The notes that follow apply strictly only to the northern tier of states and to southern Canada, in which localities it is known generally, though improperly, by the name of partridge.

Recently the writer, as opportunity has offered, has made examination of the stomach contents of a number of these birds, and although for lack of material, the investigation has not proceeded as far as desired, the results are presented here and supplemented with notes derived from field observation and from the published notes of others.

As is well known the ruffed grouse, like all gallinaceous birds, has its gullet or aesophagus enlarged into a preliminary stomach—the ingluvies or crop—where the food material is macerated in a special secretion before passing to the stomach proper, or gizzard. The walls of this crop are capable of very great extensibility—some of those examined containing nearly half a pint of material—and they also appear to be almost insensible to feeling so that even when distended with the sharped edged and angular beechnut or the needle like buds of certain trees, no discomfort seems to result.

For the identification of many of the seeds mentioned in the lists that follow, thanks are due to Prof. F. E. L. Beal, of the U S. Department of Agriculture. Many seeds, however, could not be identified for want of specimens for comparison.

Two ruffed grouse were collected in Washington Co., Wis., on Sept. 6, 1899. In their gizzards were found seeds of the following: (1) Wild black cherry, *Prunus serotina*; (2) one of the large cultivated Gramineae, probably *Andropogon sorgum;* (3) poison sumac, *Rhus Vernix*; (4) rough-leaved dogwood, *Cornus asperifolia;* (5) hooded blue violet, *Viola obliqua Hill.*

The crops of these birds were entirely empty. This was found to be the case with about half of the specimens handled, and the explanation probably lies in the fact that most birds feed only during the early forenoon and the late afternoon. During the middle of the day they are in their retreats, devoting that time to sleep and digestion.

Every sportsman knows that it is almost useless to look for game birds between the hours of 10 a.m. and 3 p.m., and it is likely that the owners of the empty crops were gathered in while on their way to their evening feeding grounds. No buds, leaves nor insect remains were found in these stomachs. The contents may be considered as only partly representative of the food taken during early fall, since the list given may be classified as grain, berries and the seeds of wild wood plants.

The eight birds from which the following list was obtained, were collected in Parry Sound District, Ontario, Canada, October 16, 1898. They probably, on account of the locality, belonged to the sub-species *B. u. togata,* the Canadian ruffed grouse, but opportunity was not afforded to decide the matter definitely. Although the above date is nearly a year earlier than that of the two birds previously mentioned, still as it is later in the season the specimens from Washington Co. have been considered first.

The crops of the eight birds contained the following: (1) buds of the birch tree, *Betula lutea or B. papyrifera*; (2) beech nuts, *Fagus Americana Sweet;* (3) leaves of white clover, *Trifolium repens;* (4) leaves of wood sorrel, *Oxalis Acetosella;* (5) leaves of sheep sorrel, *Rumex Acetosella L.;* (6) leaves of red raspberry, *Rubus strigosus Mx.;* (7) leaves of partridgeberry vine, *Mitchella repens;* (8) leaves of the sow-thistle, *Sonchus oleraceus L.;* (9) small mushrooms about three-quarters of an inch in diameter.

In the gizzards were found partly digested remains of most of the above and in addition many highly polished seeds or stones of the pin cherry *Prunus Pennsylvanica,* L., probably from dry berries picked from the ground, or possibly the bare seeds were mistaken for gravel of which the stomachs always contain considerable quantities. No insects, grain or seed were found. The long leaves of the sow-thistle were entire, and had been neatly rolled up or folded before swallowing.

Fourteen birds taken in Barron Co., in the northwestern part of Wisconsin, between November 10th and 20th, 1899, contributed to the list that follows: No insects were found in any of these stomachs, although those of insectivorous birds collected at the same time were full of insect remains.

The crops and stomachs contained seeds of (1) staghorn sumac, *Rhus hirta L.;* (2) white cedar or arbor vitae, *Thuja occidentalis;* (3) red mulberry, *Morus rubra;* (4) some member of the family Liliaceae; (5) hedge buckwheat *Polygonum dumetorum;* (6) partridge berry, *Mitchella repens;* (7) some species of Smilax; (8) cockspur thorn, *Crataegus Crus-Galli;* (9) of some

species of the Cruciferae. They also contained catkins, both the fertile and sterile kinds, of (10) the yellow birch, *Betula lutea;* and of (11) the paper birch *B. papyrifera.* Besides the above, were leaves of (12) the northern wild strawberry *Fragaria Canadensis* Michx; and of (13) round leaved hepatica, *H. triloba.*

There were also numerous very small buds of several unknown species, and seeds of eight species that could not be identified.

Our leading writers on American ornithology have described in a general way the food of the ruffed grouse. Major Bendire, however, in his "Life Histories of N. A. Birds," has treated the subject at greater length than has any of the others, and has given a considerable list of the substances constituting its diet.

If in addition to the lists already given, we avail ourselves of those published by Major Bendire and others, as well as by the results of observations in the field, it is found that the food materials made use of by the ruffed grouse may conveniently be classified as insects, seeds, fruit, nuts, leaves and buds. Of these, insects appear to be eaten only when they are most numerous and most easily obtained, and as with most birds, they also constitute the exclusive food of the very young ones. Grasshoppers, crickets, ants, caterpillars and larvae of many kinds, and beetles are devoured in considerable quantities. *Edema albifrons,* a gregarious caterpillar injurious to oaks and maples, has been found in large numbers in their stomachs, and the writer was informed while in Parry Sound District, Ontario, in 1898, that in birds shot about midsummer, the crops are frequently distended with the tent-caterpillars that infest the wild cherry trees so common in the *burnings* of that locality.

The seeds that enter into the bill of fare of *umbellus* are those of the cultivated grains and grasses and of a number of woodland plants. Members of the violet, lily, knotgrass (*Polygonum*), and cress families have already been mentioned. To these may be added the seeds of blood-root, *Sanguinaria Canadensis;* touch-me-not, *Impatiens sp.;* and species of the genera, *Vicia* and *Lathyrus.* Seeds of several of the coniferous trees are also eaten.

Berries are a staple and favorite article of diet with the ruffed grouse and probably there are few berry-producing plants whose fruit is distasteful to him. Berries and fruit of the following have been found in their stomachs: wild black cherry, *Prunus serotina;* choke cherry, *P. Virginiana;* pin cherry, *P. Pennsylvanica;* staghorn sumac, *Rhus hirta L.;* poison sumac, *R. Vernix;* poison ivy, *R. radicans;* red osier, *Cornus stolonifera;* rough leaved dogwood, *Cornus asperifolia;* red mulberry, *Morus rubra;* partridge berry, *Mitchella repens;* several species of *Similax, Rosa,*

and *Crataegus;* blackberries, raspberries, blue-berries, cranberries, huckleberries, black elder, *Sambucus Canadensis;* red elder, *S. pubens;* hobble bush, *Viburnum alnifolium*; high bush cranberry, *V. Opulus;* nanny berries, *V. Lentago;* maple leaved viburnum, *V. acerifolium;* wintergreen, *Gaultheria procumbens*; service berry, *Amelanchier Canadensis;* and the several species of grapes and wild plums.

Considering thirty species of berries that are eaten by *B. umbellus,* we find that fifteen are red or crimson, ten blue or black, and but five white. This is about the proportion in which the colors occur in nature, the majority of fruits being red, while comparatively a few are white or green. And it is well understood that the predominence of red, not only in fruits, but in ornithophilous or bird-pollinated flowers is due to the selective preference of birds for that color. The seeds of fruits are indigestible and pass through the bird uninjured, frequently at a great distance from the parent plant. Hence those plants that cater most to the color preference of birds, in other words, whose berries are most conspicuous and attractive stand the best chance of having their seeds widely distributed, and are the most numerous in species and individuals. Certainly no more effective means for the transportation and dispersion of seeds could be devised, than that which employs birds for that purpose.

Certain of the berries mentioned, viz.: *Rhus Vernix* (poison sumac), *Rhus radicans* (poison ivy) and *Sambucus Canadensis* (red elder) are poisonous to man, but innocuous to the ruffed grouse and to many other birds. Several cases of poisoning have been reported, however, from eating the flesh of the partridge, and have been attributed to the bird's having eaten largely of these berries or of the leaves of elder or *Kalmia.*

All those nuts whose shells are thin and soft are eaten greedily by the ruffed grouse. Beechnuts, chestnuts and the acorns of the white and chestnut oaks probably complete the list.

Green leaves are eaten at all times when they can be obtained. The following may be mentioned: white clover, red clover, dandelion, chickweed, sow-thistle, peppermint, ground ivy (*Glecoma hederacea*) *Mitchella repens, Kalmia latifolia,* and *K. angustifolia.*

The buds upon which they almost entirely subsist during the wintertime are those of the three birches, the black, white and yellow; also of ironwood, poplar, the willows, wild apple, laurel (*Kalmia*) and fern. The young catkins of birch, and probably also of alder are consumed in large quantities.

Mushrooms are eaten in spring and fall, and lichens occasionally in winter.

If we next consider the food of the ruffed grouse with respect to the different seasons of the year, it will be found that in spring it consists chiefly of the young leaves of plants, of the seeds of many of the early flowers—the seed pods being swallowed entire—and of some insects, especially beetles.

During the summer the leaves of such plants as clover and sorrel still constitute a considerable portion of the food supply, but now insects, especially grasshoppers, crickets and caterpillars are consumed in large numbers and practically all the berries as they appear. The young, in the region considered, appear early in June and follow the mother at once. They are fed at first on small insects, larvae, earthworms, etc., but as they are continually picking curiously at everything they see, they quickly learn to provide for themselves and soon there is little difference between their food and that of the adults.

Seeds, fruit, nuts, buds and catkins constitute the general bill of fare during the fall months. At this time as well as through the summer, the fields of the settlers are visited for grain, and the clearings, roadways, burnings and other open places in the forest, for clover leaves, raspberries, etc., as well as for crickets and grasshoppers.

In winter their stomachs are found to contain very little except the buds of some of the trees already mentioned. They now often frequent the grassy tracts along the water courses and the frozen marsh spots in the woods in search of seeds. Lichens and dried leaves are occasionally eaten. Their flesh at this time is sometimes found to have a bitter or even turpentine taste, due probably to buds of the cedar or firs that have been eaten. Their winter habit of burrowing beneath the snow, is sometimes utilized to procure such food as nuts or leaves. Frozen fruit, like that of the high bush cranberry *(Viburnum Opulus)* is also eaten.

List of Lepidoptera of the County of Milwaukee.

By F. RAUTERBERG.

(Continued from the January Number.)

NOCTUINA.

THYATIRIDAE.

Wis. No.	Amer. No.	
		THYATIRA. *Ochs.*
221	1460	Scripta—*Gosse.* Rare.
		PSEUDOTHYATIRA. *Grt.*
222	1463 a	Expultrix—*Grt.* Common.
		LEPTINA. *Gn.*
223	1472	Ophthalmica—*Gn.* Common.

NOCTUIDAE.

		PANTHEA. *Hbn.*
224	1474	Acronyctoides—*Walk.* Very rare.
		RAPHIA. *Hbn.*
225	1480	Abrupta—*Grt.* Common.
226	1481	Frater—*Grt.* Common.
		CHARADRA—*Walk.*
227	1483	Deridens—*Gn.* Rare.
		ARSILONCHE—*Led.*
228	1491	Albovenosa—*Goeize.* Common.
		ACRONYCTA. *Och.*
229	1494	Occidentalis. *G. & R.* Common.
230	1495	Morula—*G. & R.* Common.
231	1496	Lobeliae—*Gn.* Common.
232	1504	Betulæ—*Riley.* Rare.
233	1505	Innotata—*Gn.* Rare.
234	1517	Lepusculina—*Gn.* Common.
235	1518	Populi—*Riley.* Common.
236	1520	Americana—*Harr.* Common.
237	1521	Dactylina—*Grt.* Common.
238	1533	Brumosa—*Gn.* Rare.
239	1534	Superans—*Gn.* Rare.
240	1540	Hamamelis—*Gn.* Common.
241	1543	Retardata—*Walk.* Common.
242	1549	Lithospila—*Grt.* Rare.
243	1550	Oblinita—*S. & A.* Common.
		HARRISIMEMMA. *Grt.*
244	1558	Trisignata—*Walk.* Very rare.

Wis. No.	Amer. No.	
		MICROCOELIA. *Gn.*
245	1562	Fragilis—*Gn.* Rare.
246	1563	Diptheroides—*Gn.* Common.
		BRYOPHILA. *Tr.*
247	1564	Lepidula—*Grt.* Rare.
248	1567	Teratophora—*H-S.* Rare.
		CHYTONIX. *Grt.*
249	1573	Palliatricula—*Gn.* Rare.
		RHYNCHAGROTIS. *Smith.*
250	1575	Chardinyi—*Bdv.* Very rare.
251	1576	Rufipectus. *Morr.* Common.
252	1579	Cupida—*Grt.* Common.
253	1580	Placida—*Grt.* Common.
254	1582	Alternata—*Grt.* Common.
		ADELPHAGROTIS. *Smith.*
255	1603	Prasina—*Fabr.* Common.
		PLATAGROTIS. *Smith.*
256	1608	Pressa. *Grt.* Rare.
		EUERETAGROTIS. *Smith.*
257	1612	Sigmoides—*Gn.* Common.
258	1613	Perattenta—*Grt.* Rare.
		AGROTIS. *Tr.*
259	1629	Badinodis—*Grt.* Rare.
260	1632	Ypsilon—*Rott.* Very common.
		PERIDROMA. *Hbn.*
261	1655	Occulta—*Linn.* Rare.
262	1659	Saucia—*Hbn.* Very common.
		NOCTUA—*Linn.*
263	1666	Baja—*Fabr.* Rare.
264	1667	Normaniana—*Grt.* Common.
265	1669	Bicarnea—*Gn.* Common.
266	1672	C-Nigrum—*Linn.* Common.
267	1676	Phyllophora—*Grt.* Rare.
268	1681	Fennica—*Tausch.* Common.
269	1682	Plecta—*Linn.* Common.
270	1683	Collaris—*G & R.* Common.
271	1684	Haruspica—*Grt.* Common.
272	1687	Clandestina—*Harr.* Common.
		RHIZAGROTIS. *Smith.*
273	1708	Apicalis—*Grt.* Rare.
		FELTIA—*Walk.*
274	1713	Subgothica—*Steph.* Common.
275	1714	Jaculifera—*Gn.* Common.
276	1715	Herilis—*Grt.* Common.
277	1719	Gladiaria—*Morr.* Common.
278	1720	Venerabilis—*Walk.* Common.
279	1722	Vancouverensis—*Grt.* Common.
280	1724	Volubilis—*Grt.* Common.
281	1725	Annexa—*Tr.* Common.
		POROSAGROTIS. *Smith.*
282	1727	Murænula—*G. & R.* Common.
283	1728	Catenula—*Grt.* Common.
284	1731	Mimallonis—*Grt.* Common.
285	1733	Worthingtoni—*Grt.* Common.
286	1734	Rileyana—*Morr.* Common.

Wis. No.	Amer. No.	
		CARNEADES. *Grt.*
287	1746	Quadridentata—*G. & R.* Common.
288	1749	Brevipennis—*Smith.* Rare.
289	1777	Scandens—*Riley.* Rare.
290	1781	Pitychrous.—*Grt.* Rare.
291	1795	Messoria—*Harr.* Rare.
292	1825 a	Verticalis—*Grt.* Common.
293	1827	Tessellata—*Harr.* Common.
294	1844	Redimicula—*Morr.* Common.
		ANYTUS. *Grt.*
295	1854	Sculptus—*Grt.* Common.
		MAMESTRA. *Ochs.*
296	1876	Discalis—*Grt.* Rare.
297	1878	Nimbosa—*Gn.* Rare.
298	1879	Imbrifera—*Gn.* Rare.
299	1886	Lustralis—*Grt.* Common.
300	1903	Trifolii—*Rott.* Rare.
301	1905	Rosea—*Harv.* Rare.
302	1908	Picta—*Harr.* Common.
303	1910	Cristifera—*Walk.* Common.
304	1912	Latex—*Gn.* Rare.
305	1924	Lilacina—*Harv.* Rare.
306	1929	Obscura—*Smith.* Common.
307	1931	Renigera—*Steph.* Common.
308	1934	Circumcincta—*Smith.* Rare.
309	1935	Olivacea—*Morr.* Common.
310	1944	Lorea—*Gn.* Common.
311	1950	Vicina—*Grt.* Rare.
		HADENA. *Schrank.*
312	1979	Niveivenosa—*Grt.* Rare.
313	1980	Stipata—*Morr.* Rare.
314	1981	Passer—*Gn.* Common.
315	1985 [2]	*Suffusca—Morr.* Rare.
316	1990	Finitima—*Gn.* Rare.
317	1994	Sputatrix—*Grt.* Common.
318	1998	Impulsa—*Gn.* Common.
319	1999	Devastatrix—*Brace.* Rare.
320	2002	Arctica—*Bdv.* Very common.
321	2006	Perpensa—*Grt.* Common.
322	2007	Cuculliformis—*Grt.* Common.
323	2009	Verbascoides.—*Gn.* Common.
324	2011	Cariosa—*Gn.* Rare.
325	2014	Vulgaris—*G. & R.* Rare.
326	2020	Lignicolor—*Gn.* Common.
327	2036	Modica—*Gn.* Common.
328	2044	Mactata—*Grt.* Rare.
329	2060	Vulvivaga—*Morr.* Common.
330	2060 a	Fractilinea—*Grt.* Rare.
		TRACHEA. *Hrn.*
331	2075	Delicata—*Grt.* Common.
		OLIGIA. *Hbn.*
332	2083	Versicolor—*Grt.* Very rare.
		PERIGEA. *Gn.*
333	2100	Fasciata—*Hy. Edw.* Rare.
		DIPTERYGIA. *Steph.*
334	2110	Scabriuscula—*Linn.* Rare.

Wis. No.	Amer. No.	
		HYPPA. *Dup.*
335	2111	Xylinoides—*Gn.* Common.
		HOMOHADENA. *Grt.*
336	2127	Badistriga—*Grt.* Rare.
		MACRONOCTUA. *Grt.*
337	2162	Onusta—*Grt.* Common.
		POLIA. *Tr.*
338	2181	Medialis—*Grt.* Rare.
		ACTINOTIA. *Hbn.* Very rare.
339	2184	Ramosula—*Gn.*
		LAPHYGMA. *Gn.*
340	2187 a	Obscura—*Riley.* Common.
		PRODENIA. *Gn.*
341	2189	Lineatella—*Harv.* Common.
342	2190	Flavimedia--*Harv.* Rare.
343	2194	Ornithogalli—*Gn.* Rare.
344	2195	Signifera—*Walk.* Common.
		TRIGONOPHORA. *Hbn.*
345	2198	Periculosa—*Gn.* Common.
		BROTOLOMIA. *Led.*
346	2199	Iris—*Gn.* Common.
		NEPHELODES. *Gn.*
347	2201	Minians—*Gn.* Common.
348	2201 a	Violans—*Gn.* Common.
		TRICHOLITA. *Grt.*
349	2202	Signata--*Walk.* Rare.
		HELOTROPHA. *Leb.*
350	2206	Reniformis--*Grt.* Rare.
		HYDROECIA. *Gn.*
351	2209	Velata--*Walk.* Rare.
352	2209 [1]	*Sera*—*G. & R.* Common.
353	2211	Nictitans—*Bkh.* Rare.
354	2211 a	Erythrostigma—*Harv.* Rare.
355	2220	Cataphracta—*Grt.* Common.
356	2221	Purpurifascia—*G. & R.* Rare.
357	2222	Rutila—*Gn.* Rare.
358	2224	Speciosissima—*G. & R.* Rare.
359	2225	Marginidens—*Gn.* Rare.
360	2229	Nitela—*Gn.* Common.
361	2229 a	Nebris—*Gn.* Common.
		ACHATODES. *Gn.*
362	2235	Zeæ—*Harr.* Common.
		ARZAMA. *Walk.*
363	2238	Obliquata—*G. & R.* Rare.
364	2240	Vulnifica—*Grt.* Very rare.
365	2241	Diffusa—*Grt.* Rare.
		NONAGRIA. *Ochs.*
366	2242	Permagna—*Grt.* Common.
367	2249	Subcarnea—*Kell.* Common.
		LEUCANIA. *Ochs.*
368	2258	Pallens—*Linn.* Common.
369	2264	Rubripennis—*G. & R.* Very rare.
370	2266	Albilinea—*Hbn.* Common.
371	2271	Phragmatidicola—*Gn.* Rare.
372	2274	Adonea—*Grt.* Common.
373	2275	Commoides—*Gn.* Common.

Wis. No.	Amer. No.	
374	2280	Unipuncta--*Harv.* Common.
375	2283	Pseudargyria—*Gn.* Common.
		AMOLITA. *Grt.*
376	2301	Fessa. *Grt.* Common.
		NOLOPHANA. *Grt.*
377	2303	Malana—*Fitch.* Rare.
		CRAMBODES. *Gn.*
378	2310	Talidiformis—*Gn.* Common.
		CARADRINA. *Tr.*
379	2313	Miranda—*Grt.* Common.
		PYROPHILA. *Hbn.*
380	2327	Pyramidoides—*Gn.* Very common.
		ORTHODES. *Gn.*
381	2329	Infirma—*Gn.* Rare.
382	2330	Cynica—*Gn.* Common.
		TAENIOCAMPA. *Gn.*
383	2340	Peredia—*Grt.* Common.
384	2364	Subterminata—*Smith.* Common.
385	2369	Vegeta—*Morr.* Rare.
386	2372[2]	Planalis—*Grt.* Very rare.
		STRETCHIA. *Hy. Edw.*
387	2375	Plusiiformis—*Hy. Edw.* Rare.
		PSEUDOGLÆA. *Grt.*
388	2392	Tædata—*Grt.* Rare.
		TRILEUCA. *Grt.*
389	2401	Buxea—*Grt.* Very rare.
		CALYMNIA. *Hbn.*
390	2405	Orina—*Gn.* Common.
		COSMIA—*Ochs.*
391	2411	Paleacea—*Esp.* Common.
		PARASTICHTIS. *Hbn.*
392	2414	Discivaria—*Walk.* Rare.
393	2414[1]	*Gentilis*—*Grt.* Rare.
		IPIMORPHA. *Hbn.*
394	2415	Pleonectusa—*Grt.* Common.
		ANCHOCELIS. *Gn.*
395	2418	Digitalis—*Grt.* Rare.
		PYRRHIA. *Hbn.*
396	2419	Umbra—*Hbn.* Common.
397	2419 a	Angulata—*Grt.* Common.
		ORTHOSIA. *Ochs.*
398	2425	Ferruginoides—*Gn.* Common.
399	2434	Helva—*Grt.* Common.
400	2435	Lutosa—*Andr.* Common.
		HOMOGLÆA. *Morr.*
401	2442	Hircina—*Morr.* Rare.
		GLÆA. *Hbn.*
402	2445	Inulta--*Grt.* Common.
		XANTHIA. *Tr.*
403	2456	Flavago—*Fabr.* Common.
		JODIA. *Hbn.*
404	2459	Rufago—*Hbn.* Common.
		CIRROEDIA. *Gn.*
405	2460	Pampina--*Gn.* Rare.
		SCOLIOPTERYX. *Germ.*
406	2462	Libatrix—*Linn.* Common.

Wis. No.	Amer. No.	
		SCOPELOSOMA. *Curtis.*
407	2463	Græfiana—*Grt.* Very common.
408	2470	Morrisoni—*Grt.* Common.
409	2471	Devia—*Grt.* Common.
		XYLINA. *Ochs.*
410	2479	Bethunei—*G. & R.* Rare.
411	2483	Fagina—*Morr.* Rare.
412	2486	Antennata—*Walk.* Rare.
413	2487	Laticinerea—*Grt.* Rare.
414	2488	Grotei—*Riley.* Rare.
		XYLOMIGES. *Gn.*
415	2516	Crucialis—*Harv.* Rare.
		LITHOMIA. *Hbn.*
416	2524	Germana—*Morr.* Rare.
		CALOCAMPA. *Steph.*
417	2527	Cineritia—*Grt.* Rare.
		CUCULLIA. *Schrank.*
418	2532	Convexipennis—*Grt.* Rare.
419	2536	Asteroides—*Gn.* Common.
		ALETIA. *Hbn.*
420	2563	Argillacea—*Hbn.* Common.
		OGDOCONTA. *Butl.*
421	2570	Cinereola. *Gn.* Rare.
		ABROSTOLA. *Ochs.*
422	2574	Urentis—*Gn.* Rare.
		PLUSIA. *Fabr.*
423	2578	Aerea. *Hbn.* Common.
424	2579	Aereoides—*Grt.* Rare.
425	2580	Balluca—*Geyer.* Common.
426	2583	Contexta—*Grt.* Common.
427	2584	Putnami—*Grt.* Rare.
428	2587	Thyatiroides. *Gn.* Rare.
429	2590	Biloba—*Steph.* Rare.
430	2591	Verruca—*Farr.* Rare.
431	2592	Dyaus—*Grt.* Common.
432	2594	Precationis—*Gn.* Common.
433	2600	Ou—*Gn.* Rare.
434	2603	Brassicæ—*Riley.* Common.
435	2604	Oxygramma—*Geyer.* Rare.
436	2608	Mortuorum—*Gn.* Very rare.
437	2611	Viridisignata—*Grt.* Rare.
438	2616	Ampla—*Walk.* Very rare.
439	2617	Simplex—*Gn.* Very common.
		HELIOTHIS—*Hbn.*
440	2691	Rhexia—*S. & A.* Rare.
441	2694	Armiger—*Hbn.* Very common.
442	2694 a	Umbrosus. *Grt.* Very common.
443	2695	Dipsaceus—*Linn.* Rare.
444	2695 a	Maritima—*Grasl.* Very rare.
445	2696	Scutosus—*Fabr.* Rare.
		RHODODIPSA. *Grt.*
446	2706	Miniana—*Grt.* Rare.
		SCHINIA. *Hbn.*
447	2717	Trifascia—*Hbn.* Common.
448	2718	Gracilenta—*Hbn.* Rare.

Wis. No.	Amer. No.	
449	2724	Nundina—*Dru.* Rare.
450	2734	Tertia—*Grt.* Common.
451	2738	Gloriosa—*Strk.* Very rare.
452	2751	Rivulosa--*Gn.* Common.
453	2752	Digitalis—*Smith.* Rare.
454	2755 a	Atrites—*Grt.* Very rare.
		ACONTIA. *Ochs.*
455	2840	Erastrioides—*Gn.* Common.
456	2841	Candefacta—*Hbn.* Common.
		CHAMYRIS. *Gn.*
457	2852	Cerintha—*Tr.* Rare.
458	2852 [1]var.	Cerintha—*Tr.* Rare.
		XANTHOPTERA. *Gn.*
459	2863	Nigrofimbria—*Gn.* Rare.
		METATHORASA. *Moore.*
460	2889	Monetifera—*Gn.* Rare.
		EUHERRICHIA. *Grt.*
461	2890	Mollissima—*Gn.* Rare.
		ERASTRIA. *Ochs.*
462	2899	Albidula—*Gn.* Common.
463	2902	Concinnimacula—*Gn.* Very rare.
464	2903	Synochitis—*G. & R.* Very rare.
465	2906	Muscosula—*Gn.* Common.
466	2911	Apicosa—*Harv.* Common.
467	2912	Carneola—*Gn.* Very common.
		GALGULA. *Gn.*
468	2925	Hepara—*Grt.* Common
469	2926	Subpartita—*Gn.* Rare.
		HYBLÆA. *Fabr.*
470	2938	Puera—*Fabr.* Rare.
471	2938 var.	Puera—*Fabr.* Common.
		DRASTERIA. *Hbn.*
472	2939	Erechtea—*Cram.* Common
473	2939 a	Agricola—*G. & R.* Common.
474	2940	Erichto—*Gn.* Common.
		EUCLIDIA—*Hbn.*
475	2946	Cuspidea—*Hbn.* Common.
		SYNEDA—*Gn.*
476	2969	Graphica--*Hbn.* Common.
477	2981	Nubicola—*Behr.* Rare.
		CIRRHOBOLINA. *Grt.*
478	2992	Mexicana—*Behr.* Rare.
		MELIPOTIS. *Hbn.*
479	2998	Nigrescens—*G. & R.* Rare.
480	3001	Limbolaris--*Geyer.* Very rare.
		STICTOPTERA. *Gn.*
481	3007	Divaricata--*Grt.* Rare.
		CATOCALA. *Schrank.*
482	3008	Nubilis—*Hbn.* Common.
483	3011	Amica—*Hbn.* Rare.
484	3011 a	Lineella--*Grt.* Common.
485	3015	Grynea—*Cram.* Common.
486	3024	Blandula—*Hulst.* Rare.
487	3027	Nuptialis--*Walk.* Common.
488	3035	Cerogama—*Gn.* Common.
489	3037 a	Celia--*Hy. Edw.* Rare.

Wis. No.	Amer. No.	
490	3039 a	Uxor—*Gn.* Common.
491	3041	Marmorata—*Edw.* Common.
492	3042	Parta—*Gn.* Common.
493	3042 a	Petulans—*Hulst.* Common.
494	3043	Unijuga—*Walk.* Common.
495	3043 a	Meskei—*Grt.* Rare.
496	3048	Mariana—*Hy. Edw.* Rare.
497	3049	Briseis—*Edw.* Common.
498	3053	Concumbens—*Walk.* Common.
499	3054	Cara—*Gn.* Common.
500	3054 a	Carissima—*Hulst.* Common.
501	3058	Relicta—*Walk.* Common.
502	3058 a	Phrynia—*Hy. Edw.* Rare.
503	3058 b	Bianca—*Hy. Edw.* Rare.
504	3063	Serena—*Edw.* Common.
505	3066	Habilis—*Grt.* Common.
506	3068	Paleogama—*Gn.* Rare.
507	3083	Insolabalis—*Gn.* Rare.
508	3085	Obscura—*Strk.* Common.
509	3085 a	Residua—*Grt.* Rare.
		PARALLELIA *Hbn.*
510	3101	Bistriaris—*Hbn.* Rare.
		PANAPODA. *Gn.*
511	3105 b	Roseicosta—*Gn.* Rare.
		POAPHILA. *Gn.*
512	3116	Quadrifilaris—*Hbn.* Rare.
		EREBUS. *Latr.*
513	3150	Odora—*Linn.* Very rare.
		THYSANIA. *Dalm.*
514	3151	Zenobia—*Cram.* Very rare.
		HOMOPTERA. *Bdv.*
515	3158	Edusa—*Dru.* Very Common.
516	3158 a	Saundersii—*Beth.* Very common.
517	3158 b	Lunata—*Dru.* Very common.
		HOMOPYRALIS. *Grt.*
518	3197	Tactus—*Grt.* Rare.
		SPARGALOMA. *Grt.*
519	3204	Sexpunctata—*Grt.* Rare.
		PSEUDAGLOSSA. *Grt.*
520	3211	Lubricalis—*Geyer.* Rare.
521	3214	Borealis—*Smith.* Common.
		EPIZEUXIS. *Hbn.*
522	3215	Aemula—*Hbn.* Common.
523	3216	Americalis—*Gn.* Common.
		LITOGNATHA. *Grt.*
524	3225	Nubilifascia—*Grt.* Common.
		HERMINIA. *Latr.*
525	3228	Morbidalis—*Gn.* Common.
526	3229	Petrealis—*Grt.* Common.
		ZANCLOGNATHA. *Led.*
527	3238	Ochreipennis—*Grt.* Common.
		PHILOMETRA. *Grt.*
528	3246	Longilabris—*Grt.* Common.
529	3247	Eumelusalis—*Walk.* Common.
530	3247 [1]	*Serraticornis*—*Grt.* Common.

