Compliments of . . .

BERNARD B. SMYTH,

Librarian Kansas Academy of Science,

TOPEKA, KANSAS.

Kindly acknowledge receipt.

TRANSACTIONS

OF THE

THIRTIETH AND THIRTY-FIRST ANNUAL MEETINGS

OF THE

KANSAS ACADEMY OF SCIENCE.

(1897-1898.)

EDITED BY THE LIBRARIAN.

VOLUME XVI.

PRINTED BY
J. S. PARKS, STATE PRINTER,
TOPEKA, KANSAS.
JUNE 1899.

TABLE OF CONTENTS.

PROCEEDINGS.

LIST OF ILLUSTRATIONS.

PROCEEDINGS

OF THE THIRTIETH ANNUAL MEETING OF THE KANSAS ACADEMY OF SCIENCE. HELD AT BAKER UNIVERSITY, BALDWIN, KANSAS, OCTOBER 27, 28, AND 29, 1897.

BY THE SECRETARY, E. B. KNERR.

THE Kansas Academy of Science convened for the opening session of its thirtieth annual meeting in the rooms of the Ælioian literary society of Baker University, at two o'clock P. M., October 27, 1897, with President S. W. Williston in the chair.

The following members were present: S. W. Williston, L. E. Sayre, D. E. Lantz, J. W. Beede, B. B. Smyth, D. H. Otis, and C. S. Parmenter.

In the absence of the Secretary, B. B. Smyth was chosen Secretary *pro tempore*.

The following committees were appointed:

Program and press: E. B. Knerr, J. W. Beede, C. S. Parmenter.

Membership: C. S. Parmenter, D. H. Otis. E. H. S. Bailey.

Nominations: L. E. Sayre, E. B. Knerr, B. B. Smyth.

Resolutions: L. E. Sayre, D. E. Lantz.

Necrology: L. E. Sayre, S. W. Williston. E. B. Knerr.

Auditing committee: L. E. Sayre, B. B. Smyth, E. B. Knerr.

It was suggested that the membership committee serve for a year. Action was deferred.

The following papers were then read:

1. New developments in the Mentor beds. A. W. Jones. (In the absence of the author, this paper was read by J. W. Beede.)

2. Adulterations in powders as detected by the microscope. L. E. Sayre.

3. A floral clock for Kansas. B. B. Smyth.

4. A labrinthodont from the Kansas Carboniferous. S. W. Williston.

Adjourned to meet at eight o'clock P. M.

Academy assembled at eight o'clock P. M.; President Williston in the chair.

The minutes of the afternoon session were read and approved.

The committee on membership was increased by the addition of the following, who are to serve during the year and use their influence in securing desirable members:

E. B. Knerr, for Atchison.

D. H. Otis, for Manhattan.

E. H. S. Bailey, for Lawrence.

A. W. Jones, for Salina.

F. W. Bushong, for Emporia.

C. E. Becker, for Ottawa.

C. S. Parmenter, for Baldwin.

G. P. Grimsley. for Topeka.

An invitation was extended to the Academy to visit the university chapel exercises at eight o'clock A. M. next day.

The following papers were then read and discussed:

5. Some notes on birds in southern Kansas. J. R. Mead. (Read by the Secretary, in the absence of the author.)

6. A list of birds taken in Mexico and Central America by Col. N. S. Goss, with notes on localities. D. E. Lantz.

B. B. Smyth presented the report of the Board of Curators, as follows:

Your Board of Curators has the honor to report that a few additions of minerals representing economic products of the state, such as silica from Ford, Sherman, Decatur, and Cheyenne counties, ocher from Cherokee county, and zinc from Labette county, have been added to the museum. There has also been added a small collection of fossil leaves from the Dakota Cretaceous of Ellsworth county, collected this year by J. W. Beede. Your Curators have been given by the state executive council the care and custody of the Goss Ornithological Collection, and have taken steps to have the collection cleaned up and properly arranged. For this purpose Prof. D. E. Lantz was recommended to the executive council, and he was employed by them during the month of September renovating and rearranging the collection. On the conclusion of the rearrangement of the collection the room was reopened with appropriate ceremonies. The appointment of your Curators as curators of the Goss Ornithological Collection shows the esteem in which the Academy is held by the administration.

B. B. SMYTH,
J. W. BEEDE,
A. H. THOMPSON,
Curators.

On motion, the report was adopted.

On motion, a committee was appointed for the purpose of securing proper legislation to obtain for the Academy the space necessary for making a suitable exhibit of the museum and library of the Academy in the state-house. By a vote of the Academy, D. E. Lantz, L. E. Sayre and S. W. Williston were made this committee.

The Board of Curators was requested to advise the best manner of arranging the library and museum specimens, and make a written report to the executive committee before the next annual meeting of the Academy.

The following resolution was passed:

Resolved, That it is the sense of the Academy that steps be taken to arrange a series of lectures on scientific topics during the year, by members of the Academy and others, in the Academy rooms or Representative hall in the state-house.

Academy adjourned to meet at nine o'clock in the morning.

OCTOBER 28.

Academy assembled at nine o'clock A. M., with President Williston in the chair.

The reading of papers was at once entered upon, and the following were heard:

7. Relativity in science. E. B. Knerr.
8. Geological notes on Trego county and vicinity. J. W. Beede.
9. Bibliography of Kansas ornithology, with a list of birds. D. E. Lantz.
10. Therapeutical notes on Kansas plants. L. E. Sayre.
11. *Monotropa hypopitys* reported as new to Kansas. J. W. Bridwell.
12. A vertebrate fossil from the Dakota group. C. S. Parmenter.
13. Kansas Mosasauria. S. W. Williston.
14. Some tracks from the Upper Carboniferous. C. S. Parmenter.
15. A list of the Goss Ornithological Collection, being a first report of the Curator. B. B. Smyth.

Academy adjourned to two o'clock P. M.

Academy assembled at 2:15 o'clock P. M., with President Williston in the chair.

On motion, the executive committee was made a committee on time and place for next meeting, it being understood that the committee confer with the Kansas Academy of Language and Literature, with a view to holding the meeting for 1898 at the same time and place with that organization.

The committee on necrology reported as follows:

At the thirtieth annual meeting of the Kansas Academy of Science, at its second session, an announcement was made of the death of its faithful and beloved member, R. J. Brown, whose departure from this life so many institutions embracing public and philanthropic work have keenly felt. The following item was adopted by the Academy and a copy ordered sent to the family of the deceased: R. J. Brown was a life member of the Kansas Academy of Science. In its early career he was most active and influential in its support. In its history his name will be handed down as one whose earnestness and self-sacrifice in scientific work have done much to stimulate research in the departments for which this organization stands preëminent in the state.

S. W. WILLISTON, President,
E. B. KNERR, Secretary,
L. E. SAYRE,
Committee.

The following papers were then read and discussed:

16. Root tubercles and their production by inoculation. D. H. Otis.

This paper was of such high merit that a motion prevailed to have it and all the more important papers published at once and distributed as bulletins, or *separata*.

17. Physiography of southeastern Kansas. G. I. Adams.

18. Observations on elm-twig girdlers. Percy J. Parrott.

19. *Fusulina cylindrica* shell structure. A. J. Smith.

20. An aldehyde lamp. L. E. Sayre.

The faculty of Baker University extended an invitation to the Academy to a reception in the university building from five to eight o'clock P. M.

Upon request in behalf of the students of Baker University, Professor Dyche spoke of his experiences on the Pacific coast during the past summer, and gave an interesting talk on the work done at the Hopkins Seaside Laboratory, located at Monterey bay, California.

The Academy then adjourned to the reception rooms, where a bountiful supper was served.

After the reception, friends and members of the Academy assembled in the chapel to hear the retiring President, S. W. Williston, in his address on "Science in Education."

After the address, Mrs. Helen Campbell, of Manhattan, professor of household economics at the Kansas Agricultural College, favored the audience with a talk, by request, on "Household Economics."

Adjourned to meet at 8:30 o'clock in the morning.

Academy assembled at 9:30 o'clock A. M., October 29, with President Williston in the chair.

The Treasurer's report was received and referred to the auditing committee.

The committee on nominations reported as follows:

For President, D. E. Lantz, Manhattan; First Vice-President, C. S. Parmenter, Baldwin; Second Vice-President, L. C. Wooster, Emporia; Secretary, E. B. Knerr, Atchison; Treasurer, J. W. Beede, Lawrence; Librarian, B. B. Smyth, Topeka. For Curators: A. H. Thompson, chairman, Topeka; B. B. Smyth, Topeka; J. W. Beede, Lawrence; George Wagner, Lawrence.

The report was adopted, and the Secretary was instructed to cast the vote of the Academy for the officers named, and the vote was so taken.

The committee on resolutions reported as follows:

Resolved, That the hearty and appreciative thanks of the Academy be tendered to the faculty of Baker University for the excellent facilities afforded the meetings of the Academy, and for their most hospitable and generous entertainment: to the Baldwin *Ledger* and to all the citizens of Baldwin who have aided in making the thirtieth annual meeting of the Academy successful and interesting.

L. E. SAYRE,
D. E. LANTZ,
Committee.

The auditing committee reported the Treasurer's accounts to be correct.

The reading of papers was then resumed, and the following were heard and discussed:

21. The finding of insects in the Comanche Cretaceous of Kansas. C. N. Gould. (Read by S. W. Williston, in the absence of the author.)

22. The natural-history possibilities of Belvidere, Kansas. C. N. Gould.

23. The extremes and means of Kansas climate. F. H. Snow.

24. The viscosity of the ether. A. St. C. Dunstan. (Read by L. I. Blake.)

25. Equilibrium of forces in a film originally spherical, grounded in the presence of an external electric charge. L. I. Blake.

26. Some problems of marine telephony without wires. L. I. Blake. (This paper was presented in the form of a lecture, and many of the Baker students were present to hear it.)

27. The dehydration of gypsite. E. H. S. Bailey.

28. The detection of sound directions. L. D. Ikenbury. (Read by E. H. S. Bailey.)

29. Experiments in estimating sound distances. C. E. Shutt. (Read by E. H. S. Bailey.)

On motion, the following was adopted:

In view of the great interest in science manifested by Mrs. Mary E. Mudge and Mrs. Mary Savage, and of the prominence in scientific investigation attained by their husbands, we recommend that the above-named ladies be elected to associate membership in this Academy.

L. E. SAYRE.
B. B. SMYTH.

The President's address was ordered printed as soon as possible, the place and method being left to the discretion of the publishing committee.

Adjourned to meet at 1:30 P. M.

Academy assembled at 1:45 P. M. In the absence of President Lantz, Vice-President Wooster called the Academy to order.

Librarian B. B. Smyth made his report, which was duly adopted.

The following were in due form elected to honorary membership: Arnold Burgess Johnson, chief clerk United States light-house service, Washington, D. C.; W. A. Kellerman, Columbus, Ohio; Edw. L. Nichols, Ithaca, N. Y.; W. S. Franklin, South Bethlehem, Pa.

The reading of papers was then resumed:

30. Alternating currents in a Wheatstone bridge where branches contain resistance and capacities. M. E. Rice. (Read by L. I. Blake.)

THIRTY-FIRST ANNUAL MEETING.

THE Kansas Academy of Science convened for the opening session of the thirty-first annual meeting in the rooms of the state railroad commission, in the state-house, 7:30 P. M., December 29, 1898, with President Lantz in the chair.

The following members were present: J. W. Beede, F. W. Bushong, G. P. Grimsley, H. J. Harnly, E. B. Knerr, D. E. Lantz, J. T. Lovewell, J. R. Mead, Alva J. Smith, B. B. Smyth, Geo. Wagner, J. T. Willard. A number of visitors were also present.

Secretary read the correspondence which had accumulated during the year.

Secretary read the minutes of the last session of a year ago. Approved.

The following committees were appointed:

Membership—A. S. Hitchcock, J. T. Lovewell, H. J. Harnly.

Program and press—J. W. Beede, Geo. Wagner, E. B. Kneer.

President Lantz reported, for the committee appointed a year ago on bulletin publication, that they were unable to secure the results desired.

The following were duly elected to membership: L. P. Brous, 800 Main street, Kansas City, Kan.; Ross Hopkins, Lawrence; W. H. Keller, Madison; J. A. Yates, Ottawa; J. D. Hooper, Manhattan.

President Lantz reported, on the matter of lectures in the state-house during the year, as recommended last year, that one such lecture was given in Representative hall by Prof. S. W. Williston. The lecture was illustrated by the lantern and was well appreciated. The subject was "Extinct Animals of Kansas."

The following papers were then read:

1. The deep well at Madison. F. W. Bushong.

2. Silico-barite nodules from near Salina. E. B. Knerr.

3. On the correlation of the Coal Measures of Kansas and Nebraska. J. W. Beede.

4. *Antrostomus carolinus*. R. Matthews. (In the absence of the author, this paper was read by the Secretary.)

B. B. Smyth gave notice that he would offer an amendment to section 3 of the constitution.

J. W. Beede offered a motion to the effect that the Academy sustain the expense of illustration in the proceedings. Deferred to future action.

Adjourned to nine o'clock A. M. to-morrow.

DECEMBER 30, 1898.

Academy met at 9:30 o'clock A. M. in the rooms of the State Horticultural Society, with President Lantz in the chair.

Minutes of last meeting were read and approved.

The following committees were appointed:

Nominations: G. P. Grimsley, J. T. Willard, F. W. Bushong.

Resolutions: L. C. Wooster, L. L. Dyche, J. R. Mead.

Necrology: A. H. Thompson, B. B. Smyth, J. R. Mead.

Auditing: A. J. Smith, E. H. Heacock.

The following were duly elected to membership: R. Matthews, Wichita; Orr Adams, Topeka; F. E. Forbes, Topeka.

Treasurer J. W. Beede made his report, which was referred to the auditing committee.

Prof. H. J. Harnly, of McPherson, extended an invitation to the Academy to meet at McPherson next year, provided it is deemed advisable to meet so far west.

The following papers were then read:

5. *Felis concolor.* J. R. Mead.

6. Some Kansas mineral waters. E. H. S. Bailey. (Read by Geo. Wagner, in the absence of the author.)

7. Technology of gypsum. G. P. Grimsley.

8. Concretions. E. B. Knerr.

Col. Wm. Tweeddale was duly elected to membership.

Adjourned to meet at two o'clock p. m.

TWO O'CLOCK P. M.

Academy met in Horticultural hall; President Lantz in the chair.

Minutes of morning session were approved.

The following papers were read:

9. The occurrence of nitrates in well waters. E. H. S. Bailey. (Read by Geo. Wagner, in the absence of the author).

10. Is Bob White a native of Kansas? J. R. Mead.

11. Some properties of liquid ammonia. E. C. Franklin. (Read by C. A. Kraus, in the absence of the author.)

12. Occurrence of *Arenaria interpres* (the turnstone) in Kansas. D. E. Lantz.

13. The purification of water. Wm. Tweeddale.

14. A condensed weather bureau office. T. B. Jennings.

15. Some natural history notes. J. R. Mead.

16. Harmonic forms—the cube, parallelopipedon, and cylinder. B. B. Smyth.

17. The prairie-dog on Nantucket island. F. H. Snow.

The proposed amendment of section 3 of the constitution was discussed, with the result that the section was amended to read as follows:

SEC. 3. Members of the Academy shall consist of two classes, active and honorary (including associate). *Active members* may be annual or life members. *Annual members* may be elected at any meeting of the Academy, and shall sign the constitution and pay a fee of one dollar and annual dues of one dollar: but the secretary, treasurer and librarian shall be exempt from the payment of dues during the years of their service. Any person who shall at one time contribute twenty dollars to the funds of this Academy may be elected a *life member* of the Academy, free of assessment. Any member who has paid dues to the Academy for ten consecutive years, or who has been legally exempt during any portion of that time, may be elected a *life member* on the payment of ten dollars. Any person who has been a member of this Academy in good standing for twenty years may be elected a *life member* without the payment of further fees or dues.

The remainder of the section remains in force.

It was voted that the Academy adjourn *sine die* at the close of this evening's session.

Adjourned to meet in the rooms of the Y. M. C. A. at Washburn College at eight o'clock P. M.

EIGHT O'CLOCK P. M.

Academy convened, with President Lantz in the chair.

The following new members were elected: Mrs. A. H. Merrell, Topeka; C. A. Kraus, Lawrence; F. J. Titt. Topeka.

The following were elected to life membership under the amendment to section 3 of the constitution, each having been a member of the Academy for twenty or more years continuously: F. H. Snow, Lawrence; A. H. Thompson, Topeka; J. T. Lovewell, Topeka; J. R. Mead, Wichita; E. A. Popenoe, Berryton.

It was voted, in the cases of Peter McVicar and S. W. Williston, who were early members of long standing but who allowed several years to lapse before they again became active members, that they be elected life members, all fees being remitted.

Dr. A. H. Thompson and Professor Lovewell favored the Academy with reminiscences of early days.

The committee on resolutions reported as follows:

Resolved, That the thanks of the Kansas Academy of Science be tendered to President Fred. Wellhouse and Secretary W. H. Barnes, of the Kansas Horticultural Society, for the use of their rooms in the state-house for the meeting of the Academy, and to the authorities of Washburn College, for the use of a room in which the closing session was held.

L. C. WOOSTER,
L. L. DYCHE,
J. R. MEAD,
Committee.

It was voted that the Academy appropriate funds, not to exceed one-third the income of the Academy, to be expended on illustrations for the Transactions.

The auditing committee reported the Treasurer's accounts correct, and the report was adopted.

The nominating committee reported as follows: For President, E. B. Knerr; First Vice-President, A. S. Hitchcock; Second Vice-President, J. R. Mead; Secretary, D. E. Lantz; Treasurer, J. W. Beede; Librarian, B. B. Smyth. For Curators: A. H. Thompson, B. B. Smyth, W. A. Harshbarger, Geo. Wagner.

The report was adopted and the officers elected as above.

B. B. Smyth made a report for the Board of Curators. The Board held seven sessions during the year, with all present every session. The report was approved.

The committee on legislation, appointed at the last meeting, and consisting of D. E. Lantz, L. E. Sayre, and S. W. Williston. was unable to report, and the committee was continued. On motion, the names of G. P. Grimsley and Geo. Wagner were added to the above committee.

President Lantz's address on "The Kansas Academy of Science, retrospective and prospective," was then heard with great interest.

On motion, a vote of thanks was tendered the speaker for his able, timely and interesting address.

The Curators, on motion, were instructed to put temporary shelving in the Academy office for the accommodation of the books belonging to the Academy.

The reading of papers was then considered:

18. On variation of the nitrogen-content of maize, and the possibilities for its improvement. J. T. Willard.

The remaining papers on the program were read by title, as follows:

19. A review of the mineral resources of Kansas. G. P. Grimsley.

20. Some localities in Kansas which yield Dakota leaves. C. N. Gould.

21. On injurious tenebrionid larvæ. Warren Knaus.

22. Collecting notes on Kansas Coleoptera. Warren Knaus.

23. A list of Kansas Hymenoptera. J. C. Bridwell.

24. A preliminary list of the Hymenoptera of New Mexico, exclusive of bees and fossores. T. D. A. Cockerell.

25. Kansas Uredineæ. E. Bartholomew.

26. A list of plants in my Florida herbarium. A. S. Hitchcock.

27. Flora of Kansas. B. B. Smyth.

28. Medicinal plants of Kansas, preliminary. B. B. Smyth.

29. Some recent applications of the theory of solutions. E. H. S. Bailey.

30. Indian sculpture in the upper Medicine valley. C. N. Gould.
31. Evolution before Darwin. A. H. Thompson.
32. Some further pendulum experiments. J. T. Lovewell.

The matter of place and time of next annual meeting was left to the executive committee.

Adjourned to meet at call of executive committee.

E. B. KNERR, *Secretary.*

CONSTITUTION AND BY-LAWS OF THE ACADEMY.

CONSTITUTION.

SECTION 1. This association shall be called the Kansas Academy of Science.

SEC. 2. The objects of this Academy shall be to increase and diffuse knowledge in the various departments of science.

SEC. 3. Members of this Academy shall consist of two classes, active and honorary (including associate). *Active members* may be annual or life members. *Annual members* may be elected at any meeting of the Academy, and shall sign the constitution and pay a fee of one dollar and annual dues of one dollar; but the secretary, treasurer, and librarian shall be exempt from the payment of dues during the years of their service. Any person who shall at one time contribute twenty dollars to the funds of this Academy may be elected a *life member* of the Academy, free of assessment. Any member who has paid dues to the Academy for ten consecutive years, or who has been legally exempt during any portion of that time, may be elected a *life member* on the payment of ten dollars. Any member who has been a member of this Academy in good standing for twenty years may be elected a *life member* without payment of further fees or dues. *Honorary members* may be elected on account of special prominence in science, on the written recommendation of two members of the Academy. In any case a two-thirds vote of members present shall elect to membership. Applications for membership in any of the foregoing classes shall be referred to a committee on applications for membership, who shall consider such application and report to the Academy before the election.

SEC. 4. The officers of this Academy shall be chosen by ballot at the annual meeting, and shall consist of a president, two vice-presidents, secretary, treasurer, board of curators, and librarian, who shall perform the duties usually appertaining to their respective offices. The president, secretary, and treasurer shall constitute an executive committee.

SEC. 5. Unless otherwise directed by the Academy, the annual meeting shall be held at such time and place as the executive committee shall designate. Other meetings may be called at the discretion of the executive committee.

SEC. 6. This constitution may be altered or amended at any annual meeting, by a vote of three-fourths of attending members of at least one year's standing. No question of amendment shall be decided on the day of its presentation.

BY-LAWS.

I. The first hour, or such part thereof as shall be necessary, in each session, shall be set aside for the transaction of the business of the Academy. The following order of business shall be observed as far as practicable:

1. Opening.
2. Reports of officers.
3. Reports of standing committees.
4. Appointment of special committees.
5. Unfinished business.
6. New business.
7. Reports of special committees.
8. Election of officers.
9. Election of members.
10. Program.
11. Adjournment.

II. The president shall deliver a public address on the evening of one of the days of the meeting, at the expiration of his term of office.

III. No meeting of this Academy shall be held without a notice of the same having been published in the papers of the state at least thirty days previous.

IV. No bill against the Academy shall be paid by the treasurer without an order signed by the president and secretary.

V. Members who shall allow their dues to remain unpaid for two years, having been annually notified of their arrearage by the treasurer, shall have their names stricken from the roll.

VI. The librarian shall have charge of the distribution, sale and exchange of the published transactions of the Academy, under such restrictions as may be imposed by the executive committee.

VII. Eight members shall constitute a quorum for the transaction of business.

VIII. The time allotted to the presentation of a single paper shall not exceed fifteen minutes.

IX. No paper shall be entitled to a place on the program unless the manuscript, or an abstract of the same, shall have been previously delivered to the secretary.

MEMBERSHIP JANUARY 1, 1899.

OFFICERS.

Elected December 30, 1898.

President	E. B. Knerr	Atchison.
Vice-Presidents	A. S. Hitchcock	Manhattan.
	J. R. Mead	Wichita.
Secretary	D. E. Lantz	Chapman.
Treasurer	J. W. Beede	Topeka.
Librarian	B. B. Smyth	Topeka.
Curators	A. H. Thompson	Topeka.
	B. B. Smyth	Topeka.
	Geo. Wagner	Lawrence.
	W. A. Harshbarger	Topeka.

HONORARY MEMBERS.

Theo. S. Case, Ph. D.	Kansas City, Mo.
Rev. John D. Parker, Post Chaplain	Los Angeles, Cal.
Capt. Arnold B. Johnson, Lighthouse Board	Washington, D. C.
W. A. Kellerman, Ph. D., Ohio University	Columbus, Ohio.
Edw. L. Nichols, Ph. D., Cornell University	Ithaca, N. Y.
W. S. Franklin, Ph. D., Lehigh University	South Bethlehem, Pa.

ASSOCIATE MEMBERS.

Mrs. Mary E. Mudge	Manhattan.
Mrs. Mary Savage	Lawrence.

LIFE MEMBERS.

Francis H. Snow, LL.D., Kansas University	Lawrence.
A. H. Thompson, D.D.S.	Topeka.
Joseph T. Lovewell, Ph.D., Washburn College	Topeka.
J. R. Mead	Wichita.
Edwin A. Popenoe, M. A	Berryton.
Peter McVicar, D.D., Washburn College	Topeka.
S. W. Williston, Ph.D., Kansas University	Lawrence.

ACTIVE MEMBERS.

Geo. I. Adams, Ph. D., Kansas University	Lawrence.
Orr Adams	Topeka.
T. M. Aderhold, B. S., Northwestern University	Chicago, Ill.
E. H. S. Bailey, Ph. D., Kansas University	Lawrence.
S. A. Baldwin	Wabaunsee.
Elam Bartholomew, M. S.	Rockport.
Edward Bartow, Ph. D., Kansas University	Lawrence.
Wm. C. Bauer, Baker University	Baldwin.
C. E. Becker	Ottawa.
J. W. Beede, A. M., Kansas University	Lawrence.
Lucien I. Blake, Ph. D., Kansas University	Lawrence.
S. R. Boyce, Ph. G.	———.
C. M. Breese, M. S.	———.
Arthur Bridwell, Baker University	Baldwin.
J. C. Bridwell, Baker University	Baldwin.
L. P. Brous	Kansas City, Kan.
W. Barnum Brown	Carbondale.

Edw. Bumgardner, M. D	Lawrence.
F. W. Bushong, B. S., College of Emporia	Emporia.
H. P. Cady, B. A., Cornell University	Ithaca, N. Y.
Chas. S. Caldwell	San Jose, Costa Rica.
Mrs. Helen Campbell, Agricultural College	Manhattan.
M. A. Carleton, M. S., Agricultural Department	Washington, D. C.
E. C. Case, Ph. D., Chicago University	Chicago, Ill.
T. D. A. Cockerell, Ph. D., Agricultural College	Mesilla Park, N. M.
H. M. Cottrell, Agricultural College	Manhattan.
F. W. Cragin, M. S., Colorado College	Colorado Springs, Colo.
W. R. Crane, A. B., Kansas University	Lawrence.
Lottie E. Crary	Council Grove.
Chas. H. Curtis	McPherson.
F. B. Dains, B. S., Chicago University	Chicago, Ill.
R. B. Dunlevy, B. S., Southwest Kansas College	Winfield.
A. St. C. Dunstan, C. E., Kansas University	Lawrence.
L. L. Dyche, M. S., Kansas University	Lawrence.
Frank Ellsworth	Effingham.
Arnold Emch, Ph. D., Agricultural College	Manhattan.
D. E. Esterly, M. D	Topeka.
B. F. Eyer, high school	Topeka.
E. C. Franklin, Ph. D., Kansas University	Lawrence.
F. E. Forbes	Topeka.
C. N. Gould, Southwest Kansas College	Winfield.
I. D. Graham, B. A	Manhattan.
G. P. Grimsley, Ph. D., Washburn College	Topeka.
E. S. Harnly, B. S., McPherson College	McPherson.
W. A. Harshbarger, B. S., Washburn College	Topeka.
Erasmus Haworth, Ph. D., Kansas University	Lawrence.
E. H. Heacock, B. S., high school	Topeka.
H. V. Hinckley, C. E	Topeka.
A. S. Hitchcock, M. S., Agricultural College	Manhattan.
C. B. Hoffman	Enterprise.
Earl M. Hoisington	Great Bend.
Ross Hopkins	Lawrence.
J. D. Hooper	Manhattan.
S. J. Hunter, A. M., Kansas University	Lawrence.
Theo. M. Iden, Normal School	Emporia.
O. M. Irelan	Hurdland, Mo.
T. B. Jennings, United States Weather Bureau	Topeka.
A. W. Jones, B. S., Wesleyan University	Salina.
Hugo Kahl, Kansas University	Lawrence.
V. L. Kellogg, M. S., Leland Stanford, jr., University	Palo Alto, Cal.
W. H. Keller	Madison.
D. S. Kelly, A. M	Jeffersonville, Ind.
Mrs. Bertha S. Kimball Dickens, M. S	Ellinwood.
Warren Knaus, M. S	McPherson.
E. B. Knerr, Sc. D., Midland College	Atchison.
C. A. Kraus	Lawrence.
D. E. Lantz, M. S., Dickinson county high school	Chapman.
V. L. Layton	Lawrence.
W. N. Logan, B. S	Beloit.
C. L. Marlatt, M. S., Agricultural Department	Washington, D. C.

F. A. Marlatt, M. S.	———.
F. O. Marvin, C. E., Kansas University	Lawrence.
R. Matthews, D. D. S.	Wichita.
C. F. Menninger, M. D.	Topeka.
Mrs. A. H. Merrill	Topeka.
Benj. L. Miller, B. A., Penn College	Oskaloosa, Iowa.
Ephraim Miller, Ph. D., Kansas University	Lawrence.
E. C. Murphy, C. E., Kansas University	Lawrence.
H. L. Nelson, Washburn College	Topeka.
H. B. Newson, Ph. D., Kansas University	Lawrence.
A. M. Nissen, A. M., public school	Wetmore.
Matthew Noll, Ph. G.	Atchison.
J. B. S. Norton, B. S., Missouri Botanical Garden	St. Louis, Mo.
D. H. Otis, M. S., Agricultural College	Manhattan.
Walter K. Palmer, M. E., Kansas University	Lawrence.
E. N. Parker	Potwin.
C. S. Parmenter, A. M., Baker University	Baldwin.
Percy J. Parrott, A. B., Agricultural College	Manhattan.
C. W. Pratt	Howard.
J. M. Price, jr., B. S.	Atchison.
C. S. Prosser, M. S., Union College	Schenectady, N. Y.
E. G. Pultzer, Baker University	Baldwin.
Minnie Reed, M. S., high school	San Diego, Cal.
E. S. Riggs, A. M., Harvard University	Cambridge, Mass.
W. R. Ringle, Kansas University	Lawrence.
W. G. Riste, B. S., high school	Colby.
F. H. Rose, Southwest Kansas College	Winfield.
L. E. Sayre, Ph. M., Kansas University	Lawrence.
J. E. Shacklett	Fall River.
S. Z. Sharp, A. M., Plattsburg College	Plattsburg, Mo.
E. T. Shelly, M. D.	Atchison.
Alva J. Smith	Emporia.
B. B. Smyth, Academy of Science	Topeka.
J. W. Stailey	Lawrence.
Chas. H. Sternberg	Lawrence.
W. C. Stevens, M. S., Kansas University	Lawrence.
Alban Stuart, B. A., Kansas University	Lawrence.
W. T. Swingle, M. S., Agricultural Department	Washington, D. C.
F. J. Titt	Topeka.
E. E. Tyler, M. S., Polytechnic Institute	Lincoln, Neb.
Wm. Tweeddale, C. E.	Topeka.
D. M. Valentine, LL. D.	Topeka.
Geo. Wagner, Ph. C., Kansas University	Lawrence.
J. D. Walters, M. S., Agricultural College	Manhattan.
M. L. Ward, D. D., Ottawa University	Ottawa.
Lora L. Waters, M. S.	Manhattan.
Geo. F. Weida, Ph. D., Agricultural College	Manhattan.
H. C. Welty	Topeka.
J. T. Willard, M. S., Agricultural College	Manhattan.
J. W. Wilson, B. S., high school	Effingham.
L. C. Wooster, Normal School	Emporia.
J. A. Yates, Ph. D., Ottawa University	Ottawa.
J. E. Youngberg, Ph. G.	Ottawa.

TRANSACTIONS.

I. PRESIDENTIAL ADDRESSES.

SCIENCE IN EDUCATION.

BY PREST. S. W. WILLISTON, LAWRENCE.

A presidential address delivered before the thirtieth annual meeting of the Academy, at Baldwin, October 28, 1897.

During the year 1895–'96 there were in attendance at the colleges and universities of the United States nearly 50,000 students who were pursuing courses leading to the degree of bachelor of arts, and of whom nearly 10,000 received that degree. In the various technological and professional schools there were 66,000 students and nearly or quite 15,000 graduates. That is, those students seeking the so-called liberal education were less than forty per cent. of all the candidates for college degrees.

In none of the professional schools, with but few exceptions, is the possession of a college or university degree necessary for admission. A single medical school at the present time requires its matriculates to possess the bachelor degree, and some others will in the near future. In the theological schools a preparatory college education is more usual, but the whole number of theological students in the United States is relatively small, and does not seem to be rapidly increasing.

Nearly one-half of the professional students are those studying medicine, and of these I do not think more than five per cent. are graduates of other courses. Less than that percentage will be found among the engineering students, for reasons that will appear later. The profession of law, which is yet far behind the other professions in its educational requirements, has less than 10,000 students in attendance upon college instruction in our country, not one-third of the number of the medical students, though the members of the two professions in practice are much more nearly equal in numbers. A much larger proportion of arts graduates turn to the legal profession than to any other, in part due to the fact that the educational requirements of the legal profession are, in general, on so low a plane that the earnest young man is not content to enter upon his life's work with so slight a college preparation as it demands: in part because the ordinary college course offers better preparatory training for the legal profession than it does for any other, save the theological or pedagogic.

I am not aware of any statistics of the number of arts graduates among the active members of the professions in America, as a whole, but the number is clearly very small, certainly not one in ten, and I believe that there can be no question but that the percentage is steadily becoming less from year to year.

Our first impressions are that this fact is to be deplored. I believe, however, that it is rather matter of congratulation, inasmuch as it certainly means in the end better preparation for the active duties of life by the great body of professional men.

In no branch of education has there been more active progress than in that of medical education in the United States during the past fifteen years, and in none has there been a larger proportional increase of students. Twenty years ago, with almost no educational requirements for matriculation, nearly every medical institution in this country would graduate the average student after two courses of lectures, the second a repetition of the first, and each of but four or five months' duration. I have known students of average ability to receive the diplomas of some of the most renowned medical colleges of the United States whose entire medical tutelage was comprised within a period of less than one year's extent.

At the present time, many require four years of college work, or shortly will, and these college years are often eight or nine months in length, and are never less than six. Furthermore, they are not mere repetitions, but are graded from entrance to graduation, with constant laboratory practice and frequent examinations. When the course was of but two years' duration, more students relatively sought preparation in a more liberal education in the college of arts, for the same reason that seems to actuate many law students. Many of the law schools now require but two years' attendance upon college work and practically only nominal preparation for admission, and the majority of the practicing lawyers of our country have had no college professional training at all. The better colleges are now extending their course to three years, and it is only a question of a short time when the period of college study necessary for the reception of the legal diploma will be equivalent to that of the medical profession.

The modern educational requirements of the medical profession have, I believe, raised it to a distinctly higher plane than that of the law. To use the words of Justice Brewer: "A growing multitude is crowding in who are not fit to be lawyers; who disgrace the profession after they are in it; who in the scramble after a livelihood are debasing the noblest of professions into the meanest of avocations; who, instead of being leaders and being looked up to for advice, are despised as the hangers-on of police courts and the nibblers after crumbs which a dog ought to be ashamed to touch."

But this condition will not last long. The time will soon come when every one who appears before the bar of justice as an advocate will be a thoroughly educated man or woman. And does this mean that he will be required to have a four years' education in the college of liberal arts? Most certainly not. A four years' course in the law school will be required, whose certificate will carry with it the educational right to admission to the bar, and little or no attention will be paid to the so-called branches of liberal culture.

Conditions have changed much. The greatly increased competition and the greater struggle for existence now render it imperative that the professional man should be better grounded in the principles of his profession than he once was. The great accumulation of scientific knowledge has left the teas, the simples and the boluses for the quack in medicine. The lawyer cannot be a politician, a real-estate or insurance agent, and, in the intervals of his avocations, do justice to his client. The professional man cannot spend much time in purely cultural and æsthetic studies, while his competitors are spending theirs in acquiring a knowledge of how to treat their patients or how to execute a legal document.

The average course in the college of liberal arts does not prepare for the studies of the medical profession, and not many physicians now urge young men to pursue the course in arts as a preliminary to professional training. A part of that time certainly is better spent in the more thorough mastery of the professional education.

The average age of graduation from the college or university at the present time is nearly twenty-three. The ambitious graduate in medicine will desire to give at least one year to hospital practice or to travel before beginning his more

—2

active duties. He is then twenty-eight years of age, and two or three years more will certainly be needed before he becomes an independent member of society.

And this is not the worst of it. In the profession of medicine, as in all other professions, book lore, or professional lore, is only a part of the foundation for successful practice. A knowledge of mankind, of men and women, is more essential than a finished knowledge of his profession. At twenty-seven or twenty-eight a man is too old to acquire this knowledge in the best way; the plasticity of youth is waning, and new habits are hard to form. He must remain more or less controlled by his student habits, out of intimate touch with the great mass of the people and their inner life. And this lack of knowledge of human nature must surely remain as an obstacle to the most useful and successful practice.

President Eliot has said: "The average age of admission to Harvard College at this moment is fully nineteen. The student who stays here four years is twenty-three years old when he graduates. He then goes to our medical school to stay four years: so he is twenty-seven years of age before he has his medical degree, and we all know that some years intervene between that achievement and the competency to support a family. Now, that highly educated young man ought to have married at twenty-five."

The same conditions will surely confront the lawyer before long, and not only the lawyer, but the dentist, the theologian, and students of other learned professions.

An answer that is brought as a solution for this unsatisfactory state of affairs is that the fault is in the preparatory schools. That poor teachers and poor teaching make the work of preparation for the college longer than need be, is very true, but I do not think that any relief obtained here will influence students toward the college of liberal arts. As teaching in the secondary schools becomes better and more efficient, other subjects will be crowded into the high-school course, filling in all the time that is saved. This will be of added advantage to the professional student, and will more and more tend to lead him away from the college of liberal arts. Furthermore, none of the colleges of the United States have shown much, if any, tendency to shorten the course leading to, or render less difficult the requirements for, the bachelor of arts degree.

The entrance requirements for the medical and law schools are at the present time very unsatisfactory. The medical schools have labored unceasingly to increase them for the medical degree, during the past ten years, so far as professional knowledge is concerned, but they have done very little toward increasing the requirements for admission to the schools. In very few schools are they at all equivalent to those for admission to the freshman class in the better colleges of liberal arts. A very little knowledge of some foreign language, usually Latin is required; a little mathematics and a little physics, and a passable knowledge of English; but the student needs very little of what the world calls liberal culture, and practically nothing whatever is demanded.

After considering these chaotic entrance conditions to the professional colleges of law and medicine, it is refreshing to turn to another, in which, with but little pretension, with modesty and deprecation, rather a model has been set which all the other professions will, in the end, surely follow.

The engineering profession to day is, upon the whole, the best educated in America. While there may be a smaller proportion of highly trained men, there is also a far smaller proportion of poorly trained ones than in either medicine or law. It may seem strange that that profession which comes less into immediate contact with the general public should be, upon the whole, more highly trained than those which touch so closely the pecuniary and physical well-being of every one. But the reason is not hard to find. The engineer is judged more by his peers, while the lawyer's or physician's success is dependent very largely upon the public. The capacity of the engineer must invariably be made apparent to men of affairs and ability, while the lawyer or physician is judged, for the most part, by those who are incompetent to determine his real merits.

Undoubtedly, as the years go by, more rigorous requirements will be demanded from the engineer, as from the lawyer and physician, but I do not believe that they will ever be very great in extent, save as new methods of teaching are developed, and these will require ability and capacity rather than time. The engineer may enter upon active life at the age of twenty-four or -five at the outside, fully grounded in the principles of his profession. No gap is left in his education between the high school and his strictly professional course, but the one grades into the other in an harmonious way. Though he graduates with the commonplace degree of bachelor of science, it represents, on the average, more college work than does that of doctor of medicine.

If, then, the learned professions are drifting away more and more from the college of liberal arts, what is the object of a general college education? What does the average young man or young woman have in view when he enters upon a four years' course leading to the degree of bachelor of arts? Undoubtedly the larger number have nothing definite in view. They are actuated, for the most part, by the desire for a better education, without any clear idea of what they wish to accomplish in life. Had the student in the high school a definite conception of his future work in life, he would be more apt to seek that special training which would most enhance his prospects for success. Many of the universities and colleges have endeavored to attract those students who have determined upon their life-work, and who would otherwise skip the general college course, by offering some choice of studies, or by permitting the last year in the course for the arts degree to be spent in the professional school. This system of optionals has, perhaps, reached its highest development at Harvard and Leland Stanford universities, where not only great latitude is allowed in the entrance conditions, but the whole college course is made up more or less fully of optional studies. That this system has been popular is shown by the more rapid growth of these and similar institutions as compared with the more conservative institutions, where many of the older classical requirements are yet rigidly insisted upon.

But the system of optionals has gone quite far enough in some directions, not far enough in others. The average student, who has not yet made up his mind what he will do with himself, is bewildered and confused by the multiplicity of studies opened up before him. He is not competent to judge what is best for himself, and he needs at this time, more than at any other in his life, the advice and assistance of those who have gone before him over those labyrinthine roads; and he rarely gets it. The study of Chinese jurisprudence seems to have as much importance in the college curriculum as do other subjects, and, if the teacher is popular or "easy," he selects it. If he is working for his degree, as unfortunately most undergraduate students in the college are, he picks out the "soft snaps," in college parlance, and tries to double up on his studies that he may get through the sooner. Throughout all his preliminary course in the high school, as well as in his freshman and sophomore years, the study of language and mathematics has been strongly emphasized and he has had hardly a glimpse of any other branch of knowledge. In the name of common sense, then, how can he be expected to have acquired any taste whatever for unrelated and dissimilar studies, or to have any conception of their relative importance? His advisers have been chiefly linguists and mathematicians, whose ignorance of the natural sciences is often equaled only by their prejudice against them. It is a fact that the larger proportion of those who have become students of the natural sciences have had their inclination formed despite of rather than by means of the university. The university seldom intimates to them that science studies ought to form an important part of their general training.

The result of all this desultory or biased study is that the student usually graduates without any clear idea of what he will do in life. He rarely studies with any definite aim, save that of getting an education, of the value of which he has little conception. He has been taught to believe that the best possible preparation for success in any department of life is a liberal education, and he does not trouble himself much as to what his future career may be, resting self-satisfied in the delusive assumption that he will be fitted to enter upon anything.

It is true that the most earnest students that we have are those of the professional schools. A distinguished teacher of engineering has said: "It is unquestionably a fact that the engineering students of our colleges do more and harder work for a degree of equal grade than do the students of other departments." As a teacher of medical science, I know that the average medical student does fifty per cent. more work than those of like capacities in the undergraduate arts courses. There can be no denial of the fact that the most earnest students are those who seek knowledge as a direct means of success in life rather than for the mere pleasure of its possession.

I believe, therefore, that the principle, now so largely adopted, which permits the student to browse about at his own will, with a nibble here and a bite there, is wrong. He should be permitted and required, early in his life, to gaze upon the broad field of knowledge and at least to taste some of its enjoyments, in order that he may find out what his best and easiest path will be towards success. Away with the medieval idea that a course in arts fits a man for anything. It does not and never will, unless it changes very much from what it yet is. As we have seen, the degree of bachelor of science in engineering, to which we may also add that in pharmacy, represents a larger degree of training and a greater knowledge than that possessed by the bachelor of arts. Why, then, does the latter assume such transcendent importance in education? Solely upon claim of culture. How many are the sins that are committed in thy name! The classical student, who has devoted five or six of the best years of his life to the study of the ancient languages, with little or no attention given to the modern sciences, is dwarfed and narrowed in his conceptions of life, even as the scientific student would be with no knowledge of the languages. Horace Greeley meant just such students as these when he said: "Of all horned cattle, deliver me from the college graduate." I by no means wish to deprecate the study of language and of philology. They are among the noblest that the student may undertake, and well worthy of the ardent pursuit of the specialist. So, too, are the professions of law and medicine; but no one will presume to say that everybody should be a lawyer or a physician in order to be cultured.

At Yale College not less than nine or ten years of foreign-language study are required for graduation, and not one week of any natural science. In the University of Kansas, which may be taken as an average type of the western universities, five years' study of foreign language must be had, and nothing whatever of any biological science.

Is that department of human knowledge which, more than all others, has been the foundation of the civilization of the present century; which has done more to lengthen life, to ameliorate its burdens, to improve, purify and advance the world; which has furnished one of the great underlying principles of modern education, of which even the philologist boasts—laboratory methods; which has established the great underlying principle of all progress—evolution—is this department of knowledge, I say, of so little importance that it is practically ignored in the requirements of a modern liberal education? Twenty-five years ago the classical course was the almost invariable one in our colleges; but even in those times I was required to learn the rudiments at least of physics, chemistry, botany, zoology, and geology. Now modern education has liberalized the course by making the larger part of the language studies compulsory, and all, or nearly all, the natural sciences optional!

But the writing on the walls is so legible that he who runs may read. Yale College, the great exponent of the classical course, has been almost the only prominent college in the United States that has not gained materially in attendance during the past two years. Harvard, more liberal, does not insist upon so extended a study of the ancient languages, and will permit a considerable amount of science to be offered in their stead. Columbia College, which, until recently, has had requirements almost like those of Yale, has so modified its course that Greek is no longer demanded. To quote from its recent catalogue: "No one can obtain the degree of bachelor of arts who does not know something of at least one ancient language, and who has not therefore looked out through this window upon the world of antiquity. He must know also something of history, something of philosophy, something of political economy, a good deal of English, something of mathematics, and something of at least one natural science. He must also have a reading knowledge of French and German." It is refreshing to learn of one college that does require the student to leave that window of antiquity long enough to learn something of one natural science, of the laws that control the world and its inhabitants. We may be profoundly thankful that all the universities do not insist that we shall look out through two windows upon the high morality and civilization of the old Romans and Greeks.

In thus claiming some recognition for natural sciences in the course of liberal arts I shall doubtless be accused of narrowness. I trust, however, if I am, that it will not be imputed to ignorance of the classical course. I studied, when a youth, Latin and Greek for the prescribed time of six years each, and have since learned to speak or read three or four of the modern languages.

But I do more than claim recognition for the sciences. I claim broadly and emphatically that the natural sciences, any or all of them, are as valuable and as necessary as pure cultural studies as are the languages; that intelligent and successful study of them will do as much, if not more, in making the student a broad man, a successful man, as will the study of Latin or Greek. And they will do more in making him an honest man. Nowhere in all the broad field of knowledge will he learn better to think exactly than in the natural sciences. Nowhere will he be more impressed with the importance of truth for truth's sake.

Among the graduates of the University of Kansas, with whom I am best acquainted, there are not more than one-half who have had any training whatever in the natural sciences, with the exception of about ten weeks in physics and as many in chemistry, and perhaps a smattering of physiology. The simplest facts in natural history are as utterly unknown to them as is the prosody of the Hebrew language. A little, a very little, of biological science has been absorbed in the reading of fiction, of history, and the newspapers.

The simplest functions of their own bodies remain for the most part sealed mysteries; the commonest laws of nature inscrutable. In fact, the ignorance of nature as a whole among the majority of the graduates of the so-called liberal colleges is usually abysmal in its profundity; Stygian in its opacity. In the rules of philosophy they may be able to "distinguish and divide a hair betwixt south and southwest side," but are unable to tell the difference between granite and limestone, a pollywog and a porpoise. In the laws of political economy they may talk learnedly and dogmatically, but are unable to to locate the liver in their own body or to tell its functions. I verily believe that a third of the graduates in arts of our universities, and a fourth of their instructors, could not tell whether the pancreas is located above or below the diaphragm, or whether or not they have either pancreas or diaphragm at all. Grant Allen, in the *Cosmopolitan*, says: "Quite well-informed people will speak of a porpoise or a lobster as a fish. Such grotesque blunders ought to be made impossible; they ought to be considered far more damnatory evidence of ignorance and ill breeding than 'you was' or 'me and him went there.'" With such a standard, how many college graduates are there who are educated?

President Dwight, in the same periodical, says: "In any future development of the college system, the chief purpose of general culture should not give way or be subordinated to any purpose of special culture with a view of some special work in future years." It is this spirit of culture for culture's sake that has dominated Yale College so thoroughly in past years and which makes the institution to-day the best type of the non-utilitarian education in America. The same conservatism is evinced in Professor Peck's attitude toward education. The classical student with him is a "gentleman and a scholar," while the scientific student is a "sublimated tinker." No wonder that he urges the unwisdom of a higher education for the masses of the people.

There is much in favor of the primary importance of mind building in education, and no education can be the best that makes it subordinate to the mere acquisition of knowledge. But the position is assumed, by those who favor the classical education, that utilitarian studies may not be at the same time cultural; that one may not get useful knowledge and mind building at the same time.

To use President Andrews's words: "Our strictures upon classical studies in college would have less weight were it not that these subjects crowd from the curriculum numerous others which would at least be equally suitable for college drill and incomparably more valuable later. The common opinion seems to be that, to be useful in disciplining the mind, matter for study must be useless for the purposes of life. There could be no greater error. Studies like social, political, physical and biological science, and modern literature and history, all of which are vitally important for intelligent men and women who must live and act their part to-day, are precisely the ones best calculated to enlarge, cultivate and strengthen the intellect."

The mistake that President Dwight and those who think with him make is in assuming that all men are capable of the broadest and highest culture, or that a liberal education should be limited to those only who have such capacities. We urge upon the future student of medicine that he should pursue a liberal classical course in preparation for his professional training. He replies that he has no aspirations and no ability to be a leader among men: he seeks only the best education he can get that will fit him for a more humble sphere. He skips the college course, and devotes all his time to his professional studies. In fact, the strictly classical course, such as Yale best represents at the present day, is perfectly adapted for but one class of people—gentlemen of leisure, who are not dependent upon their daily toil for their bread. One would not ask the hod-carrier to pursue a course in the ancient languages before beginning his apprenticeship; nor should one require the same of the ordinary professional student.

An an opposite extreme to the conservatism of Yale may be cited Leland

Stanford University, in which knowledge of the ancient languages is not indispensable for graduation. In this institution twenty-two subjects may be offered for admission, only one of which (English) is required, the remainder to be chosen from the twenty-one other courses. This list includes algebra, geometry, trigonometry, physics, chemistry, physiology, botany, zoology, drawing, American, English and ancient history, Spanish, French, German, Latin, and Greek. In the college course certain groups of studies must be selected under advice, but this is the only restriction upon free choice. The effect that this latitude has upon the choice of studies is interesting. Of those who last year took their major work in Latin and Greek there were 76; in history and economics, 219; in mathematics, 29; in the natural sciences, 223; in modern languages, 80; in English, 140. In the ancient languages 151 students were enrolled the first semester of last year; in the modern languages, 686; in mathematics, 148; in the natural sciences, 926.

The friend of classical culture may justly say that the education that seems possible at Leland Stanford is a narrow and one-sided one. A student who knows nothing whatever of the foreign languages is as surely a dwarfed and one-sided man as is he who studies the languages only and none of the natural sciences. It is not to be supposed that the students of Leland Stanford are of a different class from the students of other universities. There their choice is almost wholly unrestricted and the natural inclination away from the ancient languages is conspicuously shown. The only bachelor degree given for work in any of the lines possible is that of bachelor of arts.

When the old classical idea was yet so firmly inwrought into higher education that all else was leather and prunella, degrees of all sorts sprung up as mushrooms—bachelor of science, of philosophy, of pedagogy, of music, of engineering, of pharmacy, of agriculture, of mechanics, and of goodness knows what. They were frank statements that such degrees did not mean liberal culture, and were given rather as placebos. These degrees have, fortunately, largely been abandoned, the older degree of bachelor of arts supplanting them; an acknowledgment that liberal culture may be obtained in other ways than the old classical one. I am aware that many will lift up their hands in classical horror at the bare suggestion that such a thing is possible as a bachelor of arts course in science, thoroughly convinced that the wolf has at last stolen bodily the raiment of the sheep.

The effect of the present requirements for the admission to the colleges and University of Kansas has been in a high degree disastrous to science instruction in the secondary schools. Chemical laboratories that once delighted and instructed the high-school pupils, the microscope and its world of revelations, the herbarium, the museum and the dissecting knife have been abandoned, and in their place Latin, German, and French have been substituted. Of all the subjects required for admission to the state university, students come best prepared in Latin, because the requirements in this subject have been made most severe and important. Instruction in the natural sciences in the secondary schools of our state is superficial and imperfect in the highest and most astounding degree. Of all those who are candidates for the state teacher's certificate to teach the sciences, it is the exception that one has as much knowledge of any branch as might be acquired by the diligent student in ten weeks of work; rare that an examination paper is the equal of those offered by the second-rate students in our university.

Put, however, the same emphasis upon botany, zoology, chemistry, and geology that is given to Latin, and the preparation would very soon be fully as good, fully as thorough. Let the high-school scholar learn that the study of the natural sciences is deemed as valuable in his preparatory training as is language or mathematics, and there will be no lack of good teachers.

Were I, then, to say what the universities and colleges ought to do, it would be this: Make all the ancient language requirements for admission optional, and demand as much preparation in the physical and biological sciences as in the foreign languages. The preparation in English should be made far more rigorous and thorough. In the college course, if anything besides English is required, and I think there should be, I would have the natural sciences as necessary a part of the education as language and mathematics. I would not have it possible for a student to graduate from the college without having studied, and thoroughly studied, mathematics as far as trigonometry, at least one foreign language, and at least one physical and one biological science. And I do not mean a few weeks of study in any of these branches, but exhaustive, careful, critical study.

The methods of study in all these branches are diverse and are absolutely essential for symmetrical mind-building.

Furthermore, an indefinite, haphazard selection of studies in the college course should be impossible. The course should be, so far as possible, adapted to the capacities, tastes and abilities of the individual, and this does not mean an indiscriminate selection on the part of the student. A person with feebly developed chest muscles might naturally prefer those physical exercises in which such muscles would take little part, but he nevertheless needs such exercise most.

It is through the great universities, and especially the state universities, that the solution of the problems of professional education must come, and, in fact, has come, for some of the professions. With such cultural training as is best adapted to the lawyer's needs, the college course should include all the strictly non-professional branches, leaving the student, after he has completed his course as bachelor of arts in law, to take up the work of the professional school and complete it in two years with the degree of doctor of laws. In the medical course there are even greater opportunities than in law. The medical colleges should resign to the undergraduate arts course all the non-professional branches. And the work rightfully belongs there. The best chemical laboratories in the United States are not in the medical colleges, but in the universities. Nowhere are physiology, histology and anatomy better taught than outside of medical colleges. As in engineering, there should be an harmonious course leading through the high school to the bachelor of arts in medicine, preparatory to two years of strictly professional work, with the degree of doctor of medicine.

When such training as this is demanded of all aspirants to professional practice we shall have uniformly well-educated men in the professions, and not until then.

THE KANSAS ACADEMY OF SCIENCE.

BY ITS PRESIDENT, D. E. LANTZ, CHAPMAN, KAN.

An address delivered December 30, 1898, before the thirty-first annual meeting of the Kansas Academy of Science.

The present session is the thirty-first annual meeting of the Kansas Academy of Science. An institution which has existed for thirty years in the state of Kansas ought to have done work which should fully justify its existence. It should have already so impressed itself upon the public as to merit the continued favor, not only of scientific circles, but of the whole commonwealth.

The Kansas Academy of Science has done all its work in the past with becoming modesty. Its meetings have been held without preliminary parade or sounding of trumpets. Its members have come up to the annual meeting with modest papers, in which some fresh discovery, some careful observation or some summary of results has been made known to our little circle. Our meetings over, each has returned to his own peculiar field of labor, encouraged to make further investigation, as his limited opportunities permitted. The work has been for its own sake, without any hope of pecuniary reward, and always at financial loss to our members, who were aware that the delay in publishing our proceedings has resulted in the loss even of that credit which belongs to every scientific investigator, growing out of priority of publication.

For the purpose of instructing our younger members, and such of the public as may be here present, I have ventured upon a short review of the work of the Academy in the past, with some suggestions for the future, which it seems to me grow out of our present conditions.

The objects of our association are briefly stated in our simple constitution to be "to increase and diffuse knowledge in the various departments of science." A steady regard for these objects characterized the founders of the Academy, and has guided our members in all their efforts. Love and enthusiasm for their favorite pursuits have been the impelling forces, and so our state has been explored; the character of her varied resources—plant, animal, or mineral—have been studied; her rocks have been examined, her geological horizons have been determined, and the records of these matters, whether they appear in our own publications or elsewhere, have been made by members of this Academy.

In the Kansas *Journal of Education* for March, 1868, appeared a letter written by Rev. Jno. D. Parker, calling attention to the benefits to be derived from an organization of the naturalists of the state. In July of the same year he issued in the same journal a call for the first meeting of those interested in the natural sciences. To this call seventeen names were appended, many of which are honored in our associations: John Fraser, D. H. Robinson, B. F. Mudge, J. A. Banfield, J. S. Hougham, Jno. D. Parker, R. A. Barker, D. Brockway, J. R. Swallow, G. F. Chapin, J. H. Carruth, R. D. Parker, Jeff. Robinson, Peter McVicar, F. H. Snow, J. S. Whitman, and Richard Cordley.

Some of these people never became members of the organization, but the majority did. Of these, some have passed over into the "unknown country," some are nearing the boundary line which marks the transition from this world, while a few, with energy and enthusiasm unabated, are still filling their places among us.

John D. Parker, who prepared the call, was then professor of natural history in Lincoln College (now Washburn). The first meeting was held in his class-room at the college, September 1, 1868. An organization was effected under the name of the Kansas Natural History Society. Its first officers were: Prof. B. F. Mudge, President; J. S. Whitman, Vice-President; John D. Parker, Secretary; Frank H. Snow, Treasurer; John A. Banfield, Curator.

The second meeting of the society was held in the Presbyterian church, Topeka, September 7, 1869. Papers were read by Professor Mudge and Edward Cave, and a public lecture on the mound-builders was delivered by John D. Parker. The officers of the previous year were reëlected. It was largely owing to the efforts of Professors Mudge and Parker that the society was kept alive in those early days. Nobody, comparatively, in the new state seems to have had any time for science.

The third annual meeting was held in the university building at Lawrence, September 5 and 6, 1870. Papers were read by Carruth, Snow, Mudge, Parker, and Saunders, and public lectures were given by John Fraser and John H. Barrows. Fraser was elected President and served in that capacity for three years. Parker was continued in the office of Secretary for four more years. At this meeting President Fraser suggested the propriety of broadening the scope of the society's work so as to include every branch of scientific exploration and research in the state, and a committee reported favorably on the proposition. As an actual fact, mathematics and archæology had already been given a place upon the program of the society.

The fourth meeting of the society was held in Leavenworth in October, 1871. The constitution and by-laws were amended in accordance with the suggestion of the previous year, and the name of the society changed to the Kansas Academy of Science. A number of valuable papers were read, and public lectures given by Professors Snow and Mudge.

The fifth session of the academy was held at Manhattan in October, 1872. About a dozen papers were contributed and Rev. Chas. Reynolds delivered a public lecture. The next session of the state legislature incorporated the Academy as a state organization by the following enactment: "The Academy of Science shall be a coördinate department of the State Board of Agriculture, with their office in the agricultural rooms, where they shall place and keep for public inspection the geological, botanical and other specimens; the same to be under the control of the officers of said Academy of Science. An annual report of the transactions of said Academy of Science shall be made on or before the 15th day of November of each year to the State Board of Agriculture, for publication in the annual transactions of said board. This section to be inoperative and void unless accepted by said Academy of Science, in writing, signed by the President and attested by the Secretary thereof." (Laws 1873, ch. 137, § 2.)

This act of the legislature, passed without any solicitation on the part of the Academy, was a recognition of the value of the Academy's work. No doubt we were largely indebted to the efforts of Alfred Gray, then secretary of the State Board of Agriculture, for this favorable legislation.

The Academy at its next meeting, in Lawrence, in 1873, formally accepted the provisions of the above act of the legislature, and thus became a coördinate department of the State Board of Agriculture. By this act, also, the Academy became the custodians of the state museum. Undoubtedly we received far more benefit from this association than we conferred. Without it the Academy would have remained for years without means for publishing its proceedings, and without a place of habitation. Yet it may be that, had the legislature of 1873 failed to make provision for the Academy as it did, a separate provision would have been made soon afterward. As it is, there are hindrances growing out of our relations to the State Board of Agriculture. Coördinate in name, we have, of necessity, and rightly, been subordinate in practice. Our requisitions for printing and supplies for years were a drain upon the already narrow resources of the board, and we could claim nothing unless it was first approved by the secretary. We have, I may say, been very fortunate in coming in contact with secretaries who were friendly to the work of the Academy, and who did all in their power to help. I doubt not, however, that the board of agriculture would now be glad to be relieved of the Academy as an annex, since our work, while not entirely foreign to agriculture, is done from a different standpoint and with a different purpose in view. Surely, too, the Academy, by reason of the value of its work, and because there is room for it as the state-house nears completion, deserves a separate maintenance. It has earned the right to stand alone.

What growth has the Academy made? In numbers, from the half-dozen men who founded it, it has increased until its nominal membership is nearly 200. The actual working membership is much less, but it has succeeded in arousing a popular interest in science in a number of communities in Kansas where the annual meetings have been held. Of its thirty previous meetings, fourteen have been held in Topeka, five in Lawrence, three in Manhattan, two in Emporia, two in Leavenworth, and one each in Atchison, Wichita, Ottawa, and Baldwin. In all of these communities there has been a considerable local membership whose interest in our work is permanent.

The number of papers read at our meetings has increased steadily, until the time allowed for their presentation has been insufficient; and, for some years past, many have been read by title only. Our Transactions, instead of filling only a score of pages in the report of the secretary of agriculture, as they once did, have grown into separate volumes of from 200 to 300 pages.

Nor have the reports of the Academy been filled with matter which is of little value. On the contrary, all papers presented have been carefully examined by a publication committee, and only those considered to be of permanent value have been published.

In geology, we have published the valuable papers of Professors Mudge, Saunders, St. John, Hay, Haworth, Sharpe, Prosser, Grimsley, and a number of other workers.

In botany, much of the work of Carruth, Kellerman, Swingle, Smyth, Hitchcock, and Miss Minnie Reed has found a public through our Transactions.

In entomology, the work of Snow, Popenoe, Knaus, Williston, and others, found in our Transactions, are of great importance.

In chemistry, I recall the names of Kedzie, Patrick, Bailey, Willard, Failyer, and Dinsmore, as contributors to our proceedings.

In pharmacy, Doctor Brown and Professor Sayre have been valued contributors.

In ornithology, the names of Snow and Goss have been preëminent, but there have been many lesser lights.

In every branch of natural science we have had enthusiastic workers whose contributions have both enriched the literature of the subject and added to our knowledge of the resources of the state.

A list of the past officers of the Academy presents an array of names which stand as a guaranty for faithful performance in the matters under their control. As Presidents we had Professor Mudge (four years), John Fraser (three years), Professor Snow (five years), Professor Lovewell (two years), Doctor Brown (two years), Doctor Thompson, Professors Nichols, Dinsmore, Failyer, Popenoe, Bailey, Sayre, Kelly, Williston, Mr. Robert Hay, Mr. J. R. Mead, and Mr. Warren Knaus.

As Secretaries we have had Jno. D. Parker, John Wherrell, Joseph Savage, Prof. E. A. Popenoe, Professor Bailey, A. M. Collette, and Prof. E. B. Knerr. Professor Popenoe served the Academy in this office for a dozen years.

We believe, too, that through all these thirty years we have maintained the scientific spirit manifested in the earlier efforts of the founders of the Academy, and that we have also added the clearer vision which must always come as observations are extended.

For many years the efforts of the Academy were directed toward securing a geological survey for Kansas, to be partly under the direction of the Academy. It is probable that our agitation in this direction was largely instrumental in securing the present survey under the direction of our state university. This work, while it is not what the Academy was seeking, is probably better than our plans contemplated, and I may add that it is all being done by our members, although entirely independent of our organization.

It was an early thought of the founders of the Academy that large scientific collections would be made by the members and that these would be secured to the state. A curator was elected at the first organization. Materials began to accumulate, but it was not until the society was given a place in the rooms of the board of agriculture, with space for its collections, that anything like a display was made. By the help of Mr. Gray and other secretaries of the board a fair series of natural-history specimens was secured; members of the Academy labeled and arranged them; and this museum in the rooms of the board of agriculture has been for many years a source of interest to all visitors to our statehouse.

There is another part of this museum which, while it would not be so attractive to the public, has a greater scientific and economic value. The mineralogical and geological specimens are stored in boxes and corners where, for the present, they are worse than useless. Under the hands of a skillful curator they could be made both attractive and instructive, provided a suitable place for their display could be secured.

Then there is the Kansas herbarium prepared by our versatile librarian, Mr. Smyth. It is stacked away in a corner where it cannot be consulted without great inconvenience. It needs roomy cases, where each genus can be placed in a separate compartment, and where any specimens can be readily accessible.

In addition to these general collections, whose value is unknown and at present unknowable, the State Executive Council has appointed the Academy of Science as curators and custodians of the magnificent museum of birds — the Goss collection — that monument to the energy and enthusiasm of a man who loved his work. Some years before his death Colonel Goss was offered $25,000 in cash for his collection, and afterward he added many rare specimens to it. It has not depreciated in value, and, if properly cared for, will not do so; for the work of Colonel Goss was thoroughly and honestly done.

The museum under the care of the Academy, as now seen in the agricultural rooms and in the Goss collection, and as not seen in the Academy's rooms, is worthy of a place for display — is worthy of the care of a paid curator, and would increase very rapidly if encouragement and opportunity were given to the Academy to work for its improvement. Forty thousand dollars is a very modest valuation for the present materials. With favorable legislation, we might in a very short time build a museum here in our state capital which would be an honor to the Academy and to the state. It is worth the effort. Our commonwealth can well afford the small outlay, and the returns to it in the cash value of the museum itself would always exceed the cost. No better means can ever be planned for advertising the resources of the state and inducing immigration and the investment of capital than that afforded by a good exhibit of our economic geology.

The dilapidated mineralogical ruin now on exhibition in the basement corridor of the south wing was thought to be a fine advertisement for the state. At the World's Fair it was fresh and attractive; but in the chaotic condition in which it has so long existed it is useless. Even when new it lacked the educational uses to which properly labeled and arranged museum specimens can be put.

The chief value of a museum is not display or advertisement. It is educational, and it is chiefly for educational purposes that our State ought to maintain a good museum at the capital. Here annually come over a thousand of the teachers of our state to attend the great educational meeting at the holiday season. Here come the delegates to dozens of meetings, whose object is a broader culture and an uplifting of our people. Hither come thousands of excursionists, men, women, and children, from all over our state, attracted by the fall festival and other shows at the capital city. Sightseers by hundreds visit the museums daily, and if they were made more attractive and given a greater educational value by further extension and greater care, their influence for good might be multiplied indefinitely.

In the room used by the Academy are, stored in book-cases and boxes, piled in stacks on the floor, spread out upon tables and chairs—occupying, indeed, much of the space in the room—the valuable collection of books and pamphlets belonging to the society.

These books represent the cumulative results of a score of years of patient exchanging with similar societies. There have been a few purchases and some donations. The government offices and the state geological surveys have sent us their publications. Many of the books are rare and could not now be purchased in any book market. They are largely the scientific publications of this and foreign governments, the transactions of the scientific societies from all parts of the world, and periodicals devoted to the sciences. Some sets are complete, or nearly so, and many have been bound, through the generosity of the State.

The narrow quarters now allowed to the society preclude any useful present disposition of the volumes. There is not half enough shelving for their use.

But, in my mind, the question of room for this growing library opens up the wider one of the economic adjustment and administration of all the libraries now in the state-house. There are here a number of libraries, each covering a somewhat different field and yet in some measure duplicating each other. For instance, the State Library, the Historical Society, the Board of Agriculture and the Academy of Science are all receiving and collecting the reports of the United States geological surveys. None of them has a complete series of these publications, and probably not one of them alone will ever be able to secure a complete set. Possibly, if the libraries were united, a full series would be found, or the duplicates could be exchanged for the volumes lacking. At least, the user of the library would be enabled to find at one place all the literature of the subject contained in the state-house, instead of being required, as at present, to try three or four libraries before exhausting their possibilities on the subject.

Both the State Library and the Historical Society are collecting large series of the volumes of our popular magazines, bound at the expense of the State. Both libraries collect the public documents issued by the national and state governments; and the problem of more room for them has been repeatedly presented, and solved for a limited time. You all know how these documents fill space in a library; and yet they are indispensable for historical and statistical reference.

This duplication is unnecessary and wasteful, not so much financially as in space and order and accessibility to the public. The seeker after information may have to try all the libraries before he finds what he wants. I have done this sometimes in hunting the bibliography of a subject. Then, too, we are confronted by different systems of classification. One library has the Dewey system, and another is without system. In all of them the crowded condition and lack of shelf room are hindrances to the literary worker, and the books are inaccessible even to the library attendants.

By all means these libraries ought to be consolidated. Give proper room to the collections, establish a general single system of classification, provide adequate reading-room facilities, and the public will reap twentyfold the benefits of these books. It will be less expensive than the present plan; but even if it should double the present cost, the economic advantage derived from the increased utility would fully justify the outlay.

Members of the Academy may ask why we should give over to the State and to public use that which has cost us the labor of years to accumulate—that which, except for our interest and forethought, would not now exist. Why surrender such a valuable property? I answer, because the Academy of Science is working in the interests of Kansas, and the State can use this property to better advantage than can the Academy. By making it a part of the general library of the State, open to the public, its benefits will reach a larger number of people than are now reached. The State, too, by paying our printing bills and binding our exchanges, has acquired an equity in this property. On no other ground than that of ultimate ownership can the State be expected to appropriate money from year to year to build up libraries. Since the question of ownership of the Academy library is, to say the least, a debatable one, I am sure that every member of the Academy would be ready to relinquish his personal rights for the greater good. Regulations could easily be provided by which our members could retain the privilege of drawing scientific books for private use.

The State Historical Society is similar to the Academy in its organization and relation to the state. Its title to its library is like ours, differing mainly in the greater size of its collection. The housing together and placing in a single collection all these libraries, under one general administration, would in nowise interfere with the function of the State Historical Society or of the Academy of Science as collectors of historical and scientific materials; on the contrary, it would assist the secretaries in doing this work, since it would relieve them of the cares of library administration.

The publication of reports and the exchanges arising therefrom should go on as at present. The historical museum and the scientific museum could be maintained under the management of each society. Even the purchase of books in each particular field could continue as at present, with safeguards to prevent wasteful duplication. It is the *care* of the books and the library *management only* that would be changed.

The duplicate volumes growing out of the union of the libraries, especially the miscellaneous books, could well be employed to help in establishing traveling libraries for circulation throughout the state.

Let me say, in this connection, that the promotors of the "traveling library" idea are forgetting the difference between the functions of a circulating library and a library of reference. Our state library is exclusively a library of reference. If it is to manage the traveling libraries, it must have a stock of duplicate books for that purpose. It would be manifestly absurd to use its stock of miscellaneous books for the circulating libraries and thus be without them for reference.

At the last annual meeting of the Academy, at Baldwin, a committee was appointed to secure proper legislation to obtain for the Academy the space necessary for making a suitable exhibit of the property and literature of the Academy in the state-house. As chairman of that committee, I have gone over that subject in many of its phases, have consulted the other members of the committee, members of the Academy, the librarians in the state-house, and out of all have evolved a plan, which I can present here only in outline. If the Academy should approve it, the plan can easily be drafted into a bill for presentation to the legislature. It can be rejected if it seems impractical, or it may be radically modified.

THE STATE LIBRARY.

I.—Governing Body. The governor of the state, the chief justice, the superintendent of public instruction, the secretary of the State Historical Society, the curator of the Academy of Science and the secretary of the State Agricultural Society shall constitute a *library board*, whose duty it shall be to meet at some stated time each four years and elect one chief librarian and three assistants, who shall serve for a period of four years or until their successors are duly elected and qualified.

II.—Departments of the Library. The library shall consist of four departments: (1) The law library; (2) The historical library; (3) The scientific library; (4) Miscellaneous books. The law library is primarily for the use of the supreme court and the legal fraternity, under such regulations as now exist. The historical library is to include all general historical works, and especially books, pamphlets and manuscripts relating to Kansas and American history. The scientific library is to include books relating to the natural and exact sciences and their applications in medicine, agriculture, engineering, and other useful arts, and the proceedings of scientific societies. The miscellaneous library is to include all books not included in the other classes.

III.—Library Staff. (1) A chief librarian elected by the library board for a period of four years. (2) One assistant librarian nominated by the judges of the supreme court and elected by the library board for the same period. He is to have immediate charge of the law library, under the direction of the chief librarian. (3) One assistant librarian nominated by the state historical society and elected by the library board. He is to have charge of the historical library under the supervision of the chief librarian. (4) One assistant librarian nominated by the Academy of Science and elected by the library board. He is to have immediate charge of the scientific library under the direction of the chief, and if required is also to assist in the other departments as the chief librarian may direct.

In addition to the above staff of four elected by the library board, there shall be a chief cataloguer and such other assistants as the legislature may provide for by biennial appropriations. The chief cataloguer and other assistants shall be appointed by the chief librarian, at his discretion; but he shall not make contracts for such service in excess of the amount appropriated for any fiscal year, nor beyond the expiration of his own term of appointment.

IV.—Compensation. The compensation of the members of the library staff shall be fixed by law, subject to change in the biennial appropriation bills.

V.—Administration. All the books of the four departments shall be placed upon a general accession list consecutively as invoiced or received; and no duplication, except when deemed wise by the chief librarian and the department assistant, shall be permitted. Each department shall also keep a title and shelf list of its own books. All books purchased, or received as donations or by exchange, or from the state printer after being bound, in any of the state offices or by any of the societies occupying rooms in the state-house, unless they are required for exchanges, or for reference in making investigations in the department through which they were received, shall be promptly turned over to the state librarian for cataloguing and placing upon the shelves of the state library. Books constantly in use for reference in any department may, however, be retained by the head of the department; and books may also be drawn from the library for temporary use in any department under regulations made by the librarian. Serial pamphlets may also be retained in the departments until volumes are complete and ready for binding.

STATE MUSEUM—ACADEMY OF SCIENCE.

The State, through its Executive Council, shall provide proper rooms and facilities for maintaining a scientific museum, in which shall be displayed specimens illustrating the natural history, geology, and especially the mineral and other economic resources of the state, and including the Goss ornithological collection. This museum shall be in charge of a curator, who shall be elected by the Kansas Academy of Science for such term as it by its constitution may determine. It shall be his duty to attend to the correspondence of the Academy with other similar bodies, the exchanging of publications, and to care for all the scientific specimens which may now be or may hereafter become the property of the State, under the direction of the Academy. He shall be in charge of the secretary's office, which shall be in connection with the museum in the state-house, and shall receive such annual compensation for his services as shall be appropriated by the legislature from time to time. The legislature may also allow an annual amount for postage and assistance to the curator.

HISTORICAL MUSEUM—STATE HISTORICAL SOCIETY.

The State Historical Society shall be allowed the use of rooms in the state-house for the proper display of all articles of an historical nature, except bound books and printed pamphlets, which may now be or may hereafter become the property of the society or the state.

This museum shall be in charge of the secretary of the state historical society, who shall have his office in rooms in the state-house contiguous to the historical museum. He shall attend to the correspondence and exchanges of the society, care for its museum, and shall be allowed such compensation for his services and such assistance as the legislature shall from time to time determine. All duplicate historical books in the state library, and other books not needed by the other departments or for traveling libraries, shall be turned over to the secretary of the State Historical Society, if he desires them, to use in exchanging for historical literature.

All acts of the legislature relating to the State Library, Academy of Science or State Historical Society which are inconsistent with the foregoing provisions are to be repealed.

I am fully persuaded that the plan just outlined, if enacted into a law, would be economical to the state and involve less actual ultimate outlay than the present system requires. Above all, it would promote the usefulness of the State Library, the State Historical Society, and the Academy of Science.

The plan just given would take the appointments out of politics and probably insure a permanently efficient library management. Moreover, it would give the Supreme Court, the Historical Society and the Academy of Science a continued and direct oversight of the book collections in which they have a chief interest.

The State Historical Society has built up a noble collection of valuable historical and general literature. Its management has been excellent. Its library, hampered as it has always been for room, is yet the best managed in the state-house, because there has been in it the greatest regard for modern library methods.

The library of the Academy of Science has been in no sense a public collection, although I think no person has ever been denied the privilege of using it. The function of the librarian of the Academy has been merely that of a book collector. He has not come in contact with the public as users of books, and so has not been required to study the broader question of library economy.

But put all these book collections together. Give them one management, under a chief who knows both books and library methods, and in whose election no question other than that of fitness shall be raised. Properly maintain and distinguish the four library sections as herein outlined: the law, the historical, the scientific, and the miscellaneous. Then give each room to grow, under the fostering care of the societies and the chief librarian and the state; and the sphere of their usefulness, and the measure of it, will continue to grow as the years pass by.

I have watched the workmen, during the past year, as they have put the finishing decorations upon the walls of the new library room, on the third floor of the north wing of this building. What a magnificent library room that will make, if properly furnished. Three tiers of steel library stacks, each seven feet high, on each side of that room, will accommodate 250,000 volumes and leave ample room for the reading public, by using the two connecting rooms. Here is room for all these libraries for many years to come.

Members of the Kansas Academy of Science, if we can secure the favor of the legislature at its coming session, so as to pass some measure like the one I have outlined, we will have conferred a favor not only upon ourselves as recipients, but upon the great institutions of the state and upon all our people. But whether we succeed or fail, the Academy itself will be benefited by the interest aroused by our efforts, and they will bear fruit in due season.

II. CHEMISTRY AND PHYSICS.

RELATIVITY IN SCIENCE.

BY E. B. KNERR, ATCHISON.

Read before the Academy October 28, 1897.

All human knowledge is relative. It is beyond the power of man to conceive an isolated fact. We know only by comparison. There is nothing new in this; the most ancient philosophers recognized the force of this truth. Evidently, then, to fully comprehend a fact, we must know it in all its bearings. But again, that is quite impossible, for to know all of any one thing is to comprise a knowledge of the whole universe, so intimately bound up is each fact in every other. As Tennyson has beautifully put it:

"Flower in the crannied wall,
I pluck you out of the crannies,
Hold you there, root and all, in my hand,
Little flower: but if I could understand
What you are, root and all, and all in all,
I should know what God and man is."

Only because of this comparative nature of all knowledge is it possible to have a science; but students of science are frequently led astray in their conclusions. Of course it is beyond any man to grasp a subject in all its bearings, for, as we have seen, that would mean omniscience; but he is the best scientist who can master the most of these relationships.

I purpose in this paper to discuss a few topics in illustration of the interdependence of scientific concepts.

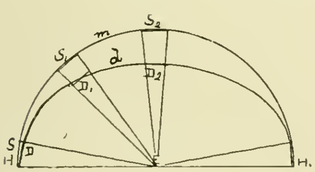
Consider first the simple idea of motion. Think of a wheel of a moving carriage. A chalk-mark on the tire is at rest in reference to that part of the wheel, moves in a circle in reference to the axle, moves in the curve of a cycloid in reference to the horizontal plane; but the path of the chalk-mark is no longer a true cycloid if you remember the earth's surface is spherical instead of plane. Again, referred to the plane of passage, the chalk-mark has a maximum velocity when it is uppermost; that is, the upper half of the wheel is going faster than the lower half: but referred to the wagon axle, the velocity is uniform. The velocity of the carriage may be five miles an hour if we conceive the roadway to be stationary; but if we recall the rotation of the earth on its axis, the velocity at once jumps to a thousand miles per hour. Now think of the motion of the earth about the sun, and, if the time be early morning, to the thousand-mile velocity you must add another nineteen-mile-per-second speed. But we are not yet done, for the sun is hurrying through space toward the constellation of Hercules with a further velocity, guessed by some astronomers to be as much as sixteen miles per second, carrying with him the earth, our carriage, its wheel, and the chalk-mark on the tire. All things considered, what is the path of that chalk-mark?

We speak of the dark Fraunhofer lines in the solar spectrum, which indeed are only dark by comparison with the much more brilliant adjacent field, and which examined independently may be demonstrated to furnish considerable light. Likewise sun-spots are "black" when contrasted with the surrounding portion of the sun's disc; and yet their darkest areas outshine the calcium light.

Frequently the related facts of comparison are quite obscure and seldom consciously recognized. Even when they are sought out they may be missed altogether in some cases, and erroneous conclusions may be stated and find wide acceptance in explanation of certain phenomena.

Consider the case of the apparently increased diameter of the sun or moon when near the horizon over what it is when nearer the zenith. An explanation frequently given for this phenomenon is the unconscious comparison which the observer makes of sun or moon with objects near the horizon. Why does the observer not remember these impressions and give the sun and moon the same value when overhead? Why should there be an "unconscious comparison" at all in the mind of the observer between terrestrial objects at the horizon and the diameter of the sun or moon or planet? This is one of those explanations which gain currency, but which do not explain. It is a false correlation of facts. The true explanation of the familiar phenomenon cited is as follows: To every observer the impression of the contour of the heavens is that of a flattened dome, and not a hemisphere. We all conceive of the heavenly bodies as traversing this dome, on the surface of which we naturally think of them as located. This is a childhood conception of the heavens, and all subsequent education and knowledge of the varying immense distances of the heavenly bodies can do practically nothing to alter these natural impressions. The dome appears flattened because we conceive of the distance to the blue in the direction of the horizon as greater than that overhead.

In the illustration herewith given, let HH_1 represent the horizon, E the position of the observer, HMH_1 a semicircle, and HdH_1 the apparently flattened dome of the heavens. The angle of vision at E, subtended by the moon's diameter, is slightly greater when the moon is in the zenith than when it is near the horizon. So the moon should actually appear larger when overhead than when rising; for when it is directly overhead we are nearer to it by the distance equal to the earth's radius. But the difference in visual angle due to this nearer approach is so slight as to pass unnoticed, unless we take special pains to detect it, as may be done by looking at the moon through a roll of paper so adjusted as to just take in its disc when at the horizon. When at the zenith the whole moon will no longer be visible through the paper roll, proving it to be actually nearer, though to the eye apparently smaller. Neglecting this small difference, the visual angle is practically the same wherever the moon may be, and therefore that body should always appear of the same dimensions; and it would so appear did we but refer its position to the surface of a sphere and therefore always at the same distance, instead of to the surface of a flattened dome, and consequently at varying distances. In the illustration, an object referred to S, S_1, or S_2 will not change in apparent dimensions, but referred successively to D, D_1, D_2, it will apparently grow smaller until directly overhead, and thereafter will seem to grow larger until again in the horizon at H_1. Thus we see that "objects near the horizon, such as trees, buildings, etc.," having nothing to do with the apparent size of the moon, sun, or other heavenly bodies. The stretch of the earth's surface far out toward the horizon, beyond which we must still think of the blue vault as located, gives us an impression of greater distance in that direction to the blue than directly overhead. Besides, the greater quantity of light that



comes from the sky overhead than from that low down would also tend to an impression of greater nearness for the former.

Scientific explanation is nothing more than the bringing together the more closely related facts. When we seek such an explanation we endeavor to discover relationships between the facts. Consider another illustration:

It is frequently asked why our visual impressions of objects about us are not inverted, inasmuch as the image on the retina of the eye can clearly be demonstrated to be inverted. Inverted with respect to what? is our first question. The reply may be: Inverted with respect to the object itself. The antonym to the term "inverted" is "erect," which means the normal position of the object with reference to the horizon and to other associated objects. In the picture formed on the retina of the eye these external relationships as they appear are not disturbed, and therefore how could the object contemplated be considered as inverted? To the acrobat standing on his head the world does not appear upside down, for he recognizes that it is he who is inverted for the time being, while all other objects hold a normal position with reference to each other.

It was only by carefully tracing the relativity of phenomena that Count Rumford and William Robert Grove and Julius Robert Mayer were enabled to arrive at that grandest of scientific generalizations, that all energy is correlated and is forever conserved. They recognized that all energy is one and the same, however variously manifested. Energy is the capacity which moving bodies have, by virtue of their mass and motion, of imparting movement to other bodies. Hence they recognized but one kind of energy, that which afterward received the name of "kinetic" energy.

All energy is kinetic, for displacement of a body through space can be accomplished only by one moving body imparting its motion to another, whether that motion be of a mass, and so known as mechanical; or of molecules, and so known as heat; or of atoms, and therefore known as chemism; or of ether vibrations, and known as light, electricity, magnetism, or gravity. The physical concept "energy" must ever hold motion as an essential property—motion of mass, of molecules, atoms, or ether particles. I am aware that an expression known as "potential energy" has crept into physical discussions and has been copied from one text-book to another now for a generation or two, and seems likely to be continued by compilers of texts on natural philosophy for some generations to come. As I endeavored to point out before this Academy six years ago, at the Ottawa meeting, I still maintain that there is no such thing as potential energy, except as we may in a loose way regard all energy as potential in the sense that it is possible, as heat, light, electricity, or gravity, to be intertransformed. As ordinarily presented in texts on physics, the concept "potential energy" is a false correlation, and the result of surprisingly slovenly thought.

To illustrate: A lad holds a ball in hand which he purposes to toss in air. Were I to assert that that ball possessed energy of any kind in relation to the conditions presented—those of the boy's hand and the plane of its position as the plane of reference, you would rightly pronounce the statement absurd. Please, then, where is the difference of related conditions after the ball has been tossed upward and rests for an instant poised in mid-air in the hand of gravity? And yet, under the latter conditions, we are told that the ball possesses a peculiar energy—"potential energy"—the result of the conversion of the kinetic energy it possessed at the beginning of its ascent. Now what is the true relation of the facts, which relation has been overlooked in presenting the false deductions called "potential energy"? They are as follows: The ball in rising is doing work against the force of gravity; that is, it is accomplishing ether displacement, for gravity must reside in the ether. But whenever work is done, energy is transformed or transferred. The energy of mass motion in the rising ball is gradually transformed to energy of ether motion as gravity, *and is not in any sense whatever stored in the ball.* As gravity energy, it exists in the ether and may at once be reconverted into energy of mass motion to return the ball to earth; or if the ball find a support at its higher elevation, that energy will persist as gravity energy. The mere possibility of the ball falling to earth again does not give it any quality of energy whatever, any more than the first possibility of its being tossed into the air made it a possessor of energy. But the nature of gravity is so little understood that the foregoing reasoning may be received with some hesitancy. Let us therefore consider another illustration commonly employed in the text-books.

The heat of fuel is frequently spoken of as "stored energy" derived from the sun at the time the plants were growing. I once heard an intelligent lady state that the iridescence of anthracite coal was fossil sunshine. Let us consider the relationship of the facts as we best know them, and we will find no room for the subterfuge of "potential energy." The energy of carbon atoms vibrating as such, and of oxygen atoms vibrating as such, is greater than that of these elements vibrating together as carbon dioxide. Therefore, in order to maintain the vibrations of carbon and oxygen separately, some energy must be taken up as transformed from some other source, it matters not from what source derived. Usually that source is sunshine. The sunshine falling upon the green chloroplasts of living leaves enables them to separate the absorbed carbon dioxide into its constituents of carbon and oxygen, because the additional necessary energy is thus furnished. But that additional energy utilized is now no longer energy of sunlight, but it is energy of chemism; and in no proper sense can it be looked upon as stored sunlight any more than the resulting products of carbon and oxygen may be regarded as stored carbon dioxide, or the lumber in a lumber-yard as stored houses. In after time, when the wood or coal is again burned, that is, when the carbon again unites with ogygen, the surplus of chemical energy necessary to the carbon atoms and the oxygen atoms as such, over that which exists in their constitution as carbon dioxide, is transformed mostly to heat, some of it to light or electricity possibly, and is but another transformation. A conspicuous absurdity of the text-books is to speak of the energy of the sunshine as all stored in the carbon or carbon compounds formed in plants from the carbon dioxide taken from the air. As we have seen, the oxygen, separated, plays as important a part in the processes as the carbon. Then why not say the solar energy was stored in the oxygen as well as in the carbon separated? When carbon and oxygen unite in combustion, why is it not said that the oxygen furnished its quota of stored solar energy?

Let us bear closely in mind the relationship of all the phenomena concerned, and "potential energy" will become an obsolete term, "stored energy" will drop from the vocabulary of physical science, and we will read there only and ever in their stead "transformed energy."

THE CHEMICAL COMPOSITION OF CEMENT PLASTER.

BY E. H. S. BAILEY, LAWRENCE.

Read before the Academy October 28, 1897.

There has been found, scattered over quite large areas in some of the central states, especially Kansas, Indian Territory, and Texas, an earthy material, which consists practically of gypsum sand, and which has been utilized for the manufacture of a material which has been called "cement plaster." This material is of light color, and when dry frequently as fine as dust, and is evidently of recent origin, deposited from water. There are often watercourses in the vicinity of the deposits; and springs of water strongly impregnated with calcium sulfate often flow from the beds. These beds cover an area of from ten to twenty acres, and vary in thickness from two to ten feet. One peculiarity of the location is that they are usually on only one side of a stream.

This material, to which we have assigned the name "gypsite," upon being examined with a microscope, is seen to consist of numerous crystals of gypsum, associated, however, with much material that seems to be amorphous in structure. As it can be readily broken up with a plow and harrow, and can be handled like ordinary dirt, being loaded upon wagons with a grader, it has been found very economical to use it for the manufacture of plaster. All expense of quarrying and grinding is thus avoided. Of course many claims are made for the superior quality of the product over the ordinary plaster of Paris, made from rock, but practical use of the material will solve the reasonableness of such claims. We have had special opportunities to examine a large number of samples of the original crude material, and of the manufactured product, in connection with some work for a report of the University Geological Survey.

COMPOSITION OF THE RAW MATERIAL.

The gypsite varies greatly in composition, even in the same area. This is due to various mixtures of clay on the one hand and of sand on the other. An expert can, by the appearance of the material, select the different grades, and mix them in such a proportion as to produce a product of the right composition. As an example of this, the following analyses may be quoted, all taken from material from the same bed, but sampled at different times by different persons. For convenience the constituents only are given here; but something will be said of the probable combinations farther on.

Constituents.	Gypsite Beds.		
	No. 1.	No. 2.	No. 3.
Silica and insoluble residue	18.69	12.29	10.23
Iron and aluminum oxids	1.21	2.27	1.12
Calcium oxid	26.11	29.69	30.78
Magnesium oxid	.43	.78	.49
Sulfuric anhydrid	33.27	34.87	34.56
Carbon dioxid (calc.)	3.15	(det.) 3.52	(calc.) 5.67
Water	15.29	16.07	17.10
Totals	98.75	99.49	99.91

It will be noticed that the proportion of insoluble material varies considerably, and the water increases as this diminishes.

MANUFACTURE OF CEMENT PLASTER.

In the process of manufacture, the ordinary iron kettles are used, of a capacity of about eight tons of crude material. These kettles are heated by a coal fire directly on the bottom and the flame is carried around the sides in flues. Each kettle is provided with a mechanical stirrer making fifteen revolutions per minute. An excellent quality of coal is used so as to produce as hot a fire as possible. The crude material is dropped into the heated kettle gradually till there is a sufficient quantity, and as the heat is applied all the time a violent boiling, as it is called, takes place, from the evolution of the steam of the moisture in the original material and the combined water. A short time before the process is complete (which requires about three hours) there is a sudden settling of the material and the evolution of steam ceases, but this begins to boil again. and after a certain time, which can be determined by the expert laborer, the kettle is opened at the bottom and all the material is dropped in a few seconds into a storage pit. The burned cement is then sifted, and any particles too large to pass through the sieve are ground and burned again. In the process considerable dust is carried off from the kettle and in the best mills this is collected and saved.

In order to study the process of manufacture more completely, I have made analyses of the material in the process as follows:

No. 1, crude gypsite.

No. 2, the completed "cement plaster."

No. 3, dust thrown off from the material while being calcined.

No. 4, tailings from the bolting reel.

No. 5, sample of the "set" cement plaster.

Nos. 2, 3, 4 and 5 were from the same kettleful of cement, while No. 1 is a mixture of twelve samples of the crude material as it was running into the kettle.

In order to arrive more fully at the composition in this case the carbonic acid was determined by actual weight, after decomposing with hydrochloric acid, and it will be noticed that there is not a sufficient quantity to combine with the calcium and magnesium. This seems to indicate that some of the bases are in the combination with silica in the form of clay or other soluble minerals.

Constituents.	Crude. No. 1.	Finished. No. 2.	Dust. No. 3.	Tailings. No. 4.	Set. No. 5.
Silica and insoluble residue....	12.29	14.31	13.48	22.02	12.03
Iron and aluminum oxids.....	2.27	2.16	2.33	2.23	1.62
Calcium sulfate...............	57.95	66.22	66.52	53.67	59.37
Calcium carbonate............	8.01	9.42	6.53	12.17	8.07
Calcium oxid..................	2.12	1.85	2.56	4.70	1.89
Magnesium oxid...............	.78	.91	.59	.56	.61
Water	16.07	4.91	6.78	4.43	16.38
Totals	99.49	99.78	98.79	99.78	99.97

It is interesting, also, to notice in this connection that the set cement agrees remarkably in composition with the original crude sample. It has just about the same quantity of water that was originally present.

In the dust there is present 6.78 per cent. water, which shows that some of the material not fully calcined had been carried off from the kettles. The tailings contain more of the silica and insoluble material. This is to be expected, as those are the parts that have not so readily broken up under the influence of heat. As the heat is carefully kept below a 400° F., there seems to be little possibility that the carbon dioxide should escape, and the comparison of the first and last samples show that this is the case. The carbon dioxide in the first was 3.52 and in the last 3.55 per cent.

There is a wide variation in the per cent. of calcium and magnesium carbonates in different samples, and the positive effect of different quantities of this substance has not been ascertained. From what is known, the magnesium plays very little part in the determination of the quality of the set cement. The amount of water in the manufactured plaster seldom falls much below five per cent.; the variation being not over two per cent. when a number of analyses are compared.

Something should perhaps be said about the use of "retarders" in cement manufacture. They are especially used with the rock plasters, though occasionally, no doubt, with the cement plasters. The common opinion is that sours and sweets act as retarders, and many substances of these classes are used, such as citric acid and sorghum molasses. It is possible by the judicious use of such a retarder to delay the setting of the cement many hours, when it would normally set in a few minutes. The action of these materials seems to be to prevent the material hardening by the formation of the crystalline compound. On the other hand, there are some things that act as accelerators, and in mixing the plasters they must be rigidly excluded. For instance, if a plaster is mixed in a vessel which contained some plaster that has previously set, the setting is very much accelerated. This would very readily remind one of the production of sudden crystallization in saturated solutions by bringing into them crystals of the same material. A number of other problems in connection with the specific gravity of the material, the amount of water that should be left in the manufactured product, and similar topics, remain to be investigated.

ON THE OCCURRENCE OF NITRATES IN WELL-WATERS.

BY E. H. S. BAILEY, LAWRENCE.

Read before the Academy December 30, 1898.

It is a well-known fact that the ammonia of the air, as well as the small quantity of nitrates and nitrites therein contained, is washed into the soil by the rains, and this water there comes in contact with the organic matter of the soil, and oxidation takes place. This organic matter is first converted by the processes of decay into ammonia, and this in turn changes to nitrites and finally to nitrates, in which latter form it is available to aid in sustaining plant life.

The process of "nitrification," as it is called, may go on in surface-waters, as in ponds and streams, and is carried on very extensively in the upper layers of a loose, porous soil, where the oxygen of the air has an opportunity to assist.

This whole matter has been very extensively studied, within the past ten years, in its applications to agriculture, and also in its applications to the impurities of water and the purification of sewage. The admirable reports of the Massachusetts Board of Health, especially for 1890, on the purification of water and sewage, show the very extensive experiments which have been carried out, and the results of these researches, which have become almost classic. There has been a growing belief in the importance of "bacteria" in producing the change formerly ascribed to simple chemical oxidation. Although great difficulty has been experienced in isolating and cultivating the specific bacteria that are necessary to produce the change, yet the latest researches show that this can be done, and that water that has been sterilized can be treated with ammonia and then sown with some of the nitrifying bacteria, which under the right conditions will change the ammonia to nitrites and nitrates.

An examination of the public water-supply of the city of Marysville, Kan., showed the presence of what we considered large quantities of nitrates, so that the matter seemed of considerable interest. The results were as follows:

Free ammonia	.075	parts per	million.
Albuminoid ammonia	.157	"	"
Nitrogen in nitrites	trace.		
Nitrogen in nitrates	9.1015	"	"

On account of the large amount of nitrogen as nitrates, and because it seemed more than would be usually found in our ground waters, some twelve more samples of water from the same city were obtained, through the kindness of the superintendent. Comparative tests on equal quantities of water were made by the use of concentrated sulfuric acid and ferrous sulfate in cold solutions; and the results were compared with those obtained with the quantitative analysis of the city supply alluded to. The results are as follows, arranging them on a scale of 1 to 4, the latter being the highest:

City water-supply, three samples: 2, 3, 2.

Wells in the same city, eleven samples: trace, $\frac{5}{10}$, 1, 1, 2, 2, 3, 3, 3, 4, 4.

It was not thought to be worth the while to make quantitative analyses of each of these wells, as the point was so well shown that the city water-supply was about the average of the wells of the city in nitrogen in the nitrates. No examination was made for nitrogen in nitrites, except in one case where only a trace was found. In this well there was found 10.6259 parts of nitrogen as nitrates, and both the free and albuminoid ammonia were a little higher than in the city supply.

It is generally held that the nitrates indicate what Frankland calls "previous sewage contamination;" and, if this is true, it is of great importance in the study of waters that are used as a source of domestic supply. It is stated that water from the drainage of cow stables has been found to contain little free or "albuminoid" ammonia, but to contain a large amount of nitrites and nitrates. Stoddart* claims that "natural waters can, at most, obtain but from 1.43 to 2.86 parts per million of nitrogen as nitrates, from other sources than animal matter; and practically the whole of the nitrogen of sewage may be oxidized into nitric acid, without diminishing the risk involved in drinking it."

Professor Mason† also quotes the results of analyses of rain-water, from various localities in Europe, as follows:

England,	interior	.19	parts per	million.
England,	cities	.22	"	"
Scotland,	near the coast	.11	"	"
"	cities	.30	"	"
"	interior	.08	"	"
"	Glasgow	.63	"	"
Montsouris, Paris, average of 18 years		.73	"	"

The results of some experiments made by Prof. G. H. Failyer,‡ upon rain-water collected at the agricultural college are of interest in this connection. He reports that the different rains contained very different quantities of nitrogen in these forms:

Maximum of nitrogen as nitrates	1.850
Minimum of nitrogen as nitrates	.029

*Water-supply, Mason, p. 379.

†Loc. cit.

‡Transactions Kansas Academy of Science, vol. XII, p. 24.

To the rain-water, then, we do not look for a very large part of the nitrogen found in our ground water; much of it must come from the oxidation of the organic matter. * The effort has been made to fix arbitrarily the maximum amount that will be allowed in natural waters before they shall be considered suspicious. Some of these attempts may be of interest by way of comparison:

Elkin, dangerous if over	6.00
Vienna Commission, dangerous if over	1.04
Hanover Commission, dangerous if over	2.60
Brandes Commission, dangerous if over	7.00

Leeds' average for American rivers is 1.11 to 3.89.

The Rivers Pollution Commission (English) gives the following average from 589 unpolluted waters for nitrogen as nitrates and nitrites together:

Rain	0.03
Upland surface	0.09
Deep well	4.95
Spring	3.83

Professor Mason also quotes from the *Analyst* the following, to show the varied character of well-waters:

	Nitrogen as nitrates.
200 feet deep, Wimbleton	0.43 parts per million.
900 " " Southend	0.71 " "
430 " " Braintree	0.28 " "
305 " " Colchester	0.00 " "
600 " " Whitham	6.43 " "
490 " " Chatham	6.85 " "
400 " " Norwich	11.43 " "

The above are deep wells which, as a rule, are more liable to contain nitrates than shallow wells. There is only one well in this list that contains as much nitrogen as the Marysville water, noticed above, namely, 9.10 parts per million. If this water alone contained a large amount of nitrogen as nitrates, we should be inclined to look upon it with suspicion, but an examination of the other wells in the town, some of which must have been so situated that they could not be polluted by sewage, leads to the conclusion that the *normal amount* of nitrates in the water of this locality is high. This conclusion but emphasizes the statement that has often been made by writers on water analysis, that the source of the abnormal ammonia, or nitrogen in any form, must be known before we are competent to decide on the quality of the water. If nitrates are high, we should not *necessarily* conclude that the water is contaminated by sewage, or even that it has previously been so contaminated.

A REPORT ON THE MINERAL SPRINGS AND WELLS OF KANSAS.

BY E. H. S. BAILEY, LAWRENCE.

Read before the Academy December 30, 1898.

The chemistry department at the university is still working on the waters of the state, and has some kind of a record in regard to 150 springs and wells in the state that are of a so-called mineral character. Of these we have quantitative analyses of about seventy-five, and we have quite a number still on hand to analyze. Those who have investigated the subject appreciate the difficulty of deciding as to which waters are really to be called mineral, and which are simply ordinary waters.

* Report, National Board of Health, 1882.

In this list is to be found every grade of waters, perhaps as large an assortment as those of any state. Contrary to the generally accepted opinion, we have waters of exceptional purity as well as waters that are loaded with sulfates and chlorids almost to saturation. There are not many of the class that contain rare ingredients; or if these are present they are so only in extremely minute quantities. There are many, however, of that other class, namely, those that contain an excess of ordinary ingredients.

Most of the waters that have been examined are in the eastern half of the state, but there are some waters of special interest, like the Great Spirit spring, which are quite a distance west.

The mineral springs properties have been allowed to run down during the recent period of financial depression, and in many places the waters are practically out of use. But the waters are *there;* and, with greater financial prosperity in the state, there is no doubt that many of them will be bought up by capitalists and improved much beyond their former condition. As mineral springs resorts belong to the class known as "luxuries," they are very quick to respond to lack of ready money in the community, especially where they are so far away from the great centers of trade that they cannot draw patronage from the larger cities. They must first have local support, and this they will soon obtain with the increase of money in a community. Baths may be a necessity, but bread is of more importance, and will always be sought first by the people when financially oppressed.

There are indications in several parts of the state that mineral springs will soon again be of greater commercial and medicinal importance. Several new localities have been discovered and considerable money has been expended in improvements.

The analyses above referred to have come from several sources. In addition to the large number that have been carried on in the laboratory of the state university, many have been furnished by the kind coöperation of Professors Failyer and Willard of the agricultural college; Professor Knerr of Atchison; Professor Lovewell of Washburn; Professor Bushong of Emporia College, and others.

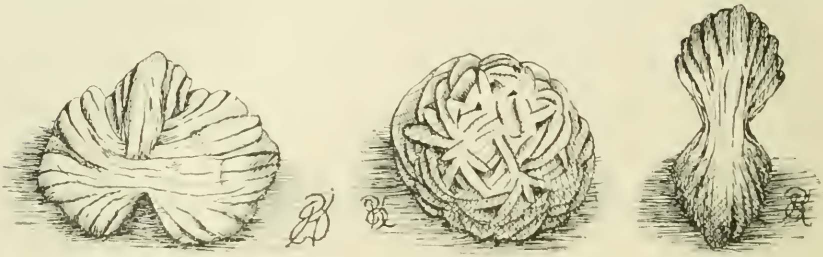
A large number of photographs of mineral springs properties has been taken, and a quantity of material collected for publication, which shows that the state has resources in this direction, only partially developed, it is true, but which will add very materially to her commercial wealth and importance.

SILICO-BARITE NODULES FROM NEAR SALINA, KAN.

BY E. B. KNERR, ATCHISON.

Read before the Academy December 29, 1898.

I desire to call the Academy's attention to, and present samples for inspection of, some peculiar nodular concretions which were found in the bed of a small stream about six miles east of Salina, Kan. I am informed that these nodules are not at all uncommon in that neighborhood, and possibly the attention of other members of the Academy has been called to them before. I find that the explanations which are locally given accounting for these formations are of interest. One theory is that they are balls of rawhide petrified. The explanation is that at one time there was located in this valley an Indian storehouse of goods, and a large portion of the stock on hand consisted of balls of rawhide. A tornado came along and destroyed the lodge containing the goods, burying its contents in the mud where the balls of hide thongs became petrified in the course of time. No mystery of natural formation in Kansas can be so deep but that it may be thoroughly cleared up, it seems, by the aid of the Indians and a cyclone.



Others explain these concretions by calling them petrified potatoes; but they fail to tell us who planted the potatoes. A chemical analysis of one specimen gave the following results:

Silicic acid	43.71	per cent.
Barium sulphate	46.60	"
Strontium sulphate	4.20	"
Aluminum oxide	5.00	"
Ferric oxide	.52	"
Potassium oxide	.20	"

The concretions, therefore, seem to be quartz sands cemented together by barium sulphate admixed with a little strontium sulphate. The specific gravity is 3.36. They vary in size from that of a chestnut to that of a baseball, are somewhat flattened, and are apparently made up of a series of plications.

CONCRETIONS.

BY E. B. KNERR, ATCHISON.

Read before the Academy December 30, 1898.

A concretion, literally, is a "growing together." Taken in its fullest significance it is, indeed, a very broad term, and we would find classed under this term all assemblages showing symmetry of structure, such as crystals, geodes, nodules, molecules, cells, and even life-forms. In fact, any structure which results from an aggregation of material about a nucleus may properly be called a concretion. Verily, the philosophy wrapped up in the homely proverb, "Birds of a feather flock together," is deep and far-reaching in its import. Could we explain fully the forces at play in the formation of a snowflake, how very much would our knowledge be extended beyond what it is to-day. Could we tell just how and why the water molecules are arranged every time along the hexagonal axes, we would know what the atom is, what the molecule is, what ions are, what the so-called positive and negative electricities are, what chemical affinity is, what gravity is, aye, even what life is.

This may seem to some a broad assertion, but the principles underlying the formation of a water crystal are the same for all crystals and all aggregations of crystals. But the same substances under like conditions always crystallize in the same forms: the structure of the molecule must therefore have something also to do with the crystalline form, and so we must understand the invisible molecule in order that we may fully understand the visible crystal. But again, the molecule depends upon the arrangement of its constituent atoms, and that in turn upon their constitution and nature and the forces at play upon them; so we must understand the atom in order to understand the visible crystal. When we shall know all this, and the driving force which impels atoms and molecules to their manifest results as symmetrical structures and organisms, who will say that we will not understand not only what light is, and electricity, but also what gravity is, and life? Our present fund of knowledge, great as it is, will be considered small indeed as compared with what it shall be then.

As a few possible hints in the direction of such knowledge, I desire to direct your attention to some concretionary forms which I shall use by way of illustration. There is an undoubted unity in the universe, one pervading principle. Indeed, the word "universe" means that very thing: all "turned to one." All facts, then, rightly comprehended, must lead toward the solution of this great problem which we have suggested.

We will first consider the structure of the "pillow-witch." A "pillow-witch" is an aggregation of feathers formed sometimes in pillows by the feathers accumulating about a nucleus or center. A few hairs will first work their way into the pillow; these will become more or less tangled under the continual movement of the contents of the pillow when in use. The feathers will always be worked in the same direction; that is, with the shaft forward. The tangled hair will arrest a few, others will be crowded in between these, always being forced into the bunch with the shaft forward. Because of the curved structure of each individual feather, the resulting concretion will be symmetrical in form, and every constituent feather will point to the nucleus.

Very similar in structure are the hair balls taken occasionally from the stomachs of cattle, and resulting from the accumulation of hair swallowed in the act of licking other cattle. If we cut into one of these balls we will find the short, curved hairs arranged approximately parallel and pointed to a nucleus, just as in the case of the feathers in the pillow-witch. A few tangled ones formed a nucleus at first, then under the churning action of the stomach others were driven end first into this mass. This is indicated by their parallel arrangement. After the shedding season is over, and hair is no longer swallowed in considerable quantities, a slimy deposit of salts begins to form over the outside, which hardening renders the ball impervious to the entry of other hairs, thus determining its size and structure.

Now, may not crystalline aggregates such as calcareous, pyrite, and flint nodules, and even crystals themselves, result by an analogous process? There are certain facts which indicate such to be the case. Too violent an agitation of the pillow will cause the outer layers of feathers to break away from the "witch," thus tending to make balls of only small size. Likewise in the formation of crystals from solutions, the crystals will always be small when obtained from hot solutions; that is, from solutions where the molecules are in violent agitation because of the high temperature. Large crystals are obtained only from cold solutions, where the agitation is relatively mild. In their formation we find the molecules are pressed toward centers or nuclei, just as the feathers were pressed toward the "witch" nucleus, by the motion of the surrounding matter.

The "pillow-witch" required a nucleus of tangled hair or broken feathers or other foreign material. It is a well-known fact that crystals also form more readily if dust or other solid particles be in the solution. Indeed, with certain degrees of concentration they fail to form in the absence of foreign solid particles, but the moment these are added crystallization begins. When it is desired to obtain large crystals of any salt the solution is concentrated to the right degree, a small particle of a crystal of the substance is dropped into the solution, and a crystal at once begins to grow about this as a center, just as the feathers accumulated about the tangled hair as a center. How very minute, though, must be the meshes to entrap the first molecule!

Another analogous aggregation is the condensation of moisture about dust particles in the atmosphere, thus starting the formation of the fog or cloud vesicles from which grow the raindrops. By the same principle a thin film of moisture is collected on every surface, no matter how dry apparently it may be; and each surface has its own entrapping power, from that of a quartz crystal where the film is inconceivably small, to the hygroscopic surface of a calcium chloride crystal where the accumulation of water is so rapid as to become visible in a few seconds.

Now, may we not go a step further and look for an analogous structure in the molecule? The theory of the molecule is that it is an aggregate of atoms suspended in an agitated medium — the ether. By the vibrations continually running through the ether the atoms are crowded to centers, thus constituting molecules. The nature of the molecule will depend upon the size, form, and weight of the atoms. These are fixed qualities of the atom; hence the resultant molecules are always the same. The apparent exceptions in the case of the allotropic forms of carbon, sulphur, and phosphorus may be explained by several arrangements being possible, though some particular one is more likely than another, as in the case of pyrite, which commonly occurs in cubes though sometimes in octahedral and dodecahedral forms. By such an hypothesis we have an explanation of chemical affinity. Chemical affinity under this view is a driving of such atoms together which most perfectly fit together in the molecule. Should another set of atoms as a reagent be introduced, they may be so constituted as to fit more perfectly with the present set than these do among themselves, and at once a reaction takes place, with a new arrangement as a result. Possibly the tendency toward rearrangement is too feeble to produce any result under the ordinary disturbances of the ether, and some special vibrations must be introduced, as when chlorine is helped to decompose water in sunlight. Here we may also find an explanation for chemical energy, by accounting for it as residing in the ether movement which binds the fitting atoms together into the symmetrical molecule. We can also account for the heat which results from chemical reaction by regarding it as the energy of the motion of the atoms as they come together being transformed into the energy of agitation of the new molecules, which is heat.

When the darkeys find feather balls in their pillows they believe that they have been hoodooed, and they find in the "pillow-witches" an explanation of all their ills and misfortunes. Why should not the chemist find in them also a solution to many of his perplexities.

VARIATIONS IN THE NITROGEN-CONTENT OF MAIZE, AND POSSIBILITIES FOR IMPROVEMENT OF IT.

BY J. T. WILLARD, MANHATTAN.

Read before the Academy December 30, 1898.

That plants vary, and that it is because of this variation that improvement is possible, is a fact known to every student of science. That chemical differences should be present in individuals which present no external differences could not be assumed, and by many would not be suspected. Twelve years ago the author presented to this Academy the evidence that individual stalks of sorghum vary greatly in their sugar-content, even when of the same variety and general development. That fact followed up by the Kansas Experiment Station and the United States Department of Agriculture resulted in the improvement of several varieties of sorghum, by selection of individual stalks by chemical analysis of the juice, to the extent of several per cents. That similar results may be obtained with corn seems not unreasonable. With corn, however, the desire is to increase the percentage of proteids in the grain. Corn is king, no doubt, now, but we desire to make him more worthy still of his regal position. Corn is rich in carbohydrates and fat, but too deficient in proteids to make it an ideal feed for any purpose. Its best utilization requires that its excess of carbonaceous constituents be balanced by the addition of feeds rich in nitrogen; hence the dairyman adds wheat bran, gluten meal, oil-cake, or some other feed rich in proteids. For growth, for labor, and even for fattening, corn lacks nitrogen. The average percentage in corn is about ten; in wheat, twelve; in bran, sixteen; and in oil-meal, thirty-three. Could we increase the proteids of corn by two or three per cent., it would raise the value of the annual crop millions of dollars.

The compilation of analyses of corn published in Experiment Station Bulletin No. 11, office of experiment stations, shows that the average protein-content of dent corn is 11.5 per cent., calculated on the dry matter; the minimum is 8.2 per cent., and the maximum 13.8.

The results about to be given were obtained in analyses incident to a joint experiment now being carried on by the farm, botanical and chemical departments of the Experiment Station of the State Agricultural College, in which the object is to improve corn in its protein-content, by seed selection based on chemical analysis. Cross-fertilization between the best varieties, it is hoped, will result in the establishment of a better one than any now known, and careful selection should lead to relative fixity of type.

As a preliminary, analyses were made of single ears from thirty-three varieties grown in this state, and collected as good ones. These showed a nitrogen-content of from 1.56 per cent. to 2.26, corresponding to 9.75 and 14.12 per cent. of proteids, respectively, calculated on the dry substance. These would not be fair figures by which to judge the varieties, as but a single ear was used for the sample, and it was found by another set of analyses that individual ears of the same variety varied to as great an extent.

To study the variation in different ears of the same variety, one was chosen which was the result of a crossing of white and yellow corn, and another which had been grown on the same farm by the same man for thirty years, without admixture of other seed. It was thought that the former would represent an unstable variety, and the latter a fixed type, if such could be formed by ordinary selection of seed. Ten individual ears of each were analyzed. The cross-bred corn showed a variation from 1.35 per cent. of nitrogen to 2.22; the other varied from 1.53 to 2.24. These great differences, even in the case of the supposed fixed type, show what wonderful possibilities in seed-selection are open to us. If the average composition can be raised to that of the best ears, the grain will be equal to wheat in feeding value, if equally digestible. In sampling for these analyses a narrow belt of kernels was taken around the middle of the ear in each case.

We went still further, and took the ear from the fixed type which had shown the highest percentage of nitrogen, and made analyses of individual kernels from it. These were taken from the middle of the ear, and were selected to as nearly as practicable the same weight, since kernels of differing size might easily be supposed to have the several parts of the grain present in differing proportions.

Fifteen individual grains were analyzed, and their variation was from 1.72 per cent. to 2.30. These figures show that, to make selection most effective, we must be able to separate the desirable kernels from the less so, and not depend simply on selection of ears. Upon this problem we are still at work. It is evident that we cannot analyze our kernel, and plant it too, and that some physical test only is available. Our task is to find a usable physical property which varies with the per cent. of nitrogen. The specific gravity suggests itself as best adapted to our needs. Investigation of this point has not yet reached definite results. The differences in specific gravity are very slight, and since parallel determinations of the nitrogen in single kernels are impracticable, a large number of analyses will be necessary before a positive result can be expected. The determination of the specific gravity, while theoretically simple by means of a heavy solution and the Westphal balance, presents considerable difficulty because of the adherence of air to the grain with great tenacity, and because of the occurrence of cavities within the kernels sometimes.

Analysis of the several parts of the grain has shown that the germ is much the richest in nitrogen. Constituting about ten per cent. of the weight, it contains sixteen per cent. of the nitrogen. It also contains sixty-five per cent. of the oil. An increase in the size of the germ, therefore, will insure an increase in the percentage of the most valuable parts. Differences in the size of the germ are easily seen by simple sections through the kernels with a sharp pocket-knife, and ears can be selected showing a predominance of large germs.

WATER PURIFICATION.

BY W. TWEEDDALE, TOPEKA.

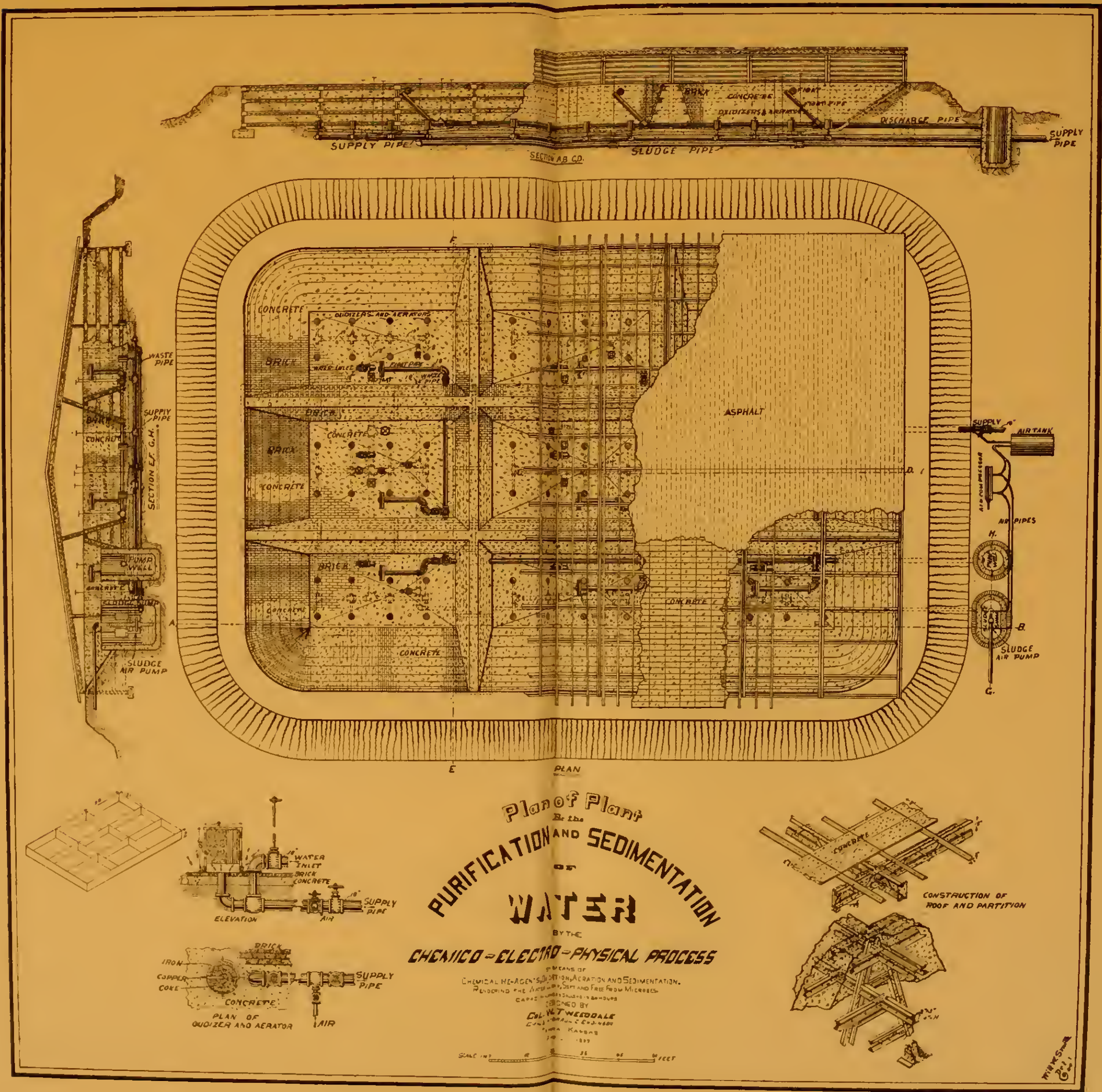
Read before the Academy December 30, 1898.

The character of the water-supply of a country is the determining element of its potential future, as regards its being the habitation of man, whether it be by the solitary pioneer or a community of individuals, as in ranch, village, town, or city like New York, with a population of millions.

Modern sanitation requires that not only shall the quantity be abundant, but that the quality shall be suited to the uses to which it is to be applied. Medical science forbids that the cholera-infected water in the sacred tanks of India be longer used for dietetic purposes; and in the same line demands that, if water for potable purposes cannot be procured, provision be made to render it so by some system of purification. The necessity for this purification is due to the very solvent power of water acting on solid substances, such as clay, the presence of which in a state of suspension causes turbidity, together with the solvent power of gases in water acting chemically on inorganic earth salts, causing the property termed hardness and the fermentation (putrefactive decomposition) of organic substances, the presence of which in this state constitutes the nidus for the development of bacteria.

In this country the purification of public water-supplies has been mainly restricted to the removal of visible impurities in suspension, including bacteria. This is sought to be done by filtration or by subsidence. There are two systems of filtration: 1st, sand filters, English system, as it is termed, with or without being allowed to deposit the coarser particles by sedimentation: and, 2d, the mechanical filters, American system, combined with the use of a coagulant.

Subsidence is the practice in cities whose sources of supply are the waters ob-


Plan of Plant
for the
PURIFICATION AND SEDIMENTATION
OF
WATER
BY THE
CHEMICO-ELECTRO-PHYSICAL PROCESS
SECTION AB CD.
SUPPLY PIPE
SLUDGE PIPE
DISCHARGE PIPE
SECTION EF. G.H.
PLAN
ASPHALT
CONCRETE
BRICK
OXIDIZERS AND AERATORS
WASTE PIPE
PUMP WELL
SLUDGE AIR PUMP
AIR TANK
AIR PIPES
ELEVATION
WATER INLET
AIR
PLAN OF OXIDIZER AND AERATOR
IRON
COPPER
COKE
CONSTRUCTION OF ROOF AND PARTITION

tained from our western rivers, an example of which is St. Louis, Mo., which in this manner treats thirty-two million gallons per diem. In Europe, where water purification by the use of sand filters is general, the rate of descent of the water through the sand of the filter varies with the degree of turbidity, ordinarily, but about sixty gallons per square foot per twenty-four hours, or 2,500,000 gallons per acre per diem.

The action of these filters is not alone that of strainers. The fermentation of the organic substances in the bed of the filter changes the organic constituents to inorganic nitrites and nitrates by the agency of bacteria. The mechanical filters act only as strainers, as the rate of passage of the water through the filter, 130 million gallons per acre per diem, is too rapid to allow of the reduction of the organic compounds by fermentation.

In the process of purifying water containing organic matter by filtration, that portion in a state of suspension will be retained on the filter as a strainer, while that carried down by subsidence will be mingled with the other precipitated impurities. In either case they will by decomposition be rendered insoluble, and in the case of the filter will pass off with the filtered water; or in the case of by subsidence will be mingled with the purified water in the settling basin; in each case containing the spores of any bacterial life there may be in the water, together with the soluble matters as a nidus for their development; for which reasons the requirement is to use sand-filtered water soon after it has been purified. The value of filtration as a means for purifying water by the removal of bacteria can be judged from the following:

Doctor Currier, biologist for the Syracuse Water Commission, experimented with a variety of filters, and found, even with the justly celebrated Chamberlain-Pasteur filter, under the hydrant pressure of New York city, when the flow was but drop by drop, that, when the filter had been sterilized by steaming for five hours, no bacteria passed through with the water; but that after three days' continued use the number of bacteria increased to 2500 per cc., and after five days of such use the number had increased to 400,000 per cc. These processes, which may be regarded as standard, take no account of the removal of inorganic substances in solution in water. These substances are earth salts, rendered soluble by the solvent action of gases contained in the water, mainly carbonic and sulphuric acid gases, so objectionable in water used for washing or for use in steam boilers. Doctor Frankland, chemist to the Parliamentary Rivers Pollution Commission in England, regards the softening of water by the removal of lime, magnesia, etc., as so important that he recommended, in a report to the above-named commission, that all companies should be compelled to provide for softening water-supplies before being allowed to raise additional capital for the extension of water-works. It was estimated that the chalk contained in the water-supply of London was 160 tons per diem, and that the saving in soap, if that were removed, would be, approximately, £250,000, equal to $1,250,000; and a cost of one penny applied for purifying water would effect a saving of soap of three shillings and eight pence, or forty-four times as much.

While the character of these impurities has been understood in a general way, it is only of late that any account has been taken of the effects, on nutrition and health, of hard water used dietetically. Based on mortuary statistics of a number of cities, it has been held that the hardness of water had no material effect on the death-rate; and, while it may be true that there is no direct evidence of this, there is much evidence that they exert a marked influence in inducing diseases,

—4

causing suffering if not immediate death. The effects produced by the dietetic use of hard water on the animal economy are:

1st. CHEMICAL. An illustration of the chemical effects of such use of hard water can be shown by putting a small quantity of the white of egg in each of two test-tubes, and adding to each the same quantity of bile from a freshly killed animal; then, after agitating for a short period of time, add to one of these tubes a portion of soft water and again agitate, when it will be found that the emulsion formed is perfect, rendering the contents assimilable and fitted for passing into the circulation. To the other tube add the same amount of hard water and agitate, when it will be found that the contents have coagulated into curd-like lumps, similar to soap in hard water, and be no more capable of providing nourishment than so much dissolved stone.

The medical congress held in Brussels in 1886 passed the following resolution: "Waters that are too hard, or that contain mineral substances that do not assimilate with the food and constitute a part of the human system, form with chyle an abnormal medium for the formation of blood, and the presence of these substances in the blood throws additional work on the kidneys, whose duty it is to filter out and remove the wastes of the blood, the too great accumulation of which substances results in the formation of concretions."

2d. PHYSIOLOGICAL. The distinguishing difference in the physical condition of the human system in youth and old age is in the increased amount of deposits of earthy matter. These are carbonates and phosphates of lime mixed with other calcareous substances. These deposits affect the physical organs and interfere with their action, causing imperfect circulation of the blood and clogging of the arteries. The change is in the nature of a slow, steady accumulation; and when they have become excessive the stiffness of old age is produced. As these substances are constituents of the food we eat and of the liquid we drink, much can be done to prevent their injurious effects by a proper selection of food and by providing, for cooking and drinking, a water which does not contain these substances, and also which by its solvent power will dilute not only the substances in the food, forming deposits, but also by acting on the deposits already formed fit them for removal, and thus tend to prolong the elasticity of youth.

3d. MECHANICAL. The nature of the mechanical action of hard water used dietetically on the system will appear when we consider that in the process of combustion of the impurities in the blood the uric acid (ashes of the blood), collected in the kidneys as an ash-pit, must, as in the case of the ash-pit to the furnace, be removed in order to secure efficient action. For this end the requirement is that the fluids passing through the body be in a condition to dilute the uric acid and thus fit it for being carried off by the channels nature has provided for their removal.

When waters used dietetically are charged with earth salts their solvent power is lessened, and they are in a condition to form deposits of the substances they hold in solution in the order of their solubility. Among the least soluble substances in solution in this case, uric acid acts as a nucleus, forming concretions producing paralysis, dropsy, Bright's disease, etc.

Dr. Lewin, of Munich, who made an extended and very careful study of the purification of water, gives the following as the requisites of any system of filtration:

"It must absorb not only substances in suspension but also all matters physically and chemically latent, and must so retain them that additional impure water or clear water cannot wash the impurities out; or purifications must be carried on in such a manner as not to injuriously affect the purity of the water.

The arrangements also should be such as to retain the property of purifying water for a considerable length of time without deterioration."

It is needless to state that this ideal purification of water has not been even approached by any known system of filtration in use. Such being the case, it is allowable to assert that no such system of filtration is possible; from which it follows that the solution of the problem of water purification to the above standard must be sought for outside of present methods, and that any process for the removal of injurious impurities in solution in water physically and chemically latent will be incomplete unless means are provided for rendering all such substances fit for removal by filtration or by sedimentation by making them insoluble and causing them to coagulate and unite with other impurities in suspension.

With the above high ideal of water purification as a standard, the writer has invented an apparatus and a process which in combination provide for the fulfillment of the above conditions.

The apparatus consists essentially of one or more vessels, tanks or reservoirs of any desired form or required capacity, with one or more oxidizers to each tank. These oxidizers are composed of metallic iron and coke arranged to form a galvanic battery, the size and number of oxidizers to depend on the dimensions of the tank, together with the requisite systems of piping for filling the tanks with water, agitating with air, drawing off the purified water, and removing the sludge whenever by its too great accumulation it is found necessary.

PROCESS.

The process fulfills the requirements above enunciated by Dr. Lewin of removing all objectionable impurities in water whether in suspension or in solution, and that, too, without deterioration of the apparatus; and consists

1st. By the use of chemical reagents, changing all substances in solution in water to an insoluble state in suspension.

2d. By combination of the galvanic action of the oxidizer, the salts of iron, and aeration; these substances, now all in suspension, by coagulation and aggregation, are fitted for being precipitated by sedimentation.

REAGENTS.

The reagents for rendering the earth salts, held in solution by the solvent acid gases in the water, insoluble in suspension are alkalis for which the solvent acid gases have a greater chemical affinity than they have for the earth salts held in solution by them. The withdrawal of these acids renders these earth salts insoluble.

The reagents for changing organic substances in water, rendered soluble by putrefactive fermentation, insoluble are metallic iron, coke, and salts of iron.

3d. The treatment consists in introducing into the tank the requisite amount of alkali necessary to absorb the carbonic acid holding the earth salts in solution, then fill with water; during the time of doing so and for the necessary length of time after, by means of compressed air, force the water through the oxidizer. This, in addition to thoroughly mixing the reagents with the water by bringing each particle of water into intimate contact with the material of the oxidizer, oxidizes or burns up the organic matter in solution in the water, thus rendering it insoluble; in addition to which the galvanic action of the oxidizer in the water kills the bacteria and causes the impurities in the water to coagulate. After completion of reaction, test for excess or deficiency of reagents and correct to neutrality if necessary. Then add reagents to absorb the sulphuric acid, and again agitate, test, and correct. After completion of reactions to neutrality, add salts of iron. The effect of this is not only to complete the oxidation of organic matter in solution, but also to hasten coagulation and destroy any excess of alkalinity there may be in the treated water; after which give final agitation and allow the water to become quiescent, when all the impurities in the water, now all in a state of suspension, will be precipitated by sedimentation.

When settled, the water is taken off from near the surface by a floating pipe, clear, soft, free from bacteria, and sterile to the development of micro-organisms.

The rate of precipitation depends on the condition of the water and the temperature. That of the water-supply of the city of Topeka at a temperature of sixty degrees is four feet per hour.

This process, by making a filter of the now all insoluble impurities and by sedimentation, passing them down through the water, instead of by filtration passing the water through the filter, and by the accumulation of impurities in the body of the filter, resulting in the deterioration of the apparatus, provides for the complete realization of Doctor Lewin's ideal water purification, and effects the following results:

1st. The removal from the water of the earth salts renders the water soft.

2d. The removal of the organic matter sterilizes it to the development of micro-organisms and the support of bacterial life.

3d. Aerating the water renders it more palatable, when used for drinking, and allows of the more rapid formation of steam in boilers required for industrial uses.

The cost of installation per square foot of surface will not exceed that for sand filters, while the rate of passage of water will be as twelve to one. The cost of operation will practically be that of the cost of reagent.

III. GEOLOGY AND PALEONTOLOGY.

PHYSIOGRAPHY OF SOUTHEASTERN KANSAS.

BY GEO. I. ADAMS, LAWRENCE.

Read before the Academy October 28, 1897.

The National Geographical Society of Washington has published a volume of monographs entitled "The Physiography of the United States." In this volume Major Powell, of the United States Geological Survey, has discussed physiographic processes and features, and defined in a comprehensive way the physiographic regions and districts of our country. It is the purpose of this paper to discuss briefly the geologic structure of Kansas as relates to the regions with which it has a common history, and in particular to define the physiographic features of the southeastern part of the state.

PHYSIOGRAPHIC REGIONS TO WHICH KANSAS IS RELATED.

The regions to be considered in a discussion of the structural history of Kansas are shown in the accompanying map. The Ozark region embraces the Ozark plateau of southern Missouri and northern Arkansas and the Ozark ranges of eastern Indian territory. The Ozark plateau extends just into the southeastern corner of Kansas. The prairie plains region extends to the north and west of this region. In Kansas it covers about the eastern fourth of the state. It is divided into a glaciated and a non-glaciated district, the division lines running approximately east and west just south of the Kansas and Missouri rivers. West of the prairie plains stretches the Great Plain plateau, terminating at the base of the mountains. That district of this region of which Kansas forms a part is known as the Arkansas plateau. The Park Mountain region embraces the mountains of southern Wyoming, central Colorado, and northern New Mexico. Between these ranges lie the mountain valleys commonly called parks.

REGIONAL BOUNDARIES IN KANSAS.

The regions are defined and mapped in a broad way by Major Powell. Just what are considered the limits in each case is not told. Within the borders of our own state, however, they are manifestly well defined in nature and will admit of closer mapping. The regional boundaries are here, also the boundaries of geological formations. In discussing the physical features of Missouri, Marbut* has made the line of separation between the Carboniferous and the Subcarboniferous the western margin of the Ozark region. In Kansas the line follows Spring river, thus giving the region but a very small extent within the state in the extreme southeast corner. The western limit of the prairie plains is apparently the escarpment along the eastern border of the Permian formation. This is a very natural division, and a traveler passing westward cannot fail to notice the sudden rise in the elevation and the change in surface features. In the southern portion of the state the transition is marked by the Flint Hills.

GEOLOGICAL STRUCTURE OF KANSAS.

The geological structure of Kansas is best understood by reference to a section extending in an east and west direction from the dome of the Ozark region to the

---

*Physiographic Features of Missouri: Mo. Geol. Surv., vol. X.

MAP OF KANSAS
and adjoining states, showing
PHYSIOGRAPHIC AREAS,
with a
GEOLOGICAL SECTION
through
Missouri, Kansas and Colorado,
showing the
STRUCTURE OF THE AREAS.
By GEO. I. ADAMS.

(Courtesy of University Geological Survey.)

Park mountains (see map, p. 54). From this section it will be seen that within the Ozark uplift is a core of archean rocks which are exposed within limited areas in southeastern Missouri. Around this core is an area of the older Palæozoic formations. Passing westward, we find the beveled edges of the later Palæozoic formations. Along the line of the section they are represented as follows: First, undifferentiated Cambrian and Silurian and the Subcarboniferous. Within the prairie plains region lies the Carboniferous. The Arkansas plateau region embraces the Permian, the Red Beds (which are referred by some to the Permian and by others to the Triassic), the Comanche, Dakota, Benton, and Niobrara; while resting unconformably upon these is an irregular deposit of the Tertiary. At the base of the Park mountains are the upturned edges of the Cretaceous and older rocks, while within the region the formations are much disturbed and the ranges contain eruptive and archean elements. Kansas may be said to be an area of slight disturbance lying between two mountainous regions, whose complex histories have produced simple oscillations over the regions of the prairie plains and the Arkansas plateaus.

We cannot reconstruct with much certainty the original areas of these various formations, but they once extended much further to the east; and to produce their present surface and beveled outcrops, erosion has been at work at varying intervals and for long periods. The westward dips and the succession from older to newer formations along this section argues in favor of the hypothesis that the shore line during Palæozoic times was to the east. This hypothesis is still further strengthened by the fact that the deposits themselves, show marginal conditions in their eastern outcrops, while the records of deep wells show deep-sea conditions to have been more prevalent to the west, as is indicated by the thinning of shale beds and the thickening of the limestone systems.

That this shore-line made many oscillations and migrations is evideuced from the alternation of oceanic and littoral deposits and the deposits of coal in the upper part and near the westernmost exposures of the Carboniferous. At the close of the Palæozoic era the land area must have advanced much further westward, since the deposits of salt and gypsum in the upper portion of the Permian indicate the absence of open seas. During the whole of the Cretaceous period deep sea conditions prevailed over most of the state, since the deposits are now present in the western two-thirds of it after a considerable erosion. At its close the raising of the mountains to the west caused the final retreat of the sea, the only remaining deposits, the Tertiary and limited Quaternary areas, being of fresh-water origin.

ORIGIN OF PRESENT DRAINAGE.

Until the close of the Cretaceous the drainage of Kansas, or such portions of it as were land areas, was to the west into the Cretaceous sea, since the deposits indicate a land mass to the eastward. The raising of the mountains to the west produced a drainage slope to the east over the newly exposed Cretaceous formations, which subjected them to a considerable erosion before the Tertiary of Kansas was laid down. Just what oscillations have occurred since then are not so easily determined. If, however, the Tertiary deposits were lacustrine to any extent, it would seem probable that there existed during that period a broad basin extending over the western part of the state far to the north and south, into which the drainage from the west flowed. If the sediments which produced the Tertiary were simply spread out on a flood plain, similar conditions probably existed. It appears therefore that not until near the close of the Tertiary times were the Park mountains sufficiently elevated to induce a drainage from that region across the Arkansas plateau to the Mississippi. We may accordingly look upon the present physiography of Kansas as being of the latest period.

DRAINAGE OF THE PRAIRIE PLAINS.

The drainage of the prairie plains is due primarily to the eastward slope of the surface. By reference to the map, it will be seen that, with the exception of the Kansas river, all the streams rise within the area. A secondary feature is the dip and strike of the rocks. In general, the dip is to the west and the streams flow at right angles to the strike, but slight deformations of the strata have caused a deflection of some of the streams to the south. There is an anticlinal ridge which has determined the divide between the Neosho and Osage river systems. In Missouri this divide continues into the Ozark region, to which the anticlinal is, no doubt, structurally related. Near the eastern border of the state this divide is spoken of by the residents as the Ozark ridge, and they will tell you that it can be traced to the Ozark mountains; but many of them mistake the escarpments which cross the ridge for the ridge itself. Along the southern border of the state the dip is to the southwest, and the streams here become more directly tributary to the Arkansas, which finds its way through the Ozark region in a synclinal trough.*

Spring river, which crosses the southeast corner of the state, flows along the line of contact between the Subcarboniferous and Carboniferous formations, and has literally slid down the extreme border of the Ozark dome, eroding the shales of the Carboniferous and accommodating itself to the uneven surface of the Subcarboniferous. In the territory the Neosho, to which Spring river is tributary, occupies a similar position, and is deflected to the west considerably before it reaches the Arkansas.

RESULTANT TOPOGRAPHY.

The formations over which the streams flow are beds of limestone alternating with beds of sandstone and shale. The unequal yielding of these materials to erosive agencies has produced in general a terraced surface, the limestones protecting the escarpments while the shales and sandstones below have been carried away by the streams.†

The inclination of the strata has produced a gradual slope (back slope) from the top of one escarpment to the base of the next higher. Not infrequently a stream cuts off a portion of an escarpment, producing a mound or ridge, and the ridge in turn is broken up into a row of mounds. In case the more resistant strata are anywhere discontinued or lose their importance the escarpment fades out, and the softer beds add their thickness to the escarpment geologically next higher. Likewise if the softer strata give place to more resistant ones, *e. g.*, a limestone system appears in a position where in other cases there is a shale bed, a new escarpment is developed. If a shale bed gradually thins out the adjacent limestones are merged into the same escarpment; and, on the contrary, if two closely associated systems are separated at any place by the thickening of intervening shales, their lines of outcrop diverge and two escarpments are produced.

A stream flowing upon a back slope will gradually slide down upon the inclined strata until it reaches the base of the next escarpment, cuts through the underlying formation, or reaches base level. In the latter case it would widen its valley, producing a plane independent of the dips of the strata. Along a single stream this area would be called a bottom land. When produced over large area by a stream and its tributaries, or by several streams, it is called lowland.

The prairie plains region in Kansas is coextensive with the Carboniferous formation. A section‡ made from Galena to Grenola passes across the entire for-

---

*Geo. H. Ashley, Geology of Paleozoic Region of Arkansas: Proc. Am. Phil. Soc., May, 1897.

† *Vide* Haworth: University Geol. Surv. of Kansas, vol. I, ch. 10.

‡ This section, made by the writer, was published in the Univ. Geol. Surv. of Kansas, vol. I; also in vol. III, *q. v.*

mation as here exposed. At its eastern limit we have the break in geological time marked by unconformity; at its western limit the transition to the Permian is marked by the fossils only. The dip of the strata, and the alternation of the easily eroded shales and sandstones with the more permanent limestones, are well exhibited by such a section drawn to scale. The lines of outcrop of the limestone systems have been traced with considerable detail and are quite identical with the escarpments which are shown in the accompanying map. It will be observed that they trend in a northeast and southwest direction, with many sinuosities where they cross the streams and divides.

DESCRIPTION OF PHYSIOGRAPHIC FEATURES.

Proceeding now to a description of the physiographic features, and beginning with the southeastern corner of the state, we find a small area of Subcarboniferous which belongs to the Ozark region and which forms our starting-point (see map, page 58). To the west of this lie the

CHEROKEE LOWLANDS.

The base of the Carboniferous consists of a bed of shales and sandstones about 450 feet thick, known as the Cherokee shales* and sandstones. They are exposed over a belt of country about twenty-five miles wide, lying between Spring river and Oswego, and extending across the corner of the state far into Missouri and Indian territory. The surface is gently undulating, the monotony of lowland topography being occasionally broken by ridges and mounds which owe their existence to heavy sandstone. Such a mound is the one west of Baxter Springs, near the territorial line. The country around Columbus exhibits a number of sandstone ridges, the city being located upon the divide between Spring river and the Neosho. Within this area are situated Pittsburg, Cherokee, Columbus, Weir City, Mineral, Sherman, and Chetopa. Over this area there are no limestones of stratigraphic importance, those which exist being usually associated with coal seams as "cap rocks." The western border of the Cherokee lowlands is the

OSWEGO ESCARPMENT.

At Oswego we meet with the first important limestones, known from their exposure at that place as the Oswego formation.*

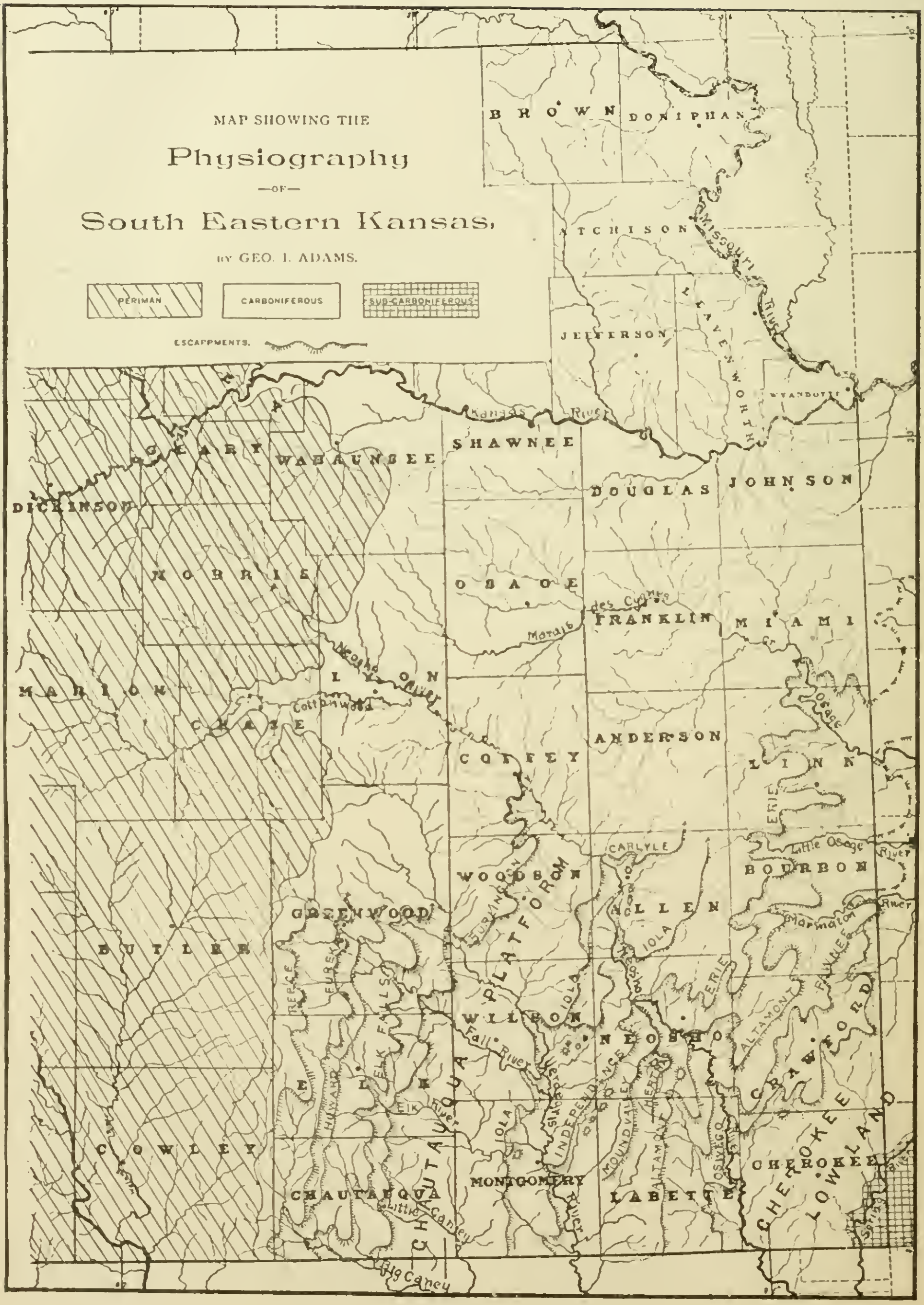
They cap the heavy shale beds and produce an escarpment which along the river bluff is 120 feet high. To the south the escarpment continues west of the Neosho river, passing into Indian territory; to the northeast it passes Sherman and produces the hills around Monmouth and to the northwest of Mineral City. Just north of Cherokee it bends to the north, crosses Cow creek near Girard, and runs a little north of east almost to the state line, being very prominent at Mulberry, from which place it bends to the north, passing in a sinuous line west of Arcadia, Bunker Hill being a part of it. From there to Fort Scott it is very irregular and has many outlying hills. East of Fort Scott it reaches the state line, but bends back up the Marmaton, and, after crossing the river, finally passes into Missouri. It is in this escarpment that coal is obtained by quarrying the limestone above it. The Oswego formation extends but a short distance to the west on the surface. The next formation met with is the Pawnee, producing the

PAWNEE ESCARPMENT.

The Pawnee limestone† formation produces but a slight influence upon the topography. To the north it becomes more important, and is seen in the escarp-

* Haworth and Kirk: Kans. Univ. Quart., vol. II. p. 105.

† Haworth and Kirk: Univ. Geol. Surv., vol. I, ch. 2.



(Courtesy of University Geological Survey.)

ment crossing the divide between Labette creek and the Neosho near Laneville. East of the Neosho it passes McCune to the south and runs up Lightning creek, crossing it near its head, from which place it follows a sinuous line, north of Girard, west of Englevale and east of Pawnee station, to Godfrey, where it blends with the Oswego escarpment.