Wis. No.	Amer. No.	
		RIVULA. *Gn.*
531	3250	Propinqualis—*Gn.* Common.
		PALTHIS. *Hbn.*
532	3252	Angulalis—*Hbn.* Common.
		HETEROGRAMMA. *Gn.*
533	3254	Rurigena—*Grt.* Common.
		RENIA. *Gn.*
534	3266	Flavipunctalis—*Geyer.* Common.
		BLEPTINA. *Gn.*
535	3273	Caradrinalis—*Gn.* Common.
		LOMANALTES. *Grt.*
536	3277	Laetulus—*Grt.* Common.
		BOMOLOCHA. *Led.*
537	3278	Baltimoralis—*Gn.* Rare.
538	3279	Scutellaris—*Grt.* Very rare.
539	3281	Bijugalis—*Walk.* Rare.
540	3283	Abalinealis—*Walk.* Rare.
541	3291	Sordidula—*Grt.* Rare.
542	3294	Perangulalis—*Harv.* Common.
		HYPENA. *Fabr.*
543	3297	Humuli—*Harr.* Rare.
544	3300	Scabra—*Fabr.* Very common.
		TORTRICODES. *Gn.*
545	3313	Bifidalis—*Grt.* Common.

GEOMETRINA.

GEOMETRIDAE.

ENNOMINÆ.

		PROCHOERODES. *Grt.*
546	3325	Clemataria—*S. & A.* Common.
547	3326	Transversata—*Dru.* Common.
		TETRACIS. *Gn.*
548	3349	Lorata—*Grt.* Common.
549	3350	Crocallata—*Gn.* Common.
		METANEMA. *Gn.*
550	3352	Quercivoraria—*Gn.* Common.
551	3355	Inatomaria—*Gn.* Common.
552	3356	Carnaria—*Pack.* Common.
		CABERODES. *Gn.*
553	3365	Confusaria—*Hbn.* Common.
554	3365 a	Metrocamparia—*Gn.* Common.
		ENNOMOS. *Tr.*
555	3373	Magnarius—*Gn.* Rare.
556	3374	Subsignarius—*Hbn.*
		ENDROPIA. *Gn.*
557	3382	Serrata—*Dru.* Rare.
558	3386	Bilinearia—*Pack.* Rare.
559	3388	Armataria—*H-S.* Rare.
560	3391	Madusaria—*Walk.* Common.
561	3394	Pectinaria—*Schif.* Rare.
562	3399	Hypochraria—*H-S.* Rare.
563	3400	Duaria—*Gn.* Common.

Wis. No.	Amer. No.	
		THERINA. *Hbn.*
564	3410	Pellucidaria—*G. & R.* Common.
		METROCAMPA. *Latr.*
565	3415	Margaritata—*L.* Common.
566	3415 a	Perlata—*Gn.*
		ANGERONA. *Dup.*
567	3429	Crocataria—*Fabr.* Very common.
		MICROGONIA. *H-S.*
568	3431	Limbaria—*Haw.* Common.
		PLAGODIS. *Hbn.*
569	3432	Serinaria—*H-S.* Very rare.
570	3433	Keutzingaria—*Pack.* Very rare.
571	3437	Alcoolaria—*Gn.* Common.
		PROBOLE. *H-S.*
572	3438	Amicaria—*H-S.* Common.
573	3438 [1]	*Nyssaria*—*Gn.* Common.
		APLODES. *Gn.*
574	3451	Mimosaria—*Gn.* Rare.
		NEMORIA. *Hbn.*
575	3470	Subcroceata—*Walk.* Common.
576	3471	Gratata—*Pack.* Rare.
577	3472	Pistaceata—*Gn.* Rare.
		DYSPTERIS. *H-S.*
578	3485	Abortivaria—*H-S.* Very rare.
		EPHYRA. *Dup.*
579	3487	Pendulinearia—*Gn.* Common.
		ACIDALIA. *Tr.*
580	3505	Insularia—*Gn.* Common.
581	3509	Nivosata—*Gn.* Common.
582	3512	Inductata—*Gn.* Common.
583	3522	Quadrilineata—*Pack.* Common.
584	3524	Ennucleata—*Gn.* Common.
585	3524 (var)	Ennucleata—*Gn.* Rare.
586	3562 [1]	Umbilicuta—*Gn.* Rare.
		ASTHENA. *Hbn.*
587	3563	Lucata—*Gn.* Rare.
588	3564	Albogilvaria—*Morr.* Very common.
		CALLEDAPTERYX. *Grt.*
589	3584	Dryopterata—*Grt.* Very rare.
		CABERINAE.
		STEGANIA. *Dup.*
590	3587	Pustularia—*Gn.* Rare.
		GUENERIA. *Pack.*
591	3589	Basiata—*Walk.* Common.
		DEILINIA. *Hbn.*
592	3590	Variolaria—*Gn.* Common.
593	3594 [1]	*Septemfluaria*—*Grt.* Common.
		CORYCIA. *Dup.*
594	3596	Vestaliata—*Gn.* Common.
		SEMIOTHISA. *Hbn.*
595	3603	Præatomata—*Harv.* Rare.
596	3606	Multilineata—*Pack.* Rare.
597	3614	Ocellinata—*Gn.* Common.
598	3614 (var)	Ocellinata—*Gn.* Rare.
599	3618	Respersata—*Hulst.* Rare.

Wis. No.	Amer. No.	
		PHASIANE. *Dup.*
600	3642	Curvata—*Grt.* Rare.
601	3643	Mellistrigata—*Grt.* Common.
602	3656 [1]	Evagaria—*Hulst.* Common.
		MARMOPTERYX. *Pack.*
603	3661	Formosata—*Strk.* Common.
		THAMNONOMA. *Led.*
604	3670	Subcessaria—*Walk.* Common.
605	3674½	Wagaria—*Hulst.* Rare.
		EUFITCHIA. *Pack.*
606	3679	Ribearia—*Fabr.* Common.
		LOZOGRAMMA. *Steph.*
607	3680	Disconventa—*Walk.* Common.
608	3684	Defluata—*Walk.* Rare.
		ORTHOFIDONIA. *Pack.*
609	3692	Exornata—*Walk.* Rare.
		LYTHRIA. *Hbn.*
610	3709	Chamæchrysaria—*Grt.* Very common.
		CATERVA. *Grt.*
611	3712	Catenaria—*Cram.* Common.
		ASPILATES. *Tr.*
612	3737	Desperaria—*Hulst.* Very rare.

BOARMINAE.

		CLEORA. *Steph.*
613	3748	Semiclusaria—*Walk.* Common.
		BOARMIA. *Tr.*
614	3769	Pampinaria—*Gn.* Common.
615	3771	Larvaria—*Gn.* Rare.
616	3772	Humaria—*Gn.* Rare.
617	3776	Crepuscularia—*Tr.* Common.
		TEPHROSIA. *Bdv.*
618	3795	Canadaria—*Gn.* Common.
619	3799	Anticaria—*Walk.* Rare.
		PARAPHIA. *Gn.*
620	3806	Subatomaria—*Grt.* Rare.
		BISTON. *Leach.*
621	3810	Ursarius—*Walk.* Rare.
		EUBYIA. *Hbn.*
622	3812	Cognataria—*Gn.* Common.
623	3814	Quernaria—*S. & A.* Rare.
624	3815	Mexicanaria—*Grt.* Rare.
		HYBERNIA. *Latr.*
625	3817	Tiliaria—*Harr.* Very common.
		PALEACRITA. *Riley.*
626	3823	Vernata—*Pack.* Very common.
		ANISOPTERYX. *Steph.*
627	3824	Pometaria—*Harr.* Common.
		HETEROPHLEPS. *H—S.*
628	3829	Triguttata—*H—S.* Common.
629	3830	Harveiata—*Pack.* Rare.
		BAPTRIA. *Hbn.*
630	3835	Albovittata—*Gn.* Common.
		LOBOPHORA. *Curt.*
631	3842	Montanata—*Pack.* Rare.

Wis. No.	Amer. No.	
		TRIPHOSA. *Steph.*
632	3846	Dubitata—*Linn.* Common.
		CALOCALPE. *Hbn.*
633	3854	Undulata—*Linn.* Rare.
		PHIBALAPTERYX. *Steph.*
634	3855	Latirupta—*Walk.* Common.
635	3856	Intestinata—*Gn.* Common.
		PETROPHORA. *Hbn.*
636	3859	Testata—*L.* Very rare.
637	3861	Prunata—*L.* Very rare.
638	3865	Diversilineata—*Hbn.* Common.
639	3871	Hersiliata—*Gn.* Rare.
		RHEUMAPTERA. *Hbn.*
640	3892	Ruficillata—*Gn.* Common.
641	3897	Lacustrata—*Gn.* Common.
642	3899	Sociata—*Bork.* Common.
643	3902	Hastata—*L.* Rare.
		OCHYRIA. *Hbn.*
644	3909	Ferrugata—*Linn.* Common.
645	3911	Designata—*Hbn.* Common.
		HYDRIOMENE. *Hbn.*
646	3923	Trifasciata—*Bork.* Rare.
		EPIRRITA. *Hbn.*
647	3929	Inclinata—*Walk.* Rare.
		PLEMYRIA. *Hbn.*
648	3934	Fluviata—*Hbn.* Very common.
		GLAUCOPTERYX. *Hbn.*
649	3941	Aurata—*Grt.* Rare.
650	3943	Implicata—*Gn.* Rare.
		EUPITHECIA. *Curt.*
651	3959	Implicata—*Walk.* Very rare.
652	3961	Absynthiata—*L.* Common.
		NEOTERPES.
653	3969[3]	Edwarssetta—*Pack.* Very rare.

PYRALIDINA.

PYRAUSTIDAE.

		MARGARONIA. *Hbn.*
654	3972	Quadristigmalis—*Gn.* Common.
		EPICORSIA. *Hbn.*
655	3977	Mellinalis—*Hbn.* Rare.
		DIATHRAUSTA. *Led.*
656	3985	Pisusalis—*Walk.* Rare.
		DESMIA. *Westw.*
657	3986	Funeralis—*Hbn.* Common.
658	3986[1]	*Maculalis—Westw.* Rare.
		PILOCROCIS. *Led.*
659	3987	Ramentalis—*Led.* Rare.
		CINDAPHIA. *Led.*
660	3990	Bicoloralis—*Gn.* Common.
		PHLYCTÆNIA. *Hbn.*
661	3992	Acutella—*Walk.* Common.
662	3993	Ferrugalis—*Hbn.* Common.

Wis. No.	Amer. No.	
663	3995	Terrealis—*Tr.* Common.
664	3996	Extricalis—*Gn.* Common.
665	3997	Tertialis—*Gn.* Common.
		NOMOPHILA. *Hbn.*
666	3998	Noctuella—*S. V.* Common.
		PYRAUSTA. *Schrank.*
667	4000	Octomaculata—*Linn.* Common.
668	4004	Orphisalis—*Walk.* Common.
669	4010	Signatalis—*Walk.* Common.
670	4036	Unifascialis—*Pack.* Common.
671	4039	Tatalis—*Grt.* Rare.
672	4040	Fumalis—*Gn.* Rare.
673	4042	Fodinalis—*Led.* Rare.
674	4042[1]	*Socialis*—*Grt.* Common.
675	4043	Penitalis—*Grt.* Common.
676	4048	Illibalis—*Hbn.* Rare.
677	4053	Futilalis—*Led.* Very rare.
678	4055	Detritalis—*Gn.* Very rare.
679	4067	Thestialis—*Walk.* Common.
680	4069	Ranalis—*Gn.* Common.
681	4071	Pertextalis—*Led.* Common.
682	4073	Theseusalis—*Walk.* Rare.
		MECYNA. *Gn.*
683	4081	Reversalis—*Gn.* Rare.
		PANTOGRAPHA. *Led.*
684	4082	Limata—*G. & R.* Rare.
		CROCIDOPHORA. *Led.*
685	4088	Serratissimalis—*Zell.* Common.
686	4089	Tuberculalis—*Led.* Rare.
		LOXOSTEGE. *Hbn.*
687	4095	Chortalis—*Grt.* Rare.
688	4099	Coloradensis—*G. & R.* Rare.
689	4104	Obliteralis—*Walk.* Common.
690	4111	Sticticalis—*Linn.* Common.
		SCOPARIA. *Haw.*
691	4127	Centuriella—*S. V.* Common.
692	4128	Libella—*Grt.* Common.
		EVERGESTIS. *Hbn.*
693	4132	Straminalis—*Zell.* Common.
694	4132 (var)	*Stramentalis*—*Hbn.*
		CATACLYSTA. *Hbn.* Common.
695	4155	Fulicalis—*Clem.* Very common.
696	4156	Bifascialis—*Rob.* Very common.
		HYDROCAMPA. *Latr.*
697	4167	Obliteralis—*Walk.* Common.
698	4169	Obscuralis—*Grt.* Common.
699	4170	Albalis—*Rob.* Common.
700	4171	Allionealis—*Walk.* Common.
701	4172	Gyralis—*Hulst.* Rare.
702	4174	Icciusalis—*Walk.* Common.
703	4175	Ekthlipsis—*Grt.* Common.
		SCHOENOBIUS. *Dup.*
704	4178	Unipunctellus—*Rob.* Rare.
705	4180	Melinellus—*Clem.* Rare.
706	4180 b	Albicostellus—*Fern.* Common.

Wis. No.	Amer. No.	
707	4181	Clemensellus—*Rob.* Common.
708	4182	Forficellus—*Thunb.* Common.
		NYMPHÆELLA. *Grt.*
709	4185	Maculalis—*Clem.* Rare.

PYRALIDIDAE.

PYRALIDINAE.

		PYRALIS. *Linn.*
710	4202	Farinalis—*Linn.* Very common.
711	4203	Costalis—*Fabr.* Common.
712	4203 [1]	*Fimbrialis—S. V.* Common.
713	4205	Olinalis--*Gn.* Common.
714	4206	Himonialis—*Zell.* Common.
715	4210	Sodalis—*Walk.* Rare.

EPIPASCHIINAE.

		EPIPASCHIA. *Clem.*
716	4216	Superatalis—*Clem.* Rare.
		BENTA. *Walk.*
717	4227	Asperatella—*Clem.* Rare.

PHYCITIDAE.

PHYCITINAE.

		ACROBASIS. *Zell.*
718	4263	Rubrifasciella—*Pack.* Common.
719	4271	Hebescella—*Hulst.* Rare.
		MEROPTERA. *Grt.*
720	4317	Pravella—*Grt.* Common.
		SALEBRIA. *Zell.*
721	4329	Lævigaetella—*Hulst.* Common.
		LAODAMIA. *Rag.*
722	4338	Fusca--*Haw.* Common.
		LÆTILIA. *Rag.*
723	4388	Coccidivora—*Comst.* Rare.
		HONORA. *Grt.*
724	4392 a	Undulatella—*Clem.* Rare.
		HOMOEOSOMA. *Curt.*
725	4408	Electellum--*Hulst.* Rare.

PEORIINAE.

		ALTOONA. *Hulst.*
726	4437	Tetradella—*Zell.* Rare.
		PEORIA. *Rag.*
727	4451	HÆMATICA. *Zell.* Common.

CRAMBIDAE.

		ARGYRIA. *Hbn.*
728	4476	Nivalis—*Dru.* Common.
729	4478	Auratella--*Clem.* Common.
		DIATRÆA. *Guild.*
730	4481	Saccharalis—*Farr.* Rare.

Wis. No.	Amer. No.	
		CRAMBUS. *Fabr.*
731	4490	Hastiferellus—*Walk.* Common.
732	4494	Hamellus—*Thunb.* Common.
733	4497	Leachellus—*Zinck.* Common.
734	4498	Unistriatellus—*Pack.* Common.
735	4499	Prætectellus—*Zinck.* Rare.
736	4505	Laqueatellus—*Clem.* Common.
737	4507	Agitatellus—*Clem.* Very common.
738	4507 a	Alboclavellus—*Zell.* Very common.
739	4511	Albellus—*Clem.* Very common.
740	4513	Girardellus—*Clem.* Common.
741	4514	Innotatellus—*Walk.* Common.
742	4523	Ruricolellus—*Zell.* Very common.
743	4524	Vulgivagellus—*Clem.* Very common.
744	4533	Caliginosellus—*Clem.* Rare.
745	4536	Inornatellus—*Walk.* Rare.
746	4537	Mutabilis—*Clem.* Very common.
		THAUMATOPSIS. *Morr.*
747	4540	Pexellus—*Zell.* Common.

PTEROPHORIDAE.

		PLATYPTILIA—*Hbn.*
748	4556	Fragilis—*Wlsm.* Common.
		ALUCITA. *Linn.*
749	4578	Homodactyla—*Walk.* Common.
750	4581	Paleacea—*Zell.* Common.
		OXYPTILUS—*Zell.*
751	4594	Periscelidactylus—*Fitch.* Common.
752	4597	Tenuidactylus—*Fitch.* Rare.

TORTRICINA.

TORTRICIDAE.

		TERAS. *Tr.*
753	4616	Hastiana—*Linn.* Common.
754	4619	Logiana—*Schif.* Common.
		CACOECIA—*Hbn.*
755	4633	Rosaceana—*Harr.* Common.
756	4634	Purpurana—*Clem.* Common.
757	4634 a	Lintneriana—*Grt.* Common.
758	4642	Argyrospila—*Walk.* Rare.
759	4644	Fervidana—*Clem.* Common.
		LOXOTAENIA—*Steph.*
760	4650	Virescana—*Clem.* Common.
761	4651	Clemensiana—*Fern.* Common.
		PTYCHOLOMA. *Steph.*
762	4653	Melaleucana—*Walk.* Common.
		TORTRIX—*Linn.*
763	4684	Fucana—*Wlsm.* Common.
		CENOPIS. *Zell.*
764	4705	Reticulatana—*Clem.* Common.
765	4706	Pettitana—*Rob.* Rare.
		DICHELIA. *Gn.*
766	4713	Sulfureana—*Clem.* Rare.

Wis. No.	Amer. No.	
		AMPHISA. *Curt.*
767	4717	Discopunctana—*Clem.* Very rare.
		GRAPHOLITHIDAE.
		EXARTEMA. *Clem.*
768	4788	Permundana—*Clem.* Common.
769	4794	Fasciatana—*Clem*, Common.
770	4796	Exoleta—*Zell.* Common.
		PENTHINA. *Tr.*
771	4804	Nimbatana—*Clem.* Common.
772	4807	Dimidiana—*Schif.* Common.
773	4821	Chionosema—*Zell.* Common.
		SERICORIS. *Tr.*
774	4828	Coruscana—*Clem.* Very common.
775	4841	Bipartitana—*Clem.* Common.
		PÆDISCA. *Tr.*
776	4909	Scudderiana—*Clem.* Common.
777	4912	Otiosana—*Clem.* Rare.
778	4914	Dorsisignatana—*Clem.* Common.
		SEMASIA. *Steph.*
779	4919	Formosana—*Clem.* Rare.
		PROTEOPTERYX. *Wlsm.*
780	4958	Deludana—*Clem.* Common.
781	4959	Spoliana—*Clem.* Very common.
		PROTEOTERAS. *Riley.*
782	4962	Æsculana—*Riley.* Common.
		CARPOCAPSA. *Tr.*
783	5023	Pomonella—*Linn.* Common.
784	5026[1]	Aurichalceana. Common.
		HYPONOMEUTIDAE.
		HYPONOMEUTA. *Zell.*
785	5155	Longimaculella—*Cham.* Common.
		ARGYRESTHIA. *Hbn.*
786	5161	Andereggiella—*F. & R.* Rare.
		GELECHIIDAE.
		MACHIMIA. *Clem.*
787	5225	Tentoriferrella—*Clem.* Rare.

NATURAL HISTORY NOTES.

Bibliographical Notes on Wisconsin Forests. BY E. BRUNCKEN. The following does not lay claims to entire completeness, but as far as it goes may be of use to students. The note is made from the botanical rather than the economic standpoint, although several of the publications entered contain much information regarding the economic conditions also. The scantiness of the list is evidence of the fact that very little is really known in an accurate manner about the biological relations of the forests of the state.

BRUNCKEN, ERNEST.

Notes on the Distribution of Some Trees and Shrubs in the Vicinity of Milwaukee.

Bulletin of Wisconsin Natural History Society, January, 1900, pp. 31-42.

BRUNCKEN, ERNEST.

Some Remarkable Trees in the Vicinity of Milwaukee.

Bulletin of Wisconsin Natural History Society, January, 1900, pp. 43-45.

BRUNCKEN, ERNEST.

The Trees of Wisconsin. Milwaukee Sentinel, Special Carnival Edition, April 21, 1898. (Biological and Historical.)

CHAMBERLAIN, T. C.

Native Vegetation. Chapter III., Geology of Eastern Wisconsin. Report of Geological Survey, Vol. II. (Attempts a classification according to zones of distribution.)

With map in acompanying atlas.

HOY, B. R.

Notes on the Woods of Wisconsin.

Transactions Wisconsin State Agricultural Society. Vol. II., pp. 419 *et sequ.* 1852.

LAPHAM, I. A.

The Forest Trees of Wisconsin.

Transactions of Wisconsin State Agricultural Society. Vol. IV., pp. 195 *et sequ.*

LAPHAM, CROCKER AND KNAPP.

Report on the Disastrous Effects of the Destruction of Forest Trees.

Submitted to the State Legislature by the commissioners appointed for this purpose, 1867.

PAMMEL, L. H.

Forest Vegetation of the Upper Mississippi.

Garden and Forest, IV., pp. 461 *et sequ.* 1891.

PUTNAM, H. C.

Report on the Forests of Wisconsin with Particular Regard to the Lumber Industry.

In Sargent's Report on the Forests of the United States, Xth Census, Vol. 13, pp. 554-558.

ROTH, FILIBERT.

On the Forestry Conditions of Northern Wisconsin. Wisconsin Geology and Natural History Survey. Bulletin No. 1, Economic Series No. 1. Madison, 1898, Map, p. 78.

There are two editions of this work published by the state. One, on large heavy paper, distributed by the Geological Survey. The other in cheaper form, for the State Forestry Commission. See also next entry.

ROTH, FILIBERT.

Forestry Conditions and Interests of Wisconsin. With a discussion of objects and methods of ascertaining forest statistics, etc., by B. E. Fernow, Chief of Division of Forestry. Bulletin 16, U. S. Division of Forestry, 1898. Map, p. 76.

This is substantially the same work as the preceding, but does not contain the accounts of conditions in individual counties.

WARDER, JOHN A.

Forests and Forestry in Wisconsin.

Transactions Wisconsin State Horticultural Society, 1880-1881.

Notes on Sylva of Milwaukee County. BY ERNEST BRUNCKEN. The hop hornbeam *(Ostrya Virginica)*, a very common tree in this locality, seldom has a larger diameter than eight inches, although it is stated that in the lower Mississippi region, where it seems to have its best development, stems of twenty inches and more are not uncommon. The largest tree of this species in our vicinity, which I know of, stands on the steep northern slope of the Menomonee Valley, near the abandoned quarry opposite Castalia Park. It is about twenty-five feet high, has eleven inches diameter at breast-height; the spread of its crown about equals its height, and the lowest branch is eight feet above the ground. It is a very vigorous tree, and last autumn bore a heavy load of seed. This tree, standing free and showing

the typical open-stand form, is evidently of "second growth." As the species is a slow grower, however, it may well be fifty years old. In the Jesup collection in the American Museum of Natural History, at New York, there is a log specimen from the northern part of that state which is twelve inches inside the bark, and shows seventy-six rings. The largest tree of this species on record seems to be one at West Stockbridge, Mass., which, in 1877, had a circumference, at four feet from the ground, of seven feet two inches, or twenty-seven inches diameter.

Shade trees of several species on the West Side have had their trunks colored conspicuously green, during the fall and winter, by some alga, possibly a *Pleurococcus*.

The year 1899, in the vicinity of Milwaukee, was a seed year for a number of trees. *Acer saccharinum* keys were very abundant on the shade trees along the city streets, and many seedlings sprouted on the lawns. The several species of oak all bore very abundantly. So did the hop hornbeam. Also the basswood.

A Rain of Frogs. By Ernest Bruncken. The sudden occurrence of frogs in very great numbers, disappearing just as suddenly, has often been recorded, and led to the popular belief in a "rain of frogs." Such an appearance of frogs, due presumably to a migration, was noticed in the vicinity of Rush Lake, Winnebago County, in August, 1897. On the 25th of that month I noticed an unusual number of leopard frogs in the garden surrounding a farm house, about two miles from that lake, and not in the immediate vicinity of any large body of water. Upon inquiry I was told by the people living there that a few days before there had been "a hundred frogs where there is one now."

A "frog rain" is mentioned as occurring at Milwaukee in 1836 by Buck in his "Pioneer History." Other old residents claim that this phenomenon occurred in 1839, and it is stated that at that time frogs were taken out of the cellars and basements in the then village of Milwaukee "by the bushel basket full."

On the Occurrence of the Evening Grosbeak in Milwaukee in the Winter of 1899-1900. By W. J. Bennetts. The winter of 1899-1900 has been characterized at Milwaukee by the presence, in considerable numbers and after ten years' absence, of the evening grosbeak *(Coccothraustes vespertina)*. Their last occurrence in this vicinity was in January and February, 1890, and previous to that in the same months of 1888, and in March and April of 1887. On each occasion they were reported also from the majority of states between the Dakotas and the Atlantic, and

as far south as southern Iowa and Kentucky. Small flocks have indeed been reported from other parts of Wisconsin in the interval since 1890, as a flock of five at Appleton, March 14, 1891, and another of about a dozen at Delavan, from January 21 to March 30, 1896, but in that period there seems to have been no general movement southeastward of these birds of the far northwest. As it is possible that their present wanderings may prove to be as extensive as those of 1887, '88, and '90, the notes that follow are given in the hope that they may assist in tracing the movements of these wandering flocks.

On November 5th of last year, 1899, I observed a solitary male of this species in a grove near Milwaukee-Downer College to the northeast of the city. It was flying restlessly from tree top to tree top, uttering a ringing metallic call and its large bill and peculiar markings were clearly distinguished through the field glass. Other single birds have been observed since then in the same locality and behaving in the same manner so that, although it was my first acquaintance with the species, I am satisfied there was no error in identification.

No more were reported until February 12th, when a boy brought a male bird, that had been shot with an air gun, to the Milwaukee Public Museum. It had been secured on the South Side of the city and was alone when taken. Another male was received under somewhat similar circumstances on February 18th, and on February 19th Mr. P. H. Dernehl found a flock of twenty-two—the majority of which were full-plumage males—on North Ave. near Second Street, feeding in a group of box-elder trees (*Acer Negundo*), and a few blocks away met with four more, three of which were males. About February 5th, some boys had reported seeing a few large, yellowish-colored birds in the neighborhood of West Park, and on February 22d Mr. F. Kirchner found a flock of about a dozen grosbeaks in some evergreens just south of the park. On the morning of the 25th, I repaired to that locality and soon discovered, in a row of box-elder shade trees, a flock of twenty-five, sixteen of which were males in full plumage. Other places, where their favorite tree was abundant, were visited in the course of the day and in two cases successfully. A flock of eleven was found during the afternoon on Twenty-third Street, about a mile from where the flock of the morning was seen. These also were in box-elder trees and nine of the eleven birds were plainly males. Half a mile away on Wells Street, four more were met with, chasing one another among the elm trees, the males which were three in number, uttering their characteristic loud call-notes repeatedly as they flew. Whether the quieter colored birds—in brown and yellowish grey—of these flocks were females

or immature males remains undecided, as no collecting was done; although from the character of their note I was inclined to the opinion that they were of the same sex as their more richly colored companions, as the note of the females was found to be—at least in the month of April—clearly different from that of the male.

One week later, on March 4th, during a heavy snow storm, I again repaired to West Park, which appeared to be the headquarters of our grosbeak visitors. Two rows of box-elder trees, laden with fruit, extend for about half a mile just east of the property, and here, as was the case before, the first flock was found. They were thirty-five in number and nineteen were males in mature plumage. Not far away, but in the center of the park, a small company of nine was found, and farther on one of sixteen. From some evergreens at the south end of the park the largest flock yet seen arose at my approach. They were estimated at being not less than one hundred and thirty in number, and flew rapidly northward, dividing into two flocks which disappeared in opposite directions. About a mile away, on Twenty-sixth Street a flock of nine was found. These were on the snow beneath the box-elder trees, picking up the fallen seeds.

During the entire month of March small flocks of a dozen or less could be found almost any day in some one of the localities mentioned. They were reported also from other and remote quarters of the city, and an examination made, personally, of box-elder trees in a cemetery some distance in the suburbs, gave unmistakable evidence that the birds had recently been feeding there also.

On March 28th a flock numbering more than a hundred was observed by F. Kirchner in West Park. No more have been seen in that locality since, so it is possible that the smaller companies may have combined just previous to their departure.

On April 8th I discovered a flock of twenty-one, all females, in the town of Wauwatosa, a suburb just west of Milwaukee. Box-elder trees of a large size are numerous there and had been stripped almost entirely of their fruit by the birds, showing that the latter had been there for a considerable time and in large numbers. These female birds, while in the trees, kept up a loud, monotonous chattering that could be heard three blocks away and which was noticeably different from the quieter, sparrow-like chirping of the males under the same conditions. When on the ground both sexes, so far as observed, are almost silent. Soon after being noticed this flock flew to a garden plat near one of the residences and began industriously searching for food. They made use of their bills rather than of their feet—lifting up and turning over the fallen leaves and occasionally several could be

seen at once holding leaves up in their bills and working them around and examining them closely. They hopped familiarly along the board walk, mounted the steps and peered into the rear entrance of the house, but would not permit of my approaching them nearer than about thirty feet. Later they flew to a small maple and remained almost silent for a considerable time, and finally when I left them they were again in the box-elders, searching for any seeds that might have escaped their previous visits.

Up to the time of writing these notes (April 16), this flock was the last known to have been in this vicinity.

The evidence thus far given would seem to show, then, that during the months of November, December and January, a few male birds—the scouts of the main grosbeak army—were present in the neighborhood of the city. The first flocks appeared about February 1st and were composed largely of males in full plumage and it is possible that many, if not all, of their sombre colored companions were also males—young immature birds.

Their numbers steadily increased and must have reached a maximum about the middle of March when the proportion of the sexes was about equal and when the grosbeak population of Milwaukee must have numbered many hundreds. Towards the end of the month their numbers appeared to diminish or at least the flocks were more difficult to find, and when found were composed chiefly of female birds, while the last companies that were noted here consisted exclusively of birds of that sex. Most of the accounts of former grosbeak visits agree in stating that but few full plumage males could be found in any of the flocks. The present migration must have been exceptional in this respect or else on former occasions the flocks could not have come under observation during the early part of their visit. As has been already stated the majority of individuals in this locality during the month of February consisted of handsome specimens of the fully developed male. A box-elder tree occupied by a number of birds of this sex was an interesting sight on a bright winter morning. Their striking colors of yellow, black and white, stood out conspicuous—if the observer were close at hand, but at a greater distance their markings so blended into the yellowish tints of the smaller twigs and samaras and the stronger and darker lines of the branches, that in a tree well loaded with mast, the grosbeaks were almost unnoticeable. During this month they were tame and unsuspicious, allowing the observer sometimes to approach within two or three feet, but if the hand were reached out to seize one, he very quickly avoided it. They were somewhat indolent in their manner of feeding, perching at one place upon a branch and reaching out on all sides for the seeds until no more were within reach, when

they flitted to a new position and repeated the operation. The snapping of their powerful bills as they bit the box-elder keys in two was distinctly audible. The key is held crosswise and divided about half an inch from one end just beyond the seed by one side of the bill, while with the other the seed itself is pressed or worked out, the two parts of the key dropping to the ground together. While feeding the males kept up a continual peeping or chirping, not much louder and very similar to that made by as many English sparrows. Occasionally they all flew to the ground to pick up any seeds that might have fallen and while there were almost invariably silent. When tired of feeding they would sometimes fly to the roof of the nearest house and when there also be quite silent, especially about mid-day.

Grosbeaks are known to eat the mast and buds of the maple, the berries of cedar and climbing bittersweet and the seeds of apples, but on this occasion they seem to have given their attention almost exclusively to the seeds of the box-elder, probably because it was so abundant and was preferred by them. Particular pains were taken to determine if they fed upon the *buds* of this tree, as it is stated that they prefer the buds to the seeds, but in no instance were they observed to pay any attention to the former. During the snow storm of March 4th they ate the snow greedily, picking it in large mouthfuls from where it accumulated on the branches and in the forks of the trees. On one occasion they were seen to search hurriedly and unsuccessfully through an apple orchard which doubtless they had previously visited and thoroughly despoiled of any frozen fruit it might have contained.