ALTAMONT ESCARPMENT.

The next limestone formation is the Altamont. It is found at the top of the escarpment which, passing east of Altamont and extending to the south, runs just east of Edna and into the territory, becoming very prominent there. Tracing the systems to the north, they are found to pass from Altamont north to Parsons, at which place they produce no escarpment. Along the west bluff of the Neosho they are again important, but the escarpment fades out around St. Paul, in the Neosho bottoms. To the northeast, past Brazilton, Farlington, and Hiattsville, there is a prominent escarpment; but it is largely due to the thick sandstone beds which produce the flagging stone quarried at many places. In the valley of the Marmaton the escarpment disappears, but is again found further north.

ERIE ESCARPMENT.

This escarpment is most prominent along the Marmaton river near Uniontown, from which place it runs to the northeast, passing out of the state east of La Cygne, according to Mr. Bennett, who is familiar with that region. Following it to the south, it passes east of Savonburg nearly to Walnut, thence westward north of Erie, where it crosses the Neosho river. It is produced by three limestone systems called collectively the Erie formation.*

They are quite closely associated along the course already described, and the escarpment is one of the most prominent in the southeastern portion of the state. South of the Neosho, however, the systems separate, due to the thickening of the intervening shale beds, and the lines of their outcrops diverge.

HERTHA ESCARPMENT.

The lower member trends to the east around the head of a creek to Hertha. An outlying area is found at South Mound. From Hertha the escarpment runs westward, crossing Labette creek south of Galesburg, and follows its west bluff for a considerable distance. It is prominent at a few places on Little Labette creek and finally terminates in the mounds west of Altamont.

THE MOUND VALLEY ESCARPMENT.

The second member of the Erie formation, the Mound Valley, has very prominent exposures all the way from the Neosho river to Galesburg and for some distance south, when it suddenly fails to produce an escarpment for a considerable way, especially near Little Labette creek. At Mound Valley, however, it is very prominent continuing so to the southwest nearly to the Verdigris river at Liberty. Here, however, the limestone has disappeared and the escarpment is produced by sandstones, which are eroded further south by the tributaries of the Verdigris.

INDEPENDENCE ESCARPMENT.

The upper system of the Erie formation, the Independence, is found on the high land east of Urbana and south of that place, producing an escarpment east of Thayer, which runs in a southwest direction to the Verdigris just below Independence. Crossing to the west side of the river, it produces a high bluff all the way to Coffeyville and after a slight digression to the west at Onion creek passes into the Indian territory. Lying to the east of this escarpment, from south of

*Haworth and Kirk: Kansas Univ. Quart., vol. II, p. 108.

Thayer to the Verdigris, is a chain of hills and mounds, including the Bender mounds and those around Cherryvale, which form a very striking feature of the country. They are simply the remains of outlying areas separated from the escarpment by erosion.

EARLTON ESCARPMENT.

The next succeeding formation is the Iola limestone formation. Below the Iola system proper lie the Earlton limestone systems. From Elk river to east of Benedict they are closely associated with the Iola; but west of Chanute and northwest of Earlton, from which place the systems take their names, they produce a separate escarpment, due to the thickening of intervening shales. Between Altoona and Earlton there are a number of mounds which have recently been protected by the limestone which produces this escarpment. The escarpment fades out in the Neosho valley, and southwest of Vilas blends with the next succeeding, which is the

IOLA ESCARPMENT.

The escarpment produced by the Iola limestone* is most prominent west of the Verdigris river from Table mound, northwest of Independence, to Benedict. South, toward the state line, it loses much of its importance, due to the preponderance of sandstone. It passes into the Indian territory just east of Tyro. Walker mound and Table mound are outlying areas of it. The prominence of the escarpment west of the Verdigris from Independence, past Neodesha, Altoona, and Guilford, to Benedict, is largely due to the position of the river valley, which runs parallel to it, and to the great thickness of the limestone. At Benedict it crosses the river and, bending somewhat to the south, takes a northerly course, passing west of Vilas, to Owl creek west of Humboldt, where the next succeeding escarpment blends with it. The Iola limestone descends to the bottom land and is not traceable far after crossing Owl creek on the west side of the Neosho river. It is exposed at Iola along Elm creek and Rock creek, as well as at several places on the east bank of the Neosho between Iola and Humboldt. At the latter place it forms the heavy ledge which is so prominent at the river bridge. Further south it recedes from the river, producing an escarpment which trends to the southeast, then curves to the northeast, running nearly parallel to Big creek, but considerably west of it, and passes just east of Moran, becoming less distinct.

CARLYLE ESCARPMENT.

This escarpment is produced by the Carlyle limestone,† which is exposed near Carlyle on both sides of Deer creek. From that place it runs to the east and then to the north, being prominent at Garnett and east of there along the Pottawatomie river. On the north side of Deer creek it trends west from Carlyle to the Neosho river, crossing it below Neosho Falls. On the west side of the Neosho it follows the river bluff for a short distance, then runs to the south, passing about half way between Iola and Piqua. At Owl creek it blends with the Iola escarpment, as already stated, although the system is traceable somewhat further to the south. North of Iola and between Iola and Humboldt, east of the river, there are a number of hills which are outlying portions of this escarpment.

CHAUTAUQUA PLATFORM AND CHAUTAUQUA SANDSTONE HILLS.

The back slopes of the escarpments thus far described possess no features which merit special description. The shale beds which produce them contain

---

*Haworth and Kirk: Kans. Univ. Quart., vol. II, p. 109.

†Haworth and Kirk: Kans. Univ. Quart., vol. II, p. 110. Since learned to be the lower member of the Garnett.

usually but little sandstone, except along the southern border of the state, and the limestones succeed each other at short intervals, so that the platforms are not very wide and their surfaces are generally undulating. West of the Iola escarpment and the Carlyle, which blends with the former, lies an area which is more diversified, due to the manner in which erosion has acted upon the heavy beds of sandstone which are present as the equivalent of the Le Roy shales* further north. North of the Neosho river sandstones are represented but sparingly in the Le Roy shales; but south of the river they gradually displace the shales, until in Chautauqua county they are everywhere predominant. From their exposure here they are named the Chautauqua sandstones. At Yates Center they become conspicuous, producing the hills upon which the town is built. From here the area broadens to the south, its eastern border passing west of Buffalo, Fredonia, and Tyro, while its western border runs approximately from Yates Center to Toronto, Fall River, Elk Falls, Sedan, and Elgin.

The area will here be described under the geographical name of the Chautauqua Sandstone Hills. These hills are as characteristic a feature of the southeastern part of the state as are the Flint Hills; and I here propose the name as one best applicable, since it is already employed somewhat in common usage for a portion of the area. The surface is intersected by many small streams which have deep valleys. The Verdigris, Fall and Elk rivers cross it, occupying narrow, deep channels, which are down to base level except along the western portion. The valleys of these rivers are narrow and walled in by bluffs, which show heavy sandstones as their protecting element. The low hills, which are the prominent feature of the area, are usually covered by a growth of jack-oaks. The sandy soil is seemingly adapted to their growth; for where the limestone areas are approached the oak timber begins to disappear. There are some small areas outside of the Chautauqua platform which have a similar growth of timber, as west of Thayer and south of Independence, along the west bluff of the Verdigris, where the Thayer shales,† which lie between the Independence and Iola limestones, carry a great deal of sandstone. Although the Chautauqua sandstone hills are nowhere very high, the difference in elevation over the entire surface being nowhere greater than 250 feet, yet they make traveling difficult because of the rocks which wear to the surface on the slopes, and the sand which accumulates in the wagon roads from the disintegration of the sandstones.

BURLINGTON ESCARPMENT.

The limestones exposed in Burlington‡ and just south of the town form the protecting element in the next escarpment. This escarpment, known as the Burlington, is prominent west of Le Roy Junction and along Turkey creek. It runs to the southwest, passing two miles west of Vernon and then around the head of Owl creek. The limestone is present three miles west of Yates Center; but the heavy sandstones which produce the hills at Yates Center mask the escarpment, as indeed they do in most places from there to the southern border of the state. This limestone formation is the upper limit of the Le Roy shales and Chautauqua sandstones, but the general character of the Chautauqua hills area persists to the next succeeding escarpment. The line of outcrop of the limestone is from Yates Center to Toronto, thence west of Coffeyville to Fall River, Longton, Sedan, Chautauqua Springs, and Elgin. In places the limestone, being underlaid by shales or softer sandstone, persists as a prominent element in the surface fea-

* Haworth and Kirk: Kans. Univ. Quart., vol. II, p. 110.
† Haworth: Univ. Geol. Surv., vol. I, p. 157; see also foot-note.
‡ Haworth and Kirk: Kans. Univ. Quart., vol. II, p. 110.

tures, but where the sandstones are in heavy ledges loses its relative importance. From Sedan to Elgin it is easily traced.

ELK FALLS ESCARPMENT.

The next escarpment is produced by two heavy limestone formations which are usually separated by a sandstone formation, which, weathering slowly, brings all three ledges into practically the same slope. These formations and subsequent ones are not here named, since it is not necessary to a discussion of the present subject and a strict correlation is not now possible. The escarpment is prominent west of Elk Falls. The two limestone formations produce the two heavy ledges seen along the railroad from Elk Falls to Moline. From Elk Falls southward the escarpment passes with many deep sinuosities around the head of Salt, North Caney, Middle Caney, and Cedar creeks, and leaves the state west of Elgin after having digressed up Big Caney nearly to Hewins. It is seen very prominent at Rogers, about five miles west of Sedan. Northward from Elk Falls it passes up Elk river nearly to Howard, then descends the river again; is found west of Hutchins creek; at Cave spring on the head of Indian creek; at Greenwood on Salt creek, and west of Fall river to the vicinity of Twin Falls. Thence it makes a broad bow to the east and so reaches Walnut creek, south of Neal. From there it trends to the northeast, but the character of the limestone and included sandstone formation is changing somewhat; so that it is not safe to conjecture what its equivalent is beyond where the field work has been carried in detail. The back slope of this escarpment, which is comparatively even, is spoken of locally as a limestone prairie, in contrast to the sandstone area to the east.

HOWARD ESCARPMENT.

This is a low, even escarpment which from a distance somewhat resembles artificial embankments. It is seen at Howard in the north part of town. It is produced by thin limestone capping a shale bed which weathers very easily. Riding on the railroad, one can see it very conspicuous on the west side of the track from Moline to Severy. From this place to Climax the road cuts off a portion of it to the east. Beyond Climax it is again seen west of the railroad to Fall River. South of Moline its course is indicated on the map as being to the west of Middle Caney. At Wauneta it is somewhat higher and produces the peculiar rounded hills near that place.

EUREKA ESCARPMENT.

This escarpment is very conspicuous at Eureka. The town lies in the valley of Fall river. the escarpment making a high wall to the north, west, and south. The shale bed in the face of the escarpment carries some coal at various places, and the limestone above the shale has been traced in detail to the south, and is found to be persistent though not very heavy. It would appear from a hasty reconnoissance that it caps the terrace which is prominent just west of the railroad from Eureka to Madison and at the latter place. From Eureka southward it runs in a sinuous line around the head of Honey and Tadpole creeks: is prominent on Otter creek, where the north and south branches unite; is found half way between Severy and Piedmont; passes to the west of Pawpaw creek and is prominent on Elk river about five miles west of Howard. West of Moline it is the first hill beyond the low ones in the edge of town which belong to the Howard escarpment. It has been traced to Leeds, thence south, passing west of Grant creek, and bending in an irregular course, producing the east bluff of the Caney at Cedarvale and for some distance north. To the south of Cedarvale it passes around the head of Rock creek to the state line.

REECE ESCARPMENT.

This escarpment has not been traced in detail. It is present at Reece as the most conspicuous topographic feature, and was seen at a distance in doing other field work between there and Grenola. It runs approximately parallel with the Eureka escarpment and about six miles to the west of it, but gradually approaching nearer to it southward. Half way between Moline and Grenola it may be seen to the north, forming the high hills. It then curves to the north around the head of Big Caney and blends with the eastern slope of the Flint Hills west of the creek.

UPPER LIMIT OF THE CARBONIFEROUS.

The Cottonwood Falls limestone and the bed of shales above constitute the upper member of the Carboniferous. The line of outcrop of this formation has not been traced. Prosser* has identified the formation west of Reece, Grenola, and Cedarvale. The line shown on the accompanying map as the limit of the Carboniferous is therefore only approximately correct. This formation does not produce a conspicuous escarpment, and the limestone is masked in the eastern slope of the Flint Hills.

CORRELATION WITH THE PHYSIOGRAPHIC FEATURES IN MISSOURI. †

The blending of two or more escarpments, or *vice versa*, the splitting up of an escarpment into two or more, as well as the total disappearance of others, make it appear that, if the same conditions hold in Missouri that we find in Kansas, there can be little certainty that any escarpment will continue across the two states.

The Cherokee lowlands are the equivalent of the Nevada lowlands. The Cherokee lowlands extend as a belt across the corner of Kansas. The Nevada lowlands are a continuation of this belt into Missouri, where the area narrows to a point, according to the mapping by Marbut.

South of Fort Scott the Pawnee and Oswego escarpments blend. North of the Marmaton river the escarpment thus formed passes into Missouri. I judge that it is this escarpment which, after a short curve to the east, continues northward to the Osage river, and is the one described by Marbut as entering Missouri at that place, and named by him the Henrietta escarpment. This escarpment is considered by him as the western border of the Nevada lowlands, just as the Oswego escarpment is the limit of the Cherokee lowlands. Its course in Missouri is rather an unexpected one to me, since it seems to cut across to the eastern border of the Carboniferous.

The Erie escarpment has been traced northward by Mr. Bennett to where it passes over the state line at the northeast corner of Linn county. It is probable that this escarpment continues in a sinuous course in Missouri around the head of some streams, and is the same one described by Marbut as the Bethany Falls escarpment, which he states enters Missouri in the southern part of Cass county. The region between the Henrietta and Bethany Falls escarpments has been called by him the Warrensburg platform. To the west of the Bethany Falls escarpment Marbut describes the Lathrop platform and the Marysville lowlands. It is not possible here to give the Kansas equivalents of these belts, since a large area intervenes which I have not studied. It would appear, however, that in Kansas the escarpments described, or others similar, continue to the Missouri river.

---

* Kans. Univ. Quart., October, 1897.

† Marbut, Geol. Surv. of Missouri, vol. X.

FUSULINA CYLINDRICA SHELL STRUCTURE.

BY ALVA J. SMITH, EMPORIA.

Read before the Academy October 28, 1897.

The living Fusulina cylindrica was a member of the animal sub-kingdom Protozoa, class Rhizopoda, order Foraminifera, family Nummulitidae.

The shape of the shell of the young is a spheroid, but changes during the growth of the animal to an ovaloid, which resembles a grain of wheat in both form and size. The shell is composed of longitudinal chambers arranged spirally around a central spherical chamber, making about ten complete whorls in the adult shell.

The average length of the Fusulina is about 6 mm. and the thickness 2.5 mm. The spheroidal nucleus or central chamber is about 1-10 mm. in diameter and is provided with many circular openings, through which the animal protrudes its thread-like pseudopodia, and is connected by a small open entrance to the second chamber.

The second chamber is about 3-100 mm. in width, while its length embraces slightly over one-half of the nucleal chamber. Each succeeding chamber extends a little beyond its predecessor. This lapping of the chambers at the ends causes the increase in the longitudinal dimensions of the shell as it grows by the addition of chamber after chamber.

The size of the chambers and the thickness and strength of their walls increase from the center out. An open passage bearing a resemblance to the siphuncle in cephalopods lies as a trough along the ventral side of the chambers and cuts away the lower half of the septa where it passes through them.

The name "involute sinus" has been proposed by Professor Williston for this trough-like passage. The width of the openings in the septa increases from about $\frac{1}{25}$ mm. at the nucleus to 1 mm. in the outer whorls. The septa are also punctured by many minute circular openings (foramina) which were once occupied by the pseudopodia of the animal, and later served as ways for the protoplasm of the animal to communicate from chamber to chamber.

The outer walls of the chambers possess very few if any foramina or other openings. They are slightly more convex than the general curve of the whorl, and extend in graceful double curves from the girdle to either end, giving a corrugated appearance to the outer surface of the shell. The living Fusulina was evidently one composite body, occupying all the chambers of the entire shell at the same time, with a common vitality: a continual circulation of protoplasm taking place from chamber to chamber through the minute foramina and the siphuncle-like openings in the septa.

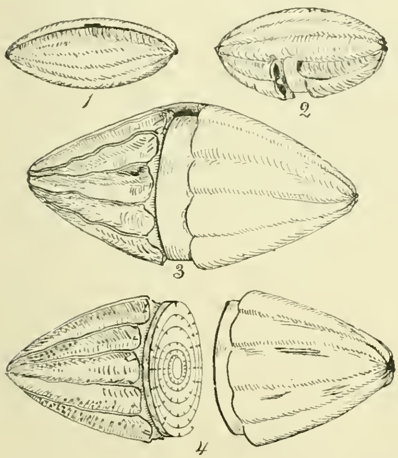
The first chamber occupied by the young Fusulina is nearly spherical. A spherical first chamber is found in a great number of Foraminifera whose later forms bear no resemblance to a sphere, the form of the succeeding chambers and the final shape of the adult shell depending upon the order in which the multiplication of chambers takes place and their manner of attachment to the parent mass.

In the Fusulina the animal occupied the central spherical shell for a time; then a portion of its ameboid contents spread out through an opening in the shell, forming a belt about $\frac{3}{100}$ mm. wide on the outside, its length embracing slightly over one-half the perimeter of the shell.

This strip of living matter soon secreted a calcareous covering, which is the second chamber of the shell. The third chamber is formed by a similar process along the sides of the one already formed. A continual repetition of this process completes the shell as we now find it fossilized in our limestone.

As I have taken issue in this paper with some eminent naturalists regarding the compound life of a rhizopod, it is right that I should give reasons for so doing.

Dana says "the cells of rhizopods are each occupied by a separate animal." While it is possible for this to be the case with some species of rhizopods, it is impossible with the Fusulina, for an independent animal occupying the central cells would have access to neither food nor oxygen, after being enclosed by the outer portions of the shell. The possession of the trough-like siphuncle indicates the flowing of matter from chamber to chamber along this course, as also do the thickened ends and rounded corners of the septa where cut by this trough. We know that an irritation of the bodies of conchiferous animals produces an increase in the calcareous secretions at tne point irritated. Then the increased thickness and rounded corners of the septa where cut by the stolon passage may point to an irritation of the Fusulina at these points, which could only come by a flowing of the protoplasm through the involute sinus. Only by a system of circulation through the openings in the septa can an ameboid animal secure the essential food and oxygen to maintain life while inhabiting the recesses of a chambered shell like the Fusulina cylindrica.



EXPLANATION OF FIGURES.

Figure 1, in the accompanying plate, represents Fusulina cylindrica magnified six diameters.

Figure 2 represents the same with a small portion of the outer surface broken away, exposing a portion of the involute sinus and the openings in the exposed ends of the chambers.

Figure 3 shows a Fusulina magnified twelve diameters, with the outer walls of the chambers removed from one-half of the shell.

Figure 4 is the same cut in half, showing a diagram of the internal coils and the central chamber.

NEW DEVELOPMENTS IN THE MENTOR BEDS.

BY A. W. JONES, SALINA.

Read before the Academy October 27, 1897.

Since the last meeting of the Academy of Science I have found the Mentor in several more localities in Saline county, and have collected quite a number of fossils, a series of which I have submitted to Prof. T. W. Stanton, of the United States Geological Survey, for determination, and as a result fourteen species have been added to the list previously given by Professors Cragin and Mudge, making the number of species from the Mentor now thirty-nine, and I think I still have two or three undetermined species on hand. Of this number nine appear to be undescribed species of the genera Unio, Linearia, Homanya, Cymella, Corbula, Glauconia, Anchuria, Sphenodiscus, and Ostrea. The other five are Rondaria quadrans Crag., Tapes belviderensis Crag., Mesalia kansasensis Meek, Turritella belviderei Crag., Pyrgulifera meekii White.

Professor Stanton in writing says: "It is noteworthy that your collection contains relatively few of the species described by Meek and White in Mudge's collection from the same region, while it does contain a large proportion of species that occur in the Comanche series of southern Kansas, Texas, and New Mexico," and asks if I am certain that I have specimens from the same horizon as Mudge's. I have stated to him in reply that a number of the fossils I sent are from within a mile of Mudge's collecting ground, and unquestionably in the same horizon, according to the statement of Mr. Hall, living south of Bavaria, who has directed me to what he says is the precise locality of Professor Mudge's collecting.

It will thus be seen that the recent additions to the fauna seem to indicate a close relationship to the Comanche, while the occurrence of Pyrgulifera meekii seems to suggest relationship with the Bear River formation of Wyoming, according to Professor Stanton. As a result of my studies during the past year, I am still of the opinion that the Mentor proper is at the base of the Dakota, and entirely below the leaf-bearing strata, although I have found in a very few instances what appear to be wood-stem or root impressions associated with shells; and have frequently found fossil leaves within ten feet above them, but never associated with or below the shell beds, and generally the Permian floor is close below the shell-bearing stone.

Another peculiar feature is that every different outcrop, even when only short distances intervene, but especially when separated by intervals of a few miles, shows a decided difference in prevailing species of fossils, some localities yielding brackish or fresh-water species, while others are entirely marine, indicating that this region was near a shore line with brackish water bays or estuaries.

The lithological character varies decidedly with different localities also, and this summer I obtained from a very limited outcrop, near Brookville, some of the finest fossils, I think, that have ever been obtained from the Mentor. The stone is an argillaceous sandstone, varying from a pinkish color, through yellowish and reddish tints, to brown, very hard and fine grained, and the fossils broken out of it are very perfect, every detail of marking being clear and distinct on some of the specimens. This locality also yielded some new forms having several casts of a new species of Anchuria and the first of the ammonite forms that I have found in the Mentor, a species of Sphenodiscus.

In addition to this, Mr. Davis Boyles, who has been taking special work in geology at the Kansas Wesleyan, made the very interesting discovery of a fossil bed northwest of Brookville that yielded some excellent specimens of fossil leaves associated with abundant casts of a mollusk, Modiolo polii White, (this species was described from the Bear River beds,) and in the same lot of material were three distinct impressions of beetle wings, the first insect fossils that I have obtained from the Dakota.

These fossils were from the upper Dakota, not more than 50 or 60 feet below the Fort Benton limestone that caps the hill tops a short distance from where the fossils were collected, and about 300 feet higher than the Mentor beds near Brookville.

The Dakota and its associations furnish a very interesting field of study for the geologist, and the rather limited shell beds at the base of the Dakota known as the "Mentor beds" are among the interesting features.

CAST OF FOSSIL TURTLE FROM THE DAKOTA EPOCH.

FOSSIL TURTLE CAST FROM THE DAKOTA EPOCH.

BY C. S. PARMENTER, BALDWIN.

The fossil cast here represented by a plate was presented to Baker University by Rev. C. K. Jones, an alumnus of Baker University, class of 1876. The specimen was given to Mr. Jones by a resident of Cloud county, whose name I have been unable to ascertain. Mr. Jones says, in a letter to myself: "The specimen was found south of Concordia, on a divide. The formation is red sandstone, which outcrops in ledges and lies scattered all over the ground in places. The specimen was secured not far from the north line of Ottawa county, on one of the spurs facing south, just north of what is called the Bethel neighborhood, thus fixing without doubt the geological position of this fossil.

The fossil cast is composed of the characteristic hard, red sandstone of the Dakota group. Its maximum length is eleven and one-half inches. Its maximum width is nine inches. The dorsal aspect is very much more convex than the ventral and bears the well-defined impressions of the flattened portions of ten ribs. Along the line of the backbone there are the indentations of the proximal ends of fourteen ribs. A deep constriction is found four inches from one end and another evidently existed at the other. In the report of the United States Geological Survey of the Territories, Vol. II, page 16, E. D. Cope, in speaking of the rocks of the Dakota epoch, says: "No vertebrate fossils have yet been obtained from them." In the University of Kansas Geological Survey, Vol. IV, Doctor Williston says: "No vertebrate remains of any kind have so far been discovered either in Kansas or elsewhere, save impressions or casts. A record of footprints from this formation was first made by Prof. B. F. Mudge in 1866, and later one by Prof. F. H. Snow." This fossil, then, makes the third evidence of vertebrate life found in the Dakota epoch and the first and only fossil cast showing something of the structure of the animal. It is therefore unique and of great interest to students of paleontology.

THE DEEP WELL AT MADISON, KAN.

BY F. W. BUSHONG, EMPORIA.

Read before the Academy December 29, 1898.

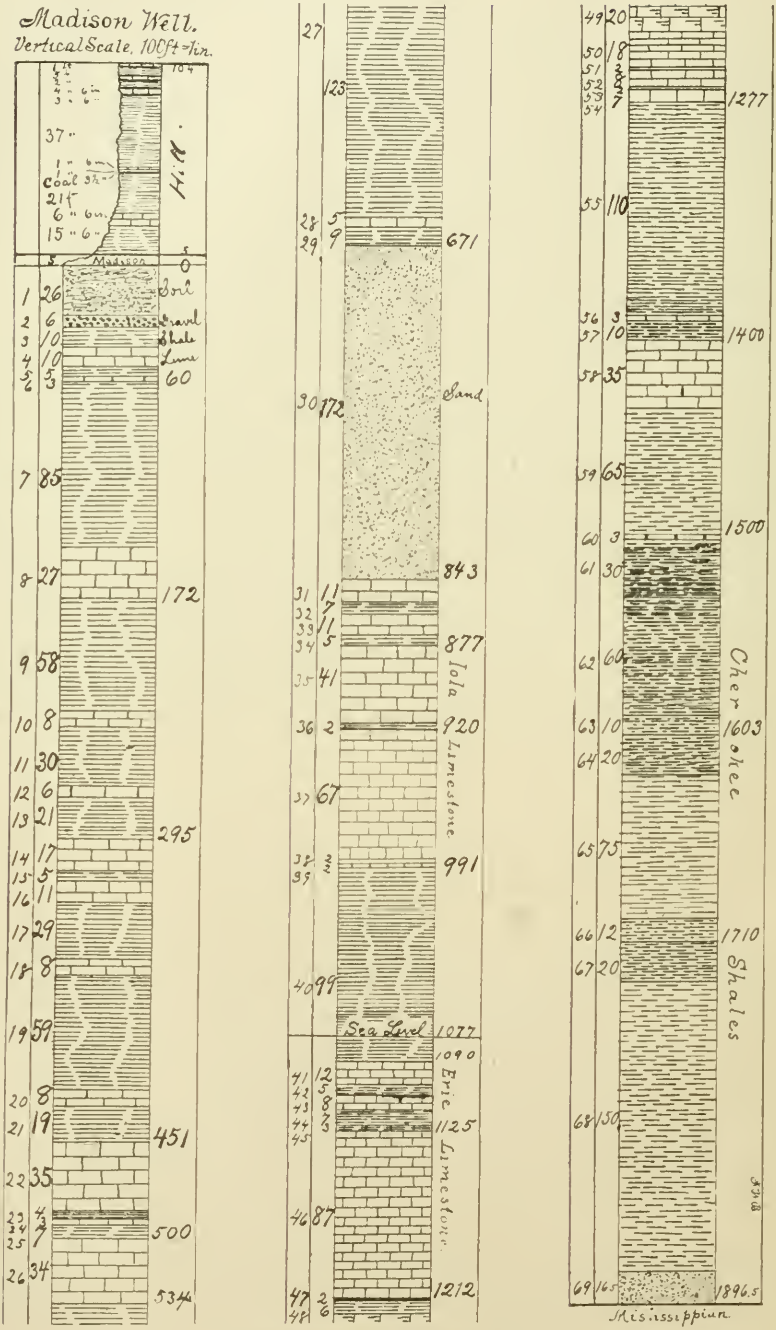
A company, with Mr. E. D. Martindale as its president, was organized at Madison, Kan., for the purpose of prospecting for gas or oil. By contract, Mr. C. L. Bloom, of Independence, Kan., agreed to drill either to the Mississippian limestone or to a depth of 2000 feet.

Work was begun in June, 1898. On the 29th of October, after frequent but not serious accidents and delays, a very hard rock, believed to belong to the Mississippian series, was reached at a depth of 1896½ feet.

The ordinary form of churn drill was used, and the measurements given below were made upon the drill rope, about half of them being made when the well was nearly filled with water. All measurements were carefully made, and are therefore correct within the limits of this method.

The well is located in the bottom land on the south bank of the Verdigris river, less than one-fourth mile north of the Santa Fe depot at Madison, the top of the well being three feet lower than the railroad track at this depot, which, according to the railroad company's engineer, is 1080 feet above sea-level. The top of the well is therefore 1077 feet above sea-level.

Transactions Kansas Academy of Science, Vol. XVI. PLATE V.



THE DEEP WELL AT MADISON, KAN.

LOG OF THE WELL.

No.	*Thickness.*	*Strata.*	*Depth.*
1	26 feet.	Soil and clay	26 feet.
2	6 "	Gravel	32 "
3	10 "	Soft shale	42 "
4	10 "	Limestone	52 "
5	5 "	Shale	57 "
6	3 "	Limestone	60 "
7	85 "	Shale.	145 "
8	27 "	Limestone	172 "
9	58 "	Shale	230 "
10	8 "	Limestone	238 "
11	30 "	Shale	268 "
12	6 "	Limestone	274 "
13	21 "	Shale	295 "
14	17 "	Limestone	312 "
15	5 "	Shale	317 "
16	11 "	Limestone	328 "
17	29? "	Shale	357? "
18	8? "	Limestone	365? "
19	59 "	Shale	424 "
20	8 "	Limestone	432 "
21	19 "	Shale	451 "
22	35 "	Limestone, hard	486 "
23	4 "	Dark shale	490 "
24	3 "	Limestone	493 "
25	7 "	Shale	500 "
26	34 "	Limestone, salt water, sp. g., 1.04	534 "
27	123 "	Shale	657 "
28	5 "	Brown limestone	662 "
29	9 "	Shale	671 "
30	172 "	Sandstone, salt water, sp. g., 1.05	843 "
31	11 "	Limestone	854 "
32	7 "	Shale	861 "
33	11 "	Limestone	872 "
34	5 "	Shale	877 "
35	41 "	Limestone	918 "
36	2 "	Shale	920 "
37	67 "	Limestone (streak of shale at 949 feet)	987 "
38	2 "	Shale	989 "
39	2 "	Lime shells	991 "
40	99 "	Shales	1,090 "
41	12 "	Limestone	1,102 "
42	5 "	Shale	1,107 "
43	8 "	Limestone	1,115 "
44	7 "	Red shale	1,122 "
45	3 "	Shale	1,125 "
46	87 "	Flinty limestone	1,212 "
47	2 "	Black slate	1,214 "
48	6 "	Shale	1,220 "
49	20 "	Gritty limestone, water	1,240 "
50	18 "	Gray limestone	1,258 "
51	2 "	White shale	1,260 "
52	8 "	Gray limestone	1,268 "
53	2 "	Brown shale	1,270 "
54	7 "	Gray limestone	1,277 "
55	110 "	Light shale	1,387 "
56	3 "	Brown limestone	1,390 "
57	10 "	Dark shale	1,400 "
58	35 "	Flinty limestone	1,435 "
59	65 "	Light shale	1,500 "
60	3 "	Brown limestone	1,503 "
61	30 "	Black shale	1,533 "
62	60 "	Dark shale	1,593 "
63	10 "	Sandy shale	1,603 "
64	20 "	Black shale (a little water)	1,623 "
65	75 "	Light shale	1,698 "
66	12 "	Sandy shale	1,710 "
67	20 "	Black shale	1,730 "
68	150 "	Shale	1,880 "
69	16½ "	Sand and water	1,896½ "
70	....	Very hard rock.	

The Cherokee shales were in general slightly sandy, dark in color, and had a strong odor. No gas or oil was found.

The following section of the hills at Madison was prepared by Mr. Alva J. Smith, and is here published with his permission:

No.	Thickness.	Strata.	Elevation above well.
1	1 foot.	Limestone	104 feet.
2	5 feet.	Shale	103 "
3	2 "	Limestone	98 "
4	4½ "	Shale	96 "
5	3½ "	Limestone	91½ "
6	37 "	Shale	88 "
7	1½ "	Limestone	51 "
8	1 "	Shale	49+ "
9	3½ inches.	Coal	48+ "
10	21 feet.	Shale	48 "
11	6½ "	Limestone	27 "
12	15½ "	Shale	20½ "
Shale and river bottom land join			5 "
Santa Fe depot at Madison			3 "

The depths of the Mississippian below sea-level are: At Neodesha, 135 feet; at Fredonia, 310 feet; at Fall River, 430 feet.* At Toronto, a well 1452 feet deep did not quite reach the Mississippian.† At Madison, hard rock, supposed to be the Mississippian, was struck at 820 feet below sea-level. The dip toward Madison is therefore about ten feet per mile from Fall River; eleven feet per mile from Fredonia; and twelve feet per mile from Neodesha. The dip from La Harpe is between seventeen and eighteen feet per mile. From Ottawa it is about sixteen feet per mile.

At Madison the Cherokee shales are 400 feet thick, while at Toronto they are more than 372 feet thick. The Pleasanton shales are much heavier at Toronto than at Madison. Above this to the top of the Iola limestone these two wells differ very little. Above the Iola a bed of shale 104 feet thick at Toronto corresponds to a bed of sandstone 172 feet thick at Madison. The limestone above these beds is 110 feet below the surface at Toronto, but is the uppermost limestone in this well. I desire in the future to locate the outcropping of the remaining strata of the Madison well along the Verdigris river, and prepare a section along the Verdigris from the state line, showing the wells at Neodesha, Fredonia, Fall River, Toronto, and Madison.

I have put up samples of the various strata to be deposited with the Kansas Academy of Science for preservation.

ON THE CORRELATION OF THE COAL MEASURES OF KANSAS AND NEBRASKA.

BY J. W. BEEDE, LAWRENCE.

Read before the Academy December 29, 1898.

Since the appearance of Meek and Hayden's Final Report of the United States Geological Survey of Nebraska in 1872, owing to the thoroughness of discussion and the care in the descriptions and figures of a large number of typical Upper Coal Measures fossils, it has become the basis for the identification of fossils of this formation of the West. On account of this fact and the great care with which the stratigraphy of the Missouri river bluffs in Nebraska was worked out, it is of great stratigraphic importance as well, forming, as it were, the type section of the Upper Coal Measures strata of the Missouri valley, leaving only the limitations to be worked out by later geologists.

Professor Prosser gives an admirable review of the history of the geology of Otoe county in the January number of the *Journal of Geology* for 1897, to

* Univ. Geol. Survey, vol. I, p. 148.

† Record of C. L. Bloom, driller.

which the reader is referred for the history and bibliography of the subject. This history is, in brief, as follows: Owen in 1852, and Swallow in 1855, referred the strata at Nebraska City, Neb., to the Upper Carboniferous; the latter to the "Upper Coal Series." Marcou in 1855 published a geological map of the United States in which these rocks were referred to the Triassic. In 1857 Hayden published a map representing them as Carboniferous. In 1864 Marcou published sections of these rocks referring them to the Permian, and the next year Meek criticizes him and refers them to the Upper Coal Measures. In 1866 Geinitz concludes with Marcou that they are Permian. In 1872 Meek published his Final Report, concluding that the rocks belonged to the Upper Coal Measures, and all later work has corroborated him in this opinion.

After an extended study of the Permian and Coal Measures in Kansas, Professor Prosser, in the article referred to, gives the results of his observations on the rocks of eastern Nebraska, based on their relation to the Cottonwood limestone above. He thinks that the rocks at Nebraska City belong to either the lower portion of the Wabaunsee formation or the upper part of the underlying formation, for he says that "Meek found *Spirifer cameratus* in the limestone above the coal, associated with plenty of other fossils characteristic of the Upper Coal Measures, and that it is clearly shown by the stratigraphy and paleontology that all the Paleozoic rocks in the vicinity of Nebraska City belong to the Upper Coal Measures (Missourian) instead of the Dyas (Permian), as claimed by Marcou. The writer is not confident whether the Nebraska City beds should be referred to the upper part of the Missouri formation or to the Wabaunsee formation of the Missourian series. However, the faunal and lithologic characters of these beds agree quite closely with those of the lower half of the Wabaunsee formation as shown along the Kansas river above Topeka, and so the writer refers them provisionally to it" (page 20, reprint). Also, on page 18 (reprint), speaking of the shales used for vitrified bricks at the Nebraska City works, occupying the position of Meek's original section, he remarks that these "shales are mostly of a drab color, somewhat micaceous as well as clayey, and resemble those used for vitrified bricks at the Topeka, Kan., works." He also studied the rocks of the bluffs on the west side of the Missouri as far as the Platte river, where the Paleozoic is covered by the Cretaceous. He says: "On the Platte river [near Louisville] the Permian is not represented and the Dakota sandstone rests unconformably on the limestones and shales of the Wabaunsee formation. This is, consequently, a very important section, as it shows that the 800 feet of Permian rocks exposed along the Kansas and Smoky Hill rivers in Kansas have disappeared and the Dakota sandstone of the Cretaceous system rests on the Wabaunsee formation of the Missourian series of the Upper Carboniferous. This conclusion agrees with that of Doctor Hayden, who on his geological map of Nebraska in 1858 represented the Lower Cretaceous (now known as the Dakota sandstone) on the Platte river as resting on the Carboniferous."

While Prosser finds the Cretaceous resting on the Wabaunsee formation on the Platte, yet he finds the Cottonwood formation four miles west of Auburn, Neb., at an elevation of about 345 feet above the Missouri river, and the base of the Permian is probably found in Gage county; and Knerr recognizes over 200 feet of Permian in Marshall county, Kansas * (adjoining Gage county, Nebraska, on the south).

The works of Meek and Prosser agree very well. Meek positively locates the rocks along the lower part of the Missouri river in Nebraska in the Upper Coal Measures. Prosser also locates them in the Upper Coal Measures and provision-

* Univ. Geol. Surv. Kans., vol. I, p. 144.

ally places them (those at Nebraska City) in the lower half of his Wabaunsee formation, basing this correlation on the nature and fauna of the rocks and their relation to the Cottonwood formation above.

It is my purpose to give a few observations on their stratigraphic relations to their supposed equivalents along the Kansas river in Kansas, and to trace some of the latter until they practically connect with the rocks studied by Meek and Hayden.

THE NEBRASKA CITY SECTION.

PROSSER'S SECTION.

The Nebraska City section, as it now appears at the brick-yards diggings, near the old landing, is accurately given by Professor Prosser in the article referred to (page 19, reprint). I quote it here, as my section adds no new features of importance:

	Thickness. ft.	in.	ft.	in.
"8. Massive somewhat calcareous sandstone	2	6	40	6
7. Rather arenaceous shales	15	0	38	0
6. Limestone with fossils, Fusulina cylindrica, etc. (No. 3 of Meek's section)	1	1	23	0
5. Black, very bituminous shales with thin layers of coal (No. 2 of Meek's section)	1	11	21	11
4. Mainly argillaceous shales	9	0	20	0
3. Arenaceous shales with thin, irregular sandstone at top	5	0	11	0
2. Massive, soft and friable brownish sandstone (about railroad level); Nos. 2 and 3 equal division D of Meek's section	3	0	6	0
1. Argillaceous shales that furnish material for vitrified bricks (the upper part of division C of Meek)	3	0	*3	0"

No. 8 is quite fossiliferous, as may be seen on the weathered edges, containing pelecypods and gastropods, though they do not weather out satisfactorily, nor can they be separated from the matrix. No. 6 sometimes attains a thickness of two feet. From the base of this section to within thirteen feet of the river at low-water level the rocks are covered. About thirteen feet above low-water mark there is a light gray massive limestone, exposed in two layers of about nine inches each, beneath which are about three feet of light green, argillaceous shales resting on some red shales. The remainder of the section is covered.

Owing to the changed condition of the section at Nebraska City, and the ease of comparing the full section with the sections and their fauna of the Kansas Coal Measures, it is necessary to give here Meek's section and the fossils collected from it:

MEEK'S SECTION.

	Thickness. ft.	in.
"Loess or bluff deposit, consisting of fine, light grayish pulverulent siliceous and more or less calcareous clay or marl, without distinct marks of stratification; rising back to the height of 80 to.	90	0
D. Yellowish-gray micaceous soft sandstone, laminated or in thin, ripple-marked layers, excepting 12 to 15 inches of the lower part, which is sometimes hardened and compact; with fragments of plants	10	0
C. Drab, ash, and lead-colored, and reddish-brown clays, with, near the middle, a 9- or 10-inch hard bluish-gray argillaceous layer, weathering to a rusty color. Fossils numerous, particularly near the lower part, as follows: Rhombopora lepidodendroides, Lophophyllum proliferum, Scaphiocrinus ? hemisphæricus, Eocidaris Hallianus, Synocladia biserialis, Fenestella Shumardi, Polypora submarginata, Glauconome trilineata, Lingula Scotica? Hemipronites crassus, Syntrielasma hemiplicata, Chonetes glabra, C. granulifera, Productus pertenuis, Productus longispinus (?), P.		

*In the above section, in the original, the total thickness is calculated without No. 1. I have taken the liberty to change the second column of figures so as to include No. 1, making the section 40 feet 6 inches, instead of 37 feet 6 inches.

	Thickness. ft.	in.
Prattenianus, P. Nebrascensis, P. symmetricus, P. semireticulatus, Rhynconella Osagensis, Spirifer cameratus, Spirifer (Martinia) planoconvexus, Spiriferina Kentuckensis, Athyris subtilita, Lima retifera, Entolium aviculatum, Aviculopecten carbonarius, A. neglectus, A. coxanus, A. occidentalis, Myalina Swallovi, M. subquadrata, Avicula longa, Avicula (?) sulcata, Aviculopinna Americana, Pseudomonotis radialis (??), Nucula Beyrichi (??), Nucula ventricosa, Yoldia subscitula, Nuculana bellistriata, Macrodon tenuistriata, Solenomya sp., Modiola subelliptica, Edmondia reflexa, Solenopsis solenoides, Pleurophorus oblongus, Schizodus curtus, S. Wheeleri, Schizodus sp., Edmondia Nebrascensis, E. (?) glabra, Prothyris subelegans, Allorisma (Sedgwickia) subelegans, A. (S.) Geinitzi, A. reflexa, Dentalium Meekianum, Bellerophon Montfortianus, B. percarinatus, B. Marcouanus, B. carbonaria, Euomphalus rugosus, Orthonema subtæniata, Aclis Swalloviana, Pleurotomaria Haydeni, P. subdecussata, P. Marcouana, P. Grayvillensis, Orthoceras cribrosum, Nautilus occidentalis, Cythere Nebrascensis, and Cythere sp.		
B. Several beds of hard, light-grayish and yellowish limestones, in layers from five to twenty inches in thickness, with soft, marly clay seams and partings. Fossils: Fusulina cylindrica, Rhombopora lepidodendroides, Lophophyllum proliferum, Erisocrinus typus, Synocladia biserialis, Hemipronites crassus, Orthis carbonaria, Meekella striatocostata, Syntrielasma hemiplicata, Chonetes granulifera, Chonetes glabra, Productus longispinus (?), P. semireticulatus, P. costatus, P. Prattenianus, P. Nebrascensis, P. symmetricus, Rhynconella Osagensis, Spirifer (Martinia) planoconvexus, S. cameratus, Athyris subtilita, Retzia punctulifera, Pinna peracuta, Myalina subquadrata, Allorisma subcuneata, Euomphalus rugosus, Bellerophon carbonaria, Phillipsia scitula, Cladodus mortifer, and Deltodus? angularis....................	51	0
A. a. Lead grayish and greenish clay, 4 feet.		
b. Reddish-brown, ferruginous, slightly gritty, indurated clay, 4 feet exposed above high-water mark	8	0
Total below drift....................................	69	0"

The section at Otoe (now Minersville) seems to be very much like what it was when Meek was there. As my time here was too limited to make a carefully detailed section, that of Meek is here given.

MEEK'S OTOE SECTION.

	Thickness. ft.	in.
"Loess, with some drift at the base	40	0
11. Soft, yellowish sandstone	10	0
10. Drab and ash-colored, with seams and concretions of arenaceous matter	3	0
9. Bluish laminated clays, passing gradually into the next below.....	7	0
8. Nearly black laminated clay or shale, with sometimes between it and the bed above a 6- or 8-inch bed of yellow limestone in the shale. Productus Prattenianus, P. longispinus (?), Sp. (Martinia) planoconvexus, Rhynconella Osagensis, Chonetes granulifera, Spiriferina Kentuckensis, Productus semireticulatus, Hemipronites crassus	3	0
7. Very hard, dark-gray calcareous layer..........................	0	4
6. Red, green, blue, and light ash-colored clays, with near the base a 2- or 3 inch seam of black shale	58	0
5. Soft, drab, marly material, becoming in parts hard and compact, or with hard calcareous seams. Millions of Fusulina cylindrica; also, Chonetes granulifera, Hemipronites crassus, Spirifer cameratus, Spiriferina Kentuckensis, Syntrielasma hemiplicata, Meekella striatocostata, Productus semireticulatus, Myalina perattenuata..................................	3	0

MEEK'S OTOE SECTION—*continued.*

	Thickness. ft.	in.
4. Light drab laminated clay, with streak of black; at one place seen to swell out so as to form a bunch of coal 6 to 8 inches thick, with efflorescence of iron sulphate	1	6
3. Soft, incoherent yellowish sandstone	6	0
2. Soft, bluish, sandy shale, with large, round, and compressed oval concretions	5	0
1. Bluish and drab clays, in parts more or less arenaceous. Productus Pratteniauus	15	0
Total, exclusive of loess and drift	111	10

MEEK'S SECTION TWO MILES ABOVE RULO, ON THE MISSOURI.

	Thickness. ft.	in.
"7. Loess, with perhaps some drift, 70 to	80	0
6. Massive yellow limestone	5	0
5. Gray and yellowish impure limestone and drab clays	4	6
4. Bluish and drab arenaceous clay with fossil ferns. Neuropteris hirsuta and N. Loschii	7	0
3. Coal	0	6
2. Indurated clay, called soapstone by the miners. (Not seen)	0	4
1. Bluish laminated sandstone, very soft, with streaks of black, and looking very much like No. 1 in the Brownville section	8	0

"The whole of this exposure seemed to me to have bodily slipped a little below its true horizon, probably by the washing away of the soft sandstone beneath by the river. This appearance is also affirmed by the statements of the miners, who informed me that the coal ended and that all the beds change abruptly at the end of the drift, forty or fifty feet in. The thickness, composition and order of succession of the beds, however, can be very clearly seen."

SHAFT AND BORING ONE AND ONE-HALF MILES SOUTH OF RULO. MEEK.

	Thickness. ft.	in.
"1. Yellow indurated clay, called soapstone by the miners	18	0
2. Yellow limestone	3	0
3. Blue clay. In this clay, lying near the shaft, we have found the following fossils: Rhombopora lepidodendroides, an encrusting species of Fistulipora: Polypora submarginata, Hemipronites crassus, Productus Nebrascensis, P. Pratteniauus, Chonetes granulifera, Syntrielasma hemiplicata, Spirifer (Martinia) planoconvexus, Sp. cameratus, Nucula (?) sp., Pleurotomaria perhumerosa, and several undetermined species of Murchisonia	12	0
4. Hard, gray limestone	11	0
5. Blue clay	17	0
6. Limestone	3	0
7. Blue clay bored into below the limestone	12	0
Total	76	0

"At the mouth of the Great Nemaha, a mile or two farther down the Missouri, Doctor Hayden saw an exposure (the same mentioned by Doctor Owen) of soft sandstone rising twenty or thirty feet above the river, with above it a thin (five- or six-inch) seam of coal connected with arenaceous shales, containing the same ferns found over the bed of coal two miles above Rulo and at Brownville.

"The elevation of this coal and sandstone here above the Missouri shows that there is quite a perceptible rising of the strata in this direction, the same coal being only about eight feet above the river two miles above Rulo, though it had apparently slidden somewhat below its true horizon at the latter place. I am inclined to believe that this sandstone under the coal is the same bed seen at Peru and Brownville and at the base of the section at Aspinwall, though it may be another holding a lower position. If it is the same, there can be little doubt but the exposures here near Rulo hold a position in the series above the horizon at the Nebraska City section. On these points, however, more detailed examination than we had an opportunity to make are desirable."

While at Nebraska City and Otoe (Minersville) the greater part of my time was devoted to collecting. Most of Meek's division C is covered by the railroad, though the upper part is well exposed, as is also division D. Prosser has shown the carbonaceous shale and argillaceous limestone, mentioned by Meek as exposed south of the section, to be present at the exposure at the brick-yards.

Following is a list of the specimens secured at Nebraska City in a day and a half of collecting. The list is provisional.

Fusulina secalica (Say)* = Fusulina cylindrica Fischer, aa†.
Lophophyllum proliferum (McChesney) Meek, c.
Rhombopora lepidodendroides Meek, rr.
Bryozoan, rr.
Meekella striatocostata (Cox) White and St. John, a.
Productus longispinus Sowerby?, a.
Productus costatus Sowerby, r.
Productus semireticulatus Martin, a.
Productus punctatus Martin, r.
Productus cora d'Orbigny, aa.
Productus pertenuis Meek, r.
Enteletes hemiplicatus (Hall) Hall and Clarke = Syntrielasma hemiplicata, r.
Chonetes granulifera Owen, aa.
Chonetes glabra Geinitz, a.
Hustedia mormoni (Marcou) Hall and Clarke = Retzia punctulifera and R. mormoni, rr.
Derbya robusta (Hall) Waagen?, rr.
Derbya crassa (Phillips) Hall and Clarke = Hemipronites crassus, rr.
Spirifer cameratus (Hall) Meek, c.
Ambocœlia planoconvexa (Shumard) Hall and Clarke = Spirifer (Martinia) planoconvexus, a.
Seminula argentea (Shepard) Hall and Clarke = Athyris subtilita, a.
Spiriferina cristata (Schlotheim) Davidson = S. kentuckensis, r.
Chonetes verneuiliana Norwood and Pratten?, rr.
Orbiculoidea sp. = Discina, rr.
Pugnax utah (Marcou) Hall and Clarke = Terebratula and Rhynconella osagensis, aa.
Chænomya sp., rr.
Aviculopecten sp., rr.
Aviculopecten occidentalis Shumard, rr.
Monopteria marian White?, rr.
Schizodus sp., rr.
Schizodus wheeleri Swallow, aa.
Schizodus curtus Meek and Worthen, a.
Allorisma costata Meek and Worthen, rr.
Allorisma subcuneata Meek and Hayden, c.
Allorisma granosa (Shumard) Meek, rr.
Allorisma reflexa Meek?, rr.
Entolium aviculatum (Swallow) Meek, c.
Modiola? subelliptica Meek, rr.
Pinna peracuta Shumard, rr.
Pseudomonotis, rr.
Myalina subquadrata Shumard, rr.
Edmondia, 2 species, rr.

* Through the kindness of Prof. Stuart Weller, of Chicago, I was informed that our Fusulina cylindrica, described by Fischer in 1837, was described by Say, under the name of Miliolites secalicus, from near the Platte river on the Missouri river, in Nebraska, in Long's Expedition, published in 1823, p. 151, foot-note. As it is impossible to confound it with any other species in the region, it gives the specific name secalica (Say) priority.

† r=rare, rr=very rare, c=common, a=abundant, aa=very abundant.

Nucula beyrichii ?? Schauroth, rr.
Macrodon sp., rr.
Lima retifera Shumard, rr.
Bellerophon carbonaria Cox, rr.
Bellerophon marcouana Geinitz, rr.
Bellerophon montfortianus Norwood and Pratten, rr.
Bellerophon ? cast, rr.
Pleurotomaria sp., rr.
Pleurotomaria subdecussata Geinitz, rr.
Murchisonia sp., rr.
Aclis sp., rr.
Straparollus (Euomphalus) subrugosus Meek, rr.
Loxonema rugosa Meek and Worthen, rr.
Small slender gastropod, rr.
Dentalium meekianum Geinitz, rr.
Cythere sp., a.
Phillipsia scitula Meek and Worthen, rr.
Nautilus forbesianus McChesney ??, rr.
Several undetermined species of Mollusca and a fish tooth.

The following were collected at the Minersville section:
Fusulina secalica (Say) Fischer, aa.
Rhombopora lepidodendroides (McChesney) Meek, c.
Bryozoa, 3 species, rr.
Productus cora d'Orbigny, c.
Productus semireticulatus Martin, rr.
Productus costatus Sowerby, rr.
Productus nebrascensis Owen, rr.
Productus pertenuis Meek, a.
Derbya crassa (Phillips) Hall and Clarke, a.
Spirifer cameratus (Hall) Meek, r.
Spiriferina cristata (Schlotheim) Davidson, rr.
Meekella striatocostata (Cox) White and St. John, rr.
Chonetes glabra Geinitz, r.
Chonetes granulifera Owen, aa.
Ambocœlia planoconvexa (Shumard) Hall and Clarke, a.
Myalina perattenuata Meek and Worthen, rr.
Allorisma sp., rr.
Nucula ventricosa Hall ?, rr.
Zeacrinus ? mucrospinus McChesney, rr.

In collecting the fossils mentioned in these two lists no attempt was made to keep those of the different strata or groups of strata separate, except the two localities, as the matrix from which they were taken had been removed from its original position and mingled to a greater or less extent. Some of the species in the above list are not mentioned by Meek, while others that he found were not to be had at this time on account of the covering of the rocks that contained them.

During the past summer the Burlingame limestone of the Wabaunsee formation was traced from the Kansas river just west of Topeka, Kan., to the Nebraska line, where it seems to connect with Meek's southern sections of the Missouri river bluffs. This seemed to be an additional evidence of the close relation of the Coal Measures of eastern Nebraska and Kansas, and led to a more close comparison of the rocks and fauna.

TOPEKA SECTION.

A general section of the rocks of Topeka, Kan., with their fossils is given in the preceding volume of these Transactions (page 27). The parts of the section here given are from the Topeka limestone to the Burlingame limestone, inclusive, in a more detailed manner and with the fossils grouped for comparison with the Nebraska City section. The Topeka limestone is exposed in the Shawnee county quarry, at the fair-grounds in the southern limits of the city; also a mile and a half southeast; and at Calhoun bluffs, three miles northeast of Topeka.

Bennett's description of the beds is the best that has yet appeared, and is here given in full: *

"In an exposure a mile east and a mile south of Topeka there is a showing of the upper section of the underlying shales. About six and one-half feet below the top of the underlying shales a fairly good building sandstone is reached, which is three feet thick. The lower limestone of the Topeka system is six feet thick, and is blue, but weathers dark buff. Above it is a foot and a half of blue shale, then above that five feet eight inches of blue and brown limestone, having a cherty layer near the top. Above this comes two feet of buff shale, and then again limestone one and one-half feet thick, above which are three feet of drab shales, which are again capped by two feet of limestone."

Bennett gives the following list of fossils as collected in this limestone: Fusulina cylindrica, Chætetes and a ramous form of Chætetes, Archæocidaris ———, Zeacrinus mucrospinus and Zeacrinus acanthropus, Fenestella ———, Chonetes granulifera, Productus punctatus, Productus longispinus, Productus costatus, Productus prattenianus, Athyris subtilita, Spirifer cameratus, Streptorhyncus crassus, Terebratula bovidens, Retzia mormoni, Bellerophon carbonarius.

I have collected the following fossils from these limestone beds:

Fusulina secalica (Say) Fischer, aa.

Lophophyllum proliferum (McChesney) Meek, r.

Archæocidaris agassizi Owen ?, plates and spines, a.

Rhombopora lepidodendroides Meek, c.

Septopora biserialis (Swallow) Ulrich = Synocladia biserialis, r., and about ten other species which seem to be of the genera Fenestella, Polypora, Streblopora, Stenopopora, and Blatostomella.

Productus cora d'Orbigny, aa.

Productus costatus Sowerby, c.

Productus longispinus Sowerby ?, aa.

Productus nebrascensis Owen, aa.

Productus punctatus Martin, c.

Productus semireticulatus Martin, c.

Productus pertenuis Meek, c.

Chonetes granulifera Owen, aa.

Spirifer cameratus (Hall) Meek, aa.

Reticularia perplexa (McChesney) Schuchert = Spirifer (Martinia) lineata, rr.

Ambocœlia planoconvexa (Shumard) Hall and Clarke, r.

Spiriferina cristata (Schlotheim) Davidson, rr.

Orbiculoidea missouriensis (Shumard) Schuchert = Discina nitida, rr.

Seminula argentea (Shepard) Hall and Clarke, aa.

Hustedia mormoni (Marcou) Hall and Clarke, r.

Derbya crassa (Phillips) Hall and Clarke, c.

Derbya robusta (Hall) Waagen, r.

Dielasma bovidens (Morton) White = Terebratula bovidens, r.

*Univ. Geol. Surv. Kan., vol. I., p. 117.

Myalina swallovi McChesney, r.
Allorisma granosa (Shumard) Meek, r.
Allorisma subcuneata Meek and Hayden, rr.
Allorisma sp., rr.
Monopteria marian White, rr.
Aviculopecten winchelli Meek??, rr.
Aviculopecten sp., rr.
Entolium aviculatum (Swallow) Meek, c.
Schizodus curtus Meek and Worthen, c.
Schizodus rossicus DeVerne?, rr.
Pinna peracuta Shumard, r.
Macrodon tenuistriatus Meek and Worthen, rr.
Macrodon sp., rr.
Cf. Murchisonia marcouana Geinitz, rr.
Aclis swalloviana Meek, rr.
Bellerophon carbonarius Cox, rr.
Orthoceras sp., rr.
Phillipsia major Shumard?, rr.
Phillipsia scitula Meek and Worthen, rr.
Peripristis semicircularis Meek and Worthen, rr.
Petalodus destructor Newberry and Worthen, rr.

Crinoids are occasionally found in this limestone, but generally too poorly preserved to admit of determination.

Overlying the Topeka limestone is a series of shales and sandstones. The only good exposure of this series near Topeka is at the Topeka vitrified brick works, three miles west of the city, where twenty-four feet of them are exposed. The lower portion of this exposure is a soft concretionary sandstone, somewhat micaceous, over which lie fifteen feet of shales, the lower portion of which is arenaceous and sometimes contains plant remains, while the upper part is bluish and argillaceous. Over these are a few feet of yellowish shales, overlaid by the Topeka-Osage coal, which varies from ten to sixteen inches in thickness. North of the Kilmer siding (about ten miles northeast of Topeka) the Topeka limestone and coal can both be located on the east slope of the hill on the east and west road. This, taken in connection with the section about a half-mile north of where the road crosses a little tributary to the Big Muddy, makes the following section:

	Thickness. ft.	in.	Total. ft.	in.
7. Covered slope, several feet.				
6. Rotten clayey limestone	1	8	74	6
5. Olive to brownish shale	4	0	72	10
4. Olive and brownish shales	10	0	68	10
3. Hard, black, arenaceous shales and coal		10	58	10
2. Shales	55	0	58	0
1. Topeka limestone exposed in the bed of the creek, of the same characteristic appearance and fossils as near Topeka	3	0	3	0

Next above these shales, overlying the Topeka limestone, is the Osage coal. This coal is not in one continuous layer, but in a series of beds of considerable extent lying in one remarkably uniform horizon, varying but few feet vertically in many miles. The Topeka bed is probably best developed along a line from a point four miles west of Topeka in a southeasterly direction to the Capital coal-mine, three miles nearly south of Topeka. The average thickness is about, or a little over, a foot in this part of the bed.

Above the coal lie the Shunganunga shales, which at the Capital coal-mine are about two feet thick, varying from a blue to deep black in color, and are very fossiliferous, while at Carbondale they are fourteen feet thick. Above these shales and grading into them lies what Swallow called the "Spring Rock" (wrongly correlating it, as he did also the "Stanton limestone," now known as the Burlingame limestone, with limestones of eastern Kansas—the names were used by the writer in the previous article on this section), a hard, bluish, argillaceous limestone of from one and one-half to two feet in thickness, which has been used in paving with good results. These three strata are well exposed in the pits of the vitrified brick works, and from there west to the Sargent brick works, east of the sugar-mill. At this latter place sixty feet of the overlying strata are exposed. The section as made up of this long but continuous exposure is as follows:

	Ft.	In.	Ft.	In.
6. Argillaceous shale, arenaceous in places, olive to blue in color, and in the upper part yellow	50	0	61	6
5. Blue, impure, argillaceous limestone	1	0	11	6
4. Blue, yellow or olive, argillaceous, in places arenaceous shales, varying in thickness from 2 to	6	0	10	6
3. Argillaceous blue limestone, weathering to a rusty color	1	6	4	6
2. Argillaceous, bluish to black shale, very fossiliferous	2	0	3	0
1. Coal	1	0	1	0

Near the bottom of No. 4 there is generally an impure limestone which, at the Sargent brick works, is a foot thick, as shown in the bed of the creek.

In order to avoid long repetition, the fossils of all these strata, except No. 6, are given in one list. They belong principally to Nos. 2 and 3, with a few in 4 and 5.

Fusulina secalica (Say) Fischer, a.

Archæocidaris agassizi Geinitz, rr.

Campophyllum torquium Owen, rr.

Delicrinus hemisphæricus, rr.

Rhombopora lepidodendroides Meek, c.

Septopora biserialis (Swallow) Ulrich, r., and other bryozoa as in the previous list.

Productus longispinus Sowerby, aa.

Productus cora d'Orbigny, c.

Productus costatus Sowerby, c.

Productus Nebrascensis Owen, r.

Productus punctatus Martin, r.

Productus semireticulatus Martin, a.

Productus symmetricus McChesney, r.

Productus pertenuis Meek, a.

Productus sp., r.

Chonetes granulifera Owen, aa.

Chonetes glabra Geinitz, c.

Spirifer cameratus (Hall) Meek, aa.

Ambocœlia planoconvexa (Shumard) Hall and Clarke, aa.

Spiriferina cristata (Schlotheim) Davidson, a.

Pugnax utah (Marcou) Hall and Clarke, c.

Orbiculoidea missouriensis (Shumard) Schuchert, aa.

Orbiculoidea convexa (Shumard) Schuchert, rr.

Lingula mytiloides Sowerby, c.

Seminula argentea (Shepard) Hall and Clarke, aa.

Hustedia mormoni (Marcou) Hall and Clarke, c.

Derbya crassa (Phillips) Hall and Clarke, c.

Derbya robusta (Hall) Waagen ?, r.
Dielasma bovidens (Morton) White, r.
Enteletes hemiplicatus (?) Hall, c.
Myalina? sp., rr.
Myalina perattenuata Meek and Hayden, c.
Myalina swallovi McChesney, c.
Allorisma granosa Meek, r.
Allorisma subcuneata Meek and Hayden, rr.
Allorisma topekaensis Swallow, rr.
Monopteria marian White, rr.
Monopteria gibbosa Meek and Worthen, rr.
Aviculopecten coxanus Meek and Worthen, rr.
Aviculopecten carboniferus Stevens, r.
Aviculopecten hertzeri Meek, rr.
Aviculopecten cf. lyelli Dawson, rr.
Aviculopecten maccoyi Meek and Hayden, rr.
Aviculopecten neglectus Geinitz, rr.
Aviculopecten occidentalis Shumard, c.
Aviculopecten rectilaterarius Cox ?, a.
Nuculana bellistriata Stevens, r.
Nuculana bellistriata attenuata Meek, r.
Modiola subelliptica Meek, c.
Solenomya radiata Meek and Worthen, r.
Entolium aviculatum (Shumard) Meek, c.
Schizodus curtus Meek and Worthen, r.
Schizodus curtiformis Walcott ?, r.
Schizodus sp., rr.
Avicula longa Geinitz, rr.
Lima retifera Shumard, r.
Nucula ventricosa Hall, rr.
Pinna peracuta Shumard, rr.
Macrodon tenuistriatus Meek and Worthen, rr.
Prothyris elegans Meek, rr.
Aviculopinna americana Meek, rr.
Macrocheilus anguliferus White, rr.
Macrocheilus ventricosus Meek, r.
Macrocheilus primigenius (Conrad) Hall, rr.
Loxonema sp. rr.
Euomphalus (Straparollus) subrugosus Hall, c.
Anomphalus rotulus Meek and Worthen ?, rr.
Bellerophon bellus Keyes. c.
Bellerophon percarinatus Conrad, rr.
Bellerophon carbonarius Cox, rr.
Bellerophon sp., rr.
Orthonema subtæniata Geinitz, rr.
Naticopsis nana Meek and Worthen, r.
Naticopsis ventricosus (Norwood and Pratten) Meek and Worthen, r.
Naticopsis altonensis McChesney ?, r.
Pleurotomaria grayvillensis Norwood and Pratten ?, rr.
Pleurotomaria illinoiensis Worthen ?, rr.
Pleurotomaria perhumerosa Meek, r.
Pleurotomaria sphærulata Conrad ?, r.

Pleurotomaria subdecussata Geinitz, rr.
Pleurotomaria tabulata Hall, rr.
Nautilus occidentalis Swallow ?, rr.
Nautilus ponderosus White ??, rr.
Nautilus cf. planovolvis Shumard, rr.
Orthoceras cribrosum Geinitz, r.
Phillipsia scitula Meek and Worthen, c.
Peripristis semicircularis Newberry and Worthen, rr.
Petalodus destructor Newberry and Worthen, rr.

The lower portion of the Burlingame shales has already been described as No. 6 of the preceding section. The upper portion of them is well exposed along the west bank of Mission creek and on the point of the hill between Mission and Blacksmith creeks a few rods south of their junction. In the latter place, on both sides of the point, about fifteen feet of olive, argillaceous shales are exposed, with occasional laminæ of more calcareous shales which are largely composed of fossils, mostly pelecypods and bellerophons, with, in one place, myriads of ostracod crustaceans. Near the upper part of the exposure, on the east side of the point, may be seen a thin layer of coal, some distance above which is a heavy limestone (farther south on the hill). At present I know of no place where these shales are all well exposed, but in various covered slopes there are many indications that in places these shales are quite arenaceous and even contain sandstone. They are 120 feet thick at the sugar works, six miles west of Topeka. Resting on this shale bed at the sugar works is a thin bed of coal, the same mentioned at the junction of Mission and Blacksmith creeks, the Silver Lake coal, and above the coal is a foot of argillaceous limestone. Along the Kansas river this limestone is somewhat continuous, but farther south near the head of Blacksmith creek it is, in one place, but a series of large, round, concretion-like forms, while at another place near there it is wanting. Overlying this limestone are shales which are moderately fossiliferous, fifteen to thirty feet in thickness, well exposed near the tops of the bluffs just west of the sugar works. They are yellow to olive in color and argillaceous.

Upon these shales rests the Burlingame limestone. This limestone is composed of four strata. The lowermost is, on the average, about five feet or a little more in thickness. Immediately above this, and separated from it by a thin parting of yellow calcareous clay, is another stratum of limestone of the same general appearance, but thinner. Both are massive, sparsely fossiliferous, and weather to a buff tint. Some distance above the second limestone, but seldom well exposed, are two small limestones separated by a parting of shale.

The fauna of the Burlingame shales and the other strata up to, and including the Burlingame limestone, is:

Fusulina secalica (Say) Fischer, aa.
Productus nebrascensis Owen, r.
Lingula mytiloides Sowerby, c.
Chonetes granulifera Owen, r.
Hustedia mormoni (Marcou) Hall and Clarke, r.
Myalina sp., rr.
Myalina swallovi McChesney, c.
Modiola subelliptica Meek, r.
Nuculana bellistriata Stevens, r.
Nuculana bellistriata attenuata Meek, rr.
Aviculopecten rectilaterarius Cox, r.
Aviculopecten occidentalis Shumard, r.

Allorisma granosa (Shumard) Meek, rr.
Allorisma topekaensis Swallow, c.
Schizodus curtus Meek and Worthen, rr.
Nucula ventricosa Hall, rr.
Pinna peracuta Shumard, rr.
Bellerophon sp., rr.
Euomphalus (Straparollus) subrugosus Hall, r.
Bellerophon carbonarius Cox, r.
Pleurotomaria subdecussata Geinitz, rr.
Nautilus occidentalis Swallow ?, rr.
Cythere sp., aa.

The general direction of the escarpment of the Burlingame limestone is northeast from Martin's hill, five miles west of Topeka, to near Meriden, where it turns north for about ten miles, to the latitude of Valley Falls. At Cedar Falls, two and a half miles west and a little north of Valley Falls, the Burlingame limestone caps the bluff. One hundred and twenty feet below the limestone (barometric measurement) the second limestone above the Osage coal appears in the bed of the creek, forming the falls, which are about four feet high. Nearly beneath the bridge the water runs over what appears to be the cap rock of the Osage coal, five or six feet below the falls. The Osage coal is mined just southeast of the bridge, about half a mile, and also northeast of Valley Falls, on the east side of the Delaware river. The base of the dam at Valley Falls is said to be on a limestone, which is probably one of the upper members of the Topeka system. By barometric measurement, it is fifty-five feet below the coal mentioned near Cedar Falls.

The Burlingame limestone appears east of the Delaware river near Valley Falls, in the divide between the heads of Spring, Crooked, and Walnut creeks, upon which the town of Winchester is situated. From here its most eastern extension passes nearly due north to the Nebraska line, bending to the westward before entering the valley of the Great Nemaha river, and passing out of the state.

After passing north from Larkin the escarpment becomes invisible and the exposures very meager and rare. In addition to this, the lower member of the limestone, if I am not mistaken, separates from those above by the thickening of the shale between and changes somewhat in appearance, becoming more of a buff color and Fusulina secalica becomes abundant. There is a quarry of this lower stratum just east of the Horton water-works, and on the road running east from the center of the city it is exposed in the ravines between there and Everest, and probably extends along the Everest divide for six or seven miles to the east of that place, and then falls back west of Robinson in crossing Wolf river. Coming back on the north side of Wolf river, it is in the hill north of Robinson at the Robinson schoolhouse and is quarried in several places near there. One of the best exposures of this neighborhood is seen three miles to the northeast on the side of the road, in a ravine running south. There is quite a quarry situated there, and beneath and south of the quarry on the west side of the ravine is an exposure of about fifteen feet of olive, blue and black shales, including a thin stratum of limestone, which is composed for the most part of fossil mushroom-shaped organisms of considerable size. Beneath these there is a foot or more of impure limestone.

Coal has been mined at Robinson, in the creek bed. It is considerably below the limestone at the schoolhouse. The upper part of the exposure at the creek is composed of sandy shales and crumbly sandstone, beneath which the coal lies generally hidden.

The coal-mines of the northeastern part of the state are a great aid in the study of the stratigraphy. After passing north from Valley Falls it seems to be the Silver Lake coal that is mined. Mines are or have been located "five miles southwest of Horton" (I was unable to verify this statement, but it was probably on Cedar creek), about five miles southwest of Severance, at Robinson, on Roys creek about eight miles west of White Cloud, and on the north side of the Nemaha river in Nebraska nearly due north of Robinson, Kan., and near Rulo, Neb.

I think all the above mentioned mines are in the horizon of the Silver Lake coal, though it is possible that it is that of the Osage coal, and the limestone here considered as the base of the Burlingame system is the same as the cap-rock to the Osage coal. I did not have the opportunity to settle this point completely. On the north side of the road, three miles west of Hiawatha, on a little southern branch of Walnut creek, is a quarry of limestone, the elevation of which is a trifle over 1000 feet A. T., or about the same as the quarry mentioned near Robinson, which is almost ten miles east of this. Considering the fact that the strata are almost level here (probably dipping a little to the west), one would expect this western quarry to be stratigraphically somewhere from twenty to fifty feet above that at Robinson. The nature of the rock in the Hiawatha quarry is almost exactly the same as that of the Wakarusa limestone, which is fifteen to forty feet above the Burlingame limestone near Topeka. It is literally a mass of shells crushed together, forming a solid limestone two or three feet thick. With this check on the tracing, I think it safe to correlate, provisionally, the Robinson limestone with the Burlingame.

On Roys creek and its tributaries, eight to ten miles north of Robinson, are some fairly good exposures showing the same sections as at Robinson. The lower member of the Burlingame limestone is exposed near the base of the bluff on the north side of the Great Nemaha, in Nebraska, north of the bridge, which is nearly due north of Robinson, Kan. My time was so limited that I was unable to make detailed observations except at this particular place. Coal has been mined in the very lowermost part of the bluff, a little west of the road, and a little above the base of the bluff is a stratum of massive, buff limestone which I believe to be the Burlingame. There seems to be a limestone forming a terrace about midway between the lower limestone and the top of the hill, which is probably one or more of the other members of the Burlingame system.

It is but a little way east of here to the mouth of the Great Nemaha where Hayden saw, as previously quoted, the exposure on the Missouri with the coal and sandstone in place. This is, without doubt, the same coal that is mined on the north side of the Nemaha just described, and at Robinson, and is, consequently, probably of the same horizon as the Silver Lake coal.

Meek places the Minersville (Otoe) section above that at Nebraska City, which, though unable to trace the strata from one place to the other, I think is correct. He also, provisionally, places the limestone at Rulo (the Burlingame) just above the Minersville section. I have never been over the ground between Rulo and Minersville; but the rocks at Minersville and Nebraska City are just what we should expect if Meek's correlation were correct, as a comparison will show: At the base of the section (Nebraska City) are several layers of limestone, then, above, a thick bed of shales and sandstone, coal, and limestone: then over 100 feet of shales which contain a second coal (though somewhat lower than might be expected), and on above this another limestone, which makes it agree in stratigraphic succession, as it does in fossils, with the Topeka section. Thus, considering the great care with which Meek did the work, we can but come to the conclusion that his correlation is probably correct.

If the foregoing statements are correct, we are forced to the conclusion that the Nebraska City section of Meek, from the base of the lower limestone to the top of the Minersville section, corresponds to the Topeka section from the Topeka limestone nearly to the base of the Burlingame limestone. Looked at in this light it also agrees very well with Prosser's work. It makes his remark that "These shales are mostly of a drab color, somewhat micaceous as well as clayey, and resemble those used for vitrified bricks at the Topeka, Kan., works," quite significant. The location of the Burlingame limestone at Rulo also agrees very well with his Cottonwood limestone four miles west of Auburn, Neb., 345 feet above the Missouri river. It is true that the shales corresponding to the Minersville shales in the Topeka section are less highly colored and, in places, less sandy, but on the whole I think this is of little importance in so long a distance. Besides, these highly colored shales can be correlated here as well as anywhere between the base of the Permain and the lower part of the Upper Coal Measures, which are certainly far below them, with one exception, which is considerably above the Topeka section, and here, I think, the succession of strata and the fossils are both different from the Missouri river sections.

At any rate, it can be stated with a moderate degree of certainty that the rocks at Nebraska City, Neb., and at Topeka, Kan., belong to the same general horizon.

Paleontological Laboratory, University of Kansas, November 10, 1898.

IV. PHYTOLOGY AND THERAPEUTICS.

THERAPEUTICAL NOTES AND DESCRIPTION OF PARTS OF MEDICINAL PLANTS GROWING IN KANSAS.

BY L. E. SAYRE, LAWRENCE.

Read before the Academy October 28, 1897.

There have been several more or less extensive lists of plants growing in Kansas made by different members of the Academy, reported at various meetings, and some work has been done in separating and commenting upon the medicinal character of those which have remedial action, but thus far there has not been any attempt to give a careful description of the parts of the plants used as medicine, and little has been said of medical virtues. At the present meeting of the Academy I shall confine myself to but two or three Kansas plants which have somewhat recently come to notice as medicinal, one of them taking a somewhat prominent position. In future meetings of the Academy I shall endeavor to collect information adding to the list of local medicinal plants, and shall endeavor to give such information as is not usually published in books of reference.

As I make reference to these I shall not try to arrange them in any scientific order. The three I shall comment upon at this meeting are plants which have come to my notice as medicinal within the last few years. The first two of which I shall speak have no wide reputation, and it is a question whether they deserve any more than a passing notice; but the plants are interesting, as may be seen. I refer to the *Cucurbita perrenis* Gray (wild pumpkin, buffalo gourd, man-in-the-ground), and the *Ipomea leptophylla* (wild morning-glory). The roots of these plants came to my notice about three years ago. They were sent to me asking for an analysis of their constituents, parties claiming for the roots remarkable tonic and aperient qualities. An analysis was made, and a report of the same was published in the proceedings of the American Pharmaceutical Association, 1895, p. 301. It is not necessary, therefore, for me to give the analysis in detail—suffice it to say that the analysis demonstrated the fact that the medicinal virtues, if any, resided in an oleo-resinous extractive, soluble in alcohol and in chloroform. Diluted alcoholic tinctures of the roots were very bitter, and fairly represented their virtues.

The wild pumpkin is found in western Kansas, where it is dry and sandy. In some parts of the state, where irrigation has been carried on, this root has become quite a pest. It is extremely large, and difficult to remove. It cannot be uprooted by an ordinary scraper, but has to be chopped out with the axe. The fruit, a spherical pepo, is smooth, yellow, and about the size of an orange. Within the hard, coriaceous rind, beside the fibers, there is a white, spongy, medullary matter and numerous ovate seeds. When the vine disappears in the winter the fruit remains in heaps as if some one had spilled a box of oranges. For this fruit some have claimed the purgative qualities of the Asiatic colocynth—one of the most valuable cathartics in the list of materials of medicine. The colocynth apple resembles the wild pumpkin fruit somewhat, but the former is very much more bitter. The thought has occurred that the colocynth apple might be profitably raised in the western part of our state. There is quite a demand for it in this country: our supply coming mostly from the Levant, from whence it is shipped. It grows largely in Turkey and in the islands of the Archipelago.

Little may be said of the wild morning-glory, as it possesses scarcely a local interest. It is interesting, however, to state that this root, like the other, is enormous in size, containing a vast amount of stored-up nourishment, weighing in some cases as much as seventy pounds, and is amply protected against the hungry gophers, moles, mice and other animals by its intense bitterness. Professor Bessey, writing upon this subject, says that in the struggle for existence only those roots have remained whose bitterness was sufficient to overcome the hunger and thirst of the animals cf the plains.

The most noteworthy plant growing abundantly in the state and of medicinal quality is *Echinacea angustifolia* (the vulgar name, niggerhead, from the black capitulum when ripe). I have had collected of the root of this plant for manufacturing houses no less than about 300 pounds. Students during the late summer and early fall months find in it a little profit at twenty-five cents a pound. Quite a lengthy article has just been published upon the plant by Prof. J. U. Lloyd, who stated that it had had quite a reputation as a remedial agent among the eclectic practitioners. Mr. R. C. Collison, a student in pharmacy, made an analysis of the root last spring: with the analysis he presented a brief history of the plant. From his paper I shall quote quite freely.

The root is dark brown externally and wrinkled longitudinally. The interior is grayish white, with radiating lines composed of alternating layers of dark and light tissue of a spongy nature. It has a very peculiar acrid, tingling taste, suggesting a solution of cocaine or tincture of aconite, and causing an increase in the flow of saliva to a considerable degree.

The plant is found growing in sandy soil and hillsides upon the prairie lands of Iowa and Illinois, southwest through Kansas and Colorado. The specific use, as given by the late Professor Scudder, is as follows: "Echinacea is an alterative of great value in strumous diathesis, syphilis, old sores, and wounds. Its most promising use, however, is as a powerful antiseptic, locally and internally, in diphtheria, typhoid conditions, cholera infantum, and blood-poisoning. It causes an excessive flow of saliva and perspiration. The fresh root scraped and given freely is the treatment used by the Sioux Indians for snake bite." It is said to be especially beneficial in typhoid, dysentery or any intestinal trouble requiring an antiseptic.

Although there are certain troubles in which it is indicated, its exact mode of action is not definitely known, and to it has been applied "A correcter of blood dyscrasia." It seems to cover the ground ascribed to antiseptics, antiferments, and antizymotics. Its first use was in these depressions produced by introduction into the blood of the poisons of serpents and insects. Some claims have been made for it in hydrophobia, boils, abscesses, carbuncles, and many pus-forming cellular inflammations: to it also has been attributed medicinal properties in treatment of cerebro-spinal meningitis. Fetid conditions of the bronchial tract, as fetid bronchitis, the stench of pulmonary gangrene, and carcinematous disorders are said to be effectually removed by the internal administration of this drug. A number of cases are cited by Dr. H. Lewis Hamilton, Colusa, Cal., in the *Eclectic Medical Journal*. A case is recorded of a Mr. W., dry-goods salesman. While measuring goods he accidentally punctured the index finger of his right hand with the brass pin attached to the price mark of the goods. He considered it a trivial matter and gave it no further notice, until twelve o'clock that night he was awakened from sleep by a sense of pain in his arm, which by this time had become slightly swollen as far up as the elbow. We were called to see the patient some six hours after and found him suffering most excruciating pain. The entire arm and hand were swollen to an enormous size and greatly discolored. Temperature of arm, 103 degrees. We encased the entire arm and hand in absorbent cotton and ordered it to be kept wet with the following:

Echafolta	ounces 4
Aqua dist. q. s	ounces 12

Internally we gave him:

Echafolta	drachms 2
Aqua dist. q. s.	ounces 4

Sig.: One teaspoonful every half-hour for two hours; then every hour.

We watched this case carefully, and as we wished to give echafolta a fair test we prescribed nothing but this drug.

End of thirty minutes, patient free from pain; temperature, 102.

End of two hours, swelling subsiding; temperature, 100.

End of four hours, swelling entirely gone; temperature normal.

End of six hours, the external application was discontinued, but the internal treatment continued until the prescription was exhausted.

Echafolta appears to be a liquid extract of Echinacea. Professor Lloyd, in summing up the value of the drug, says: "In Echinacea the medical profession has unquestionably a conspicuous remedy; one that a careful test of eleven years induces me to believe is destined to assume an important place in the materia medica."—*Eclectic Medical Journal*, August, 1897.

A minute description of the chemical analysis need not be given, but below will be found a table showing the results of this, giving the constituents and proportion of same in percentages.

Moisture in fresh drug	33.7	per cent.
Ash	8.38	"
Solubility of ash in:		
Water	37.0	per cent.
HCl	44.3	"
NaOH	17.65	"
Insoluble residue	1.05	"
Petroleum spirit extract	1.408	"
Ether extractive	1.996	"
Solubilities of other extractives in:		
Water	18.837	per cent.
Alcohol	57.308	"
Insoluble residue	23.855	"
Solubility of alcoholic-etherial extract in:		
Carbon bisulfide	49.7	per cent.
Benzene	19.2	"
Residue insoluble in dilute acids	31.1	"
Alcoholic extractive	10.32	"
Of the alcoholic extract, the following are the constituents and percentages:		
Resin	9.2	per cent.
Vegetable acids	39.0	"
Coloring matter	51.8	"
Aqueous extract	19.956	"

Inorganic constituents:

Sodium, potassium, calcium, magnesium, aluminum, iron, phosphates, and carbonates.

In 1890 Mr. S. R. Boyce, my assistant, made a distillation of a large quantity of the ground root. He obtained by this process an oil of a yellowish color, which soon blackened. This oil has a very acrid taste and pungent odor, evidently containing the medical properties of the root in concentrated form.

ROOT TUBERCLES AND THEIR PRODUCTION BY INOCULATION.

BY D. H. OTIS, MANHATTAN.

Read before the Academy October 28, 1897.

HISTORY AND LITERATURE.

General Statement.—By examining the roots of such plants as clover, alfalfa, beans, and peas, one will usually find, scattered over their exterior surface, tubercles of various sizes and shapes. These tubercles are, with very few exceptions, peculiar to a certain order of plants known as Leguminosæ, and, as far as agricultural plants are concerned, only to the suborder Papilionaceæ. These tubercles are the outgrowths of the plants themselves, and are produced by the action of certain micro-organisms working within the tissues of the root. Formerly, these tubercles were considered abnormal appendages and as injurious to the plants: but later observations revealed the fact that, where these tubercles were wanting, the plants did not make the growth that was made by plants where the tubercles were present. Later examination has brought out the fact that these tubercles are the homes of minute microscopic bacteria, *Bacillus radicicola* Beyer. The bacteria have the remarkable property of taking the free nitrogen of the atmosphere and transforming it into available compounds for plant food. So it is a case of symbiosis, the plant furnishing food and shelter for the bacteria, and the bacteria in turn furnishing the plant with nitrogen. This is what makes the leguminous plants so valuable as soil enrichers, and especially prized for green manuring.

Early Opinions Concerning the Tubercles.—It is just about a century ago that root tubercles became the subject of agricultural inquiry and experimentation. The early ideas were very crude, some supposing the tubercles to be fungi, others lenticels, root branches, swellings caused by insects, and some used them as a part of the description of plants. Even those who took them to be peculiar to the order Leguminosæ entertained widely different views as to their functions. Some thought they were swollen lateral roots used in the absorption of food, or, still better, a storehouse for reserved food material. Others maintained that they were dwarfed roots, while still others classed them as imperfect buds, capable of developing into new plants. About fifty-five years ago Boussingault carried on a series of experiments with a large number of plants, from which he concluded that not even the leguminous plants had the power to obtain free nitrogen from the air. Similar experiments at Rothamsted confirmed Boussingault's conclusions. It should be noted, however, that these experiments were conducted under the conditions of sterilization and enclosure which eliminated the micro-organisms from the soil. Thus it will be seen that the earliest conclusions were very incomplete, and in many cases were the result of mere superficial observation.

Investigation of the structural and etiological phase of the subject was begun in 1816. It was started by Woronin, and he was followed by Eriksson, DeVries, Schindler, Cornu, Mattei, Kny, Prillieux, and, in 1879, by B. Frank. It was about this time that M. Berthelot called in question the accuracy of the conclusion that plants do not assimilate free nitrogen. This stimulated further investigations, the results of which tended to strengthen confidence in the view that these tubercles were the result of the irritation, or stimulation, of some soil organism, but as to the character of this organism there were many diverse opinions. In 1885 Brunhorst came forward with a paper in which he maintained that root tubercles were not caused by organisms but were normal structures. This view received the indorsement of others, and, for a time, shook the confidence in the theory that micro-organisms were the cause of root tubercles. Even Frank forsook his former conclusions. So at the close of what Atkinson calls the second, or middle, period of investigation (about 1886) the etiology of the whole subject still "hangs in the balance."

Recent Investigations.—In 1887 Marshall Ward published the results of a very careful series of experiments in which he proves that root tubercles are caused by some kind of a soil organism, and this view is supported aud confirmed by such investigators as Hellriegel, Wilfarth, Lawes, and Gilbert. Some authors give Hellriegel the credit of being the first to discover the true function of root tubercles.

Doctor Salfeld was the first to experiment with this discovery under field conditions, and found that it was possible to increase the number of tubercles on a leguminous plant by inoculation. In 1888 appeared a valuable contribution by Beyerink, in which he names the bacteria causing these tubercles "*Bacillus radicicola*." In the same year appears an article by Vuillemin, in which he agrees with those authors who call the organism a symbiont, but disagrees with others as to its nature. A. Prazmowski, in 1888, claimed that tubercles were the result of a parasitic fungus, but in a year or two later maintained that they were caused by bacteria. This later view was supported by others, as Delphino, Mattei, Laurent, and Frank, the last in 1890 partially returning to his former views.

One of the first records of an American author in connection with this subject is that of Schneider, who, in 1892, published an article on the bacterioids of several species of leguminous plants. In 1891, F. Nobbe, E. Schmid and L. Hiltner investigated the physiological meaning of root tubercles on non-leguminous plants. Nobbe and Hiltner are also the originators of what is known as "pure cultures." They have isolated the bacteria for seventeen different leguminous plants and are now able to grow these artificially. This discovery was first announced before a German agricultural society February 19, 1896. They now prepare these bacteria on a commercial scale and sell them in bottles under the name of "Nitragin." Geo. W. Atkinson of Cornell University, formerly of Alabama, has published in the Botanical Gazette for 1893 (Vol. 18) a history of the subject, together with some original work he carried on while in Alabama. He takes up the biological phase of the subject and gives some plates illustrating the manner in which the bacteria infect the root. Atwater, Woods, and Kedzie have also done some work along the same line.

From what has beeu published on the subject it is clear that all the problems connected with the assimilation of free nitrogen, through the intervention of root tubercles, have by no means been solved. Even the best authorities seem to disagree on some of the most vital points. However, it is pretty well settled that the tubercles are the result of a micro-organism; but it has been proven that the organism producing tubercles on the pea or bean will not produce tubercles on clover and alfalfa, and *vice versa*. Whether these organisms are different species for different plants, or a modification of the same species, is yet a disputed question. Again, as the organisms attack the root, it is supposed that they exist in the soil, and the question would naturally arise as to whether they could be transported and spread with the soil; and, if so, whether that is the only way, or whether the seed from plants with tubercles will produce tubercles when grown in soil devoid of the organism adapted to that particular plant. To test some of these questions, and others connected with them, experiments were carried on with the soy-bean, *Glycine hispida* Maxim.

EXPERIMENTS IN THE FIELD.

METHODS OF INOCULATION.—Since 1890 soy-beans have been grown at the Kansas Experiment Station, but frequent and numerous examinations of the roots failed to reveal the presence of any nodules or tubercles. Knowing that the Hatch Experiment Station, at Amherst, Mass., had been successful in producing tubercles on the soy-bean, it was proposed that an attempt be made to inoculate the Kansas beans with Massachusetts soil. Two quarts of the soil in which beans had been grown the previous year was ordered by express for immediate use, and a half bushel by freight for additional experiments in the greenhouse. In both cases the soil arrived in a dry, pulverized condition, not unlike the dust in our roads during a dry season. The field experiment was situated on a sandy loam soil with a western exposure, and consisted of two series of three plats each. Series I was planted with yellow soy-beans, in which the plats were treated as follows: Plat A was inoculated with soil, plat B with extract, and plat C was not treated. Series II was a repetition of series I with the exception that the medium green bean, a variety grown at the Hatch Experiment Station, was used instead of the yellow soy. The object was to note whether there was any difference in the production of tubercles between a variety whose seed was obtained from plants grown in Massachusetts soil and seed obtained from plants grown in Kansas soil. Both series were seeded May 29, 1896. Each plat contained three rows, two and one half feet apart, and each row contained eight hills twenty inches apart. Between the plats was placed a guard row in which the beans were not treated and were planted in drills from two to three inches apart. The arrangement of the series and the plats is shown in the plan on the following page.

On plats A and D about 21^{cc} (25 grams) of the pulverized Massachusetts soil was placed in the bottom of each hill and the beans placed on top of this. Plats B and E were treated with an extract of the Massachusetts soil. This extract was obtained by mixing a quantity of soil with about seven times its bulk of water, stirring thoroughly, and allowing to settle, after which the water was poured off and used for the inoculation. The aim was to use about the same quantity of soil in obtaining the extract as was used on the same number of plants where the soil was applied direct. Rows 1 and 4 of plats B and E respectively were inoculated at the time of planting, *i. e.*, about 170^{cc} (168 grams) of the extract was poured in the bottom of each hill just previous to planting the beans. Rows 2 and 5, 3 and 6, were inoculated June 13, seven days after the plants were up, and rows 3 and 6 were again inoculated on July 2 and on July 17, or twenty-six and forty-one days respectively after the plants appeared above ground. The extract reached the roots through a round hole made with a pointed stick. Plats C and F were planted in the same manner as the others except the inoculation. The purpose of these plats was to serve as a check on the others and at the same time as a means of comparison with the inoculated plats as regards growth and general appearance.

CULTURE AND GROWTH.—The season was favorable to the growth of the beans. A heavy rain fell the next day after planting, and subsequent rains fell at intervals sufficiently close together to supply the plants with the necessary moisture. The beans were up June 6 and on June 13 all the plats received a

SERIES I: A, inoculated with soil: B, inoculated with extract (1) at time of planting, (2) once after planting, (3) three times after planting; C, not treated.

				1	2	3				
o	o	o		o	o	o		o	o	o
o	o	o		o	o	o		o	o	o
o	o	o		o	o	o		o	o	o
o	o	o	Guard row	o	o	o	Guard row	o	o	o
	— A —				— B —				— C —	
o	o	o		o	o	o		o	o	o
o	o	o		o	o	o		o	o	o
o	o	o		o	o	o		o	o	o
o	o	o		o	o	o		o	o	o

SERIES II: D, inoculated with soil: E, inoculated with extract (4) at time of planting, (5) once after planting, (6) three times after planting; F, not treated.

				4	5	6				
o	o	o		o	o	o		o	o	o
o	o	o		o	o	o		o	o	o
o	o	o		o	o	o		o	o	o
o	o	o	Guard row	o	o	o	Guard row	o	o	o
	— D —				— E —				— F —	
o	o	o		o	o	o		o	o	o
o	o	o		o	o	o		o	o	o
o	o	o		o	o	o		o	o	o
o	o	o		o	o	o		o	o	o

thorough hoeing. On the latter date some of the extra plants were pulled up and there were found several well defined nodules on the roots of those inoculated with soil, but none were found on any of the others at this date. On June 22 it was noted that the beans inoculated with soil appeared to have a little larger growth. The difference was not very striking, however. On July 14 the yellow soys were in full bloom, but the medium green, being a little later variety, did not appear in full bloom until July 20. Measurements were taken for the average height of the plants on August 20, with the following results:

TABLE I.

Plat.	Row 1.		Row 2.		Row 3.		Av. for plat.	
	Ft.	In.	Ft.	In.	Ft.	In.	Ft.	In.
Yellow Soy:								
A	....	....	....	....	....	....	2	8.5
B	2	9.5	2	7	2	4.5	2	7.0
C	....	.	.	....	....	....	2	5 5
	Row 4.		Row 5.		Row 6.		Av. for plat.	
Medium Green:								
D	....	...	....	....	....	....	2	4.0
E	2	2	2	2	2	.5	2	1.0
F	....	...	....	....	....	....	2	0.0

From the above table, it will be noticed that the yellow soy attained a greater height at this date than the medium green. This is due, however, to the difference in the variety, the latter being a late-maturing and a somewhat more bushy plant than the yellow soy. It will also be noticed that, in case of plats B and E, rows 1 and 4, inoculated at time of planting, attained, on the whole, a little greater height than rows 2 and 5, and 3 and 6, inoculated subsequently to the time of planting. This would indicate that the best time to inoculate is at the time of planting. Furthermore, the last column of the table shows, in this case at least, that the plants inoculated with soil averaged a little greater height than the others. However, the differences above noted are not great, and, with the exception of the difference due to variety, would not be noticed by the ordinary observer without the application of a measuring rod.

Appearance of the Roots.—On August 27 two hills each of the treated plats and one of the untreated were dug up, together with about a two-foot cube of the soil surrounding each hill. These were placed in large tubs of water and after a thorough soaking the roots were carefully washed out and examined for tubercles. The latter were found in great number and of a large size on the inoculated plants: but not a single tubercle could be found on the plants not treated, from either the yellow soy or the medium green, nor were there any signs of tubercles on the plants in the guard rows between the inoculated plats. The tubercles on the plants inoculated with soil were fairly uniform and situated mainly on the upper portion of the roots, not far from where the soil was placed at the time of planting. In case of the plants inoculated with extract there was a marked difference between the varieties; the tubercles on the yellow soy were very numerous and well developed, while those on the medium green were scanty and rather inferior. All the inoculated plants showed a greater diameter of the lower portion of the stem than the plants not treated. Pictures were taken of the different treatments and are here given.

Transactions Kansas Academy of Science, Vol. XVI.

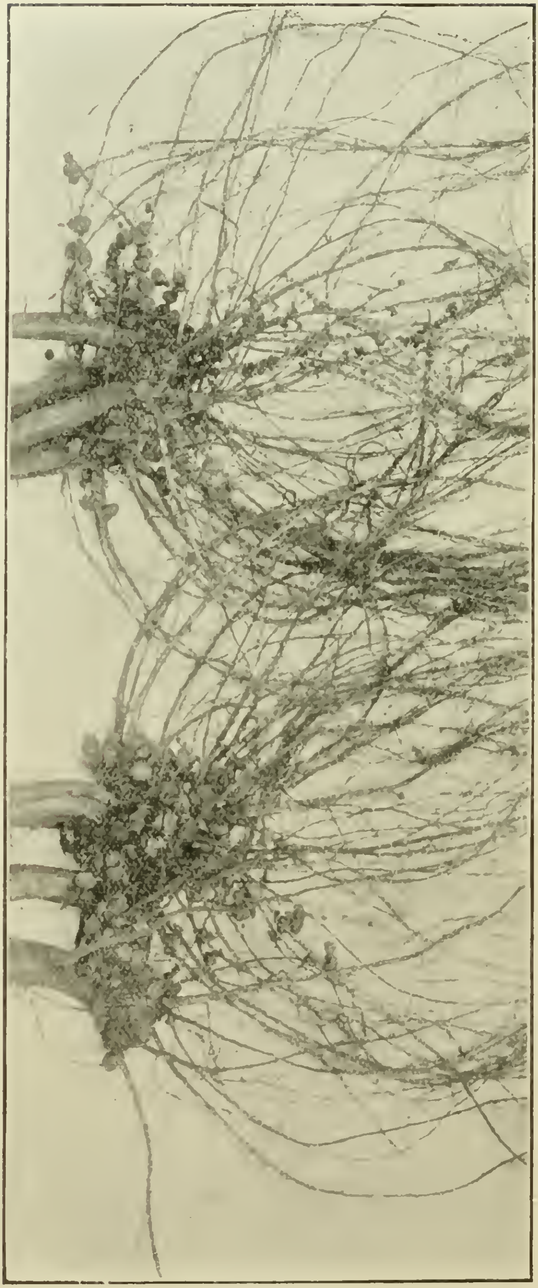
PLATE VI.

MEDIUM GREEN. YELLOW SOY.

I. SOY-BEANS NOT TREATED.

Transactions Kansas Academy of Science, Vol. XVI.

PLATE VII.

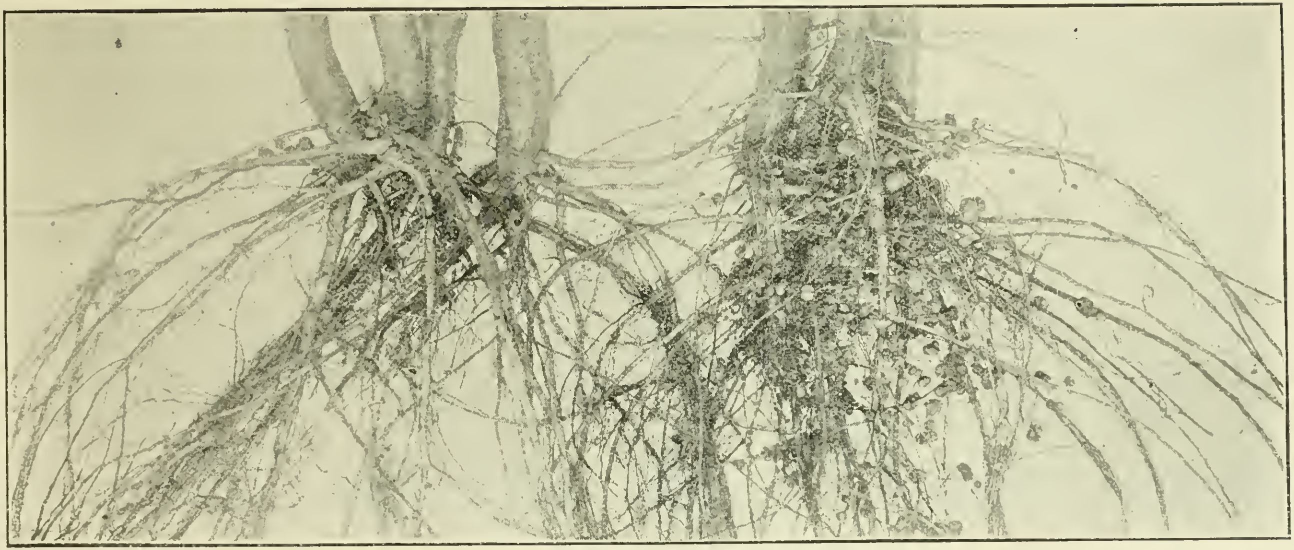


MEDIUM GREEN. YELLOW SOY.

II. SOY-BEANS INOCULATED WITH SOIL.

Transactions Kansas Academy of Science, Vol. XVI.

PLATE VIII.



MEDIUM GREEN. YELLOW SOY.

III. SOY-BEANS INOCULATED WITH EXTRACT.

NITROGEN CONTENT.—On September 17 an average sample of six stalks each was taken from plats D and F of series II for analysis, with the purpose in view to ascertain whether there would be any difference in the content of nitrogen between the plants with tubercles and those without tubercles. The seed being the most constant in composition of any part of the plant, it was thought that the difference, if any, would be in the fodder, and so, after the samples were thoroughly dried, the beans were all shelled out and the fodder ground up fine. From this a sample was taken and pulverized for analysis. The per cent. of nitrogen is shown in the following table, together with the protein and water:

TABLE II.

TREATMENT.	Nitrogen, per cent.	Protein, per cent.	Water, per cent.
Inoculated with soil	1.439	8.996	7.89
Not treated	1.395	8.719	7.30
Difference	.044	.277	.59

The analysis does not show any great difference in favor of inoculating, there being an increase of only .04 of 1 per cent. of nitrogen and .27 of 1 per cent. of protein in favor of the beans with tubercles. This would be .8 pound nitrogen and 5.4 pounds protein increase for each ton. But it must not be concluded that this is the only difference. The roots with tubercles rich in nitrogen must possess greater fertilizing properties than the roots with no tubercles, the results of which would be shown in the succeeding crop or crops. Furthermore, had the tubercles been grown on poor soil instead of rich soil, doubtless there would have been a still greater difference in favor of inoculating. The remaining crop of the medium green was harvested October 2.

DATA AS TO YIELD.—When matured the beans were harvested and placed in gunny sacks to cure. The leaves had nearly all fallen off and a few of the pods were about ready to pop open, although many still had a green appearance. When both varieties had attained sufficient dryness the beans were thrashed out by hand and account taken of the weight of both grain and dry stalks. In case of the stalks the results cannot be considered entirely accurate, as many of the leaves had fallen off before the beans were fully ripe; and, furthermore, it was noticed that plats C and F, not treated, remained green longer than the inoculated plants, which tended to increase their fodder yield in comparison with the others. The results are shown in table III. From this table it will be seen that the yellow soys, plat B, inoculated with extract, yielded a little the best of both grain and fodder; but the difference is very slight. Of the medium green, plat F, not treated, yielded the most grain; and plat D, inoculated with soil, the most fodder. In all these cases the differences are not great, and, as the plats were very small, it would be impracticable to pass any judgment as to comparative yield. The benefits from inoculation lie largely in the increased fertility of the soil resulting from the decay of the nitrogenous roots, and would not be seen until after the growth of the succeeding crop.

EXPERIMENTS IN THE GREENHOUSE.

REPETITION AND EXTENSION OF FIELD EXPERIMENT.—Pots containing native soil were planted to beans and treated in the same manner as in the field experiment, and were attended with practically the same results. The test, in this case, was extended so as to include other varieties of the soy-bean, namely, the edamame, kiyusuke daidzu, yamagata cha-daidzu, early white, and the medium

TABLE III.

Plat.	No. of stalks in plat.	Weight of grain, pounds.	Weight of dry stalks, pounds.	Weight in proportion to number of stalks.		Rate per acre.	
				Grain, pounds.	Stalks, pounds.	Grain, bushels.	Stalks, tons.
Yellow soy:							
A	85	2.875	4.562	3.246	5.152	23.27	1.10
B	73	2.625	4.312	3.451	5.669	24.74	1.21
C	100	3.437	5.312	3.299	5.099	23.65	1.09
Medium green:							
D	82	2.750	8.312	3.218	9.730	23.07	2.09
E	67	2.125	6.125	3.044	8.775	21.82	1.88
F	82	3.062	7.812	3.584	9.144	25.69	1.96

black. In all these cases, where the plants were inoculated with either soil or extract, numerous and well defined tubercles appeared on the roots. In a few instances, however, one or two tubercles were found on the plants not treated, but these were isolated cases and were undoubtedly due to infection resulting from the manipulation of tools and pots when the beans were planted.

How Soon Do the Tubercles Appear?—To obtain information on this point, a small bed was planted in the greenhouse June 19 and inoculated with Massachusetts soil, from which plants were taken up nearly every day to ascertain when the tubercles began to appear. They were first visible to the naked eye on July 3, thirteen days after the beans were planted, or eight days after they appeared above the ground. From this it would be inferred that the bacteria begin their work very soon after the young roots are formed and increase their activity with the growth of the roots.

Effect of Sterilizing the Soil.—Pots of both Kansas and Massachusetts soil were sterilized by heating them to 200 C. (392 F.) The results obtained, both in the field and in pots, as well as by previous experience, showed that as far as the soy-bean organism was concerned the Kansas soil was already sterile. In the case of the Massachusetts soil, however, these results showed that the bacteria were killed at the above temperature, and plants grown in this soil produced no tubercles except when inoculated. It might be well to state in this connection that the heating of the soil produced other effects than those of a bacteriological nature, and the plants grown in it did not possess a healthy and vigorous appearance.

Plants Grown in Massachusetts Soil.—Since 21^{cc} of Massachusetts soil was capable of producing such good results, both in the field and in pots, it was thought that plants grown in this soil alone would give still more striking results in tubercle formation. One pot each of yellow soy and medium green were grown in Massachusetts soil. The plants did well and ranked among the best in the greenhouse, but on washing out the roots the tubercles were found to be only moderate in size but fairly well distributed over the roots. In fact they did not show up so well as plants which were inoculated with only a small portion of Massachusetts soil. This experiment is repeated and results given under the second series of experiments in the greenhouse.

Inoculating at Top, Middle, and Bottom of Pot.—To test the rapidity with which the organisms spread in the soil, three pots each of yellow soy and medium green were inoculated at the top, middle, and bottom of the pots respectively with 21^{cc} of Massachusetts soil. The washing out of the roots revealed the fact that the plants inoculated at the top of the pot produced tubercles on the

—7

upper portion of the roots with only a few extending downward and none on the lower portion of the roots. The plants inoculated at the middle of the pot produced tubercles about midway between the upper and lower portion of the roots. And, lastly, the plants inoculated at the bottom of the pot showed the tubercles on the lower portion of the roots, with a few tending upward. This is a very interesting point, and indicates that, without mechanical mixing, the micro-organisms spread very slowly in the soil, and that in spite of the fact that the plants were frequently watered on upper surface of pot, which one might suppose would have carried the bacteria deeper into the pots. The number and position of the tubercles are shown in the accompanying drawings.

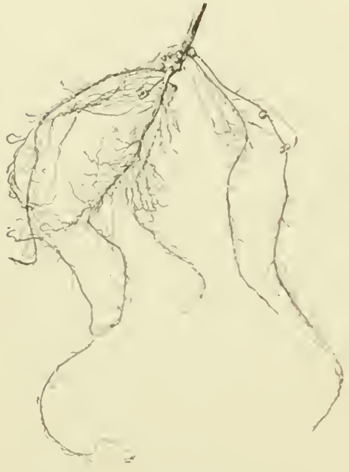


Fig. 1.
Soy-bean inoculated at top of pot.

Fig. 2.
Soy-bean inoculated at middle of pot.

FURTHER EXPERIMENTS IN THE GREENHOUSE.

Plants Grown in Pure Massachusetts Soil.—Fearing that the results obtained in the previous experiment might be due to local conditions or disturbances, the subject was further tested by planting yellow soy-beans in seven pots of pure Massachusetts soil, and comparing with these seven pots of Kansas soil, all of which were inoculated with 21^{cc} of Massachusetts soil. The results obtained were similar to those of the previous experiment, only that no appreciable difference could be seen in the results of the two treatments. Why a soil so thoroughly infected with micro-organisms as was this Massachusetts soil should not cause greater development of tubercles is a question not readily answered, and one that will bear further investigation.

Inoculating with Different Amounts of Massachusetts Soil.—To test the effect of varying amounts of Massachusetts soil on the number and size of tubercles produced, ten pots of yellow soy-beans were grown in which the soil had been inoculated with 21^{cc} of Massachusetts soil for pot 1, 42^{cc} for pot 2, and so on, increasing 21^{cc} for each succeeding pot, until the tenth pot was reached, which received 210^{cc} of Massachusetts soil. No particular difference could be detected in the growth of the plants, and what was true of the upward growth was likewise found to be true of the roots and tubercles. The differences were slight, and these so irregular that it could not be said that one was any better than the others. These results, taken in connection with those obtained from pure Massachusetts soil, seem to indicate that the micro organisms are sufficiently numerous and active for ordinary inoculating in a comparatively small amount of the Massachusetts soil, and that an increase of this infectious soil does not perceptibly increase the number or size of the tubercles.

EFFECT OF LIGHT ON THE MICRO-ORGANISMS.—Two broad, shallow dishes, each with about 210^{cc} of the Massachusetts soil spread over their surfaces, were placed, one in diffused light and the other in sunlight, and enough to inoculate one pot was taken from each of these at the end of one, two, three, four, and six weeks, respectively. In the meantime the soil was kept stirred so as to expose all portions equally to the light. All pots contained tubercles: and, although the results slightly favor the pots whose inoculating material was exposed the least, the differences are very small. In fact, it seems that light could have but little effect on the micro-organisms when the soil is kept together in any quantity.

Fig. 3.
Soy-bean inoculated at bottom of pot.

INOCULATING AT DIFFERENT TEMPERATURES.—To see what degrees of temperature these micro-organisms could stand, soil was heated to ten different points, varying from 40° to 150° C. (104° to 302° F.) Tubercles were found in all the pots except 120° and 150° C. Unless the micro-organisms happened to possess less vitality in the former instance, the lack of tubercles could scarcely be attributed to the heat, as tubercles were found on the plants whose inoculating material was heated to 140° C. It was observed that the tubercles developed the best at the lower temperature and they seemed to decrease as the temperature increased, although this variation was not entirely regular. It would seem that some of the bacteria possessed more vitality than others and that the ones with less vitality were killed by the heat. A similar test was made by heating extract from 35° to 90° C. (95° to 174° F.); but as this was considerably lower than that to which the soil was heated, tubercles were formed in all the pots, as might be expected after the former discovery. But even here the same gradation existed as was noticeable in the case of the soil, the tubercles being more numerous at the lower temperatures. In both of these cases the results show that the micro-organisms can stand quite a high degree of heat.

INOCULATING WITH KANSAS SOIL.—Will soil which has once been inoculated serve to inoculate non-infected soils? First, five pots were filled with soil taken from the immediate vicinity of roots previously inoculated. Second, five pots were filled with soil which had been soaked and washed out from plants that had produced tubercles in the field. Since nearly a two-foot cube was taken up with each hill, the number of micro-organisms must have been less in this instance than in the first five pots. Tubercles were produced in all the pots; but the results, as might be expected, were somewhat more in favor of the first five. To test this matter still further, two pots were inoculated each with 21cc of the above classes of soil, with the result that in both cases tubercles were formed in the same relative proportion to the above. This shows that Kansas soil, being once inoculated, can be used to inoculate other soils.

INOCULATING WITH TUBERCULOUS ROOTS.—After remaining in loose soil about a month, some of the roots which had previously produced tubercles were taken to inoculate a pot of yellow soy-beans. The plants grew well and ranked among the best in the greenhouse. On washing out the roots, large and numerous tubercles were discovered, which were by far the best of any produced in the greenhouse during this experiment. Likewise, washed roots that had been air-dried in diffused light for about the same time were placed in another pot; tubercles were formed, but neither the growth of the plant nor the tubercles were equal to the above. In the former case the roots had more or less soil adhering to their surface, but in the latter there was practically none.

EFFECT OF INOCULATING OTHER LEGUMES WITH MASSACHUSETTS SOIL.—Four pots each of adzuki beans (*Phaseolus radiatus*), cow-peas, Canada field peas, alfalfa, and red clover were planted, half of these being inoculated with Massachusetts soil and the other half not treated. On the roots of the adzuki beans and the cow-peas no nodules were apparent in any of the pots: the alfalfa showed several: and on the clover and Canada field peas they were very numerous; but no difference could be detected on any of them that was due to the Massachusetts soil. Evidently these plants were attacked by a different kind of organism from that attacking the soy-bean.

ROOT TUBERCLES UNDER THE MICROSCOPE.

PREPARATION OF SLIDES.—This phase of the subject was taken up with the hope of observing the way micro-organisms behave within the tissues of the root. Tubercles were cut from the roots of plants seventy-two and ninety-nine days old, respectively, which had been grown in the greenhouse under rather unfavorable circumstances. These were placed in one per cent. chromic acid for eighteen hours, after which they were washed out and placed in fifteen per cent. alcohol for seventeen hours, then in thirty per cent. for nine hours, then fifty, sixty, eighty and ninety per cent., and absolute alcohol for six hours each, more or less, at convenience. They were then transferred to one-half alcohol and one-half turpentine for seven hours previous to placing them in pure turpentine. Following this treatment paraffine was added sufficient to make a saturated solution. This was placed on a radiator for twelve or fifteen hours to keep the paraffine melted and thus to more thoroughly saturate the tubercles, when they were removed to a water-bath and kept in paraffine at a temperature of fifty-eight degrees C. for two or three hours. The tubercles with the melted paraffine were then poured into a paper box, which was floated on the surface of water until the paraffine formed a scum on its upper surface, after which the whole was rapidly cooled by immersing it. From this solid paraffine pieces containing tubercles were cut out and mounted for the microtome.

When the sections were cut, they were placed on a glass slide previously covered with a thin coat of albumen solution to make them stick. This was then held over an alcohol lamp until the paraffine was all melted. After being allowed to cool, the paraffine was dissolved off with turpentine, and the specimen carried back through the various strengths of alcohol until it could be placed in water. It was then put into a solution of hæmatoxylon for twenty minutes to stain it and, after being brought up through alcohol to turpentine, was mounted in Canada balsam. The apparent infecting mycelium in the tubercle absorbed the stain more readily than the cell tissue, and could be seen with a Zeiss microscope fitted with 1-12 (2mm.) homogeneous objective and a No. 4 eyepiece. This gave a magnification of 850 diameters. Drawings representing cross-sections of the tubercles at this power were obtained with the aid of an improved Abbe camera. Specimens representing a portion of a cross-section of tubercles taken from plants seventy-two and ninety-nine days old are shown in figs. 4 and 5, respectively.

Explanation of Mycelium.—It should be noted that the mycelium that appears to run from cell to cell is a bacterial product and is therefore not a true mycelium. The apparent mycelium is what is known as a bacterioid condition; the bacteria become distributed throughout the cells and finally die. It is in this dead or decayed condition that the bacteria become available as plant food. The mycelium, or bacterioid condition, is the transition stage from the individual bacteria until their absorption by the plant. The change of the bacteria into the bacterioid condition is shown at *d*, fig. 5.

Explanation of Microscopic Drawing.—Fig. 4 shows the cells, *a*; the nuclei, *b*; and the infecting mycelium (bacterioid condition), *c*. It will be noticed that the mycelium is formed through the cell-wall, appears to send off branches, and has a special liking for the cell nuclei. In the lower portion of

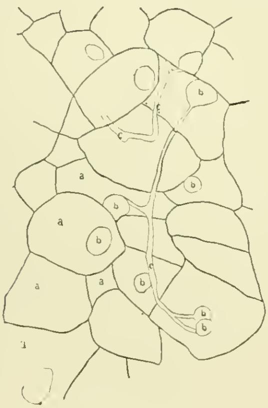


Fig. 4.

Cross-section of soy-bean root tubercle.

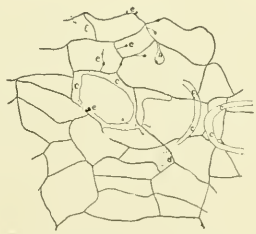


Fig. 5.

Cross-section of soy-bean root tubercle.

fig. 4 is shown the mycelium branching to two nuclei, one of which seems to lie below the other and many belong to a lower layer of cells. Fig. 5 shows a cross-section at a little later stage of development. As in the former case, it shows the mycelium, *c*, but in a little different form. In one instance the mycelium seems to envelop the inner wall of nearly all of one cell, and a portion extends through the cell wall into the adjoining cell. In addition to this, there is shown at *d* a cluster of small dots, which are probably individual bacteria. Also at *e* are found peculiar dark bodies, some of which are imbedded within the cell wall, while others are isolated or connected with threads, or hyphæ. The latter bodies may possibly be bacteria, but it seems to be more probable that they are something else. They may be due to some foreign substance that has the power of absorbing the stain to a greater degree than the surrounding tissues.

EXTENT OF SOY-BEAN MICRO ORGANISM IN THE UNITED STATES.

After the success of inoculating the beans with imported soil was assured, it was thought to be an interesting point to ascertain how far these particular micro-organisms had spread in this country. Accordingly inquiries were sent to all the experiment stations of the United States, and the following table constructed from the replies:

TABLE IV.

Micro-organisms indigenous to the soil.	Micro-organisms obtained through inoculation.	No tubercles found on the roots.	Have made no examination for root tubercles.	Too cold to successfully grow the soy-bean.	Have not grown the soy-bean.
Indiana	Conn. [Storrs],	California	Arizona	Minnesota	Kentucky
Louisiana.	Kansas	Florida	Arkansas	Washington	Maine
Mass. [Hatch],		Iowa	Colorado		Montana
N. Carolina		Michigan	Conn. [State]		Nevada
Rhode Island,		South Dakota,	Georgia		Pennsylvania
Tennessee			Illinois		Utah
			Maryland		Virginia
			Missouri		Wyoming
			Mississippi		
			Nebraska		
			New Jersey		
			N. Y. [Cornell],		
			N. Y. [State]		
			Ohio		
			Texas		
			Vermont		
			West Virginia		
			Wisconsin		
6	2	5	18	2	8

CONCLUSION.

The above experiments were not planned with a view to obtain comparative results as to yields; and where yields have been given they are only incidental. The main object was to ascertain whether or not a leguminous plant could be made to produce tubercles by inoculating it with a soil impregnated with the right kind of micro-organisms. As the Kansas soil contained none of these organisms, the conditions were entirely under control, and results obtained which otherwise would have been impossible. The results show conclusively that inoculation is entirely possible; and this, taken in connection with the fact that it has been repeatedly proven that tubercles are valuable adjuncts to leguminous plants, both for yield and as a fertilizer, suggests the practicability of inoculating fields deficient in micro-organisms that would be beneficial to the particular leguminous crop to be grown.

When we realize that in the Eastern states many farmers are paying from six to ten dollars an acre for fertilizers, which in the aggregate amount to a tax of millions of dollars, and as we in the West are fast tending in the same direction, should it not behoove us to lay hold of one of nature's most effective means of maintaining and even increasing the fertility of the soil? Free nitrogen is around and about us in superabundance, it composing four-fifths of the air; but, without the aid of these bacteria working within the tubercles of the roots, plants have no power to make use of it. By growing leguminous crops in rotation, and inoculating the soil when the latter is deficient in the proper species of bacteria, and thus controlling the action of these microscopic plants, the farmer may find them to be among his best friends and strongest financial supporters.

A BIBLIOGRAPHY OF LITERATURE RELATING TO THE EFFECTS OF WIND ON PLANTS.

BY J. B. S. NORTON, ST. LOUIS, MO.

Read (by title) before the Academy October 29, 1897.

The following bibliography was prepared during the winter of 1896 in a study of the effects of the tornado of May 27, 1896, on trees about St. Louis, Mo., and has since been amplified. While I have not completed the original work on this subject that I have in mind, I present this list of the already published works which have come to my knowledge, believing it will be of interest and perhaps some aid to persons living in a state in whose economy wind plays so important a part. Usually little notice is taken of the influence of wind on plants or modifications brought about in them by its action, in comparison with what has been written regarding other less potent forces of nature. A study of the flora of our Western plains, where strong winds are almost constant and severe ones common, from this standpoint, would no doubt reveal many interesting points.

The effects of wind on plants may be classed under several heads:

A. Indirect, such as—

1. Carrying moisture in the form of clouds which supply plants with water.
2. Aiding transpiration by change of moist for dry air. The effects of hot winds might be placed here.

B. More direct effects.

1. Injuries, such as breaking and uprooting.
2. Adaptations for using the wind.
   a. In effecting pollination.
   b. In disseminating fruits and seeds.
3. Adaptations protective against wind.
   a. In wood structure.
   b. In leaf structure.
   c. In habit.
   d. In location.

The following list of references does not claim to be complete. I have endeavored especially to cite those relating to mechanical injury by wind and adaptations brought about by wind action, omitting all works relating only to wind pollination and dissemination. Many accounts of tornadoes and other wind-storms in which tree destruction or injury is mentioned have been published of which only a few noteworthy ones have been given. Further search into botanical literature would no doubt reveal many other works which should have been included here, but which I have not seen. I would gladly receive information about any others. The literature relating to wind-resisting structure is very comprehensive and many other references can be obtained from the ones here given (see Tschirch and Haberlandt.)

The work has been done in the library of the Missouri Botanical Garden.

Ammann, A. Die Pflanzenkrankheiten. Stuttgart. 1867.

Anderson, T. Report of the damages sustained by the botanical gardens in the cyclone of the 5th of October, 1864. [Calcutta.] May, 1865.

Bailey, E. H. S. Observations on a cyclone near Williamstown, Kan. Science, *22:* 3. 1893.

Belhazy, J. A szélvihar alta luczfenyvesekben elöidézett Karok egy uj neme. Erdézeti Lapok, *28:* 240–243. Budapest, 1889.

Berkeley, M. S. Anemosis. J. Lindley and T. Moore. Treasury of Botany, *1:* 65. London, 1870.

Bernhardt. Waldbeschädigungen durch Wind, Schnee, Eis, und Duftbruch. Centralbl. Gesammte Forstwesen. Hempel., 1878: 29.

Braun, A. ——— Monatsber. Akad. Berlin. 1861: 691.

Campbell, J. T. Track of a cyclone which passed over western Indiana more than three hundred years ago. Am. Nat., *20:* 348-353. Jan., 1886.

Caspary, R. Ueber die Veränderungen der Richtung der Aste holziger Gewächse bewirkt durch niedrige Wärmegrade. ———.

——— Beschädigung der Rosskastanien Blätter durch Reibung mittelst Wind. Bot. Zeit., *27:* 201-207. 1869.

Chappelsmith, J. Account of a tornado near New Harmony, Ind., April 30, 1852, with a map of the track, etc. Smithson. Contrib., 7. 1853.

Darwin, C. Journal of researches into the natural history and geology of the countries visited during the voyages of H. M. S. Beagle round the world, p. 3. London, 1845.

Divers, W. H., and others. The gale of October 14. Gard. Chron., n. s., *16:* 535. 1881.

Eisen, G. Forms of trees as determined by climatic influences. Zoe, *3:* 1-11. 1892. Gard. and Forest, *5:* 322, 331. 1892.

Finley, J. B. Something about tornadoes. Science, *13:* 83, 105.

Fisher, W. R. Forest protection. Schlich's Manual of Forestry, *4:* 455.

Frank, B. Die Pflanzenkrankheiten. A. Schenk, Handbuch der Botanik, *1:* 468-470.

Goebel, K. Die Vegetation der Venezolanischen Paramos. Pflanzenbiologische Schilderungen, *2:* 1-160. Marburg, 1891.

Haberlandt, G. Das Mechanische System. Physiologische Pflanzenanatomie, 134-180. Leipzig, 1896.

Hough, F. B. Report upon forestry prepared under the direction of the commissioner of agriculture in pursuance of an act of congress approved August 15, 1876. 1877: 56; 1878-'79: 67. Washington.

Houston, E. J. Outlines of forestry, p. 66. Philadelphia, 1893.

Hoyt, B. F. The wind and the tree tops. Am. Nat., *20:* 1051-1052. 1886.

Jungner, J. R. Klima und Blatt in der Regio Alpina. Flora, *79:* 219-284. 1894.

——— Anpassungen der Pflanzen an des Klima in den Gegenden der regenreichen Kamerungebirge. Bot. Centralb., *47:* 353-360. 1891.

Kerner, A. Die Schutzmittel des pollens gegen die Nachtheile vorzeitiger Dislocation und gegen die Nachtheile vorzeitiger Befruchtung. Innsbruck, 1893.

Kerr, W. C. Storms of August 24 and 29. Proc. Nat. Sci. Assoc. Staten Island, *3:* 48-51. Sept., 1893. Science, *22:* 155. 1893.

———. Survival of storm-injured leaves. Proc. Nat. Sci. Assoc. Staten Island, *4:* 32. Dec., 1894.

——— Notes on the destructiveness of wind and rain in storms. Proc. Nat. Sci. Asso. Staten Island, *4:* 64-66. Mar., 1895.

Kihlman, A. O. Pflanzenbiologische Reise nach Russisch-Lappland. Acta Soc. pro Fauna et Flora Fennica, *6*. 1890.

Kjellman, F. R. Ur polarnäxternas lif. Nordenskiöld, Studier och Forsaningar, 1884: 474.

Klinge, J. Ueber den Einfluss der mittleren Windrichtung auf das Verwachsen der Gewässer nebst Betrachtung anderen von der Windrichtung abhängiger Vegetations-erscheinungen im Oostbalticum. Engler's Bot. Jahrb., *11:* 264-313. 1890.

Knight, T. A. On the causes which influence the direction of the growth of roots. Phil. Trans. R. Soc. London, 1811: 209-219. Nicholson Journ., *30:* 370-378. 1812.

——— Account of some experiments on the descent of the sap in trees. Phil. Trans. R. Soc. London, 1803: 277-289. Journ. R. Inst. Great Britain, 1803: 71-74.

Kny, L. Ueber die Anpassung der Laubblätter an die mechanischen Wirkung des Regens und Hagels. Ber. deutsch. bot. Ges., *3:* 207-213. 1885.

Kuntze, O. Schutzmittel der Pflanzen gegen Thiere und Wetterungunst und die Frage vom Salzfreien Urmeer. Gratis Beilage zur Bot. Zeit. Leipzig, 1877.

Lapham, I. A. [A report on windfalls in Wisconsin.] 1870-72.

Ludwig, F. Lehrbuch der Biologie der Pflanzen, p. 205. Stuttgart, 1895.

Magnus, P. Beschädigung der Blätter durch Sturm. Verhandl. bot. Ver. Brandenb., *18:* viii-xi. 1876.

Massart, J. La biologie de la vegetation sur le littoræ Belge. Bull. Soc. Bot. Belge, *82:* 7-43. 1893.

Maury, M. F. Influence of wind on plants. Western Journal and Civilian, *4:* 315.

Miall, L. C. Round the Year, a series of short nature studies. London, 1896.

Middendorff, A. von. Die Gewächse Sibiriens. Sibirische Reise, *4*[1]: 525-783. St. Petersburg, 1864.

Mohr, C. Timber pines of the southern United States. U. S. Dept. Agr., Div. Forestry, Bull. 13. 1896.

New York. Annual report of the forest commission for the year 1893, *1:* 251, 328.

Nicholson, G. Wind. Illustrated dictionary of gardening, *4:* 211. London.

Norton, J. B. S. The effects of wind on trees. Gard. & Forest, *10:* 292. Cf. also Bot. Gaz., *24:* 142. 1897.

Pammel, L. H. Wind-storms and trees. Science, *19:* 205. 1892.

Parsons, G. H. The climate of Colorado and its effect on trees. U. S. Dept. Agr., Div. Forestry, Bull. 2: 230-232.

Plumbly, G. The late stormy weather. [Feb. 27-28.] Gard. Chron., Mar., 1860.

Rees, A. Wind, qualities and effects of. Cyclopedia of arts, sciences, and literature, *38.* London, 1819.

Rossmassler, E. A. Der Wald, 3 ed., 118, 252, 255, 324. Leipzig, 1881.

Saint Louis. Report of Board of Commissioners of Tower Grove Park, 1896: 7-8.

Sargent, C. S. The hot winds of the prairies. Gard. & Forest, *8:* 331. 1895.

Schacht, H. Der Baum, p. 334. Berlin, 1853.

Schrenk, H. von. The trees of St. Louis as influenced by the tornado of 1896. Contributions from Shaw School of Bot., 10. Trans. Acad. Sci. St. Louis, *8:* 25-41. 1897.

Schwarz, F. Forstliche Botanik, p. 180. Berlin, 1892.

Sickels, J. Exercises in wood working, p. 28; *f. 14.* New York, 1889.

Stahl. Regenfall und Blattgestalt. Ann. Jard. bot. Buitenzorg, *11:* 98-182; *t. 10-12.* 1893.

Tschirch, A. Das mechanische System. Angewandte Pflanzenanatomie, 285. Wien und Leipzig, 1889.

Warming, E. Lehrbuch der ökologischen Pflanzengeographie, p. 36-41. Berlin, 1896.

FLORAL HOROLOGE FOR KANSAS.

BY B. B. SMYTH, TOPEKA.

Read before the Academy October 27, 1898.

This "clock" represents the time of day of the opening and closing of a goodly number of native flowers and a few naturalized flowers in the state of Kansas, and is the result of many years observations on Kansas plants. The time given for each species is that observed during the height of the flowering season for that particular species. The time of opening (and closing) is modified somewhat by the length of the day and dense cloudiness. The clock is still subject to correction, the result of further needed and closer observation:

1 a. m. Argemone alba, thistle poppy: flowers remain open all day.
Convolvulus incanus, hoary bindweed: flowers close about noon.

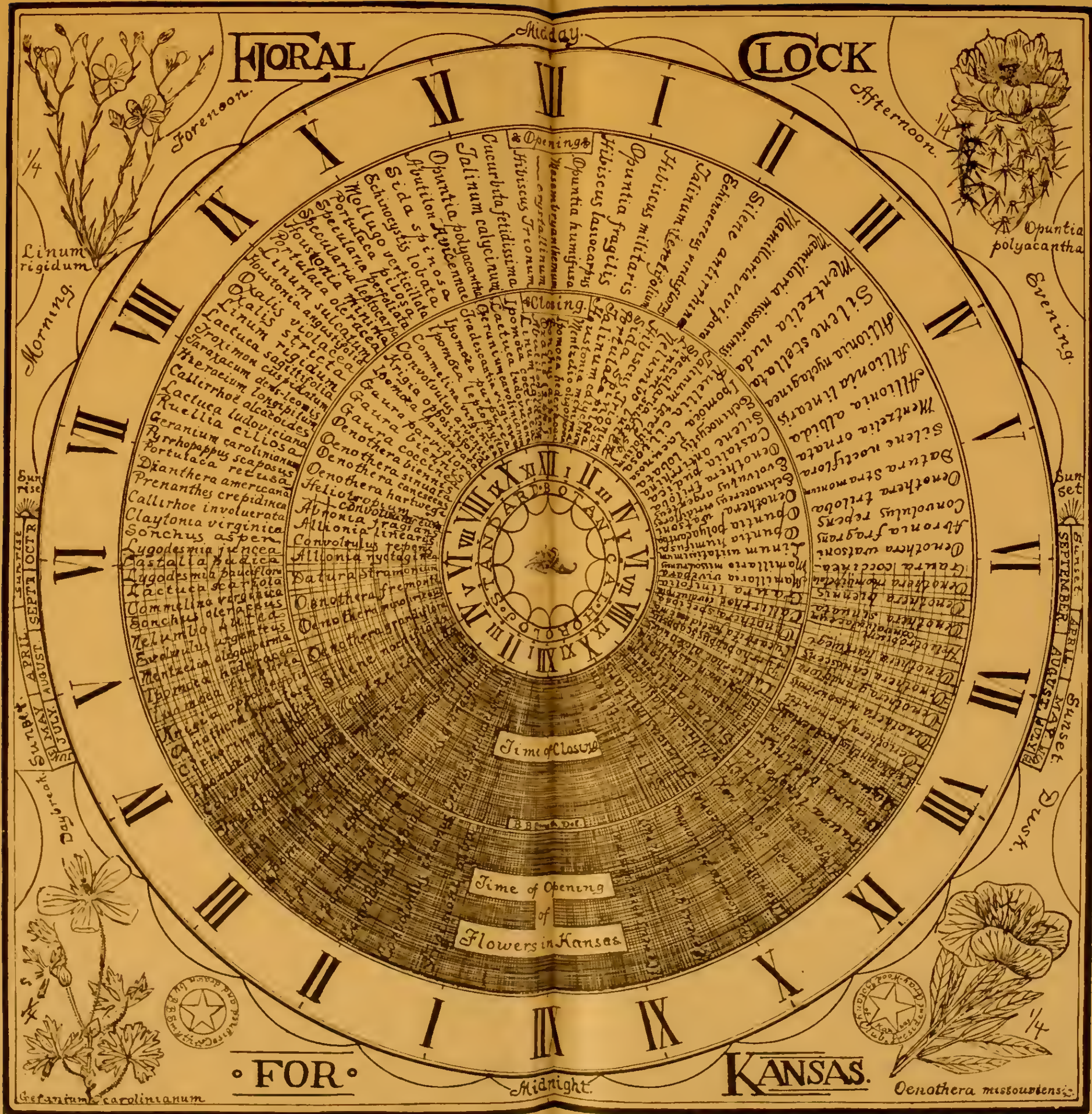
2 a. m. Convolvulus sepium, hedge bindweed: flowers close at evening.
Ipomoea pandurata, wild moonflower: close at 10 a. m.

3 a. m. Ipomoea leptophylla, bush morning-glory; close at noon.
Tragopogon porrifolius, salsify; close before noon.
Ipomœa lacunosa, wild potato vine: close about 2 p. m.

4 a. m. Convolvulus arvensis, bindweed: close at 10 a. m. in sunshine, later in cloudy weather.
Cichorium Intybus, chicory: close before noon.
Ipomœa quamoclit, cypress-vine: close about noon.
Ipomœa coccinea, scarlet cypress vine: close about noon, except in cloudy weather.
Oenothera speciosa, white evening-primrose: last all day.
Krigia oppositifolia, dwarf dandelion; close at 10 a. m.

5 a. m. Ipomœa purpurea, morning-glory: close about 11 a. m., except in cloudy weather.
Ipomœa hederacea, blue morning-glory: close about noon, except in cloudy weather.
Mentzelia oligosperma, small mentzelia: close at 1 p. m.
Sonchus oleraceus, sow thistle: withers about noon.
Commelina virginica. day-flower: close in heat of day.
Evolvulus argenteus, dwarf morning-glory; close at 3 p. m.
Nelumbo lutea, yellow water-lily: close at 2 p. m.; reopen several days in succession.
Lactuca scariola, prickly lettuce: close at or before noon.
Lygodesmia pauciflora, tooth-leaved gas-plant: close early in afternoon.

6 a. m. Tradescantia virginiana, spiderwort: close about noon.
Lygodesmia juncea, small-leafed gas-plant: close early in the afternoon.
Sonchus asper, sow thistle; wither at noon.
Claytonia virginica, spring beauty; close in afternoon; reopen once.
Callirrhoe involucrata, rose mallow: close 6 to 7 p. m.: reopen next day once or twice.
Prenanthes crepidinea, large drop-flower; drop off in afternoon.
Castalia pudica, white water-lily; close at 3 p. m.; reopen several days in succession.
Pyrrhopappus scaposus, tuberous dandelion, close at 6 p. m.: reopen for several days in succession; close also in continued rain or dense cloudiness.


FLORAL CLOCK
FOR KANSAS.
Midday.
Forenoon.
Afternoon.
Morning.
Evening.
Sunrise
Sunset
Daybreak.
Dusk.
Midnight.
Linum rigidum
Opuntia polyacantha
Geranium carolinianum
Oenothera missouriensis
Opening
Closing
Time of Closing
Time of Opening of Flowers in Kansas.
HOROLOGIUM STANDARD BOTANICAL
B. B. Smyth Del.

7 a. m. Geranium carolinianum, wild geranium; close at noon.
Lactuca ludoviciana, wild lettuce; close at noon.
Lactuca floridana, blue-flowered wild lettuce; close after noon.
Ruellia ciliosa, ruellia; flowers drop off about 3 p. m.
Dianthera americana, water justicia; drop off middle of afternoon.
Hieracium longipilum, hairy hawkweed; close middle of afternoon.
Portulaca retusa, notched purslane; close after noon.
Callirrhoe alcæoides, pink rose-mallow; close in evening to reopen next day.
Lactuca sagittifolia, arrow-leaved lettuce; flowers close at noon.

8 a. m. Troximon cuspidatum, wild dandelion; close at dusk; reopen next day.
Taraxacum dens-leonis, dandelion; close at dark to reopen next day, except in rainy weather, when it may be closed in daytime and open at night. Do not close for a shower in sunshiny weather.
Oxalis stricta, sorrel; close at noon for good.
Oxalis violacea, pink sorrel; close at noon to reopen (?).
Houstonia angustifolia, bluets; close at noon; reopen for two or three days in succession.
Linum rigidum, yellow flax; fall off at 1 p. m.
Linum sulcatum, large-flowered yellow flax; fall off at 2 p. m.

9 a. m. Houstonia minima, little bluets; close at 2 p. m.; reopen next day once.
Specularia leptocarpa, Venus mirror; close permanently at 2 p. m.
Specularia perfoliata, Venus mirror; close at 2 p. m. and disappear.
Portulaca oleracea, purslane; wilt after noon.
Portulaca pilosa, wild portulaca; close at 1 p. m.; do not reopen; while the flowers of *P. grandiflora*, a cultivated plant said to be a variety of this and whose flowers open and close at about the same time, do reopen.

10 a. m. Echinocystis lobata, wild cucumber; close at 3 p. m.
Linum usitatissimum, flax; drop off about 5 p. m.
Abutilon avicennæ, velvet-leaf; close before noon.
Sida spinosa, prickly sida; close at 2 p. m.
Opuntia polyacantha, many-spined prickly pear; close at 4 p. m. to reopen for several days. This has sensitive stamens.

11 a. m. Talinum calycinum, large-flowered talinum; close early in afternoon.
Cucurbita fœtidissima, wild gourd; close at 3 p. m.
Opuntia fragilis, little prickly pear; close at 4 p. m., to reopen for several days.

12 a. m. Opuntia humifusa, western prickly pear; close at 5 p. m. to reopen.
Hibiscus trionum, flower-of-an-hour; close at 2 p. m.

1 p. m. Hibiscus militaris, evening hibiscus; remain open until dark.
Talinum teretifolium, terete-leaved talinum; close 2 to 3 p. m.
Silene antirrhina, catchfly; close at 3 or 4 p. m.

2 p. m. Mamillaria missouriensis, straw-colored pincushion-cactus; close at 5 p. m. to reopen next day.
Mamillaria vivipara, red pincushion-cactus; close at 5 p. m. to reopen next day.

3 p. m. Mentzelia nuda, great mentzelia; close at daylight to reopen.
Silene stellata, starry campion; close toward midnight.

4 p. m. Allionia nyctaginea, wild four-o'clock; close next day.
Allionia linearis, narrow-leafed wild four-o'clock; close next morning.
Allionia albida, white wild four-o'clock; close next morning.

5 p. m. Mentzelia ornata, great mentzelia; close in the morning to reopen in the evening.

Silene noctiflora, evening catchfly; wilt next morning.

Oenothera triloba, cone-stem evening-primrose; last nearly all next day.

6 p. m. Abronia fragrans; wilt early in the morning.

Datura stramonium, jimson; wilt next morning.

Convolvulus repens, evening beauty; close next morning.

Gaura coccinea, scarlet gaura; flowers turn pink next morning and fade about 11 a. m.

Oenothera watsoni, stemless evening primrose; last all next day.

Oenothera biennis, tall evening-primrose; wilt next day.

Heliotropium convolvulaceum, sweet-scented heliotrope; wilt next day.

Oenothera rhombipetala, point-petaled evening-primrose; wilt next day about 9 to 10 a. m.

Oenothera sinuata, small-flowered evening-primrose; wilt next day.

Oenothera hartwegi; wilt at 10 a. m. next day.

7 p. m. Oenothera missouriensis, Missouri evening-primrose; wilt at sunrise.

Oenothera grandiflora, large evening primrose; open very promptly; wilt at 7 a. m. next day.

Oenothera canescens, pink evening-primrose; wilt next morning.

Oenothera fremontii; open promptly; wilt at 9 a. m. next day.

Cephalanthus occidentalis, button-bush.

8 p. m. Gaura biennis; wilt promptly at 10 a. m. next day.

Gaura parviflora; wilt about 11 a. m. next day.

9 p. m. Gaura (Stenosiphon) linifolia; flowers last and remain white all next day.

There are many other plants that open at periodic times; but observations upon them have not been sufficient to determine positively their habits.

(The "clock" contains the names of a few cultivated plants in parentheses.)

LIST OF PLANTS IN MY FLORIDA HERBARIUM.

A. S. HITCHCOCK, MANHATTAN.

Read (by title) before the Academy December 30, 1898.

The list presented is based entirely upon plants in my herbarium. There are yet a number of specimens that remain unidentified, especially among the palms, pines, and the genera *Paspalum* and *Panicum*. Others have been somewhat doubtfully referred to certain species though they show some differences and may ultimately prove to be new species. But it seems best to leave the description of new species to those who have access to the large herbaria.

For the sake of brevity, the collector's name is represented by his initial in most cases. These initials are:

C = Mr. A. H. Curtiss, sets of North American plants.

N = Mr. Geo. V. Nash, sets of Florida plants.

R = Prof. P. H. Rolfs, Lake City, Florida Agricultural College, who has given me much help in the work.

W = Mr. H. J. Webber, Department of Agriculture, Washington, for several years stationed at Eustis.

S = Mr. J. H. Simpson, plants distributed by the Department of Agriculture.

Many of these are without number or locality other than "Florida," but are from the region south of Tampa.

P = Plants from the Keys recently distributed by Messrs. Pollard, Collins, and Morris.

H = My own collection. The first series was obtained in June and July of 1894 at Eustis and vicinity. While here Messrs. Webber and Swingle gave me much valuable assistance. The second series was obtained in the winter of 1895–'96, along the east coast, from Palm Beach to Cocoanut Grove, on Biscayne Bay. Under the latter locality are included collections from Cape Florida. A few labeled East Florida were collected at various places on the way down, chiefly at Jacksonville and St. Augustine. The third series was obtained during the summer of 1898 on a trip on foot from Monticello to Bayport following the line of railroad to Live Oak, Branford, Archer, Dunellon, Fitzgerald, and Brooksville. The plants collected on this trip are labeled by counties. Those labeled Columbia county were collected in the southern part, and so are distinguished from those collected at Lake City.

RANUNCULACEAE.

1. **Clematis baldwinii**, T. & G. Orlando, R 58, C 3; Hernando county, H 1.
2. **Clematis catesbyana**, Nutt. Lake City, H 8; Eustis, N 1731; Istachatta, C 5968, C 11.
3. **Clematis reticulata**, Walt. Jefferson county, H 4; Madison county, H 5; Columbia county, H 3; Lake City, R 59, 60, H 6; Alachua county, H 7; Eustis, N 611, 1890, H 2; ——, R 1082.
5. **Clematis crispa**, L. Duval county, C 8.

MAGNOLIACEAE.

6. **Illicium floridanum**, Ellis. Walton county, C 73.
7. **Magnolia grandiflora**, L. Jefferson county, H 9; Lake City, H 10; Eustis, N 1605.
8. **Magnolia glauca**, L. Jefferson county, H 11; Lake City, R 45; Eustis, N 523, H 13.

ANONACEAE.

9. **Asimina parviflora**, Dunal. Madison county, H 14; Suwanee county, H 17; Lake City, H 15, 17; Duval county, C 85.
10. **Asimina grandiflora**, Dunal. Suwanee, H 18, 19; Lake City, R 52, H 20; Duval county, C 86.
11. **Asimina obovata**, Nash. Eustis, H 21; Hernando county, H 28.
12. **Asimina cuneata**, Shuttlw. Clear Water, R 431; Tampa, N 2477; New River, H 34.
13. **Asimina angustifolia**, Gray. Quincy, C 5878; Jefferson county, H 30; Suwanee county, H 31; Lake City, R 51, N 2153, H 29, 32, R 967.
14. **Asimina pygmaea**, Dunal. Alachua county, H 22, 27; Lake City, R 968, H 25; Duval county, C; Eustis, R 53, N 359, H 23, 24, 26.
15. **Anona laurifolia**, Dunal. Narrows of Indian River, C 83*; Cocoanut-grove, H 34.

MENISPERMACEAE.

16. **Cocculus carolinus**, D. C. Leon county, N 2358; Columbia county, H 36; Levy county, H 35.
17. **Calycocarpum lyoni**, Gray. Chattahoochee, C 5934.

NYMPHAEACEÆ.

18. **Cabomba caroliniana**, Gray. Lake City, R 603, 1336, H. 42.
19. **Brasenia schreberi**, Gmel. Madison county, H 43.

20. **Nelumbo lutea**, Pers. Lake City, R 1, 658, H 44.
21. **Nymphaea odorata**, Ait. Jefferson county, H 48, 50; Lake City, H 49, R 659; Eustis, N 1153, H 45, 46, 47. This is described by Mr. Nash under *Castalia reniformis*. It seems to be a different species from *N. odorata*, but whether it is *N. reniformis*, Walt. is another question.
22. **Nymphaea flava**, Leitner. Duval county, C 101*a*.
23. **Nuphar macrophyllum**, Small. Lake City, H 52; Duval county, C 102; Eustis, N 1751, H 51.
24. **Nuphar sagittaefolium**, Pursh. Santa Rosa county, C 104.

SARRACENIACEAE.

25. **Sarracenia psittacina**, Michx. Apalachicola, C 106.
26. **Sarracenia rubra**, Walt. Walton county, C 107.
27. **Sarracenia drummondii**, Croom. Apalachicola, C 108.
28. **Sarracenia variolaris**, Michx. Madison county, H 38; Lake City, N 2184, R 277, 1062, H 37; Duval county, C 110; Eustis, H 39.
29. **Sarracenia flava**, L. Lake City, R 1343.

PAPAVERACEAE.

30. **Argemone mexicana**, L. Key West, P 1, S 351.
31. **Argemone leiocarpa**, Greene. Key West, P 2, C 5653.
32. **Argemone alba**, Lestib. Madison county, H 41; Lake City, R 1075; Levy county, H 40.

FUMARIACEAE.

33. **Corydalis micrantha**, Gray. Duval county, C 125a.

CRUCIFERAE.