When flying low, as from one feeding place to another not far away, their flight was undulating and only moderately fast, but when flying at a greater height it was direct and very rapid.

Note on the Food of the Canada Jay, *(Perisoreus canadensis).* By W. J. Bennetts. The following was found in the stomach of a Canada Jay collected in Barron County, Wisconsin, on Nov. 15th, 1899. It will be noted that the list is characterized by considerable variety and that although a cold spell prevailed at the time insects were still to be obtained.

The stomach contained (1) five seeds of staghorn sumac *(Rhus typhina);* (2) ten seeds unknown; (3) one carabid beetle; (4) one large weevel *(Phyncophora);* (5) one Hymenopter; (6) one Hemipter *(Capsid);* (7) one Tettix grasshopper; (8) several caterpillars; (9) bone of some batrachian, probably tree frog, and (10) bits of shell of mollusc.

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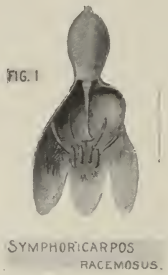

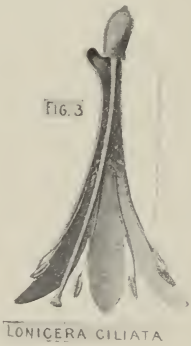

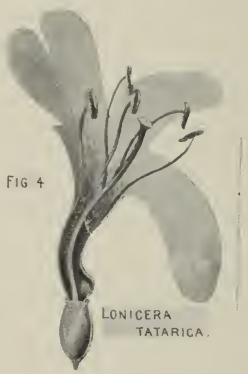

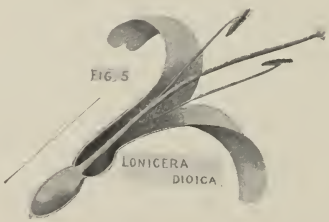

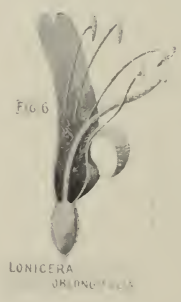

FLOWERS OF SYMPHORICARPOS AND LONICERA. *See Page* 141.

DRAWN BY JOHN A. BRANDON.

[The straight lines represent the natural size of the flowers.]

BULLETIN

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WISCONSIN NATURAL HISTORY SOCIETY.

Vol. 1, New Series. **JULY, 1900.** **No. 3.**

Proceedings of the Wisconsin Natural History Society.

March 29, 1900 to July 5, 1900.

THURSDAY, MARCH 29, 1900.

Twenty-eight persons attended this meeting which was held as usual in the museum lecture room. President Peckham occupied the chair.

Messrs. A. F. Laue and Chas. Knopf were made ordinary members of the society and Mr. H. P. Hamilton of Two Rivers, Wis., a corresponding member.

The resignation of Mr. Armin Neitzke from membership was accepted.

A motion made by Chas. E. Monroe that the quarterly bulletin be henceforth mailed to all members was carried.

The attention of the society was called to the fact that all members who contemplated reading papers at any of the meetings should notify the secretary, and dates would be assigned them in the order in which the notifications were received.

Mr. C. E. Monroe then read an interesting paper of a popular character—entitled "Geological Rambles." The leading points of interest to the geologist in Milwaukee and Ozaukee counties were touched upon, and the principal fossils noted, and their geological significance detailed. Certain quarries and exposures in the vicinity of Port Washington were considered at some length, also the bluff moraines bordering on the lake between Mequon and Cudahy. Evidence was also given in support of the theory that the basins now occupied by Lake Michigan and the other Great Lakes were once occupied by the ocean.

THURSDAY, APRIL 26, 1900.

The general meeting for April was also the annual meeting of the society and was held in the usual place—the museum lecture room.

In the absence of the president, Mr. Ernest Bruncken presided over the meeting. Twenty-six persons were present.

The report of the secretary for the past twelve months was then read as follows,—

Secretary's Report for the Year from April 27th, 1899 to April 26th, 1900.

Number of general meetings held during the year..... 9
" section " " " 19
" directors " " " 1
Membership of the society, April 26, 1900.....87
Members added to the society during the year.....23

The following twelve papers were read at the general meetings during the year:

Rambles in Prehistoric France .....Charles E. Doerflinger
The Hamilton Formation at Milwaukee.....E. E. Teller
Local Botany.....Philip Wells
Winter Habits of the Great Northern Shrike.....W. J. Bennetts
Indian Dialects of the Algonquins.....D. W. Fowler
Some Remarkable Trees in the Vicinity of Milwaukee, E. Bruncken
Notes on the Distribution of some Trees and Shrubs in the Vicinity of Milwaukee.....E. Bruncken
The Colors of Flowers.....W. H. Dudley
Our Early Wild Flowers and their Insect Visitors..Dr. S. Graenicher
Practical Taxidermy.....Geo. Shrosbree
The Giant Squid and Its Allies.....Dr. H. Dorner
Geological Rambles .....Chas. E. Monroe

In January of the present year, 1900, the society began the publication of its transactions in the form of an octavo quarterly, which it has named "Bulletin of the Wisconsin Natural History Society." The first number which contained about 70 pages and 4 plates was well received by tne other publishing societies of America and Europe. The second or April number was at the time of writing about to leave the hands of the printer.

This report having been approved, the election of officers for the ensuing year was then taken up and the following were nominated and unanimously elected,—

For President.....Edgar E. Teller
" Vice President.....Dr. S. Graenicher
" Recording Secretary.....Wm. J. Bennetts
" Corresponding Secretary.....Lee R. Whitney
" Treasurer.....John A. Brandon
" Librarian.....Paul H. Dernehl

DIRECTORS OF SECTIONS.

Entomology.....Charles E. Brown
Botany.....Ernest Bruncken
Ethnology.....W. H. Ellsworth
Mineralogy.....Louis Lotz
Geology.....Chas. E. Monroe
Ornithology.....John A. Brandon

Chas L. Owen of Chicago was elected a corresponding member of the society.

Reports from the directors of the several sections were then heard, after which those present listened with much interest to a paper entitled "Dakota Indian Mounds," by Lee R. Whitney. Mr. Whitney in the fall of 1899 had taken advantage of a visit to Ransom county in N. Dakota to dig into a series of mounds on the bluffs of the Cheyenne River, and in the paper he described the results of his explorations, and to illustrate it exhibited several skulls and Indian implements he had there unearthed.

Messrs. Geo. A. West and Chas. E. Brown took part in the discussion that followed.

The secretary was instructed to convey the thanks of the society to the retiring officers Dr. Peckham and Mr. F. Meinecke for their efficient services during the year that was past, after which there being no further business to transact the meeting was adjourned.

THURSDAY, MAY 31, 1900.

The general meeting for May was held in the trustees' room of the public museum with president Teller in the chair and 23 persons present.

Paul H. Dernehl reported upon a joint meeting of the biology sections that had been held on the 10th of the month, and Lee R. Whitney upon a meeting of the archaeology section that had been held at the home of Mr. Geo. A. West.

Mr. E. Bruncken then commenced the lecture of the evening taking "Forestry" as his subject. He drew attention to the many misconceptions that existed concerning the meaning of this term and defined forestry as the art of providing the United States and the world with one of the necessities of life—timber and wood.

This the forester aimed to do—not by planting trees—but by taking advantage of the natural laws governing forests and trees. With moisture and light he was most concerned. The first however was in most cases beyond his control so his methods related mostly to the other. It was shown how—in regard to their ability to endure shade—trees could be classified as tolerant and

intolerant, and that the succession of trees depended upon their relationship in this respect. The opinion so current among lumbermen that the white pine will not succeed itself was shown to be a fallacy. Attention was also called to the inevitable extermination of the hemlock on account of its extremely slow growth and its dependence upon a humid soil for its existence. The speaker drew attention to the spreading of the forests in the southern part of the state and their encroachment upon the prairies and explained it as being largely due to the absence of destructive prairie fires which formerly killed all the young trees.

In closing Mr. Bruncken impressed upon his hearers the importance of their influencing legislators by all means in their power regarding the importance of re-foresting the denuded tracts of our state, as well as the preventing of the unwise destruction of forests now existing.

The following were nominated for membership by Mr. H. Nehrling and elected by the directors at the close of the meeting,—Messrs. Chas. L. Kiewert, Aug. Cloos, A. T. Schoenebeck and Carl Schoenebeck.

Mr. Slocum called the attention of the meeting to the Mining Congress that was shortly to assemble in the city and to the interesting exhibit of minerals that could then be seen at the Exposition building.

The meeting was then adjourned.

THURSDAY, JULY 5, 1900.

This meeting was held in the usual place, the museum lecture room. President Teller occupied the chair and 28 persons were present.

Chas. E. Monroe of the geology section spoke at some length on the relation of the formation known as the Lower Heldeburg to those lying immediately below and above it, viz: the Upper Silurian and the Hamilton, and stated that geologists were at present undecided with which it was the more closely connected. The speaker said however he hoped during the summer to obtain considerable evidence tending to settle the question by taking advantage of the opening of a quarry at Lake Church in Ozaukee county which cut into this formation.

Ernest Bruncken described the botanical features of the sand dunes at Ottawa Beach in Michigan. They there exhibit all stages of formation and are heavily forested with pine and hemlock, with an underbrush of hardwood. Willows of several species are abundant. Sassafras and tupelo were also noted.

Mr. Teller then spoke on the crustaceans found in the Niagara Formation of this vicinity and illustrated his remarks by means

of specimens of the different fossils taken from his own collection.

Mr. Geo. A. West then related an exciting experience he had had while collecting specimens of the Sea Devil C. Vampirus off the west coast of Florida. He also gave a detailed description of the form and anatomy of this creature and exhibited specimens of its eyes and whip-like tail.

Chas. E. Brown suggested the formation of a sub-section of numismatics in connection with the archaeology section, and it was thought best to leave the matter with the members of that section.

The following were elected to membership,—Messrs. David Harlowe, W. F. Sandrock, Geo. J. Cline and Dr. H. V. Ogden.

W. J. BENNETTS, Recording Secretary.

The Fertilization of Symphoricarpos and Lonicera.

By Dr. S. GRAENICHER.

Symphoricarpos and Lonicera are two closely related genera, belonging to the Caprifoliaceae or honeysuckle-family. In our flora these two genera, taken together, are represented by 7 species of plants, all of which occur in the immediate vicinity of the city of Milwaukee.

Symphoricarpos, Juss.

One of our species, *Symphoricarpos racemosus, Michx.*, has been enumerated among the so called "wasp-flowers" ever since H. Mueller (1) in giving an account of the fertilization of this species, mentioned the fact that wasps are among the principal visitors of the flowers. His observations were made on plants of this species, growing at different points in Germany, and furnished the remarkable results that in a certain part of that country, with an abundance of wasps, the latter formed over nine tenths of the visitors, while in an other locality, where wasps seemed to be scarce, bees were the most frequent visitors. More recent investigators have obtained similar results, as for example Knuth (2), who for years never succeeded in witnessing the visit of a single wasp on *Symphoricarpos racemosus* in Pommerania, until in 1897, when wasps, belonging to several species were numerous on these flowers in Usedom, an island on the coast of Pommerania. This is significant, and shows that the extent to which these flowers receive the attention of wasps in a given locality, depends mainly on the frequency, with which wasps occur in that locality. Where wasps are few in number, the flowers are visited efficiently by a variety of other insects, mostly bees and flies, and according to MacLeod's (3) observations in Flanders by moths (Noctuidae). For this reason there has been a tendency on the part of a few observers to drop the term "wasp-flower", the visits of wasps to such a flower being, in their opinion of no more importance than the visits of wasps to any other flower. But the fact must be admitted that a wasp-flower is more attractive to wasps, than is the ordinary beeflower. The dimensions of such a flower, together with its bellshaped or cupshaped form, enable wasps to thrust their heads into the flower

(1) H. Mueller. Die Befruchtung der Blumen durch Inseckten, 1873. pp. 360–361.

(2) P. Knuth. Handbuch der Bluetenbiologie, 1898. Vol. II, Part 1, p. 527.

(3) MacLeod. Untersuchungen ueber die Befruchtung der Blumen. Bot. Centralblatt. Vol. XXIX, p. 119, 1887.

in search of nectar, which is usually secreted in abundance. A wasp-flower is therefore simply a bee-flower, which owing to certain peculiarities in form and structure, favors the visits of wasps to some extent. Taken in this sense, the term "wasp-flower" undoubtedly has a right to stand.

The genus Symphoricarpos has 2 representatives in this part of the country: *S. racemosus, Michx.,* and *S. occidentalis, Hook.,* which differ somewhat from each other, as regards the structure of the flowers.

Symphoricarpos racemosus, Michx. Snowberry.

(See Frontispiece. Fig. 1)

This is a rather common plant around Milwaukee, forming in many places small patches, and blooming from June 6. to July 25. The reddish, bellshaped flowers are collected in clusters at the ends of the branches, and are more or less pendulous. As the stamens are inclined towards the middle of the corolla tube, the introrsely opening anthers form a small circle a short distance above the stigma. Honey is secreted in the lower portion of the tube, and is protected by patches of hairs, arising from the inner surface of the tube, and filling out the entrance to the flower. This species presents a case of homogamy, the stigma being receptive at the same time the anthers shed their pollen. From the situation of the anthers in advance of the stigma it is evident that pollen can not fall on the stigma and effect spontaneous self-fertilization, unless the flowers be erect, which usually is not the case. Besides, there is hardly ever a necessity for the flowers to resort to spontaneous self-fertilization, as they are abundantly visited by insects. Proceeding from flower to flower with grains of pollen attached to the lower parts of their heads, the visitors are liable to insure cross-fertilization, but they may also carry pollen from the anthers to the stigma of the same flower.

Symphoricarpos racemosus is a native of this country. The flowers of this species from plants growing in our neighborhood are decidedly smaller than those observed by H. Mueller in Germany, on cultivated specimens. This author gives a length of 7 to 8 mm., and a width of 5 mm. for the flowers, while those from our locality attain a length not exceding 6 mm., and a width of not more than 4 mm. Observations of the visits of insects to these flowers have been recorded from different parts of Europe, but none from this country. Robertson (4) has published an account of the fertilization of *Symphoricarpos symphoricarpos*

(4) C. Robertson. Flowers and Insects. Trans. Acad. Sc. St. Louis, Vol. VII, No. 6, pp 173-174.

(*L*), *MacM.* (*S. vulgaris, Michx.*), a North American species, agreeing in most respects with *S. racemosus.* His list refers to 14 visitors, observed in Macoupin Co., Southern Illinois, 7 or 50 per cent. of which are wasps (Vespidae and Eumenidae).

During the last two seasons, I have taken the following insects on the flowers of *Symphoricarpos racemosus, Michx.*

A. Hymenoptera.

Apidae: (1) *Apis mellifica,* L. ☿*; (2) *Bombus americanorum, F.* ☿; (3) *B. consimilis, Cr.* ☿♀; (4) *B. fervidus, F.* ♀; (5) *B. pennsylvanicus, DeG.* ♀; (6) *B. ternarius, Say.* ♀☿; (7) *B. virginicus, Oliv.* ♀; (8) *Clisodon terminalis, Cr.* ♀; (9) *Megachile latimanus, Say.* ♀; (10) *M. melanophaea, Sm.* ♀; (11) *Alcidamea producta, Cr.* ♂; (12) *Osmia albiventris, Cr.* ♂; (13) *O. distincta, Cr.* ♀; (14) *O. simillima, Sm.* ♀; Andrenidae: (15) *Halictus fasciatus, Nyl.* ♀; (16) *H. similis, Sm.* ♀; (17) *H. inconspicuus, Sm.* ♀; (18) *Agapostemon radiatus, Say.* ♀; (19) *A. viridulus, F.* ♀; (20) *A. splendens, Lep.* ♀; (21) *Augochlora vividula, Sm.* ♀; (22) *Andrena bipunctata, Cr.* ♀; (23) *A. pruni, Rob.* ♀; (24) *A. vicina, Sm.* ♀; (25) *A. zabriskiei, Ashm.* (M. S.) ♀; (26) *Andrena sp.* ♀; (27) *Colletes aestivalis, Patton* ♀; (28) *Prosopis modesta, Say.* ♀; Vespidae: (29) *Vespa diabolica, Sauss.;* (30) *V. vidua, Sauss.;* Eumenidae: (31) *Eumenes fraternus, Say.* (32) *Odynerus foraminatus, Sauss.;* (33) *O. philadelphiae, Sauss.;* (34) *O. tigris, Sauss.;* Sphecidae: (35) *Ammophila vulgaris, Cr.—;* all s.

B. Diptera.

Syrphidae: (36) *Eristalis bastardi, Macq.;* (37) *E. dimidiatus, Wied.;* (38) *Helophilus conostomus, Will.;* (39) *H. similis, Macq.;* (40) *Tropidia quadrata, Say.;* Conopidae: (41) *Zodion fulvifrons, Say.;* Tachinidae: (42) *Belvosia bifasciata, F.;* (43) *Sturmia albifrons, Walk.;* (44) *Tachina robusta, Town.;* (45) *Peleteria robusta, Wied.;* (46) *P. tessellata, F.;* (47) *Archytas analis, F.;* Muscidae: (48) *Phormia regina, Mg.;* (49) *Lucilia cornicina, F.*—all s.

C. Lepidoptera.

Rhopalocera: (50) *Neonympha eurytus, F.;* (51) *Phyciodes tharos, Drury;* (52) *Anosia plexippus, L.;* (53) *Lycaena pseudargiolus, Boisd.—Lec.;* (54) *Thorybes pylades, Scudder;* Heterocera: (55) *Alypia octomaculata, Hbn.;* (56) *Plusia simplex, Gn.;* (57) *Leucania unipunctata, Haw.*—all s.

D. Coleoptera.

Scarabaeidae: (58) *Trichius piger, F. s.*

This list is made up of a great variety of insects, prominent

* ☿ Worker; ♂ Male; ♀ Female; s Sucking; c p Collecting Pollen; f p Feeding on Pollen.

among them being the bees (Apidae and Andrenidae) with about fifty per cent. of the visitors, while the wasps are represented by six species or hardly ten per cent. This result is not surprising, when we consider the fact that wasps, and especially those belonging to the genus Vespa occur in small numbers in our neighborhood and have been remarkably scarce for the last two seasons. And besides, the total number of visiting species is so large that the percentage of wasps is necessarily reduced to a low rate.

In addition to the bees and wasps observed on the flowers, flies belonging to the families Syrphidae and Tachinidae and butterflies appear as regular visitors.

Symphoricarpos occidentalis, Hook. Wolfberry.

(Fig. 2.)

Although not as widespread as the preceding species, it occurs in abundance in a few places in the Menomonee Valley, growing in large patches. The blooming period is from June 15. to August 26. The clusters of reddish flowers are situated either at the ends of the erect or nodding branches or in the axils of the leaves. The numerous sweet scented flowers may be observed in all positions between erect and pendulous. There is a contrast of color between the white inner surface of the open flowers and the distinct reddish color of the buds and thereby the conspicuonsness of the inflorescence is increased. In the open flower the lobes of the corolla are spread outwardly, giving the flower the shape of a funnel and rendering it more accessible to short-tongued and less-specialized visitors than the bellshaped flower of *S. racemosus,* with its erect corolla lobes. When the lobes are entirely spread, the flower attains a diameter of 10 mm., while the entrance to the corolla tube at the base of the lobes is only 3 mm. wide. In this species, as in the preceding, the entrance is closed by tufts of dense, white hairs and in this way the nectar is protected to a certain extent from the visits of unwelcome guests but especially from rain. Nectar is secreted at the bottom of the tube, but it also appears in minute drops on the layer of succulent tissue, which lines the interior surface of the tube. The depth of the tube being only 4 mm. and its width of 3 mm. at the entrance enabling insects to insert the lower part of their heads, it is evident, that honey can be procured by relatively short-tongued visitors. The erect style, bearing the small capitate stigma arises from the middle of the flower and protrudes from the latter for a length of 4 mm., being altogether 8 mm. long. The stamens attain the same length as the style, they are strongly divergent and for this reason the anthers are not likely

to come in contact with the stigma. There is a slight dilation of one side of the corolla tube in its lower portion, which is more pronounced in the bud.

The flowers are homogamous and the introrse anthers open gradually, one by one. Insects insert their heads, as a rule between the stigma and the anthers. Visiting flower after flower, with the sides of their heads dusted with pollen, they naturally convey pollen to the stigmas which are on the same level with the anthers and usually effect cross-fertilization. Spontaneous self-fertilization may take place by the falling of pollen on the stigmas when the flowers are horizontal or pendulous; in erect flowers this can not occur.

In the following I give a list of insects taken on the flowers in the summer of 1899:

A. Hymenoptera.

Apidae: (1) *Apis mellifica, L.* ♀; (2) *Bombus americanorum, F.* ♀; (3) *B. consimilis, Cr.* ♀♀; (4) *B. fervidus, F.* ♀; (5) *B. pennsylvanicus, Deg.* ♀; (6) *B. pleuralis, Nyl.* ♀; (7) *Ceratina dupla, Say.* ♀; (8) *Osmia atriventris, Cr.* ♀; (9) *Nomada affabilis, Cr.* ♀; Andrenidae: (10) *Halictus fasciatus, Nyl.* ♀; (11) *H. similis, Sm.* ♀; (12) *Halictus sp.* ♀; (13) *Agapostemon, radiatus, Say.* ♀; (14) *A. viridulus, F.* ♀; (15) *Andrena claytoniae, Rob.* ♀; (16) *A. forbesii, Rob.* ♀; (17) *A. rugosa, Rob.* ♀; (18) *Colletes eulophi, Rob.* ♀; (19) *Sphecodes dichrous, Sm.* ♀; Vespidae: (20) *Vespa germanica, F.*; (21) *V. maculata, L.*; (22) *Polistes pallipes, Lep.*; Eumenidae: (23) *Eumenes fraternus, Say.*; (24) *Odynerus capra, Sauss.*; (25) *O. foraminatus, Sauss.*; (26) *O. leucomelas, Sauss.*; (27) *O. tigris, Sauss.*; (28) *O. walshianus, Sauss.*; Crabronidae: (29) *Crabro interruptus, Lep.*; Philanthidae: (30) *Philanthus bilunatus, Cr.*; (31) *P. punctatus, Say.*; (32) *Cerceris fumipennis, Say.*; (33) *C. nigrescens, Sm.*; Bembecidae: (34) *Bembex spinolae, Lep.*; Larridae: (35) *Tachytes pepticus, Say.*; Sphecidae: (36) *Ammophila vulgaris, Cr.*; (37) *Pelopoeus cementarius, Drury*; (38) *Sphex ichneumonea, L.*; (39) *S. pennsylvanica, L.*; Pompilidae: (40) *Pompilus tenebrosus, Cr.*; Scoliidae: (41) *Scolia confluenta, Say.*—all s.

B. Diptera.

Syrphidae: (42) *Syrphus americanus, Wied.*; (43) *Allograpta obliqua, Say.*; (44) *Mesogramma geminata, Say.*; (45) *M. marginata, Say.*; (46) *Sphaerophoria cylindrica, Say.*; (47) *Eristalis bastardi, Macq.*; (48) *E. dimidiatus, Wied.*; (49) *E. flavipes, Walk.*; (50) *E. meigenii, Wied.*; (51) *E. transversus,*

Wied.; (52) *Helophilus similis, Macq.;* (53) *Mallota cimbiciformis, Fall.;* (54) *M. posticata, F.;* (55) *Tropidia quadrata, Say.;* (56) *Syritta pipiens, L.;* Stratiomyidae: (57) *Stratiomyia norma, Wied.;* Tachinidae: (58) *Hyalomyodes triangulifera, Loew.;* (59) *Ocyptera carolinae, Desv.;* (60) *Peleteria robusta, Wied.;* (61) *P. tessellata, F.;* Muscidae: (62) *Stomoxys calcitrans, L.;* (63) *Calliphora erythrocephala, Mg.;* (64) *Phormia regina, Mg.;* (65) *Lucilia caesar, L.;* (66) *L. cornicina, F.;* (67) *Graphomyia americana, Desv.;* (68) *Morellia micans, Mg.;* Sarcophagidae: (69) *Sarcophaga sarraceniae, Riley;* (70) *Sarcophaga sp.*—all s. or f. p.

C. Lepidoptera.

Rhopalocera: (71) *Basilarchia disippus, Gdt.;* (72) *B. astyanax, F.;* (73) *Pyrameis atalanta, L.;* (74) *P. huntera, F.;* (75) *Argynnis cybele, F.;* (76) *Phyciodes tharos, Drury;* (77) *Anosia plexippus, L.;* (78) *Libythea bachmanni, Kirtl.;* (79) *Chrysophanus thoe, Boisd.—Lec.;* (80) *Lycaena pseudargiolus, Boisd. —Lec.;* (81) *Colias philodice, Gdt.;* (82) *Limochores manataaqua, Scud.;* (83) *L. taumas, F.;* Heterocera: (84) *Hemaris diffinis, Bdv.;* (85) *Plusia simplex, Gn.*—all s.

D. Coleoptera.

Scarabaeidae: (86) *Trichius piger, F.* s.

The results obtained from a comparison of this list with that of *S. racemosus,* are in accordance with what might be expected on account of the difference in structure of the two flowers. The percentage of true wasps (Vespidae and Eumenidae) is the same on both species, amounting to ten per cent. The bellshaped flowers of *S. racemosus,* with their more concealed nectar are more attractive to bees (48 per cent.) than the funnelshaped flowers of *S. occidentalis,* with their shorter corolla tube (22 per cent. of bees). The latter show a decided increase in the visits of less-specialized insects, notably entomophilous and fossorial wasps and flies. Instead of 1 entomophilous wasp or hardly 2 per cent. in S. racemosus, we have 13, or 15 per cent. of the visitors belonging to the entomophilous and fossorial wasps in *S. occidentalis;* the increase in the visits of flies is from 24 per cent. in *S. racemosus* to 34 per cent. in *S. occidentalis.* Both species of Symphoricarpos receive the attention of Lepidoptera, but *S. occidentalis* seems to be the more attractive of the two to this order of insects. *Trcihius piger,* the only beetle frequenting both species is a regular visitor, which succeeds in forcing its head into the flowers in search of honey.

For the sake of comparison, I add the following table; it refers to observations made in this country, as well as in Europe on the fertilization of the species of Symphoricarpos.

		Bees.	Vespidae and Eumenidae.	Other Wasps.	Diptera.	Lepidoptera.	Coleoptera.	Total.
S. symphoricarpos (5)	Southern Illinois	5	7	2	.....	.....	.....	14
S. racemosus (6)	Germany	7	8	1	1	.....	.....	17
S. racemosus (7)	Germany	2	4	.....	6	.....	.....	12
S. racemosus [8]	Belgium	.....	.....	.....	.....	8	.....	8
S. racemosus	Milwaukee, Wis.	28	6	1	14	8	1	58
S. occidentalis	Milwaukee, Wis.	19	9	13	29	15	1	86

Lonicera, L. Honeysuckle.

Lonicera furnishes an example of a genus, producing numerous species, which present a great amount of variation in their floral characters, and, for this reason are adapted to various kinds of visitors. The main factor which separates the species from each other is the variation in length and width of the corolla tube, while points of minor importance, such as difference in length of stamens and style, in color, in position of the flower (erect or pendulous) etc., have also a determining effect. The length of the corolla tube in the different species corresponds more or less with the length of the tongues of their visitors and accordingly we come across wasp-flowers, bee-flowers, bumble-bee-flowers, hawk-moth-flowers and bird-flowers among the honeysuckles.

Lonicera alpigena, L., a native of the Alps has a short wide-mouthed tube and is visited mainly by wasps. This is the only wasp-flower among the species of Lonicera. Other short-tubed species are adapted to the smaller bees, while in the bumblebee-flowers the tube ranges from 4 mm. to about 20 mm. in length. Two European honeysuckles, *L. periclymenum, L.* and *L. caprifolium, L.* are fertilized by hawk-moths in the evening and have long, narrow tubes of 22 to 30 mm. in length. The trumpet-honeysuckle, *L. sempervirens, Ait.* with its bright scarlet flowers is a native of this country, but occurs in our latitude in a cultivated state only. The slender flowers attain a length of 25 to 35 mm. and are adapted to the ruby-throated humming-bird, *Trochilus colubris, L.*

(5) C. Robertson, loc cit., p. 174. (7) H. Mueller, loc. cit., p, 361 and Weitere Beobachtungen, Vol. III, p. 73, (7) E, Loew. Weitere Beobachtungen ueber d. Blumenbesuch von Insekten, etc., Jahresb. d. Bot. Gart. Berlin, Vol. IV. p. 99. (8) MacLoed, loc. cit., p. 119.

Five species of Lonicera belong to the flora of Milwaukee County, four of which are indigenous, while the fifth, *L. tatarica, L.*, has escaped from our gardens and has succeeded in gaining a strong foothold at various points around the city. In this country observations have been recorded on the fertilization of 2 of our species: *L. ciliata,* Muhl. and L. *Sullivantii,* Gray and in Germany on *L. tatarica, L.*, while of our 2 remaining species: *L. dioica, L.* and *L. oblongifolia, Muhl.* no account has been given as yet. In the following the species are to be considered in the order of the appearance of their first flowers.

Lonicera ciliata, Muhl. American Fly Honeysuckle.

(Fig. 3.)

This is the earliest of our honeysuckles, its blooming period extending from May 4. to May 17. It figures on Wheeler's list of the flora of Milwaukee County, but seems to be a rare plant in our surroundings; the only specimen I have ever seen, was found about half a mile west of Soldier's Home, in Johnson's woods, in the spring of the present year. Lovell (9) has given an account of the fertilization of this species and reported the visits of a bumble-bee, *Bombus vagans, Sm.* ♀ "and several small bees", without mentioning the names of the latter. The greenish-yellow flowers are pendulous and have a funnel-shaped corolla of 16 mm. length, 11 mm. of which indicate the length of the tube. The five lobes of the corolla being equal, there is not the slightest trace of the formation of an upper and a lower lip, as is often the case with honeysuckles. Near its base the tube bears a spur-like gibbosity, the seat of the nectary and which is usually filled with honey. The corolla tube has a width of 5 mm. at its mouth but it gradually becomes narrower towards the base. Hairs on the wall of the tube in its narrower portion prevent the nectar from flowing downward and protect it somewhat from unbidden guests. As soon as the lobes of the corolla open, the capitate stigma, which is already receptive, appears in the mouth of the corolla, about 2 mm. in advance of the anthers. A short time later the anthers begin to empty their pollen. Proterogyny is therefore present, but in a slight degree only.

The width of the tube enables small bees of the genera Osmia and Halictus to crawl up into the flower and obtain nectar, while larger bees, as for example the species of Andrena observed as visitors can insert their heads only. The position of the stigma in the entrance to the flower and in advance of the anthers favors cross-fertilization, as the insects are apt to strike the

(9) John H. Lovell. The Visitors of the Caprifoliaceae. The American Naturalist, Vol. XXXIV, p. 45, 1900.

stigma before reaching the anthers. Their visits to newly opened flowers, before the anthers dehisce, can have only one result: cross-fertilization. The stigma may be bent over to one side and touch one of the anthers, with the possibility of effecting spontaneous self-fertilization; this may take place in older flowers especially, where the corolla tube grows longer and brings the anthers nearer to the stigma. In this manner the flowers may finally resort to spontaneous self-fertilization in case fertilization through insect-agency has not been accomplished. Besides being well supplied with nectar, the flowers are fragrant. I have seen them visited frequently by the following bees.

Apidae: (1) *Osmia atriventris, Cr.* ♂, ♀, s.; (2) *O. distincta, Cr.* ♂ *s;* Andrenidae: (3) *Halictus quadrimaculatus, Rob.* ♀, s. and cp.; (4) *Halictus sp.* ♀, s.; (5) *Andrena vicina, Sm.* ♀, s.; (6) *A. pruni, Rob.* ♀, s.