34. **Lepidium virginicum**, L. Jefferson county, H 61; Lake City, R 630; H 59; Eustis, H 60; Polk county, R 545; Palm Beach, W 384, H 58; Key West, P 8.
35. **Senebiera pinnatifida**, DC. Aspalaga, C 196; Pensacola, R 489.
36. **Capella bursa-pastoris**, Medic. Pensacola, R 488.
37. **Cakile maritima**, Scop. Sanibel Is. W 177; Marquesas Key, C 198*; Coon Key, S 242; Knight's Key, C 5645; Lemon City, H 63; Palm Beach H 62, W 243.
38. **Nasturtium tanacetifolium**, H. & A. Madison county, H 53; Lake City, R 1349; Levy county, H 54; Hernando county, H 55.
39. **Cardamine curvisiliqua**, Shuttl. Lake City, H 57; Duval county, C 5865.
40. **Warea cuneifolia**, Nutt. Indian River, C 171; Lemon City, W 285; Cocoanut Grove, H 56.
41. **Warea sessilifolia**, Nash. Bellair, N 2544.
42. **Warea amplexifolia**, Nutt. Haines City, C 5958.

CAPPARIDACEAE.

43. **Polanisia tenuifolia**, T. & G. Eustis, N 760, H 64; Alachua county, H 65; Tavares, R 1317; Polk county, R 546; Melbourne Beach, C 5769; Cape Malabar, C 201.
44. **Cleome pentaphylla**, L. Duval county, C 203, R 555.
45. **Capparis jamaicensis**, Jacq. Palm Beach, H 67, W 257; South Florida, Swingle; Key West, C 204; ———, S.
46. **Capparis cynophallophora**, L. Palm Beach, H 66, C 204*, 5529; No Name Key, S.

CISTACEAE.

47. **Helianthemum corymbosum**, Michx. Madison county, H 71; Lake City, R 613, 614, H 77; Alachua county, H 73; Levy county, H 75;

Eustis, H 78; Hernando county, H 74; Kissimee, R 1359; Palm Beach, H 76; New River, H 70; Lemon City, H 72.

48. **Helianthemum arenicola,** Chapm. Apalachicola, C 226.

49. **Helianthemum nashi,** Britton. Eustis, N 815, 1813.

50. **Helianthemum carolinianum,** Michx. Madison county, H 68; Lake City, R 611; Duval county, C 5830; Alachua county, C 225; Hernando county, H 69.

51. **Lechea major,** Michx. Madison county, H 79; Lake City, R 213, N 2154, H 81; Duval county, C 229; Levy county, H 80; Eustis, H 82, 83; Palma Sola Bay, S.

52. Var. **divaricata,** Gray. Eau Gallie, C 5709; Hernando county, H 84.

53. **Lechea tenuifolia,** Michx. Suwanee county, H 87; Duval county, C 232*; Eustis, H 90; Hernando county, H 88; New River, H 89.

54. **Lechea racemulosa,** Lam. Eau Gallie, C 5833; New River, H 86.

55. **Lechea patula,** Leggett. Suwanee county, H 91; Lake City, R 25, 995, N 2490, H 92; Duval county, C 232**; Eustis, N 1599, H 93; Tavares, R 230.

VIOLACEAE.

56. **Viola insignis,** Pollard. Lake City, R 37, 41, 43, 44, 639, 1081, 1093, 1451, H 94; Hernando county, H 95.

57. **Viola cucullata,** Ait. Lake City, R 42, 1080.

58. **Viola primulaefolia,** L. Lake City, R 38, 40, 647; Eustis, W 399, N 339.

59. **Viola vittata,** Greene. Lake City, R 39; Duval county, C 208; Polk county, R 36.

60. **Viola canina** var. **multicaulis,** Gray. Lake City, R 641, H 96.

CANELLACEAE.

61. **Canella alba,** Murr. No Name Key, C 277, 5439; Cape Sable, S 213.

CARYOPHYLLACEAE.

62. **Silene antirrhina,** L. Madison county, H 145.

63. **Silene baldwinii,** Nutt. Chattahoochee, C 286.

64. **Stellaria media,** Cyrill. Pensacola, R 483; Lake City, R 149; N. E. Fla. H 146.

65. **Stellaria uniflora,** Walt. Mosquito Inlet, C 313.

66. **Arenaria alsinoides,** Willd. Jefferson county; H 139, Columbia county, H 137; Levy county, H 138; Eustis, N 987, H 140.

67. **Arenaria caroliniana,** Walt. Walton county, C 302.

68. **Stipulicida setacea,** Michx. Madison county, H 142; Apalachicola, C 336; Palm Beach, H 141; Lantana, C 5390.

69. **Stipulicida filiformis,** Nash. Levy county, H 144; Eustis, N 14, 1885, R 147, H 143; Polk county, R 151, 1420.

FICOIDEAE.

70. **Mollugo verticillata,** L. Lake City, R 152, 1335 in part, H 701; Duval county, C 347; Eustis, N 1399, H 700; Polk county, R 148.

71. **Cypsella humifusa,** Turp. ——, S 30.

72. **Trianthema portulacastrum,** L. Indian Key, C 350*; Key West, C 5658, S 344.

73. **Sesuvium portulacastrum,** L. Port Orange, W 462; Ponce Park, W 482; Titusville, N 2310: Hernando county, H 699; Palm Beach, W 220; Jupiter Inlet, C 5560; Sanibel Is., W 173, 188; Mangrove Key, P 15; ——, S.

74. **Sesuvium pentandrum,** Ell. Merritt's Is., C 350; Key West, C 5619; ——, S.

PORTULACACEAE.

75. **Portulaca oleracea**, L. Madison county, H 152; Lake City R 1368, H 147; Alachua county, H 148: Eustis, H 151; Palm Beach, H 150.

76. **Portulaca halimoides**, L. Cocoanut Grove, H 157: Rabbit Key, S 290.

77. **Portulaca pilosa**, L. Suwanee county, H 154; Lake City, R 1367, H 153; Alachua county, H 149; Levy county, H 156; Eustis, H 155.

78. **Talinum patens**, Willd. Eustis, N 1274; Ten Thousand Islands, S 312.

HYPERICACEAE.

79. **Ascyrum pumilum**, Michx. Duval county, C 5829.

80. **Ascyrum hypericoides**, L. Lake City, R 32: Eustis, N 1609.

81. **Ascyrum stans**, Michx. Jefferson county, H 159; Lake City, N 2489, R 32 in part: Duval county, C 5759; Marion county, H 158.

82. **Ascyrum amplexicaule**, Michx. Duval county, C; Eustis, N 1977; H 160, 161; E. Fla., H 162; Citrus county, H 163; Tampa, R 1128, 1135; Kissimee, R 31; New River, H 164, 165; Manatee, S.

83. **Hypericum microsepalum**, Gray. Apalachicola, C 247.

84. **Hypericum myrtifolium**, Lam. Jefferson county, H 167; Lake City, R 22, 612, 971, 1357, H 168: Eustis, N 708; Hernando county, H 166; Polk county, R 20, 1384.

85. **Hypericum fasciculatum**, Lam. Jefferson county, H 169: Lake City, H 170: Eustis, N 439, H 171; Tampa, R 1147; Kissimee, R 33.

86. **Hypericum aspalathoides**, Willd. Eustis, N 755, H 172; Tavares, R 29; Polk county, R 21, 1383; Mosquito Lagoon, C 258*.

86*a*. **Hypericum galioides**, Lam. Jefferson county, H 177, N 2513; Lake City, N 2190; Levy county, H 178.

86*b*. **Hypericum opacum**, T. & G. Lake City, R 24, H 174; Duval county, C; Eustis, N 846, H 176; Polk county, R 27, 1431; Palm Beach, H 175; New River, H 173.

87. **Hypericum pilosum**, Walt. Duval county, C 268.

88. **Hypericum maculatum**, Walt. Madison county, H 183; Lake City, H 184; Argyle, C 5940.

89. **Hypericum mutilum**, L. Eustis, N 552, H 191: Lake City, R 1316; Citrus county, H 192: Hernando county, H 193.

90. **Hypericum gymnanthum**, E. & G. Jefferson county, H 179, 182; Lake City, R 216, H 180, 181: Duval county, C 264*, 5951; Eustis, N 870, H 178.

91. **Hypericum nudicaule**, Walt. Jefferson county, H 187; Suwanee county, H 188; Lake City, R 23, H 189; Duval county, C 272, N 2319; Citrus county, H 186; Hernando county, H 185.

92. **Hypericum virginicum**, L. Lake City, H 190.

TERNSTROEMIACEAE.

93. **Gordonia lasianthus**, L. Lake City, H 194; Duval county, C 405; Eustis, N 2089, H 195.

MALVACEAE.

94. **Malvastrum rugellii**, Wats. Palm Beach, H 202; Biscayne Bay, C 5499; Palmetto, N 2462; Chokoliska Is., S 208.

95. **Modiola multifida**, Moench. Pensacola, R 485; Apalachicola, C 5889; Madison county, H 203: Hillsboro river, C 383.

96. **Sida ciliaris**, L. Long Key, C 5445.

97. **Sida supina**, L'Her. Indian Key, C 372.

98. **Sida cordifolia**, L. Eustis, H 205; Hernando county, H 206, 207; Tampa, R 1123; Cedar Keys, C 371*.

99. **Sida spinosa**, L. Clear Water, R 428; Hernando county, H 210.
100. **Sida rhombifolia**, L. De Funiak, R 175, Jefferson county, H 225; Madison county, H 226; Lake City, H 222, 223; Tallahassee, N 2399; Columbia county, H 221; E. Fla., H 224, 227; Eustis, N 454, H 219; Duval county, C 375; Palm Beach, H 220; No Name Key, P 118.
101. **Sida acuta**, Burm. Madison county, H 212; Citrus county, H 214; Lake City, R 67, 69, H 211; E. Fla., H 216, 217, 218; Eustis, N 1445, H 213; Tavares, R 68; Palm Beach, H 215; Manatee, S.
102. **Sida elliottii**, T. & G. Columbia county, H 209; Eustis, N 565; Hernando county, H 208; Biscayne Bay, C 377; Miami, C 5853, P 263.
103. **Sida rubra-marginata**, Nash. Tampa, N 2472. This is included under *S. elliotti* in the Synoptical Flora, but Nash's specimen does not have the aspect of that species as I have seen it growing in Florida.
104. **Abutilon theophrasti**, Medic. Suwanee county, H 196.
105. **Abutilon pedunculare**, HBK. Eustis, N 1280; Cedar Keys, C 379*.
106. **Abutilon permolle**, Sweet. Turner River, S 224; Key Largo, P 169.
107. **Abutilon crispum**, Medic. Key Largo, C 382; Cape Sable, S 192; Sugar Loaf Key, P 40.
108. **Malachra alceaefolia**, Jacq., var. **rotundifolia**, Gurke. Chokoluskee Bay, C 383*; ——, S.
109. **Urena lobata**, L. Eau Gallie, C 5707; Indian River, C 382*; Eustis, N 882, H 230; Levy county, H 229; Tavares, R 66; Hernando county, H 228.
110. **Pavonia spinifex**, Cav. Merritt's Is., C 386; Cape Canaveral, C 5710.
111. **Pavonia racemosa**, Sw. Arch creek, C 5462; Cocoanutgrove, H 204.
112. **Kosteletzkya smilacifolia**, Gray. Sarasota, S.
113. **Kosteletzkya altheaefolia**, Gray. Duval county, C 5696, R 64; Clear Water, R 62; Eustis, N 1267; Tavares, R 65; Titusville, N 2308; ——, S 47; Hernando county, H 201.
114. **Hibiscus furcellatus**, Lam. Indian River, C 5771, 388*; New River, H 199.
115. **Hibiscus aculeatus**, Walt. Madison county, H 197; Lake City, N 2205, R 63, H 198; Duval county, C 388, 5950.
116. **Hibiscus grandiflorus**, Michx. Duval county, C 391; Sanford, N 2280.
117. **Hibiscus incanus**, Wendl. Lake City, R 989, H 200; Eustis N 673.
118. **Hibiscus coccineus**, Walt. Duval county, C 394. *Hibiscus rosa-sinensis* L., Clear Water, R 70, may be an escape from cultivation.
119. **Hibiscus tiliaceus**, L. Meigs Key, C 398.
119*a*. **Cienfuegosia heterophylla**, Garcke. Grassy Key, C 398*.
120. **Gossypium herbaceum**, L. Key West, C 5655; Key Largo, W 346.
121. **Gossypium barbadense**, L. Upper Metacumbe Key, P 134.

STERCULIACEAE.

122. **Melochia hirsuta**, Cav. Caloosa River, C No. A.
123. **Melochia corchifolia**, L. Mosquito Lagoon, C 400*.
124. **Waltheria americana**, L. Haines City, C 5957; Caximbas, S 285; Pine Key, C 400; Jewfish Key, P 130; Boca Chica Key, P 105.

TILIACEAE.

125. **Tilia pubescens**, Ait. River Junction, C 5875; Jackson county, C 401*; Columbia county, H 231; Lake City, N 2188, R 548, 549, H 232.
126. **Triumfetta semitriloba**, Jacq. New River, H 233; Lemon City, H 234; Biscayne Bay, C 404.
127. **Corchorus siliquosus**, L. Biscayne Bay, C 403.

LINACEAE.

128. **Linum floridanum**, Trel. Eustis, N 1529, 2046, H 235; Duval county, C 412; Lake City, R 593, N 236; Levy county, H 237.
129. **Linum striatum**, Walt. Jefferson county, H 238; Suwanee county, H 240; Citrus county, H 239; Hernando county, H 241.
130. **Linum rigidum**, Pursh. Lemon City, H 242.

MALPIGHIACEAE.

131. **Byrsonima lucida**, HBK. Boca Chica Key, C 501, 5434; No Name Key, S 210, C 5632; Big Pine Key, P 88.

ZYGOPHYLLACEAE.

132. **Tribulus cistoides**, L. Key West, C 5654; Indian Key, C 215; Bates.
133. **Tribulus maximus**, L. Key West and Tampa, C 416.
134. **Guaiacum sanctum**, L. Upper Metacumbe Key, C 417; ——, S.

GERANIACEÆ.

135. **Geranium carolinianum**, L. Columbia county, H 243; Lake City, R 554; Duval county, C 419.
136. **Oxalis corniculata**, L. E. Fla., H 862. The specimens of Oxalis were identified by Prof. William Trelease.
137. Var. **dillenii**, Trel. Lake City, R 644.
138. **Oxalis filipes**, Small. Jefferson county, H 858; Lake City, R 553, 1260; Eustis, H 861; Levy county, H 860; Hernando, H 859.

RUTACEAE.

139. **Ptelea trifoliata**, L. Lake City, R 557; Eustis, N 976.
140. **Xanthoxylum pterota**, HBK. Eustis, N 942; Hillsboro and Indian Rivers, C 434; Palm Beach, W 391, C 5366, H 247; Miami, C 5366; Coon Key, S 243, C 434; Sugar Loaf Key, P 31.
141. **Xanthoxylum clava-herculis**, L. Lake City, R 551, H 245; Madison county, H 246; Palm Beach, H 244.
142. **Xanthoxylum flavum**, Vahl. Bahia Honda Key, C 433.
143. **Xanthoxylum coriaceum**, A. Rich. Lemon City, H 248; Fort Lauderdale, C 5844.
144. **Amyris elemifera**, L. Indian river, C 441; Palm Beach, C 5528; W 209, 227, H 255, 256; No Name Key, S 146.

SIMARUBIACEAE.

145. **Suriana maritima**, L. Lemon City, H 249; Sanibel Is., W 171; Virginia Key, C 5171; Ragged Keys, W 275; Long Key, S 287; Ramrod, C 878; Mangrove Key, P 17.
146. **Simaruba glauca**, DC. Palm Beach, W 386, H 250, 251; Cocoanut-grove, H 252; Elliott's Key, C 439; Key Largo, P 187; Key West, C 5625.
147. **Picramnia pentandra**, Sw. Palm Beach, H 253, 254; Biscayne Bay, C 441*.

BURSERACEAE.

148. **Bursera gummifera**, L. Indian River, C 440; Palm Beach, Swingle; Chokaliska Is., S 217.

ANACARDIACEAE.

149. **Rhus metopium**, L. Palm Beach, H 329, 330; Cape Florida, C 5477; Key Largo, C 5638; Biscayne Key, W 269; No Name Key, S 227; Bahia Honda Key, C 448; Sugar Loaf Key, P 65.
150. **Rhus toxicodendron**, L. Jefferson county, H 334; Suwanee county, H 332; Lake City, H 333; Levy county, H 335; Palm Beach, H 331;

Tampa, R 247. H 332 and 335 have the leaflets pinnately lobed, like oak leaves.

151. **Rhus copallina,** L. Jefferson county, H 336; Lake City, R 544, 654, N 2497, H 337; Duval county, C 444; Eustis, N 1659.

152. **Rhus canadensis,** Marsh. Jefferson county, H 338. *Mangifera indica* has escaped in places, Palm Beach, H 339; Cocoanutgrove, H 340; Sugar Loaf Key, P 61.

MELIACEAE.

153. **Melia azedarach,** L. Tallahassee, N 2359; Jefferson county, H 258; Eustis, H 257; Lemon City, H 259.

AQUIFOLIACEAE.

154. **Ilex opaca,** Ait. Jefferson county, H 268; Suwanee county, H 269; Lake City, R 439, N 2233, H 270.

155. **Ilex cassine,** L. Jefferson county, H 273; Lake City, R 443, 1086, 2210 (var. *angustifolia*, Willd.), H 277; Duval county, C 1747; Eustis, N 315, 423, 1550, 1651, H 276; Polk county, R 441; Palm Beach, H. 271, 272, 274, 275; New River, W 327; ———, S.

156. Var. **myrtifolia,** Sarg. Suwanee county, H 278; Duval county, C 1746, N 2412. This seems a distinct species as observed in Florida.

157. **Ilex vomitoria,** Ait. Pensacola, R 491; De Funiak, R 235, 675; River Junction, N 2374; Suwanee county, H 279; Lake City, R 623; E. Fla., H 281; Hernando county, H 280.

158. **Ilex ambigua,** Chapm. Lake City, R 440, 442, 1337, H 282; Duval county, C 1748*; Marion county, H 284; Eustis, N 1660, H 283.

159. **Ilex glabra,** Gray. Jefferson county, H 287; Lake City, R 444, 574, 1089, H 286; Duval county, C 1755; Eustis, N 2, 422, 570, H 288; Tavares, W 374; Palm Beach, H 285; ———, R 1324.

160. **Ilex coriacea,** Chapm. Lake City, H 289, 290; Duval county, C 1756; Eustis, N 522, 1131, H 291.

CYRILLACEAE.

161. **Cyrilla racemiflora,** L. Apalachicola, C 5885, 1774; St. Mark's, N 2543; Jefferson county, H 292; Lake City, R 375, N 2218.

162. **Cliftonia nitida,** Gaertn. De Funiak, R 446, 670; ———, C 1775 ("Ogeechee River, Georgia, fls. in Florida.")

OLACINEAE.

163. **Ximenia americana,** L. Duval county, C 409, 5677; Eustis, N 622, H 260, 261; Lemon City, H 262.

CELASTRACEAE.

164. **Euonymus americanus,** L. Lake City, R 580, H 266; Hernando county, H 265.

165. **Celastrus scandens,** L. Columbia county, H 267.

166. **Maytenus phyllanthoides,** Benth. Key West, C 5613, P 10; Pumpkin Key C 483; ———, S.

167. **Gyminda grisebachii,** Sarg. Lemon City, H 263; Key West, C 478.

168. **Rhacoma ilicifolia,** Trel. No Name Key, C 477.

169. **Rhacoma crassopetalum,** L. Cocoanutgrove, W 355, H 264; Biscayne Bay, C 476, 5188; No Name Key, S 168; ———, S.

170. **Schaefferia frutescens,** Jacq. Upper Metacumbe Key, C 479.

RHAMNACEAE.

171. **Rhamnidium ferreum,** Sarg. Palm Beach, C 5370; Upper Metacumbe Key, S 462.

172. **Berchemia volubilis,** DC. River Junction, N 2383; Columbia county, H 302; Citrus county, H 301; Eustis, N 255.

173. **Reynosia latifolia**, Griseb. Key West, C 5615; Boca Chica Key, C 5135; Bahia Honda Key, C 467*; ———, S.
174. **Sageretia michauxii**, Brongn. Marion county, H 303; Citrus county, H 304; Indian river, C 5774.
175. **Ceanothus americanus**, L., var. **intermedius**, Trel. Jefferson county, H 300; Madison county, H 296; Lake City, R 542, 543; Duval county, C 469; Eustis, N 431, H 297, 298; Polk county, R 541; Hernando county, H 295.
176. **Ceanothus microphyllus**, Michx. Madison county, H 293; Lake City, R 638, 540. Duval county, C 471; Orlando, R 261; Eustis, N 11, H 294.
177. **Colubrina ferruginosa**, Brongn. Losman Key, S 163; Boca Chica Key, C 473, 5628.
178. **Gouania domingensis**, L. Merritt's Is., C 474.

VITACEAE.

179. **Vitis rotundifolia**, Michx. River Junction, C 6072; Jefferson county, H 311; Lake City, R 34, 35; N 2237, H 312, Duval county, C 5870.
180. **Vitis munsoniana**, Simpson. Eustis, H 313, N 1910, 558 (this specimen looks like the preceding species, but they are difficult to distinguish in herbarium specimens); Palm Beach, H 314.
181. **Vitis cordifolia**, Michx. Tallahassee, N 2357; Jefferson county, H 315.
182. **Vitis æstivalis**, Michx. Jefferson county, H 319; Lake City, H 317; Eustis, N 525, H 316.
183. **Vitis caribæa**, DC. Lake City, N 2493.
184. **Vitis candicans**, Engelm., var. **coriacea**, Bailey. Titusville, N 2285; ———S.
185. **Vitis simpsoni**, Munson. Eustis, N 399; H 318.
186. **Cissus stans**, Pers. Suwanee county, H 305; Lake City, R 712; Clear Water, R 429; Eustis, N 689, H 307; Palm Beach, H 306.
187. **Cissus acida**, L. Key West, C 5514.
188. **Cissus incisa**, Desmoul. Hillsboro River, C 458; Cape Canaveral, C 5725.
189. **Cissus sicyoides**, L., var. **floridana**, Planch. Cape Sable, C 457*.
190. **Ampelopsis quinquefolia**, Michx. Jefferson county, H 308; Lake City, R 558, H 309; Tampa, N 2171; Palm Beach, H 310.

SAPINDACEAE.

191. **Acer rubrum**, L., var. **drummondii**, T. & G. Tallahassee, N 2351; Lake City, R 71, 1094, 1095, H 325: Eustis, N 872, 2147, H 320; New River, H 321, 322: Jefferson county, H 324.
192. **Acer floridanum**, Pax. River Junction, N 2392, C 497*, 5874; Columbia county, H 323.
193. **Acer negundo**, L. Columbia county, H 326.
194. **Dodonæa viscosa**, Jacq., var. **spathulata**, Benth. Indian River, C 485; Sanibel Is., W 191; Long Key, S 308.
195. **Cardiospermum halicacabum**, L. E. Fla., C 489; Key Largo, C 5640 (a robust pubescent form), P 156.
196. **Cardiospermum microcarpum**, HBK. Eustis, N 378; H 327; Palmetto, N 2457.
197. **Sapindus saponaria**, L. Cape Sable, C 487*; Key Largo, P 186.
198. **Sapindus manatensis**, Radelk. ——, S 50.
199. **Exothea oblongifolia**, Macf. Miami, C 5848; Hillsboro River, C 487; No Name Key, S 180.

200. **Hypelate trifoliata**, Sw. Upper Metacumbe Key, C 486.
201. **Æsculus pavia**, L. River Junction, N 2338, C 494; Jefferson county, H 328.

POLYGALACEAE.

202. **Polygala grandiflora**, Walt. Suwanee county, H 123; Alachua county, H 126; Eustis, N 1347, H 127; Hernando county, H 124; Tampa, R 1137; Cocoanutgrove, H 125; No Name Key, P 115.
203. Var. **angustifolia**, T. & G. Jefferson county, H 129, 131; Lake City, R 300, H 130; Duval county, C 513; N. Fla., H 128; Polk county, R 278, 1432; Palm Beach, H 132; ——, S.
204. **Polygala polygama**, Walt. Clear Water, R 434; Eustis, N 204.
205. **Polygala boykini**, Nutt. Chattahoochee, C 605, 5871; Hernando, H 121; ——, S.
206. **Polygala incarnata**, L. Madison county, H 113; Lake City, R 1277, 1322 in part; Duval county, C 515; Clear Water, R 435; Levy county, H 111; Eustis, N 512; Hernando county, H 112; New River, H 110.
207. **Polygala leptostachys**, Shuttl. Madison county, H 107, 108; Alachua county, H 109.
208. **Polygala verticillata**, L. Titusville, N 2307.
209. **Polygala setacea**, Michx. Suwanee county, H 103; Lake City, H 104; Falling Creek, R 1280; Duval county, C; Eustis, N 790, H 102; Polk county, R 280, 1430; Hernando county, H 106; New River, H 105.
210. **Polygala chapmanii**, T. & G. De Funiak, C 5907; Walton county, C 508; N. Fla., H 120.
211. **Polygala cruciata**, L. Duval county, C 509, R 292; Hernando county, H 114; Polk county, R 279, 1434.
212. **Polygala nana**, DC. Lake City, R 290, 1271; Duval county, C; Eustis, N 1778; Hernando county, H 101; Polk county, R 282, 1338.
213. **Polygala lutea**, L. Jefferson county, H 98; Lake City, R 284, 291, H 97; Eustis, N 532, H 100; Hernando county, H 99.
214. **Polygala rugelii**, Shuttl. Eustis, N 1032, 1912, H 122; Tavares, R 286, 288; Polk county, R 281, 1436; Jupiter, C 5555; Mosquito Lagoon, C 522**; ——, S.
215. **Polygala cymosa**, Walt. Jefferson county, H 118; Lake City R 993; Duval county, C, R 289; Eustis, N 1017, H 116; Levy county, H 119; Hernando county, H 117; Polk county, R 283, 1336.
216. **Polygala ramosa**, Ell. Lake City, R 287; Glen St. Mary, R 632; Baldwin, R 285; N. Fla., H 115; Eustis, N 585.
217. **Polygala baldwini**, Nutt. Duval county, C; Eustis, N 1179.

LEGUMINOSAE.

218. **Crotalaria sagittalis**, L. Suwanee county, H 398; Lake City, R 1169; Eustis, N 805, H 396.
219. **Crotalaria ovalis**, Pursh. Tallahassee, N 2325; Lake City, R 650, 637, 117, H 409; Duval county, C 562; Jefferson county, H 406; Madison county, H 407; Polk county, R 119; Eustis, H 395; Lemon City, H 408.
220. **Crotalaria purshii**, DC. Eustis, W 400, N 287, H 399, 400, 401, 402; Levy county, H 404; Citrus county, H 405; Hernando county, H 403; Polk county, R 86.
221. **Crotalaria pumila**, Ortega. Indian River, C 533*; Palm Beach, C 5361, W 233, H 391, 392.
222. **Crotalaria incana**, L. Lake City, R 101; Indian River, C 530*; Palm Beach, H 394; Lemon City, H 393; Miami, P 273; Cape Florida, C 5476.

223. **Lupinus villosus,** Willd. Lake City, R 118.
224. **Lupinus diffusus,** Nutt. Madison county, H 471; Lake City, R 110; Eustis, N 42; Eau Gallie, C 5832; Citrus county, H 472; Polk county, R 91, 1400; Cape Canaveral, C 530.
225. **Medicago denticulata,** Willd. Pensacola, R 490.
226. **Medicago sativa,** L. Pensacola, R 102.
227. **Melilotus officinalis,** Willd. Pensacola, R 493.
228. **Trifolium tomentosum,** L. Pensacola, R 1162. Probably a ballast plant.
229. **Trifolium reflexum,** L. Madison county, H 544; Polk county, R 80.
230. **Trifolium repens,** L. Eustis, H 545.
231. **Trifolium carolinianum,** Michx. Chattahoochee, C 542; Lake City, R 1159.
232. **Psoralea virgata,** Nutt. Glen St. Mary, R 631; Duval county, C (1876).
233. **Psoralea canescens,** Michx. Madison county, H 488; Lake City, R 218; Duval county, C 557; Eustis, N 695, H 489, 490; Hernando county, H 491.
234. **Psoralea lupinellus,** Michx. Madison county, H 487; Duval county, C 5419; Eustis, N 634.
235. **Petalostemon corymbosus,** Michx. Lake City, R 351, 369, 315, H 478; New River, H 477.
236. **Petalostemon gracilis,** Nutt. Lake City, R 105; Lemon City, W 270.
237. **Petalostemon carneus,** Michx. Duval county, C 568, N 2251; Citrus county, H 475; Manatee, S; Miami, P 255.
238. **Petalostemon feayi,** Chapm. Carabelle, C 5880; Eustis, N 1523, H 476; Palm Beach, H 480; Mosquito Lagoon, C 568.
239. **Dalea domingensis,** DC. Palm Beach, C 5374; Cocoanutgrove, H 410.
240. **Amorpha virgata,** Small. Eustis, N 261, H 352.
241. **Amorpha fruticosa,** L. Duval county, C 572; Levy county, H 351; Palm Beach, H 350.
242. **Amorpha herbacea,** Walt. Sumter county, C 573; Eustis, H 348; Hernando county, H 349.
243. **Wistaria frutescens,** DC. Suwanee county, H 550.
244. **Tephrosia virginiana,** Pers. Eustis, N 1072, H 526.
245. **Tephrosia spicata,** T. & G. Jefferson county, H 528, 529; Madison county, H 534; Suwanee county, H 533; Lake City, R 115, 1163, 1318, H 531; Eustis, N 754, H 527; Alachua county, H 530, R 1166; Levy county, H 532.
246. **Tephrosia hispidula,** Pursh. Madison county, H 538; Lake City, R 1168, H 539; Duval county C, 5682; Eustis, N 804.
247. **Tephrosia floridana,** Vail. Eustis, N 1552, H 543.
248. **Tephrosia chrysophylla,** Pursh. Madison county, H 541; Alachua county, H 542; Eustis, N 811, H 540; Tampa, R 1155.
249. **Tephrosia ambigua,** Curt. Suwanee county, H 536; Madison county, H 537; Lake county, R 74, N 819, 1555, H 535; Lake City, R 1158.
250. **Tephrosia leptostachya,** DC. Jupiter Inlet, C 5561; Cape Malabar, C 584*.
251. **Tephrosia angustissima,** Shuttl. Eau Gallie, C 584, 5708.
*252. **Indigofera caroliniana,** Walt. Jefferson county, H 464; Alachua county, H 463; Eustis, N 810, H 461, 462; Polk county, R 89, 1429.
253. **Indigofera miniata,** Ort. Miami, P 217; Cutler, C 5475; Key Largo, C 586.

254. **Indigofera tinctoria**, L. Halifax River, C 587; Palm Beach, H 459; Lemon City, H 460.

255. **Sesbania vesicaria**, Ell. Lake City, R 83, H 518; E. Fla., H 516; Eustis, N 709, 1724, H 515; Indian River, C 589*; Tampa, R 1152, N 2415; Manatee, S 107.

256. **Sesbania macrocarpa**, Muhl. Upper St. Johns River, C 590; Tampa, N 2478.

257. **Sesbania punicea**, Benth. Pensacola, C 590**; Apalachicola, C 590*, 5884; Milton, R 669.

258. **Astragalus obcordatus**, Ell. Duval county, C 597; Citrus county, H 354; Eustis, N 307.

259. **Astragalus villosus**, Michx. Lake City, R 645.

260. **Vicia acutifolia**, Ell. Duval county, C 647; Eustis, N 917, H 547; Tavares, R 111; Hernando county, H 546; Tampa, R 922; Manatee, S.

261. **Vicia floridana**, Wats. Duval county, C 647*.

262. **Æschynomene hispida**, Willd. Suwanee county, H 344; Lake City, H 345; Eustis, N 1054, H 346, 347.

263. **Æschynomene viscidula**, Michx. Lake City, R 104, H 343; Duval county, C 607; Eustis, N 593, H 341, 342; Archer, R 1167.

264. **Zornia tetraphylla**, Michx. Lake City, R 107; Eau Gallie, C 5766; Indian River, C 610; Citrus county, H 551; Eustis, N 912, H 552; ——, S.

265. **Stylosanthes elatior**, Sw. Jefferson county, H 523; Madison county, H 524; Lake City, H 522, R 1161; Eustis, N 1309, H 525.

266. **Chapmania floridana**, T. & G. Levy county, H 386; Haines City, C 5955; Sumterville, C 608; Eustis, N 384, 1769, H 387, 388; Tavares, R 76; Polk county, R 92, 1392.

267. **Lespedeza repens**, Bart. Jefferson county, H 465.

268. **Lespedeza striata**, H. & A. Lake City, R 108, 77, 97, 1360; Duval county, C 5810; Alachua county, H 469.

269. **Lespedeza hirta**, Ell. Suwanee county, H 467; Lake City, H 466; Duval county, C 639, 5780; Archer, R 84.

270. **Lespedeza intermedia**, Britt. Lake City, R 98; Duval county, C 5781, 636*a*.

271. **Lespedeza angustifolia**, Ell. Lake City, H 468; Duval county, C 640*a*, 5782.

272. **Desmodium pauciflorum**, Nutt. Apalachicola, C 627; Chattahoochee, C 6002.

273. **Desmodium nudiflorum**, DC. Lake City, R 106, H 411.

274. **Desmodium canescens**, DC. Lake City, H 413; Polk county, R 1439 in part, 1413.

275. **Desmodium tortuosum**, DC. Jefferson county, H 423; Suwanee county, H 419; Columbia county, H 422; Lake City, R 81, 95; Duval county, C 623; Eustis, N 495, H 420; Lemon City, H 421.

276. **Desmodium dillenii**, Darl. Lake City, R 100.

277. **Desmodium paniculatum**, DC., var. **chapmani**, Britt. Duval county, C 6011.

278. **Desmodium strictum**, DC. Lake City, H 412; Duval county, C 631, 5793.

279. **Desmodium lineatum**, DC., var. **polymorphum**, Gray. Duval county, C 621*, 5798.

280. **Desmodium rhombifolium**, DC. Suwanee county, H 417; Madison county, H 416; Lake City, H 418; Eustis, H 414; Eau Gallie, C 5717; Polk county, R 88 in part, 1439; Palm Beach, H 415.

281. **Desmodium triflorum**, DC. Tampa, C 632*; Meyers, R 602.
282. **Rhynchosia minima**, DC. Duval county, C 656; Lemon City, H 507; Miami, P 219; No Name Key, P 113; ——, S.
283. **Rhynchosia parvifolia**, DC. ——, S.
284. **Rhynchosia menispermoides**, DC. Levy county, H 505; Sanford, N 2314; Miami, P 220, C 5857; Tampa, C 659, R 1146.
285. **Rhynchosia tomentosa**, H. & A. Madison county, H 499; Suwanee county, H 498; Lake City, R 109, 113; Duval county, C 660 in part; Polk county, R 93.
286. **Rhynchosia cinerea**, Nash. Eustis, N 1336, 1852, H 503; Tavares, R 73; Polk county, R 93, 1399; Pelican Key, S 293.
287. **Rhynchosia erecta**, DC. Suwanee county, H 497; Madison county, H 496; Columbia county, H 495; Lake City, R 115, H 493, 494; Eustis, N 962, H 492, 503; Duval county, C 660, 5797; Levy county, H 501. This specimen is erect and bushy branched, lower leaves unifoliate, upper trifoliate, clusters axillary.
288. **Rhynchosia reniformis**, DC. Columbia county, H 504; Duval county, C 660 in part; Eustis, H 502; Polk county, R 93 in part.
289. **Rhynchosia galactioides**, Endl. Walton county, C 661, 5900, R 677; Lake City, R 1240.
290. **Apios tuberosa**, Moench. Lake City, H 353; Duval county, C 662; Eustis, N 702.
291. **Phaseolus perennis**, Walt. Duval county, C (1876).
292. **Phaseolus sinuatus**, Nutt. Madison county, H 481; Duval county, C 5796; Indian River, C 664; Hernando county, H 482.
293. **Phaseolus helvolus**, L. Duval county, C 666, 5764.
294. **Phaseolus umbellatus**, Britt. Bellair, N 2548; Duval county, C 5788.
295. **Phaseolus smilacifolius**, Poll. Lake City, N 2505, H 483.
296. **Phaseolus lunatus**, L. Manatee, S 333; Sugar Loaf Key, P 42.
297. **Vigna luteola**, Benth. Indian River, C 668; Daytonia, W 506; Titusville, N 2296; Palm Beach, H 548, 549; Cutler, C 5174; Long Key, S 306; Eau Gallie, C 5770 (var. *angustifolia*): ——, S.
298. **Cajanus indicus**, Spreng. Jensen, R 953; Elliott's Key, Swingle; Sugar Loaf Key, P 39.
299. **Erythrina herbacea**, L. Jefferson county, H 430; Lake City, R 120, H 432; Eustis, N 175, 1468, H 431; Palm Beach, H 433; Daytonia, W 458; Miami, P 227.
300. **Clitoria mariana**, L. Duval county, C 670; Eustis, N 956, H 389; Levy county, H 390; Polk county, R 87.
301. **Centrosema virginiana**, Benth. Jefferson county, H 377; Madison county, H 378; Suwanee county, H 382; Duval county, C 671; Eustis, H 383; Lake City, R 1165; ——, R 1161. The following are var. *angustifolia:* Eustis, H 380; Suwanee county, H 381; Lake City, R 1160, 1156, H 379.
302. **Amphicarpaea monoica**, Nutt. Lake City, R 103.
303. **Galactia erecta**, Vail. Walton county, C 680.
304. **Galactia cubensis**, HBK. Cape Romano, S 267; Upper Metacumbe Key, C 674*, 5642; Ragged Keys, W 322.
305. **Galactia pilosa**, Ell. Tallahassee, N 2347; Jefferson county, H 439; Madison county, H 452; Suwanee county, H 453; Lake City, R 114, 991, H 440, 441, 447; Alachua county, H 443, 446, 450; Marion county, H 445; Citrus county, H 444; Eustis, H 449; Hernando county, H 442;

Jupiter, C 5557; Palm Beach, H 448. One group of specimens has thin leaves, and slender, nearly glabrous inflorescence, and young shoots. The other group has thick reticulated leaves, and inflorescence, and young shoots densely pubescent, the former not so slender.

306. Var. **angustifolia**, T. & G. Citrus county, H 454; Cocoanutgrove, H 455.

307. **Galactia mollis**, Michx. Suwanee county, H 436; Lake City, H 435; Eustis, N 919.

308. **Galactia floridana**, T. & G. Alachua county, H 434 (small-leaved form); Tampa, N 2474; Key Largo, P 179; Boca Chica Key, P 108.

309. **Galactia fasciculata**, Vail. Tampa, N 2480.

310. **Galactia glabella**, Michx. Columbia county, H 451; Duval county, C 678; Eustis, N 542, 1091, H 437, 438; Merritt's Is., C 5727; Daytonia, W 476.

311. **Galactia elliottii**, Nutt. Duval county, C 681, 5661; Lake City, R 112; Eustis, H 456, 457; Tavares, R 75; Polk county, R 90, 1407.

312. **Canavalia obtusifolia**, DC. Indian River, C 682; Palm Beach, W 425, H 361, C 5522; Coon Key, S 255; Sugar Loaf Key, P 71.

313. **Piscidia erythrina**, L. Key West, C 5656; Elliott's Key, W 312; White Horse Key, S 234; Ramrod Key and Jewfish Key, C 685.

314. **Ecastophyllum brownei**, Pers. Indian River and Lake Worth, C 705*, 5391; Palm Beach, H 425, 426, 427, 429; New River, H 428; Lemon City, W 295; Old Rhodes Key, C No. C; ——, S.

315. **Baptisia lanceolata**, Ell. De Funiak, R 671; Lake City, R 85. Apalachicola, C 689.

316. **Baptisia lecontei**, T. & G. De Funiak, R 676; Columbia county, H 355; Duval county, C 694; Citrus county, H 356; Hernando county, H 357.

317. **Baptisia calycosa**, Canby. Walton county, C 699*, 5899.

318. **Baptisia leucantha**, T. & G. Jefferson county, H 358.

319. **Sophora tomentosa**, L. Indian river, C 704; Merritt's Is., C 5721; Tampa, R 1112; Lemon City, H 519, 520, 521, W 289; ——, S.

320. **Cercis canadensis**, L. Jefferson county, H 385; Lake City, H 384.

321. **Tamarindus indica**, L. Key West, S 348; Sugar Loaf Key, P 68. Escaped.

322. **Cassia occidentalis**, L. Madison county, H 362; Lake City, H 363; Eustis, N 1726.

323. **Cassia tora**, L. Madison county, H 364; Lake City, N 2230, R 82, H 365.

324. **Cassia ligustrina**, L. Clear Water, R 99; Eustis, N 1720; Jupiter, C 5544.

325. **Cassia bahamensis**, Mill. Miami, P 243; No Name Key, C 709, 5630; Sugar Loaf Key, P 72.

326. **Cassia chamaecrista**, L. Suwanee county, H 368; Duval county, C 711; Alachua county, H 367; Eustis, N 701, H 366; Miami, P 245.

327. **Cassia aspera**, Michx. Lake City, R 96; Levy county, H 371; Eustis, N 1717; Palm Beach, H 370; New River, H 369.

328. **Cassia depressa**, Poll. River Junction, N 2571, C 5980; Lake City, H 372.

329. **Cassia grammica**, Spreng. No Name Key, C 5510, S 194.

330. **Cassia simpsoni**, Poll. No Name Key, P 110; ——, S.

331. **Cassia multipinnata**, var. **nashii**, Poll. River Junction, N 2577; Jefferson county, H 373; Palm Beach, H 374; New River, H 375.

332. **Krameria lanceolata**, Torr. Walton county, C 527; Eustis, N 405, H 133, 134, 135; Hernando county, H 136; Polk county R 726.

333. **Gleditschia triacanthos,** L. Suwanee county, H 458; Kissimee, R 1359, in part.
334. **Caesalpinia pauciflora,** B. & H. Big Pine Key, C No. D.
335. **Caesalpinia bonduc,** B. & H. Indian River, C 713; Palm Beach, H 359, 360, W 265; Raccoon Key, P 102.
336. **Parkinsonia aculeata,** L. Key West, C 712 A.
337. **Mimosa strigillosa,** T. & G. Eau Gallie, C 717, 5704; Eustis, N 687, H 474; Levy county, H 473.
338. **Schrankia floridana,** Chapm. Suwanee county, H 508; Eustis, N 1838.
339. **Schrankia angustata,** T. & G. Jefferson county, H 510; Lake City, H 513; Duval county, C 719; Levy county, H 511; Citrus county, H 512; Eustis, N 483, H 514.
340. **Schrankia horridula,** Chapm. De Funiak, R 236; Suwanee, H 509.
341. **Pithecolobium unguis-cati,** Benth. Palm Beach, W 226, H 484, 485, 486; Miami, R 942; Sugar Loaf Key, P 53; Meyers, W 200; Key West, C 5614; Ragged Key, W 313; Key Largo, C 720; Biscayne Key, W 268; Sanibel Is., S 300.
342. **Pithecolobium guadalupense,** Chapm. Bahia Honda Key, C 721.
343. **Leucaena glauca,** Benth. Miami, H 470; Key West, C 716*b*, S 351.
344. **Acacia farnesiana,** Willd. Sanibel Is., S 297; Pensacola, R 1157; Key West, C 716*, P 5; Boca Chica Key, P 107; Cudjoe Key, P 91.
345. **Lysiloma latisiliqua,** Benth. Boca Chica Key, C 716*a*; Key Largo, P 154.
346. **Desmanthus virgatus,** Willd. Little Pine Key, C 725.
347. **Neptunia floridana,** Small. Eustis, N 686; Sarasota Bay, S; Miami, C 5850; Biscayne Bay, C 726.

CALYCANTHACEAE.

348. **Calycanthus laevigatus,** Willd. Kissimee, R 1359. It is doubtful if this is indigenous in this region.

ROSACEAE.

349. **Chrysobalanus oblongifolius,** Michx. Madison county, H 577; Lake City, R 1363, H 578; Eustis, R 210, N 734, H 575; Eau Gallie, C 5779; Indian River, C 727; Glen St. Mary, R 631; Polk county, R 13; Clearwater, R 380; Lemon City, H 576.
350. **Chrysobalanus icaco,** L. Indian River, C 728; Palm Beach, H 579; New River, C 5815; Miami, P 247; S. Fla., Swingle; ——, S.
351. **Prunus umbellata,** Ell. Jefferson county, H 563, 564; Columbia county, H 561; Lake City, R 624, 1268, H 562; Duval county, C 731, 5603; Eustis, N 1174, H 560.
352. **Prunus serotina,** Ehrh. Jefferson county, H 557; Lake City, H 559; Eustis, H 558; ——, N (label lost).
353. **Prunus caroliniana,** Ait. River Junction, N 2375; Duval county, C 738.
354. **Prunus sphaerocarpa,** Sw. East of Everglades, C 738*.
355. **Agrimonia hirsuta,** Bickn. Lake City, R 18.
356. **Agrimonia microcarpa,** Wallr. River Junction, N 2395; Lake City, R 1326, H 593; Citrus county, H 594; ——, R 410.
357. **Agrimonia incisa,** T. & G. Madison county, H 587; Lake City, R 19; Duval county, C 5753.
358. **Fragaria indica,** Andr. Jackson county, C 780.

358. **Rubus villosus**, Ait. Jefferson county, H 580; Columbia county, H 581; Lake City, H 582.
360. **Rubus cuneifolius**, Pursh. Jefferson county, H 586; Lake City, R 11, H 584; Duval county, C 791; E. Fla., H 583; Eustis, H 585.
361. **Rubus trivialis**, Michx. Lake City, R 10, 12, 655, 1064.
362. **Rosa carolina**, L. Columbia county, H 555; Lake City, R 14, H 553; Duval county, C 794; Eustis, N 1695, H 554.
363. **Rosa rubiginosa**, L. Levy county, H 556. Well established.
364. **Rosa laevigata**, Michx. Duval county, C 798.
365. **Crataegus spathulata**, Michx. River Junction, N 2380, C 802, 5989.
366. **Crataegus apiifolia**, Michx. Apalachicola River, C 806; River Junction, N 2396, C 5983; Hernando county, H 565.
367. **Crataegus arborescens**, Ell. Chattahoochee, E 5997; Ellaville, R 1083; Columbia county, H 566.
368. **Crataegus rotundifolia**, Borck. River Junction, N 2379; Quincy, N 2568; Jefferson county, H 572; Lake City, H 571.
369. **Crataegus flava**, Ait., var. **integra**, Nash. Eustis, N 1142, 1974, H 567; Hernando county, H 568.
370. **Crataegus glandulosa**, Michx. River Junction, C 5982; Madison county, H 573; Lake City, R 9, 569, 1265 in part; Duval county, C 811; Gainesville, C 811*.
371. **Crataegus parvifolia**, Ait. Lake City, R 8, N 2172, H 570.
372. **Pyrus angustifolia**, Ait. Tallahassee, N 2366; Jefferson county, H 588.
373. **Pyrus arbutifolia**, L., var. **erythrocarpa**, Chapm. Jefferson county, H 592; Lake City, R 17, 640, 1356, H 590; Duval county, C 815*; Eustis, W 374, H 589; Hernando county, H 591.

SAXIFRAGACEAE.

374. **Itea virginica**, L. Columbia county, H 598; Duval county, C 831; Eustis, N 304, H 597.
375. **Hydrangea radiata**, Walt. Curtiss (1875).
376. **Hydrangea quercifolia**, Bartr. Aspalaga, C 833.
377. **Decumaria barbata**, L. Tallahassee, N 2354; Columbia county, H 596; Lake City, R 4, H 595; Duval county, C 835.

CRASSULACEAE.

378. **Penthorum sedoides**, L. Tallahassee, N 2352.
379. **Bryophyllum calycinum**, Salisb. Key West, C 877*. Spontaneous near dwellings.

DROSERACEAE.

380. **Drosera intermedia**, D. & H. Eustis, N 538; Polk county, R 56.
381. **Drosera capillaris**, Poir. Lake City, R 54, 55, 1062; Eustis, N 948, 465, H 600; Levy county, C 599.
382. **Drosera brevifolia**, Pursh. Duval county, C (1876).

HAMAMELACEAE.

383. **Hamamelis virginica**, L. River Junction, N 2385; Jefferson county, H 605; Lake City, R 3, 547, 1088, 1352, H 602.
384. **Liquidambar styraciflua**, L. Jefferson county, H 604; Lake City, R 2, H 601; Eustis, N 860, H 603.

RHIZOPHORACEAE.

385. **Rhizophora mangle**, L. Palm Beach, H 613; Lemon City, H 612; Indian River, C 942; Miami, R 941; Tampa, R 72; Palmetto, N 2442; Torch Key, C 5438; Mangrove Key, P 16; ——, Swingle; ——, S 299.

COMBRETACEAE.

386. **Laguncularia racemosa**, Gaertn. Merritt's Is., C 943; Palm Beach, H 614: Manatee, S; Indian River and Biscayne Bay, C 5180; Ragged Key, W 272.

387. **Conocarpus erecta**, Jacq. Merritt's Is., C 945, 945*; Palm Beach, Swingle, H 615, 616, 617; Miami, C 5470; Ragged Key, W 331; Key West, P 14; ——, Swingle.

388. Var. **sericea**, DC. Tampa, S; Meyers, W 194; Saddlebunch Key, P 21.

389. **Terminalia catappa**, L. Boca Chica Key, C 946, 5627. Probably not wild in Florida.

390. **Terminalia buceras**, B. & H. Elliott's Key, C 946*, 5151.

MYRTACEAE.

391. **Eugenia dichotoma**, DC. E. Fla., C 982; ——, S.

392. **Eugenia confusa**, DC. Elliott's Key, C 983; Key West, C 5626.

393. **Eugenia garberi**, Sarg. Miami, C 5841.

394. **Eugenia longipes**, Berg. No Name Key, C No. E, S.

395. **Eugenia axillaris**, Willd. Indian River, C 984; Palm Beach, Swingle 120, H 619; New River, H 620; Charlotte Harbor, W 165; Tampa, S; Meyers, W 197; Key Largo, C 5455; Panther Key, S 259, berries too large for this species.

396. **Eugenia buxifolia**, Willd. Indian River, C 985; Miami, C 5461; ——, Garber (1877).

397. **Calyptranthes chytraculia**, Sw. Elliott's Key, C 5152; Big Pine Key, S 149; Key Largo, P 163.

398. **Psidium guayava**, Raddi. Cocoanutgrove, H 618; Indian River, C 987*. "Spontaneous in old fields."

MELASTOMACEAE.

399. **Rhexia mariana**, L. Jefferson county, H 630, 632; Lake City, H 633; Duval county, C 5754; Eustis, N 863, H 634; Hernando county, H 631.

400. **Rhexia lanceolata**, Walt. Lake City, H 636; Duval county, C 935; Eustis, N 623, H 638; Citrus county, H 637; Polk county, R 1377.

401. **Rhexia floridana**, Nash. Eustis, N 1218; Hernando county, H 635.

402. **Rhexia stricta**, Pursh. Jefferson county, H 628, 629; Duval county, N 2317.

403. **Rhexia glabella**, Michx. De Funiak, R 179; Jefferson county, H 627; Lake City, R 1321, 1322; Duval county, C 5695, R 505, N 2245.

404. **Rhexia ciliosa**, Michx. Lake City, R 975, H 625; Duval county, C 939, 5689; Eustis, H 622; Marion county, H 624; Citrus county, H 623; Hernando county, H 626.

405. **Rhexia serrulata**, Nutt. Lake City, R 500; Duval county, C 940; Eustis, H 621.

406. **Rhexia lutea**, Walt. Glen St. Mary, R 634.

LYTHRACEAE.

407. **Ammannia latifolia**, L. Titusville, N 2288; Indian River, C 949; Palm Beach, H 639, 640; Key Largo, P 183.

408. **Ammannia humilis**, Michx. De Funiak, C 5901; Lake City, R 204; Indian River, C 947.

409. **Lythrum alatum**, Pursh. Duval county, C 953; Eustis, H 641, N 1217.

410. **Lythrum flagellare**, Shuttl. Citrus county, H 642; ——, S.

411. **Lythrum lineare**, L. Palm Beach, H 643.

412. **Nessaea verticillata**, HBK. Lake City, H 644.

HALORAGEAE.

413. **Proserpinaca palustris,** L. Jefferson county, H 606; Duval county, C 889.
414. **Proserpinaca pectinacea,** Lam. Jefferson county, H 608; Duval county, C 890: Lake City, R 132; Eustis, N 1039, H 609; Polk county, R 124, 1427; New River, H 607.
415. **Myriophyllum heterophyllum,** Michx. Lake City, R 125, H 611.
416. **Myriophyllum scabratum,** Michx. Eustis, H 610.

ONAGRACEAE.

417. **Gaura angustifolia,** Michx. Jefferson county, H 670; Lake City, R 212, H 673; Alachua county, H 672; Eustis, H 671, N 1464; Clear Water, R 451.
418. **Gaura filipes,** Spach. River Junction, N 2578, C 6003.
419. **Oenothera biennis,** L. Madison county, H 671; Lake City, R 122, H 670, 672.
420. **Oenothera humifusa,** Nutt. Eau Gallie, C 5720; Sea Breeze, W 508; E. Fla., C 905*; Palm Beach, W 419, H 673; ——, S 31.
421. **Oenothera sinuata,** L. Jefferson county, H 675; Lake City, R 133, 651; Alachua county, H 676; Eustis, N 225, H 674.
422. **Oenothera fruticosa,** L. Jefferson county, H 677.
423. **Oenothera linearis,** Michx. Aspalaga, C 909; Tallahassee, R 123.
424. **Jussiaea leptocarpa,** Nutt. Tallahassee, N 2401; Madison county, H 678; Lake City, R 127; Duval county, C 914, R 134; Eustis, N 355, H 679; Caloosa River, C 915*.
425. **Jussiaea peruviana,** L. Eustis, N 735; Tavares, R 121.
426. **Jussiaea suffruticosa,** L. Pensacola, C 5918.
427. **Jussiaea decurrens,** DC. River Junction, C 5985; Tallahassce, N 2400.
428. **Ludwigia alternifolia,** L. Tallahassee, N 2349.
429. **Ludwigia virgata,** Michx. Jefferson county, H 645; Lake City, R 219, H 648; Duval county, C 918, 919; Eustis, N 750; H 647; Sanford, R; Tavares, R 1324; Polk county, R 253; New River, H 646; Tampa, R 1141.
430. **Ludwigia hirtella,** Raf. Walton county, C 920.
431. **Ludwigia linearis,** Walt. Lake City, R 257; St. Mark's, N 2540; McClenny, C 6007; E. Fla., H 650.
432. **Ludwigia linifolia,** Poir. Duval county, C 922; Eustis, N 1210; Hernando county, H 649.
433. **Ludwigia cylindrica,** Ell. River Junction, N 2390; Jefferson county, H 651.
434. **Ludwigia pilosa,** Walt. Lake City, R 129, 259, N 2191, H 652; Eustis, N 1041.
435. **Ludwigia sphaerocarpa,** Ell. Washington county, C 925.
436. **Ludwigia capitata,** Michx. Madison county, H 656, Lake City, R 126, 978, H 658: Eau Gallie, C 927; Levy county, H 657; Eustis, N 950, H 653, 654, 655; Polk county, R 130, 1424; Tavares, R 232; Manatee, S 115.
437. **Ludwigia alata,** Ell. Duval county, C 929; Turkey Hammock, S 114; Lake City, N 2502; Palm Beach, H 659; Clear Water, R 592; ——, S.
438. **Ludwiga microcarpa,** Michx. Duval county, C 930; Alachua county, H 663; Citrus county, H 664; Sanford, N 2278; Eustis, N 2136; Jupiter, C 5515; Palm Beach, H 662; New River, H 660, 661.

439. **Ludwigia palustris**, Ell. Eustis, N 1207.
440. **Ludwigia natans**, Ell. Duval county, C 933.
441. **Ludwigia arcuata**, Walt. Jefferson county, N 2509, H 667; Lake City, R 128, 131, H 666, 669; Levy county, H 668; Eustis, N 607, H 665; Tampa, C 934. N 2509 and H 669 were floating in deep water.

LOASACEAE.

442. **Mentzelia floridana**, Nutt. Lake City, R 1366; Duval county, C 959; Palm Beach, W 255, H 674, 675, 676, 677; Miami, C 5842.

TURNERACEAE.

443. **Piriqueta caroliniana**, Urb. Jefferson county, H 679; Lake City, R 135, 137, 556; Duval county, C 960; Eustis, N 903, H 678; Polk county, R 136; La Costa Is., S 322; Miami, P 250; Levy county, H 680.
444. Var. **glabra**, Urb. Eustis, N 830; Cocoanutgrove, H 681.
445. **Turnera ulmifolia**, L. Key West, C 5657. Escaped.

PASSIFLORACEAE.

446. **Passiflora incarnata**, L. Jefferson county, H 683; Madison county, H 684; Lake City, H 686; Duval county, C 5681; Eustis, N 414, H 681.
447. **Passiflora lutea**, L. Lake City, R 1345; Citrus county, H 687; Clear Water, R 426.
448. **Passiflora suberosa**, L. Duval county, C 973; Ten Thousand Islands, S 260; Upper Metacumbe Key, C 5641.
449. **Passiflora angustifolia**, Sw. Palm Beach, W 225, H 688; Cape Malabar, C 974; Key Largo, P 158.
450. **Passiflora multiflora**, L. Upper Metacumbe Key, S 494; Key Largo, P 181.
451. **Carica papaya**, L. Palm Beach, C 5531, H 682; Miami, R 934; Hillsboro River, C 976; Turkey Hammock, S; Sugar Loaf Key, P 28.

CUCURBITACEAE.

452. **Melothria pendula**, L. Madison county, H 695; Eustis, N 1277; Palm Beach, H 690; Hernando county, H 694; Lake City, H 696.
453. **Melothria nashii**, Small. Palm Beach, H 691, 692; Miami, P 216; Tampa, N 2469; ——, Bates.
454. **Melothria crassifolia**, Small. Duval county, C 5738; Eustis, N 865, H 693.
455. **Momordica charantia**, L. Lake City, H 689. Escaped.
456. **Lagenaria vulgaris**, Ser. Levy county, H 697. Naturalized around ponds in high pine woods.

BEGONIACEAE.

457. **Begonia.** An undetermined species is well established around Lake City, N 2481, H 698.

CACTACEAE.

458. **Opuntia vulgaris**, Mill. Madison county, H 701; Lake City, H 703.
459. **Opuntia rafinesquii**, Engelm. Jensen, R 951; Eustis, N 1867, H 702.

UMBELLIFERAE.

460. **Hydrocotyle bonariensis**, Lam. Pensacola, C 5922.
461. **Hydrocotyle umbellata**, L. Jefferson county, H 719; Lake City, R 146, 1072, 1361, H 717; Duval county, C 991, 5676; Eustis, N 351, H 715; Levy county, H 718; Palm Beach, H 716.
462. **Hydrocotyle ranunculoides**, L. Apalachicola, C 5888.
463. **Hydrocotyle interrupta**, Muhl. Columbia county, H 723; Lake City, N 2485; Palm Beach, C 5376.

464. **Hydrocotyle repanda**, Pers. Suwanee county, H 720; Lake City, H 721; Duval county, C 988; Eustis, N 587, H 722.
465. **Crantzia lineata**, Nutt. Duval county, C 993.
466. **Sanicula canadensis**, L. Tallahassee, N 2362; Madison county, H 731; Lake City, R 214, N 2244, H 730; Duval county, C 994.
467. **Eryngium yuccaefolium**, Michx., var. **synchaetum**, Gray. Madison county, H 712; Lake City, R 138, H 713; Eustis, N 1487; Hernando county, H 714.
468. **Eryngium virgatum**, Lam. Walton county, C 1000; River Junction, N 2573; St. Mark's, N 2539; McClenny, C 6008.
469. **Eryngium ravenelii**, Gray. St. Mark's, N 2537.
470. **Eryngium mettauri**, Wood. Duval county, C 998*.
471. **Eryngium aromaticum**, Baldw. Lake City, N 2491, R 141; Hernando county, H 707; New River, H 705, 706, 708.
472. **Eryngium baldwinii**, Spreng. Jefferson county, H 709; Suwanee county, H 710; Lake City, R 139, 142, H 711; Duval county, C 5414; Eustis, N 1874, 545; Indian River, C 1002; Kissimee, R 1355.
473. **Cicuta maculata**, L. Duval county, C 1030, R 144; Eustis, N 1025, H 728.
474. **Apium leptophyllum**, Muell. Duval county, C 1034*.
475. **Leptocaulis divaricatus**, DC. Suwanee county, H 724; Lake City, R 145; Duval county, C 1036; Eustis, N 392.
476. **Discopleura capillacea**, DC. Jefferson county, H 726; Suwanee county, H 727; Lake City, R 1339, H 725; Eustis, N 837; Palm Beach, W 413.
477. **Thaspium pinnatifidum**, Gray. Jackson county, C 1023.
478. **Angelica dentata**, Chapm. Aspalaga, C 1014.
479. **Tiedemannia ternata**, C. & R. Apalachicola, C 1010.
480. **Tiedemannia teretifolia**, DC. Duval county, C 1011, N 2596; Lake City, R 140.
481. **Daucus pusillus**, Michx. Jefferson county, H 729; Lake City, R 143.
482. **Chaerophyllum teinturieri**, H. & A. Duval county, C 1039.
483. **Chaerophyllum sativum**, Lam. Sister Islands, C 1040.

ARALIACEAE.

484. **Aralia spinosa**, L. Madison county, H 746; Lake City, R 220, H 742, 743; Eustis, N 1256, H 744, 745.

CORNACEAE.

485. **Cornus sericea**, L. Tallahassee, N 2517; Hernando county, H 734.
486. **Cornus microcarpa**, Nash. River Junction, N 2589; Lake City, H 733; Eustis, H 732.
487. **Cornus florida**, L. Jefferson county, H 735; Lake City, R 5, N 2159, H 736.
488. **Nyssa caroliniana**, Poir. Tallahassee, R 176; Jefferson county, H 738; Madison, H 739; Lake City, R 172, 171, 6, 972, N 2183; H 740, 741; Duval county, C 1061, 5787; Hernando county, H 737; ——, S 27.
489. **Nyssa capitata**, Walt. McClenny, C 5976.

CAPRIFOLIACEAE.

490. **Sambucus canadensis**, L. Jefferson county, H 748; Lake City, R 937, H 749; Duval county, R 156, C 1032; Eustis, N 377, H 747; Polk county, R 155, 1404.
491. **Viburnum molle**, Mx., var. **tomentosum**, Chapm. River Junction, C 5896, N 2586; Hernando county, H 761.

492. **Viburnum nudum**, L. Jefferson county, H 754; Lake City, R 154, 157, 1069, H 755, 756; Duval county, C 1086; Eustis, N 269, 1016, 1617.

493. **Viburnum prunifolium**, L. Jefferson county, H 753; Lake City, R 154, 158, H 752.

494. **Viburnum obovatum**, Walt. River Junction, N 2593, a large-leaved form; Columbia county, H 757; Lake City, R 153, 971; Duval county, C 5714; E. Fla., C 1087; Marion county, H 758; Eustis, N 1492, H 759; Hernando county, H 760.

495. **Lonicera sempervirens**, Ait. Madison county, H 750; Lake City, R 988; Eustis, N 246; Hernando county, H 751.

496. **Lonicera japonica**, Ait. Duval county, C 5809. "Spontaneous in moist thickets."

RUBIACEAE.

497. **Exostema caribaeum**, R. & S. Upper Metacumbe Key, C 1132, 5505; No Name Key, S 161.

498. **Pinckneya pubens**, Michx. Quincy, C 5877; ——, C 1131.

499. **Houstonia rotundifolia**, Michx. Jefferson county, H 819; Lake City, R 57, 1090, 1340; Eustis, H 820; Levy county, H 818; Sea Breeze, W 500; Palm Beach, H 816; Merritt's Is., Bates; Hernando county, H 817.

500. **Houstonia angustifolia**, Michx. Argyle, C 5933; Levy county, H 821; ——, S.

501. Var. **filifolia**, Gray. Biscayne Bay, C 1137*; Cocoanutgrove, C 5484.

502. **Oldenlandia glomerata**, Michx. Lake City, R 196; Duval county, C 5807; Eustis, N 1282, 782, H 769; Titusville, N 2301; Rockledge, C 5732; Citrus county, H 771; Hernando county, H 770.

503. **Pentodon halei**, Gray. Citrus county, H 801; Inverness, C 5975; E. Fla., C 1135; Eustis, N 1566.

504. **Hamelia patens**, Jacq. Indian River, C 1128; Eustis, N 1278; Cutler, C 5500; Sugar Loaf Key, P 27.

505. **Catesbaea parviflora**, Sw. Bahia Honda Key, C 5633, No. B.

506. **Randia aculeata**, L. Palm Beach, C 5400, W 205, H 800, 801, 802; Lemon City, H 799; S. Fla., Swingle; Charlotte Harbor, W 164; Pavilion Key, S 200; Ragged Keys, W 314; Upper Metacumbe Key, C 1129; Sugar Loaf Key, P 32.

507. **Genipa clusiaefolia**, Griseb. Lemon City, H 796; New Found Harbor Key, P 81; Key Largo, C 5503; Ragged Keys, W 315; Indian Key, S 207; Bahia Honda Key, C 1130.

508. **Cephalanthus occidentalis**, L. Jefferson county, H 811; Lake City, R 202, H 810; Duval county, C 1118; Eustis, N 679, 892, H 808; New River, H 809.

509. **Morinda roioc**, L. Jupiter, C 5548; Lemon City, H 805; Miami, R 945; Caximbas Is., S 264; Sugar Loaf Key, P 70; Upper Metacumbe Key, C 1120.

510. **Guettarda scabra**, Lam. Biscayne Bay, C 5492.

511. **Guettarda elliptica**, Sw. Upper Metacumbe Key, C 1125.

512. **Erithalis fruticosa**, L. Palm Beach, C 5365, W 440, H 803; Big Pine Key, S 334; Lower Metacumbe Key, C 1127.

513. **Chiococca racemosa**, Jacq. Duval county, C 1121; Cape Canaveral, C 5765; Palm Beach, H 812; S. Fla., Swingle; Sugar Loaf Key, P 58.

514. Var. **parvifolia**, Gray. Lemon City, H 813, 815; Cocoanutgrove, W 354, H 814.

515. **Psychotria undata**, Jacq. Palm Beach, C 5380; Lemon City, H 798; Halifax River, C 1121*; Indian Key, S 232; Key Largo, C 5501.

516. **Psychotria tenuifolia**, Sw. Indian River, C 1122; Jupiter, C 5536; Palm Beach, C 1122; Key Largo, P 159.

517. **Strumpfia maritima**, Jacq. Shore of key in Sugar Loaf Sound, C 1124.

518. **Ernodea littoralis**, Sw. Indian River, C 1117; Palm Beach, Swingle, H 767, 768; Sanibel Is., W 193; Boca Chica Key, C 5629; Long Key, S 305; Sugar Loaf Key, P 54.

519. **Mitchella repens**, L. Lake City, R 201, 1070, H 807; Marion county, H 806.

520. **Richardia scabra**, L. Jefferson county, H 763; Lake City, R 194; Duval county, C 1112*a*; Eustis, N 394, W 515, H 764; Citrus county, H 762; Tampa, R 1121.

521. **Richardia brasiliensis**, Gom. Eustis, N 730, 1929, H 765.

522. **Spermacoce glabra**, Michx. Miami, C 1109.

523. **Spermacoce tenuior**, L. Key West, C 1111.

524. **Spermacoce parviflora**, Gray. Levy county, H 773; Eustis, N 208; Indian River, C 1113; Palm Beach, H 772; Polk county, R 199, 1381; Jupiter, C 5549; Cocoanutgrove, H 774; No Name Key, P 122; ——, S 5.

525. **Spermacoce podocephala**, Hemsl. Biscayne Bay, C 1114; Miami, P 225; Cocoanutgrove, C 5481.

526. **Diodia virginiana**, L. Columbia county, H 780; Eustis, N 1275; New River, H 78.

527. **Diodia tetragona**, Walt. Jefferson county, H 782; Lake City, R 197, N 2214, H 783; ——, S.

528. **Diodia hirsuta**, Pursh. Jefferson county, H 776; Lake City, R 195, H 778, 779; Eustis, N 1346, 729, H 775, 777.

529. **Diodia teres**, Walt. Jefferson county, H 786; Duval county, C 1116; E. Fla., H 784; Eustis, N 1587, H 785; Polk county, R 198.

530. **Galium pilosum**, Ait., var. **puncticulosum**, Gray. Jefferson county, H 795; Suwanee county, H 793; Lake City, R 215, H 794; Eustis, N 1383, H 792; Levy county, H 791.

531. **Galium trifidum**, L. Eustis, H 788.

532. **Galium uniflorum**, Michx. Columbia county, H 787; Lake City, R 217.

533. **Galium hispidulum**, Michx. Duval county, C 1096; Eustis, H 789, N 1232; Palm Beach, W 442, H 790.

VALERIANACEAE.

534. **Valeriana scandens**, L. Merritt's Is., C 1142; Columbia county, H 1449.

COMPOSITAE.

535. **Elephantopus tomentosus**, L. Tallahassee, N 2328; Lake City, R 657, 764; Alachua county, H 923; Eustis, N 1657, H 924; New River, H 922; ——, R 412; ——, S.

536. **Vernonia altissima**, Nutt. Columbia county, H 1115; Marion county, H 1116; Eustis, N 944.

537. **Vernonia angustifolia**, Michx. Jefferson county, H 1111; Madison county, H 1114; Lake City, R 355, 1281, 1304, H 1113; Eustis, N 1289, H 1112; Duval county, C 1157.

538. **Sclerolepis verticillata**, Cass. Jefferson county, H 1069; Suwanee county, H 1068.

539. **Ageratum littorale**, Gray. Jewfish Key, C 5146; No Name Key, S 246; Boca Chica Key, C 1163; Key West, P 12.

—9

540. **Hartwrightia floridana,** Gray. McClenny, C 6006.
541. **Mikania scandens,** Willd. Columbia county, H 1036; Lake City, R 312, H 1031; Levy county, H 1034; Eustis, N 867, H 1038; Palm Beach, W 239, H 1032, 1033, 1035, 1037; No Name Key, C 1213*; Upper Metacumbe Key, P 136.
542. **Eupatorium heteroclinum,** Griseb. Lignum Vitæ Key, C 1195*.
543. **Eupatorium conyzoides,** Vahl. Cape Sable, S 215; Key Largo, P 196.
544. **Eupatorium purpureum,** L. Eustis, N 2118.
545. **Eupatorium coronopifolium,** Willd. Columbia county, H 942; Lake City, R 313: Duval county, C 1193; ——, S.
546. **Eupatorium foeniculaceum,** Willd. Lake City, H 946; Duval county, C 1195; Levy county, H 944, Palm Beach, H 943, 945, 947; Miami, P 231.
547. **Eupatorium mikanioides,** Chapm. Indian River, C 1200; Eau Gallie, C 5734; Sanford, N 2279; Hernando county, H 2620; Lemon City, H 948; Palma Sola Bay, S 133.
548. **Eupatorium serotinum,** Michx. Duval county, C 5746; Ormand, W 473; Eustis, N 1565.
549. **Eupatorium album,** L. De Funiak, R 180; Jefferson county, H 949; Suwanee county, H 951; Alachua county, H 950; Lake City, N 2217, R 324, H 952; Duval county, C 1190, 6012.
550. **Eupatorium hyssopifolium,** L. Quincy, N 2566; Suwanee county, H 957; Lake City, R 966, H 958; Duval county, C 1196, 5693; Eustis, H 953; Alachua county, H 956; Polk county, R 345, 1426; Hernando county, H 955; New River, H 954; Eustis, N 422 (var. *laciniatum*, Gray).
551. **Eupatorium tortifolium,** Chapm. Madison county, H 959; Lake City, H 960; Duval county, C; Eustis, N 1526.
552. **Eupatorium semiserratum,** DC. Washington county, C 1201; Chattahoochee, C 5992; Jefferson county, H 961.
553. **Eupatorium teucrifolium,** Willd. Duval county, C 1211; Eustis, N 2263.
554. **Eupatorium rotundifolium,** L. Jefferson county, H 964; Lake City, R 963, H 963; Eustis, N 1688, 2262; Hernando county, H 962; Palma Sola Bay, S.
555. **Eupatorium perfoliatum,** L. Jefferson county, H 967; Lake City, R 353, H 965; Hernando county, H 966.
556. **Eupatorium incarnatum,** Walt. Chattahoochee, C 1197.
557. **Eupatorium aromaticum,** L. Suwanee county, H 971; Lake City, R 341, 413, H 972; E. Fla., H 968; Duval county, C 1192; New River, H 970; Lemon City, H 969.
558. **Eupatorium coelestinum,** L. Suwanee county, H 973; Columbia county, H 974; Lake City, R 404; Sanford, N 2256; Merritt's Is., C 5730.
559. **Eupatorium anomalum,** Nash. Lloyds, N 2515.
560. **Eupatorium villosum,** Sw. Biscayne Bay, C 1212; Miami, C 5839.
561. **Kuhnia eupatorioides,** L., var. **gracilis.** Biscayne Bay, C 1187*, 5493.
562. **Brickellia cordata,** Ell. Bellair, N 2554.
563. **Liatris elegans,** Willd. Quincy, N 2570; Lake City, R 308, 333, 408, 515.
564. **Liatris spicata,** Willd. St. Mark's, N 2542; Duval county, C 1178; Hernando county, H 1015; Palm Beach, H 1016.