The length of the corolla tube points to an adaptation to bumble-bees, and Lovell has, as stated above, observed this kind of visitors in New England. Although I did not witness the visit of a single bumble-bee to the relatively small number of flowers under observation, yet, I entertain no doubts as to their paying attention to these flowers in our locality.

In color, size, structure and position of the flower, this species agrees closely with *Lonicera coerulea, L.,* a bumble-bee-flower growing in the alpine region, the fertilization of which has been observed first by Ricca (10).

Lonicera tatarica, L. Tartarian Bush-Honeysuckle.

(Fig. 4.)

This species, a native of Siberia, is a favorite shrub in our gardens, and grows in a wild state along the eastern bank of the Milwaukee river above the city, west of the city in the Menomonee valley and in various other places. Its blooming season is from May 20 to June 11. The flowers which are found in our neighborhood agree in a general way with the description given by Hermann Mueller (11) of flowers observed in Germany on cultivated specimens. They stand erect, in pairs, are white or rose-colored and have a corolla tube of 7 mm. length, which is slightly curved and somewhat dilated on the outer side near the base, so as to form a nectar-producing gibbosity. The tube is narrower than in the preceding species, having a width of 3 mm. at the mouth and 1½ mm. near the base. The long lobes of the

10. Ricca. Osservazioni sulla fecondazione incrociata dei vegetali alpini e subalpini. Atti. Soc. Ital. Sc. XIV. 255.

11. H. Mueller. Die Befruchtung der Blumen, etc., p. 363.

corolla are arranged so, that the outer one forms a lower lip, a convenient landing place for insects, while the 2 adjoining lobes are directed laterally and the 2 remaining ones, which are hardly separated from each other, represent the upper lip. The slightly divergent stamens protrude from the flower for a length of 6 mm. and shed their pollen at about the same time the stigma becomes receptive. The latter reaches as far as the middle of the dehiscent anthers and may easily come in contact with them and cause spontaneous self-fertilization to take place. There is a change of color in the older flowers, they become yellowish. The nectar is protected by thin, white hairs arising from the walls of the tube as also from the style. The sweet-scented flowers attract numerous visitors belonging to the following species:

A. Bees.

Apidae: (1) *Bombus americanorum, F.* ♀, s.; (2) B. *bimaculatus, Cr.* ♀, s.; (3) *B. consimilis, Cr.* ♀, s.; (4) *B. terricarius, Say.* ♀; s.; (5) *B. virginicus, Oliv.* ♀; s.; (6) *Megachile brevis, Say* ♀, s. and cp.; (7) *Osmia albiventris, Cr.* ♀, s. and cp.; (8) *O. distincta, Cr.* ♀, s. and cp.; Andrenidae: (9) *Halictus similis, Sm.* ♀, s.; (10) *H. fasciatus, Nyl.* ♀, s.; (11) *H. quadrimaculatus, Rob.* ♀, s.

B. Flies.

Syrphidae: (12) *Mesogramma marginata, Say,* f.p.

C. Hawk-Moths.

Heterocera: (13) *Hemaris diffinis, Bdv.,* s.

D. Birds.

(14) *Trochilus colubris, L., s.* .. ..

The bumble-bees and the smaller bees of the genus Halictus usually insert their heads between the anthers and the stigma and transport pollen on the sides of their heads from one flower to another. The bees belonging to the genera Megachile and Osmia collect pollen from the flowers and to this end they press the brushes on the ventral surface of their abdomen down against the anthers, thereby coming in contact with the stigma and effecting either cross- or self-fertilization. On account of the shortnes of the style and the stamens, the visiting hawk-moth, *Hemaris diffinis* rarely touches the anthers or the estigma with the under side of its body, its visits are for this reason of little or no avail to the flowers. The visit of the small-sized Syrphid-fly is of no

significance. Our humming-bird, *Trochilus colubris, L.*, an occasional visitor, may carry pollen on its beak and act as a cross-fertilizer.

In *Lonicera tatarica* we have an adaptation to the smaller bees, such as Osmia, Megachile, Halictus, etc.; this is indicated by the short tube, the short stamens and style and the erect position of the flower.

Lonicera dioica, L. Smooth-Leaved Honeysuckle.

(Fig. 5.)

A common species, blooming from May 22 to June 7. The flowers are collected in whorls at the ends of the branches, a branch bearing, as a rule, two whorls of about 6 flowers each. They are usually of a dark purplish color, but occasionally plants are found in our neighborhood producing greenish-yellow flowers only. While in the bud, the flower is erect, but after opening it assumes a horizontal position. The corolla tube is 8 mm. long and 4 mm. wide at its mouth and becomes only slightly narrower towards its base. Immediately above the base is a distinct dilation of the tube, the seat of the nectary. Numerous hairs, growing on the inner surface of the tube, afford protection to the deeply concealed nectar. The outer lobe of the corolla, representing the lower lip, is directed downward, while the remaining lobes participate in the formation of an upper lip. The anthers are situated 9 mm. above the entrance to the corolla tube, but they are 3 mm. behind the stigma. In some flowers the anthers begin to shed their pollen within the bud, a very short time before the latter opens; in other cases newly opened flowers may be observed with the anthers still closed. There certainly exists much irregularity in this respect, while of the stigmas it may be stated, that they always emerge from the bud in a receptive condition. Accordingly we have either a case of homogamy or of short-lived protenogyny. Inside of the bud, which is about to open, the capitate and receptive stigma is firmly pressed against one of the corolla lobes; in this way contact between the stigma and one of the prematurely opening anthers is prevented and for this reason spontaneous self-fertilization can hardly take place within the bud.

In favorable weather the flowers of this species open at all hours throughout the day. *Lonicera dioica* is a bumble-bee flower. Bumble-bees are the visitors, which on account of the length of the stamens and style are the most capable of coming in contact with the anthers and the stigma, while sucking honey. Cross-fertilization is favored by the stigma being in advance of

the anthers, as the visiting bumble-bee is likely to strike the stigma before the anthers. I have seen the following insects on the flowers:

A. Bees.

Apidae: (1) *Bombus americanorum, F.* ♀, s.; (2) *B. consimilis, Cr.* ♀, s. and cp.; (3) *Osmia albiventris, Cr.* ♀, s. and cp.; (4) *O. distincta, Cr.* ♀, s.; (5) *O. atriventris, Cr.* ♀, s.; (6) *O. simillima, Sm.* ♀, s.; Andrenidae: (7) *Halictus coriaceus, Sm.* ♀, cp.; (8) *H. fulvipes, Sm.* ♀, cp.; (9) *H. similis, Sm.* ♀, s.

B. Birds.

(10) *Trochilus colubris, L.*

The most frequent visitor seen on the flowers was one of our bumble-bees; *Bombus consimilis.* The visits of the smaller bees (Osmia and Halictus) are of little importance to the flowers, as they may obtain honey and pollen, without touching the stigma. On one occasion a small bee: *Halictus fulvipes* was observed collecting pollen by first alighting on the corolla, climbing up a filament to the anther, descending with a load of pollen. climbing up a neighboring filament, and so on. In mistaking the style for a filament, it climbed up to the stigma, crawled over the latter before discovering its mistake and undoubtedly deposited grains of pollen on the stigma. As it repeated this procedure on several flowers, always making the mistake with the style, it may in this peculiar way have caused either self- or cross-fertilization.

This honeysuckle is also visited by the hummingbird.

Lonicera oblongifolia, Muhl. Swamp Fly-Honeysuckle.

(Fig. 6.)

This is the rarest of the honeysuckles in our locality, a few full grown specimens still lingering in damp soil in the Menomonee Valley, at the foot of the bluffs, west of Wells Street Viaduct. The blooming season is short, from May 30 to June 10. The erect flowers are situated in pairs on long, slender peduncles. They are yellowish-white, more greenish towards the base, but a change of color to light purplish takes place in the older flowers, mostly on the third day. The corolla has a length of 12 mm., but it is deeply cleft between the two lips, leaving only 4 mm. for the length of the tube. As the two flowers of a pair stand close together, their entirely erect upper lips nearly come in contact with each other; the slender lower lip is recurved to one side

of the flower. The short tube of the corolla is 2 mm. wide at its mouth, but lower down it becomes dilated, forming a honey secreting gibbosity. Dense, white, wooly hairs, arising from the upper portion of the tube, as also from the style and the filaments, protect the honey in the erect flowers from rain and probably from the visits of intruders, ants for example. In the open flower the stamens gradually become longer and attain a length of 8 mm. outside of the tube, while the style is 1 mm. shorter. At first only the style and the 2 stamens next to the lower lip protrude from the newly opened flower; the style bends outwardly and takes up a position in the middle between the 2 stamens, which are divergent. The stigma is receptive from the time on it escapes from the bud, while the 2 neighboring anthers do not open as early. This slight degree of proterogyny is sufficient to insure cross-fertilization in many cases, as the flowers attract a numerous set of visitors. The 3 remaining stamens are usually erect, their anthers do not begin to dehisce until the 2 others have shed their pollen. The style retains its first position for about a day, and then it moves towards the upper lip; in the new position the stigma may touch an anther of one of the erect stamens and become self-fertliized, in case fertilization has not been accomplished previously. As the recurved lower lip is placed out of the way of the visitors, the latter are likely to alight on the protruding stamens and style. This is a contrivance favoring cross-fertilization, especially in the younger flowers, as long as the style is directed outwardly. The flowers emit a faint odor. In the following I give a list of the visitors observed.

A. Bees.

Apidae: (1) *Apis mellifica, L.* ☿ s.; (2) *Bombus americanorum, F.* ♀ ☿, s.; (3) *B. consimilis, Cr.* ♀ ☿, s.; (4) *B. edwardsii, Cr.* ♀, s.; (5) *B. pennsylvanicus, De G.* ♀☿, s.; (6) *B. ternarius, Say* ♀, s.; (7) *B. virginicus, Oliv.* ♀, s.; (8) *Ceratina dupla, Say* ♂, ♀, s. and cp.; (9) *Osmia albiventris, Cr.* ♀, s.; (10) *O. atriventris, Cr.* ♀, s.; Andrenidae: (11) *Halictus coriaceus, Sm.* ♀, s.; (12) *H. fasciatus, Nyl.* ♀, s. and cp.; (13) *H. similis, Sm.* ♀, s. and cp.; (14) *Agapostemon radiatus, Say* ♀, s.; (15) *Andrena vicina, Sm.* ♀, s.;

B. Birds.

(16) *Trochilus colubris, L.* s.

In regard to its floral structure, *Lonicera oblongifolia, L.*

resembles *L. nigra, L.,* a honeysuckle growing in the Alps, an account of which has been furnished by Hermann Mueller (12).

Lonicera Sullivantii, Gray. Sullivant's Honeysuckle.

It is the commonest species in this part of the country and the latest to appear, blooming from June 5 to July 2. Robertson (13) has published an account of its fertilization and reported the visits of 3 bees, 1 Syrphid-fly and the hummingbird. This is a bumble-bee flower, like *L. dioica,* resembling the latter in many respects and blooming directly after it. In this species too the flowers are in whorls at the ends of the branches and are mostly in a horizontal position. They are whitish-yellow, but later on change to purplish. The formation of a lower and an upper lip is much the same as in L. dioica. Flowers from our neighborhood present the following dimensions: The corolla tube has a length of 14 mm., a width of 4 mm. at its mouth and of 2 mm. in its narrowest portion, immediately above the nectar-secreting gibossity. Nectar is also secreted in small drops along the lower wall of the tube as far as the middle of the latter, and this accounts for the rather frequent visits of short-tongued bees, which are able to crawl into the mouth of the tube and reach these drops of honey. At the bottom of the tube honey accumulates to a height of 2 or 3 mm. and this can of course be obtained by long-tongued visitors only, such as bumble-bees, hawk-moths and hummingbirds. The stigma is 10 mm. from the mouth of the tube and about 1 mm. in advance of the anthers. As in L. dioica the flowers are homogamous or slightly proterogynous. I have repeatedly seen the style, bearing the receptive stigma protrude for a length of 3 to 5 mm. from the bud previous to its opening These cases furnish an excellent opportunity for cross-fertilization, which is brought about by bees crawling over the inflorescence, with pollen attached to the underside of their bodies. On sunny days the flowers may be observed opening at all times of the day.

The following is a list of the visitors as taken during the last two seasons:

A. Bees.

Apidae: (1) *Apis mellifica, L.* ♀, s.; (2) *Bombus americanorum, F.* ♀, s.; (3) *B. consimilis, Cr.* ♀ ♀, s.; (4) *B. edwardsii, Cr.* ♀, s.; (5) *Clisodon terminalis, Cr.* ♂ ♀, s.; (6) *Anthophora abrupta, Say.* ♂, s.; (7) *Synhalonia atriventris, Sm.* ♀,

12. H. Mueller. Alpenblumen, ihre Befruchtung, etc., p. 394-395.
13. C. Robertson. Flowers and Insects. XVIII. Bot. Gaz. Vol. XXV. (1898) p. 242.

s. and cp.; (8) *Ceratina dupla, Say.* ♀, s.; (9) *Megachile relativa, Cr.* ♀, s. and cp.; Andrenidae: (10) *Halictus coriaceus, Sm.* · ♀, cp.; (11) *H. forbesii, Rob.* ♀, cp.; (12) *H. similis, Sm.* ♀, s. and cp.; (13) *Augochlora vividula Sm.* ♀, cp.; (14) *Agapostemon radiatus, Say.* ♀, s.

B. Flies.

Syrphidae: (15) *Mesogramma marginata, Say,* fp.; (16) *Syrphus xanthostomus, Will.* fp.

C. Butterflies and Hawk-Moths.

Rhopalocera: (17) *Atrytone zabulon, Boisd.-Lec.,* s.; Heterocera: (18) *Hemaris diffinis, Boisd.,* s.

D. Birds.

(19) *Trochilus colubris, L.,* s.

As has been stated above, *Lonicera Sullivantii* is adapted to bumble-bees; 2 species of the latter: *Bombus americanorum* and *B. edwardsii* are the most frequent among the visitors, as I have often observed. The visits of the smaller bees are of slight significance. If they appear on the newly opened flowers, as long as the stamens and style are short and close together, they may, while collecting pollen at the same time touch the stigma and cause either self- or cross-fertilization. The hawk-moth: *Hemaris diffinis* and the hummingbird may be of benefit to the flowers, while the pollen-eating Syrphid-flies can render no services whatever.

REVIEW: Our species of Lonicera, which have been considered in the foregoing, are all adapted to bees. They differ from each other mainly in the length of their corolla tubes, *L. oblongifolia* having the shortest tube, with a length of 4 mm. only, while the longest tube, that of *L. Sullivantii* attains a length of 14 mm. in our locality, and of even 18 mm. in Southern Illinois, as reported by Robertson. The length of the stamens and style is also of much importance, as those of our honeysuckles with long and widely divergent stamens and a long style can hardly be efficiently visited by the small-bodied bees, but have to rely to a certain extent on the cooperation of bumble-bees.

The following table refers to the number of visitors, as observed on our 5 species of Lonicera in different localities:

		Bumble-Bees.	Other Bees.	Syrphid-Flies	Butterflies & Hawk-Moths.	Hummingbird	Total.
Bee-Flowers.							
L. oblongifolia	Milwaukee, Wis	6	9			1	16
L. tatarica (14)	Germany		3	1			4
L. tatarica	Milwaukee, Wis	5	6	1	1	1	14
Bumble-Bee Flowers.							
L. ciliata (15)	Maine	1	?				?
L. ciliata	Milwaukee, Wis		6				6
L. dioica	Milwaukee, Wis	2	7			1	10
L. Sullivantii (16)	Southern Illinois	2	1	1		1	5
L. Sullivantii	Milwaukee, Wis	3	11	2	2	1	19

A glance at the figures of this table, furnishes evidence of the important part, taken by bees in the fertilization of these flowers, as the visits recorded above give an average of 83% in favor of the bees. The species adapted to the smaller bees are also frequently visited by bumble-bees, and on the other hand the smaller bees pay much attention to the bumble-bee-flowers. The absence of wasps from these flowers is worthy of mention; I have not witnessed the visit of a single wasp to any of these honeysuckles. The latter seem to be rather attractive to the hummingbird, this visitor having been observed on all our species, with the exception of *L. ciliata,* the first of our honeysuckles to appear in spring.

NOTE—It affords me great pleasure to express my thanks to a number of gentlemen, wno have kindly aided me in various ways in connection with this paper: To Mr. J. A. Brandon, the treasurer of our society, who made the drawings of the flowers, reproduced on the accompanying plate; to Mr. Wm. H. Ashmead and Mr, D. W. Coquillett, both from the division of entomology of the Department of Agriculture, Washington, D. C., for the courteous help given me, in determining many of the hymenopterous and dipterous insects taken on the flowers.

(14) H. Mueller, loc. cit., p. 364 and Weitere Beobachtungen, p. 235.

(15) John H. Lovell, loc. cit., p. 46.

(16) C. Robertson, loc. cit., p. 242.

The American Crocodile.

By GEO. A. WEST.

A desire to see the Everglade country of Florida more thoroughly than is possible to ordinary tourists, led to the formation of a party to spend a portion of the winter of 1892 there.

The party consisted of Prof. Carl E. Akeley, W. H. Ellsworth, Dr. E. W. Beebe and the writer. It gives me pleasure to acknowledge that it would have been impossible to accomplish much, had it not been for the cheerful and efficient aid which my companions rendered.

A true crocodile, *Crocodilus Americanus*, is found only in Florida, and from careful investigation, I am convinced inhabits not to exceed fifteen square miles of country. We found one colony of them living in Indian Creek, about six miles north of Miami, and others making their homes in two unnamed creeks, about half a mile apart, and extending back from Black Water Bay, four or five miles to the Everglades. Our native guides, who were familiar with every foot of Southern Florida, insisted that the crocodile lived in only these two locations and that no alligator existed within several miles of the abodes of these reptiles. We attributed this to the fact that the crocodile is much larger, more active and savage than the alligator, and doubtless wages a war of extermination against him.

We found the American crocodile inhabiting nothing but brackish water; not marshy streams of fresh water and mud banks, as they are claimed to do by most writers. Their homes were in clear water; their sunning beds on the highest and dryest banks they could find, and every particle of earth was invariably cleared away, leaving the white, clean coral for a bed. Their places of retreat were caves in the coral; never muddy bottoms like those of the alligator. The fact that they do not hibernate there may account for their having cleaner habits than is attributed to other species of the same genus.

Their exceeding wildness made it nearly impossible to get within rifle shot while in their sunning beds, and despite the fact that most writers credit these reptiles with depending principally on their sense of hearing and smell, I am convinced that their keenness of sight is equal to that of any animal. Observations at short range were had by the writer from the branches of a convenient tree, located on the bank of Caesar's pool, a clear,

deep spring of a quarter of an acre in extent, with outlet into Indian Creek, through which frequent visits were made by the reptiles. They would occasionally come in, make a circuit of the pool, and invariably halt opposite my point of observation, although I was exceedingly careful not to move, they would at once fasten their eyes on me, remaining in the same position for an hour at a time, only occasionally winking and working the valves of their ears and nose. One visitor was an old female with two young, each probably 16 inches long. As she passed, the old fellow opposite me made a quick lunge at one of the little fellows; instantly the female was upon him and a terrible struggle followed, resulting in his being driven out of the pool. The mother then swam around and around, apparently hunting for her young, seemingly in great distress, and plainly indicating considerable natural affection for her offspring.

Not being able to induce any one of my visitors to present enough of his head above the water to offer a fair rifle shot, a wounded pelican was obtained and hung from an overhanging limb, within two feet of the water, but Mr. Crocodile could not be induced to touch it. The bird was then allowed to swim around the pool, and although five crocodiles were in sight, none seemed to have a taste for fowl. One, however, made a lightning-like dash, catching a fish of the drum variety, weighing about three pounds.

The second day's watch resulted in my getting a successful shot at one, and later we obtained several specimens, one of which was a badly scarred and tailless veteran, twelve feet in length. We occasionally located one in the bottom of a stream and found it possible to row our boats over it, without its moving, provided we did not look down, but the moment our eyes were turned toward the reptile, it would dart away with lightning-like speed.

Three were captured by means of "graining," that is, striking them with a two-tined spear in the back of the neck. When one was struck it would dash up or down the stream a short distance, towing our boat after it, then stop and roil the water; we would then row our boat over the place and carefully place a wire noose over its nose, when it would at once feign death and allow us to take it into our boat with impunity. Contrary to the common idea, we found that they did not use their tails for striking, but invariably struck a side blow with their long and bony heads. When attacked it would hiss like a serpent and emit a strong odor of musk from glands located in the lower part of its jaw. They

are of a drab or lead color on the back and sides, shading into a white below, and we judge do not grow to exceed sixteen feet in length.

We found the dermal armor quite deficient of bony plates, so far as the neck was concerned, thus accounting for more freedom of motion of the head than is generally the case with this family. As is common to all crocodiles, the toes, of which there are five on each of the anterior limbs and four on the posterior pair, are considerably webbed, while the three inner ones are provided with claws, the hind limbs being handsomely fringed.

The tongue seemed to be attached all around to the bottom of the mouth; the lungs confined to the thorax; the heart four valved, the venal and arterial blood mingling outside the heart. Traces of a diaphram were very pronouncd in one specimen, thus showing an approach in organization to the warmer blooded animals, and beyond doubt placing them among the highest order of living reptiles. The teeth are distinctly socketed, with exactly thirty-six on upper jaw and thirty on lower, the two second teeth of the lower jaw, when the mouth is closed, projecting through holes in the upper jaw, and the tenth tooth of the upper jaw being by far the largest. The fourth, or canine teeth, so-called, of the lower jaw, are the largest on that jaw. Each tooth contained from one to four smaller teeth, one fitting closely over the other. The brain cavity was about double the size of that of the alligator. The stomachs of two which we examined contained only fragments of fish and turtle. The writer concluded that the American Crocodile is particular with his diet, never eating dead things when he can kill his own food, and that he does not take food to his cave and let it putrify, as many writters suggest; possibly, however, because of the abundance of food in his American home.

We heard none make a noise of any kind, excepting the hiss common to reptiles, and while we "grunted" out alligators from their muddy retreats with ease, our efforts in this direction with the crocodile were futile.

Additions to the Flora of Milwaukee County.

By W. J. BENNETTS.

A Second Supplement to W. M. Wheeler's "Flora of Milwaukee County."

In 1888, a list of the flowering plants and ferns of Milwaukee county by W. M. Wheeler, then curator of the Milwaukee Public Museum, was published in the transactions of this society. It contained the names of 691 species and was followed in 1889 by a supplementary list containing 58 additional names.

Since that date no work appears to have been done in the way of cataloguing our Milwaukee wild plants until the past year, 1899, when the botanical section of the Milwaukee Natural History Society inaugurated among its members what might be termed a "co-operative card catalogue" system of collecting and recording facts relating to our local flora. As, however, it will be several years before sufficient data can in this way be accumulated to warrant the publishing of the elaborate report this system appears to render possible, it has been thought best to publish at intervals the names of such additions to our flora as have become known since the publication of the previous list.

The list which follows contains 82 species, bringing the number thus far recorded for Milwaukee county up to 831. In compiling it, the writer has had the cheerful co-operation of three of our local botanists, Dr. S. Graenicher, and Messrs. Ernest Bruncken and Philip Wells. Dr. Graenicher has contributed the following 10 numbers of the list: 769, 770, 778, 780, 800, 804, 820, 823, 826, 831. Mr. Wells furnished 14 names, viz. numbers 753, 754, 764, 772, 776, 781, 788, 794, 796, 802, 803, 821, 828, 830; while the following 11 were supplied by Mr. Bruncken: numbers 760, 763, 779, 799, 806, 808, 809, 810, 811, 812, 813. Of the remaining 47 numbers 45 were supplied by the writer and 2 by P. H. Dernehl.

An examination of this list of plants shows that they admit of being arranged into 4 classes. In the first class can be placed those species that have been introduced from Europe or Asia. Some of these are troublesome weeds like the Russian Thistle *Salsola Targus, L.*), the remainder are in general plants that have escaped from gardens or from cultivated fields. This group contains 21 species as follows: *Anagallis arvensis, L., Aquilegia vulgaris, L., Bromus hordeaceus, L., Crateagus Oxyacantha, L., Echium vulgare, L., Eragrostis*

major, Host., Genista tinctoria, L., Lepidium ruderale, L., Lonicera Japonica, Lonicera Tatarica, L., Ranunculus acris, L., Rhamnus cathartica L., Rosa rubiginosa, L., Salix babylonica, L., Salix pentandra, Salsola Tragus, L., Sisymbrium altissimum, L., Silene vulgaris, Garcke, Trifolium dubium, Sib·th., T. agrarium L., and T. incarnation L.

A second class may be formed of 5 American species that are eastern in their range; never having been reported as far as the writer knows any farther west than the state of Indiana, so that their occurrence here is equivalent to an extension of the western limit of their range. These species are: *Aster Shortii, Hook., Aster Lowrieanus, Porter., Bromus hordeaceus, L., Conopholis Americana, Wallr., and Leptamnium Virginianum Raf.*

Six species have come to us from the west and as they have all been found growing chiefly, if not exclusively, along the railway tracks of the city, their seeds were no doubt first introduced here by railway trains from the states west of us. These species are: *Gaertneria acanthicarpa, Britton, Helianthus scaberrimus, Ell., Linum Lewisii, Pursh., Ratibida columnaris, Don., Solanum rostratum, Dunal. and S. triflorum Nutt.* Two European species, *Sisymbrium altissimum, L.*, and *Salsola Tragus, L.*, may also be placed in this class as they first established themselves in the Western states and are now extending their range eastward.

With the exception of 2 tropical species, *Datura Metel, L.*, and *Ipomoea purpurea, Roth.*, which have escaped from gardens, the 50 species remaining are native plants, whose range overlaps the area considered in the list, and which one might therefore expect to occur in our county wherever the natural conditions are suited to the habits of the species.

The nomenclature followed is that of Britton & Brown's "Illustrated Flora of the Northern United States and Canada," edition of 1898. In a few cases, however, the more familiar names of Gray's Manual have been added in parenthesis.

List of Species.

750 Æsculus glabra, Willd. Ohio Buckeye. A shade tree along Hanover Street on the South Side.

751 Alnus Alnobetula, K. Koch. Mountain Alder. Near Oakwood station in township of Oak Creek.

752 Amelanchier rotundifolia, Roem. Round-leaved June-berry. Occasional along the east bank of the Milwaukee River.

753 Anagallis arvensis, L. Scarlet Pimpernell. By the roadside on Hawley Road, south of National Ave.

754 Aplectrum spicatum, B. S. P. Adam and Eve Orchid. Koeffler's Woods, Wauwatosa; Reynold's Woods, Greenfield.

755 Aquilegia vulgaris, L. European Columbine. Has been found along the Milwaukee River (P. H. Dernehl).

756 Asclepias tuberosa, L. Butterfly Weed. I found a number of specimens of this milkweed in 1895 in an open space in a woods a mile and a half south of South Milwaukee.

757 Aster azureus, Lindl. Sky Blue Aster. In the Menomonee Valley and along the Milwaukee River.

758 Aster Shortii, Hook. With the last, in the Menomonee Valley and in the northwestern part of the county.

759 Aster Lowrieanus. Porter. Lowrie's Aster. Common around Milwaukee along with *A. cordifolius* which it much resembles.

760 Betula lutea, Mich. f. Yellow Birch. Two places in Town of Wauwatosa.

761 Bromus hordeaceus, L. Soft Chess. Menomonee Valley and elsewhere.

762 Carex hystricina, Muhl. Porcupine Sedge. Whitefish Bay and Menomonee Valley.

763 Celtis occidentalis L. Hackberry. Menomonee Valley and Mud Creek.

764 Chenopodium Boscianum, Moq. Bosc's Goosefoot. Vacant lots near Coldspring show grounds.

765 Conopholis Americana, Wallr. Squaw Root. On the east bank of Milwaukee River near Mineral Spring Park, also at South Milwaukee.

766 Crataegus Oxyacantha, L. Hawthorn. Along fences within the city limits—escaped from gardens.

767 Crataegus mollis, Scheele. Not rare throughout the county.

768 Cyperus esculentus L. Yellow Nut Grass. Milwaukee River near the Cement Mills.

769 Cynoglossum Virginicum, L. Wild Comfrey. In woods at Bay View.

770 Dasystoma (Gerardia) grandiflora, Wood. Bay View, in open woods.

771 Datura Metel, L. In waste places within the city—an escape from gardens.

772 Echium vulgare, L. Viper's Bugloss. Along Northwestern R. R. tracks opposite Mineral Spring Park.

773 Eleocharis palustris glaucescens, Gray. Near the Cement Works on the Milwaukee River.

774 Epilobium Hornemanni, Reichenb. Near the Milwaukee River in S. E. quarter of section 18, Township of Milwaukee.

775 Eragrostis major, Host. Menomonee Valley near Sixth Street Viaduct.

776 Gaertneria acanthicarpa, Britton. Hooker's Gaertneria. Along the St. Paul tracks near West Milwaukee.

777 Gaultheria procumbens L. Creeping wintergreen. In a woods in N. E. part of the county (P. H. Dernehl).

778 Gaura biennis L. Numerous in the Menomonee Valley near the Grant Marble Works.

779 Genista tinctoria, L. Base Broom. At Juneau Park. (E. Bruncken.)

780 Geranium Carolinianum, L. Carolina Crane's Bill. A single specimen found in a dry pasture south of National Ave. at Silver City. (Dr. S. Graenicher.)

781 Gyrostachys (Spiranthes) cernua, Kuntz. Nodding Ladies' Tresses. In a wet meadow southwest of the city near the Janesville Road. (P. Wells.)

782 Helianthus scaberrimus, Ell. Near the Northwestern R. R. tracks foot of Florida Street.

783 Heteranthera dubia, MacM. Western Star Grass. In the Milwaukee River near the Cement Works.

784 Impatiens aurea Muhl. Pale Touch-me-not. Common in Perine's Woods on the Milwaukee River, Section 18, Town of Milwaukee.

785 Impomoea purpurea Roth. Morning Glory. Escaped from gardens and growing along fences and in waste places within the city limits.

786 Lactuca Scariola L. Prickly Lettuce. A troublesome weed everywhere.

787 Lepidium ruderale L. Narrow-leaved Pepper Grass. Waste places in the city.

788 Leptamnium (Epiphegus) Virginianum, Raf. Beech Drops. Cancer Root. In a grove north of the city limits near Oakland Avenue.

789 Lithospermum latifolium, Michx. American Gromwell. In a woods near Lisbon Road, Town of Wauwatosa.

790 Lilium superbum L. Turk's Cap Lily. In a woods near Whitefish Bay—rare.

791 Linum Lewissi, Pursh. I found this species or the *L. perenne* of Europe for two successive years growing in a vacant lot on the East Side.

792 Lonicera Japonica. Thunb. Escaped from cultivation in a few places in and near the city.

793 Lonicera Tatarica, L. Tartarian Bush Honeysuckle. Common in the vicinity of Milwaukee.

794 Œnothera rhombipetala, Nutt. Rhombic Evening Primrose. Northwestern R. R. tracks near Juneau Park.

795 Panicum Porterianum, Nash. Porter's Panicum. Banks of Milwaukee River near Mineral Spring Park, also in Wauwatosa.

796 Potentilla arguta, Pursh. Tall Cinquefoil. In Town of Milwaukee north of the city.

797 Polygonum Hartwrightii, Gray. In a swamp in woods west of Soldiers' Home grounds.

798 Polygonum punctatum, Ell. Water Smart-weed. In the Menomonee Valley near the Wells Street viaduct.

799 Quercus velutina, Lam. (Q tinctoria, Bart.) Quercitron. Menomonee Valley.

800 Ranunculus Pennsylvanicus, L. Bristly Buttercup. Near a tamerack swamp by New Coeln.

801 Ranunculus acris, L. Tall Buttercup. Menomonee Valley and waste places on the West Side.

802 Ratibida columnaris, (Sims.) D. Don. Prairie Cone Flower. Wauwatosa near the pumping station of garbage plant.

803 Rhamnus cathartica, L. Buckthorn. Escaped from hedges near the Lisbon road in Township of Wauwatosa.

804 Ribes rubrum, L. Red Currant. Dr. S. Graenicher has found this species in the Menomonee Valley near the Wells Street viaduct also in a woods west of Soldiers' Home.