565. **Liatris gracilis**, Pursh. Duval county, C 1181; New River H 1020; Lemon City, H 1019.
566. **Liatris tenuifolia**, Nutt. Lake City, R 330, 1299 in part, H 1017; Duval county, C 1174; Eustis, N 2599; New River, H 1018.
567. **Liatris garberi**, Gray. Palmetto, N 2430.
568. **Liatris chapmanii**, T. & G. Apalachicola, C 1182; Bellair, N 2547; Tampa, N 2473 (var. *longifolia*, Nash).
569. **Liatris pauciflora**, Pursh. Eustis, N 1711.
570. **Garberia fruticosa**, Gray. Tampa, C 1186.
571. **Carphephorus pseudo-liatris**, Cass. Apalachicola, C 1166.
572. **Carphephorus corymbosus**, T. & G. Suwanee county, H 884; Lake City, R 323, 1333, H 881; Eustis, H 882; Levy county, H 883; Duval county, C 1168; Tampa, R 1143; New River, H 1102, 1103, 1104; Manatee, S.
573. **Trilisa odoratissima**, Cass. River Junction, N 2592; Lake City, H 1101; Eustis, N 1590.
574. **Trilisa paniculata**, Cass. Lake City, R 340; Duval county, C 1185.
575. **Heterotheca lamarckii**, Cass. Suwanee county, H 997; Alachua county, H 999; Eustis, N 1718, H 998; Port Orange, W 488; Tampa, R 140.
576. **Chrysopsis graminifolia**, Ell. Madison county, H 891; Sanford, N 2313; Eustis, H 888; Lake City, R 390; Sea Breeze, W 496; Palm Beach, H 889, 890; Manatee, S.
577. **Chrysopsis argentea**, Ell. Lake City, N 2492, R 338, 401, H 892; New River, H 893. This specimen has slender radical leaves about a foot long and one to two lines wide, and has numerous slender rhizomes.
578. **Chrysopsis oligantha**, Chapm. Argyle, C 5942; Walton county, C 1361; Suwanee county, H 902; ——, Buckley.
579. **Chrysopsis flexuosa**, Nash. Bellair, N 2545.
580. **Chrysopsis scabrella**, T. & G. Braidentown, S; Hernando county, H 894.
581. **Chrysopsis trichophylla**, Nutt. E. Fla., H 896, 897; Eau Gallie, C 1364; Sanford, R 317; Melbourne, C 5735; Eustis, N 1239; Polk county, R 347, 1441; Hernando county, H 898; New River, H 895.
582. **Chrysopsis hyssopifolia**, Nutt. Indian River, C 1364; Melbourne, C 5736.
583. **Chrysopsis mariana**, Nutt. Duval county, C 6057.
584. **Chrysopsis gossypina**, Nutt. Lake City, H 900, R 1311; Citrus, H 901; Eustis, N 1307, H 899.
585. **Aplopappus divaricatus**, Gray. Bellair, N 2556; River Junction, C 6005; Lake City, R 321.
586. **Aplopappus megacephalum** (*Eriocarpum megacephalum*, Nash). Palmetto, N 2432.
587. **Bigelovia nudata**, DC. Lake City, R 331; Baldwin, N 2597; New River, H 872; ——, Calkins.
588. **Solidago sempervirens**, L. Duval county, C 6014; Lemon City, W 283, H 1076, 1079; New River, H 1075, 1077, 1078; Cape Sable, S 155; ——, R 319; Miami, P 262.
589. **Solidago angustifolia**, Ell. Duval county, C 6074; Jensen, R 948.
590. **Solidago odora**, Ait. Lake City, R 1299, H 1080.
591. **Solidago chapmani**, Gray. Lake City, R 1287, 992, 1307; Eustis, N 1373, H 1083; Palm Beach, H 1081; New River, H 1082.
592. **Solidago tortifolia**, Ell. Alachua county, H 1086; Duval county, C 6015.

593. **Solidago pilosa**, Walt. Lake City, R 389, 322; Duval county, C 5791; Eustis, H 1084; New River, H 1085; ——, R 393.

594. **Solidago amplexicaulis**, T & G. Jackson county, C 1300.

595. **Solidago boottii**, Hook., var. **ludoviciana**, Gray. Bellair, N 2557.

596. **Solidago tenuifolia**, Willd. Lake City, R 314; E. Fla., H 1087, 1088; New River, H 1089, 1090; Tampa, R 1124.

597. **Solidago canadensis**, L. Jefferson county, H 1092; Lake City, H 1091.

598. **Aphanostephus arkansanus**, Gray. Pensacola, C 1355*, 5916.

599. **Sericocarpus conyzoides**, Nees. De Funiak, C 5924.

600. **Sericocarpus tortifolius**, Nees. Madison county, H 1070; Lake City, R 391, 336, 402, 411; Eustis, N 295; Tampa, R 1142.

601. **Aster eryngifolius**, T. & G. Apalachicola, C 5887.

602. **Aster carolinianus**, Walt. Lake City, R 394; Eustis, H 832; Hernando, H 833; Palm Beach, H 834.

603. **Aster concolor**, L. Alachua county, H 830; Lake City, R 360, 397; Duval county, C 1234; Palm Beach, H 831; Lemon City, W 282.

604. **Aster adnatus**, Nutt. Hernando county, H 844.

605. **Aster undulatus**, L., var. **diversifolius**, Gray. Duval county, C 1278*.

606. **Aster dumosus**, L., var. **cordifolius**, T. & G. Columbia county, H 838; Lake City, R 1309; Duval county, C 1232*; Tampa, R 1120; New River, H 842, 843. These specimens have smooth stem, scabrous-margined leaves, the lower only narrowed at base, and extensively creeping slender rhizomes.

607. **Aster reticulatus**, Pursh. Jefferson county, H 837; Lake City, R 384; 1274, 1282; Eustis, N 340, H 835; Hernando county, H 836; Polk county, R 1292.

608. **Aster chapmani**, T. & G. Apalachicola, C 1232.

609. **Aster tenuifolius**, L. Duval county, C 1241; E. Fla., H 840; Palm Beach, H 839; Cape Romano, S 265.

610. **Aster subulatus**, Michx. Duval county, C 1250; Hernando county, H 841; Tampa, N 2416.

611. **Erigeron nudicaulis**, Michx. Jefferson county, H 932; Suwanee county, H 931; Lake City, R 1291, H 930; Eustis, N 202, 505, H 934.

612. **Erigeron quercifolius**, Lam. Duval county, C 1284; Eustis, N 199; Polk county, R 1275; Tampa, R 925.

613. **Erigeron strigosus**, Muhl. Jefferson county, H 936; Lake City, R 356, H 937; Duval county, C 1287; Eustis, H 935.

614. **Erigeron linifolius**, Willd. Apalachicola, C 5890; Duval county, C 1370, N 2315.

615. **Erigeron canadensis**, L. Jefferson county, H 940; Lake City, R 332, 1306, H 939; Eustis, H 938.

616. **Baccharis halimifolia**, L. Jefferson county, H 848; Madison county, H 847; Lake City, R 319; Duval county, C 1371, 6058.

617. **Baccharis glomeruliflora**, Pers. Lake City, R 354; Duval county, C 1372; Palm Beach, H 849, 850, 851, 852.

618. **Baccharis angustifolia**, Michx. Duval county, C 1373; Ormond, C 5564; Hernando county, H 846; Palmetto, N 2453; Lemon City, H 845.

619. **Pluchea odorata**, Cass. Key West, C 1377*, 5612.

620. **Pluchea quitae**, DC. Pensacola, C 1377**, ballast wharf.

621. **Pluchea longifolia**, Nash. Titusville, N 2293; Hernando county, H 1042.

622. **Pluchea bifrons,** DC. Duval county, C 1374; Eustis, N 758, H 1046.
623. Var. **imbricata.** Jefferson county, H 1044; Lake City, R 962, H 1043; Archer, R 362; Eustis, N 1434, H 1045.
624. **Pluchea camphorata,** DC. River Junction, C 5990; Marion county, H 1048; Lake City, N 2484; Duval county, R 367, C 1376; Eustis, N 1470, H 1046; Clearwater, R 329; New River, H 1047; Upper Metacumbe Key, P 142.
625. **Pterocaulon pycnostachyon,** Ell. Jefferson county, H 1056; Lake City, R 1310, H 1054; Duval county, C 1378; Archer, R 1284; Eustis N 365, H 1057; Polk county, R 344; New River, H 1055; Miami, P 254; ——, Buckley; ——, S.
626. **Gnaphalium purpureum,** L. Pensacola, R 359; Jefferson county, H 981; Lake City, H 980, R 348, 388, 387, 1076, 1450; Duval county, N 1551; Eustis, N 190, H 978; E. Fla., H 982; Hernando county, H 979; Polk county, R 1421; Palm Beach, W 389. N 190 and R 387 have narrow leaves and may be some other species.
627. **Gnaphalium polycephalum,** L. Lake City, R 310, 350, 1299 in part, H 983.
628. **Inula viscosa,** Ait. Pensacola, C 1369*, ballast wharf.
629. **Polymnia uvedalia,** L. Tallahassee, N 2327; Lake City, H 1049; Manatee, S.
630. **Acanthospermum humile,** DC. Pensacola, C 1491*.
631. **Acanthospermum xanthioides,** DC. Jefferson county, H 823; Lake City, R 625, 342, H 822; Duval county, C 1491, 5515; Eustis, N 724, H 824.
632. **Silphium asteriscus,** L. Chattahoochee, C 5946; Jefferson county, H 1073, 1074; Palma Sola Bay, S; ——, S (1889). Simpson's specimens seem different from others.
633. **Silphium compositum,** Michx. Walton county, C 1384, 5941; Columbia county, H 1072.
634. **Berlandiera tomentosa,** Nutt. Jefferson county, H 866; Lake City, R 368, 629, 1294, N 2215; Falling Creek, R 379; Polk county, R 1290.
635. **Berlandiera subacaulis,** Nutt. Lake City, R 307; Alachua county, H 863; Eustis, N 808, R 385, H 864, 865; Eau Gallie, C 5699; Orlando, R 399; Kissimee, R 326; Mosquito Lagoon, C 1393; ——, S.
636. **Parthenium hysterophorus,** L. Key West, C 5649; another specimen from Curtiss which has by mistake the label for 1508.
637. **Iva imbricata,** Walt. Sea Breeze, W 492; Upper Metacumbe Key, C 5507.
638. **Iva frutescens,** L. Duval county, C 1396; Titusville, N 2287; Hernando county, H 1007.
639. **Ambrosia artemisiaefolia,** L. Columbia county, H 828, 827; Duval county, C 1404; Hernando county, H 826.
640. **Ambrosia hispida,** Pursh. Palm Point, S 187; Boca Chica Key, P 106; Key West, C 1403, 5610.
641. **Xanthium strumarium,** L. Lake City, R 1279.
642. **Zinnia pauciflora,** L. Duval county, C 1417.
643. **Heliopsis gracilis,** Nutt. Chattahoochee, C 5872.
644. **Tetragonotheca helianthoides,** L. Walton county, C 1419; Columbia county, H 1100; Archer, R 363; Citrus county, H 1099.
645. **Eclipta alba,** Hook. Chattahoochee, C 5993; Duval county, R 366; Eustis, N 588, H 919; Palm Beach, W 412, H 920, 921.

646. **Melanthera hastata**, Michx. Jefferson county, H 1029; Eustis, H 1030; Hernando, H 1025; Palmetto, N 2433; Palm Beach, H 1026, 1028; Miami, C 5851.

647. **Melanthera deltoidea**, Michx. Long Key, C 5508; Elliott's Key, C 1415: Upper Metacumbe Key, P 133.

648. **Melanthera lanceolata**, Benth. Fort Lauderdale, C 5846; Palm Beach, H 1027; Lemon City, W 284.

649. **Spilanthes repens**, Michx. Columbia county, H 1098; Biscayne Bay, C 1501: ——, S.

650. **Rudbeckia triloba**, L., var. **pinnatifida**, T. & G. Jackson county, C 1428*.

651. **Rudbeckia bicolor**, Nutt. Duval county, C 5673; Sanford, N 2272. I cannot satisfactorily distinguish these from *R. hirta* in the herbarium specimens.

652. **Rudbeckia hirta**, L. Jefferson county, H 1066; Madison county, H 1062: Lake City, R 383, 396, 398, 327, 1296, 1301, H 1064; Duval county, C 1423; Eustis, N 961, H 1063; Polk county, R 358; Hernando county, H 1065.

653. **Rudbeckia fulgida**, Ait. Chattahoochee, C 5996; St. Mark's, N 2535.

654. **Rudbeckia mollis**, Ell. Lake City, H 1067.

655. **Wedelia carnosa**, Rich. Jupiter, C 5540.

656. **Borrichia arborescens**, DC. Torch Key, C 5436: Ragged Keys, W 317; Bahia Honda Key, S 356, C 1412.

657. **Borrichia frutescens**, DC. Lake City, R 334; Titusville, N 2289; E. Fla., H 876; S. Fla., Swingle; Palm Beach, H 874; Lemon City, H 875; Hernando county, H 873; Key West, P 4, C 5420: Biscayne Key, W 278.

658. **Helianthus debilis**, Nutt. Lake City, R 405; Palm Beach, W 417, 238, C 5373, H 990; Indian River, C 1441; Sarasota Key, C 1455.

659. **Helianthus angustifolius**, L. Lake City, R 339; Duval county, C 1437; Levy county, H 991.

660. **Helianthus radula**, T. & G. River Junction, N 2591.

661. **Helianthus heterophyllus**, Nutt. ——, Buckley.

662. **Helianthus occidentalis**, Ridd. Washington county, C 1454.

663. **Helianthus strumosus**, L. River Junction, N 2581; Jefferson county, H 994; Madison county, H 993; Columbia county, H 992.

664. **Helianthella grandiflora**, T. & G. Suwanee county, H 996; Eau Gallie, C 5700; Sanford, R 318; Eustis, N 1225, H 995; Tavares, R 320; Tampa, R 1138, C 1463; ——, Buckley.

665. **Helianthella tenuifolia**, T. & G. Apalachicola, C 5891.

666. **Verbesina virginica**, L. Jefferson county, H 1109; Lake City, N 2504, R 403, 1232; Hernando county, H 1108; Palm Beach, H 1110.

667. **Verbesina nudicaulis**, Gray. Walton county, C 1468, 5910; Jefferson county, H 1107; Madison county, H 1105; Lake City, N 2202, H 1106.

668. **Verbesina heterophylla**, Gray. Duval county, C 1468*a*.

669. **Verbesina encelioides**, B. & H. Key West, C 1503*, 5650.

670. **Coreopsis nudata**, Nutt. Duval county, C (1876).

671. **Coreopsis gladiata**, Walt. Duval county, C 1477; New River, H 910.

672. **Coreopsis angustifolia**, Ait. Duval county, C 5568.

673. **Coreopsis leavenworthii**, T. & G. Eustis, N 1257, 2255, 832; Levy county, H 911; Palm Beach, H 913, W 414, C 5375; New River, H 912; Halifax River, C 1480; Sanibel Is., W 176; Anna Marie Key, R 1127.

674. **Coreopsis tinctoria**, Nutt. Eustis, H 914. May have escaped from cultivation.

675. **Coreopsis lanceolata**, L. Pensacola, R 358, 392; Aspalaga, C 1481; Tallahassee, R 309; Madison county, H 915.
676. **Coreopsis pubescens**, Ell. Jackson county, C 1485*.
677. **Coreopsis senifolia**, Michx. ——, Buckley.
678. **Coreopsis aurea**, Ait. Lake City, R 1286, H 917; Duval county, C 1472; Eustis, N 336, H 916; Hernando county, H 918; Polk county, R 400.
679. **Bidens nashii**, Small. Tallahassee, N 2336.
680. **Bidens leucantha**, Willd. Lake City, R 1278; E. Fla., H 869; Orlando, R 409; Ovieda, R 1297; Eustis, N 653, H 867; Palm Beach, C 5387, H 868; Mosquito Lagoon, C 1498; Sugarloaf Key, P 59.
681. **Bidens bipinnata**, L. Lake City, R 335, N 2495, H 871; Duval county, C 1499, 6013; Eustis, H 870.
682. **Baldwinia uniflora**, Nutt. Lake City, R 982, 1356 in part: Duval county, C 1521, N 2322.
683. **Baldwinia multiflora**, Nutt. Marion county, H 853; Lake City, R 352, 1288, 1300, 1276; Duval county, C 1522; Eustis, H 854; Tavares, R 1305; Alachua county, H 857; Levy county, H 855; Tampa, R 1154; New River, H 856.
684. **Marshallia angustifolia**, Pursh. Walton county, R 1303, C 5932; Lake City, R 370, 406, 973, H 1024; Baldwin, N 2318; ——, Buckley.
685. **Tridax procumbens**, L. Elliott's Key, C 5453; Upper Metacumbe Key, P 150.
686. **Hymenopappus scabiosaeus**, L'Her. Suwanee county, H 1006; Gainesville, C 1508.
687. **Polypterus integrifolius**, Nutt. Lake City, R 1293, 1308; Duval county, C 1507; Alachua county, H 1050; Citrus county, H 1053; Eustis, H 1051; Polk county, R 349, 1373; Tampa, R 1148; New River, H 1052; ——, S.
688. **Palafoxia feayi**, Gray. Eustis, H 1040; Indian River, C 1507*; Palm Beach, H 1038; Lemon City, H 1039.
689. **Helenium tenuifolium**, Nutt. Pensacola, R 1250; River Junction, C 5898; Tallahassee, N 2355; Jefferson county, H 985; Lake City, H 984; Archer, R 386; Hernando county, H 986.
690. **Helenium nudiflorum**, Nutt. Suwanee county, H 988: Duval county, C 1520; Eustis, N 1877, 550; Hernando county, H 987; Citrus county, H 989; Sumter county, C 1520*. The last two specimens are rayless.
691. **Helenium autumnale**, L. St. Mark's, N 2534.
692. **Helenium vernale**, Walt. Kissimee, R 325.
693. **Gaillardia lanceolata**, Michx. Madison county, H 977; Duval county, C 1506; Eustis, N 602, H 976.
694. **Flaveria linearis**, Lag. Daytonia, W 509; Titusville, N 2301; Indian River, C 1504; Palm Beach, C 5524, H 975; Jensen, R 949; Sanibel Is., W 175; No Name Key, S 185; Newfound Harbor Key, P 79.
695. **Flaveria contrayerba**, L. Pensacola, C 1504**, R 492, ballast plant.
696. **Pectis ciliaris**, L. Tampa, N 2479; Sanibel Is., S 301.
697. **Pectis linifolia**, Less. Biscayne Bay, C 1162, 5496; Cocoanutgrove, H 1041; Cape Sable, S 170; Sugarloaf Key, P 34.
698. **Anthemis cotula**, L. Madison county, H 829.
699. **Anthemis mixta**, L. Pensacola, C 5914, ballast plant.
700. **Achillea millefolium**, L. Madison county, H 825.
701. **Chrysanthemum leucanthemum**, L. Suwanee county, H 887.
702. **Senecio lobatus**, Pers. Chattahoochee, C 1565; Losman's Key, S 154.

703. **Cacalia floridana,** Gray. Walton county, C 1560*: Madison county, H 879; Lake City, R 374; Archer, R 1285; Eustis, N 853, H 877, 878; Manatee, S.
704. **Cacalia lanceolata,** Nutt. Hernando county, H 880; ——, S 33.
705. **Erechtites hieracifolia,** Raf. Madison county, H 926: Lake City, R 357, H 928; Duval county, C 1556: Daytonia, W 478; Eustis, H 927; Palm Beach, H 925; Upper Metacumbe Key, P 141.
706. **Emilia sonchifolia,** DC. Jensen, R 952.
707. **Cnicus horridulus,** Pursh. Madison county, H 904; Lake City, H 906; Eustis, N 367, H 905; Cape Romano, S 258; Hernando county, H 907; ——, Powell.
708. **Cnicus virginianus,** Pursh. Lake City, R 1302; Duval county, C 1585.
709. **Cnicus nuttallii,** Gray. Duval county, R 365; Eustis, N 663, H 909; Levy county, H 908; Clearwater, R 328.
710. **Cnicus repandus,** Ell. Biscayne Bay, C 1589; Palm Beach, H 903.
711. **Chaptalia tomentosa,** Vent. Duval county, C 1595; Lake City, R 403; Lake Helm, W 361; New River, H 885, 886; ——, R 395.
712. **Krigia virginica,** Willd. Madison county, H 1009; Lake City, R 364, 646, 1068; Eustis, N 278, H 1008; Duval county, C 1599.
713. **Hieracium gronovii,** L. Tallahassee, N 2324; Suwanee county, H 1003; Lake City, R 763, 1273, H 1005; Alachua county, H 1001, 1002; Levy county, H 1004; Duval county, C 1608; Eustis, H 1006.
714. **Hieracium megacephalum,** Nash. Eustis, N 390; Polk county, R 346, 1440; New River, H 1000.
715. **Prenanthes serpentaria,** Pursh. Duval county, C 5790.
716. **Lygodesmia aphylla,** DC. Jefferson county, H 1021; Madison county, H 1022; Duval county, C 1620; Eustis, N 280, H 1023; Polk county, R 343, 1391.
717. **Pyrrhopappus carolinianus,** DC. Jefferson county, H 1058, 1060; Madison county, H 1059; Lake City, R 407, 1085, H 1061; Duval county, C 1623.
718. **Lactuca canadensis,** L. Tallahassee, N 2398.
719. **Lactuca graminifolia,** Michx. Jefferson county, H 1010; Madison county, H 1014; Tallahassee, N 2362; Lake City, R 1295, H 1013; Eustis, H 1013.
720. **Lactuca floridana,** Gaertn. Columbia county, 1012; Duval county, C 1629, 5763; Eustis, H 1011.
721. **Sonchus oleraceus,** L. Lake City, R 1289; Columbia county, H 1095; Alachua county, H 1094; Marion county, H 1096; Eustis, H 1093, 1097; Upper Metacumbe Key, P 144.

GOODENIACEAE.

722. **Scaevola plumieri,** Vahl. Palm Beach, C 5523, W 223, R 223; Cape Malabar, C 1649; Sanibel Is., W 189; Palma Sola Bay, S; Boca Chica Key, P 104.

LOBELIACEAE.

723. **Lobelia cardinalis,** L. Duval county, C 1634.
724. **Lobelia puberula,** Michx. Duval county, C 5565; ——, S.
725. Var. **glabella,** Hook. Lake City, R 1245.
726. **Lobelia amoena,** Michx., var. **obtusata,** Gray. Cocoanutgrove, H 1117.
727. **Lobelia glandulosa,** Walt. Lake City, R 450, 449; Duval county, C 1640; Hernando, H 1119; Palm Beach, H 1118.

728. **Lobelia paludosa**, Nutt. Lake City, R 1246; Falling Creek, R 1280 in part; Duval county, C 1647; Eustis, N 501, H 1120; Hernando county, H 1121; Polk county, R 448, 1395; ——, S.

729. **Lobelia nuttallii**, R. & S. Walton county, C 1643, 5902.

730. **Lobelia cliffortiana**, L., var. **xalapensis**, Gray. Hernando county, H 1122; ——, S.

731. **Lobelia feayana**, Gray. Mosquito Inlet, C 1641*; Tampa, R 924; Cape Canaveral, C 5831.

CAMPANULACEAE.

732. **Campanula floridana**, Wats. Mosquito Inlet, C 1651*; New Smyrna, C 5863.

733. **Specularia perfoliata**, A. DC. Lake City, R 447; Duval county, C 1657.

ERICACEAE.

734. **Gaylussacia dumosa**, T. & G. Jefferson county, H 1128; Suwanee county, H 1131; Lake City, H 1129, 1132; Eustis, N 9, 1938, H 1130; Duval county, C 1660.

735. **Gaylussacia frondosa**, T. & G. Jefferson county, H 1124; Lake City, R 577, 587, 589, 590, 591, 604, 1063, 1242, H 1123; Duval county, C 1661, 1661 (var. *nana*); Eustis, H 1126, 1127, N 530 (var. *nana*); Hernando county, H 1125.

736. **Vaccinium arboreum**, Michx. Suwanee county, H 1158; Lake City, N 2175, R 584, 586, 1065, H 1159; Eustis, N 81, H 1157; Hernando county, H 1156.

737. **Vaccinium stamineum**, L. Suwanee county, H 1162; Lake City, R 251, 572, H 1163; Eustis, N 573, H 1161; Hernando, H 1162.

738. **Vaccinium myrsinites**, Michx. Jefferson county, H 1166; Lake City, R 279, 580, 605, 606, H 1169; Duval county, C 5827 (*V. nitidum*, Andr.), R 1078; Eustis, N 55, 1969, H 1168; Hernando county, H 1165; Palm Beach, H 1164; New River, H 1167; Miami, P 268. I cannot separate *V. nitidum* in my specimens.

739. **Vaccinium formosum**, Andr. Lake City, R 583, 1091, 1242; Duval county, C 5825.

740. **Vaccinium virgatum**, Ait., var. **tenellum**, Gray. Duval county, C 1670.

741. **Vaccinium cubense**, Griseb. Cape Canaveral, C 1669*.

742. **Vaccinium corymbosum**, L., var. **fuscatum**, Gray. Lake City, N 2179; R 221, 581, 635.

743. **Andromeda phillyreifolia**, Hook. Walton county, C 1699.

744. **Andromeda nitida**, Bartr. Jefferson county, H 1134; Lake City, R 576, 1061, H 1136; Eustis, N 64, H 1137, 1138, W 398; Polk county, R 568, 1397; Palm Beach, H 1133, 1135.

745. **Andromeda mariana**, L. Jefferson county, H 1139; White Springs, R 954; Lake City, N 2223; Falling Creek, R 377; ——, S.

746. **Andromeda ferruginea**, Walt. Jefferson county, H 1153; Marion county, H 1154; Lake City, R 1364; Eustis, N 17, H 1152, 1155; Tavares, R 228.

747. **Andromeda fruticosa.** Jefferson county, H 1150; Lake City, R 585, 588, H 1151; Hernando county, H 1146; Eustis, N 700, 1815, H 1147, 1148; Polk county, R 570; Palm Beach, H 1143, 1145; New River, H 1150; Lemon City, H 1144; ——, Buckley; ——, S.

748. **Andromeda ligustrina**, Muhl. Jefferson county, H 1141; Lake City, R 653, H 1142; Eustis, N 528, H 1140.

749. **Oxydendrum arboreum,** DC. Jefferson county, H 1176.
750. **Leucothoe axillaris,** Don. Duval county, C 1690.
751. **Leucothoe acuminata,** Don. Duval county, C (1876).
752. **Leucothoe racemosa,** Gray. Jefferson county, H 1185; Suwanee county, H 1184; Lake City, R 245, 246, 578, H 1183; Eustis, N 177, H 1182.
753. **Kalmia hirsuta,** Walt. Jefferson county, H 1177; Lake City, N 2193, R 976, H 1178.
754. **Azalea viscosa,** L. Jefferson county, H 1172; Eustis, N 1306, H 1171.
755. **Azalea nudiflora,** L. Chattahoochee, C 1718*; Jefferson county, H 1173.
756. **Bejaria racemosa,** Vent. Citrus county, H 1181; Leesburg, R 582; Eustis, N 803, H 1179; Tavares, R 573; Polk county, R 569, 1393; New River, H 1180.
757. **Clethra alnifolia,** L. Walton county, R 673, C 5943; Jefferson county, N 2508, H 1170.
758. **Monotropa uniflora,** L. Lake City, R 571; Eustis, H 1174; Palm Beach, W 302, H 1175.

PLUMBAGINACEAE.

759. **Statice caroliniana,** Walt. Duval county, C 5581; Ponce Park, W 480; Hernando county, H 1187.
760. **Plumbago scandens,** L. Hillsboro River, C 1791; S. Fla., Swingle; Palm Beach, C 5367, H 1186.

PRIMULACEAE.

761. **Centunculus minimus,** L. Gilbert's Bar, C 5862.
762. **Samolus floribundus,** HBK. Suwanee county, H 1190; Columbia county, H 1188; Duval county, C 1810; Eustis, N 253, H 1189; Key Largo, P 185.
763. **Samolus ebracteatus,** HBK. Hernando county, H 1192; Indian River, C 1811; New River, H 1191; Sanibel Is., W 182; Cape Florida, C 5179; Tampa, N 2425; Clearwater, R 436; Sugarloaf Key, P 77.

MYRSINACEAE.

764. **Myrsine rapanea,** R. & S. Rockledge, Swingle; Palm Beach, W 228, H 1197; Arch Creek, C 5459; Lemon City, H 1194, 1195, 1196; Palmetto, N 2440; Sanibel Is., W 195; Sugarloaf Key, P 57.
765. **Ardisia pickeringii,** T. & G. Jupiter Inlet, C 5552; Indian River, C 1779; Palm Beach, H 1193; Palmetto, N 2458; S. Fla.; Swingle, Sugarloaf Key, P 52; ——, S.
766. **Jacquinia armillaris,** L. South border of Everglades, C 1777; Jewfish Key, C 5447; Saddle Bunch Key, P 25; Key West, S 294.

SAPOTACEAE.

767. **Chrysophyllum olivaeforme,** Lam. Merritt's Is., C 1758*.
768. **Sideroxylon mastichodendron,** Jacq. Indian River and Upper Metacumbe Key, C 1759; Indian Key, S 218; Palm Beach, Swingle, H 1198.
769. **Dipholis salicifolia,** A. DC. Biscayne Bay, C 1760; Miami, C 5859; Chokoliska Is., S. 223; Key Largo, P 197.
770. **Bumelia tenax,** Willd. Duval county, C 5678; Sea Breeze, W 467.
771. **Bumelia lanuginosa,** Pers. Lake City, R 46, H 1200; Eustis, N 2167, 818, H 1201; Marion county, H 1202; Hernando county, H 1199.
772. **Bumelia lycioides,** Gaertn. Lake City, R 1353; Mosquito Inlet, C 1761.

773. Var. **reclinata**, Gray. Marion county, H 1203; ——, S 48.
774. **Bumelia cuneata**, Sw. South border of Everglades and Bahia Honda Key, C 1765; Ragged Keys, Swingle 117; Key Largo, Swingle 116; Caxambas Is., S 276.
775. **Mimusops sieberi**, A. DC. Torch Key, C 5437; No Name Key, S 212, Boca Chica Key, C 1766; Key West, P 6.

EBENACEAE.

776. **Diospyros virginiana**, L. Jefferson county, H 1204: Lake City, R 663. H 1205; Eustis, N 2033; Hernando county, H 1206; Polk county, R 621.

STYRACACEAE.

777. **Symplocos tinctoria**, L'Her. Lake City, R 628, 445, 1067; Duval county, C 5605.
778. **Halesia diptera**, L. Jackson county, C 1770; River Junction, N 2393, C 5987.
779. **Halesia tetraptera**, L. River Junction, N 2373.
780. **Styrax pulverulenta**, Michx. Duval county, C 1768.

OLEACEAE.

781. **Fraxinus americana**, L. Jefferson county, H 1208; Lake City, H 1209; Eustis, N 723.
782. **Fraxinus epiptera**, Michx. Columbia county, H 1212; Citrus county, H 1211; Eustis, N 941, 1698, H 1210.
783. **Fraxinus cubensis**, Griseb. Palmetto, N 2431.
784. **Chionanthus virginica**, L. River Junction, N 2391; Lake City, R 661; Eustis, N 275, 2127.
785. **Forestiera porulosa**, Poir. Palm Beach, Swingle; Palm Beach and Miami, C 5364; Tampa, N 2423; White Horse Key, S 254; Sanibel Is., W 192.
786. **Osmanthus americanus**, B. & H. Duval county, C 2314; Eau Gallie, C 5778; Sea Breeze, W 498; Eustis, N 986, H 1207.

APOCYNACEAE.

787. **Vallesia glabra**, Cav. Cape Sable, S 151: Key West, C 2271, 5620.
788. **Amsonia ciliata**, Walt. Bellair, N 2546; Tallahassee, R 955; Aspalaga, C 2269; Alachua county, H 1214; Citrus county, H 1215.
789. **Vinca rosea**, L. Lemon City, H 1217; Eustis, N 726; Hernando, county, H 1216: Key Largo, P 177.
790. **Apocynum cannabinum**, L. Jefferson county, H 1213; Lake City, R 720, 731.
791. **Echites andrewsii**, Chapm. Summerland, S 214; Upper Metacumbe Key, C 2267.
792. **Echites paludosa**, Vahl. Palm Beach, H 1219; New River, H 1220; Lemon City, H 1218, 1221; Miami, C 2266*; Old Turner Place, S 252.
793. **Echites umbellata**, Jacq. Palm Beach, W 434; Lemon City, H 1222; Miami, R 943; Elliotts Key, W 325; Cape Sable, S 152, C 2266; Old Rhodes Key, C 5448; Sugarloaf Key, P 78.
794. **Trachelospermum difforme**, Gray. Chattahoochee, C, 5893.

ASCLEPIADACEAE.

795. **Philibertia viminalis**, Gray. Indian River, C 2306; Palm Beach, H 1223, 1224; Cape Sable, S 331; Key West, C 5624.
796. **Podostigma pubescens**, Ell. Eustis, H 1226; Pease Creek, C 2299; Hernando county, H 1225.

797. **Anantherix connivens**, Gray. Eustis, N 2055.
798. **Asclepiodora viridis**, Gray. Levy county, H 1227.
799. **Asclepias tuberosa**, L. Jefferson county, H 1241; Suwanee county, H 1238; Duval county, C 2290; Lake City, R 730, 725, 1208, 1209, 1212, H 1234; Alachua county, H 1239; Eustis, H 1240; Polk county, R 724, 1394; New River, H 1242.
800. **Asclepias paupercula**, Michx. Lake City, R 1207; Duval county, C 5418; Eustis, N 2048; Hernando, H 1244; ——, S 33.
801. **Asclepias incarnata**, L. Eustis, N 1514.
802. **Asclepias obtusifolia**, Michx. Suwanee county, H 1245; Lake City, H 1246; Alachua county, H 1247.
803. **Asclepias amplexicaulis**, Michx. Suwanee county, H 1247; Madison county, H 1248; Lake City, R 727, H 1251; Eustis, H 1249; Citrus county, H 1250.
804. **Asclepias tomentosa**, L. Duval county, C 5688; Eustis, H 1252, 1254; Citrus county, H 1253; Mosquito Lagoon, C 2289.
805. **Asclepias obovata**, Ell. Madison county, H 1258; Lake City, H 1255; Levy county, H 1156; Eustis, H 1257; Polk county, R 723.
806. **Asclepias curtissii**, Gray. Lake City, R 1211; Eustis, R 1210, H 1259.
807. **Asclepias cineria**, Walt. Suwanee county, H 1261; Lake City, N 2220; Eustis, H 1260; Polk county, R 721.
808. **Asclepias perennis**, Walt. River Junction, N 2389; Columbia county, H 1262; Tocoi, C 2283; ——, S.
809. **Asclepias verticillata**, L. Suwanee county, H 1264; Eustis, H 1263; Levy county, H 1265; Polk county, R 722.
810. **Asclepias angustifolia**, Ell. Lake City, R 729.
811. **Asclepias feayi**, Gray. Eustis, N 796.
812. **Metastelma blodgettii**, Gray. Palm Beach, H 1228; Biscayne Bay, C 2301; Lemon City, H 1229; No Name Key, C 5141, P 119; ——, S 195.
813. **Metastelma bahamense**, Griseb. Indian River, C 2300; Ragged Keys, W 321; Bahia Honda Key, C 5443.
814. **Seutera maritima**, Dec. Titusville, N 2300; Hernando county, H 1230; Sugarloaf Key, P 36; ——, S.
815. **Vincetoxicum scoparium**, Gray. Upper Metacumbe Key, C 5504; Key Largo, C 5639.
816. **Gonolobus suberosus**, R. Br. Eustis, N 1986, 2133.
817. **Gonolobus hirsutus**, Michx. Columbia county, H 1236; Lake City, R 507, 636, H 1235; Duval county, C 5948; Eustis, N 1132, H 1237.
818. **Gonolobus pubiflorus**, Engelm. Columbia county, H 1234; Alachua county, H 1233; Levy county, H 1232; Eustis, H 1231.

LOGANIACEAE.

819. **Gelsemium sempervirens**, Ait. Jefferson county, H 1268; Lake City, R 615, 1092, N 2166, H 1267; Levy county, H 1266.
820. **Spigelia anthelmia**, L. Elliotts Key, C 5454.
821. **Spigelia loganioides**, A. DC. Sumterville, C 2258.
822. **Mitreola petiolata**, T. & G. Suwanee county, H 1261; Columbia county, H 1260; Duval county, C 5751; Indian River, C 2261; Citrus county, H 1262; Manatee, S; Cocoanutgrove, H 1269.
823. **Mitreola sessilifolia**, T. & G. Lake City, R 258; Baldwin, N 2320.
824. Var. **angustifolia**, T. & G. Duval county, C 5752, N 2248.

825. **Polypremum procumbens**, L. Jefferson county, H 1267; Alachua county, H 1265; Lake City, R 192, 504, H 1266; Eustis, N 727, H 1268, 1269; Tavares, R 616; E. Fla., H 1264; Polk county, R 193, 1422; Palm Beach, H 1263.

GENTIANACEAE.

826. **Sabbatia macrophylla**, Hook. Argyle, C 5931; Lake City, R 1369; Baker county, C 2224.

827. **Sabbatia lanceolata**, T. & G. De Funiak, C 5906; Orange county, C 2222; Eustis, N 849, H 1279, 1280.

828. **Sabbatia calycosa**, Pursh. Columbia county, H 1282; Eustis, H 1281.

829. **Sabbatia stellaris**, Pursh. Daytonia, W 505; Hernando county, H 1283; Tampa, R 1134.

830. **Sabbatia gracilis**, Salisb. Lake City, R 1344; Titusville, N 2303; Duval county, C 5228; ——, Buckley.

831. Var. **grandiflora**, Gray. Baldwin, R 499; Eustis, N 763, 1982, H 1285, 1286, 1287; Polk county, R 274, 1389, 1435; Mosquito Lagoon, C 2228*; New River, H 1284; ——, Buckley.

832. **Sabbatia elliottii**, Steud. Lake City, R 272, 455; Tampa, N 2422, R 1144.

833. **Sabbatia angularis**, Pursh. Merritts Is., C 2227.

834. **Sabbatia chloroides**, Pursh. Milton, C 5928; Jefferson county, H 1288; Duval county, R 275, N 2250, C 2231; Polk county, R 273. Specimens from the last three localities are var. *stricta*.

835. **Sabbatia gentianoides**, Ell. Baker county, C 2233.

836. **Gentiana saponaria**, L. Lake City, R 501.

837. **Eustoma exaltatum**, Griseb. Indian River, C 2234; Titusville, N 2284; Hernando county, H 1295; Lemon City, H 1296, 1297; Boca Chica Key, C 5432; No Name Key, S 271.

838. **Bartonia verna**, Muhl. Columbia county, R 503; Duval county, C 2251, R 502, 1077.

839. **Limnanthemum trachyspermum**, Gray. Madison county, H 1294; Lake City, R 940, H 1293; Eustis, N 1144, H 1289, 1290, 1291, 1292; Indian River, C 2255.

POLEMONIACEAE.

840. **Phlox glaberrima**, L. River Junction, C 5873, One plant belongs to the next.

841. **Phlox pilosa**, L. River Junction, C 5873 in part; Jefferson county, H 1273; Suwanee county, H 1272; Lake City, R 732; Madison county, H 1271; Duval county, C 2146; Eustis, H 1270; Hernando county, H 1274. Some of these may be *P. floridanum*, but I cannot separate them.

842. **Phlox subulata**, L. Alachua county, H 1275; Duval county, C 2150, 5868.

843. **Phlox drummondii**, Hook. Lake City, R 734, 1266, H 1278; Alachua county, H 1276; Citrus county, H 1277. Escaped.

844. **Gilia coronopifolia**, Pers. Cape Canaveral, C 5705; Grand Island, R 224; Eustis, N 1189.

HYDROPHYLLACEAE.

845. **Nama jamaicensis**, L. E. Fla., H 2621; Key West, C 2137.

846. **Hydrolea corymbosa**, Ell. Sanford, N 2281.

847. **Hydrolea quadrivalvis**, Walt. River Junction, C 5939; Tallahassee, N 2353; Jefferson county, H 1298.

BORAGINACEAE.

848. **Cordia sebestena**, L. Rabbit Key, S 206; Key West, C 2084.
849. **Cordia globosa**, HBK. Key West, C 5428, No. F.
850. **Bourreria havanensis**, Miers. Elliott's Key, C 2085, 5427.
851. **Tournefortia gnaphalodes**, R. Br. Palm Beach, W 221, H 1299; Grassy Key, C 5635; Newfound Harbor Key, P 83; Upper Metacumbe Key, C 2087.
852. **Tournefortia volubilis**, L. Palm Beach, W 387; Key West, C 2088, 5429.
853. **Heliotropium polyphyllum**, Lehm. Biscayne Bay, C 2092*; Lemon City, H 1300 (in fruit).
854. Var. **leavenworthii**, Gray. Indian River, C 2090*; Citrus county, H 1301; Rabbit Key ?, S (labeled 290, *Portulaca halimoides*).
855. **Heliotropium europaeum**, L. Pensacola, C 2089, ballast wharf.
856. **Heliotropium curassavicum**, L. Mosquito Lagoon, C 2090; Key West, C 5426.
857. **Heliotropium anchusaefolium**, Poir. Hernando county, H 1307. Escaped.
858. **Heliotropium parviflorum**, L. Palm Beach, W 411, C 5396, H 1302, 1303; Palmetto, N 2455; Clearwater, R 433; Hillsboro River, C 2094; Miami, R 939; Upper Metacumbe Key, P 138.
859. **Heliotropium indicum**, L. River Junction, C 5988.
860. **Lithospermum tuberosum**, Rugel. Chattahoochee, C 2105.
861. **Lithospermum hirtum**, Lehm. Walton county, C 2106.
862. **Onosmodium virginianum**, DC. Jefferson county, H 1305; Lake City, H 1305; Duval county, C 2098; Eustis, N 99, H 1306; Polk county, R 618, 1417.

CONVOLVULACEAE.

863. **Dichondra repens**, Först. Madison county, H 1328; Lake City, R 252; Eustis, N 200.
864. **Ipomoea bona-nox**, L. Lake City, R 1348; Eustis, H 1309; Jupiter, C 5543; Palm Beach, H 1308; Key Largo, P 170.
865. **Ipomoea quamoclit**, L. Eustis, N 2600; Duval county, C 2155, 6009.
866. **Ipomoea hederacea**, Jacq. Tallahassee, N 2532; Duval county, C 5800.
867. **Ipomoea cathartica**, Poir. Merritt's Is., C 2168; Palm Beach, H 1310; Lemon City, H 1311; Miami, C 5843; Western Key, S 296; Jewfish Key, P 128.
868. **Ipomoea pes-caprae**, Sweet. E. Fla., C 2160; Jupiter Inlet, C 5533; Palm Beach, H 1312.
869. **Ipomoea batatas**, Lam. Sugarloaf Key, P 73.
870. **Ipomoea pandurata**, Mey. Jefferson county, H 1315; Alachua county, H 1314; Lake City, R 506 in part, 512, 1255; H 1316, 1317; Eustis, N 777, H 1313; —— R 1256.
871. **Ipomoea sagittata**, Cav. Eustis, N 720; Tavares, R 513; Hernando county, H 1318; Palma Sola Bay, S.
872. **Ipomoea sinuata**, Ort. Eustis, N 934; Tampa, S.
873. **Ipomoea commutata**, R. & S. Lake City, H 1319; Eustis, N 719; Manatee, S 105; No Name Key, P 111; Key Largo, P 165.
874. **Ipomoea triloba**, L. Duval county, C 5575.
875. **Ipomoea acetosaefolia**, R. Br. ——, Curtiss.
876. **Convolvulus sepium**, L. Eustis, H 1320.
877. Var. **repens**, Gray. Duval county, C 2172; Tavares, R 514.

878. **Convolvulus arvensis,** L. Pensacola, C 5915.
879. **Convolvulus nodiflorus,** Desr. Palm Beach, W 230, H 1321; Bahia Honda Key, B 5646.
880. **Convolvulus havanensis,** Jacq. Palm Beach, C 5860; Lemon City, H 1322; Cocoanutgrove, H 1323; Bahia Honda Key, C (labeled 5646, but probably an error).
881. **Jacquemontia violacea,** Choisy. No Name Key, C 5631; Upper Metacumbe Key, P 149.
882. **Jacquemontia tamnifolia,** Griseb. Chattahoochee, C 5995; Tallahassee, N 2516; Miami, R 957.
883. **Jacquemontia curtissii,** Peter. Biscayne Bay, C 2170; Miami, C 5856.
884. **Evolvulus alsinoides,** L. Losmans Key, S 199.
885. **Evolvulus sericeus,** Sw. Suwanee county, H 1325; Alachua county, H 1326; Eustis, H 1324; Levy county, H 1327; Polk county, R 475, 1402; Biscayne Bay, C 2179.
886. **Breweria grandiflora,** Gray. Tavares, R 511; Eustis, N 1326, H 1329.
887. **Breweria humistrata,** Gray. River Junction, N 2367.
888. **Breweria villosa,** Nash. Eustis, N 770, 771, 1508*a*; Polk county, R 452, 1378.
889. **Breweria angustifolia,** Nash. Suwanee county, H 1332; Alachua county, A 1331; Eustis, N 971, H 1334; Citrus county, H 1330. Corolla only half the usual length, peduncles about one-half inch long, leaves very narrow, one-half inch long.
890. **Breweria aquatica,** Gray. De Funiak, C 5903 (labeled *Evolvulus sericeus*): Jefferson county, H 1335; Madison county, H 1333; Lake City, H 1336; Miami, C 5855.
891. **Cuscuta arvensis,** Beyr. Carabelle, C 5881; Marion county, H 1337; Titusville, N 2283.
892. **Cuscuta neuropetala,** Engelm. Lake City, R 509 (on *Eupatorium foeniculaceum*); Palma Sola Bay, S (on *Myrica cerifera*); ——, R 627 (on egg plant).
893. **Cuscuta compacta,** Juss. Lake City, R 508 (on *Ilex glabra*), 510 (on *Vitis rotundifolia*); Duval county, C 2193 (on *Andromeda*).

SOLANACEAE.

894. **Solanum nigrum,** L. Pensacola, R 718; Jefferson county, H 1348; Suwanee county, H 1352; Citrus county, H 1345; Levy county, H 1351; Lake City, R 709, 713, 719, H 1355; Eustis, N 1220, H 1347, 1350; Polk county, R 454, 1396; St. Cloud, R 708; Palm Beach, W 256, H 1354, 1357 (low, with small dentate leaves); New River, H 1356; Key Largo, P 190.
895. **Solanum verbascifolium,** L. New River, H 1344; Hillsboro River, C 2198; Miami, R 937; Elliotts Key, W 309; Key Largo, C 5456; Sugarloaf Key, P 38.
896. **Solanum blodgettii,** Chapm. Losmans Point, S 156; Upper Metacumbe Key, C 2199; Key West, 9349, 350, P 3, 7.
897. **Solanum bahamense,** L. Palm Beach, C 5519, W 207, Swingle, H 1345; Lemon City, H 1346; Elliott's Key, W 336; Jewfish Key, P 129; Key Largo, P 173.
898. **Solanum aculeatissimum,** L. Marion county, H 1341; Madison county, H 1342; Lake City, R 717, H 1343; Eustis, H 1340.

899. **Solanum elaeagnifolium**, Cav. Pensacola, C 5913.
900. **Solanum carolinense**, L. Tallahassee, R 178; Jefferson county, H 1335; Citrus county, H 1338.
901. **Solanum sisymbrifolium**, Lam. Pensacola, R; Duval county, C 5686.
902. **Physalis angulata**, L. Lake City, R 710, 711, 714, 716; Duval county, C 2208, 5737; Eustis, N 1052; Levy county, H 1358.
903. **Physalis angustifolia**, Nutt. No Name Key, C 5442, P 117; Grassy Key, C 2212; ——, S.
904. **Physalis elliottii**, Kuntze. Palm Beach, H 1359; Lemon City, H 1360; Miami, C 5854, P 228; Hernando county, H 1361.
905. **Physalis barbadensis**, Jacq. Columbia county, H 1363; Lake City, R 719, H 1361, 1362; Eustis, N 1251.
906. **Physalis arenicola**, Kearney. Jefferson county, H 1368, 1371; Madison county, H 1369; Columbia county, H 1370; Lake City, H 1374; Melbourne Beach, C 5713; Eustis, N 2116, 1170, H 1372; Polk county, R 453, 1270, 1412; Levy county, H 1373; ——, R 1254.
907. **Physalis viscosa**, L. Suwanee county, H 1375; Madison county, H 1377; Alachua county, H 1376.
908. Var. **maritima**, Rydb. Eustis, N 198, 1049, H 1367; Palm Beach, H 1355, 1366; Lemon City, H 1354; Sea Breeze, W 463.
909. **Capsicum baccatum**, L. Eustis, N 985. Difficult to distinguish from the next in herbarium specimens.
910. **Capsicum frutescens**, L. Palm Beach, W 382, H 1378; Key Largo, C 5458, P 172; Caxambas Is., S 273.
911. **Lycium carolinianum**, Michx. Duval county, C 2216; Rockledge, Swingle; Meyers, W 201; Elliotts Key, W 324; ——, R 240.
912. **Datura stramonium**, L. Lake City, H 1379; Citrus county, H 1380.
913. **Datura tatula**, L. Jefferson county, H 1381; Lake City, R 1213, H 1382.
914. **Datura meteloides**, DC. Key West, C 2220*.
915. **Cestrum diurnum**, L. Between Marco and Key West, S 219; Key West, C 2220*. (Same number as preceding.) Escaped.
916. **Nicotiana glauca**, Grah. Pensacola, C 2221*, 5917.
917. **Petunia parviflora**, Juss. Pensacola, C 2221**; Apalachicola, C 5883.

SCROPHULARIACEAE.

918. **Verbascum thapsus**, L. Madison county, H 1413; Lake City, R 469.
919. **Verbascum blattaria**, L. Marion county, H 1414.
920. **Linaria canadensis**, Dumont. Jefferson county, H 1418; Lake City, R 642, 472, 468, 1071, H 1419; Duval county, C 1845; Eustis, H 1417.
921. **Linaria floridana**, Chapm. Apalachicola, C 1846; Eustis, N 192, H 1421; Hernando county, H 1420; Polk county, R 459; Jensen, C 5835.
922. **Pentstemon laevigatus**, Sol. Lake City, R 1251; Archer, R 471; Eustis, N 1290, H 1402; Polk county, R 462, 1382; Lemon City, H 1401; Miami, P 259.
923. **Pentstemon pubescens**, Sol. Suwanee county, H 1403; Madison county, H 1404; Tallahassee, R 470; Eustis, N 636; Polk county, R 464, 1218 in part, 1438.
924. **Herpestis nigrescens**, Benth. Eustis, N 688; Hillsboro river, C 1868; Citrus, H 1427.
925. **Herpestis chamaedryoides**, HBK. Biscayne Bay, C 1869*, 5498; Key West, C 1869.

926. **Herpestis amplexicaulis**, Pursh. Lake City, R 456, 1351; Eustis, H 1430, 1429; Eau Gallie, C 1866.
927. **Herpestis repens**, C. & S. Duval county, C 5743.
928. **Herpestis monniera**, HBK. Eustis, N 2057; Hernando county, H 1426; Miami, P 265.
929. **Gratiola sphaerocarpa**, Ell. Duval county, C 1872, 5606.
930. **Gratiola ramosa**, Walt. Jefferson county, N 2510, H 1395; Suwanee county, H 1396; Citrus county, H 1397; Polk county, R 467.
931. **Gratiola pilosa**, Michx. Jefferson county, H 1394; Lake City, H 1393; Eustis, N 1005, H 1392; Manatee, S 117.
932. **Gratiola subulata**, Baldw. Suwanee county, H 1398; Lake City, R 977; Duval county, C 5685; Eustis, N 584, H 1400; Tavares, R 227; Eau Gallie, C 5805; Levy county, H 1399; Polk county, R 466, 1425; Clearwater, R 607; Tampa, R 1133.
933. **Ilysanthes grandiflora**, Benth. Eau Gallie, C 5701; Eustis, N 1686; Hillsboro River, C 1880.
934. **Ilysanthes gratioloides**, Benth. Pensacola, R 487; Jefferson county, H 1425; Madison county, H 1422; Lake City, H 1423; Eustis, H 1424; Tampa, C 1881.
935. **Micranthemum orbiculatum**, Michx. Madison county, H 1415; Lake City, N 2160; Hernando, H 1416.
936. **Micranthemum nuttallii**, Gray. Manatee, S.
937. **Scoparia dulcis**, L. Jefferson county, H 1434; Suwanee county, H 1433; Lake City, H 1431; Eustis, N 918, H 1432; Tavares, R 225.
938. **Scoparia grandiflora**, Nash. Tampa, N. 2417.
939. **Capraria biflora**, L. Biscayne Bay, C 1901; Elliotts Key, W 308; Key West, C 5648, P 13.
940. **Buchnera elongata**, Sw. Madison county, H 1405; Lake City, R 1263, H 1408; Levy county, H 1407; Eustis, N 791, H 1409; Polk county, R 463, 1433; Cocoanutgrove, H 1406; Hernando county, H 1410.
941. **Seymeria tenuifolia**, Pursh. Lake City, R 457, H 1412; Duval county, 1906; Hernando county, H 1411; Tampa, R 1126; —— S.
942. **Seymeria pectinata**, Benth. Duval county, C 1907; Eustis, N 888, 1683.
943. **Dasystoma pectinata**, Benth. Marion county, H 1384; De Funiak, R 174, 237; Eustis, N 829, H 1383; Polk county, R 465, 1428.
944. **Gerardia linifolia**, Nutt. Duval county, N 2598.
945. **Gerardia purpurea**, L., var. **fasciculata**, Chapm. Lake City, R 458, H 1391; Duval county, C 1913, 6022; Eustis, N 1376, H 1390; Hernando county, H 1389; Polk county, R 461, 1379; Tampa, R 1149.
946. **Gerardia maritima**, Raf. Eau Gallie, C 5767; Titusville, N 2299; Hernando county, H 1385; Pine Island, S 295.
947. **Gerardia filifolia**, Nutt. Duval county, C (1876.)
948. **Gerardia divaricata**, Chapm. Duval county, C 1910; Hernando county, H 1386.
949. **Gerardia skinneriana**, Wood. Lake City, R 474; Polk county, R 460, 1376.
950. **Gerardia aphylla**, Nutt. Duval county, C (1876.)
951. **Paulownia imperialis**, S. & Z. Quincy, N 2559. Escaped?

OROBANCHACEAE.

952. **Conopholis americana**, Wallr. Lake City, R 617, 1087.
953. **Epiphegus virginiana**, Bart. Lake City, R 575, 733.

LENTIBULARIACEAE.

954. **Utricularia inflata,** Walt. Lake City, R 622, 739; E. Fla., F. A. White. (Curtis, N. A. P. Without number.)
955. **Utricularia floridana,** Nash. Eustis, N 492, 1970.
956. **Utricularia oligosperma,** St. Hil. Eustis, N 248, H 1441, 1442, 1443.
957. **Utricularia biflora,** Lam. Jefferson county, H 1435; Madison county, H 1436; Duval county, C 1819.
958. **Utricularia fibrosa,** Walt. Eustis, N 108.
959. **Utricularia macrorhyncha,** Barnhart. Jessamine, Pasco county, Barnhart 2537.
960. **Utricularia purpurea,** Walt. Eustis, N 1583, H 1439.
961. **Utricularia resupinata,** Greene. Eustis, N 1299.
962. **Utricularia subulata,** L. Duval county, C 1824; Eustis, N 93, H 1438; Polk county, R 476; New River, H 1437.
963. **Utricularia cornuta,** Michx. Eustis, N 1302, H 1440: Polk county, R 736, 1423.
964. **Utricularia juncea,** Vahl. Eustis, N 1292.
965. **Pinguicula pumila,** Michx. Lake City, R 737, 1206 in part; Duval county, C 1829: Eustis, N 7.
966. **Pinguicula elatior,** Michx. Lake City, R 735, 1073; Duval county, C 1827; Eustis, N 333; Kissimee, R 738, 1205.
967. **Pinguicula lutea,** Walt. Lake City, R 643, 1206, 1271 in part; Duval county, C 1826; Eustis, N 1.

BIGNONIACEAE.

968. **Bignonia capreolata,** L. Jefferson county, H 1444; Lake City, R 728, 619, 1063, H 1445; Duval county, C 1831.
969. **Tecoma radicans,** Juss. Jefferson county, H 1447; Lake City, R 1239, H 1446; Eustis, N 722.
970. **Tecoma stans,** Juss. Chokoliska Is., S 236: Key West, C 5651, 1833.
971. **Crescentia cucurbitina,** L. Miami, R 936, C 5838; Lemon City, H 2624.

PEDALIACEAE.

972. **Martynia proboscidea,** Glox. Madison county, H 1448.

ACANTHACEAE.

973. **Elytraria virgata,** Michx. River Junction, N 2369, C 5947: Alachua county, H 1450; Sumterville, C 1936; Hernando county, H 1451.
974. Var. **angustifolia,** Fernald. Biscayne Bay, C 5494.
975. **Calophanes humistrata,** Nees. Suwanee county, H 1457; Hernando county, H 1458.
976. **Calophanes oblongifolia,** Don. Jefferson county, H 1453; Lake City, R 190, 1354, H 1452; Eustis, N 184, H 1454; Polk county, R 188, 1415, 1437.
977. **Calophanes angusta,** Gray. Palm Beach, H 1455; Miami, C 5858; Cocoanutgrove, H 1456.
978. **Ruellia ciliosa,** Pursh. Madison county, H 1460; Columbia county, H 1464; Lake City, H 1461; Duval county, C 1944*; Eustis, N 415, H 1459, 1465; Citrus county, H 1463; Hernando county, H 1462; Polk county, R 189; ——, S.
979. **Stenandrium dulce,** Nees., var. **floridanum,** Gray. Biscayne Bay, C 1945*; Hernando county, H 2622.
980. **Dianthera crassifolia,** Chapm. Citrus county, H 1466.

981. **Dianthera ovata,** Walt. River Junction, N 2371; Columbia county, H 1467; ——, Buckley.
982. **Gatesia laetevirens,** Gray. Chattahoochee, C 1951, 6001.
983. **Dicliptera assurgens,** Juss. Eustis, N 380; Howes Key, S 280; Key Largo, W 347; Knights Key, C 5634; Upper Metacumbe Key, P 140; Lignum Vitae Key, C 1952. What appears to be *Thunbergia larrifolia* has escaped at Eustis, H 1468.

VERBENACEAE.

984. **Phryma leptostachya,** L. Tallahassee, N 2360.
985. **Stachytarpheta jamaicensis,** Vahl. Palm Beach, H 1483; Miami, R 940; C 1964; Key Largo, P 168; Chokoliska Is., S 226; Key West, C 5424.
986. **Verbena urticaefolia,** L. Lake City, R 209; Eustis, N 1248; Hernando county, H 1478.
987. **Verbena caroliniana,** Michx. Jefferson county, H 1481; Suwanee county, H 1482; Lake City, R 191; Eustis, H 1480; Hernando county, H 1479; Polk county, R 1248.
988. **Verbena aubletia,** L. Daytonia, W 479.
989. **Verbena tampensis,** Nash. Madison county, H 1476; E. Fla., C 1963*; Palm Beach, H 1477, 1478; Cape Canaveral, C 5706; Biscayne Bay, W 301.
990. **Lippia nodiflora,** Michx. Suwanee county, H 1485; Eustis, N 855; Clearwater, R 427; Palm Beach, H 1484.
991. **Lantana involucrata,** L. Lake City, R 1265; Indian River, C 1967; Lemon City, H, 1469; Miami, R 939; Palmetto, N 2431; Key West, C 5423; Biscayne Key, W 300; Cudjoes Key, P 89; Key Largo, P 178.
992. **Lantana camara,** L. Duval county, C 5692; Daytonia, W 502; Eustis, N 19, 943; Polk county, R 187; Hernando county, H 1475, this seems certainly to be indigenous in the flatwoods of western part of county; Clearwater, R 438; Palm Beach, W 427, H 1474; Lemon City, H 1472; Cocoanutgrove, H 1473; Point Losmans Key, S 198. Some cultivated species have escaped, as: Eustis, N 775; Alachua county, H 1470; Lake City, H 1471.
993. **Citharexylum villosum,** Jacq. Merritts Is., C 5722; Cape Malabar, C 1969; Palm Beach, W 431, H 1468, 1487, 1488.
994. **Callicarpa americana,** L. Jefferson county, H 1490; Lake City, R 185, 183, H 1491; Eustis, N 725, H 1492; Polk county, R 185; Palm Beach, H 1489.
995. **Avicenna nitida,** Jacq. Palmetto, N 2450; Tampa, R 248; Meyers, W 195; Biscayne Bay, W 277; Lemon City, H 1493, 1494; ——, S.

LABIATAE.

996. **Trichostema dichotoma,** L. Marion county, H 1523; Lake City, R 526; Hernando county, H 1525; Duval county, C 1976; Palmetto, N 2452; Palm Beach, H 1524; New River, H 1522.
997. **Trichostema frutescens,** Kearney. Eustis, N 625, H 1528.
968. **Trichostema lineare,** Nutt. Palm Beach, H 1527; New River, H 1526.
999. **Teucrium canadense,** L. Tavares, R 536.
1000. **Teucrium nashii,** Kearney. Duval county, C 1975, 5952; Eustis, N 1496.
1001. **Ocymum micranthum,** Willd. Key West, C 1979, 5622.
1002. **Hyptis radiata,** Willd. Lake City, R 1258 Duval county, C 1980; Citrus county, H 1495; Eustis, N 1714; Palm Beach, H 1498; Arch Creek, W 306; New River, H 1499; Hernando county, H 1497.

1003. **Hyptis spicigera**, Lam. S. Fla., C 1981*.
1004. **Hyptis spicata**, Poir. Columbia county, H 1501; Duval county, R 530; E. Fla., H 1499; Levy county, H 1500.
1005. **Collinsonia canadensis**, L. Lake City, R 260.
1006. **Collinsonia anisata**, Sims. Chattahoochee, C 2029.
1007. **Mentha rotundifolia**, L. Tallahassee, R 177; Jefferson county, H 1530; Baldwin, N 2252.
1008. **Mentha piperita**, L. Tallahassee, N 2338.
1009. **Lycopus sessilifolius**, Gray. Lake City, R 200, 534; Duval county, C 1990*, 5579 (var. *pubens*, Gray).
1010. **Lycopus rubellus**, Moench. Lloyd, N 2507.
1011. **Pycnanthemum nudum**, Nutt. Lake City, R 965, H 1504; Baldwin, N 2316.
1012. **Pycnanthemum aristatum**, Michx. Lake City, N 2182, R 525; Archer, R 1267.
1013. **Pycnanthemum hyssopifolium**, Benth. Jefferson county, H 1505; St. Marks, N 2536.
1014. **Pycnanthemum muticum**, Pers. Jefferson county, H 1506; Madison county, H 1808; Sanford, N 2259; Hernando county, H 1507.
1015. **Pycnanthemum albescens**, T. & G. River Junction, C 5981.
1016. **Satureia rigida**, Bartr. Palm Beach, H 1535; New River, W 305; Jensen, R 950; Fort Lauderdale, C 5847.
1017. **Micromeria brownei**, Benth. Enterprise, C 2023; Alachua county, H 1529; Sanford, N 2254.
1018. **Calamintha caroliniana**, Sweet. River Junction, N 2588.
1019. **Calamintha coccinea**, Benth. Indian River, C 2012.
1020. **Conradina puberula**, Small. Apalachicola, C 2014; Eden, C 5836; Palm Beach, H 1531.
1021. **Ceranthera densiflora**, Gray. Lake City, R 594.
1022. **Salvia lyrata**, L. Madison county, H 1511; Lake City, R 996, 1253 in part; Duval county, C 2034; Eustis, N 40, H 1512; Levy county, H 1510.
1023. **Salvia coccinea**, L. Eustis, N 1158, H 1509.
1024. **Salvia serotina**, L. Palm Beach, H 1513; Biscayne Bay, C 2032; Cocoanutgrove, H 1514; Chokoliska Is., S 244; No Name Key, S 142, P 116; Key West, C 5621.
1025. **Salvia privoides**, Benth. S. Fla., C 2032*.
1026. **Monarda punctata**, L. River Junction, C 5981; Columbia county, H 1502; Lake City, R 527, 535, N 2483; Alachua county, H 1503.
1027. Var. **leucantha**, Nash. Palmetto, N 2456.
1028. **Scutellaria canescens**, Nutt., var. **punctata**, Chapm. River Junction, N 2384; Bellair, N 2555; Marion county, H 1515; Eustis, W 514.
1029. **Scutellaria integrifolia**, L., var. **hyssopifolia**. Walton county, C 2060**; Jefferson county, H 1518; Suwanee county, H 1516; Lake City, R 529, 1252, 1293, H 1517; ——, R 477.
1030. Var. **major**, Chapm. Lake City, R 316; Duval county, C 5671.
1031. **Scutellaria arenicola**, Small. Eustis, N 1316.
1032. **Physostegia virginiana**, Benth. Columbia county, H 1536.
1033. **Physostegia denticulata**, Britt. Glen St. Mary, R 1259; Lake City, R 1261; Falling Creek, R 381, 1280 in part; Indian River, C 2051*; Eustis, N 2049; Duval county, C 5869; ——, R 473.
1034. **Leonotis nepetaefolia**, R. Br. River Junction, C 6004; Madison county, H 1533; Lake City, N 2189, H 1534; Hernando county, H 1532; ——, S 347.

1035. **Stachys floridana**, Shuttl. Madison county, H 1519; Lake City, R 528, 531, 533, 1253, 1257; Eustis, N 223; Levy county, H 1521; Archer, R 1267 in part; Hernando county, H 1520.

PLANTAGINACEAE.

1036. **Plantago lanceolata**, L. Columbia county, H 1538; Lake City, R 1320; Eustis, H 1537.

1037. **Plantago aristata**, Michx. Jefferson county, H 1540; Eustis, H 1539; Levy county, H 1541.

1038. **Plantago virginica**, L. Lake City, R 532, 1262; Duval county, C 1786; Eustis, N 344.

NYCTAGINACEAE.

1039. **Pisonia aculeata**, L. Palm Beach, H 1542, 1543; Key Largo, P 155; Key West, C 5611, 2337, S 233.

1040. **Pisonia obtusata**, Sw. Indian River, C 2338; Palm Beach, C 5379; Big Pine Key, S 342.

1041. **Pisonia rotundata**, Griseb. No Name Key, S 148, C No. G.

1042. **Boerhaavia decumbens**, Vahl. Eustis, N 974, H 1544.

1043. **Boerhaavia viscosa**, Lag. Tampa, N 2466.

1044. **Boerhaavia hirsuta**, Willd. Hillsboro River, C 2335; Tampa, R 1153.

1045. **Boerhaavia erecta**, L. Madison county, H 1547; Lake City, H 1545; Eustis, N 973, H 1551; Levy county, H 1548; Citrus county, H 1550; Palm Beach, H 1546, 1549; Key Largo, P 176.

ILLECEBRACEAE.

1046. **Gibbesia rugelii**, Small. Suwanee county, H 1552; Citrus county, H 1553.

1047. **Paronychia herniarioides**, Nutt. Eustis, N 1185; Tavares, R 226.

1048. **Paronychia baldwinii**, Chapm. Columbia county, H 1555; Lake City, N 2200, R 150; Marion county, H 1554; Alachua county, H 1556.

1049. **Siphonychia diffusa**, Chapm. Madison county, H 1558; Columbia county, H 1559; Eustis, N 1167; Levy county H 1557; Cedar Keys, C 343.

1050. **Siphonychia americana**, T. & G. Lake City, R 1365; Merritt's Is., C 342; Citrus county, H 1560; Jupiter, C 5546; Daytonia, W 507; Rosewood, Garber.

CHENOPODIACEAE.

1051. **Chenopodium album**, L. Madison county, H 1562; Suwanee county, H 1563. This specimen has broad, toothed, mealy leaves, and the upper leaves pink; the other specimens have small, thin, scarcely mealy leaves. Eustis, N 2109; Hernando county, H 1561.

1052. **Chenopodium murale**, L. Pensacola, R 495.

1053. **Chenopodium anthelminticum**, L. Madison county, H 1566; Lake City, H 1569; E. Fla., H 1564; Eustis, H 1565; Levy county, H 1568; Polk county, R 741; Palm Beach, H 1567.

1054. **Salicornia mucronata**, Bigel. Titusville, N 2290; Ragged Keys, W 320.

1055. **Salicornia ambigua**, Michx. Titusville, N 2291; Ponce Park, W 499; Hernando county, H 1570; S. Fla., Swingle.

1056. **Atriplex cristatum**, HBK. Indian River, C 2357; Palmetto, N 2441; Ragged Keys, W 318; Upper Metacumbe Key, C 5506.

1057. **Sueda linearis**, Moq. Titusville, N 2292, 2310*a*; Ponce Park, W 468; ——, S; Sugar Loaf Key, P 41.

AMARANTACEAE.

1058. **Amarantus chlorostachys**, Willd. Lake City, H 1571.

1059. **Amarantus hybridus**, L. Eustis, H 1578; Levy county, H 1579.

1060. **Amarantus spinosus**, L. Madison county, H 1573; Lake City, R 742, H 1575; E. Fla., H 1574; Eustis, H 1572; Alachua county, H 1577; Palm Beach, H 1576; Key Largo, P 199.

1061. **Celosia paniculata**, L. Key Largo, P 189: Key West, C 5652.

1062. **Euxolus lividus**, Moq. Pensacola, R 483; Eustis, H 1592; Palm Beach, H 1593; Sarasota Key, C 2373.

1063. **Scleropus crassipes**, Moq. Key West, C 5421, 2378.

1064. **Acnida cannabina**, L. Duval county, C 2379.

1065. **Acnida australis**, Gray. Citrus county, H 1591; Eustis, N 868; Palm Beach, H 1590: ——, S.

1066. **Acnida tamarascina**, Wood, var. **prostrata**, U. & B. Cape Canaveral, C 5775.

1067. **Iresine vermicularis**, Moq. Eau Gallie, C 2380; Jupiter Inlet, C 5559; Palm Beach, H 1580; Clearwater, R 437; Charlotte Harbor, W 167; Palmetto, N 2435; Key Largo, W 348; Key West, P 91.

1068. **Iresine celosioides**, L. Palm Beach, H 1581, 1582; Upper Metacumbe Key, P 148.

1069. **Alternanthera achyrantha**, R. Br. Key Largo, P 166; Key West, C 5422.

1070. **Alternanthera aspera**, L. Key West, S 205, C 543.

1071. **Alternanthera pungens**, HBK. Pensacola, C 5921.

1072. **Telanthera maritima**, Moq. Palm Beach, W 234, 437, C 5405.

1073. **Telanthera floridana**, Chapm. Merritt's Is., C 2387; Palm Beach, W 224, 430, 439, H 1583, 1584, 1585; Old Rhodes Key, C 5450; Key West, P 9.

1074. **Froelichia floridana**, Moq. Suwanee county, H 1589; Lake City, H 1586; E. Fla., H 1588; Eustis, N 2011, 705, H 1587; Tavares, R 293.

PHYTOLACCACEAE.

1075. **Petiveria alliacea**, L. Duval county, C 2341; Eustis, N 1727; Palm Beach, C 5520, H 1597.

1076. **Rivina humilis**, L. Eustis, N 1273; Palm Beach, C 5383, W 376, H 1594, 1595, 1596; Upper Metacumbe Key, P 137.

1077. **Rivina octandra**, L. Chokoliska Is., S.

1078. **Phytolacca decandra**, L. Jefferson county, H 1600; Lake City, H 1599; Duval county, C 2341; Eustis, N 1733; Polk county, R 303, 1375.

BATIDACEAE.

1080. **Batis maritima**, L. Ponce Park, W 495; Palmetto, N 2436; Hillsboro River, C 2535; Sugar Loaf Key, C 5647.

POLYGONACEAE.

1081. **Rumex crispus**, L. Pensacola, R 486.

1082. **Rumex floridanus**, Meisn. Titusville, N 2286.

1083. **Rumex hastatulus**, Baldw. Jefferson county, H 1623; Lake City, R 301; Eustis, N 400, H 1622; ——, R 1076.

1084. **Polygonella parvifolia**, Michx. Indian River, C 2433; Eustis, N 1764; Tampa, R 1145; Palm Beach, C 5525, H 1630; ——, S.

1085. **Polygonella gracilis**, Meisn. Levy county, H 1629; Duval county, R 297; Cocoanutgrove, H 1628.

1086. **Polygonum pennsylvanicum**, L. Lake City, R 620; Levy county, 1607. Upper part of stem hispid, with somewhat appressed, broad-based hairs.