805 Rosa rubiginosa, L. Sweetbrier. I have found this rose growing in a meadow along Oak Creek, also along fences near the Lisbon Road.

806 Salix Bebbiana, Sarg. Bebb's Willow. Occasional throughout the county.

807 Salix candida, Fluegge. Hoary Willow. In a former tamerack—S. W. quarter of Section 22, Town of Oak Creek.

808 Salix Babylonica, L. Weeping Willow. Occasionally this species or some of its varieties is found growing wild.

809 Salix discolor, Muhl. Glaucous Willow. Our earliest blossoming willow, common in moist places throughtout the county.

810 Salix nigra, Marsh. Black Willow. One of our commonest willows.

811 Salix nigra falcata (Pursh), Torr. Occasional throughout the county.

812 Salix amygdaloides, Anders. Peach-leaved Willow. Very common in swamps.

813 Salix pentandra. Occasionally found growing wild.

814 Sambucus pubens, Michx. Red Elder. In the southwest part of the county—rare.

815 Salsola Tragus, L. Russian Thistle. Rapidly spreading and monopolizing waste places and vacant lots around the city especially where the sod has been removed.

816 Scirpus Americanus, Pers. Perine's Woods on the Milwaukee River.

817 Sisymbrium altissimum, L. A common weed in some parts of the city.

818 Silene vulgaris (Moench), Garcke. Bladder Campion. I found a few plants growing along the Janesville Road about three miles from the city in 1897.

819 Silphium perfoliatum, L. Indian Cup . Common along the Mukwonago Road about a mile S. W. of North Greenfield.

820 Smilax ecirrhata, S. Wats. Upright Smilax. Frequent throughout the county.

821 Solanum rostratum, Dunal. Sand Bur. Waste places and Railway tracks—occasional.

822 Solanum triflorum, Nutt. Cut-leaved Nightshade. Along Railway tracks in the Menomonee Valley near the Sixth Street viaduct.

823 Synosma (Cacalia) suaveolens (L) Raf. Sweet Scented Indian Plantain. East bank of Milwaukee River near Mineral Spring Park.

824 Symphoricarpos occidentalis, Hook. Wolfberry. In the Menomonee Valley.

825 Tofieldia glutinosa, (Michx.) Pers. Lake bluffs from Whitefish Bay northward, also reported from south of the city.

826 Trillium nivale Riddell. Snow Trillium. Dr. Graenicher, who has observed this species growing along the Menomonee river just west of Wauwatosa declares it to be our earliest entomophilous flower, blooming some years as early as April 19th.

827 Trillium erectum, L. Common throughout the county especially north and west.

828 Trifolium dubium, Sibth. Least Hop Clover. North Greenfield and fifteenth ward.

829 Trifolium agrarium, L. Hop Clover. I have found it in the Menomonee Valley. It has been found near Cudahy by C. E. Brown.

830 Trifolium incarnatum, L. Italian or Napoleon's Clover. Banks of Honey Creek in Wauwatosa.

831 Verbena stricta, Vent. Hoary Vervain. Along railway tracks west of Layton Park.

The Syrphidae of Milwaukee County.

By Dr. S. GRAENICHER.

Of all the insects visiting flowers in search of honey and pollen, none are more apt to attract the attention of the observer, than the flies belonging to the family of Syrphidae. They display an elegance of form and markings, and a gracefulness in their movements, when on the wing, which rarely fail to win our admiration. As agents in transferring pollen from one flower to another, and thereby effecting cross-fertilization, they are of the utmost importance. Some of the species are represented by great numbers of individuals, and may, in our latitude, be observed as flower-visitors from the beginning of April to the later part of October. The species which never resort to flowers are few in number.

During the past five years, while studying the mutual relations of flowers and insects, I have become acquainted with 64 species of Syrphidae, occurring within the limits of Milwaukee county, few of which have hitherto been recorded from the State of Wisconsin. In the following I present a list of these species, and accompany the name of each with a few remarks, pertaining to the time of flight, the geographical distribution of the species and the flowers visited by the insect at the date of capture referred to:

1. Microdon tristis, Loew. Rare. 3 ♂ *specimens taken in June, flying along dry, sunny paths, near the ground. I have never observed this species as a flower-visitor. Previously reported for the Atlantic States, Oregon and the Mackenzie River.
2. Paragus bicolor. Fabr. Not common. From May (on flowers of *Mitella diphylla, L.*) to September (on flowers of *Aster lateriflorus (L.) Britt).* Occurs in Europe and North America. Has been recorded from Connecticut, Washington, Montana southward to New Mexico, and also from Illinois.
3. Paragus tibialis, Fallen. Not commoner than the preceding. Fron May (on flowers of *Veronica serpyllifolia, L.*) to October (on flowers of *Eupatorium ageratoides, L.*). Inhabits Europe and North America and has been recorded from the New England States, California, New Mexico and Illinois.

(*) ♂ Male ♀ Female

4. Pipiza femoralis, Loew. Rare. 1 ♂ and 1 ♀ taken in May on the flowers of *Ribes cynosbati, L.*

   Previously recorded from Pennsylvania and Illinois.

5. Pipiza pistica, Will. Rare. 1 ♂ and 2 ♀ taken in May and September. One of these specimens was obtained from the flowers of *Agastache scrophulariaefolia, (Willd.) Kuntze,* and another one from the flowers of *Solidago Canadensis, L.*

   Described from 2 ♀ specimens, captured in Connecticut and also recorded from Illinois.

6. Chrysogaster pulchella, Will. Rare. 1 ♀ taken in June on the flowers of *Angelica atropurpurea, L.*

   Previously recorded from the New England States and Canada.

7. Chrysogaster nitida, Wied. Although not common, it is the species of Chrysogaster generally observed in our neighborhood. From June (on umbels of *Thaspium trifoliatum aureum, (Nutt.) Britt.*. to October (on flowers of *Hamamelis Virginiana, L.*).

   Occurs in South America and North America and has been recorded from the Atlantic States, Illinois and Kansas.

8. Chrysogaster pictipennis, Loew. Rare. From May (on catkins of *Salix lucida, Muhl.*) to July (on flowers of *Solidago serotina, Ait.*).

   Has been recorded from the Atlantic States, Illinois and Nebraska.

9. Chilosia cyanescens, Loew. Not common. 7 ♂ specimens and a single ♀ taken in May and June on the flowers of *Uvularia grandiflora, Smith.* and *Caltha palustris, L.,* mostly on the latter.

   Previously reported for Connecticut, New Hampshire and Illinois.

10. Melanostoma obscurum, Say. Not rare. From April (on catkins of *Salix discolor, Muhl.*) to October (on flowers of *Aster cordifolius, L.*)

    Has been recorded from the Atlantic States and Illinois.

11. Melanostoma mellinum, L. Rarer than the preceding. Has been captured in April (on catkins of *Salix discolor, Muhl.*) and May (on flowers of *Valeriana edulis, Nutt.*)

    Inhabits Europe and North America and has been recorded from the Atlantic and Pacific States, Kansas and Illinois.

12. Platychirus quadratus, Say. A common species, occurring from May (on flowers of *Saxifraga Pennsylvanica, L.*) to August (on umbels of *Sium cicutaefolium, Gmelin*).

Previously reported for the Eastern, Middle and Pacific States.

13. Platychirus hyperboreus, Staeg. Not common. From July to September, preferably on the flowers of umbelliferous plants (*Oxypolis rigidus, (L.) Britt.*, and *Coniose-linum Chinense (L.) B. S. P.*)

Has been reported for the Atlantic States, Illinois Colorado and for Greenland.

14. Platychirus peltatus, Meig. Rare. 2 ♀ specimens taken in June.

Inhabits Europe and North America. Has been reported for a few Atlantic States and Alaska.

15. Syrphus arcuatus, Fallen. Rare. 1 ♀ taken in September.

Occurs in Europe and North America and has been observed throughout the northern part of the United States, from the Atlantic to the Pacific coast, extending its range southward as far as Colorado and northward to Hudson's Bay Territory and Nova Scotia.

16. Syrphus ribesii, L. Very common throughout the season, from April (on catkins of *Salix discolor, Muhl.*) to October (on flowers of *Hamamelis Virginiana, L.*)

Inhabits Europe and North America, from the Atlantic to the Pacific States, south to Arizona, north to Canada.

17. Syrphus torvus, O. S. Not common. Taken in September and October on flowers of *Aster laevis, L.*

Inhabits Europe, North America and Siberia. Has been recorded from various points of this continent, from the Atlantic to the Pacific coast, south to Colorado and north to Greenland.

18. Syrphus lesueurii, Macq. Rare. A single ♂ specimen captured in June on the umbels of *Cicuta maculata, L.*

Previously recorded from the New England States, Washington and Alaska.

19. Syrphus americanus, Wied. An abundant species throughout the season, from April (on catkins of *Salix discolor, Muhl.*) to October (on flowers of *Hamamelis Virginiana, L.*)

Has been recorded from the Atlantic States to Montana, from Canada and Texas.

20. Syrphus umbellatarum, O. S. Rare. Taken in August visiting the flowers of 2 species of Umbelliferae (*Oxypolis rigidus, (L.) Britt.,* and *Conioselinum Chinense (L.) B. S. P.*)

    Previously reported for New Hampshire, Arizona and Alaska.

21. Syrphus xanthostomus; Will. Rare. 1 ♂ and 1 ♀ the latter taken in June on the flowers of *Lonicera Sullivantii, Gray.*

    Has been previously recorded from Pennsylvania and Ohio.

22. Didea fasciata fuscipes, Loew. Not common. From June (on umbels of *Angelica atropurpula, L.*) to August (on umbels of *Oxypolis rigidus, (L.) Britt.*).

    Reported for Connecticut, Pennsylvania, Ohio and Illinois.

23. Xanthogramma flavipes, Loew. Very rare. A single ♂ specimen captured in May.

    Previously reported for 3 Atlantic States.

24. Allograpta obliqua, Say. A common species, from May (on umbels of *Thaspium trifoliatum aureum, (Nutt.) Britt.*) to October (on flowers of *Hamamelis Virginiana, L.*)

    An inhabitant of North and South America (Argentine Republic). Recorded from different parts of the United States, from the Atlantic to the Pacific Ocean.

25. Mesogramma (Mesograpta) polita, Say. Not rare, flying in autumn. Taken in September (on umbels of *Sium cicutacfolium, Gmelin.*) and October (on flowers of *Aster cordifolius, L.*)

    Recorded from several states of the Atlantic coast, from Illinois and Kansas and from Cuba.

26. Mesogramma marginata, Say. Abundant from May (on flowers of *Sanguinaria Canadensis, L.*) to October (on flowers of *Aster laevis, L.*)

    Occurs throughout the northern part of the United States, from the Atlantic to the Pacific coast, and has been reported for Florida in the South.

27. Mesogramma geminata, Say. Abundant throughout the season, from April (on catkins of *Salix discolor, Muhl.*) to October (on flowers of *Hamamelis Virginiana, L.*)

    Inhabits South and North America. Has been recorded from the Atlantic and Pacific States and from Illinois.

28. Sphaerophoria cylindrica, Say. Abundant from May (on flowers of *Mitella diphylla, L.*) to October (on flowers of *Hamamelis Virginiana, L.*)

Previously recorded from the New England States, Illinois, Minnesota and Washington, as also from Canada and Nova Scotia.

29. Neoascia globosa, Walk. Rare. A few specimens taken in May (on flowers of *Amelanchier Canadensis, (L.) Medic.* and June (on flowers of *Unifolium Canadense, (Desf.) Greene*).

Has been recorded from the New England States and Oregon.

30. Neoascia distincta, Will. This is a very rare species. The only specimen in my collection is a ♀, captured in May.

This species was described from 2 ♀ specimens collected in Massachusetts and has not, to my knowledge, been recorded from any other part of the United States.

31. Baccha clavata, Fabr. (B. Babista, Walk.) Not frequent. From June (on umbels of *Thaspium trifoliatum aureum, (Nutt.) Britt.*) to August (on flowers of *Verbena urticifolia, L.*)

This is a southern species and has been previously recorded from Mexico, Florida, Georgia, Arizona, California and Nebraska.

32. Baccha fuscipennis, Say. Commoner than the preceding, from June to August in shady woods. I have never seen this species on flowers.

It extends its range southward as far as San Domingo and Guadeloupe and has been reported for the New England States, Ohio, Illinois and Kansas.

33. Baccha aurinota, Harris. This is the rarest of our species of Baccha. 2 ♂ specimens were obtained by me 2 years ago in the first week in September, visiting the flowers of *Solidago Canadensis, L.;* an additional ♂ was taken last season, at the same time of the year by Mr. Paul Dernehl.

Previously recorded from Canada, a few Eastern States, Ohio and Indiana.

34. Rhingia nasica, Say. Rare. A single ♂ taken in August, visiting the flowers of *Impatiens biflora, Walt.* and 2 ♀ in October on flowers of *Polymnia Canadensis, L.*

Has been reported for the Atlantic States, Kentucky, Ohio, Indiana and Illinois.

35. Sericomyia militaris, Walk. Not frequent. I have observed this species in September, visiting the flowers of several species of Compositae, as for example *Aster puniceus, L.* and *Soildago caesia, L.*

Ranges northward as far as Nova Scotia and Hudson's Bay Territory, and has been recorded from a few Eastern States, Colorado and New Mexico.

36. Eristalis tenax, L. Abundant throughout the season, from April (on catkins of *Salix discolor, Muhl.*) to October (on flowers of *Hamamelis Virginiana, L.*)

Inhabits Europe, Africa, Asia, Japan and North America, and has been reported for many of the states.

37. Eristalis aeneus, Fabr. Not frequent, but occurring at all times of the season, from April (on catkins of *Salix discolor, Muhl.*)to October(on flowers of *Aster laevis, L.*)

Inhabits Europe, Africa, Syria and North America and has been reported for New York, Ohio and Illinois.

38. Eristalis dimidiatus, Wied. A very common species on flowers, from April (on catkins of *Salix discolor, Muhl.*) to September (on flowers of *Aster puniceus, L.*)

Has been previously recorded from the Eastern States to Ohio, Illinois and Kansas.

39. Eristalis meigenii, Wied. (E. brousi, Will.) Rather frequent, from April to October (on flowers of *Aster laevis, L.*)

This species has a wide range of distribution in this continent, going northward to Nova Scotia and Alaska, southward to South America; within the United States it has been recorded from the Eastern, Middle and Western States to Idaho.

40. Eristalis bastardi, Macq. Not common. From May (on flowers of *Prunus Americana, Marsh.*) to October (on flowers of *Aster laevis, L.*)

Occurs as far north as Nova Scotia and Labrador, and has been reported for the New England States, Ohio and Illinois.

41. Eristalis flavipes, Walk. Not common. From July (on flowers of *Solidago serotina, Ait.*) to October (on flowers of *Aster laevis, L.*)

Previously recorded from British Columbia, Washington, Minnesota, Illinois, Michigan, Ohio and the New England States.

42. Eristalis transversus, Wied. An abundant species, from May (on flowers of *Senecio palustris, (L.) Hook.*) to October (on flowers of *Hamamelis Virginiana, L.*).

An inhabitant of the Atlantic States, from Canada to Florida and also reported for Ohio and Illinois.

43. Eristalis vinetorum, Fabr. Very rare. 2 ♀ specimens captured, one in August on the flowers of *Solidago serotina, Ait.* and the other in September on the flowers of *Solidago Canadensis, L.*

This species extends southward to Cuba and Brazil and has otherwise been recorded from Mexico, a few Southern States, Illinois, Indiana and Pennsylvania.

44. Helophilus latifrons, Loew. Not as common as the next, for which it is easily mistaken. Captured in September on the flowers of *Aster laevis, L.*

Has been previously recorded from the Atlantic to the Pacific States and Texas.

45. Helophilus similis, Macq. Abundant, from April (on catkins of *Salix discolor, Muhl.*) to October (on flowers of *Aster cordifolius, L.*).

Reported for New England, Canada, Indiana, Illinois, Kansas and California.

46. Helophilus laetus, Loew. Not frequent. Taken in May (on flowers of *Vagnera stellata, (L.) Morong.*) and July (on umbels of *Pastinaca sativa, L.*)

Has been previously recorded from 2 Eastern States and Illinois, and is one of the few species, which has been formerly reported for Wisconsin.

47. Helophilus chrysostomus, Wied. Rare. From May (on flowers of *Vagnera stellata, (L.) Morong.*) to August (on flowers of *Alisma Plantago-aquatica, L.*)

Recorded from several Eastern States and Georgia.

48. Helophilus distinctus, Will. Very rare. I have so far taken only a single specimen of this species.

Previously reported for Connecticut, Pennsylvania and Virginia.

49. Helophilus conostomus, Will. Rare. Taken in June on flowers of *Symphoricarpos racemosus, Michx.* and July on flowers of *Carduus arvensis, (L.) Robs.*

Previously reported for the Atlantic States from Canada to New York and for Illinois.

50. Mallota posticata, Fabr. Not frequent. Captured in May and June (on flowers of *Unifolium Canadense (Desf.) Greene.*)

Occurs in the Atlantic States from Canada to Pennsylvania, and has also been recorded from Indiana.

51. Mallota cimbiciformis, Fallen. Not frequent. From June (on flowers of *Vagnera stellata, (L.) Morong.*) to July (on flowers of *Cicuta maculata, L.*)

Previously recorded from the Atlantic States (Canada to Georgia) and besides from Ohio, Illinois and Nebraska.

52. Triodonta curvipes, Wied. Rare. 7 ♂ specimens of this beautiful fly taken in July on the flowers of *Carduus arvensis, (L.) Robs.*

Has been reported for New England, Mexico, Colorado and California.

53. Tropidia quadrata, Say. A common species from May (on flowers of *Vagnera stellata, (L.) Morong.*) to August (on flowers of *Gerardia tennifolia, Vahl.*)

Has been recorded from the New England States, Canada and Nova Scotia in the East and Ohio, Illinois and Washington in the West.

54. Criorhina (Cynorhina) analis, Macq. Rare. 4 ♂ and 1 ♂ taken in May and June. None of these specimens were observed on flowers.

Reported for the Eastern States.

55. Criorhina (Somula) decora, Macq. Very rare. 1 ♂ specimen obtained in June.

Previously recorded from the Eastern and Middle States, as also from Illinois.

56. Crioprora cyanogaster, Loew. Rare. This is an early flying species. I have captured 1 ♂ and 2 ♀ specimens in April (on catkins of *Salix discolor, Muhl.*) and May (on flowers of *Solidago serotina, Ait.*)

Reported for Pennsylvania and Colorado.

57. Xylota ejuncida, Say. Not frequent. From May to July (on flowers of *Solidago serotina, Ait.*)

Occurs throughout the United States, from the Atlantic to the Pacific coast and from Canada to Alaska.

58. Xylota fraudulosa, Loew. Rarer than the preceding. 3 ♂ specimens taken in July.

This species has been observed throughout the northern part of the United States, from the Atlantic to the Pacific coast, and has been previously recorded from Wisconsin.

59. Xylota chalybea, Wied. Very rare. A single ♂ specimen taken in July, but not visiting flowers.

Reported for Pennsylvania, Virginia, Ohio and Illinois.

60. Syritta pipiens, L. A very common species throughout the season, from April (on catkins of *Salix discolor, Muhl.*) to October (on flowers of *Hamamelis Virginiana, L.*)

An inhabitant of Europe, Africa, Asia and North America, occurring all over the United States.

61. Spilomyia longicornis, Loew. Not frequent. Several specimens taken in August on flowers of *Eupatorium perfolitatum, L.* and *Solidago Canadensis, L.*

Has been recorded from the New England States, Texas, Ohio, Illinois and Kansas.

62. Spilomyia fusca, Loew. Rare. One ♂ specimen taken in July (on flowers of *Solidago serotina, Ait.*) and one ♀ taken in August (on flowers of *Eupatorium ageratoides, L.*)

Previously recorded from the Eastern States, from Canada to Georgia.

63. Spilomyia quadrifasciata, Say. Not frequent. From July (on flowers of *Solidago serotina, Ait.*) to September (on flowers of *Solidago Canadensis, L.*).

Reported for the Atlantic States, Illinois and Nebraska.

64. Milesia ornata, Fabr. Very rare. The only specimen I have seen, is a ♀ in Mr. F. Rauterberg's collection, which was captured by this gentleman two years ago in the neighborhood of Milwaukee.

This species has been recorded from the Eastern States, Ohio, Indiana, Illinois and Kansas and extends its range southward to Texas, Florida and Guadeloupe.

The 64 species of this list are distributed among 28 genera, and represent about one fifth of the number of species and one half of the number of genera enumerated and described in S. W. Williston's "Synopsis of the North American Syrphidae," published in 1886. Ten species of the list are common to this continent and Europe and three among these, viz.: *Eristalis tenax, L., Eristalis aeneus, Fabr.* and *Syritta pipiens,* L. have a

very extended range of distribution, occurring in America, Europe, Asia and Africa. Among the species, which have never been observed outside of the American continent, the following five are inhabitants of North America and of South America besides: *Chrysogaster nitida, Wied, Allograpta obliqua, Say., Mesogramma geminata, Say., Eristalis meigenii, Wied.,* and *Eristalis vinetorum, Fabr.* Several of our species occur as far north as Alaska, Hudson's Bay Territory and even Greenland, as for example *Microdon tristis, Loew., Platychirus hyperboreus, Staeg., Syrphus arcuatus, Fall., Syrphus torvus, O. S., Syrphus lesueurii, Macq., Syrphus umbellatarum, O. S., Sericomyia militaris, Walk.* and *Xylota ejuncida, Say.*

The foregoing remarks on the geographical distribution of our species are based on the present standing of our knowledge of the subject. A careful study of the flies, belonging to this family, at different points of our continent, as well as of other continents, will certainly result in materially changing our views on the distribution of the species. Even in our own country, relatively little work has been done in this direction in most of the states, and this accounts for the fact, that several species, figuring on our list, have up to the present time been recorded only from regions, situated at a great distance from our locality. This is the case with *Microdon tristis, Loew.,* our two species of Neoascia, *Baccha clavata, Fabr., Helophilus distinctus, Will., Crioprora cyanogaster, Loew.,* and other species.

In determining the species, I have relied almost exclusively on Williston's "Synopsis of the N. Am. Syrphidae," referred to above, and have gained much information, regarding the geographical distribution of the species therefrom. Besides, I have had access to the following papers:

1. *Chas. Robertson.* Flowers and insects. Nos. I to XVIII, published in the Botanical Gazette. Vol. XIV, May 1889 to Vol. XXV, April 1898.

   Five additional papers of the same series appeared in Vol. V, Nos. 3 and 4, Vol. VI, Nos. 4 and 14 and Vol. VII, No. 6 of the Transactions of the Academy of Science of St. Louis.

2. *W. D. Hunter.* A contribution to the knowledge of North American Syrphidae. Paper No. I in the Canadian Entomologist, Vol. XXVIII, No. 4, April 1896; Paper No. II in the Canadian Entomologist, Vol. XXIX, No. 6, June 1897.

3. *Nathan Banks.* Some Syrphidae from Long Island. Journal of the New York Entomological Society, Vol. V, No. 1, March 1897.
4. *Oliver S. Westcott.* The distribution of some North American Syrphidae. Entomological News, Vol. VIII, No. 8, October 1897.
5. *C. H. Tyler Townsend.* Diptera from the White Sands, on the Tularosa plains of Southern New Mexico. Psyche, Vol. 8, No. 259, November 1897.
6. *James S. Hine.* Twenty-five species of Syrphidae, not previously reported for Ohio. Seventh Annual Report, Ohio State Academy of Science, Columbus, 1899.
7. *James G. Needham.* The fruiting of the blue flag (Iris versicolor, L.) The American Naturalist, Vol. XXXIV, No. 401, May 1900.

On the Forest Conditions in the Vicinity of Milwaukee.

By ERNEST BRUNCKEN.

The territory to which these notes refer comprises the townships Milwaukee and Wauwatosa, and the northern halves of the townships Lake and Greenfield. It is essentially a rolling plateau of glacial and postglacial clays, with occasional gravelly areas. Boulders of crystalline rocks are common in the glacial, and rare in the post-glacial deposits. The bed rock, formed of Niagara limestone, except in the northwestern portion, where it is Hamilton cement rock, shows very few outcrops, and those of very limited extent. Towards Lake Michigan, this plateau falls off very abruptly, forming almost vertical banks of an average height of fifty feet. In the town of Milwaukee there is a series of terraces of an average width of about 1,000 feet. The banks are in many places deeply dissected by ravines. The entire plateau is deeply eroded by the Milwaukee, Menomonee and Kinnickinnic rivers and numerous smaller water courses. Springs are common at the base of hills and bluffs. There are a number of small ponds, and in the depressions there are many marshy places, in some of which, during wet seasons, open water remains at the surface all summer.

This territory was originally covered with a heavy hardwood forest, with the exception of a marshy area, covered with sedges, at the mouth of the rivers. There was a large tamarack swamp in the southwest portion, and smaller ones in many other places. Settlement and the consequent clearing away of most of the forest took place between 50 and 60 years ago. Since then the forests of this neighborhood have consisted of isolated patches, the largest ones about 100 acres in extent, and ranging down to little groves of two and three acres. In the aggregate, there is a very respectable amount of wood land to be found in this region, but reliable statistics as to its acreage are not in existence. In this regard, as well as in regard to the condition in which these small forest tracts are found, the neighborhood of Milwaukee is typical of much of the settled and agricultural part of the state, and for this reason these notes may be of more than local interest.

The economic importance of these timber lots at the present moment is not very great. They are mostly parts of farms, and nearly all of them serve as pastures for farm cattle. They pro-

duce a considerable amount of fuel, both for domestic use and for consumption in various industrial establishments. A few trees are cut and sold for use as piles in the foundations of buildings, but no lumber has been manufactured from trees grown in this vicinity for a great many years. Under these circumstances the forest area of the region has been practically stationary for several decades. There has been some clearing for agricultural purposes in recent years, but the inroads made on the forest in this way are about counterbalanced by the reforestation that has taken place in the manner to be described below. An exception must be made with the areas formerly covered by tamarack. These swamps have nearly all been turned into meadow or tilled land, largely within the last twenty years. This is not to be regretted. For tamarack forests are of little value, while the soils on which they grow, when properly drained, or dried by natural processes, are among the most fertile of our agricultural lands.

Less satisfactory than the extent of these forests is the condition in which they are found at the present day. Being the property of so many different owners, who manage them with every conceivable variety and degree of care and skill, it is to be expected that their condition varies from lot to lot. Sometimes one can find startling contrasts between two neighboring wood lots, each but a few acres in extent. Such a contrast, for instance, may be seen in the northeast quarter of section 28, Wauwatosa. One of these lots consists of vigorous oaks and maples in the pole stage, with the usual proportion of the other species common to this region. There are numerous stumps of standards and veterans to show that not very many years ago a fine crop of wood was taken off the land. The crown cover is almost perfect; the floor is loose, with a considerable amount of leaf cover; there is no grass, and a moderate amount of underbrush and herbage. Numerous seedlings, largely of the very tolerant sugar maple, are showing a prosperous growth. About the only criticism one could make is that too many valueless trees, especially hop hornbeam, are allowed to take up space that ought to be occupied by their betters.

Divided from this well-kept tract by nothing but a rail fence is a startling contrast. Here reckless cutting has broken the canopy and let in an excessive amount of sunshine. As a result the floor is covered either with a matted carpet of grass, or hardened to the likeness of rock. Hardly a seedling can be found on the tract. In many places there is a wild tangle of brambles and useless shrubs. Not a few of the trees begin to be stag-headed and show other signs of decay, although they are still far from maturity.

The most common fault observed in the management of these wood lots is the excessive breaking of the crown cover. The most common result of this is that grasses occupy the floor, and make it almost impossible for tree seeds to sprout. Where the locality is not too dry, the injury may stop with the ceasing of reproduction. But elsewhere the remaining trees, especially elm and basswood, are usually doomed to gradual decay. Very often the proprietors are rather pleased if the forest floor becomes better pasturage for horses and cattle. They help this process along by removing all underbrush. Of course, where pasturage is really the most profitable use to which a wood lot can be put, nothing can be said against the practice. But the proprietor ought to realize that in this way he dooms his forest to extinction, unless once in a series of years he takes proper steps to regenerate it.

Where in a wood lot treated in this manner the trees allowed to remain have survived the transition period without injury, they are sometimes benefited if looked at as individuals, rather than as a forest. The abundant light they receive from all sides tends to cause an increased diameter growth in their boles, and a spreading and rounding of their crowns. This gives a very pleasing, park-like aspect to a number of such tracts. It reminds one of the "openings" in other parts of the state. Only, here the trees are mostly young, and do not present the picturesque gnarled appearance of the veteran oaks of the prairie "openings."

Generally speaking, a grass-covered floor is an entire check to the reproduction of a forest in this region. There are some places, however, (for instance, in a young wood with northern exposure, in the south half of section 27, Wauwatosa), where numerous seedlings of oak were observed in 1899 and 1900, notwithstanding a dense and long covering of grass. The seedlings of no species save oak were ever found by me in such localities. Next to a grassy floor, the poorest condition for the growth of seedlings seem to prevail in the places occasionally found (e. g. near Whitefish Bay) where the floor is occupied by *Amphicarpaea monoeca,* which allows no alien species to find a place in its dense carpet. Such weeds as goldenrod and sunflower, which are exceedingly common in many portions of this territory, seem to present no appreciable obstacle to the growth of tree seedlings. But the best conditions for the latter are found where herbage on the ground is entirely absent or confined to scattered patches. This state of things is rarely found in the smaller lots, but occassionally met with in portions of the larger timber tracts, such as that west of the Soldiers' Home.

The trees which constitute the forests of this vicinity are a mixture of hardwoods with the sugar maple, the white oak and the bass wood far out-numbering all other species. Other common trees of forestal value are the red oak, swamp white oak, burr oak, white ash, black ash, butternut, shell bark hickory and cherry. In a narrow strip along the lake shore the beech and the paper birch are of common occurrence. The elm is confined to the river bottoms and some particularly moist localities on the uplands. There are many other species which occur in such small numbers or such restricted localities that they are of little importance from a forestal standpoint, however interesting they may be to the student of plant distribution. Finally there are those small and inferior species, like hop hornbeam, blue beech, crab apple and others, which are far too common and aggressive to delight the forester.

Among the changes which have taken place in the forests of this region since the beginning of settlement the most important, next to the great diminution of forest area, is the disappearance of the old trees. The bulk of the trees composing the forests of the present day are young, rarely more than fifty years of age. Where a veteran is found, it has usually been spared by the axe simply because its wood was rotten or worthless. While trees of large size are therefore rare, the remaining stumps are evidence that all the common species are capable of growing to great dimensions in this region. It is impossible to collect data concerning the rate of growth, because no fellings on a large scale have been undertaken for a great many years, and are not likely to be undertaken for many years to come. The only one of the common indigenous species which seems to be incapable of large growth in the region appears to be the beech (1).

A species which was formerly common, but has almost entirely disappeared, is the black walnut. On the other hand there is some evidence that the two aspens, *Populus tremuloides* and *P. grandidentata*, are newcomers in this region. Hardly a profitable exchange! There is also considerable evidence for the belief that the oaks, and particularly white oak, are spreading at the expense of other species. There are many places, especially where the shade is very light, in which the only seedlings observable are those of oak. On the other hand, where the crown cover is dense, the seedlings of sugar maple are sometimes found to the exclusion of other and less tolerant species.

There are a number of areas which were denuded of their tree growth a number of years ago, but where the forest is re-establishing itself. These are mostly tracts that were used as

(1.) See Bull. Wis. Nat'l. History Society, January 1900, p. 33.

pastures. The process of reforestation, which may be observed in all its stages in various localities, appears as follows: At first the sward of grasses is broken in such a manner as to allow non-gramineous herbs to establish themselves. The places so occupied afford an opportunity for the various shrubs that form the underbrush in this region, such as hazel, witch hazel, prickly ash, and many others. After the lapse of a number of years, these shrubs may cover the entire field, forming a more or less interrupted thicket. When this stage is reached, the trees will find little difficulty in sprouting, and in due time they will overtop the shrubs and resume their sway. This process is much accelerated in localities where stumps had remained after clearing, from which shoots could grow. A typical area of this kind, which has almost completed the cycle, is found on northwest quarter section 35, town of Milwaukee. Here there is a dense thicket formed by coppice growth of oak and basswood, the various shrubs mentioned above, with the witch hazel particularly numerous, and a great many large seedlings, among which, unfortunately, the hop hornbeam is excessively represented. Many of the stool shoots are 7 inches in diameter, while some of the seedlings are twelve feet high. In places the crowns begin to close, and there are traces of a lessened vitality among the witch hazel.

This course of regeneration is of course much retarded and often made impossible by the cropping of cattle. The effects of pasturing are conspicuous in a peculiar manner in the various species of hawthorn, a genus that is very common both within the forest and on neighboring pastures. The young plants, being constantly deprived of their leading shoots, spread laterally, with a great number of short spurs, until they form low clumps of semi-globular or pyramidal form, each short spur protected by formidable thorns. When these masses become large enough to prevent the cattle from reaching the buds in the centre of the mass, a leader begins to shoot upwards, and the plant at last succeeds in assuming its normal, tree-like form, with the globular or pyramidal mass of twigs surrounding the base of the trunk. Not rarely, a group of these grotesquely shaped hawthorns form a natural fence, behind which other shrubs and trees may grow in safety from the nibbling cows.

Taking it all in all the condition of woodlands in this vicinity is far from desperate. For one thing, fire, the curse of most American woods, is practically unknown here. While the value of the growing timber is at present small, it is not at all improbable that this will change after a while. The two species of timber most prosperous here are white oak and hard maple. Both

of these are exceedingly valuable where the market conditions are in their favor. As to maple, Wisconsin lumber of this kind is now supposed to be inferior to the Michigan product, but the maple groves of lower Michigan are rapidly nearing exhaustion. Very likely the price of such lumber will rise considerably within the next twenty-five years. Then it may become profitable to set up a number of saw mills, of limited capacity, in Milwaukee, to utilize the hardwoods of this region. With proper management, the existing timber lots of this county would be capable of furnishing a permanent, annual supply of logs to such mills. The only condition would be that the individual owners of forest tracts would have intelligence enough to content themselves with an occasional, but substantial revenue by the sale of a limited number of trees at the proper time, instead of attempting to realize a small fortune at once by cutting and selling everything in sight. In anticipation of that time it will be wise for timber owners in this neighborhood to promote, by proper forestal management, the growth of the more valuable species, particularly maple and oak, on their lands, so that they may participate in the profits, when market conditions shall become favorable.

NATURAL HISTORY NOTES.

Notes on the Habits of the Mexican Horned Toad, *(Phrynosoma orbiculare,)* **in captivity.** BY P. H. DERNEHL—

Peculiar to the cold and dry regions of the Mexican plateau, where it inhabits sandy spots exposed to the sun, this lizard is frequently brought into our northern homes and markets. At various times I have received specimens, in an apparently healthy condition, sent to me from Mexico, through the mail, packed between layers of cotton in pasteboard boxes.

Those which I kept I provided with a large box on the front side of which I had arranged a wire netting admitting ample air and light. This cage I placed upon the veranda roof where the sun might strike it from all sides. They seemed to enjoy lying in the sun and basking for hours at a time and they were then quite active. On cold days or at night I found the creatures to be rather torpid and they then sought a small grotto, arranged within the cage, remaining within this seclusion until enticed to leave by the warmth of the day. They never attempted to bury in the sand which I had placed to a depth of eight inches upon the floor of their cage.

They permitted themselves to be handled without attempting to bite the hand that seized them or showing their disapproval in any other way.

Their food consisted mainly of flies. I used a wire fly trap to catch the flies, and when it was well filled with insects emptied the contents into the creatures' cage. The flies upon being thus liberated crawled to the wire front of the cage and crawled up and down it, and immediately upon noticing the flies within their domain the lizards would come close to the front and crouch down, in the manner of a cat, preparing for a spring, closely watching every move of the flies, and whenever an insect came within their immediate reach they would make a quick dart at it and though rather awkward in doing so, seldom missed their mark. Various beetles and other insects that were offered them at intervals were refused. I never noticed my specimens to drink from a small basin filled with water and kept in their cage, though I lay for hours at a time watching them through a small circular hole in the back of their cage.

In confinement this creature is at all times dull and stupid, and indifferent to its surroundings. It shows no sign of recognizing its keeper and in fact displays no qualities that might tend to make it in any manner attractive or to recompense those interested for the attention and care it demands.

With the best of care I have never succeeded in keeping my specimens alive for a longer term than six months and other persons likewise interested have reported the same results. Evidently the change of climate and diet is the cause of their short survival in captivity.

November Wild Flowers. BY W. J. BENNETTS. The following 36 species of plants were observed in flower in the vicinity of Milwaukee during the first 5 days of November of the present year, 1900. A period of winter weather had its beginning on Nov. 6 so that the season of wild flowers may be said to have closed on that date. It will be noted that the majority of the plants mentioned are common weeds and introduced species, although a few as the species of Gentiana, Aster, Hamamelis, are native plants with a late or extended flowering period.

Chrysanthemum Leucanthemum L. Oxe-eye Daisy. Abundant in a pasture south of the city.

Alsine media L. Chickweed. Common in a rich woods.

Rudbeckia hirta L. Yellow Daisy. One specimen found in a ravine.

Gentiana crinita Froel. Fringed Gentian.

Gentiana quinquefolia L. Five-flowered Gentian. Both species were found to be numerous in several ravines near County Line, 14 miles south of the city.

Sonchus asper (L.) All. Spiny sow-thistle. Not rare in several cultivated fields.

Sonchus oleraceus L. Found with S. asper.

Verbascum Thapsus L. Mullen. A few were still in flower in pastures and along lanes.

Carduus lanceolatus L. Bull thistle. A few flowering heads still remained on stout plants in several woody pastures.

Trifolium pratense L. Red Clover. Second crop in flower on many farms.

Trifolium hybridum L. Alsike. With the last.

Trifolium repens L. White Clover. In sheep pastures.

Melilotus alba Desv. Sweet Clover. Second growth plants in flower nearly everywhere.

Aster Lowrieanus Porter. A few found along roads and fences.
Aster laevis L. On the face of the lake bluffs.
Aster puniceus L. One specimen found in a woods.
Erigeron annuus Pers. Daisy Fleabane. Was very numerous in some fields.
Leptilon Canadense Britton. A few found in fields.
Gnaphalium obtusifolium L. Sweet Everlasting. One plant in a woody pasture.
Solidago Canadensis L. Canada Goldenrod. One specimen found in a woods.
Solidago flexicaulis L. Zigzag Goldenrod. One specimen found in a ravine.
Brassica arvensis L. Field Mustard. Abundant in many fields.
Brassica nigra L. Black Mustard. Was still common in the city.
Onagra biennis (L.) Scop. Evening Primrose. Not rare in fields along railroads, &c.
Prunella vulgaris L. Heal-all. Several found in a ravine.
Nepeta Cataria L. Catnip. By a fence in a pasture.
Bidens frondosa L. Beggar-ticks. Growing in water in a ravine.
Galinsoga parviflora Cav. Observed in a few waste places on the south side. Also on lawns on Grand ave.
Anthemis Cotula L. White-weed. A few found still lingering in waste places in the city.
Pastinaca sativa L. Wild Parsnip. Noted along railway tracks in the Menomonee valley.
Arctium minus Schk. Burdock. Found on weedy slopes of the Menomonee valley.
Saponaria officinalis L. Bouncing Bet. A few noticed near Calvary cemetery.
Bursa Bursa-pastoris (L.) Britton. Shepherd's Purse. On lawns in the city.
Taraxacum Taraxacum (L.) Karst. Dandelion. Scattered specimens were noted everywhere.
Hamamelis Virginiana L. Witchhazel. Common in thickets and woods.
Echinospermum Sp. Stickseed. One specimen near Juneau park.

The Last Anthophilous Insects of the Season. BY DR. S. GRAENICHER.—Sunday, Nov. 4th, of the present year was a remarkable day viewed from the standpoint of one interested in the study of the mutual relations of insects and flowers. The exceptionally warm weather prevailing at noon induced the writer to make a trip to the Menomonee Valley, west of the city limits, in order

to catch a glimpse of what might be going on at the few flowers still in bloom in that neighborhood. What I saw surpassed my expectation; I had never thought of the possibility of witnessing such a gathering of flower-visiting insects so late in the season. The flowers on which the visitors were observed represented the following species: *Erigeron annuus, Pers., Taraxacum officinale, Weber, Sonchus oleraceus, L., Melilotus alba, Lam.* and *Pastinaca sativa, L.* Insects were numerous on the umbels of the latter, the wild parsnip, a few specimens of which were still in full blossom, growing along the railroad tracks. About 2 o'clock in the afternoon, the situation changed very abruptly; a cold wind set in from the northwest, driving the insects to shelter, and within a few minutes the flowers were deserted. This event marked the closing of the season.

Below I add a list of the 40 species observed on that day, November 4, 1900. This is an exceedingly late date of observation in our latitude:

Hymenoptera. Andrenidae: (1) Halictus disparilis, Cr. ♀; (2) H. laevissimus, Sm. ♂; (3) H. pattonii, Ashm. (M. S.) ♀; (4) H. inconspicuus, Sm. ♀; (5) Halictus sp. ♂;

Vespidae: (6) Polistes pallipes, Lep. ♀;

Braconidae: (7) Apanteles sp.;

Ichneumonidae: (8) Ichneumon sp.;

Diptera. Syrphidae: (9) Chrysogaster nitida, Wied.; (10) Syrphus americanus, Wied.; (11) Mesogramma marginata, Say.; (12) Eristalis, meigenii, Wied.; (13) E. tenax, L.; (14) Helophilus similis, Macq.; (15) Syritta pipiens, L.;

Conopidae: (16) Oncomyia loraria, Loew.;

Tachinidae: (17) Phorantha occidentis, Walk.; (18) Tachina mella, Walk.; (19) Trichophora ruficauda, v. d. W.;

Sarcophagidae: (20) Helicobia helicis, Town.; (21) Sarcophaga sp.;

Anthomyidae: (22) Phorbia fusciceps, Zett.; (23—24) Phorbia spp.;

Muscidae: (25) Stomoxys calcitrans, L.; (26) Pollenia rudis, F.; (27) Lucilia sericata, Mg.; (28) L. cornicina, F.; (29) Compsomyia macellaria, F.; (30) Morellia micans, Mg.;

Scatomyzidae: (31) Scatophaga squalida, Mg.;

Sepsidae: (32) Sepsis violacea, Mg.;

Agromyzidae: (33) Agromyza aeneiventris, Fall.;
Trypetidae: (34) Tephritis clathrata, Loew.;

Lepidoptera. Rhopalocera: (35) Pyrameis huntera, F.; (36) Pieris rapae, L.; (37) Colias philodice, Gdt.;
Heterocera: (38) Plusia simplex, Gn.;

Hemiptera. Capsidae: (39) Lygus pratensis, L.; (40) Lygus sp.

Mounds Near Lisbon, Ransom Co., North Dakota. BY LEE R. WHITNEY. A solitary mound, occupying an elevated position on the west shore of a beautiful valley and about five miles northwest from Lisbon, was selected for exploration.

Its form was that of a frustrum of a cone, the diameter of whose base measured thirty feet, that of its superior plane, twenty feet, the height of the latter being about four feet.

I commenced digging a little to the west of the center, removing the earth stratum by stratum, observing and noting objects of interest as they appeared. After going to a depth of one foot, charred bones were found, and for a radius of six feet a little to the west of the center of the mound, nothing but charred bones were found, such as vertebrae, ribs, cranea, etc., also a skull of some small animal, charred. These had been apparently thrown in promiscuously, as if from disarticulated limbs. These bones were very easily broken and it was nearly impossible to secure a leg, arm or in fact any large bone intact that had been charred. Some of the bones of the leg, hand and back were found in a very good state of preservation, although considerably charred. Parts of the jaw bone were found with the teeth intact, all charred and burnt. About a foot to the east of the fire limit, in very nearly the center of the mound and about six inches deep, was found a shell ornament, consisting of a good size clam shell polished, with two deep notches and several smaller notches at the larger end. The deep notches being opposite one another, indicated that it probably had been used as a pendant. A polished bone needle three and one half inches long and a bone scraper made from a rib bone were also found near the shell.

To the west, one foot from the fire limit, was found a portion of a skull, a lower jaw bone, arm bones, etc., which had evidently escaped the fire. The jaw was found resting in the skull; the arm bones were placed promiscuously on top of the skull and jaw, and extended into the fire space. To the north of the fire limit, two feet away, was found a portion of the base of a skull which had been fractured before having been placed there, a piece having been broken out and two distinct cracks showing, as

though caused by a heavy blow. Search was made for the remainder of the skull, but none was found.

After removing the charred bones, a layer two inches thick of charred wood, grass, twigs and leaves were found. This layer gradually thinned out at the outer edge of the fire. The center of this charred mass was matted together, probably by the glutinous subsance from the bones. Where this substance had not reached the twigs, etc., they were found to be loose and as soon as the trowel touched them, they broke and crumbled. Some very large logs were found. There were four logs or poles six inches through and at least six feet long, extending from nearly the center of the mound out in opposite directions, dividing the mound into four sections and apparently forming or shaping the mound, the central ends being elevated higher than the outer ends. The only piece that was procured intact was a portion of the central end of one log which extended through the fire and was partially burnt. This piece is very well preserved. The logs extending into the other portions of the mound not touched by fire had scarcely enough cohesiveness to enable them to retain their form. These logs were found in the same strata the bones were in and appear to be of a species of oak still growing in this vicinity in the ravines.

Prof. W. G. Crocker of Lisbon also excavated a small mound about two and one-half miles southeast of Lisbon on the east side of the river. In an interview he states that but one skeleton was found in this mound. It was in a sitting position in the center of the mound with arms extended, and in the hands was found a large shell, in the bowl of which were found the bones of some bird.

The Purple Martin. BY P. H. DERNEHL. The following record of the arrival and departure of this species may prove of interest:

In 1895	they returned	to	their	boxes in my garden,	April 2, left August 18
In 1896	"	"	"	"	April —, left August 16
In 1897	"	"	"	"	April 7, left August 15
In 1898	"	"	"	"	April 9, left August 13
In 1899	"	"	"	"	April 4, left August —
In 1900	"	"	"	"	April 15, left August 15

Their food while here consisted solely of insects—chiefly, wasps, bees, beetles and all manner of garden insects.

Mr. Jno. A. Brandon has mentioned an instance of the voraciousness of these birds. In a martin house which he had erected near his dwelling, in such a position that he could easily observe

them while feeding their young, he noted among other insects brought by the parents, large dragon flies measuring fully three and one half inches in length. These the youngsters would greedily seize and gradually gorge head foremost until only the abdomen protruded. By degrees, this too disappeared and the little gluttons were then ready for another meal.

In a neighboring garden last summer a pair of martins took possession of a box, but after a time suddenly disappeared, the owner found upon investigating that the parents had left behind them a brood of four nearly naked nestlings. He took them into his house and fed them with insects which they readily took. Gradually as they grew older they demanded more attention; small insects in sufficiency to satisfy their cravings were difficult to procure, so as a last resort this gentleman engaged a couple of boys to catch grasshoppers for them and the number of these insects they devoured was astonishing—three large grasshoppers at a time being none too many. A short time of such procedure and the martins would come to him at his whistle and even after they were fully fledged and able to fly they would come from high where they soared with others of their kind, perch on his hand and take the offered morsel.

I have noted that the purple martin will invariably drive after and fight until he succeeds in driving from the vicinity of his place of abode, both the barn and the white-bellied swallows, whereas the sparrow, robin, wren, oriole and other birds different in habits, but holding to the same localities as the martin are left unmolested, so long as they do not assume the aggressive.

In the care of its own young the martin is very negligent. The young martins frequently tumble out of their nests and are invariably lost or become a prey to the cat. In times of draught many young martins perish and are at times entirely deserted by their parents, while from the four or six eggs which the martin lays, but three are hatched and reared successfully, on an average. When the time of migration arrives, their migratory instinct seems to conquer their maternal instinct and they frequently desert their tender young, leaving them to perish invariably in their nests. I have always found when lowering my martin boxes that the parents left behind them either eggs or more frequently one or two of their young.

Notes on Some Migratory Birds. BY J. A. BRANDON—THE SAPSUCKERS. *(Sphyropicus varius.)* These birds when on their northward journey generally arrive between April 8th and 12th, in vast numbers over night, and the next day the trees both in and out of the city literally swarm with them. They do

not appear to do any material damage to the trees, yet one may see the punctures which they make in such a systematic way, in almost every tree. I observed one fellow in North Greenfield who had pierced the bark, I think of an elm, in three places one above the other; and I watched him for almost an hour, consecutively visiting these three wounds. When descending to the lower one he invariably went tail first. I repeatedly saw him excrete and before doing so he would reach up and catch hold of the bark with his bill and then let go his tail brace for the moment. They sojourn here in large numbers for a week or two, and during that time furnish rare sport for the mischievous boys with stones, slingshots and air rifles. The birds seem to be very stupid, and if a stone strikes close to one on a limb he generally remains still, thinking, perhaps, that a boy cannot hit the same place twice, and as a consequence they are frequently knocked off.

THE FOX SPARROW. *(Passerella iliaca.)* I have never seen a fox sparrow in the city, but during the two weeks they generally remain in the suburbs on their northward trip, they furnish abundant opportunity for interesting study. They have a very pleasing song, more so I think than any of the other sparrows except the vesper. When disturbed they do not seem to flit from one bush or limb to another, but generally make a good job of it and fly entirely away, not being so averse to crossing large spaces as most other small birds commonly are.

In scattered flocks of from ten to one hundred individuals, these busy fellows may often be found, and indeed heard, industriously scratching away among the dead leaves under the dense underbrush in the woods. He is a strong, hardy bird and scratches with both feet at the same time. They are generally so intent upon their hunting among the leaves that an observer can, when cautious, succeed in getting right amongst them without their taking the slightest notice of him, although they are usually shy birds and easily alarmed.

THE AMERICAN REDSTART, *(Setophaga ruticilla)* acts much in the same way as does the magnolia warbler only if possible it is more restless. Half flying, half jumping from one twig to another only to spring into the air a few feet away and viciously snap its beak on some passing insect which the observer is quite sure not to have seen; flitting, struting and jumping with quivering wings and tail spread, showing to advantage the beautiful band across it of salmon red, as well as the brilliant salmon red and black and white waist coat. This species is a common victim of the cow bird; their nests almost invariably containing one or more eggs of this parasite. In one instance I found a redstart

nest containing four of the cow-bird eggs and the eggs of the owner were lying on the ground beneath, mostly broken. I have repeatedly found the eggs of this unbidden guest in the nests of the wood thrush, brown thrush, song sparrow, robin, chipping sparrow, field sparrow, red eyed vireo and yellow warbler, the last two almost sure to contain them. Eight or ten years ago I was fortunate enough to discover one of the two-storied nests of the yellow warbler which is so often written about but so seldom seen. The lower story contained an egg of the warbler with two of the cow bird, then another story built on top of this containing two of the cow bird and one of the owner. I have one in my possession only partly completed. The lower part was not finished before the parasite deposited an egg, the second part being started but left unfinished.

The Ruby Throated Humming Bird. *(Trochilus colubris.)* Strange as it may seem this humming bird arrives as early as the last week in April. I have seen them as early as the twenty-fourth, visiting the flowers of *Salix discolor,* probably after minute insects and perhaps the pollen which is so abundant. It may be of interest to some to note that our common red squirrel is exceedingly fond of eating these blossoms.

The Cedar Waxwing. *(Ampelis cedrorum.)* This species in the spring has a decided liking for the buds of the soft maple. I have often seen them carefully insert their bills in the partially opened buds and apparently extracting something therefrom, probably the more tender inner parts. They also detach the buds and pick them to pieces and many will swallow the buds entire, the ground below some of the large trees being literally covered with mutilated buds. The trees do not seem to suffer in the least from this treatment, the foliage afterward coming in ordinary abundance.

These birds also seem to take to the berries of the mountain ash more ravenously at this time also. In a few hours they will entirely denude a tree of its berries, which have remained untouched all the previous winter.

The Magnolia Warbler. (*Dendroeca maculosa.*) This warbler when feeding mostly confines himself to the upper and outer parts of a shrub, fluttering two or three feet into the air after some passing insect, returning, jumping here and there, then into the air again, always seemingly in a flurry of excitement.

The Black and White Warbler, *(Mniotilta varia.)*, on the contrary, methodically and deliberately pursues his way, almost in silence, up and down, over and around the limbs and stems, sys-

tematically scrutinizing every inch of surface, hanging, back head or tail downward, which ever way most suits his convenience, climbing downward head first, tail first or sidewise, with only his long slender claws to support and brace him, as his little bob tail invariably sticks straight out from his body and seldom or never comes in contact with the limb as does that of the woodpecker. He is perfectly fearless, as I have had them come within a few inches of my face, and in one instance hop onto my shoulder and off to a limb quite unconcerned. He confines his operations mostly to the inner and lower parts of the bushes, exploring them thoroughly from the ground out to the small twigs.

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Pellenes, and Some Other Genera of the Family Attidae.

GEORGE W. PECKHAM and ELIZABETH G. PECKHAM.

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Pellenes and Some Other Genera of the Family Attidae.

Pellenes E. S. 1876.

The cephalothorax is high, convex, and a little longer than wide, with the cephalic plate inclined, and the thoracic part dilated, and somewhat widened out from above downward. The quadrangle of the eyes is from one-fourth to one-third wider than long, occupies two-fifths of the cephalothorax, and is usually wider behind than in front, although in some cases it is equally wide in front and behind or wider in front. The front eyes form a straight or slightly curved row, the middle eyes being near together and about twice as large as the lateral, from which they are distinctly separated. The second row is about halfway between the first and the third; the third, is nearly as wide as the cephalothorax at that place, the eyes being almost equally distant from each other and from the lateral borders. The labium is at least as wide as long and is half as long as the maxillae. The falces are vertical, parallel and rather weak, with small fangs. Among the European species the legs are 1342 in the males and 3142 in the females, but among the American, the third and fourth are most commonly longer than the first and second in both sexes. The male palpus is very constant in form, the bulb being short and rounded.

The males of *Pellenes* have, usually, some peculiar modification of form, color, or ornament, appearing in the first and third legs. These fringes, enlargements, and markings are used to attract and delight the female during courtship, the posturing and dancing being such as to show off every beauty to the greatest advantage.* They make the identification of the males comparatively easy, while the females resemble each other so closely as to make it very difficult to distinguish them. The young males are like the females until within one or two moults from maturity.

*An account of the courtship of *P. splendens* and *P. Howardii* may be found in our paper, *Sexual Selection in Spiders of the Family Attidae*, Occ. Pap. Nat. Hist. Soc. of Wisconsin, Vol. 1, No. 1, 1899, and Vol. 1, No. 3, 1900.

All the species which we have formerly described under *Habrocestum* we now place in *Pellenes,* M. Simon, who is the author of both genera, having assured us that this is their proper place, while *pulex* Hentz, which we had supposed to belong to *Saitis,* is classed by him under *Habrocestum.* The species resemble each other closely in their form, and often in their patterns.

To make this paper as complete as possible we include in the key such of Mr. Banks' species as he has been able to lend to us. Mr. Banks thinks the spider which we describe as *P. auratus* H. is a new species, but in this we disagree with him. He also says (Jour. N. Y. Ent. Soc. p. 92, June, 1895) that his species *Habrocestum latens,* 1892 (together with *Ergane taeniata* Keys, and *Hasarius Hoyi* P.), is a synonym of *Ergane borealis Blkw. H. latens* Bks. must not be confused with our *Habrocestum latens* 1896, which we now place under *Pellenes.*

The first species described by M. Simon under the genus *Pellenes* is *lapponicus,* which may therefore be regarded as the type.

So far as we have seen the species described by Koch and Keyserling, in *Arachniden Australiens,* under the name *Habrocestum,* we think them nearer to *Saitis* E. S. than to *Pellenes* or *Habrocestum.*

We hope that the key. made from the American species of *Pellenes* in our collection, will lessen the difficulty of identification. Besides the species described in this paper the key includes *borealis* and *signatus* Banks, both described in *The Canadian Entomologist,* the former in 1895 and the latter in 1900, *conjunctus, divaricatus and aztecanus* Banks, *Arachn. from Baja California and other parts of Mexico,* Proc. Acad. of Sci. of California, 3rd Series, Vol. I, No. 7, pp. 285-287, *montanus* Emerton, *Canadian Spiders,* Trans. Conn. Acad., IX, July 1894, p. 420, *coecatus* H., *auratus* H., *viripedes* H., *cristatus* H., *hirsutus* P., *peregrinus* P., *oregonensis* P., *splendens* P., described in our *Attidae of North America,* Wisconsin Acad. Sci. Arts and Letters, Vol. VII, *latens, mexicanus, belligerus* and *paratus* P., *Attidae of Central America and Mexico,* Occ. Pap. Nat. Hist. Soc. of Wisconsin, Vol. III, No. 1, April 1896. We have omitted *coronatus* H. because our specimen is immature. All of these species were described under the generic name *Habrocestum.*

Key to Males of Pellenes.

1	Some of the legs fringed, or enlarged, or both...	2
	Legs not fringed nor enlarged.....	14
2	Legs 3142, 3142 or 3142.....	3
	Legs 3412*.....	6

*In some individuals of *hirsutus* the relative length of the legs is 3142, but the iridescence on the first leg serves to distinguish the species.

3	Third leg not modified	4
	Third leg modified	5
4	Red hairs on clypeus	*signatus*
	No red hairs on clypeus	*auratus*
5	Longitudinal white band on middle of abdomen	*Howardi*
	Transverse white band on middle of abdomen	*brunneus*
6	Only the first leg modified	7
	Third leg, or both first and third legs modified	9
7	First leg much enlarged, tibia as wide as long, with fringe of stiff dark hairs; spider nearly covered with iridescent red	*oregonensis*
	First leg dark, with metatarsus flattened and iridescent; clypeus red	*hirsutus*
	First leg yellow or brown, with metatarsus not flattened nor iridescent; clypeus not red	8
8	Legs brown. Fringe of white hairs on upper sides of femur patella and tibia of the first, and of smoky hairs on lower sides of the same joints. Clypeus white with a touch of fawn-color below the middle eyes	*Birgei*
	First leg with fringes above and below, on femur, patella and tibia, the hairs being white on all three joints above and on the femur and patella below, while on the underside of the tibia they are dark; no black lines on metatarsus and tarsus of first	*conjunctus*
	Clypeus and front faces of falces covered with fawn-colored hairs, legs yellow. First leg with a fringe on upper side of femur, patella and tibia and on the under side of the tibia, the hairs on the femur being white, on the upper side of the patella and tibia white with a bunch of dark ones in the middle of each joint, and on the underside of the tibia, dark; no black lines on metatarsus and tarsus of first	*elegans*
	First leg with only a dark fringe on the under side of patella and tibia; metatarsus and tarsus of first with black lines	*tranquillus*
9	Clypeus red; no iridescence on metatarsus of first leg	*coecatus*
	Clypeus not red; or clypeus red, and metatarsus of first leg iridescent	10
10	Abdomen having longitudinal median, and encircling white bands, with velvety black on sides; no transverse nor oblique bands	11
	Abdomen with transverse or oblique white bands.	12
11	Clypeus covered with long, thick white hairs; habitat, eastern United States	*peregrinus*
	Clypeus dark, with a long white spot under each lateral eye; habitat, Mexico	*divaricatus**
12	Abdomen with broken figures down middle line and two oblique bands on each side	*mexicanus*
	Abdomen with white basal band and second transverse band further back, the two connected by a median white band	13

**Divaricatus* is distinguished from all other species by having, along with the peculiar modification of the patella of the third leg, a serrated edge on the apophysis of the tibia of the palpus, and an unusual coloration of the clypeus. The palpus is well shown in Mr. Banks' illustration of this species.

13	Length 6 mm; tibia of first leg with two longitudinal black lines; femur and patella of third each with an apophysis: falces brown.....	*festus*
	Length 5 mm; femur, patella and tibia of first leg with one longitudinal black band; no apophysis on femur of third, which has distal half light colored, with transverse black lines; patella of third yellow, with a strong apophysis which is blackish on the end, with a long, stout spine; falces covered with white hairs on the inner two-thirds, with the outer third black.....	*aztecanus*
	Length 4.5 mm; tibia of first without black lines; femur of third without apophysis; patella of third with two apophyses; falces covered with white hairs.....	*Klauserii*
14	Legs 1342; clypeus red.....	*paratus*
	Third leg longest; clypeus not red.....	15
15	Cephalothorax and abdomen highly iridescent, cephalothorax dark, abdomen bright red.....	*splendens*
	Different coloration.....	16
16	Tibia of palpus with a large apophysis, straight on lower edge, rounded above, wider at end than at base; legs 3142.....	*montanus*
	Tibia of palpus without any such apophysis.....	17
17	Abdomen with median and encircling bands white, and two yellow bands on sides; no transverse band	*limatus*
	Abdomen with different coloration.....	18
18	Cephalic part with two white streaks starting between the large middle eyes and diverging a little as they pass backward, and two white bands running from the lateral eyes back on to thoracic part; no crest of black hairs.....	*viridipes*
	Cephalic part without white bands but having a crest of long black hairs over first row of eyes..	*borealis*

Key to Females of Pellenes.

1	Third leg longer than fourth by less than tarsus..	2
	Third leg longer than fourth by at least tarsus..	3
2	Habitat, New Hampshire.....	*borealis*
	Habitat, California.....	*signatus*
3	Third leg longer than fourth by a little more than tarsus	4
	Third leg longer than fourth by tarsus and metatarsus	14
4	First leg longer than second by less than tarsus and metatarsus.....	5
	First leg longer than second by tarsus and metatarsus	13
5	First leg longer than second by tarsus and nearly the matatarsus; a white streak running back from between middle anterior eyes; a herringbone stripe on the abdomen; habitat, Texas..	*Townsendii*
	First leg longer than second by only tarsus.....	6
6	A distinct light basal band on abdomen.....	7
	No distinct light basal band on abdomen.....	12

7	Clypeus chestnut-colored and white	8
	Clypeus not chestnut-colored and white	9
8	Clypeus with a white margin	*carolinensis*
	Clypeus without a white margin	*sabulosus*
9	Abdomen having longitudinal central and side bands white, with dark bands between	10
	Abdomen without such bands	11
10	Cephalothorax with scalloped yellow band marking off eye-region; habitat, United States	*peregrinus*
	Cephalothorax without such band; habitat, Mexico	*simplex*
11	Cephalothorax with a white streak running back from clypeus, between middle eyes, on to cephalic plate, where there is a diamond shaped white spot	*hirsutus*
	Abdomen with a scalloped yellow band, distinctly outlined in black	*viridipes*
	No white streak nor yellow band	*latens*
12	Body all covered with gray hairs; a white band on posterior part of abdomen with oblique chestnut-colored bars on the edges; habitat, Utah	*griseus*
	Abdomen dark with herring-bone stripe and oblique bands white; habitat, Canada	*montanus*
	First leg longer than second by less than tarsus; abdomen sometimes having an indistinct light basal band, and marked by two oblique light bands, which in some specimens are continuous over the anterior dorsum, a light spot, outlined in black, and two light spots above the spinnerets; habitat, east and south United States	*cristatus*
	Body fawn-colored; sides and thoracic part of cephalothorax whitish; abdomen with two oblique black bands on each side; habitat, Wisconsin	*Howardii*
	Body fawn-colored; lower sides of abdomen with indistinct white bands, upper sides with two black scallops; posterior part with light chevrons outlined in black; habitat, Guatemala	*belligerus*
	Body yellowish-gray, having, under alcohol, an indistinct light herring-bone stripe on the abdomen; when dry, without markings; habitat, Utah	*candidus*
13	Abdomen black and white, the latter having sometimes a tinge of salmon	*splendens*
	Abdomen brown	*nemoralis*
14	First leg longer than second by less than tarsus and metatarsus	15
	First leg longer than second by tarsus and metatarsus	17
15	First leg longer than second by tarsus and part of metatarsus; cephalothorax covered with a mixture of red and white hairs; a ridge of black hairs over anterior eyes	*superciliosus*
	First leg longer than second by only the tarsus	16
16	Clypeus with chestnut-colored spots; habitat, New Mexico	*politus*

16	Three longitudinal white bands throughout the length of the cephalothorax; habitat, Mexico..	*mexicanus*
	Cephalothorax fawn-color with a black margin; a light, median, longitudinal band on abdomen, on each side of which the color is dark; habitat, Mexico	*placidus*
	Body gray, with white spots down middle of abdomen, and white oblique bands on sides; habitat, New York, South Carolina, Georgia.....	*auratus*
17	Cephalothorax with three white, longitudinal streaks, those on sides including lateral and dorsal eyes, the middle one sometimes indistinct....	*cognatus*
	No such streaks.....	*dolosus*

Abbreviated Descriptions of the American Species of Pellenes. Males.