1087. **Polygonum hydropiperoides,** Michx. Jefferson county, H 1617, 1620; Suwanee county, H 1611; Columbia county, H 1615; Lake City, R 296, 299, 306, 1236, H 1612, 1613, 1621; Duval county, C 2411, 2402, 305, R 298; Eustis, N 1087, 713, H 1616, 1619; Tavares, R 294; Levy county, H 1614; Polk county, R 304, 1398; Palm Beach, H 1618; Miami, P 266. Some of them may be *P. opelousianum*, but I am unable to separate them.

1088. **Polygonum setaceum,** Baldw. Eustis, N 237; Duval county, C 5740.

1089. **Polygonum hirsutum,** Walt. Madison county, H 1610; Lake City, H 1609; Eustis, N 652, H 1608; Tavares, R 295.

1090. **Polygonum aviculare,** L. Pensacola, R 1342.

1091. **Polygonum cristatum,** E. & G. Duval county, C 5802.

1092. **Thysanella fimbriata,** Gray. Columbia county, H 1625; Palm Beach, H 1624, 1626; Cocoanutgrove, H 1627; Jensen, C 5837.

1093. **Coccoloba uvifera,** Jacq. Merritt's Is., C 2439; Palm Beach, C 5382, H 1601; Upper Metacumbe Key, C 5382, 2439; Sugar Loaf Key, P 62.

1094. **Coccoloba floridana,** Meisn. Merritt's Is., C 2440; Palm Beach, C 5388, W 212, H 1602; Lemon City, W 271; Chokoliska Is., S 221; Key Largo, P 160, 209.

1095. **Brunnichia cirrhosa,** Banks. Chattahoochee, C 5935.

1096. **Eriogonum longifolium,** Nutt. Lake City, R 1238; Eustis, N 704, H 1605; Polk county, R 302; Welchton, H 1606; Haines City, C 5954. This was not observed from Monticello to Fitzgerald.

1097. **Eriogonum tomentosum,** Michx. Suwanee county, H 1603; Lake City, R 1237; Eustis, N 296, H 1604; Polk county, R 296; Haines City, C 5953; Tampa, C 2443.

ARISTOLOCHIACEAE.

1098. **Aristolochia tomentosa,** Sims. ——, C (1875).

1099. **Aristolochia nashii,** Kearney. Columbia county, H 1631; Lake City, H 1631; Eustis, H 1633.

PIPERACEAE.

1100. **Saururus cernuus,** L. Jefferson county, H 1636; Lake City, R 537, H 1634; Eustis, N 310, H 1635; Duval county, C 2460.

1101. **Peperomia magnoliaefolia,** C. DC. S. Fla., Swingle; Lemon City, H 1637.

1102. **Peperomia leptostachya,** Chapm. Merritt's Is., C 5773.

LAURACEAE.

1103. **Persea gratissima,** Gaertn. Key Largo, P 162. Escaped.

1104. **Persea carolinensis,** Nees. Eustis, N 448, 1281; Cedar Key, C (1875); Miami, R 956.

1105. **Persea pubescens,** Sarg. Lake City, R 961; H 1643; Duval county, C 5663; Eustis, N 435, 1812, H 1644; Palm Beach, H 1645; ——, S 44.

1106. **Persea humilis,** Nash. Eustis, N 574, 2601; Palm Beach, H 1646.

1107. **Nectandra willdenoviana,** Nees. Merritt's Is., C 2445; Palm Beach, C 5368, W 208, H 1641; Lemon City, H 1642; S. Fla., Swingle; Turner River, S 201; Key Largo, P 198.

1108. **Sassafras officinale,** Nees. Jefferson county, H 1639; Lake City, R 539, H 1640.

1109. **Cassytha filiformis,** Mill. Merritt's Is., C 4250 (2450 ?); Palm Beach, H 1638; Jupiter, 5542; Sanibel Is., W 194; Lower Metacumbe Key, P 132; Sugarloaf Key, P 75.

EUPHORBIACEAE.

1110. **Euphorbia corollata**, L., var. **angustifolia**, Ell. Walton county, C 2470 *, R 1323; Jefferson county, H 1680; Madison county, H 1681.

1111. Var. **apocynifolia**, Millsp. River Junction, C 5979; Quincy, N 2567.

1112. **Euphorbia discoidialis**, Chapm. Alachua county, H 1671; Baker county, C 2477.

1113. **Euphorbia polyphylla**, Engelm. Indian River, C 2498 *; Eau Gallie, C 5733.

1114. **Euphorbia sphaerosperma**, Shuttl. Walton county, C 2479, 5905, R 173.

1115. **Euphorbia telephioides**, Chapm. Apalachicola, C 2504.

1116. **Euphorbia ipecacuanhae**, L. Suwanee county, H 1674; Lake City, R 1249, H 1673; Eustis, H 1672.

1117. **Euphorbia heterophylla**, L. De Funiak, R 239; E. Fla., H 1679; Eustis, N 1353; Palm Beach, W 217, H 1676, 1677, 1678; Upper Metacumbe Key, P 151; No Name Key, P 125.

1118. Var. **graminifolia**, Engelm. Indian River, C 2484 *; Palm Beach, W 216, H 1675; Clearwater, R 432; Old Rhodes Key, C 5449; Lower Metacumbe Key, P 131; Boca Chica Key, P 109; Egmont Key, R 1151.

1119. **Euphorbia trichotoma**, HBK. Jupiter Inlet, C 5539; Cape Malabar, C 2502; Tampa, N 2421; ——, S.

1120. **Euphorbia hypericifolia**, L. Eustis, N 930, 1076, H 1701, 1702; Citrus county, H 1704; New River, H 1703; Upper Metacumbe Key, C 2486.

1121. **Euphorbia preslii**, Guss. Eustis, H 1700.

1122. **Euphorbia nutans**, Lag. Tallahassee, N 2519; Alachua county, H 1697; Levy county, H 1698; Citrus, H 1699.

1123. **Euphorbia buxifolia**, Lam. E. Fla., C 2481; Palm Beach, C 5404, W 236, Swingle, H 1670; Sanibel Is., W 172; Newfound Harbor Key, P 80.

1124. **Euphorbia pilulifera**, L. Indian River, C 2496; Eustis, H 1705; Hernando county, H 1706; Palm Beach, C 5395, H 1708; Braidentown, S; Cocoanutgrove, H 1707; Miami, C 5849; Key Largo, P 188; Upper Metacumbe Key, C 2496.

1125. **Euphorbia garberi**, Engelm. No Name Key, C 5511; Cape Sable, C 2479 *.

1126. **Euphorbia deltoidea**, Engelm. Biscayne Bay, C 2474 *; Miami, C 5468.

1127. **Euphorbia serpens**, HBK. Pensacola, C 5920; Lake City, R 425.

1128. **Euphorbia ammannioides**, HBK. Sea Breeze, W 464; Caxambas Is., S 286; Caxambas Inlet, C 2468 *.

1129. **Euphorbia cordifolia**, Ell. Madison county, H 1696; Alachua county, H 1695; Eustis, N 1070, H 1694; Haines City, C 5959.

1130. **Euphorbia maculata**, L. Jefferson county, H 1688; Madison county, H 1689; Alachua county, H 1686; Columbia county, H 1685; Lake City, H 1682, 1684; Duval county, C 2491; Eustis, N 655, H 1691, 1692; Tampa, N 2427; Hernando county, H 1690; Palm Beach, H 1687; Lemon City, H 1683, 1693.

1131. **Euphorbia blodgettii**, Engelm. Upper Metacumbe Key, C 2487.

1132. **Euphorbia adenoptera**, Bertol. Biscayne Bay, C 2468 **, 5486; Lemon City, H 1709.

1133. **Hippomane mancinella**, L. Elliott's Key, W 233; No Name Key, S 272; Key West, C 2505, 5623.

1134. **Sebastiana ligustrina**, Muell. Jefferson county, H 1713; Alachua county, H 1712; Duval county, C 2510.

1135. **Sebastiana lucida,** Muell. Bahia Honda Key, S 336; Upper Metacumbe Key, C 2512.
1136. **Stillingia sylvatica,** L. Jefferson county, H 1714; Madison county, H 1717; Lake City, R 250, H 1718; Eustis, H 1716; Polk county, R 418; Palmetto, N 2428; Lemon City, H 1715; ——, S.
1137. **Stillingia aquatica,** Chapm. Apalachicola, C 2509, 5892.
1138. **Acalypha gracilens,** Gray. Jefferson county, H 1648; Duval county, C 3513*; Eau Gallie, C 5768; Eustis, N 1026, 1057, H 1650; Citrus county, H 1647; Levy county, H 1649.
1139. **Acalypha corchorifolia,** Willd. Biscayne Bay, C 2514; Miami, P 230; Cocoanutgrove, C 5483, H 1651.
1140. **Acalypha caroliniana,** Walt. Eustis, N 1493.
1141. **Tragia urens,** L. Jefferson county, H 1721; Columbia county, H 1720; Lake City, H 1723; Duval county, C 5412; Eustis, N 1079, H 1719; Citrus county, H 1722.
1142. Var. **linearifolia.** Duval county, C 5413; Eustis, N 1080, H 1724; Polk county, R 417, 1405.
1143. **Tragia urticaefolia,** Michx. Biscayne Bay, C 2517.
1144. **Croton maritimus,** Walt. Jupiter Inlet, C 5532; Palm Beach, W 229, H 1662.
1145. **Croton capitatus,** Michx. Citrus county, H 1663.
1146. **Croton betulinus,** Vahl. Miami, C 5840.
1147. **Croton balsamiferus,** Willd. Key West, C 2520.
1148. **Croton argyranthemus,** Michx. Jefferson county, H 1667; Lake City, R 420; Polk county, R 423, 1418; Eustis, N 358, H 1666.
1149. **Croton glandulosus,** L. Madison county, H 1659; Lake City, H 1661; Daytonia, W 504; Duval county, C 5683; Eustis, N 579, H 1657; Levy county, H 1660; Palm Beach, H 1658; Polk county, R 416, 1385; Miami, P 218.

Var. **maritimus.** Haines City, C 5956; Palm Beach, C 5398; Gasparilla Key, C 2523*.
1150. **Croton linearis,** Jacq. Palm Beach, C 5360, H 1664; Biscayne Bay, H 1665; Lemon City, H 1665; Ocean Grove, W 351; No Name Key, S 186; Big Pine Key, P 84.
1151. **Crotonopsis linearis,** Michx. Jefferson county, H 1669; Lake City, H 1668.
1152. **Crotonopsis spinosa,** Nash. Pease Creek, C 2526; Melbourne, C 5715; Eustis, N 1971.
1153. **Argyrothamnia blodgettii,** Chapm. Lemon City, H 1652; Key West, S 316, C 2527, 5617.
1154. **Cnidosculus stimulosus,** Gray. Jefferson county, H 1654; Lake City, R 419, 1269, H 1656; Duval county, C 2506; Eustis, N 759, H 1655; Polk county, R 424, 1403; Palm Beach, H 1653.
1155. **Ricinus communis,** L. Duval county, C 2507. Spontaneous near dwellings.
1156. **Phyllanthus carolinianus,** Walt. Palm Beach, C 5403, H 1710.
1157. **Phyllanthus niruri,** L. Biscayne Bay, C 2528*; Cocoanutgrove, C 5482, H 1711; No Name Key, P 114.
1158. **Drypetes crocea,** Poit. Palm Beach, W 378, C 5381; Biscayne Bay, C 2530.

URTICACEAE.

1159. **Urtica urens,** L. Pensacola, R 494; Sister Is., C 2553.
1160. **Pilea microphylla,** Leitn. Hernando county, C 2556*.

1161. **Parietaria debilis**, Forst. Pensacola, R 484; Palm Beach, C 5371.
1162. **Boehmeria cylindrica**, Willd. Columbia county, H 1740; Eustis, H 1742; Palm Beach, H 1741.
1163. Var. **scabra**, Port. Lake City, R 664, 1335, H 1739; Duval county, C 2557, 5749; Eustis, N 1177, H 1738; Levy county, H 1737; Tavares, R 231.
1164. **Morus rubra**, L. Jefferson county, H 1727; Lake City, R 186, H 1729; Palm Beach, H 1728.
1165. **Ficus aurea**, Nutt. Palm Beach, H 1743; Miami, C 5465; Caxambas Is., S 274; Key Largo, P 164.
1166. **Ficus pedunculata**, Willd. Biscayne Bay, C 4491; Cocoanutgrove, H 1744; Key Largo, C 2547.
1167. **Ficus brevifolia**, Nutt. Merritt's Is., C 2546; No Name Key, S 269.
1168. **Ulmus floridana**, Chapm. Jefferson county, H 1732; Lake City, H 1733; Eustis, N 895, 693, H 1735; Hernando county, H 1734.
1169. **Ulmus alata**, Michx. Lake City, R 372; Citrus county, H 1736.
1170. **Celtis occidentalis**, L. Jefferson county, H 1725; River Junction, N 2382.
1171. **Celtis mississippiensis**, Bosc. Eustis, N 694; Palm Beach, H 1726.
1172. **Trema micrantha**, B. & H. Palm Beach, H 1731, Lemon City, W 294, H 1730; Biscayne Bay, C 2543*; Miami, C 5169, R 944; Turner River, S 231; Key Largo, P 153.

PLATANACEAE.

1173. **Platanus occidentalis**, L. Madison county, H 1745.

MYRICACEAE.

1174. **Myrica cerifera**, L. De Funiak, R 674; Tallahassee, N 2518; Jefferson county, H 1746; Lake City. R 276 in part, 205, H 1748; Duval county, C 2606, 5607; Eustis, N 306, 314; Tampa, R 1132; Palm Beach, H 1747; Lemon City, H 1749; Sea Breeze, W 494; Sugarloaf Key, P 51; ——, R 422.
1175. Var. **pumila**, Michx. Lake City, N 2224, R 276 in part; Falling Creek, R 378.
1176. **Myrica carolinensis**, Mill. Duval county, C 2606*.
1177. **Myrica inodora**, Bartr. Argyle, C 5944; Indian River, 2607.

LORANTHACEAE.

1178. **Phoradendron flavescens**, Nutt. Lake City, R 538, 1079; Duval county, C 2459.

JUGLANDACEAE.

1179. **Carya tomentosa**, Nutt. Jefferson county, H 1751, 1752; Lake City, N 2171, H 1750.
1180. **Carya porcina**, Nutt. Tallahassee, N 2341, 2342; Jefferson county, H 1755; Madison county, H 1756; Lake City, R 160, H 1754; Duval county, C 2570; Eustis, H 1753; Levy county, H 1757.
1181. **Carya aquatica**, Nutt. Chattahoochee, C 5994; Jefferson county, H 1758; Upper St. Johns River, C 2573.

CASUARINACEAE.

1182. **Casuarina equisetifolia**, Forst. Biscayne Bay, C 2675*a*.

CUPULIFERAE.

1183. **Quercus phellos**, L. Jefferson county, H 1762; Suwanee county, H 1761; Lake City, R 170; Duval county, C 2591, 5604; Eustis, N 1663.
1184. **Quercus laurifolia**, Michx. Eustis, N 1672.

1185. **Quercus cinerea**, Michx. Jefferson county, H 1767; Lake City, R 169, 1315, H 1766; Eustis, H 1764, N 1692; Duval county, C 5608. *Cinerea* × *catesbaei*, Eustis, N 1586.

1186. **Quercus aquatica**, Walt. Jefferson county, H 1772, 1773, 1774; Marion county, H 1770; Apalachicola River, C 2575; Columbia county, H 1768; Lake City, H 1775; Duval county, C 5574; Eustis, N 1756, 1655, 1664, H 1769; Hernando county, H 1771.

1187. **Quercus plenocarpa**, Small. Eustis, N 1677?

1188. **Quercus catesbaei**, Michx. Jefferson county, H 1778; Lake City, R 166, 167, H 1777; Duval county, C 2577; Eustis, N 1645, H 1776. *Catesbaei* × *cinerea*, Eustis, N 1577.

1189. **Quercus falcata**, Michx. Tallahassee, N 2408; River Junction, N 2386; Jefferson county, H 1779, 1780, 1781; Lake City, N 2196, R 1312, H 1782, 1783, 1784.

1190. **Quercus myrtifolia**, Willd. Jupiter Inlet, C 5541; Eustis, N 1646, H 1785, N 1640.

1191. **Quercus pumila**, Walt. Lake City, N 2229, R 371, 970; New River, H 1763; Miami, P 248.

1192. **Quercus stellata**, Wang. Quincy, N 2569; Jefferson county, H 1786; Lake City, R 168, H 1787; Eustis, N 1576.

1193. **Quercus parvifolia**, Small. Apalachicola, C 2589*; Duval county, C 6010; Eustis, N 1639, 179; Palm Beach, H 1788, 1789.

1194. **Quercus alba**, L. Jefferson county, H 1790.

1195. **Quercus michauxii**, Nutt. Chattahoochee, C 2593 C; Tallahassee, N 2526; Lake City, R 165, 1314, H 1792; Hernando county, H 1791.

1196. **Quercus virens**, Ait. Suwanee county, H 1796; Lake City, R 964, 969, H 1797; Duval county, C 5786; Sea Breeze, W 460, 497; Eustis, N 2414, 1623, 516, 1759, 1762; Palm Beach, H 1793, 1794; Hernando county, H 1795.

1197. **Castanea pumila**, Michx. Madison county, H 1807; Lake City, R 162, 163, 1313, N 2234; Eustis, N 963, H 1805.

1198. **Castanea nana**, Muhl. Jefferson county, H 1805, Columbia county, H 1808; Lake City, H 1806, 1809, R 164.

1198*x*. **Fagus ferruginea**, Ait. Tallahassee, N 2339; Lake City, R 159.

1199. **Carpinus americana**, Michx. Tallahassee, N 2340; Columbia county, H 1802; Lake City, R 161, H 1803; Citrus county, H 1804.

1200. **Ostrya virginiana**, Willd. Columbia county, H 1799; Lake City, N 2158, H 1801; Hernando county, H 1800.

BETULACEAE.

1201. **Alnus serrulata**, Ait. River Junction, N 2590; Lake City, R 482.

SALICACEAE.

1202. **Salix wardii**, Bebb. Jefferson county, H 1810; Lake City, R 496, 1066; Eustis, N 134.

1203. **Salix occidentalis**, Koch., var. **longipes**, Bebb. Jefferson county, H 1811; Lake City, H 1812; Duval county, C 5826; Tavares, R 222.

EMPETRACEAE.

1204. **Ceratiola ericoides**, Michx. Alachua county, H 1814; Enterprise, R 206; Lake City, R 1327, 1362; Eustis, N 1121, H 1813; Tavares, W 393, R 1328; Indian River, C 2534; Palm Beach, C 5392, H 1816; Clearwater, R 608; New River, H 1815.

CERATOPHYLLACEAE.

1205. **Ceratophyllum demersum**, L. Columbia county, H 1818; Lake City, H 1817.

BURMANNIACEAE.

1206. **Burmannia biflora**, L. Eustis, N 1439, H 1821.
1207. **Burmannia capitata**, Chapm. Eustis, N 1081.
1208. **Apteria setacea**, Nutt. Lake City, R 600; Eustis, H 1820; Palm Beach, H 1819.

HYDROCHARIDACEAE.

1209. **Halophila engelmannii**, Asch. Palm Beach, H 1823, C 5399: Cape Sable, C 2704*.
1210. **Limnobium spongia**, Rich. Washington county, C 2749; Madison county, H 1822; Duval county, C 5756; Eustis, N 908, R 249.

ORCHIDACEAE.

1211. **Microstylis ophioglossoides**, Nutt. ——, R 252.
1212. **Corallorhiza odontorhiza**, Nutt. Merritt's Is., C 2816.
1213. **Epidendrum conopseum**, Ait. Lake City, R 694; Columbia county, H 1837, C 2804; Eustis, H 1838; Istachatta, C 5971; Hernando county, C 2804.
1214. **Epidendrum tampense**, Lindl. Eustis, H 1840; Merritt's Is., C 5723; Hillsboro River, C 2805; Palm Beach, H 1839; Upper Metacumbe Key, P 139.
1215. **Epidendrum cochleatum**, L. Lemon City, H 1841.
1216. **Epidendrum nocturnum**, L. Lemon City, H 1842, 1843.
1217. **Tipularia discolor**, Nutt. Tallahassee, N 2361.
1218. **Bletia verecunda**, Swartz. Eustis, N 1521; Titusville, N 2294.
1219. **Hexalectris aphyllus**, Raf. Lake City, R 687, 1220; Eustis, N 2150; Clearwater, R 430; New River, H 1825.
1220. **Polystachya luteola**, Hook. Lemon City, H 1824.
1221. **Cyrtopodium punctatum**, Lindl. No Name Key, S 313.
1222. **Calopogon pulchellus**, R. Br. Madison county, H 1828; Lake City, R 689, 693 (B), 695, 1226, 1219, 1228; Glen St. Mary, R 633; Duval county, C 2799; Eustis, N 793; Hernando county, H 1827; Polk county, R 681, 1408; ——, S.
1223. **Calopogon parviflorus**, Lindl. Eustis, N 6; Tampa, R 1150; Polk county, R 691, 1217, 1218, 1414.
1224. **Pogonia ophioglossoides**, Nutt. Lake City, R 684, 685, 692, 696, 1215, 1227, 1222, 1221; Duval county, C 2794; Eustis, N 538, H 1826; Polk county, R 698, 697, 1409.
1225. **Pogonia divaricata**, R. Br. Lake City, R 686.
1226. **Habenaria nivea**, Spreng. De Funiak, R 254; Lake City, H 1835; Baldwin, R 208; Eustis, N 1927.
1227. **Habenaria ciliaris**, R. Br. Lake City, R 994; Eustis, N 1534.
1228. **Habenaria cristata**, R. Br. De Funiak, R 672, C; Hernando county, H 1836.
1229. **Habenaria conspicua**, Nash. Lake City, N 2501.
1230. **Habenaria repens**, Nutt. Eustis, N 873, 578, H 1834; Citrus county, H 1833; Sumter county, C 2772; Polk county, R 682, 1387.
1231. **Spiranthes odorata**, Nutt. E. Fla., Swingle; Eustis, H 1829.
1232. **Spiranthes praecox**, Wats. Madison county, H 1830; ——, C (by error has label of 2698); Polk county, R 683, 1372.
1233. **Spiranthes gracilis**, Bigelow. Lake City, R 690, 1216; Eustis, H 1831; Tampa, R 1136; Hernando county, H 1832.

1234. **Physurus querciticola**, Lindl. Miami, C 2780.

1235. **Ponthievia glandulosa**, R. Br. Chattahoochee, C 2792; Lake City, R 1225, 1223; Polk county, R 688.

CANNACEAE.

1236. **Thalia divaricata**, Chapm. Lake City, H 1844; Upper St. Johns River, C 2827: Ocala, R 932.

1237. **Canna flaccida**, Roscoe. Madison county, H 1846; Eustis, N 1654, H 1845.

IRIDACEAE.

1238. **Iris hexagona**, Walt. Tampa, C 2852.

1239. **Sisyrinchium anceps**, Cav. Lake City, R 597, 1334; New River, H 1850; Palm Beach, H 1847, 1848; Lemon City, H 1849.

1240. **Sisyrinchium atlanticum**, Bicknell. Madison county, H 1852; Lake City, R 652, 1243, 256, 598: Alachua county, H 1854; Eustis, N 133, H 1851; Citrus county, H 1853: New River, H 1855; Miami, P. 264.

AMARYLLIDACEAE.

1241. **Zephyranthes atamasco**, Herb. Ellaville, R 270; Lake City, R 649; Duval, C 2829*; Eustis, N 201; Hernando county, H 1860.

1242. **Zephyranthes simpsoni**, Chapm. ——, S 28.

1243. **Pancratium caribaeum**, L. Cape Canaveral, C 5726; Cape Malabar, C 2830; Lemon City, H 1864.

1244. **Crinum americanum**, L. Milton, R 668; Columbia county, H 1862; Palm Beach, H 1863; mouth of Snake River, Swingle (1894).

1245. **Agave virginica**, L. Jefferson county, H 1861.

1246. **Agave sisalana**, Porrin. Indian Key, C 5644; Sugarloaf Key, P 56.

1247. **Hypoxis erecta**, L. Columbia county, H 1859.

1248. **Hypoxis juncea**, Smith. Suwanee county, H 1856; Lake City, R 648, 255, 565, 127; Eustis, N 952, 2072, H 1857; Tampa, R 1130; Polk county, R 599, 1419; New River, H 1858.

BROMELIACEAE.

1249. **Tillandsia utriculata**, L. Eustis, N 858; Merritt's Is., C 2843; New River, H 1876, 1877; Sugarloaf Key, P 98.

1250. **Tillandsia flexuosa**, Swartz. Sugarloaf Key, P 99.

1251. **Tillandsia fasciculata**, Swartz. Merritt's Is., C 2844; Miami, P 275; Biscayne Bay, C 5489; No Name Key, S 314.

1252. **Tillandsia juncea**, LeConte. Eustis, N 1703, H 1875; Lemon City, H 1874; Miami River, C 5467; Caloosa River, C 2846.

1253. **Tillandsia bulbosa**, Hook. Miami, C 5466; S. Fla., Swingle (1894): Sugarloaf Key, P 100.

1254. **Tillandsia setacea**, Swartz. Lake City, R 680, 1108, H 1871; Alachua county, C 2847; Eustis, N 1499, 774, H 1872; Citrus county, H 1873; Merritt's Is., C 2848; Meyers, W 405.

1255. **Tillandsia recurvata**, Pursh. Lake City, R 678; Eustis, N 1372, H 1869; Merritt's Is., C 5772; Hernando county, H 1870.

1256. **Tillandsia usneoides**, L. Jefferson county, H 1867: Lake City, R 679, H 1866; Eustis, N 464, H 1868; E. Fla., H 1865.

NOTE.—Owing to the peculiar type used in this paper and the limited time remaining for the completion of this volume, the remainder of this paper is necessarily left over to a succeeding volume.—EDITOR.

ADDITIONS TO THE FLORA OF KANSAS.

BY B. B. SMYTH, TOPEKA.

Much in a botanical line has been done (by others) in the past two years. The writer has done some original work, though not so much as usual. Opportunity has been given for an additional trip to the southwest, and much uncertainty verified. A trip has also been taken through the counties from Russell to Wallace, with side trips into Thomas and Sheridan counties; and several weeks spent in collecting in those counties. Professor Hitchcock has taken several trips into southeastern and southern Kansas, and has studied pretty thoroughly those regions. He has kindly given me a part of the results of his labors. Mr. Bartholomew has, as usual, worked assiduously in his line of microscopic fungi, and has sent me the results of his labors. Several new species are here described for the first time. The writer has also determined several species that have lain in his herbarium for several years, the results of former trips to the northwest and southwest. More remains to be told.

A new catalogue of the flora of the state is greatly needed. So many of the plants of the state have been reported under erroneous names, and under various names, and nomenclature is in such a confused and chaotic condition, that it is difficult to tell, when one sees a new name reported from Kansas, whether it is a new plant or merely a new name for an old and familiar one. So that no attempt is made this time to say how many species of plants there are now in the state, after adding the present list. The number of species is probably not increased from the number given two years ago, namely: Flowering plants, 1997; cryptogamic plants of all kinds, 1027; total, 3024.

Species marked (H) have been found by Professor Hitchcock; species marked (B) are reported by Mr. Bartholomew.

FLOWERING PLANTS.

POLYPETALOUS EXOGENS.

1. Ranunculus acris L. Tall buttercup. Riley and Clay counties. (H)
2. Ranunculus divaricatus Schrank. Phillips and Logan counties. In state herbarium.
3. Ranunculus missouriensis Greene. Missouri buttercup. McPherson county, in Lake Inman.
4. Ranunculus pennsylvanicus L. f. Bristly buttercup. McPherson county. (H)
5. Ranunculus sceleratus L. Ditch crowfoot. Wet places near Arkansas river, at Garden City.
6. Ranunculus septentrionalis Poir. Marsh buttercup. Wyandotte and Cherokee counties. (H)
7. Corydalis crystallina Eng. Spangle-pod. Southeast Kansas. (H)
8. Corydalis curvisiliqua Eng. Curve-pod corydalis. Cherokee and Chautauqua counties. (H)
9. Arabis glabra Bernh. Tower mustard. Topeka; occasional in suburban streets.
10. Arabis hirsuta Scop. Hairy rock-cress. Riley and Clay counties. (H)
11. Arabis ludoviciana Meyer. Western rock-cress. Cherokee county. (H)
12. Camelina microcarpa Andrz. Slender false-flax. In waste places, about barns, etc.; introduced.

13. Cardamine pennsylvanica Muhl. Pennsylvania bitter-cress. McPherson county. (H)

14. Cardamine rotundifolia Mx. Round-leafed water-cress. Morris and Russell counties; in springs southwest of Council Grove and north of Russell, near Salt creek.

15. Draba brachycarpa Nutt. Short-pod draba. Cherokee and Chautauqua counties. (H)

16. Lepidium campestre R. Br. Field cress. Occasionally seen in Kansas fields; introduced in grass seeds from the East.

17. Lesquerella argentea MacM. Silvery bladder-pod. Logan county.

18. Lesquerella engelmanni Wats. Englemann's bladder-pod.

19. Lesquerella gracilis Wats. Slender bladder-pod. Western Kansas, on dry prairies.

20. Sinapis juncea L. Indian mustard. Northern Kansas; frequent near dwellings in waste places.

21. Alyssum maritimum Lam. Sweet alyssum. Topeka; escaped; rare.

22. Arenaria serpyllifolia L. Thyme-leaved sand-wort. Occasional in rocky places in central Kansas.

23. Cerastium compactum (Robinson). Throughout Kansas; occasional.

24. Lychnis githago Scop. Cockle. Shawnee and neighboring counties; occasional in wheat fields.

25. Paronychia depressa (Nutt.) Hamilton county. In state herbarium.

26. Sagina procumbens L. Decumbent pearlwort. Cherokee and Chautauqua counties. (H)

—. Silene cucubalus Wibel. Bladder campion. Occasionally seen in meadows in eastern Kansas; introduced from the east. Heretofore listed as *S. inflata.*

27. Silene divaricata (Robinson). Apetalous catchfly. Shawnee county; occasional.

28. Vaccaria vulgaris Host. Cow-herb. Phillips to Thomas counties.

29. Sphaeralcea stellata T. & G. Starry-haired globe-mallow. Southern Kansas.

30. Oxalis cymosa Small. Tall sorrel. Eastern Kansas; frequent.

31. Cassia tora L. Low senna. Wyandotte county. (H)

32. Prosopis glandulosa Torr. Prairie mesquite. Barber and Clark counties.

33. Astragalus distortus T. & G. Curved-pod buffalo-pea. Cherokee county. (H)

34. Astragalus tenellus Pursh. Loose-flowered buffalo-pea. Western Kansas.

35. Desmodium bracteosum DC. Large-bracted tick-trefoil. Eastern Kansas; occasional. (H)

36. Desmodium hirsuta (Hook.) Hairy tick-trefoil. Atchison and Wyandotte counties. (H)

37. Desmodium longifolium (T. & G.) Long-leafed tick-trefoil. Southeast Kansas; occasional. (H)

38. Galactia glabella Mx. Smooth milk-pea. Southeastern Kansas. (H)

39. Galactia volubilis Britt. Downy milk-pea. Southeastern Kansas. (H

40. Lathyrus pusillus Nutt. Dwarf pea. Montgomery to Cherokee counties. (H)

41. Lespedeza leptostachya Eng. Prairie bush-clover. Shawnee county, etc., on prairies.

42. Lespedeza repens Bart. Creeping bush-clover. Coffey county. (H)

43. Medicago lupulina L. Blackseed hop-clover. Lyon and other counties of southeastern Kansas.

44. Medicago sativa L. Alfalfa. Topeka; in streets; infrequent.

45. Oxytropis multiceps Nutt. Tufted loco-pea. Sherman and Cheyenne counties: occasional on rocky prairies.

46. Petalostemon tenuifolius Gray. Silky petalostemon. Norton county.

47. Psoralea linearifolia T. & G. Narrow-leaved leather-root. Seward county.

48. Psoralea obtusiloba T. & G. Short-leaved leather-root. Northwestern Kansas; occasional.

49. Robinia hispida L. Rose acacia. Shawnee county; rare; escaped from nurseries.

50. Trifolium carolinianum Mx. Carolina clover. Topeka and elsewhere; occasional; introduced.

51. Vicia cracca L. Tufted vetch. Clay county. (H)

52. Vicia sativa L. Common vetch. Wyandotte county. (H)

53. Cercocarpus parviflorus H. & A. Small-leafed cercoparpus.

54. Crataegus viridus L. Southern thorn. Southeastern Kansas; frequent. (H)

55. Potentilla pentandra Eng. Five-stamened cinquefoil. Riley and Shawnee counties. (H)

56. Potentilla strigosa (Pursh.) "Kansas." (Britton & Brown, Illust. Flo. II, 214.

57. Rosa canina L. Wild brier. Common near old dwellings in eastern counties.

58. Rosa rubiginosa L. Sweetbrier. Frequently seen; escaped from cultivation.

60. Cerasus mahaleb Mill. Mahaleb cherry. Frequently seen near old nurseries and orchards in eastern Kansas.

61. Epilobium adenocaulon Haussk. Northern willow-herb.

62. Oenothera brachycarpa Gray. Short-pod evening-primrose.

63. Oenothera grandis (Britton). Great-flowered evening-primrose. Barber county.

64. Oenothera oklahomense Norton. Oklahoma evening-primrose.

65. Oenothera spinulosa T. & G. Spiny-leaved evening-primrose.

66. Peucedanum villosum Nutt. Hairy parsley. Rice county.

67. Sanicula gregaria Bickn. Clustered snake-root. Shawnee county.

GAMOPETALOUS EXOGENS.

68. Artemisia kansana Britton. Kansas artemisia. Southern Kansas. May be a form of *A. frigida*.

69. Aster acutidens (Burgess). Sharp-toothed aster. Eastern Kansas; occasional along streams.

70. Aster bellidiflorus Willd. Large-panicled aster. Shawnee county and eastward, in moist places.

71. Aster exilis Ell. Slender aster. Stafford county, in salt marsh.

72. Aster missouriensis Britt. Missouri white-rayed aster. Eastern Kansas, in moist soil.

73. Aster pilosus (Porter). Hairy frostweed. Eastern Kansas.

74. Baccharis neglecta Britt. Long-leafed pencil tree. Cheyenne county, along streams.

—. Berlandiera pinnatifida. Heretofore listed as Engelmannia pinnatifida T. & G.

75. Carduus megacephalus (Porter). Large-head thistle. Norton county.

76. Carduus nebraskensis Britt. Nebraska thistle. Jennings, Decatur county; collected in 1892.

77. Erigeron beyrichii. Slender daisy-fleabane. Western Kansas; occasional in dry soils.

78. Filago nivea Small. Tufted cotton-rose. Common on dry hills.

79. Solidago gilvocanescens (Rydb.) Yellow-haired goldenrod.

80. Lobelia leptostachys DC. Spiked lobelia. Shawnee county, on rocky hills.

81. Lobelia hirtella (Gray). Hairy lobelia. Jefferson county.

82. Acerates viridiflora Eaton. Green-flowered milkweed. Barton and other counties of central Kansas.

83. Asclepias galioides HBK. Kansas milkweed. Western Kansas, on prairies: occasional.

—. Physalis heterophylla Nees. Clammy ground-cherry. Eastern and central Kansas; frequent. Badly affected in some counties by worms. Heretofore called *P. viscosa*.

84. Physalis lagascae R. & S. Small-flowered ground-cherry. Southern Kansas.

85. Physalis rotundata Rydb. Round-leafed ground-cherry. Comanche and Clark counties.

86. Solanum triquetrum Cav. Angled solanum. Comanche and Clark counties.

87. Convolvulus incanus Vahl. Hoary bindweed. Southern Kansas, in dry places: occasional.

88. Cuscuta coryli Eng. Hazel dodder. Shawnee county, on hazel; not frequent.

89. Cuscuta epithymum Murr. Alfalfa dodder. Sent in from Jefferson and Clay counties; said to be very bad in some fields. Introduced from the east.

90. Calamintha nuttallii Benth. Low calamint. Eastern Kansas, on banks; rare.

91. Mentha citrata Ehrh. Bergamot mint. Shawnee county, in wet places; introduced.

92. Monarda scabra Beck. Wild bergamot. Atchison county.

93. Pycnanthemum torreyi Benth. Torrey's sweet basil. Shawnee county, in a roadside near Burnett's mound.

94. Scutellaria campestris Britt. Prairie skullcap. Northeastern Kansas, in sandy soils.

95. Castilleja indivisa Eng. Narrow-leaf painted-cup. Barber county.

96. Castilleja minor Gray. Small-flowered painted-cup. Shawnee and Douglas counties, along the Wakarusa.

97. Pentstemon haydeni Wats. Hayden's pentstemon. Northwest Kansas, in moist places; frequent.

98. Seymeria macrophylla Nutt. Mullein foxglove. Shawnee county, near Richland, along the Wakarusa.

99. Monotropa hypopitys L. Pine-sap. Found in Franklin county by J. W. Bridwell, Baldwin.

100. Plantago occidentalis Dec. Western plantain. Shawnee county; occasional in dry prairies.

APETALOUS EXOGENS.

101. Acnida tamariscina Wood. Water-hemp. In swampy places; frequent.

102. Allionia bodini Morong. Bodin's allionia. Western Kansas; frequent in dry soil.

103. Amaranthus graecizans L. Tumble-weed. All over Kansas; very common.

104. Aristolochia serpentaria L. Serpentary. Cherokee county.

105. Asarum reflexum Bickn. Wild ginger. Eastern Kansas, in river valleys; frequent.

106. Chenopodium berlandieri Moq. Berlandier's goosefoot. Barber county; abundant in dry, broken ground.

107. Chenopodium incanum (Wats.) n. sp. Annual, erect, $\frac{1}{4}$ dm. high, stout, grooved, much branched, the whole plant white-mealy; leaves thick, $\frac{1}{4}$ cm. long, triangular-hastate, slightly sinuate-dentate or entire; obtuse, short petioled; spikes panicled, compact, with short pedicils; calyx $1\frac{1}{3}$ mm. in breadth, segments obtuse, nearly covering the fruit; seed horizontal, somewhat attached to the pericarp; embryo a complete ring. Norton and adjacent counties; very abundant in neglected fields on high dry prairies.

108. Chenopodium leptophyllum Nutt. Narrow-leaved goosefoot. Central and western Kansas; frequent in dry situations.

109. Chenopodium viride L. Green goosefoot. Atchison county.

110. Corispermum villosum Rydb. Northern Kansas.

111. Eriogonum alatum Torr. Winged eriogonum. Sherman county.

112. Eriogonum flavum Nutt. Yellow eriogonum. Sherman county.

113. Eriogonum jamesii Benth. Wallace and other western counties.

114. Eurotia lanata Moq. White sage. Logan county. (H)

115. Sueda diffusa Nutt. Spreading blite. Barton to Pratt counties; frequent in saline lands.

116. Polygonum dumetorum L. Hedge buckwheat. Atchison and Shawnee counties: occasional.

117. Polygonum macouni (Small). Macoun's water-pepper. Perennial, somewhat stout, decumbent or erect, clothed with appressed hairs; leaves lanceolate, obtuse; ocreae cylindric, fringed with long bristles; ocreolae ciliate; calyx white, or whitish. All through Kansas in wet places: rare.

118. Croton lindheimerianus Scheele. Lindheimer's croton. Southern Kansas, in dry soil.

119. Celtis mississippiensis Bosc. Southern hackberry. Cherokee to Montgomery counties. Sent by Dr. W. S. Newlon.

120. Quercus texana Buckley. Texas red oak. Southeast Kansas; frequent. (H)

121. Salix amygdaloides Anders. Peach-leafed willow. River and stream banks; common.

122. Salix gracilis Anders. Limber twig willow. Eastern Kansas.

123. Salix prinoides Pursh. Chestnut willow. Shawnee county; not common.

FLORIFEROUS ENDOGENS.

124. Lemna minima Phillipi. Least duckweed. Eastern Kansas.

125. Lemna trinervis. Three-nerved duckweed. Cherokee county. (H)

126. Wolffia papulifera Thompson. Pointed duckweed. Eastern Kansas, in still waters.

127. Potamogeton lucens L. Shining pondweed. Comanche county. (H)

128. Sagittaria platyphylla J. G. Smith. Ovate-leaved arrowhead. Cherokee county. (H)

129. Iris hexagona Walt. Southern blue flag. Cherokee county. (H)

130. Lilium canadense L. Wild yellow lily. Leavenworth and Jefferson counties.

131. Ornithogalum umbellatum L. Star of Bethlehem. Douglas county.

132. Trillium sessile L. Sessile-flowered trillium. Cherokee county. (H)

133. Uvularia grandiflora Smith. Large-flowered bellwort. Cherokee county. (H)

134. Commelina angustifolia. Narrow-leafed day-flower. Southwest Kansas; common.

135. Commelina crispa Wooton. Western day-flower. Western Kansas; common in gravelly soil.

136. Tradescantia bracteata Small. Long-bracted spiderwort. Eastern Kansas, in sandy soil.

137. Tradescantia occidentalis (Britton). Western spiderwort. Hamilton to Norton counties; frequent.

138. Tradescantia reflexa Raf. Reflexed spiderwort. Shawnee county, on drift hills; frequent.

139. Juncus robustus Cov. Stout rush. Southeastern Kansas.

140. Juncoides campestre Kuntze. Common wood rush. Cherokee county. (H)

GLUMIFEROUS ENDOGENS.

Cyperaceæ.

141. Carex bicknellii Britt. Bicknell's sedge. Eastern Kansas; occasional.

142. Carex crus-corvi Shuttlw. Raven's-foot sedge. Wyandotte county. (H)

143. Carex douglasii Boott. Douglas's carex. Norton county.

144. Carex fusca All. Brown sedge. Cherokee county. (H)

145. Carex jamesii Schwein. James's carex. Lower Kaw valley; rare.

146. Carex monile Tuck. Necklace sedge. Eastern Kansas; occasional in marshes.

147. Carex muskingumensis Schwein. Muskingum sedge. Wyandotte county; rare. (H)

148. Carex nebraskensis Dewey. Nebraska sedge. Cheyenne county. (H)

149. Carex oligocarpa Schk. Few-fruited sedge. Wyandotte county. (H)

150. Carex pubescens Muhl. Pubescent sedge. Wyandotte county. (H)

155. Carex trisperma Dewey. Three-seeded sedge. Trego county.

156. Carex xalapensis Kth. Mexican carex. Northern Kansas; common.

157. Cyperus capitatus (Boeckl.) Headed cyperus. Kingman county. (H)

158. Cyperus compositus (Britt.) Compound cyperus. Jackson and Jefferson counties.

159. Cyperus flavescens L. Yellow cyperus. Douglas and Johnson counties.

160. Cyperus hallii Britt. Hall's cyperus. Southeastern Kansas.

161. Cyperus ovularis Torr. Globose cyperus. Southeastern Kansas. (H)

162. Cyperus pseudovegetus Steud. Marsh cyperus. Cherokee county. (H)

163. Cyperus robustior (Kunth.) Stout cyperus. Cherokee and Clark counties. (H)

164. Eleocharis atropurpurea Kth. Purple spike-rush. Norton and Barber counties.

165. Eleocharis capitata R. Br. Round-headed spike-rush.

166. Eleocharis glaucescens Willd. Smooth spike-rush. All over Kansas; frequent.

167. Eleocharis olivacea Torr. Olive spike-rush. Cherokee county. (H)

168. Fimbristylis vahlii Link. Vahl's fringed rush. Cherokee county. (H)

169. Hemicarpha aristulata (Cov.) Southeastern Kansas; occasional.

170. Scirpus campestris Britt. Prairie bulrush. Western Kansas; on wet prairies.

171. Scirpus cyperinus Kunth. Wool-grass. Cherokee county. (H)

172. Scirpus hallii Gray. Hall's club-rush. Rooks county. (Barth.)

173. Scirpus lineatus Mx. Reddish bulrush. Eastern Kansas; frequent.

174. Scirpus longispicatus (Britt.) Long-spiked rush. Trego county.

175. Scirpus nanus Spreng. Dwarf club-rush. Kansas; in salt marshes.

176. Scleria pauciflora Muhl. Small-flowered nut-rush. Southeastern Kansas.

Gramineæ.

177. Andropogon torreyanus Steud. Pratt county and southwest; occasional.

178. Agropyron pseudorepens Scribn. & Small. Rough wheat-grass. Shawnee county, in river valleys: occasional.

179. Agropyron spicatum Scribn. & Small. Western wheat-grass. Eastern Kansas, in bottom land.

180. Agrostis elliottiana Schultes. Elliott's bent-grass. Chautauqua county. (H)

181. Aristida divaricata H. & B. Spreading awn-grass. Barber county.

182. Gymnopogon racemosus Beauv. Broad-leaved gymnopogon. Chautauqua county. (H)

183. Oplismenus obtusum (HBK.) Smooth cockspur grass. Reno county and southwest, frequent in wet draws.

184. Poa arachnifera Torr. Texas blue-grass. Southern Kansas, on prairies; not common.

185. Poa wolfii Scribn. Wolf's spear-grass. Southeast Kansas.

186. Sporobolus neglectus Nash. Small rush-grass. Eastern Kansas; frequent.

187. Syntherisma fimbriata Vail. Fringed crab-grass. Southern Kansas, in sandy soil.

188. Triodia elongata (Buckley). Long-panicled redtop. Southwestern Kansas, on prairies.

189. Isoetes butleri Engelm. Butler's quillwort. (H)

FLOWERLESS PLANTS—FUNGI.

HYMENOMYCETES (MUSHROOMS).

190. Amanita prairiicola Peck. Bare ground in open prairies, Rooks county. (B)

191. Cryptophallus albiceps Peck. In a cornfield, Rooks county. (B)

192. Galera fragilis Peck. Among short grass in pasture, Rooks county. (B)

193. Lepiota sublilacea Peck. Bare ground in pastures, Rooks county. (B)

194. Psilocybe obscura Peck. Red leaf-mold in woods, Rooks county. August. (B)

195. Psilocybe sabulosa Peck. Sandy soil in pastures, Rooks county. August. (B)

PYRENOMYCETES (BLACK FUNGI).

196. Amphisphæria separans E. & E. On cottonwood shingle, Smith county. (B)

197. Calloria kansensis E. & E. On rotten wood. (H. F. Roberts.)

198. Colletotrichum solitarium E. & B. On leaves of *Solidago radula*, Rooks county. (B)

199. Cucurbitaria astragali E. & E. On dead stems of *Astragalus* sp., Rooks county. (B)

200. Cyathus rufipes E. & E. On underside of old sods, in plowed field, Rooks county. (B)

201. Didymosphæria major E. & E. On decorticated wood of *Rhus glabra*, Rooks county. (B)

202. Didymosphæria rhoina E. & E. On decorticated wood of *Rhus glabra*, Rooks county. (B)

203. Homostegia diplocarpa E. & E. On *Distichlis maritima*, Rooks county. (B)

204. Leptosphæria rhoina E. & E. On decorticated wood of *Rhus glabra*, Rooks county. (B)

205. Lophidium rude E. & E. On weather-beaten cottonwood shingles, Smith county. (B)

206. Lophiosphæra zeicola E. & E. On old corn-stalks, Rooks county. (B)

207. Lophiostoma pusulatum E. & E. On dead shoots of grapevine, Rockport. (B)

208. Lophiostoma rhopalosporum E. & E. On dead shoots of grapevine, Rockport. (B)

209. Lophiotreme fraxini E. & E. On decorticated sticks of *Fraxinus viridis*, Rooks county. (B)

210. Peniophora occidentalis E. & E. On dead leaves of deciduous trees, westward to Colorado. (N. A. F. 2314.)

211. Pleospora juglandis E. & E. On dead black-walnut limbs, Rooks county. (B)

212. Pyrenochæta graminis E. & E. On dead leaves of *Chloris verticillata*, Rooks county. September. (B)

213. Schizothyrella fraxinia E. & E. On fallen leaves of *Fraxinus viridis*, Rooks county. (B)

214. Sordaria ostiolata E. & E. On rabbit's dung, Rooks county. August. (B)

215. Sphæropsis acerina E. & E. On dead branches of *Acer dasycarpum*, Topeka. January. (B)

216. Teichospora infuscans E. & E. On old cottonwood log, Rooks county. August. (B)

217. Teichospora populina E. & E. On decorticated limbs of *Populus monilifera*, Rooks county. (B)

218. Valsa amorphæ E. & E. On dead limbs of *Amorpha fruticosa*, Rooks county. (B)

219. Valsa celtidis E. & E. On dead limbs of *Celtis occidentalis*, Rooks county. (B)

220. Valsa macrocarpa E. & E. On dead bur-oak limbs, Rooks county. (B)

221. Valsa socialis E. & E. On dead limbs of *Salix cordata*, Rooks county. (B)

SPHÆROPSIDÆ (DUST FUNGI).

(New species, by Ellis and Bartholomew.)

222. Phyllosticta monardæ Ell. & Barth., n. sp.

On living leaves of *Monarda citriodora*, Rooks county, Kansas, June 11, 1898. (No. 2477.)

Spots amphigenous, scattered, suborbicular, minute, about 1 mm. in diameter, dark purple at first, soon whitened out in the center. Perithecia punctiform, black, few on a spot (2–4). Sporules oblong-elliptical, hyaline, 5–6 x 1½ micros (micromillimeters).

223. Phoma canescens Ell. & Barth., n. sp.

On decorticated cottonwood limbs, Rooks county, Kansas, January 18, 1899. (No. 2536.)

Perithecia scattered, semi-emergent, small, ¼–½ mm. in diameter, compressed laterally so as to have the appearance of a *Lophiostoma*. Sporules oblong, hyaline, 6–8 x 2–3 micros. The host presents a grayish appearance from the thickly scattered perithecia.

224. Dothiorella ribicola, E. & B., n. sp.

On dead *Ribes aureum*, Rooks county, Kansas, March 21, 1899. (No. 2562.)

Perithecia small, 100–150 micros. Connate and erumpent in the orbicular or elongated botryoid clusters, 1–2 mm. in diam., loosely bordered by the ruptured epidermis, white inside, 6–15 in a cluster, united in a more or less perfectly developed dothideoid stroma. Sporules fusoid, 2–4, nucleate, hyaline, 20–24 x $4\frac{1}{2}$–$5\frac{1}{2}$ micros. Differs from *D. ribis* (Fckl.) in its smaller, more numerous, erumpent perithecia and smaller, fusoid sporules. *D. dura* (Preuss.) Sacc. has ovoid smoky hyaline sporules, but otherwise must be much like this.

225. Sphaeropsis juglandis E. & B., n. sp.

On dead shoots of *Juglans nigra*, Rooks county, Kansas, March 26, 1897. (No. 2383.)

Perithecia thickly scattered, sub-cuticular, small ($\frac{1}{3}$ mm.), globose, raising the epidermis into pustules pierced at the apex by the minute papilliform ostiola. Sporules oblong, elliptical, brown, 15–22 x 7–10 micros. Common in many situations.

226. Haplosporella juglandis E. & B., n. sp.

On dead shoots of Juglans nigra, Rooks county, Kansas, April 22, 1897. (No. 2400.)

Stromata thickly scattered, subglobose, 1 mm. in diameter, surrounded by the free margin of the ruptured epidermis. Perithecia minute, ovate, subcircinate. Sporules oblong-ovate, light brown, 14–20 x 5–7 micros.

227. Haplosporella macluræ E. & B., n. sp.

On fallen limbs of *Maclura aurantiaca*, Rooks county, Kansas, March 16, 1897. (No. 2380.)

Stromata verruciform, flattened above, 1–$1\frac{1}{2}$ mm. diam., covered by the epidermis which finally disappears above, thickly gregarious but hardly confluent. Perithecia ovate, minute, closely packed, 10–20 in a stroma. Ostiola punctiform. Sporules oblong-elliptical, brown, 15–20 x 6–8 micros.

This is a very different thing from *Sphæropsis macluræ* Cke., which sparingly occurs on the same specimens, with gregarious, small, subepidermal perithecia which are not even confluent and by no means collected in a stroma, having, besides, much larger sporules.

228. Haplosporella minor, E. & B., n. sp.

On dead limbs of *Maclura aurantiaca*, Rooks county, Kansas, March 10, 1899. (No. 2552.)

Stromata thinly scattered, prominently erumpent, black, imperfectly developed, multi-peritheciate, seated on the inner bark, scarcely penetrating to the wood. Sporules short-elliptical, smoky hyaline to pale brown, 5–7 x 3–4 micros.

Very distinct from *H. macluræ* E. & B. on the same host.

229. Haplosporella dothideoides, E. & B., n. sp.

On dead shoots of *Ailanthus glandulosa*, Rooks county, Kansas, March 21, 1899. (No. 2565.)

Stroma seated in the inner bark and erumpent above through the ruptured epidermis, orbicular or elliptical, 1–$1\frac{1}{2}$ mm. in diam., of soft, waxy-carnose texture, dark brown, hemispheric or depressed-conical; perithecia hardly more than dothideaceous, ascigerous cells of irregular shape, crowded in the stroma. Sporules oblong or oblong-elliptical, brown, 12–16 x 4–7 micros.

Apparently not well developed and so not certainly distinct from *H. ailanthi*, E. & E. (Jour. Mycol. V, p. 147), but the smaller sporules and distinct stroma seem to indicate specific difference.

230. Diplodia compressa E. & B., n. sp.

On decorticated, weather-beaten limbs of *Maclura aurantiaca*, Rooks county, Kansas, January 9, 1899. (No. 2533.)

Perithecia scattered, compressed, about ½ mm. long, partly covered by the loosened fibers of the wood. Sporules oblong-elliptical, 10–14x5–6 micros. Not constricted. Differs from *D. microsporella* Sacc., especially in its compressed perithecia.

231. Hendersonia lophiostomoides E. & B., n. sp.

On decorticated, weather-beaten limbs of *Maclura aurantiaca*, Rooks county, Kansas, March 31, 1897. (No. 2352.)

Perithecia scattered, erumpent-superficial, 400–500 micros in diam., subglobose, partly covered by the loosened fibers of the wood. Ostiolum mostly compressed, as in *Lophiostoma*. Sporules oblong-elliptical, brown, 3-septate but scarcely constricted, rounded and obtuse at the ends, 12–20x6–8 micros. At first hyaline and uniseptate.

232. Stagonospora cytisporoides E. & B., n. sp.

On dead branches of *Amorpha fruticosa*, Rooks county, Kansas, February 20, 1897. (No. 2372.)

Perithecia scattered, subcuticular, about ½ mm in diameter, raising the epidermis into pustules pierced by the small white disc with a single perforation. Sporules oblong-cylindrical, hyaline, 3–4-nucleate, often becoming 2–3-septate, 12–15x3–3½ micros.

233. Camarosporium juglandis E. & B., n. sp.

On dead limbs of *Juglans nigra*, Rooks county, Kansas, January 9, 1899. (No. 2531.)

Perithecia thickly scattered and sometimes partly connected by a slight stromatic crust, small, mostly less than ½ mm. in diameter, globose, covered by the epidermis, which is raised into pustules perforated at the apex. Sporules variable in size and shape, from subglobose, 8–12 micros in diameter, to ovate or elliptical, 12–25 micros in diameter, 3-septate. The larger ones constricted at the septa and submuriform.

234. Cladotrichum brassicæ E. & B., n. sp.

On old cabbage leaves (*Brassica oleracea*), Rooks county, Kansas, April 22, 1897. (No. 2399.)

Forming dense, subolivaceous, subpulvinate tufts, 1 mm. to ½ cm. across, and thickly scattered over both sides of the leaf. Fertile hyphæ erect, sparingly branched and sparingly septate, swollen at intervals, yellowish-brown, 110–150x6–7 micros. Conidia oblong-elliptical, brown, 12–20x10–12 micros, 1-(exceptionally 3-) septate.

HYPHOMYCETES (MILDEWS).

235. Helminthosporium tomato E. & B. On decaying fruit of tomato; Rooks county. (B)

THE KANSAS UREDINEAE.

BY ELAM BARTHOLOMEW, STOCKTON, KAN.

Read (by title) before the Academy December 30, 1898.

In preparing a state monograph on this interesting and widely distributed group of fungi—the rusts—the author has sought to bring together, in a small compass, all species known to occur in Kansas, and to indicate in popular language, as nearly as may be possible, their geographical distribution, frequency of occurrence, and destructive qualities to their several host plants, a list of which will be found at the end of the catalogue.

Since the publication of the list of seventy-five species compiled by Doctor Kellerman and Mr. Carleton in TRANS. KAN. ACAD. SCI., Vol. X, pp. 88–99, 1886, no effort has been made to catalogue the *Uredineae* of this state. During the twelve years that have elapsed since the publication of that list, by the assiduous labors of our collectors at various locations, the number of known species has more than doubled, and there are doubtless many yet to be added.

Of the 154 species and varieties here recorded Kansas is given as the type locality of twenty-six. In each case where the word "type" follows the date of collection it will be understood to indicate the date and locality of discovery.

All collections made in Rooks and Phillips counties, as indicated in the body of the catalogue, have been made by the author, unless otherwise specified. Where collections have been made by him in other counties, to prevent confusion, the abbreviation "Barth." will follow the locality and date of collection. In all other cases the collectors' names are given in full. All species here enumerated, with the exception of one or two, are represented in the author's herbarium and that of the State Agricultural College, at Manhattan.

At this time of critical readjustment and revised nomenclature, many obstacles must be met and overcome if one expects to make a very near approach to accuracy. Yet, after all his painstaking efforts, he is almost sure to awake to the somewhat annoying realization of the fact that what was an accepted scientific truth yesterday may be, in more ways than one, an error to-morrow! Some revision has been made in host nomenclature where collectors were obviously in error, but generally the revision in phanerogamic nomenclature, *of the latest pattern*, has not been followed.

The use of technical terms has been avoided as much as possible, with a view to making the catalogue of practical utility in a popular sense, yet scientific names have been adhered to strictly, that its scientific value might not be impaired.

Some stress has been put on the matter of citation of original publication, that the *age* in nomenclature may be readily seen and referred to by collectors and students generally, without necessity of referring to the many publications in which the original descriptions are found. Along this line it will be noted that not only the months are given in which the several species occur in the greatest abundance, but the *years* of collection are also given for the benefit of those who may follow this work in the future.

The various reasons should be obvious to all. The very near approach to each other, at least in gross form as well as more minutely, of *Puccinia helianthi*, Schw., *Puccinia tanaceti*, DC., and *Puccinia variolans*, Hark., has seemed to make it necessary, for the purposes of this catalogue, to separate these forms more along the line of host plants than on any well marked characters of the fungi themselves. Hence, all forms on *Helianthus* have been referred to *P. helianthi;* those on *Artemisia* and *Actinella* to *P. tanaceti;* those on *Aplopappus* to *P. variolans*.

Puccinia cirsii is dropped and all forms on *Cnicus* are referred to *P. suaveolens*, (Pers.) Wint.

Those on *Pyrrhopappus*, *Taraxacum* and *Troximon* are placed in *P. hieracii*, (Schum.) Mart. These changes are only in the line of establishing order where confusion has previously reigned. It seems, in a great measure, that each mycologist gets into a rut among these many-named species and follows it through all his work for years, as the examination of any herbarium in the country will usually show.

I wish to thank most sincerely the following persons for the many favors received from their hands, in the preparation of this catalogue, viz.: Dr. W. A. Kellerman, of Columbus, Ohio, for rare Kansas specimens furnished from his private herbarium for examination and comparison; Prof. J. C. Arthur, of Lafayette, Ind., for much valuable assistance in nomenclature and citation; Mr. George L. Clothier, of Manhattan, Kan., for his hearty and willing assistance in getting out the species in the herbarium of the agricultural college.

UROMYCES, Link.

1. **Uromyces appendiculatus**, (Pers.) Lev. II, III.
   Obs. I, p. 17.
   On Phaseolus diversifolius, Manhattan, Sept. 1884, W. A. Kellerman; Rooks county, Sept. 1889.
   On Phaseolus pauciflorus, Manhattan, Oct. 1884, W. A. Kellerman; Cloud county, Aug. 1885, M. A. Carleton.
   On Phaseolus sp., Wichita, Oct. 1889, Kellerman.
   On Phaseolus sp. cult., Rooks county, Aug. 1895.
   A common species in many parts of the state, though not very destructive to its several hosts.

2. **Uromyces aristidæ**, E. & E. III.
   1887: Jour. Mycol. p. 56.
   On Aristida basiramea, Manhattan, Dec. 1893, M. A. Carleton; Sept. 1892, J. B. S. Norton.
   This is a rare and inconspicuous species.

3. **Uromyces astragali**, (Opiz.) Sacc. II, III.
   Myc. Ven. Spec. p. 208.
   On Astragalus mollissimus, Rooks county, Aug. 1892, II; Aug. 1896, III; Seward county, Oct. 1892, M. A. Carleton; Ford county, summer of 1892, A. S. Hitchcock.
   A rare and inconspicuous species.

4. **Uromyces caladii**, (Schw.) Farl.
   1822: Syn. Fung. Carol. No. 480.
   On Arisaema dracontium, Chase county, May 1888, M. A. Carleton; Manhattan, June 30, 1892, C. H. Thompson.

5. **Uromyces euphorbiæ**, C. & P. II, III.
   XXX Rept. N. Y. State Mus. p. 90.
   On Euphorbia marginata, Rooks county, Aug. 1892, Seward county, July 1892, and Butler county, summer of 1892, A. S. Hitchcock: Republic county, July 1890, D. K. Thomas; Manhattan, Aug. 1893, W. A. Kellerman.
   On Euphorbia preslii, Manhattan, July 1886, W. A. Kellerman; July 1891, C. H. Thompson; Rooks county, Aug. 1893.
   On Euphorbia dentata, Manhattan, Oct. 1886, M. A. Carleton; June 1891, C. H. Thompson; Rooks county, Sept. 1887, II, June 1895, III.
   On Euphorbia obtusata, Rooks county, June 1889.

On Euphorbia petaloidea, Manhattan, July 1886, W. A. Kellerman.
On Euphorbia glyptosperma, Wallace county, July 1885, W. A. Kellerman; Manhattan, July 1891, C. H. Thompson.
On Euphorbia cordifolia, Rooks county, Oct. 1896.
On Euphorbia serpens, Manhattan, July 1886, W. A. Kellerman.
On Euphorbia maculata, Sept. 1887, Kellerman and Swingle.
On Euphorbia heterophylla, June 1891, C. H. Thompson: Johnson county, Aug. 1892, M. A. Carleton.
On Euphorbia geyeri, Manhattan, Aug. 1891, C. H. Thompson.
This common and widely distributed species usually does little damage to its many hosts, with perhaps the single exception of Euphorbia dentata, which it often destroys in large quantities.

6. **Uromyces fabae**, (Pers.) Roem.
In Roem. N. Mag. III. p. 116.
On Vicia americana linearis, Manhattan, May 1888, Kellerman and Swingle; Cloud county, June 1888, M. A. Carleton: Osborne county, June 1891, Benj. Brown.
Rare and not very destructive.

7. **Uromyces genistae-tinctoriae**, (Pers.) Wint.
Rab. Krypt. Fl. I, 146.
On Colutea arborescens, Manhattan, Aug. 1887, Kellerman and Swingle; Oct. 1893, M. A. Carleton.

8. **Uromyces glycyrrhizae**, (Rabh.) Mag. II, III.
1890: Deutsch. Bot. Gesell. B. 8, Heft 10.
On Glycyrrhiza lepidota, Wallace county, July 1885, W. A. Kellerman; Cloud county, June 1888, M. A. Carleton; Hamilton county, summer of 1892, A. S. Hitchcock: Rooks county, June 1891, II.
Rare, but quite destructive at times on individual plants.

9. **Uromyces graminicola**, Burrill, II, III.
1885: Parasitic Fungi of Illinois, p. 170.
On Panicum virgatum, Manhattan, Dec. 1888, Kellerman and Swingle (Kan. Fungi, No. 48); Rooks county, Aug. 1894, II, Oct. 1892, III; Osborne county, Mar. 1894, C. L. Shear: Franklin county, Dec. 1893, Grace Meeker; Reno county, Oct. 1889, W. A. Kellerman.
This widely distributed species, which appears to be abundant in all parts of the state, is noticeably destructive in many instances.

10. **Uromyces hedysari-paniculati**, (Schw.) Farl. II, III.
1822: Syn. Fung. Carol. No. 53. (A Puccinia).
On Desmodium acuminatum, Manhattan, Oct. 1884, Kellerman.
On Desmodium illinoense, Sept. 1893, Carleton and Norton.
On Desmodium sessilifolium, Aug. 1892, C. H. Thompson.
On Desmodium canescens, Pottawatomie county, Aug. 1893, Carleton.
On Desmodium sp., Douglas county, Sept. 1891, C. H. Thompson.

11. **Uromyces howei**, Peck.
XXIII Rept. N. Y. State Mus. p. 94.
On Asclepius cornuti, Manhattan, Oct. 1884, W. A. Kellerman.
A very rare species.

12. **Uromyces hyalinus**, Peck, II, III.
1878: Bot. Gazette, p. 34.
On Sophora sericea, Rooks county, June 1888 and June 1898; Ford county, June 1888, Kellerman and Swingle (in Kansas Fungi, No. 49);

Sherman county, June 1893, A. S. Hitchcock; Ford, Hamilton and Seward counties, summer of 1892, Hitchcock.

This species is common throughout the western part of the state, and usually renders abortive each plant attacked.

Issued in Fungi Columbiani, as Uromyces sophoræ, Pk. Critical examinations made from the large amount of material on hand convince me that the two names here given belong to the same species, and as the former has the priority I have given it the preference.

13. **Uromyces junci,** (Desm.) Tul. II, III.
Desm. Pl. Crypt. ed. 2d, No. 170.
On Juncus tenuis, Rooks county, Aug. 1892.
On Eleocharis palustris, Rooks county, Dec. 1894; Seward county, Oct. 1892, M. A. Carleton. (Ured. Am. No. 23.)
Rare and inconspicuous.

14. **Uromyces lespedezæ,** (Schw.) Peck, III.
1822: Syn. Fung. Carol. Nos. 497 and 498.
On Lespedeza capitata, Sept. 1884, Kellerman: Sept. 1892, J. B. S. Norton.
Rare and not destructive.

15. **Uromyces œnotheræ,** Burrill, II, III.
1884: Bot. Gazette, p. 187.
On Œnothera fremonti, Rooks county, Sept. 1887; Phillips county, Oct. 1895: Graham county, July 1885, Kellerman.
This species is rare even in the western part of the state, where the host is very abundant.
Doctor Kellerman's Graham county specimens were labeled in the State Agricultural College herbarium "Puccinia œnotheræ, Vise uredo;" but by a careful examination of his material I find it to be the true Uromyces œnotheræ in both II and III.

16. **Uromyces polygoni,** (Pers.) Fckl. II, III.
1801: Disp. Meth. Fung. p. 39. (Puccinia polygoni, Pers.)
On leaves of Polygonum aviculare, Manhattan, June 1889, Kellerman and Swingle; Cloud county, April 1888, Mitchell county, June 1888, Saline county, July 1892, and Hamilton county, Oct. 1892, all by M. A. Carleton; Sherman county, June 1892, A. S. Hitchcock.
On Polygonum ramosissimum, Dec. 1888, III, July 1889, II, Manhattan, Kellerman and Swingle; Riley county, July 1892, C. H. Thompson.
While rather common and widely distributed, this species is not very destructive to its hosts.

17. **Uromyces psoraleæ,** Peck, II, III.
1881: Bot. Gazette, p. 289.
On Psoralea tenuiflora, Rooks county, July 1885, Kellerman; June 25, 1892, and July 1895 (Barth.)
On Psoralea argophylla, Cloud county, June 1886, Carleton; Manhattan, July 1891, C. H. Thompson.
Rare and not destructive.

18. **Uromyces scirpi,** Burrill, III.
1885: Parasitic Fungi of Illinois, p. 168.
On Scirpus fluviatilis, Rooks county, Oct. 1888.
On Scirpus maritimus, Stafford county, Oct. 1892, M. A. Carleton.
Inconspicuous and very rare.

19. Uromyces spermacosis, (Schw.) Curt.
1867: Curt. Cat. Plants N. Carol. p. 123.
On Diodia teres, Cherokee county, July 13, 1887, Kellerman and Swingle.
A very rare species—collected but once in the state, so far as I am able to find a record of it.

20. Uromyces sporoboli, E. & E. II, III.
1893: Proc. Phil. Acad. Nat. Sci. p. 155.
On Sporobolus asper, Rooks county, Sept. 1892—type. Not found again on this host until Oct. 1898.
On Sporobolus vaginæflorus, Rooks county, Mch. 1892 (not identified at that time): Phillips county, Sept. 1896.
On Sporobolus sp., Manhattan, Dec. 1893, M. A. Carleton.
A rare species, doing but small damage to its hosts.

21. Uromyces terebinthi, (DC.) Wint. II, III.
Fl. Franc. VI, p. 71.
On leaves of Rhus toxicodendron, Rooks county, Sept. 1892 and Sept. 1896; Cloud county, Aug. 1885, M. A. Carleton.
Common to many parts of western Kansas, but scarcely affecting its host.

22. Uromyces trifolii, (A. & S.) Wint.
Die Pilze, I, p. 159.
On Trifolium pratense, Manhattan, Oct. 1892, C. H. Thompson.
This species, which is very common east of the Missouri river, is seldom found in Kansas.

23. Uromyces zygadeni, Peck, II, III.
1881: Bot. Gazette, p. 239.
On Zygadenus nuttallii, Manhattan, May 1886 and June 1884, W. A. Kellerman.
Rare and seldom noticed.

MELAMPSORA Cast.

24. Melampsora farinosa, (Pers.) Schroet.
1801: Syn. Meth. Fung. p. 217.
On Salix amygdaloides, Rooks county, Sept. 12, 1894, II, Oct. 31, 1892, III; Manhattan, Oct. 1885, II and III, M. A. Carleton; Pottawatomie county, Aug. 1893, Carleton.
On Salix nigra (?), Manhattan, Oct. 1887, Kellerman and Swingle; Aug. 1892, II. C. H. Thompson.
On Salix cordata, Rooks county, Aug. 1896, II.
On Salix longifolia, Manhattan, Oct. 1893, II, Lora Waters.
This species is common to all parts of the state and quite destructive some seasons, causing much of the foliage to be cast prematurely.

25. Melampsora populina, (Jacq.) Lev. II, III.
1847: Ann. Sci. Nat. VIII, p. 375.
On Populus monilifera, Kingman county, Oct. 1889, W. A. Kellerman; Rooks county, Aug. 1891, Aug. 1896, Mch. 1892, and Feb. 1896; Manhattan, Sept. 1893, M. A. Carleton.
On Populus dilatata, Rooks county, Sept. 1896.
This rust, which is common in all parts of the state during September and October, often proves quite destructive to young trees on low land, in many cases completely denuding and killing them outright.

26. **Melampsora lini**, (DC.) Tul.
Ann. Sci. Nat. Ser. 4, II, p. 93.

On Linum rigidum, Ford county, summer of 1892, A. S. Hitchcock.

A rare and inconspicuous species, found at no other time or place in the state so far as known.

PUCCINIA, Pers.

27. **Puccinia agropyri**, E. & E. II, III.
1891: Jour. Mycol. VII, p. 131.

On Agropyrum glaucum, Rooks county, Sept. 1895.

This is a well marked but very rare and inconspicuous species, doing little or no harm to its host. The subangular form of the teleutospores separates it readily from other species on gramineal hosts.

28. **Puccinia amphigena**, Diet. III.
1895: Hedwigia, p. 291.

On Calamagrostis longifolia, Rooks county, Feb. 1893 (part of type), also Mch. 1897; Manhattan, Sept. 1892, C. H. Thompson; Dec. 1893, M. A. Carleton.

The Manhattan specimens were labeled in the college herbarium as Puccinia graminis, Pers. It may usually be determined in the gross form with little difficulty by its persistently amphigenous teleutosori, even in the closely bound sheaths.

29. **Puccinia andropogonis**, Schw. II, III.
1834: Syn. N. Am. Fungi, p. 295.

On Andropogon provincialis, Rooks county, Sept. 1892 and Mar. 1897; Manhattan, Sept. 1893, M. A. Carleton; Franklin county, Dec. 1893, Grace Meeker; Reno county, Oct. 1889, Kellerman and Swingle.

On Andropogon scoparius, Rooks county, Jan. 1893, Dec. 1895, and Sept. 1897, II: Manhattan, Mar. 1891, C. H. Thompson; Sept. 1887, Kellerman and Swingle; Franklin county, Dec. 1893, Grace Meeker.

This rust, which is common every year and probably found in every county in the state, is not very destructive to its hosts.

30. **Puccinia anemones-virginianæ**, Schw. III.
1822: Syn. Fung. Carol. No. 486.

On Anemone virginiana, Manhattan, July 1892, C. H. Thompson.

On Anemone nemorosa, Manhattan, June 1887, Kellerman and Swingle. Puccinia solida, Schw., and P. compacta, DeBy., are synonyms of this species.

31. **Puccinia angustata**, Peck, III.
XXX Rept. State Bot. N. Y. p. 125.

On Scirpus atrovirens, Rooks county, April 1890 and Sept. 1896; Manhattan, July and Sept. 1892, M. A. Carleton.

Rare and not destructive.

32. **Puccinia asteris**, Duby, III.
1830: Bot. Gall. II, p. 888.