P. Howardii.

The abdomen has a white band down the middle with a black band on either side, and is encircled by white. The first leg is fringed with white hairs. In the third leg the patella has the distal end enlarged. Legs 3142. From Wisconsin.

P. brunneus.

First Leg of Male.

The abdomen has a white basal band and a second transverse white band further back, the two being connected by a white band which extends from one to the other. Further back is a short median longitudinal white band. The first leg is heavily fringed with white and brown hairs, and the third, has one apophysis on the femur and two on the patella. Legs 3142. From Florida.

P. hirsutus.

First Leg of Male.

The clypeus is red. The first leg is heavily fringed and has the metatarsus flattened, and bluish-iridescent in color, with two long dark spines. The third leg is unmodified. From Oregon, Utah and New Mexico.

P. elegans.

First Leg of Male.

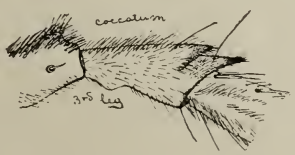
The abdomen is brown with median longitudinal, and encircling white bands. The first leg is fringed, with alternating bunches of white and brown hairs. Legs 3412. The cephalothorax, including clypeus and falces, is covered with fawn-colored hairs. From California.

P. tranquillus.

First Leg of Male.

First leg with tibia enlarged and fringed with long white hairs underneath. The patella and tibia have, also, a fringe of dark hairs. The metatarsus and tarsus have black lines. Legs 3412. From Arizona.

P. coccatus.



Third Leg of Male.

The clypeus is red. First leg with brushes of hairs on the femur. Third leg with apophysis on the patella. Legs 3412. From Eastern and Southern United States.

P. festus.

Legs 3412. The abdomen is black, with a basal band and a second transverse band further back, white, the two being connected by a white band which runs from one to the other. The first leg is fringed with white hairs, and has, on the tibia, two longitudinal black lines. In the third leg the femur and patella have each an apophysis. From Utah.

P. Klauserii.

The abdomen is black, with a basal band and a second transverse band further back, white, the two being connected by a white band which runs from one to the other. The first leg has a short fringe of white hairs. The third leg has an enlargement at the distal end of the femur and two apophyses on the patella. The falces are covered with white hairs. From New Mexico.

P. limatus.

The abdomen has white bands encircling the dorsum, and down the middle, and a band of yellow hairs down each side. The legs are not fringed nor enlarged, the relative length being 3412. The third leg is longer than the fourth by part of the tarsus. The clypeus is yellow. From California.

P. Birgei.

The abdomen has median longitudinal and encircling bands white, with brown on each side of the dorsum. Legs 3412, the third exceeding the fourth by the tarsus and half of the metatarsus. The clypeus is white. From New Mexico.

P. signatus.

Legs 3142, covered with short white hairs. The first leg has a bunch of short black hairs under the femur and a dark fringe under the tibia and patella. The third leg is unmodified. The clypeus is red. From California.

P. auratus.

The abdomen has median longitudinal and encircling white bands, with black bands down the sides. There are bunches of dark hairs on the femur, patella and tibia of the first leg. The relative length of the legs is 3142. The third leg is unmodified. From Eastern and Southern United States.

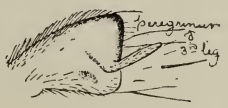
P. oregonensis.

The cephalothorax (including clypeus) and abdomen are nearly covered with iridescent red hairs. The first leg is much enlarged, the tibia being as wide as long with a fringe of stiff dark hairs. From Oregon.

P. conjunctus.

The cephalothorax is reddish, this color being brightest on the cephalic plate, between the eyes of the first row, and along the upper sides of the cephalic part. Across the clypeus and around the margin is a white band. The relative length of the legs is 3412. The first leg has a white fringe along the upper side of the femur, patella and tibia, and along the under side of the femur and patella, the tibia having dark hairs below. The abdomen is brownish with median longitudinal and encircling white bands. From Lower California.

P. peregrinus.



The abdomen has a white band down the middle, a velvety black band on either side, and is encircled by white. The clypeus is covered with white hairs. The patella of the third leg is enlarged. The relative length of the legs is 3412. From Eastern United States.

P. divaricatus.

The clypeus is brown with a pure white elongated spot below each lateral eye running vertically to the margin. The tibia of the palpus has a serrated apophysis. From Lower California.

P. mexicanus.

The abdomen is brownish with broken figures down the middle line, and two oblique bands, white. The relative length of the

legs is 3412. The first leg has fringes of brown hairs on each side of the femur and patella. At the distal end of the femur of the third is a rounded enlargement with a black spot in the middle. From the northeastern part of Mexico.

P. aztecanus.

The abdomen has a basal band and a second transverse band, white, the two being connected by a short white band. The falces are covered with white hairs on the inner two-thirds, while the outer third is black. The relative length of the legs is 3412. The femur of the third leg has the distal half light colored with transverse black lines, and the patella of this leg is yellow, with a strong apophysis, which is blackish at the end with a long stout spine. The clypeus is white. From Mexico.

P. paratus.

The clypeus is red. The abdomen is covered with yellow hairs, excepting three large white spots on the back, and four obliquely elongated white spots on each side. The relative length of the legs is 1342, the first being much the longest. Tibia of palpus with an apophysis which is blunt, and nearly as wide as long. From the eastern part of Guatemala.

P. splendens.

The cephalothorax and abdomen are highly iridescent, the cephalothorax being dark and the abdomen bright red. The legs are not modified. From Wisconsin, Massachusetts and Florida.

P. montanus.

The abdomen has a light herring-bone stripe down the middle, and a row of oblique light and dark markings on each side. Legs 3142, unmodified. Tibia of palpus with a large apophysis, straight on lower edge, rounded above, and wider at end than at base. From Rocky Mountains, Canada.

P. viridipes.

Legs 3412, unmodified. The cephalothorax has four white lines from the first row of eyes, extending over the cephalic plate. The abdomen is black, with a basal band, a scalloped band which encircles the posterior two-thirds of the dorsum, and a central spot, of a yellowish-white color. From Southern United States.

P. borealis.

The abdomen is black with a white basal band and a second white transverse band further back. The legs are unmodified, their relative length being 3412. From New Hampshire.

P. clypeatus.

The abdomen is black with a basal band and a median stripe white. The clypeus is black with a few white hairs in the center, and a conspicuous, elongated, vertical spot under each side eye. The first leg is black except the metatarsus and tarsus, which are pure white; the leg is clothed with white scales, those under the tibia being extremely long and pedicellate. The third leg is not modified. From Colorado. Not in our collection.

P. dorsalis.

The abdomen is brown, paler beneath, with white scales and long hairs. There is a narrow white median stripe from base to apex, its posterior part broken into spots. There are some small spots on the sides. The clypeus is dark. The third leg is unmodified. From Hermosillo, Mexico. Not in our collection.

Females.

P. nemoralis.

General color, brown. The cephalic plate is covered with white and copper-colored hairs. There is no ridge of hairs above the first row of eyes (as in *superciliosus*). The third leg is longer than the fourth by a little more than the tarsus. From Arizona.

P. superciliosus.

The abdomen is reddish brown, with pale chevrons down the middle. There is a ridge of black hairs above the first row of eyes. The third leg is longer than the fourth by the tarsus and metatarsus. From Arizona.

P. politus.

The cephalic part has three longitudinal white bands. There is a white basal band on the abdomen. The hairs around the front middle eyes are rufus, above and below, and white on the sides. The middle of the clypeus has a large snow-white triangle, and outside of this are alternating bands of white and chestnut. The third leg longer than the fourth by the tarsus and metatarsus. From New Mexico.

P. hirsutus.

There is a distinct light basal band on abdomen. The white between the two middle eyes of the first row is continued back, soon dividing into two bands, which unite with the bands that come up from the thoracic slope, thus a diamond shaped

white spot is formed on the cephalic plate. There are also white lines extending from the anterior lateral eyes to the dorsal eyes on each side. From Oregon, Utah and New Mexico.

P. simplex.

The abdomen has longitudinal central and side bands light-colored with dark bands between. On the sides of the cephalothorax the hairs are white; the lower margin has a black line between two white lines. From Vera Cruz, Mexico.

P. griseus.

The abdomen is grey, with a central white band on the posterior part, on the sides of which are oblique chestnut-colored bars. The cephalothorax has on its margin a black line between two white lines. From Utah.

P. candidus.

There is no light basal band on the abdomen, which is entirely covered with yellowish-grey hairs. There are white hairs on the sides and posterior thoracic slope of the cephalothorax. From Utah.

P. carolinensis.

The abdomen is velvety black, with markings of a bright pinkish and salmon-color. Clypeus white, with a chestnut-colored band running outward from each of the middle eyes, not reaching the margin. The third leg is longer than the fourth by little more than the tarsus. From South Carolina.

P. sabulosus.

The abdomen is black, mottled with gray, with a lighter basal band running on to the sides. Clypeus white, with a chestnut-colored spot passing outward from each of the middle eyes down to the margin. The third leg is longer than the fourth by little more than the tarsus. From Georgia.

P. placidus.

The abdomen is dark brown, with a median longitudinal light band which reaches neither base nor apex. The third leg is longer than the fourth by the tarsus and metatarsus. The first leg is longer than the second by only the tarsus. From Mexico.

P. cognatus.

There are three longitudinal white bands on the cephalic part. The abdomen is fawn-colored with a light encircling band, and

a band of light chevrons, reaching neither extremity, on the abdomen. The clypeus is white. The third leg is longer than the fourth by the tarsus and metatarsus, and the first leg exceeds the second by the same joints. From Kansas and New Mexico.

P. dolosus.

The third leg is longer than the fourth, and the first is longer than the second, by the tarsus and metatarsus. There are no white bands on the cephalothorax. The clypeus is covered with white hairs. The falces are brown. From Arizona.

P. Townsendii.

The first leg is longer than the second by tarsus and nearly all of the metatarsus. There is a white streak running back from between the middle anterior eyes. There is a white herring-bone stripe on the abdomen. From Texas.

P. peregrinus.

The first leg is longer than the second by only the tarsus. The abdomen has a distinct white basal band and three white stripes, with black between. The clypeus is white. From New York, Connecticut.

P. viridipes.

The third leg is longer than the fourth by a little more than the tarsus, and the first is longer than the second by only the tarsus. The abdomen is blackish, with a basal band, a scalloped band which encircles the posterior two-thirds, and a central spot, of a yellowish white color. From Southern United States.

P. latens.

The first leg is longer than the second by only the tarsus. There is a light band on the base and sides of the abdomen, and on the posterior third of the dorsum are some alternating light and dark chevrons. From British Honduras.

P. montanus.

The first leg is longer than the second by only the tarsus. There is no distinct light basal band on the abdomen, which is dark, with white herring-bone stripe and oblique bands. From Canada.

P. cristatus.

The first leg is longer than the second by less than the tarsus. The abdomen is covered with grayish-rufus hairs, and has slender lighter bands edged with black, which curve up over the sides

toward the middle. Behind is a lighter spot edged with black, and two light spots above the spinnerets. From Eastern and Southern United States.

P. Howardii.

The first leg is longer than the second by only the tarsus. The body is fawn-colored, except the sides and thoracic part of the cephalothorax, which are whitish, and two oblique black bands on each side of the abdomen. From Wisconsin.

P. belligerus.

The first leg is longer than the second by only the tarsus. The abdomen is fawn-colored with indistinct light bands on the lower sides, and with two black scallops on the upper sides. The posterior part has light chevrons, outlined in black. From Guatemala.

P. splendens.

The first leg is longer than the second by the tarsus and metatarsus. The abdomen is velvety black, with basal, central and lateral white bands, which are sometimes tinged with salmon. From Wisconsin, Massachusetts and Florida.

P. mexicanus.

The third leg is longer than the fourth by the tarsus and metatarsus, while the first is longer than the second by only the tarsus. There are three longitudinal white bands throughout the length of the cephalothorax. The clypeus is covered with long white hairs. From Reynosa, Mexico.

P. auratus.

The first leg is longer than the second by only the tarsus. The abdomen is gray with white spots down the middle, and oblique white bands on the sides. From New York, South Carolina and Georgia.

P. signatus and *P. borealis* Banks.

These two species are distinct from all others by having the third leg longer than the fourth by less than the tarsus. They are very like each other, and as our specimen of *borealis* is one moult from maturity they cannot be distinguished by the epigynes. *Borealis*, however, is from New Hampshire, while *signatus* is found in California.

P. cinctipes Banks.

The abdomen is light gray, with a large, long brown stripe above with projections on its sides, and containing some pale

chevrons behind; the sides and venter are light gray. The anterior pair of legs is dark, pale at bases of patellae, tibiae and metatarsi; the other pairs are pale, all joints being dark at bases and tips. The clypeus is dark with long white hairs on the margin. From Cape Region of Lower California. Not in our collection.

P. dubitatus Banks.

The abdomen is pale on the sides and below. Above it is mostly brownish, with a median white stripe behind and two white side spots. The clypeus is white with long white hairs. From Cape Region of Lower California. Not in our collection.

Pellenes Howardii, n.

Pl. I, figs. 1-1b.

♂. Length, 4.3 mm.; ♀, 5.5 mm. Legs, 3$\overline{14}$2, the first very little stouter than the others. In the male the legs of the first pair are fringed, and those of the third pair have an enlargement on the patella.

The quadrangle of the eyes is one-third wider than long and is wider behind than in front. The first row of eyes is straight, the middle eyes subtouching, and less than twice as large as the lateral, which are separated from them. The clypeus is nearly as wide as the middle eyes.

In the male the cephalic plate is covered with hairs of a soft fawn-color tinged with reddish, and is limited, behind, by a ridge and a scalloped yellowish-white band. The sides of the cephalothorax and the middle of the thoracic slope, are velvety black. A wide white band runs back from each dorsal eye to the posterior margin, and then curves forward and passes along the lower side as far as the dorsal eye. Around the lower margin is a black line with a narrow white line above it. The abdomen has velvety black bands on the sides of the dorsum, on each of which, near the posterior end, is a white dot. There is a wide encircling white band, which sends up an oblique band in the anterior part, and down the center is a wide white band which is enlarged in the middle to form an arrow-shaped mark. The first legs, in life, are of a tender green color, the others yellowish with white scales. The first has, on the outer under side of the femur, a thick fringe of white, continued in a thin fringe which is short on the patella and long on the tibia. The tibia has also some long white hairs, and two black spines on the inner side. The third leg has the patella enlarged at the distal end, and has a short curved apophysis which extends over the tibia. The front

face of the enlarged part is pale and on it is a small black spine. This is evidently in the nature of an ornament since it is used in display during courtship. The clypeus and the front of the falces are covered with thick snow-white hairs. The palpi are brown with white hairs.

In the female the body is nearly covered with a mixture of white and fawn-colored hairs with longer black hairs over them. The fawn-color predominates everywhere excepting on the sides and thoracic part of the cephalothorax, which are nearly white. There are two oblique black bands on each side of the abdomen. The clypeus is thickly covered with brownish white hairs. The falces have only a few white hairs. We have numerous examples from Wisconsin.

Pellenes brunneus, n.

Pl. I, fig. 2.

♂. Length, 5 mm. Legs, 3142.

Quadrangle of eyes a trace wider behind than in front, and one-third wider than long. First row straight, all slightly separated. Middle eyes nearly twice lateral. Second row halfway between the others. Clypeus nearly equal to diameter of middle eyes. Labium as long as wide, and about half the length of maxillae. The sterum is light brown, with a circle of white hairs surrounding the central part. The first leg is adorned with fringes, the femur, patella, and tibia having two rows of dark hairs, with many white hairs extending beyond their tips, and also disposed over other parts of the leg; on the tarsi and metarsi the hairs are too thin to form fringes. Two large, dark spatulate spines come off from the anterior side of each tibia.

The cephalothorax is dark brown. Covering the clypeus, and extending back on either side is a narrow band of white. This white turns up on the thorax but does not reach the top. Behind each dorsal eyes is a short white spot. The cephalic plate is covered with short yellowish hairs, surrounded by a whitish border, which lies just within the quadrangle of the eyes. The abdomen is black, with a white basal band, which runs down on to the sides. Near the middle is a second transverse white band, the two being joined by a white band which extends from one to the other in the middle of the dorsum. Further back there is another short median longitudinal band, also white, with white spots on either side just above the spinnerets. The posterior sides are scalloped, the points of the scallop coming up a little toward the top of the abdomen. The under side has four light bands uniting at the spinnerets; between the bands the color is dark.

The last three pairs of legs are yellow, with many short white hairs and some black marks. The third leg has the femur constricted and rounded at the distal end with a short apophysis above, and a black dot in front. Several black longitudinal lines appear on the anterior and upper sides. The patella has two short apophyses on the upper part. The joints of the palpus are covered with short white hairs. We have one male from Florida.

Pellenes hirsutus Peckham.

Hab. hirsutum 1888. ♂. *North American Attidae,* Wis. Acad. of Sciences, Arts and Letters, Vol. VII, p. 64.

Length, ♂ 5 mm.; ♀ 6 mm. Legs, 3412 or 3142. Third leg in the male longer than fourth by tarsus and part of metatarsus.

Quadrangle of eyes plainly wider behind, and one-third wider than long. First row straight, all eyes subtouching, middle eyes nearly twice lateral, second row halfway. Clypeus one-half as high as middle eyes of first row. Labium about as wide as long and less than half maxillae. The sternum is light yellow in the center, surrounded by a dark brown band. The first leg of the male is modified and enlarged; the femur has a fringe of white hairs on the under side, and a second white line parallel with it, which, on the dark color of the femur, is very striking. On the upper side are several long, moderately stout spines. On the under side of the patella and tibia are fringes of long hairs. One, the shorter, is a smoky brown, the other, much longer, is white; the two layers of hairs being in apposition. There are no fringes on the upper part of the patella, but the one on the tibia is short, thick and dark, the tibial joint, while enlarged, is still about twice as long as wide. The metatarsus is flattened in front, and is iridescent bluish in color. There are two long, dark-colored spines, and a fringe of white hairs, on the under side; the latter extends to the tarsus. The other legs are unmodified in both sexes.

In the male the cephalothorax is yellowish-brown. White bands on the lower margin run back on either side, from a point below the location of the small eyes; before reaching the end they turn up over the back, and slightly approach each other. At the dorsal eyes they become indistinct, in some specimens being continued as far forward as the first row of eyes, while in others they blend with the yellowish color of the cephalic plate. The anterior sides and the clypeus* are rather yellow than brown, while the back, between the white bands, is quite dark. The

*In some specimens the clypeus is red.

femora of the posterior three legs are yellow, the other joints are darker, and all are covered with short white hairs. The abdomen is dark-brown, with many lighter colored hairs. Two white bands come off from the base of the abdomen and run obliquely down the sides; and just above the spinnerets are three or four very short white chevrons. Underneath, the color is light yellow.

In the female the cephalothorax is yellowish-brown, mottled with many white hairs; the lower margin is white, except at the middle of the posterior slope; the two lateral bands pass up over the back, at first very slightly approaching each other, just at the dorsal eyes, and thereafter diverging. The clypeus is white, and the white is continued up and between the two anterior middle eyes, when it divides into two bands, which unite with the two that come up from behind; thus a diamond-shaped white spot is formed on the cephalic plate. White lines extend from the anterior lateral eyes to the dorsal eyes on each side. These patterns are more or less distinct, depending upon the amount of white mixed with the brownish ground color. The abdomen, while brownish in color, is much more mixed with white hairs than in the male; there is a more distinctly white basal band, which passes down the sides. There are two oblique white bands on each side just behind the middle. In the middle of the posterior half of the back is a darker band, marked with two or three white chevrons or spots. The legs are light yellowish-brown, more or less covered with short white hairs.

We have this species from Oregon, Utah and New Mexico. (Prof. T. D. A. Cockerell.)

We have four males of *Pellenes* with the clypeus red, *signatus,* California, *hirsutus,* Oregon, Utah and New Mexico; *coecatus,* Southern and Eastern United States, and *paratus,* Guatemala. *Hirsutus* is distinguished from the others by the flattened iridescent metatarsus of the first leg; *coecatus,* by the modification of the third leg; *paratus,* by having the first leg plainly longest and stoutest, with no modification of either the first or third; it has, also, the apophysis on the tibia of the palpus as wide as long. *Signatus* has no modification of the third leg, no iridescence on the metatarsus of the first, and has the relative length 3142. *Coronatus* Hentz has a red clypeus, but we have never seen a mature specimen, and are inclined to think that it may be the last moult before maturity of *coecatus.*

Pellenes elegans, n.

Pl. I, fig. 3.

♂. Length, 5 mm. Legs, 3412.

Quadrangle of eyes wider in front, and nearly one-third wider than long. First row of eyes straight, and but little separated, the middle being nearly twice as large as the lateral. Second row nearer first than third. Clypeus about half as high as diameter of large eyes. Labium wider than long, and hardly one-third the length of the maxillae. The sternum is light brown. The first leg is ornamented; on both sides of the femur and on the under side of the patella are fringes of white hairs; on the upper side of the patella the fringe is dark in the middle and white at the ends; the tibia has dark hairs underneath, while above, the hairs are white, then dark, and thereafter white; the metatarsus and tarsus are without fringes. The arrangement of the white and dark hairs on the first leg is very striking, and serves to distinguish it from all the males thus far described.

The whole cephalothorax is covered with short fawn-colored hairs, including the clypeus and front of falces; on the lower margin of the sides are two white lines, separated by yellow hairs. At the posterior end of the head the lines unite and are continued back as a white band. These bands do not appear to have run up the back of the thorax, as is so common in other species of this genus, but as our specimen is rubbed we cannot be certain on that point.

The abdomen is brown with a tinge of gold. The sides are white, and in the middle is a white band extending from base almost to the end; this band is slightly attenuated behind. The legs are yellow with darker bands.

We have one male from California.

Pellenes tranquillus, n.

Pl. I, fig. 4.

♂. Length, 5 mm. Third leg, 4 mm. Legs, 3412. First leg longer than second by tarsus and one-half metatarsus. Third leg longer than fourth by tarsus.

Quadrangle of eyes wider behind than in front. First row straight, with the middle eyes subtouching, and the lateral a little separated from them; middle twice as large as lateral eyes. Eyes of third row as large as lateral eyes of first row, placed a little further from each other than from lateral borders. Clypeus two-thirds as high as middle eyes of first row. Maxillae truncated in front and straight on inner edges. Labium as wide as long. Sternum oval. On the upper side of the femur of the first leg are three small points. This leg has the tibia enlarged, and ornamented with a long fringe of white hairs underneath, and some yellowish-white rice-like scales. Metatarsus and tarsus

of this leg marked with a line of black. Second leg with a short fringe under the patella and tibia.

Our specimen is very much rubbed. The clypeus seems to have been covered with fawn-colored hairs. On the sides of the cephalothorax are many white hairs, which are also found above the first row of eyes, and at the anterior end of the abdomen. The species must be distinguished by the first leg and the palpus.

We have one male from Arizona.

Pellenes coccatus Hentz.

1845. *Attus coccatus*, H., ♂. Jour. Bost. Soc. Nat. Hist., Vol. V.
1875. *Attus coccatus*, id., ♂. Coll. Hentz's Arachn. Writ., p. 65.
1888. *Habrocestum coccatum*, ♂. North Amer. Attidae, Peckham, p. 60.

♂. Length, 5 mm. Length of third leg, 6 mm. Legs, 3412. First leg longer than second by two-thirds of tarsus. Third leg longer than fourth by tarsus.

♂. Length, 4.3 mm. Length of third leg, 4.4 mm.

Quadrangle of eyes equally wide in front and behind. First row straight, middle eyes subtouching, lateral slightly separated from middle eyes, and rather less than one-half as large. Eyes of third row nearly as large as lateral eyes of first row, placed equally distant from each other and from lateral borders. Clypeus two-thirds as high as middle eyes of first row. Maxillae small, rounded. Labium very small, rounded, about as wide as long, less than half as long as maxillae. Anterior coxae separated by fully the width of the labium. Sternum oval. The femur of the first leg of the male has, at the distal end, two stout brushes of hair; and on the inner side of the tibia, two long flattened apophyses or strong spines; while the third leg has the distal end of the femur enlarged, and has, on the dorsal surface of the patella, a little ridge and a weak apophysis.

The cephalothorax is black, with some brownish hairs over the first row of eyes, and some white hairs on the thoracic part. The abdomen is black, more or less covered with whitish hairs, which form (sometimes not distinctly) a white basal band which extends on to the sides, a transverse curved white band across the middle, a central diamond-shaped white spot behind this, and two short white lines just above the spinnerets. The clypeus is covered with short, brilliant red hairs; where these are rubbed off it is brown. The falces are brown. The legs are brown, the first being the darkest. They all have blackish longitudinal bands on the femoral joints. The femur of the first has two stiff brushes of dark-colored hair, one on the anterior and one

on the posterior side, toward the distal end. The patella and tibia of the first have a good deal of white rice-like hair, and the tibia has, on the anterior side, near the distal end, two black flattened spines. The femur of the third has, on the anterior face, at the distal end, a clear space with a black dot. The spines on the third leg are light-colored, excepting on the last two joints, where they are black. Palpus lighter brown than legs, with scanty white hairs on tarsus.

Habitat: Pennsylvania, New York, Alabama, New Mexico. (Prof. T. D. A. Cockerell.)

In the description of this species in our *North American Attidae,* the female sign was inadvertently substituted for that of the male. We have no female of *coccatus.*

Pellenes festus, n.

Pl. I, fig. 5.

♂. Length, 6 mm. Third leg, 6 mm. Legs, 3412. Third leg longer than second by tarsus and metatarsus. Third leg longer than fourth by tarsus.

Quadrangle of eyes slightly wider behind than in front. First row almost straight, eyes small, the middle about twice as large as the lateral; middle eyes subtouching; lateral separated from the middle by one-third their own diameter. Eyes of the third row about as large as the lateral eyes of the first row, placed as far from each other as from the lateral borders. Clypeus two-thirds as high as middle eyes of first row. Maxillae wedge-shaped, slightly rounded in front, inclined toward each other. Labium a little longer than wide, half as long as maxillae. Sternum large, oval. Anterior coxae separated by the width of the labium. Tibia of first leg with two long stiff spines or apophyses. Femur and patella of third leg each with an apophysis at distal end.

The cephalothorax is black, probably covered with a mixture of short white and yellow hairs. In our specimen there remain, of these, a good many on the thoracic part, while the eye-region is thickly covered. There are also some long, darker colored hairs over the first row of eyes. The abdomen is black, surrounded by white, with a white longitudinal central band, a curved transverse white band coming up from the sides over the middle of the dorsum, and two white bars at the spinnerets. Clypeus white. Falces brown with sparse white hairs.

Legs brown, the first being a little darker than the others, and having two longitudinal black lines on the upper face of the tibia. On the under side of the posterior face of the femur, patella, and tibia of the first, is a fringe of long white hairs; and

on the under side of the anterior face of the same joints is a similar, but less pronounced fringe. The third leg has the anterior face of the femur pale, with two longitudinal dark lines, while at the distal end is a pale space having in the center a black dot. This pale space is in a constricted part, and a small apophysis comes off just above. All the spines on the third leg are light-colored.

From Utah. This species is close to *coccatum,* the leg modifications being very similar. *Coccatum,* however, has, on the distal end of the anterior face of the tibia of the first leg two large, flattened black spines; and has also, on the anterior and posterior faces of the femur of the first, toward the distal end, two stiff brushes of dark-colored hair; while the first leg in *festus* is as above described, adorned with fringes of white hair. Moreover in *coccatus* the clypeus is red, while in *festus* it is white.

Pellenes Klauserii, n.

Pl. I, fig. 6.

♂. Length, 4.5 mm. Legs, 3412.

Quadrangle of eyes wider behind, and nearly one-third wider than long. First row of eyes straight, the middle near together, the lateral a little separated, the latter less than half the former. Second row nearer the first than the third. Clypeus equal to diameter of middle eyes. Labium as wide as long, and half as long as maxillae. The sternum light yellow. The first leg has fringes of hairs, but they are not so long as in *H. brunneus,* or the other species with these ornaments. The femur has fringes on the two sides, while on the patella and tibia, although there are hairs on the anterior sides, it is only on the posterior that they are well marked; the hairs on the upper side of the femur are dark, the others white. Two long, thick, black spines come off from the anterior face of the tibia. The third leg is modified; the femur, near its distal end, is constricted, the part beyond being somewhat enlarged and rounded; on the face of this part is a black spot, and above it is a black ridge. The patella has two apophyses on its upper side.

The cephalothorax is black. The clypeus and face of falces are covered with white hairs. White lines, rather narrow, extend back along the margin, and on reaching the posterior end turn upward, as in other species of this genus, and merge with fawn-colored hairs that cover the cephalic plate. In some specimens all these markings are fawn-colored.

The abdomen is black, with a basal band running down the sides, and a second transverse band, narrower than the first, the two united, along the middle, by a wide band; the posterior

part of the abdomen has a median line of short chevrons reaching the spinnerets. On each side of this line, just above the spinnerets, are spots. All these markings may be made up of white, or of fawn-colored hairs. The under side of the abdomen is without markings. The three posterior legs are covered with hairs; on the femur of the third leg there are two black lines, with lighter lines edging them, and on the constricted part there is often a tinge of red.

We have two males from New Mexico, from Prof. T. D. A. Cockerell.

Pellenes limatus, n.

Pl. I, fig. 7.

♂. Length, 6.5 mm. Legs, 3412; the first scarcely stouter than the others.

The quadrangle of the eyes occupies only a little more than one-third of the cephalothorax, is barely one-fourth wider than long, and is only a very little wider behind than in front. The front eyes form a curved row; the middle eyes are subtouching, and fully twice as large as the lateral, which are separated from them.

The sides of the cephalothorax, and the middle upper part, are covered with yellow hairs. Two white bands run from above the lateral eyes to the posterior end. These are met by white marginal bands, which begin at the dorsal eyes and pass backward. The abdomen is white, with two longitudinal bands of yellow hairs, which have on their edges, in the posterior part, a series of darker bars, giving them a jagged appearance. The clypeus is covered with yellow hairs. The falces are brown. The tibia of the first leg is dark, but otherwise the legs and palpi are yellow, covered thickly with white hairs.

We have a single male from California.

Pellenes Birgei, n.

Pl. I, fig. 8.

♂. Length, 5 mm. Legs, 3412.

Quadrangle of eyes slightly wider behind, and one-quarter wider than long. First row of eyes straight, middle touching, and lateral eyes a little separated; the middle eyes are twice as large as the lateral. Second row about halfway between the others. Clypeus two-thirds as high as the middle eyes. The first leg has a fringe of moderately long hair on the upper side of the femur, patella and tibia, pure white on the femur, not so white on the other joints; on the under side of the same articulations there is also a fringe, which is dark in color, and not quite

so long. Labium as long as wide, and nearly half as long as maxillae.

The clypeus is white with some fawn-colored hairs under the middle eyes which reach on to the upper part of the falces. The white of the clypeus extends in a band along the lower margin of the cephalothorax, passes up behind the dorsal eyes, and is continued forward, more or less distinctly, to the anterior lateral eyes. The cephalic plate and the sides are fawn-colored. The sides and base of the abdomen, and a median longitudinal band are white, and the other parts reddish-brown. The legs and palpi, excepting the tarsi, are covered with short white hairs.

We have one male sent to us by Prof. Cockerell, from Mesila Park, New Mexico.

Pellenes Townsendii, n.

Pl. I, fig. 9.

♀. Length, 5.5 mm. Legs, 3412, first a little the stoutest.

The quadrangle of the eyes is one-fourth wider than long, and a little wider behind than in front. The front eyes are all plainly separated and form a strongly curved row, the middle being twice as large as the lateral. The second row is halfway between the other two. The third row is not so wide as the cephalothorax. The clypeus is two-thirds as wide as the middle eyes. The labium is more than half as long as the maxillae, which are rounded.

The cephalothorax is covered with fawn-colored hairs. There is a white band running from the clypeus up between the middle eyes, and then backward on the cephalic part, widening as it goes, until it fills all the space between the dorsal eyes. There is a white band around the margin, which is joined behind by two white bands which run from the lateral eyes along the upper sides, and downward on the thoracic slope. The face is very striking. The first row of eyes is strongly curved, and from the outer side of each of the large middle eyes a broad brown streak runs outward and obliquely downward. The two middle eyes are separated by white hairs, which also cover the middle part of the clypeus and the spaces under the lateral eyes. The falces are brown and vertical. The abdomen has a fawn-colored region on each side of the dorsum, a white encircling band, which is jagged on the inner side, and, down the middle, a white band which is made up of a series of blunt arrowheads, which point forward. The palpi and legs are brown, with black spines and white hairs, the first legs being the darkest.

While in the marking of the clypeus this species bears a strong resemblance to *carolinensis* and *sabulosus, Townsendii* is distinct

from them by the median longitudinal white band running throughout the length of the abdomen.

We have one female from Texas, sent to us by Mr. Townsend.

Pellenes carolinensis, n.

Pl. I, figs. 10-10b.

A distinctly marked, black and salmon-colored species.

♀. Length, 5.5-7 mm. Legs, 3412, first and second a little stouter than the others.

The quadrangle of the eyes is equally wide in front and behind, and is one-third wider than long. The front row is straight, with the middle eyes subtouching, and twice as large as the lateral, which are separated from them. The maxillae are rounded, and are more than twice as long as the labium. The clypeus is two-thirds as wide as the middle eyes.

The hairs on the cephalic part are bright yellowish-red over the first row of eyes, and silvery further back. There is a scalloped, salmon-colored band behind the dorsal eyes. The lower margin has a black line between two white lines. In our specimens the other parts of the cephalothorax are rubbed bare, excepting the clypeus, which is white in a band along the margin, in a large spot under each lateral eye, and in a narrow band which begins just between the middle eyes, and widens as it passes downward to the margin, and which has an oblique chestnut-colored band running outward from below each of the middle eyes. The abdomen is velvety black, with markings of a bright pinkish and salmon-color, there being a wide transverse band near the front end, an oblique band on each side, further back, two oblique marks in the middle and two irregular, sometimes continuous spots on the posterior part of the dorsum, and two dots near the spinnerets. The pattern is complicated by a sprinkling of salmon-colored hairs, which surround the posterior part of the dorsum. The legs are yellowish, and are covered with white and salmon-colored scales.

Carolinensis bears a general resemblance to *viridipes* but is distinguished by the chestnut-colored hairs on the clypeus.

We have several females from Charleston, S. C.

Pellenes sabulosus, n.

Pl. I, figs. 5, 11-11a.

A very dark species, with indistinct markings.

♀. Length, 6-8 mm. Legs, 3412.

The quadrangle of the eyes is equally wide in front and behind, and is one-fourth wider than long. The front row of eyes is slightly curved, the middle eyes being slightly separated and not

quite twice as large as the lateral, which are further from them than they are from each other. The clypeus is a little more than one-half as wide as the middle eyes. The maxillae are twice as long as the labium, and are rounded.

The integument of the cephalothorax is black, with a short covering of yellow hairs. There are wide white bands on the sides, which unite behind, but do not run up on to the thorax. The margin has a black line between two white lines. The clypeus is much like that of *carolinensis* but lacks the white margin. It has a white spot in the middle, running from between the middle eyes to the falces, and an oblique chestnut-colored spot passing outward from under each of the middle eyes to the margin. Above these, below the lateral eyes, it is white. The abdomen is black, mottled with gray, with a lighter basal band running on to the sides. There are two pairs of gray spots on the anterior part of the dorsum and a central gray spot further back. Near the spinnerets are two snow-white dots. The legs have the coxae and trochanters yellow, contrasting strongly with the other joints, which are dark, with many white hairs. The front faces of the falces are thinly covered with white hairs. The under parts are light gray.

We have several females from Georgia.

Pellenes simplex, n.

Pl. I, fig. 12.

♀. Length, 5.5 mm. Legs, 3412, first and second stoutest.

The quadrangle of the eyes is slightly wider behind than in front, and is one-third wider than long. The front eyes are all separated and form a curved row, the middle being twice as large as the lateral. The maxillae are more than twice as long as the labium, and are wide, and slightly rounded. The clypeus is nearly as wide as the middle eyes.

The cephalic plate is covered with short yellow hairs and a thin growth of long black hairs; on the sides of the cephalothorax the hairs are white, and the lower margin has a black line between two white lines. The upper thoracic part, in our single specimen, is rubbed bare. The abdomen has gray hairs around the base and sides, and in an irregular band down the middle, and a dark band on either side which becomes black where it forms the scalloped outline of the gray side bands. The legs and palpi are yellow, with white hairs. The clypeus and the spaces between the eyes are covered with yellowish-white hairs, and the reddish-brown falces have white hairs growing thinly over their front falces.

We have one female from Vera Cruz, Mexico.

Pellenes griseus, n.

Pl. I, fig. 13.

A yellowish-gray species.

♀. Length, 6 mm. Legs, 3412.

The quadrangle of the eyes is wider behind than in front, is one-third wider than long, and occupies scarcely more than one-third of the cephalothorax. The front row of eyes is nearly straight. The middle eyes are subtouching, and are twice as large as the lateral, which are separated from them. The clypeus is nearly as wide as the middle eyes. The maxillae are more than twice as long as the labium, and are rounded.

The cephalothorax is covered with gray hairs, the margin having a black line between two white lines. The clypeus is covered with white hairs. The abdomen is gray, with a central white band on the posterior part, on the sides of which are oblique chestnut-colored bars. The legs are yellow, with gray hairs.

We have a single female from Utah.

Pellenes candidus, n.

Pl. I, fig. 14.

♀. Length, 6.5 mm. Legs, 3412.

The quadrangle of the eyes is one-fourth wider than long, and is equally wide in front and behind. The anterior eyes are all separated, and form a straight row, the middle being twice as large as the lateral. The clypeus is three-fourths as high as the middle eyes.

Under alcohol the spider is of a pale yellowish color, the eye-region being darker than the rest, with an indistinct, light, herring-bone stripe on the abdomen. When dry, the upper surface of the cephalothorax, and the entire abdomen, above and below, are closely covered with yellowish-gray hairs, giving a pale golden tint, with scattering, long, black hairs over all. There are white hairs on the sides and posterior thoracic slope of the cephalothorax. The clypeus and the spaces between the eyes have long white hairs, which are also found on the palpi. The falces are brown with a few white hairs, and the legs reddish, with white scales.

We have one female from Salt Lake City, Utah.

Pellenes nemoralis, n.

Pl. I, fig. 15.

♀. Length, 5.3 mm. Third leg, 5 mm. Legs, 3412. First leg longer than second by tarsus and metatarsus. Third leg longer than fourth by tarsus.

Quadrangle of eyes a little wider behind. First row slightly curved, middle eyes of first row a little separated; lateral separated from the middle eyes by fully two-thirds of their own diameter; middle not quite twice as large as the lateral eyes. Eyes of the third row a little smaller than the lateral eyes of the first row, placed a little further from each other than from the lateral borders, on the margin of the cephalothorax. Clypeus two-thirds as high as the middle eyes of the first row. Maxillae nearly square, truncated in front, straight on the inner edges. Labium as wide as long, more than one-half as long as maxillae. Anterior coxae separated by a little more than the width of the labium. Sternum oval. General color brown. This specimen has the eye-region covered with white and copper-colored hairs, and has patches of the same on the abdomen, where, however, they are nearly all rubbed off, leaving pale chevrons and mottlings visible. Clypeus covered with thick white hairs. Falces brown, with some white hairs. Legs light brown, with some light-colored and white hairs. Habitat: Arizona.

See remarks under *superciliosus* and *dolosus*.

Pellenes superciliosus, n.

Pl. I, fig. 16.

♀. Length, 7 mm. Third leg, 5.4 mm. Legs, 3412. First leg longer than second by tarsus and a little of metatarsus. Third leg longer than fourth by tarsus and metatarsus.

Quadrangle of eyes a little wider behind. First row slightly curved, with the middle eyes a little separated, and the lateral separated from the middle by one-half their own diameter; middle twice as large as lateral eyes. Above the eyes of the first row is a ridge of upright black hairs, thickest and longest in the middle. Eyes of the third row as large as lateral eyes of the first row, and equally distant from each other and the lateral borders. Clypeus about as high as middle eyes of first row. Maxillae rounded in front and on inner edges. Labium about as wide as long, one-half as long as maxillae. Sternum oval. Anterior coxae separated by less than the width of the labium.

Cephalothorax covered with a mixture of short white and red hairs. Abdomen, in this specimen, showing a few similar hairs at the spinnerets, but otherwise rubbed bare, the integument being reddish-brown, with chevrons, oblique bands on the sides, and many small spots, pale. Clypeus covered with white hairs. Falces brown with sparse white hairs. Legs light yellowish, barred with blackish.

Habitat: Arizona.

Distinguished from *dolosus* and *nemoralis* by the upright hairs over the first row of eyes.

Pellenes politus, n.

Pl. I, fig. 17.

♀. Length, 6.5 mm. Legs, 3412, first and second stoutest.

The quadrangle of the eyes is a little wider behind than in front, and is one-fourth wider than long. The front eyes are in a straight row, the middle subtouching and fully twice as large as the lateral, which are a little separated from them. The clypeus is two-thirds as wide as the middle eyes. The maxillae are more than twice as long as the labium, and are rounded.

The whole body is thinly covered with a mixture of white and rufus hairs. On the cephalic part are three longitudinal white bands. The sides of the cephalothorax are white, and the margin has a black line with a white line below it. The abdomens of our specimens are badly injured, showing only a white basal band, and two white spots near the spinnerets. The hairs around the front middle eyes are rufus above and below, and white on the sides. The middle of the clypeus has a large snow-white triangle, the apex being above, and the broad base covering the margin. Running obliquely outward from below the middle eyes, are two chestnut-colored bars, and outside of these, running from between the lateral and middle eyes, two oblique snow-white bands. Just under each lateral eye is another short chestnut-colored streak. The legs are brown with white hairs.

We have two females from New Mexico, sent us by Prof. Cockerell.

Pellenes placidus, n.

Pl. I, fig. 18.

♀. Length, 7 mm. Legs, 3412.

Quadrangle of eyes plainly wider behind, and one-third wider than long. First row of eyes straight, all touching, the middle fully twice as large as the lateral. The second row is halfway between the other two. Clypeus very nearly as high as the middle eyes. Labium as wide as long, and about one-half the length of the maxillae. The sternum is light brown.

The cephalothorax is entirely covered with fawn-colored hairs. Along the lower margin, but not passing over the clypeus, is a narrow black line. The sides of the abdomen are covered with fawn-colored hairs; along the middle is a light-colored band that reaches neither the apex nor base; the band is of irregular outline. On each side of the band, the abdomen is dark brown. All the legs are yellowish-brown, with many white hairs.

We have one female from Chihuahua, Mexico.

Pellenes cognatus, n.

Pl. I, fig. 19.

♀. Length, 6 mm. Legs, 3412, first a little the stoutest.

The quadrangle of the eyes is wider behind than in front, and is one-third wider than long. The front eyes are all separated, and form a straight row, the middle being plainly twice as large as the lateral. The second row is halfway between the other two. The third row is not so wide as the cephalothorax. The labium is wider than long, and half as long as the maxillae. The clypeus is one-half as wide as the middle eyes. The cephalothorax and abdomen are covered with a close mixture of fawn-color, white and black, the white predominating to form three longitudinal bands on the cephalic part, one down the middle, and one on each side, an encircling band on the abdomen, and a band of three white chevrons, or arrow-heads, in the middle of the dorsum, this band reaching neither extremity. On the margin of the cephalothorax is a narrow line of black. The eyes are surrounded by yellowish-white hairs, which also cover the clypeus. Under each of the middle eyes, at the outer edge, there is a spot faintly tinged with chestnut, which passes downward to the black marginal line. The legs and palpi are light brown, thickly covered with white hairs. The falces are brown.

This species is much like *placidus,* from Mexico, but the shield to the opening of the epigynum is not widened in front. The whitish bands on the cephalic part, and around the abdomen, and the spots on the clypeus, also serve to distinguish it.

We have two females, one from Kansas, and one from New Mexico, sent to us by Prof. T. D. A. Cockerell.

Pellenes dolosus, n.

Pl. I, fig. 20.

♀. Length, 7.5 mm. Third leg, 5.5 mm. Legs, 3412. First leg longer than second by tarsus and metatarsus. Third leg longer than fourth by tarsus and metatarsus.

Quadrangle of eyes a little wider behind. First row straight, with all the eyes subtouching; middle fully twice as large as the lateral and projecting. Eyes of the third row as large as the lateral eyes of the first row, placed a little further from each other than from the lateral borders. Clypeus one-half as high as middle eyes of first row. Maxillae as wide as long, truncated in front, rounded on inner sides. Labium fully as wide as long, less than one-half as long as maxillae. Anterior coxae separated by about the width of the labium. Sternum oval.

Cephalothorax blackish, pretty generally covered with short white hairs. The abdomen in this specimen has the hairs almost entirely rubbed off, only a few white ones remaining at the base. The integument is blackish, with pale chevrons and mottlings. Clypeus thickly covered with white hairs. Falces brown. Legs and palpi, light brown, the first legs being a little darken than the others, with some light-colored and white hairs. Habitat: Arizona.

Distinguished from *nemoralis* by the eyes of the first row, which in this species are all subtouching, and form a straight row, while in *nemoralis* they are separated and form a curved row.

Poultonia, gen. nov.

Pl. II, figs. 1-1b.

Small spiders. The cephalothorax is rather high, not much longer than wide. Sides nearly parallel and vertical, highest at dorsal eyes from which point it slants in both directions.

The quadrangle of eyes is one-fifth wider than long and is wider in front. The first row of eyes is a little curved, and the cephalic slant is so great that these eyes look down; the middle are subtouching, the lateral are a little separated. All the eyes of this row are large, the lateral being four-fifths as large as the middle, the eyes of the second row are about halfway. The dorsal eyes are as large as the lateral, are as wide as the cephalothorax at that place, and stand out distinctly. The quadrangle occupies one-half of the cephalothorax. The thoracic plate slants slightly in its first half and thereafter abruptly. The abdomen is small; the upper spinnerets are very long, almost equalling in length the abdomen. Legs, 4312, all slender.

This genus is founded on a spider from South America, *P. caudata*, and is named for our friend, Prof. E. B. Poulton of Oxford University.

Poultonia caudata, n.

Pl. II, figs. 1-1c.

Small spiders with spinnerets nearly as long as the abdomen. ♂. Length, 3.5 mm. Legs, 4312, all slender.

The cephalothorax has the cephalic part covered with fawn-colored, and the thoracic with grayish-brown hairs. The abdomen has grayish-brown hairs, which show reddish metallic reflections when thoroughly dried. It is probable that the cephalothorax also had metallic coloring, in life. The upper spinnerets are covered with grayish-brown hairs except at the end, where they are enlarged and black. The legs are all yellow. The femur

of the first has a black, longitudinal band, and the tibia and metatarsus have each two longitudinal black lines. Nearly all the joints of the other legs have longitudinal black lines with some additional oblique ones on the femur of the third and of the fourth. The clypeus is nearly as wide as the large middle eyes, and has two transverse white bands with a narrow black line between them. The palpi are yellow with white hairs, and have the under side of the distal end of the femur black with a bunch of black hairs. The patella has a black ring at the distal end. The falces are vertical and rather weak.

We have several males from Chapada and Sao Paulo, sent to us by Mr. Moenkhaus.

Grauhara, gen. nov.

Pl. II, figs. 2-2b.

This genus, which belongs to the Homalattus Group, is distinguished by its slender shape and elongated first legs.

The cephalothorax is moderately high and is two-thirds as wide as long. It is narrow in front, but bulges out at the dorsal eyes. The sides are nearly vertical. The cephalic part is a little inclined forward, and the thoracic drops almost immediately behind the dorsal eyes. The quadrangle of the eyes occupies a little more than half of the cephalothorax, is one-fifth wider than long, and a little wider in front than behind. The front eyes are all close together in a straight line, the middle ones being plainly more than twice as large as the lateral, and bulging forward. The second row is nearer the first than the third, and the third is nearly as wide as the cephalothorax. The first legs are elongated. The falces are horizontal and short. The maxillae are rounded, and the labium is small.

Grauhara vivida, n.

Pl. II, figs. 2-2d.

This is a graceful species with brown and white coloring. It is readily distinguished by the large eyes of the first row, and by the shape of the fangs, which are notched on the outer side.

♂. Length, 4 mm. Legs, 1423, the first much elongated, with the coxa and trochanter reaching to within a third of the distal end of the femur of the second.

The cephalothorax is brown with the eye-region covered with white hairs, and two small spots of white on the posterior slope of the thorax. The abdomen is brown, the posterior fifth being much darker than the rest, the two color regions being marked off sharply. A white band runs along each side, ending abruptly where the color darkens, and just above the spinnerets there is

a white spot. The legs are not at all hairy. The first pair is brown, elongated, and somewhat thickened; the others are slender, rather short, and pale yellow. The palpi are rather long, and are pale brown in color. The falces are brown, and are short, horizontal and wide, the width at the end being equal to the length. There is a wide apophysis at the distal end, on the inner side, upon which is a small tooth. The fang has a notch on the outer side of the proximal end.

We have one male from Santarem, Brazil, sent to us by Mr. Moenkhaus.

Irura, gen. nov.

Pl. II, figs. 3-3b.

This very distinct genus belongs to the Homalattus Group, being most closely allied to *Rhene,* but differing from that genus in having the upper surface of the cephalothorax flat, and a wider quadrangle of the eyes.

Both cephalothorax and abdomen are short, wide and rounded, the cephalothorax being plainly wider than long and widest behind the dorsal eyes. It is very low, and is perfectly flat on top. The sides are nearly vertical. The quadrangle of the eyes occupies slightly more than half of the cephalothorax, is twice as wide as long, and is plainly wider behind than in front. The front middle eyes are close together, the lateral being separated from them, and about half as large. This first row is straight. The second row is plainly nearer the first than the third, and the third is not quite so wide as the cephalothorax. The falces are short, vertical, robust and slightly divergent. The first legs have the joints thickened.

Irura pulchra, n.

Pl. II, figs. 3-3c.

Small spiders, covered with pinkish iridescent scales. The femur of the first leg is iridescent steel blue, with a fringe of white hairs.

♀. Length, 4 mm. Legs, 1423.

The cephalothorax is dark colored with a covering of brilliant pinkish iridescent scales. The ground-color of the abdomen is pale yellow, with two pairs of darker spots, the posterior pair being larger than the others and placed in the middle of the dorsum. The whole is covered with iridescent scales, those on the central part being golden, while around the edges they are pink and green. The first legs and the palpi have the joints thickened with a covering of pinkish iridescent scales. The femur of the first leg, on the front, or inner side, is iridescent steel-blue,

with a thin fringe of white hairs. The patella is as long as the tibia, and both of these joints have a thin fringe of brown hairs on the inner side. The other legs are yellow.

One female from Ceylon, sent to us by Rev. O. P. Cambridge.

Tacuna, gen. nov.

Pl. II, figs. 4-4b.

This genus differs from *Rhene* in having the cephalothorax low and flat, and the quadrangle of the eyes only a quarter wider than long. In *Irura* it is twice as wide as long.

The cephalothorax is low and flat, and is as wide as long, the widest point being at the dorsal eyes. The thoracic part is truncated, and the sides are almost vertical. The quadrangle of the eyes occupies two-thirds of the cephalothorax, is one-fourth wider than long, and is very much wider behind than in front. The first row of eyes is very slightly bent downward. The middle eyes are close together and are about twice as large as the lateral, which are slightly separated from them. The second row is nearer the first than the third. The third row is nearly as wide as the cephalothorax. The relative length of the legs is 1423, the first being much the longest.

Tacuna delecta, n.

Pl. II, figs. 4-4c.

Small brown spiders with the tibia of the first leg nearly as wide as long, and bearing a stiff ridge of hairs. Metatarsus and tarsus of the first leg very slender.

♂. Length, 3 mm. Legs, 1423, the first much the longest, with the femur and tibia enlarged.

The whole spider is brown, the cephalothorax being much darker than the abdomen. It seems to have been covered with white hairs, but in our single specimen these are nearly all rubbed away excepting on the sides of the cephalothorax, where they grow rather thinly, with the points directed upward. On the abdomen are three pairs of black dots. The first leg is much enlarged. There is nothing conspicuous on the femur and patella, but on the under side of the tibia there is a stiff spiny ridge of black hairs. The metatarsus and tarsus are very slender. All the legs are yellowish brown. The falces project very slightly forward, and are delicate and tapering, with rather long fangs, and toothed apophyses on the inner sides. The labium is wide and the maxillae are rounded.

We have one male from Rio Janeiro, sent to us by Mr. Moenkhaus.

Homalattus hispidus, n.

Pl. II, figs. 5-5a.

This species is very distinct through the ornamental hair tufts at the anterior end of the abdomen, but is difficult to place generically since it goes almost equally well into *Homalattus* and *Beata,* while it agrees perfectly with neither.

♀. Length, 7 mm. Legs, 1423, not very different in length, the first stoutest.

The widest point of the cephalothorax is at the dorsal eyes. The cephalic part is a little inclined, while the thoracic falls slightly in the first half and then abruptly, the posterior slope being truncated. The quadrangle of the eyes occupies about one-half of the cephalothorax, is one-third wider than long and is plainly wider behind than in front. The front eyes are in a straight row, the middle touching and less than twice as large as the lateral which are a little separated from them. The second row is nearer the first than the third.

The cephalothorax is golden brown. Above the first row of eyes are five tufts of hairs, the middle and the two external ones being white, while the other two are reddish-brown. From the lateral eye, on each side, a band of white hairs runs to the posterior end, the hairs lengthening into a white tuft behind each dorsal eye. The abdomen is yellow with a mottled pattern of spots and chevrons in white, which may be best understood by the illustration. At the anterior end are three tufts of stout yellow hairs, and behind these are two tufts of yellow hairs with little bunches of black hairs above them. When not perfectly dry these hairs form an untidy mass as in the drawing. The clypeus is covered with white hairs. The falces are brown, with an oblique band of white hairs across the front face, and a fringe of white hairs at the end. The palpus has long white hairs on the tibia and tarsus. The legs are brown and are short and stout.

We have one female from San Rafeal, Mexico, sent to us by Mr. Tyler Townsend.

Explanation of Plates.

Plate I.

Fig. 1, *Pellenes Howardii,* dorsal view of male, × 8; 1a, palpus; 1b, epigynum.
Fig. 2, *P. brunneus,* palpus.
Fig. 3, *P. elegans,* palpus.
Fig. 4, *P. tranquillus,* palpus.
Fig. 5, *P. festus,* palpus.
Fig. 6, *P. Klauserii,* palpus.
Fig. 7, *P. limatus,* palpus.
Fig. 8, *P. Birgei,* palpus.
Fig. 9, *P. Townsendii,* epigynum.
Fig. 10, *P. carolinensis,* dorsal view of abdomen of female; 10a, face of female; 10b, epigynum.
Fig. 11, *P. sabulosus,* face of female; 11a, epigynum.
Fig. 12, *P. simplex,* epigynum.
Fig. 13, *P. griseus,* epigynum.
Fig. 14, *P. candidus,* epigynum.
Fig. 15, *P. nemoralis,* epigynum.
Fig. 16, *P. superciliosus,* epigynum.
Fig. 17, *P. politus,* epigynum.
Fig. 18, *P. placidus,* epigynum.
Fig. 19, *P. cognatus,* epigynum.
Fig. 20, *P. dolosus,* epigynum.

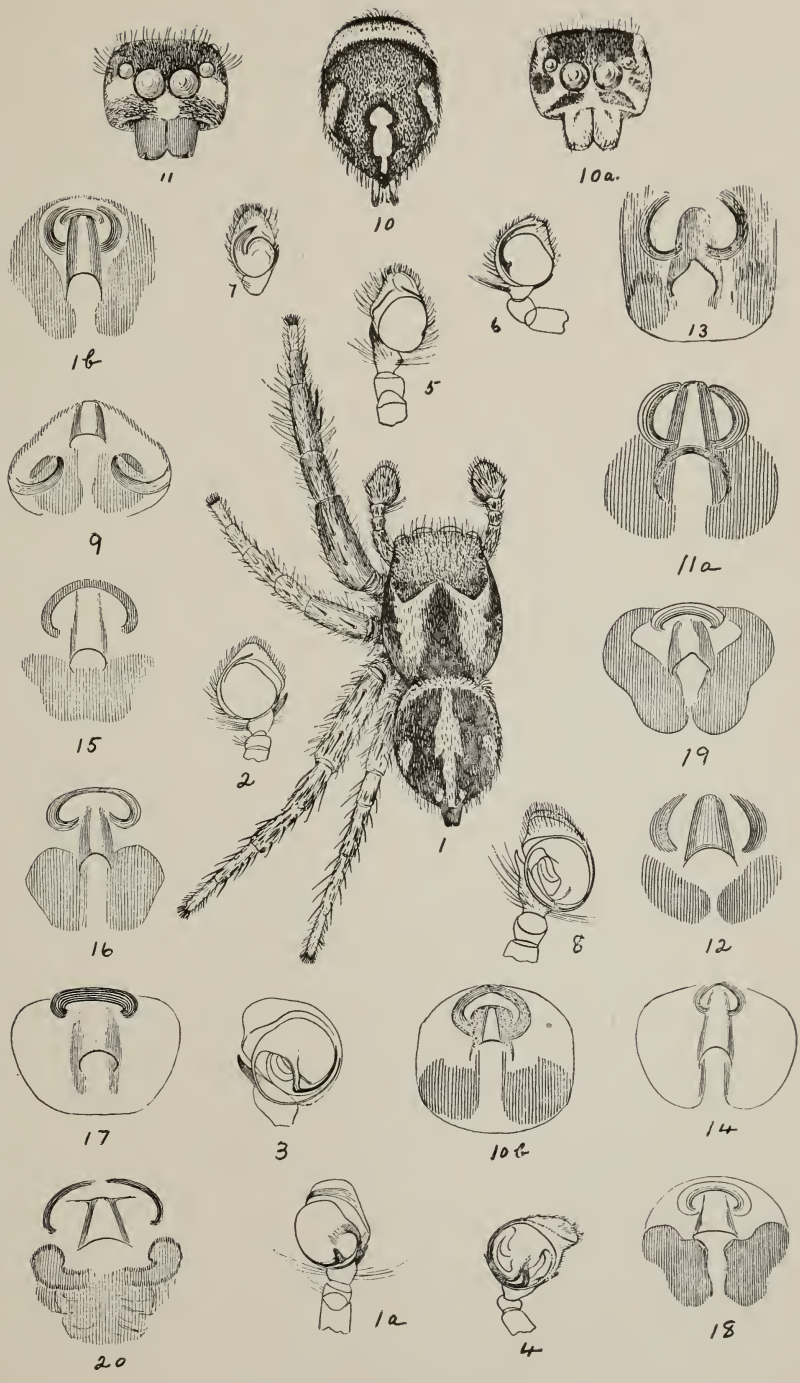


PLATE I.

Plate II.

Fig. 1, *Poultonia caudata,* dorsal view of male, × 8; 1a, side view of cephalothorax of male; 1b, face of male; 1c, palpus.

Fig. 2, *Grauhara vivida,* dorsal view of male, × 8; 2a, side view of cephalothorax of male; 2b, face of male; 2c, ventral view of palpus; 2d, side view of palpus.

Fig. 3, *Irura pulchra,* dorsal view of female, × 8; 3a, side view of cephalothorax of female; 3b, face of female; 3c, epigynum.

Fig. 4, *Tacuna delecta,* dorsal view of male, × 8; 4a, side view of cephalothorax of male; 4b, face of male; 4c, palpus.

Fig. 5, *Homalattus hispidus,* dorsal view of female, × 8; 5a, epigynum.

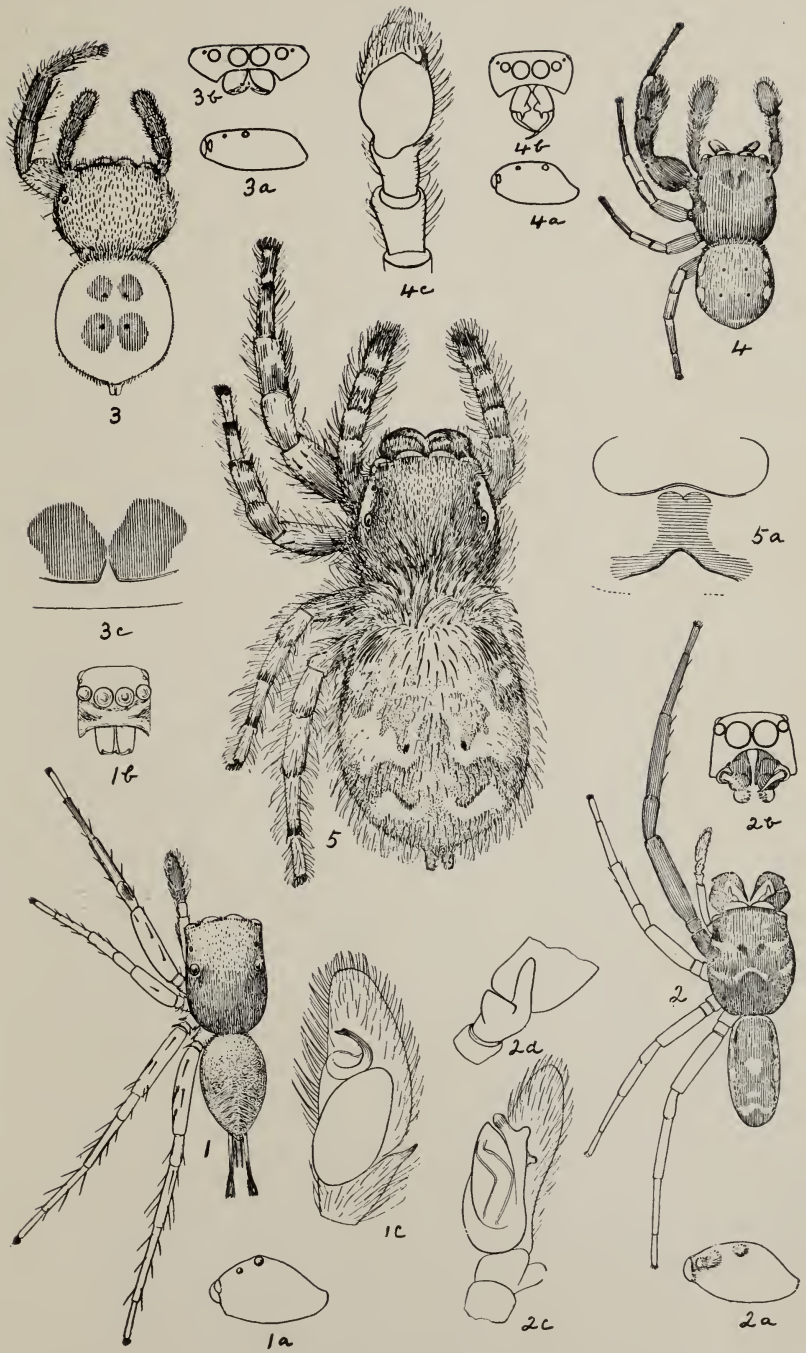


PLATE II.

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