On Aster multiflorus, Rooks county, Sept. 1887; Manhattan, July 1887, Kellerman and Swingle.

On Aster salicifolius, Rooks county, June 1889 and Oct. 1894.

On Aster drummondii, Manhattan, Aug. 1892, C. H. Thompson; Aug. 1893, M. A. Carleton.

On Aster paniculatus, Manhattan, Oct. 1889, Kellerman and Swingle; June 1892, C. H. Thompson.

A common and widely distributed species, but not very destructive.

33. **Puccinia bartholomæi**, Diet. II, III.
1892: Hedwigia, p. 290.
On leaves, sheaths and culms of Bouteloua oligostachya, Rooks county, Mar. 1892—type. Also collected Oct. 1892, Aug. 1895, and Dec. 1895.
On leaves of Bouteloua racemosa, Mar. 1893 and July 1894.
This species has been repeatedly mistaken for Puccinia vexans, Farl., by various collectors, but it differs much from that, especially in the smaller size of the teleutospores and the absence of the large number of one-celled spores usually found in that species. Not very common, yet frequently found in favorable situations, especially about cultivated ground, covering large tufts of the grass, particularly of the first-named host, on every leaf, sheath, and culm.

(NOTE.—Doctor Dietel's specific, "Bartholomewii," does not make a proper Latin terminal for this word; hence the change to "Bartholomæi.")

34. **Puccinia caricis**, (Schum.) Reb. II, III.
1803: Flora Saell. p. 233.
On Carex stricta, Rooks county, Oct. 1892 and Oct. 1896.
On C. sparganioides, Mch. 1892.
Cn Carex vulpinoidea, Emporia, Oct. 1892, Carleton.
On Carex straminea, Manhattan, Dec. 1890, Thompson.
On Carex muhlenbergii, Manhattan, July 1892, Thompson.
On Carex sp., Cloud county, April 1888, M. A. Carleton.
Common in all parts of the state, on various species of Carex.

35. **Puccinia chloridis**, Diet. III.
1892: Hedwigia, p. 289.
On Chloris verticillata, Rooks county, Mar. 1892—type; Manhattan, Dec. 1893, M. A. Carleton.
A rare species, of infrequent occurrence.

36. **Puccinia circææ**, Pers.
1797: Disp. Meth. Fung. p 39.
On Circæa lutetiana, St. George, Pottawatomie county, Aug. 1893, J. B. S. Norton.

37. **Puccinia clavispora**, Ell. & Barth. II, III.
1896: Erythea, IV, p. 79.
On Andropogon nutans, Phillips county, Aug. 1895—type; Rooks county, Sept. 1896, and Sept. 1897.
This is a well-defined species, rather rare, but quite destructive to its host in favorable situations. Doctor Underwood reports it from Alabama on the same host, and Prof. B. M. Duggar reports it on Andropogon tener from the same state.

38. **Puccinia convolvuli**, (Pers.) Cast. II, III.
Obs. I, p. 16.
On Convolvulus sepium, Rooks county, Sept. 1887 and Sept. 1897; Manhattan, July 1892, C. H. Thompson; Mitchell county, Oct. 1887, Cloud county, June 1888, and Shawnee county, Aug. 1892, M. A. Carleton.
Not common nor very destructive.

39. **Puccinia cryptandri**, Ell. & Barth. II, III.
1897: Erythea, V, p. 47.
On Sporobolus cryptandrus, Rooks county, Sept. 1896—type, Oct. 1897.

This species, which was formerly confounded with Puccinia sporoboli, Arth., on S. heterolepis, differs much from that, especially in the prominent gross character of the brown uredosori, which almost completely cover the upper sides of the leaves. The uredo of this species is very common in many counties of western Kansas from July to October, but the III is of very rare occurrence. See also Arth. & Holw. Uredineæ Exsiccatæ et Icones, No. 24.

40. Puccinia cyperi, Arth. II, III.

1891: Bot. Gazette, p. 226.

On Cyperus strigosus, Rooks county, July 1894; Manhattan, Sept. 1893, M. A. Carleton.

On Cyperus filiculmis, Manhattan, July 1892, C. H. Thompson.

On Cyperus speciosus, Manhattan, July 1892, M. A. Carleton.

On Cyperus schweinitzii, Manhattan, Aug. 1892, M. A. Carleton.

On Cyperus strigosus, Topeka, July, 1892, Carleton.

Not very common, but yet quite destructive to some of its hosts in favorable seasons.

41. Puccinia dochmia, B. & C. III.

North Pacific Expl. Expedition, No. 131.

On Muhlenbergia glomerata, Rooks county, Oct. 1892 and Dec. 1896; Osborne county, Dec. 1890, Benj. Brown.

On Muhlenbergia mexicana, Rooks county, Oct. 1892 and Sept. 1895; Manhattan, Aug. 1891, C. H. Thompson.

This species is probably common in all parts of the state where these hosts are found. One the latter-named host the fungus attack is of such character as to often affect the plants to such an extent that the panicle becomes abortive and fails to make its appearance.

42. Puccinia eleocharidis, Arth. III.

1884: Bull. Iowa Agr. Coll. p. 156.

On Eleocharis palustris, St. George, Pottawatomie county, Aug. 1893, and on Eleocharis sp., Manhattan, Nov. 1892, M. A. Carleton.

A rare and inconspicuous species.

43. Puccinia emaculata, Schw. III.

1834: Syn. N. Am. Fungi, p. 295.

On Panicum capillare, Rooks county, Feb. 1892 and Oct. 1896; Manhattan, Oct. 1887, Kellerman and Swingle; Sedgwick and Osage counties, Oct. 1889, Kellerman and Swingle.

On Triodia cupræa, Manhattan, Oct. 1892, Carleton.

Not very common and not destructive.

44. Puccinia flaccida, B. & Br. II, III.

1873: Jour. Linn. Soc. Bot. XIV, p. 91.

On Panicum crus-galli, Rooks county, Sept. 1892, Sept. 1895, and Sept. 1896.

A rather rare species, but usually very noticeable and abundant when it occurs, rendering the upper surface of the broad green leaves a rich brown by the profuse discharge of the uredospores. The III is very rare.

45. Puccinia galiorum, Lk. III.

1825: Linn. Sp. Plant. II, p. 76.

On Galium aparine, Manhattan, June 1886, W. A. Kellerman.

46. **Puccinia grindeliæ**, Peck, III.
1879: Bot. Gazette, p. 127.
On Grindelia squarrosa, Rooks county, June 1889 and Aug. 1894; Seward county, Oct. 1892, M. A. Carleton; Sheridan county, June 1892, A. S. Hitchcock; Trego county, June 1885, W. A. Kellerman.

47. **Puccinia helianthi**, Schw. II, III.
1822: Syn. Fung. Carol. p. 73.
On Helianthus annuus, Rooks county, Aug. 1894, II, Sept. 1893, III; Manhattan, Aug. 1892, Carleton, Aug. 1883, Kellerman; Fort Scott, May, 1887, II, Carleton; Osborne county, Sept. 1890, Benj. Brown.
On Helianthus hirsutus, Manhattan, Oct. 1893, M. A. Carleton.
On Helianthus grosse-serratus, Manhattan, Aug. 1892, M. A. Carleton.
On Helianthus maximiliani, Rooks county, Oct. 1892, III, Aug. 1894, II; Manhattan, Oct. 1892, J. B. S. Norton.
On Helianthus doronicoides, Rooks county, Oct. 1892, III; Manhattan, Sept. 1891, C. H. Thompson.
On Helianthus petiolaris, Rooks county, Aug. 1894, II, Sept. 1893, III; Greeley county, summer of 1892, Minnie Reed; Manhattan, Aug, 1892, and Seward county, Oct. 1892, M. A. Carleton.
On Helianthus rigidus, Manhattan, Sept. 1891, C. H. Thompson.
On Helianthus tuberosus. Manhattan. July 1892, Geo. L. Clothier.
This is one of our most common and widely distributed rusts, occurring abundantly every year. The large Russian sunflower in cultivation is often completely killed by the uredo stage, which not only attacks the leaves but also the stems, petioles and bracts of the involucre. Its attacks, however, on the wild species of western Kansas are never sufficiently severe to prevent the ripening of a full crop of seed.

48. **Puccinia heterospora**, B. & C. III.
1869: Jour. Linn. Soc. X, p. 356.
On Abutilon avicennæ, Manhattan, Sept. 1890, Topeka, Sept. 1892, M. A. Carleton; Pottawatomie county, Oct. 1890 and Oct. 1893, Barth.
On Malva sylvestris, Pottawatomie county, Oct. 1890, Barth.

49. **Puccinia hieracii**, (Schum.) Mart. II, III.
1803: Flora Saell. II, p. 232.
On Pyrrhopappus scaposus, Rooks county, II, June 1898, III; Osborne county, June 10, 1891, Benj. Brown.
On Troximon cuspidatum, Rooks county, June 1888, II, III; Gove county, June 1885, W. A. Kellerman.
On Taraxacum officinale, Manhattan, July 1892, M. A. Carleton.
In my examination of the material comprising the several specimens of this species, I have classed Puccinia flosculosorum (A. & S.) Roehl., P. troximontis, Ph., and P. variabilis as mere synonyms, believing that there is not sufficient specific difference to warrant their separation.

50. **Puccinia kansensis**, Ell. & Barth. II, III.
1896: Erythea, IV, p. 1.
On Buchloe dactyloides, Rooks county, Sept. 1894—type; Aug. and Sept. 1895.
This species, which was very rare during 1894, the type year, was very abundant during Aug. and Sept. 1895 and 1896, but did not make its

appearance at all in 1897 and 1898. In the seasons favorable to its production it was quite destructive in places, covering large patches of the wool-like host brown with the loosely discharged uredospores.

51. **Puccinia kuhniae**, Schw. III.
1834: Syn. N. Am. Fungi, p. 296.
On Kuhnia eupatorioides gracilis, Rooks county, Oct. 1896. Excellent specimens on one good plant.
This fine species has not been reported elsewhere in the state.

52. **Puccinia lateripes**, Berk. & Rav. I, II, III.
Grevillea, III, p. 52.
On Ruellia ciliosa, Manhattan, July 1884, Kellerman; July 1892, Thompson; June, Aug. and Sept. 1893, Carleton.
On Ruellia strepens, Pottawatomie county, Oct. 1892, Hitchcock.

53. **Puccinia lithospermi**, Ell. & Kell. III.
Jour. Mycol. I, p. 2, 1885.
On Evolvulus argenteus, (Manhattan, type locality. Original specimens not in college herbarium); Hamilton county, July 1893, C. H. Thompson.
A very rare species, observed but few times.

54. **Puccinia lobeliae**, Gerard.
1773: Bull. Buffalo Soc. Nat. Sci. I, p. 68.
On Lobelia syphilitica, Manhattan, Aug. 1887, Kellerman and Swingle; Doniphan county, Aug. 15, 1888, O. E. Olin.
Syn.: *Puccinia microsperma*, B. & C.
Rare and inconspicuous, doing small damage to its host plant.

55. **Puccinia ludibunda**, E. & E. II, III.
1893: Proc. Phil. Acad. Nat. Sci. p. 153.
On Carex sparganioides, Rooks county, Oct. 1892—type, III; Aug. 1894, II.
This species, while not very common, is yet usually separated with little difficulty, in its gross form, from P. caricis, (Schum.), on the same host by the general character and prominence of the teleutosori.

56. **Puccinia lygodesmiae**, E. & E. III.
1893: Proc. Phil. Acad. Nat. Sci. p. 154.
On Lygodesmia juncea, Rooks county, Oct. 1892 and Oct. 1894; Greeley county, July 1892, Minnie Reed; Grant and Hamilton counties, June 1893, C. H. Thompson; Saline county, July 1892. M. A. Carleton.
Not very common, though quite noticeable when it occurs on account of the black tumid sori which surround the stems and smaller branches. Widely distributed throughout the great plains region.

57. **Puccinia menthae**, Pers. II, III.
1801: Syn. Meth. Fung. p. 227.
On Mentha canadensis, Manhattan, Sept. 1892, C. H. Thompson.
On Monarda fistulosa, Manhattan, May 1881, II, Nov. 1883, Kellerman; Emporia, Oct. 1893, Pottawatomie county, Sept. 1892, Mitchell county, Oct. 1887, Carleton.
Common where these two hosts are found, though not very destructive.

58. **Puccinia montanensis**, Ell. II, III.
1891: Jour. Mycol. VII, p. 274.
On Elymus canadensis, Rooks county, Aug. 10, 1892, II, Aug. 27, 1894, III; Manhattan, June 1891, C. H. Thompson.

—12

On Elymus virginicus, Manhattan, July 1891, C. H. Thompson.

This species in its gross characteristics much resembles Puccinia rubigovera (DC.): rare and inconspicuous, doing little damage to its host.

59. **Puccinia nigrescens**, Peck, II, III.

1878: Bot. Gazette, p. 35.

On Salvia azurea grandiflora, Rooks county, Sept. 1887; Manhattan, Sept. 1888, Kellerman and Swingle; June 1891, II, Thompson.

On Salvia lanceolata, Rooks county, Sept. 1887 and Oct. 1896; Manhattan, Oct. 1883, W. A. Kellerman; June 1889, Kellerman and Swingle.

Locally this is a truly intermittent species, as it may prevail in great abundance one season and not make its appearance again in the same community for five or more years.

60. **Puccinia obtecta**, Peck, II, III.

1885: Parasitic Fungi of Illinois, p. 196.

On Scirpus lacustris, Manhattan, Oct. 1893, M. A. Carleton (Ured Am. No. 14); Wamego, Pottawatomie county, Oct. 1893, Barth.

On Scirpus pungens, Manhattan, March 1893, Carleton.

This interesting and well-defined species is of rare occurrence and does little harm to its hosts.

61. **Puccinia panici**, Diet. II, III.

1895: Erythea, Vol. III, p. 80.

On Panicum virgatum, Rooks county, Sept. 1892 and Sept. 1893; Phillips county, Sept. 1895; Pawnee county, Oct. 1887, Kellerman and Swingle; Manhattan, Sept. 1892, C. H. Thompson; Stafford county, Oct. 1892, M. A. Carleton.

This species, which has been recently separated from P. emaculata, Schw. by Doctor Dietel, is quite common on this host in many parts of the state, and is often associated on the same leaves with Uromyces graminicola, Burrill.

62. **Puccinia phragmitis**, (Schum.) Körn. II, III.

1876: Hedwigia, p. 179.

On Phragmites communis, Hamilton county, Oct. 1892, M. A. Carleton.

On Spartina cynosuroides, Rooks county, Aug. and Nov. 1895, also Aug. 1897; Pottawatomie and Clay counties, Oct. 1893, Barth.; Manhattan, Mar. 1888, Kellerman and Swingle; Sedgwick county, Mar. 1888, M. A. Carleton; McPherson county, July 1892, A. S. Hitchcock; Johnson county, Aug. 1892, M. A. Carleton.

This species is one of our most noticeable grass rusts. On Spartina in many cases it covers the sheaths and leaves in the III with a nearly solid coat of black.

Syn.: *Puccinia sparganioides*, Ell. & Barth., Erythea, IV, p. 2, on leaves of Carex sparganioides, will have to be abandoned, as careful examinations show it to be P. phragmitis on short, sedge-like leaves of Spartina cynosuroides. Issued erroneously in N. A. F. 3475 and Fungi Col. 1072.

63. **Puccinia physalidis**, Pk. I.

1879: Bot. Gazette, p. 218.

On Physalis lanceolata, Rooks county, June 1891; Cloud county, June 1895, M. A. Carleton: Osborne county, June 1894, C. L. Shear: Manhattan, July 1893, J. B. S. Norton; Saline county, May 1893, A. W. Jones.

On Physalis comata, Ellis county, June 1894, Barth.

Not very common, yet destroying almost completely every plant attacked. Most probably perennial; II and III not found.

Syn.: *Æcidium solani*, Mont.

64. **Puccinia poculiformis**, (Jacq.) Wett. II, III.

1885: Verh. Zool.-Bot. Ges. Wien, p. 544.

Syn.: *Puccinia graminis*, Pers., and *P. jubata*, E. & B.

On Agropyrum glaucum, Rooks county, Oct. 1892.

On Elymus canadensis, Aug. 1892 and Aug. 1898.

On Eatonia obtusata, Aug. 1898, II, III.

On Festuca tenella, June 1898, II.

On Avena sativa, Sept. 1894, II, Jan. 1892, III; Woodson county, July 1891, J. G. McCormick.

On Bromus secalinus, Manhattan, July 1892, C. H. Thompson.

On Bromus pratensis, Manhattan, Nov. 1892, Carleton.

On Agrostis alba vulgaris, Manhattan, Oct. 1892, Thompson.

On Hordeum vulgare, Manhattan, July 1891, Thompson; Ford county, summer of 1892, A. S. Hitchcock.

On Hordeum jubatum (*Puccinia jubata*, E. & B.), Phillips county, Mch. 1895; Rooks county, Aug. 1898; Manhattan, Aug. 1892, C. H. Thompson; Stafford county, Dec. 1892, M. A. Carleton.

On Triticum vulgare, Rooks county, June 1892, II, Jan. 1892, III; Manhattan, July, 1893, II and III, M. A. Carleton.

This species, the "black rust" of the cereals, is unquestionably the most universal one in the whole list, and is found in all parts of the world. Its list of hosts is also greater in number than that of any other species in the state. Its destructive qualities in the grain fields are too well known to need further comment here. I have no knowledge of the æcidial stage ever having been collected on cultivated Berberis in the state. The genus is not indigenous to Kansas.

NOTE.—It has been with some qualms of conscience that I have discarded the time-honored name of Puccinia graminis, Pers., for this species and adopted the one here given. The evolution in nomenclature, however, which is constantly bringing order out of chaos, forces upon us the necessity of giving preference to priority where subsequent names are positively known to be mere synonyms. See Arth. & Holw. Ured. Ex. et Icones No. 30.

65. **Puccinia polygoni-amphibii**, Pers. II, III.

1801: Disp. Meth. Fung. p. 227.

On Polygonum muhlenbergii, Rooks county, Sept. 1895; Manhattan, Nov. 1883, Kellerman, Aug. 1891, C. H. Thompson; Emporia, Oct. 1893, M. A. Carleton.

Specimens in the state herbarium at Manhattan labeled P. amphibii, Fckl., P. polygoni, Pers., and P. polygonorum, Lk., and those in my own herbarium labeled the same, are all included in this species.

66. **Puccinia pruni**, Pers. II, III.

1801: Syn. Meth. Fung. p. 226.

On Prunus americana, Rooks county, Oct. 1892 and Sept. 1896; Manhattan, Sept. 1893, Carleton.

On Prunus watsoni (sand plum), Rooks county, Aug. 1894.

On Prunus pumila (sand cherry), Rooks county, Sept. 1892, Sept. 1896, and Sept. 1897.

Common and widely distributed, doing considerable damage some seasons.

67. **Puccinia redfieldiæ**, Tracy, III.
1891: Jour. Mycol. VII, p. 281.
On Redfieldia flexuosa, Garden City, July 1889—type, Dr. Geo. Vasey.
This species is very rare and has only been collected once. It was discovered by Professor Tracy on herbarium specimens of the host distributed by the Division of Botany of the U. S. Department of Agriculture.

68. **Puccinia rhamni**, (Pers.) Wett. II, III.
1885: Verh. Zool.-Bot. Ges. Wien, p. 545.
On Avena sativa, Manhattan, June 1892, II, July 1892, III, M. A. Carleton: Hamilton county, summer of 1892, A. S. Hitchcock: Woodson county, July 1891, J. W. G. McCormick.
Common on this host, but so far not found in the state on other gramineal hosts.
Syn.: *Puccinia coronata*, Corda.

69. **Puccinia rubigo-vera**, (DC.) Wint. I, II, III.
Flora Franc. VI, p. 83.
On Onosmodium carolinianum, Rooks county, June 1, 1888, I. Very rare: found only once.
On Triticum vulgare, Rooks county, June 17, 1892, II, June 28, 1892, III.
Also represented in the Manhattan herbarium by specimens collected by various persons in Decatur, Ford, Osborne, Riley, Elk, Sedgwick, Seward and Woodson counties.
On Secale cereale, Rooks county, June 25, 1890, II, III; Manhattan, June 25, 1892, M. A. Carleton.
On Hordeum pusillum, Rooks county, June 1, 1897, II, III.
On Kœleria cristata, Greenwood county, summer of 1892, Hitchcock.
On Eatonia obtusata, Rooks county, June 1898, II, III.
On Elymus striatus, Hamilton county, Nov. 1892, Carleton.
This is the "red rust" of the cereals which is so noticeable in the uredo stage. Like Puccinia poculiformis, it is one of the universal species, being found in all parts of the world, but it is not so destructive in its qualities as that species. The III is inconspicuous as the sori are persistently tectate—covered by the epidermis of the culm, sheath, or leaf.

70. **Puccinia saniculæ**, Grev. III.
1821: Flora Edin. p. 431.
On Sanicula canadensis, Manhattan, Aug. 1892, C. H. Thompson.
On Sanicula marylandica, Pottawatomie county, Aug. 17, 1893, Norton and Dorman.
Rare and not destructive.

71. **Puccinia schedonnardi**, Kell. & Sw. II, III.
1888: Jour. Mycol. IV, p. 95.
On Schedonnardus texanus, Manhattan, Mar. 1889 (Kell. & Swing., Kan. Fungi, No. 16); Phillips county, Sept. 1895; Rooks county, Dec. 1895 and June 1896.
Rare and inconspicuous. Must be looked for diligently to be seen at all.

72. **Puccinia seymeriæ**, Burrill.
1884: Bot. Gazette, p. 189.
On Seymeria macrophylla, Manhattan (no date), Kellerman and Swingle.
The single piece of a leaf in the college herbarium labeled as this species contains no fungus whatever! The presumption is that the species has been collected in the state: hence its place in this catalogue.

73. Puccinia sherardiana, Körn. III.
1877: Hedwigia, p. 29.
On Malvastrum coccineum, Rooks county, Sept. 1889 and Aug. 1895; Cloud county, July 1887, Carleton; Ford county, June 1888, Kellerman and Swingle; Mitchell county, July 1888, Carleton; Republic county, July 1888, Kellerman; Osborne county, June 1891, Benj. Brown; Seward county, Oct. 1892, Carleton; Hamilton county, Aug. 1884, Kellerman; Greeley county, Aug. 1892, Minnie Reed.
Very common throughout the west half of the state, and quite destructive to its host in favorable seasons for its development. As Puccinia malvastri, Peck, is only a synonym, on the best authority, all specimens labeled thus have been included in this species. My examinations show no specific difference.

74. Puccinia silphii, Schw. III.
1834: Syn. N. Am. Fungi, p. 296.
On Silphium integrifolium, Rooks county, June 1892 and July 1894; Manhattan, May 1889, Kellerman and Swingle (Kansas Fungi, No. 45); also, June 1892, M. A. Carleton (Ured. Am. No. 41); Cloud county, July 1888, Carleton.
On Silphium laciniatum, Manhattan, July 1884, W. A. Kellerman; Osborne county, June 10, 1891, Benj. Brown.
Common in many parts of the state and quite destructive to the first-named host when the stems are attacked, killing many of the most vigorous plants.

75. Puccinia smilacis, Schw. III.
1822: Syn. Fung. Carol. p. 72.
On Smilax hispida, Manhattan, Nov. 1894 and Oct. 1895, M. A. Carleton.
Of rare occurrence and not noticeably destructive.

76. Puccinia sorghi, Schw. II, III.
1834: Syn. N. Am. Fungi, p. 295.
On leaves of Zea Mays, Rooks county, Sept. 1892 and Sept. 1895; Manhattan, Aug. 1891, C. H. Thompson; Butler county, July 1892, A. S. Hitchcock.
This is another of our universal rusts, being found in all parts of the United States. It affects, however, very slightly the vigor of its host.

77. Puccinia suaveolens, (Pers.) Wint. II, III.
Obs. II, p. 24.
On Cnicus undulatus, Rooks county, June 1892, II, June 1898, III; Osborne county, June 1891, Benj. Brown; Manhattan, July 1891, C. H. Thompson; Seward county, summer of 1892, A. S. Hitchcock.
Rare and not easily noticed, being mostly hypophyllous. The yellowish discoloration on the upper side of the leaves usually indicates its presence.

78. Puccinia subnitens, Dietel, III.
1895: Erythea, III, p. 81.
On Distichlis spicata, Saline river, Ellis county, Sept. 9, 1895, Barth.
Rare; found only once in the state. Abundant and quite destructive in the locality indicated above.

79. Puccinia substriata, Ell. & Barth. II, III.
1897: Erythea, V, p. 47.
On Paspalum setaceum, Rooks county, Aug. 20, 1896, mostly II – type; Sept. 29, III.

Abundant in one locality, but nevertheless a rare species. It did not occur in the same place in 1897 and 1898. Quite destructive.

80. **Puccinia sydowiana**, Dietel, II, III.
1897: Hedwigia, XXXVI, p. 299.
On Sporobolus asper, Rooks county, Nov. 1892, Feb. 1893, and Mar. 1895 III, July 1896 and Aug. 1898, II; Manhattan, Dec. 1892, A. S. Hitchcock; Franklin county, Dec. 1893, Grace Meeker.
This species is very common and profusely abundant on the host. Some seasons it is quite destructive, rendering abortive many plants. It was issued in N. A. F. 2887, and in Fungi Col. 48, as Puccinia sporoboli, Arth., from which it differs in many ways. Its first appearance under the present name was in Syd. Ured. No. 1032, the material of which was submitted to Doctor Dietel, who separated it from P. Sporoboli, Arth., and gave it specific distinction. In Arth. & Holw. Ured. Ex. et Icones No. 26, the question is discussed at some length, and a new nomenclature—P. vilfæ, Arth. & Holw.—has been adopted, which, for the purposes of this catalogue, it has been thought best not to follow.

81. **Puccinia tanaceti**, DC. II, III.
Flor. Fran. II, p. 222.
On Artemisia ludoviciana, Manhattan, Sept. 1884, W. A. Kellerman.
On Artemisia filifolia, Seward county, Oct. 1892, M. A. Carleton.
This fungus, which is so common in the Rocky Mountain states on many species of Artemisia, is very rare in western Kansas.

82. **Puccinia tanaceti**, DC., var. **actinellæ**, Web. III.
1890: Flora of Nebraska, p. 66.
On Actinella scaposa, Osborne county, June 10, 1890, Benj. Brown; Decatur county, summer of 1892, A. S. Hitchcock; Rooks county, May 27, 1898.
This variety, which Professor Webber reports so abundant and destructive in western Nebraska, is very rare here, although the host is very common. Actinella scaposa (Kansas), and Actinella acaulis (Nebraska), I feel quite sure stand for the same plant.

83. **Puccinia tecta**, Ell. & Barth. II, III.
1896: Erythea, IV, p. 79.
On Carex sparganioides, Rooks county, Oct. 7, 1895—type.
A rare species, found only once. Abundant in that locality. I quote the following note from the original description: "Approaches Puccinia angustata, Peck, but differs from that in its paraphysate uredosori and in its persistently tectate teleutosori."

84. **Puccinia triodiæ**, Ell. & Barth. II, III.
1896: Erythea, IV, p. 3.
On Triodia purpurea, Rooks county, Aug. 1895—type; also Aug. 20, 1896.
Abundant in one place, but not very destructive. On this species I also quote from the original description: "Pedicels stout, persistent, sometimes oblique; . . . closely allied to Puccinia windsoriæ, Schw., but that has teleutospores distinctly obovate and pedicels much shorter."

85. **Puccinia variolans**, Hark. III.
1884: Bull. Calif. Acad. Sci. p. 15.
On Aplopappus spinulosus, Rooks county, June 15, 1889.
On Aplopappus rubiginosus, Hamilton county, Oct. 11, 1892, M. A. Carleton.

Rare and usually not destructive. This species has been labeled by various collectors, and distributed not only under the name here given but also under those of P. grindeliæ, Peck, and P. tanaceti, DC. (Fungi Col. No. 754). It seems the most appropriate, however, that the form on Aplopappus should be referred to P. variolans, and on the authority of Prof. J. C. Arthur it is thus given.

86. **Puccinia vernoniæ**, Schw. II, III.
1834: Syn. N. Am. Fungi, No. 2926.
On Vernonia baldwinii, Rooks county, Sept. 1893, III, July 1894, II; Manhattan, July 1883, W. A. Kellerman, Sept. 1891, C. H. Thompson; Sedgwick county, Oct. 1891, M. A. Carleton; Barber county, summer of 1892, Hitchcock; Saline county, July 1893, M. A. Carleton.
Common in many parts of the state and sometimes quite destructive to its host. After a careful consideration of the matter from the abundant material at hand, I have decided to discard Professor Burrill's varietal form (P. tanaceti, DC., var. vernoniae, [Schw.]), and restore the form on Vernonia to its former specific position. See also N. A. F. No. 3050 and Fungi Col. Nos. 263 and 353.

87. **Puccinia vexans**, Farl. II, III.
1883: Proc. Am. Acad. Arts & Sci. p. 82.
On Bouteloua racemosa, Rooks county, Jan. 1893 and Oct. 1896; Manhattan, Aug. 1892, C. H. Thompson; Pottawatomie county, Nov. 1893, M. A. Carleton.
Common but not destructive. In its microscopic characters this species is peculiarly interesting on account of the wide divergence in the teleutospores, which range from the aculeate, thick, short-stalked unicelled form to that of the typical long-pediceled uniseptate spores.

88. **Puccinia violæ**, (Schum.) DC. I, II, III.
1803: Flor. Saell. II, p. 224.
On Viola cucullata, Rooks county, May 1888 and June 1894, I; Manhattan, May 1886, I, July 1886, II, III, W. A. Kellerman; Cloud county, April 1888, Chase county, May 1888, and Douglas county, May 1892, I, M. A. Carleton.
On Viola delphinifolia, Manhattan, May 1888, Kellerman.
On Viola pedatifida, Manhattan, June 1893, I, Douglas county, May 1892, M. A. Carleton; Sedgwick county, May 1892, A. S. Miller.
On Viola tricolor (cult. pansy), Manhattan, May 1893, E. A. Popenoe.
On Viola nuttallii, Rooks county, June 1888, I.
This species is common every year, especially in I (Æcidium Violæ, Schum.), which is often quite destructive. The II and III are very rare. I have never found either of these in the west half of the state, where the first stage is very abundant.

89. **Puccinia virgata**, E. & E. III.
1893: Proc. Phil. Acad. Nat. Sci. p. 154.
On Panicum virgatum, Rooks county, Jan. 23, 1892—type (N. A. F. No. 2888); Pawnee county, Oct. 1889, Kellerman and Swingle.
This rare and interesting species is peculiar from the fact, which is not noted in the original description, that the teleutospores are so nearly sessile that they may be said to be non-pedicellate! The Rooks county specimens were found in abundance on one solitary tuft of grass about

two feet across. It has not been found anywhere else since. The Pawnee county material, which is of prior collection, I found in the agricultural college herbarium labeled P. emaculata, Schw.

90. **Puccinia xanthii**, Schw. III.
1882: Syn. Fung. Carol. p. 73.
On Xanthium canadense, Rooks county, Aug. 1892 and Aug. 1891; Wallace county, June 1885, W. A. Kellerman; Sedgwick county, Sept. 1888, Carleton; Manhattan, Aug. 1884, W. A. Kellerman; Hamilton county, July 1893, C. H. Thompson.
On Ambrosia trifida, Rooks county, July 1889 and Aug. 1894; Manhattan, July 1891, C. H. Thompson; Wichita, Sept. 1888, M. A. Carleton.
On Ambrosia psilostachya, Rooks county, June 1889 and Aug. 1894; Manhattan, Oct. 1887, Kellerman and Swingle.
On Ambrosia artemisiæfolia, Manhattan, June 1887, Kellerman and Swingle.
This species is very common in all parts of the state on the first-named host, but it is considerably less frequent on the Ambrosias.

91. **Puccinia xanthiifolia**, E. & E. III.
1890: Jour. Mycol. VI, p. 120.
On Iva xanthiifolia, Manhattan, Oct. 1888 — type; also, Aug. 1892, C. H. Thompson; Rooks county, Sept. 30, 1895.
A very rare species and not destructive.

UROPYXIS, Schroeter.

92. **Uropyxis amorphæ**, (Curt.) Schroet. II, III.
1875: Hedwigia, p. 165.
On Amorpha canescens, Rooks county, Sept. 3, 1889, III, Aug. 14, 1895, II, III; Mitchell county, Sept. 1887, M. A. Carleton; Manhattan, Aug. 1895, Carleton.
On Amorpha fruticosa, Rooks county, Sept. 3, 1889, II, III, Sept. 21, 1891, III; Manhattan, July 1887, W. T. Swingle; Stafford county, Oct. 1892, Carleton (in Ured. Am. No. 13).
Common and widely distributed. Somewhat destructive at times on the last-named host.

93. **Uropyxis petalostemonis**, (Farl.) De Toni, I, II, III.
1886: Trans. Wis. Acad. Sci. p. 25.
On Petalostemon candidus, Rooks county, July 1895, III; Manhattan, July 1892 and June 1893, Carleton and Clothier (Ured. Am. No. 8, II, III).
On Petalostemon multiflorus, Manhattan, July 22, 1866, III, W. A. Kellerman.
On Petalostemon violaceus, Rooks county, May 27, 1889, II; Manhattan, May 31, 1886, I, July 5, 1885, II, W. A. Kellerman; June 6, 1887, I, II, W. A. Carleton.
Not very common, yet quite destructive to each plant attacked.

GYMNOSPORANGIUM, Hedw.

94. **Gymnosporangium globosum**, Farl. III.
1880: Gymnos. of the U. S. p. 18.
On red cedar (Juniperus Virginiana), Manhattan, May 8, 1893, M. A. Carleton.
Rare. I have only one record of its collection in the state,

95. **Gymnosporangium macropus**, Lk. III.
Spec. Plant. II, p. 27.
On red cedar (Juniperus Virginiana), Manhattan, April 10, 1891, C. H. Thompson; Osborne county, June 10, 1897, Benj. Brown.
Common and disagreeably destructive in many parts of the state.

PHRAGMIDIUM, Link.

96. **Phragmidium speciosum**, Fr. III.
Sum. Veg. Scand. p. 507.
On living stems of Rosa Arkansana, Rooks county, Jan. 1892 and Sept. 1898; Manhattan, Feb. 1889, Kellerman and Swingle; July 1892, C. H. Thompson.
On Rosa setigera, Rooks county, Feb. 17, 1893.
This species, which is quite common in many parts of the state, usually attacks shoots of the present year's growth, killing outright many in the same related group. Even the novice may readily identify it, as it commonly covers the lower part of the stems with a soft, black tomentum, resembling somewhat the black knot on plum twigs.

97. **Phragmidium subcorticium**, (Schrank) Wint. I, II, III.
1793:
On Rosa Arkansana, Rooks county, June 3, 1892, I, Aug. 1, 1894, II, Oct. 5, 1892, III; Cloud county, June 1888, M. A. Carleton; Osborne county, June 1891, Benj. Brown; Manhattan, July and Aug. 1893, II, III, M. A. Carleton (in Ured. Am. No. 15).
On Rosa setigera, Riley county, Sept. 7, 1892, Carleton.
On Rosa, sp. cult., Manhattan, Sept. 3, 1891, C. H. Thompson.
This species is also widely distributed, and is more or less common every year in all three stages, which are readily separated in their gross forms without the aid of the microscope. A fine species, with well-marked characteristics, but usually not destructive with us.

COLEOSPORIUM, Lev.

98. **Coleosporium solidaginis**, (Schw.) Thum.
1822: Syn. Fung. Carol. p. 472.
On Solidago radula, Rooks county, Sept. 15, 1888.
On Solidago serotina, Rooks county, Sept. 6, 1892, and Oct. 1, 1896.
On Solidago canadense, Manhattan, July 13, 1892, M. A. Carleton.
On Solidago lanceolata, Manhattan, Sept. 1893, C. H. Thompson (in Ured. Am. No. 44).
Goldenrod rust is found in all parts of the state in proper situations, when the conditions are favorable, and at times it is quite destructive.

99. **Coleosporium sonchi-arvensis**, (Pers.) Wint.
1801: Syn. Meth. Fung. p. 217.
On Silphium laciniatum, Wilson county, Sept. 22, 1891, T. C. Davis.
On Aster cordifolius, Manhattan, Aug. 5, 1892, C. H. Thompson.
On Aster paniculatus, Manhattan, Aug. 11, 1891, C. H. Thompson.
On Aster salicifolius, Rooks county, Aug. 12, 1898.
On Aster sp., Osborne county, July 1890, Benj. Brown.
Not very common or destructive.
Syn.: Coleosporium compositarum, Lev.

100. Coleosporium vernoniae, B. & C.
Grev. Vol. III, p. 57.
On Vernonia baldwinia, Manhattan, Aug. 10, 1891, C. H. Thompson; Rooks county, Sept. 2, 1891, and Oct. 2, 1896.
This species, the golden rust of ironweed, is quite common where its host is found on cultivated ground, but it cannot be said to be very destructive.

PUCCINIASTRUM, Oth.

101. Pucciniastrum crotonis (Cke.) De Toni, II, III.
1888: Sacc. Syll. Fung. VII, p. 763.
On Croton monanthogynus, Rooks county, Sept. 7, 1887, and Aug. 20, 1896, II, III; Manhattan, Aug. 1884 and Oct. 1887, W. A. Kellerman.
On Croton texensis, Rooks county, Sept. 4, 1887, and Russell county, Sept. 1895, II, III, Barth.
This species is quite rare and not very destructive to its hosts.

ÆCIDIUM, Pers.

102. Æcidium abundans, Pk.
1878: Bot. Gazette, p. 34.
On Symphoricarpos vulgaris, Manhattan, June 1886, W. A. Kellerman.
Rare; not found in western Kansas.

103. Æcidiums aeculi, E. & K.
1884: Bull. Tor. Bot. Club, p. 114.
On leaves of Æsculus arguta, Manhattan, May 6, 1888, Kellerman and Swingle (in Kan. Fungi, No. 1); Pottawatomie county, May 1892, A. S. Hitchcock; Chase county, May 1888, M. A. Carleton; Riley county, May 1885, M. A. Carleton; Rooks county, May 25, 1897.
Rather common where the host is found and sometimes quite destructive. The foliage on several small trees in Rooks county was much damaged in 1897. Type locality, Manhattan.

104. Æcidium alliicolum, Wint.
1885: Hedwigia, p. 260.
On Allium reticulatum, Rooks county, June 4, 1889; Sedgwick county, May 19, 1892, M. A. Carleton. (This specimen is labeled in the agricultural college herbarium Æ. convallariae, Schum.!)
Very rare; no other records of its occurrence in the state.

105. Æcidium anisotomes, Reich.
1865: Ber. d. Akad. zu Wien, p. —.
On Peucedanum fœniculaceum, Manhattan, May 1892, A. C. Pike, and May 1893, J. B. S. Norton.

106. Æcidium apocyni, Schw.
1822: Syn. Fung. Carol. p. 68.
On Apocynum cannabinum, Manhattan, May and June 1886, W. A. Kellerman.
Rare and not destructive.

107. Æcidium asterum, Schw.
1822: Syn. Fung. Carol. p. 67.
On Aster salicifolius, Rooks county, June 1889.
On Aster sp., Riley county, May 1885, and Chase county, May 1888, M. A. Carleton.

On Solidago canadense, Manhattan, June 1887, Kellerman and Swingle.
On Solidago rigida, Rooks county, June 1888.
On Solidago serotina, Rooks county, June 1888 and July 1894.
Common to many parts of the state, and sometimes quite destructive to the last-named host.

108. Æcidium brandegei, Peck.
1878: Bot. Gazette, p. 34.
On Asclepias verticillata pumila, Rooks county, June 21, 1889.
This is a rare and rather inconspicuous species, yet usually destroying each plant attacked.

109. Æcidium caladii, Schw.
1834: Syn. N. Am. Fungi, No. 2860.
On Arisæma dracontium, Manhattan, May 1884, W. A. Kellerman; Chase county, May 1888, M. A. Carleton.

110. Æcidium callirrhoes, E. & K.
1886: Jour. Mycol. II, p. 4.
On Callirrhoe involucrata, Manhattan, May 30, 1889, Kellerman and Swingle (Kan. Fungi, No. 26); Rooks county, June 1891 and June 1898.
Quite common in the western part of the state and sometimes rather destructive. Type locality, Manhattan.

111. Æcidium cassiæ, E. & K.
1887: Ell. & Everh. N. A. Fungi, No. 1825.
On Cassia chamæcrista, Manhattan, May 1889, Kellerman and Swingle. Type locality, Manhattan.
Presumptively rare. I have not seen this species.

112. Æcidium ceanothi, E. & K.
1884: Bull. Torr. Bot. Club, p. 114.
On leaves, petioles and growing shoots of Ceanothus ovatus, Rooks county, June 10, 1889, and May 28, 1898; Manhattan, May 1884, W. A. Kellerman, and May 1889, Kellerman and Swingle.
This species is of rather rare occurrence, but some seasons, such as that of 1898, it is quite destructive. Type locality, Manhattan.

113. Æcidium cephalanthi, E. & K.
1884: Bot. Gazette, p. 191.
On Cephalanthus occidentalis, Pottawatomie county, May 1887, Kellerman and Swingle; Manhattan, May 1886, Kellerman, June 1893, Carleton (Ured. Am. No. 20).

114. Æcidium clematidis, DC.
Flor. Fran. II, p. 243.
On Clematis fremonti, Mitchell county, June 1892, M. A. Carleton.
A very rare species, probably found in the state only once.

115. Æcidium compositarum, Mart.
Flor. Erlang. p. 314.
On Silphium laciniatum, Manhattan, July 5, 1886, W. A. Kellerman.
On Cacalia atriplicifolia, Pottawatomie county, May 1886, M. A. Carleton.
On Eupatorium perfoliatum, Manhattan, May 1887, Carleton.
On Lactuca sp., Douglas county, May 1892, Carleton.
On Helianthus annuus, Rooks county, July 1894.

Probably found in all parts of the state and on many more hosts than those here given. In this form the æcidia clusters are usually very large and few—oftentimes only one—on a leaf. Vide succeeding number.

116. Æcidium compositarum, Mart., var. **Helianthi**, Burrill.

1885: Parasitic Fungi of Illinois, p. 232; Sacc. Syll. VII, p. 799.

On Helianthus dororicoides, Rooks county, July 1894 and June 1898.

On Helianthus annuus, Cloud county, April 28, 1888, M. A. Carleton.

On Helianthus sp., Bourbon county, May 1887, M. A. Carleton.

This form is generally rare, yet sometimes quite abundant, though doing but little damage to the host. While the spores are very similar to those of the preceding number, yet the æcidia clusters are so different in structure and occurrence—very small and very many on each leaf—that the varietal form in my judgment should be raised to the distinction of a species, as there appear to be no intermediate forms.

117. Æcidium daleæ, Kell. & Sw.

1889: Jour. Mycol. V, p. 13.

On Dalea laxiflora, Rooks county, June 12, 1888—type; also June 1892 and June 1896.

A rather rare species, yet quite destructive at times, distorting all the leaves on each plant attacked.

118. Æcidium dicentræ, Trel.

1886: Trans. Wis. Acad. Sci. Arts & Lit. p. 32.

On Corydalis aurea, Manhattan, May 20, 1884, W. A. Kellerman.

On Dicentra cucullaria, Manhattan, May 1888, Kellerman and Swingle (in Kan. Fungi, No. 2).

Rare and not destructive.

119. Æcidium erigeronatum, Schw.

1834: Syn. N. Am. Fungi, No. 2869.

On Erigeron annuus, Manhattan, June 1887, M. A. Carleton.

On Erigeron canadense, Manhattan, May 1885; Cloud county, June 1886, and Pottawatomie county, May 1893, M. A. Carleton; Manhattan, June 1890, C. H. Thompson.

On Erigeron strigosus, Rooks county, June 17, 1892; Sherman county, summer of 1892, A. S. Hitchcock; Manhattan, June 1892, M. A. Carleton (in Ured. Am. No. 45.).

Not very common, but somewhat destructive.

120. Æcidium euphorbiæ, Gmel.

Linn. Syst. Nat. II, p. 1473.

On Euphorbia dentata, Manhattan, May 1887, Carleton; Rooks county, July 1894.

On Euphorbia marginata, Decatur county, summer of 1892, A. S. Hitchcock; Rooks county, June 16, 1888, and June 20, 1898.

On Euphorbia obtusata, Rooks county, June 6, 1888.

On Euphorbia preslii, Rooks county, Aug. 29, 1893.

Widely distributed. Quite common in the western part of the state, and usually quite destructive to the first-named host.

121. Æcidium fraxini, Schw.

1822: Syn. Fung. Carol. No. 430.

On Fraxinus pubescens, Clay county, July 1888, Kellerman and Swingle.

On Fraxinus viridis, Rooks county, June 1892, and June 1894; Manhattan, July 1884, Kellerman, June 1892, Carleton (in Ured. Am. No. 33); Clay county, July 1888, Kellerman and Swingle; Republic county, July 1888, W. A. Kellerman; McPherson county, summer of 1892, A. S. Hitchcock; Mitchell county, June 1888, M. A. Carleton.

Widely distributed and periodical in appearance. Quite destructive some seasons, especially to small trees.

122. Æcidium gaurinum, Peck.

1879: Bot. Gazette, p. 218.

On Gaura coccinea, Rooks county, June 15, 1891.

A rare species, found only once in the state.

123. Æcidium geranii, DC.

Flor. Fran. VI, p. 93.

On Geranium carolinianum, Manhattan, May 1891, C. H. Thompson; St. George, Pottawatomie county, May 1893, Carleton.

124. Æcidium grossulariæ, Schum.

1803: Flor. Saell. II, p. 223.

On Ribes aureum, Rooks county, May 13, 1889. Abundant and destructive on this host.

On Ribes gracile, Chase county, May 1888, and Douglas county, May 1889, M. A. Carleton; Manhattan, May 1893, J. B. Dorman.

On Ribes rotundifolium, Manhattan, May 1884, W. A. Kellerman; May 1891, C. H. Thompson.

Neither very common nor very destructive.

125. Æcidium houstoniatum, Schw.

1834: Syn. North. Am. Fung. No. 2891.

On Houstonia angustifolia, Rooks county, June 1891; Decatur county, June 1892, Hitchcock; Manhattan, May 1886, M. A. Carleton; Osborne county, June 1894, C. L. Shear.

Not very commou, but quite destructive to the individual plants attacked.

The Osborne county material collected by Prof. C. L. Shear was examined by Prof. J. B. Ellis and erected to the position of a new species (Æ. cylindricum, E. & E., Bull. Torr. Bot. Club, 1895, p. 61): but by a careful comparison of this material with the usual form of Æ. Houstoniatum on the same host, I am fully convinced that they are the same, and the fact that the æcidia are a little longer in the proposed new species than usual is not sufficient ground to warrant a specific distinction.

126. Æcidium impatientis, Schw.

1822: Syn. Fung. Carol. No. 674.

On Impatiens fulva, Manhattan, May 1887, Kellerman and Swingle; St. George, Pottawatomie county, Aug. 1893, Norton and Dorman.

127. Æcidium jamesianum, Peck.

1880: Bot. Gazette, p. 34.

On Asclepius cornuti, Manhattan, June 1892, Thompson.

On Asclepius speciosa, Rooks county, June 1888 and July 1891.

On Asclepius meadii, Rooks county, June 10, 1898.

On Asclepius tuberosa, Rooks county, June 1888 and Aug. 1894.

On Acerates viridiflora, Manhattan, June 1886, and Seward county, June 1888, Kellerman; Rooks county, June 15, 1888.

On Asclepiodora viridis, Manhattan, June 1887, Kellerman and Swingle.

Common, but not very destructive. A fine species. —

128. Æcidium kellermani, De Toni.
1888: Sacc. Syll. Fung. VII, p. 788.
On Baptisia leucophaea, Manhattan, June 11, 1888—type locality.
This species is apparently very rare, as I have no knowledge of its collection in the state during the past ten years.

129. Æcidium liatridis, Ell. & Anderson.
1891: Bot. Gazette, p. 47.
On Liatris scariosa, Manhattan, June 1893, Grace M. Clark.
Apparently very rare in this state.

130. Æcidium lysimachiae, (Schl.) Wallr.
1833: Flora Crypt. Germ. p. 252.
On Steironema ciliatum, Manhattan, May 1887, Kellerman and Swingle; Lawrence, May 1892, M. A. Carleton.

131. Æcidium macrosporum, Pk.
1873: XXIII Rept. N. Y. State Mus. p. 61.
On Smilax hispida, Manhattan, June 25, 1886, Kellerman.

132. Æcidium oxalidis, Thum.
1876: Flora, p. 425.
On Oxalis stricta, Manhattan, May 1887, M. A. Carleton.
This and the preceding species are seemingly very rare, never having been collected in the state but once.

133. Æcidium pammelii, Trel.
1886: Trans. Wis. Acad. Sci. Arts and Lit. p. 32.
On Euphorbia marginata, Rooks county, June 22, 1891, June 20, 1896, and June 20, 1898: Manhattan, Oct. 1887, and Wallace county, July 1885, W. A. Kellerman.
On Euphorbia sp., Chase county, May 1888, Carleton.
Common, but never abundant. Little damage is done to other than small plants, which sometimes are nearly if not completely destroyed.

134. Æcidium peckii, De Toni.
1888: Sacc. Syll. Fung. VII, p. 790.
On Œnothera biennis, Rooks county, June 11, 1892, and June 16, 1896; Manhattan, May 25, 1885, W. A. Kellerman: Cloud county, April 1888, Sedgwick county, May 1888, and Pottawatomie county, May 1893, M. A. Carleton.
On Œnothera serrulata, Rooks county, June 10, 1891; Manhattan, June 1893, J. M. Westgate.
On Œnothera speciosa, Manhattan, May 1889, Kellerman and Swingle.
On Gaura parviflora, Rooks county, May 25, 1890, and June 1898.
Common in all parts of the state, and some seasons quite destructive, especially on the first-named host.

135. Æcidium pentstemonis, Schw.
1822: Syn. Fung. Carol, p. 68.
On Pentstemon albidus, Rooks county, June 1888 and May 1897.
On Pentstemon acuminatus, Cloud county, May 1888, M. A. Carleton.
On Pentstemon grandiflorus, Manhattan, May 8, 1889, Kellerman and Swingle (Kan. Fungi, No. 28); St. George, Pottawatomie county, May 1893, M. A. Carleton: Rooks county, May 25, 1897.
On Pentstemon cobaea, Cloud county, May 1888, M. A. Carleton.
Common and widely distributed. Sometimes quite destructive to the first-named host.

136. Æcidium polygoni, Chev.
1826: Flor. Paris, 1, p. 391.
On Polygonum aviculare, Cloud county, April 1888, M. A. Carleton.
Rare: no other reported in the state.

137. Æcidium porosum, Peck.
1878: Bot. Gazette, p. 34.
On Lathyrus ornatus, Cloud county, May 1887, M. A. Carleton.
On Vicia americana linearis, Rooks county, May 17, 1892, and May 21, 1898; Manhattan, May 1884, W. A. Kellerman; Osborne county, June 1891, Benj. Brown.
Common in favorable seasons, and completely destructive to each plant attacked in the last-named host.

138. Æcidium psoraleæ, Peck.
1885: Bull. Ill. State Lab. Nat. Hist. II, p. 225.
On Psoralea argophylla, Cloud county, June 1888, M. A. Carleton; Sherman county, June 1892, A. S. Hitchcock.
On Psoralea lanceolata, June 6, 1888, and May 24, 1898; Chase county, May 1888, M. A. Carleton.
On Psoralea tenuiflora, Rooks county, June 3, 1891, and May 25, 1895; Manhattan, May 22, 1886, W. A. Kellerman; Chase county, May 1888, and Cloud county, June 1888, M. A. Carleton; Osborne county, June 1891, Benj. Brown; Sedgwick county, May 1887, M. A. Carleton.
This species is common to all parts of the state and is usually fatal to each plant attacked.

139. Æcidium punctatum, Pers.
1801: Syn. Meth. Fung. p. 212.
On Anemone decapetala, Rooks county, June 7, 1892.
A very rare and inconspicuous species.

140. Æcidium pustulatum, Curt.
1873: XXIII Rept. N. Y. State Mus. p. 60.
On Comandra umbellata, Manhattan, May 31, 1886, Kellerman and Swingle (in Kan. Fungi, No. 29); Douglas county, May 1892, M. A. Carleton.
Rare and not very destructive.

141. Æcidium sambuci, Schw.
1822: Syn. Fung. Carol. p. 67.
On Sambucus canadensis, Manhattan, May 22, 1886, W. A. Kellerman.
Few collections of this species have been made in the state, indicating its rarity; not destructive.

142. Æcidium smilacis, Schw.
1822: Syn. Fung. Carol. p. 69.
On Smilax hispida, Manhattan, May 30, 1884, W. A. Kellerman.
This species is also rare, with only one record of its collection in the state.

143. Æcidium tuberculatum.
1888: Jour. Mycol. IV, p. 26.
On Callirrhoe involucrata, Rooks county, Sept. 15, 1887—type; also May 20, 1889, and June 10, 1892; Wichita, June 1888, M. A. Carleton; Osborne county, June 1891, Benj. Brown; Decatur county, June 1892, A. S. Hitchcock; Manhattan, May 1893, M. A. Carleton (in Ured. Am. No. 30).

This species is perennial. It occurs on the same individual plant from year to year until the plant is finally vanquished in the unequal strife. Usually every leaf of the plant is attacked to such an extent that such plants never bloom or mature fruit. It is by far the most abundant Æcidium in the west half of the state.

144. Æcidium urticæ, Schum.
1803: Flor. Saell. II, p. 222.
On Urtica gracilis, Manhattan, May 14, 1887, Kellerman and Swingle.
Rare and not destructive.

145. Æcidium verbenicolum, E. & K.
On Verbena stricta, Rooks county, July 1893 and July 1894; Decatur county, June 1892, A. S. Hitchcock; Manhattan, June 1893, Carleton, in Ured. Am. No. 21. (Æ. verbenæ, Speg.)
On Verbena hastata, Rooks county, July 17, 1894.
On Verbena urticæfolia, Manhattan, July 1884, W. A. Kellerman.
Common, and on the first named host quite destructive some seasons. This species has been somewhat unfortunate in having been made a synonym of Æcidium verbenæ, Speg., and issued as that species by Professor Carleton, as noted above, and also by Ellis and Everhart in Fungi Columbiani, No. 270. Our species and the South American one on Verbena are said, by those who have examined both, to be very distinct; so, at the suggestion of Prof. J. C. Arthur, I have restored our species to its original specific position. Type locality, Manhattan.

146. Æcidium xanthoxyli, Peck.
1881: Bot. Gazette, p. 275.
On Xanthoxylon americanum, Manhattan, June 1884, W. A. Kellerman; also, June 1893, M. A. Carleton (in Ured. Am. No. 60): St. George, Pottawatomie county, Aug. 1893, M. A. Carleton.

ROESTELIA, Rebent.

147. Rœstelia lacerata, (Sow.) Fr.
1849: Summ. Veg. Scand. p. 510.
On Cratægus coccinea mollis, Manhattan, Aug. 1892, C. H. Thompson.
Rare; only record of collection.

148. Rœstelia pirata, (Schw.) Thaxter.
1834: Syn. North Am. Fungi, No. 2896.
On Pyrus coronaria, Manhattan, Aug. 1889, Kellerman and Swingle; Decatur county, June 1892, A. S. Hitchcock; Lawrence, Aug. 1891, W. C. Stevens; Manhattan, July and Sept. 1892, M. A. Carleton.
On Pyrus ioensis, Manhattan, Aug. 1892, and Johnson county, Aug. 1892, M. A. Carleton: Osborne county, June 1898, Benj. Brown.
On Cratægus coccinea, Manhattan, June 1892, and Johnson county, Aug. 1892, M. A. Carleton.
On Cratægus sanguinea, Manhattan, June 1892, M. A. Carleton.
This and the preceding number, for convenience, have been retained in Rœstelia, but perhaps more properly should have been placed as I in Gymnosporangium, where they rightfully belong.

UREDO, Pers.

149. Uredo agrimoniæ, (DC.) Schroet.
1869: Abh. d. Schles. Ges. Nat.
On Agrimonia eupatoria, Pottawatomie county, Oct. 16, 1893, Barth.

Rather rare, but the bright orange-colored spores which are freely discharged over the under side of the leaves make the fungus very conspicuous.

150. Uredo confluens, Pers.
1801: Syn. Meth. Fung. p. 214.
On leaves of Ribes aureum, Rooks county, Aug. 22, 1892.
This species, which is said to be common in the Rocky Mountain region on several hosts in the Grossulariæ, is rare in Kansas. The following are all presumed to be synonyms, viz.: Cæoma ribis-alpina, Wint.; Cæoma ribesii, Lk.; Cæoma confluens, (Pers.) Schroet.; Uredo jonesii, Peck, and Uredo ribicola C. & E.

151. Uredo gaurina, (Peck.)
1889: Bot. Gazette, p. 218.
On Gaura coccinea, Rooks county, June 15, 1891.
On Gaura villosa, Seward county, Oct. 1892, M. A. Carleton.
Of very rare occurrence and doing small damage to its hosts.

152. Uredo kansensis, Kell. & Sw.
1889: Jour. Mycol. V, p. 77.
On Amorpha fruticosa, Rooks county, July 1885—type, W. A. Kellerman; Manhattan, June 21, 1887, and June 20, 1889, Kellerman and Swingle; Rooks county, June 20, 1888, and July 16. 1894.
Neither common nor destructive.

153. Uredo nitens, (Schw.) De Toni.
1822: Syn. Fung. Carol. No. 458.
On Rubus canadensis, Manhattan, May 1887, Kellerman and Swingle; Lawrence, May 1892, M. A. Carleton.
On Rubus villosus, Manhattan, May 1889, Kellerman and Swingle (in Kansas Fungi, No. 31). Also collected by Carleton, June 1892.
This, the blackberry rust, which is so destructive from the Missouri river eastward, usually does but little damage in Kansas.

154. Uredo quercus, Brond.
In Duby: Botan. Gall. II, 893.
On leaves of Quercus macrocarpa, Manhattan, Oct. 1886, Kellerman and Swingle (in Kansas Fungi, No. 24.)
Apparently very rare, as there is no other record of its collection in the state.

HOST INDEX.

V. ZOOLOGY, ETC.

COLLECTING NOTES ON KANSAS COLEOPTERA.

BY W. KNAUS, M'PHERSON, KAN.

Read (by title) before the Academy October 28, 1897.

An experience of eighteen years in collecting coleoptera in Kansas would naturally lead to the discovery of several good collecting grounds, and to many interesting observations on the abundance or scarcity of certain species for one or more years.

I have found my most interesting and profitable ground on the salt marshes or flats of Wilson county in southeastern Kansas, and Republic and Mitchell counties in north central Kansas; in the valleys of the Verdigris river in Wilson county, of the Republican river in Jewell county, the Smoky Hill river in Wallace county, and the Arkansas river in Hamilton county; the two latter in extreme western Kansas.

I have also collected for years at the electric lights at McPherson. Another most interesting and profitable locality is in the sand-hills twenty miles southwest of McPherson. In these sand-hills I have taken, during the past eight years, *Cicindela scutellaris*, *formosa*, and *venusta*, all beautiful species; *Stephanucha pilipennis* Kraatz, one of the rarest scarabeids; *Serica curvata* Lec.; *Canthon nigricornis* Say; *Ammodonus fossor* Lec., and *Chalcodermus collaris* Horn. I took from the electric lights last season for the first time a few specimens of *Stenomorphus rufipes* Lec., a southwestern species, but never recorded as taken in this state. McPherson is probably near its northern limit. I also took at the electric lights, in June of last year, for the first time, four specimens of *Lachnosterna spreta* Lec., the first capture of this species in the state. Another rare species taken at the lights was *Lachnosterna ulkei* Smith; but only two or three specimens were captured. *Lachnosterna bipartita* Horn was taken in considerable numbers, both at the lights and in early evening flight. Another beetle taken sparingly at the electric lights in May and June was *Nothopus zabroides* Lec.; this place is probably near its southeastern limit. *Platynus texanus* Lec. also occurred sparingly at the lights for the past two years. Each year a few of the handsome *Eretes sticticus* Linn. are also taken from the electric-light globes.

One of my most interesting collecting grounds is at the range of sand-hills parallel to the Arkansas river in Reno county, and about eight miles north of the river. These hills or dunes are blown about by the wind, and in many places are excavated by the air currents to a depth of 75 to 150 feet; and the fine white sand is piled in huge dunes, usually north of the excavation. Visits to this region made in May and June are usually well rewarded. The season of 1896 I took *Cicindela scutellaris* Say and *Cicindela formosa* Say in numbers, the former species being the more abundant. I also took the beautiful *Cicindela venusta* Lec. with the two preceding species, but less abundant. Some seasons only a few specimens are taken.

Beginning with the collecting season of 1891, I have each year taken a few specimens—never more than six or eight in a season—of the rare *Stephanucha pilipennis* Kraatz, first described in 1888, from Nebraska. I have taken it only from May 1 to May 20, crawling sluggishly over the sand, and have found occasionally dead perfect specimens. Warm evenings during the latter part of April will probably furnish the best collecting results for this species. Another handsome and desirable insect taken in May and June in this locality is *Cremastochilus nitens* Lec. During the cooler parts of the day it can be picked up from the bare sand, but during the hottest part of the day it must be handled quickly, as it becomes active and is a quick flier.

One of the best finds, *Ammodonus fossor*, was made in this locality May 16, 1897. After collecting over the hills for about three hours, I went up the side of a sand-hill. about twenty feet from the bottom of a blow-out, and sat down to eat a lunch. I soon saw a small round tenebrionid running over the sand, and captured it. It was difficult to see, as it was almost the exact color of the sand, and only the closest observation would distinguish it from its surroundings. By digging out depressions left by cattle in passing over the sand, and examining the few plants growing around, I soon took twenty-two specimens from an area of ten feet square. Specimens were sent to Dr. George H. Horn, of Philadelphia, and through his kindness, and that of Mr. Chas. Liebeck, were identified as above. The species occurs in sandy locations in Maryland and New York, and in California and Arizona: although the specimens from the extreme west are of larger size.

In this locality, in 1891, I took *Chalcodermus collaris* Horn quite abundantly; but have not since seen a single specimen.

The valley of the Smoky Hill river at Wallace, Kan., within twenty miles of the Colorado line, is an attractive locality for the collector of insects. The clay bluffs south of the Smoky furnish a home and feeding-ground for the king of Cicindelidæ, *Amblychila cylindriformis* Say. Three short visits to this locality in as many years were rewarded with the capture of a few specimens of this desirable insect. At rare reasons they are quite abundant; but usually only a few can be taken each night. Another desirable beetle I took by beating the willows on the banks of the Smoky was *Poecilonota thureura* Say. *Calosoma obsoletum* Say is found in alfalfa fields and along old roads in the latter part of July and during August. Beating thistles near Wallace resulted in the capture of eight or ten specimens of rare *Clerus cordifer* Lec. Under old cow chips, near the bluffs, were taken a number of the curious and sluggish *Ologlyptus anastomosis* Say; also numbers of *Trimytis pruinosa* Lec., and a few *Ophyrastes vittatus* Say were found under the same shelter.

Almost directly south of Wallace and distant about 100 miles is Coolidge, in the Arkansas valley. I collected in this locality one day, July 7, 1897. The general insect fauna is very similar to that at Wallace, although several species occur at Coolidge that are not taken at the former place. In an alfalfa field adjoining the town, from which the hay was being raked, I took a fine series of *Calosoma triste* Lec. This species is evidently a variable one, as the elytra of one specimen will be almost smooth, while that of the next one taken would approach the sculptured markings of *obsoletum*.

From horse droppings I took a fine lot of *Canthon depressipennis* Lec., and from thistle heads dislodged *Euphoria kernii* Hald. and *inda* Linn., in proportion of two of the latter to one of the former. But one specimen of the black variety of *kernii* was taken. Beating vegetation alongside small rivulets and depressions in the prairie yielded numerous specimens of *Monoxia consputa* Lec., and a few *Diabrotica tricincta* Say. At Garden City, fifty miles east of Coolidge, a few minutes' beating of plants along the roadside yielded numerous specimens of *Copturus adspersus* Lec., *Anthonomus squamosus* Lec., and *Smicronyx vestitus* Lec.

The Verdigris valley in Wilson county yielded a number of desirable things to the collector of coleoptera. April 20 to 30 marks the appearance of *Lachnosterna calceata* Lec., the most common scarabeid in that region. In favored localities, on still evenings, they swarm over the tender shoots of the young oaks. By jarring these, dozens of the insects fall to the ground, and by the use of the lantern are easily picked up and transferred to the cyanide jar. Other *Lachnosterna* occurring at about this time are *hornii* Smith, *gibbosa* Burm., *crenulata* Frch., *vehemens* Horn, and *crinita* Burm. At about the same time, upon a species of dock that grows over bottom land, can be taken numbers of the beautiful *Phytonomus eximius* Lec. They are very shy, and drop quickly to the ground on the first alarm. The open mouth of the cyanide bottle should be under them before the plant is touched. From the opening leaf-buds of the young hickories may be beaten *Conotrachelus nenuphar* Herbst. and *affinis* Boh.; and the sap from stumps of freshly cut hickory trees attracts numbers of *Colastus semitectus* Say, *Soronia undulata* Say, *Perthalycra murrayi* Horn, *Pocadius helvolus* Er., *Cryptarcha concinna* Mels., and *Bactridium striatum* Lec. Under stones near the bluffs bordering the valley may be found rather sparingly *Pasimachus californicus* Chd., and, resting under the same shelter, an occasional *Diplotaxis corvina* Lec. While collecting over the tree-covered stony knoll near Benedict, in this county, in September, 1896, I took a single fresh specimen of *Nomaretus cavicollis* Lec., the only specimen of this beautiful carabid I ever took south of the Kansas river at Manhattan.

Collecting at Salina, Kan., in 1884 and 1885, yielded a number of apions, identified by Mr. H. C. Fall of Pasadena, Cal. Among them were *Apion segnipes* Say, rather common; *attenuatum* Smith, *griseum* Smith, and *occidentale* Fall, MS., occurring rarely, and all new to the Kansas list. On the Kansas and Nebraska line, near Superior, Neb., in the latter part of May, 1895, I took *Apion minor* Smith, *spinipes* Fall, MS., and *nebraskense* Fall, MS., a few specimens of each. Near Rago, Kingman county, Kansas, August 15, 1896, I took a half dozen specimens of *Apion modestum* Smith, a species also new to the list of Kansas coleoptera. In the same locality I took *Anthonomus moleculus* Casey, *Orthoris crotchii* Lec., and *Pseudohazis farcta* Lec.

Some seventy-five miles southwest of Rago, at Belvidere, Kan., I took, August 16, numbers of *Plectrodera scalator* Say. This handsome borer was easily taken about sunset on the leaves and twigs of young willows and cottonwoods. Other desirable species taken at this locality were: *Lappus lividus* Casey, *Mitostylus tenuis* Lec., *Anthonomus tectus* Lec., *Cœliodes asper* Lec., *Zygogramma disrupta* Rogers, *Zygogramma heterothecæ* Linell.

Cicindela violacea Fab., the beautiful blue or green tiger beetle, is taken in May or June in the wooded valleys of eastern Kansas. I took two or three specimens near Benedict, Wilson county, southeastern Kansas, last season. Have never taken it west of Manhattan, at the junction of Big Blue and Kansas rivers.

THE ELM TWIG-GIRDLER (*ONCIDERES CINGULATUS* SAY).

BY PERCY J. PARROTT, OF MANHATTAN.

Read before the Academy October 28, 1897.

Of the insects attacking the elms of this state the *Oncideres cingulatus* is, perhaps, the most interesting if not the most injurious. To all appearances it seems to be gradually increasing in numbers and destructiveness. Although it is called the elm twig-girdler, its attacks are not confined to the elms, since it does considerable damage to the oak, persimmon, and basswood.

The injury to the trees consists in the girdling and cutting of twigs and small branches, so that, sooner or later, they fall to the ground, either of their own weight or through the influence of the wind. By the excessive pruning they receive the elms become scraggy and unsymmetrical. The insect's capacity for doing damage will be more apparent either after a storm, when the ground beneath the trees will be strewn with a large number of branches, or during the winter months, when the large number of decaying stubs can readily be seen.

The girdling of the twigs is the work of the adult female: and it is of such an unusual character that it is scarcely to be wondered that many are misled as to the cause of it. The male, partly to satisfy his hunger and partly from his destructive habits, busies himself with barking small offshoots of the branch to be severed or the overlapping twigs of neighboring branches. This work serves a good purpose, as it hastens the dying of the twig, which must be brought to a state of decay for the ensuing larvæ.

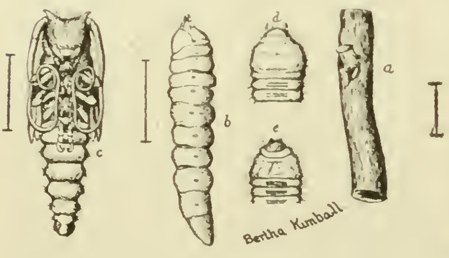


FIG. 1. *a*, egg deposited at base of offshoot; *b*, larva; *c*, pupa; *d*, *e*, showing markings on upper and lower side of larva.

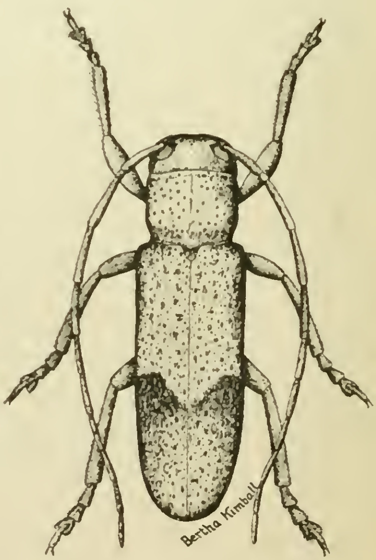


FIG. 4. Oncideres cingulatus (adult).

The adults are of a brownish-gray color, with a brownish colored band across the elytra, which are dotted with numerous tawny spots. They vary from seven- to nine-sixteenths of an inch in length—the males being smaller than females. About the 1st of August the beetles gnaw a hole through the bark of the channel in which they have passed their earlier stages and escape. Upon alighting on

FIG. 2. *a*, girdling of twig; *b*, *c*, channels of larvæ.

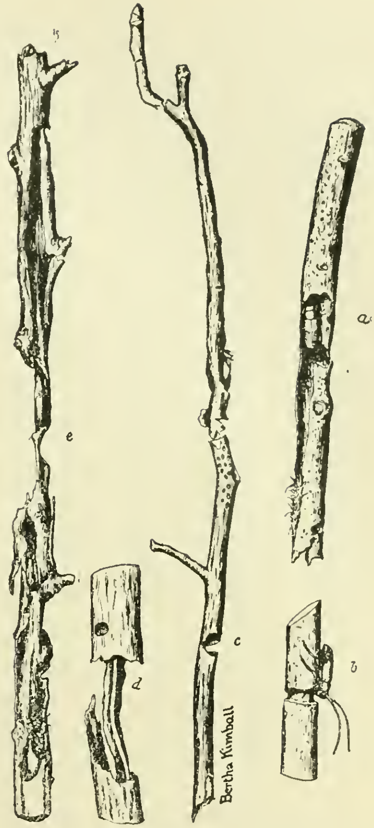


FIG. 3. *a*, bark removed, showing adult just emerging from pupa; *b*, adult girdling; *c*, hole through which adult has emerged; *d*, *e*, bark removed, showing work of larvæ.

an elm the female selects a twig or a small branch which she at once commences to girdle. Thrusting the tips of her mandibles into the woody tissue, she commences a series of cutting and tearing, prying first with one mandible and then with the other till a small shaving or splinter is raised, which she severs with one movement of her mandibles. Thus taking section by section on the same circumference she in time completely girdles the twig, which will soon fall to the ground. It is during the process of cutting that the eggs are laid. After cutting one section the female either takes another one or passes up the branch to deposit an egg. Upon returning to work she continues to girdle, cutting in the same manner as with the first section. After cutting several sections she deposits another egg or in some instances goes over the work that has been done.

In depositing an egg, the girdler first makes a hole just below an offshoot or an aborted bud of the main stem of the branch to be severed. Within this hole she deposits one egg. To protect and to disguise the egg, she caps the hole with a gummy substance. The time consumed in depositing the egg, including the cutting and sealing of the hole, is from ten to twelve minutes.

The egg is of a whitish color, of an elongated oval shape, being about four times as long as broad. Usually but one egg is deposited at the base of an offshoot, though often four or five are deposited, not only below but at the side of and above the offshoot. The number of eggs deposited in one branch varies from one to a dozen, and even higher. The eggs laid during the summer hatch in less than two weeks, but those laid late in the fall often take longer. In many instances the larvæ do not emerge from the latter till spring.

The larvæ are whitish in color, with the mouth-parts tinged with brown. During the winter months they remain in a dormant state, but as soon as the warm days of spring appear they commence to make rapid growth. The moisture of the winter months has brought the interior wood of the twig to a proper state for the larvæ to devour. The larvæ now commence to burrow. They gradually excavate a channel from the point where the egg is deposited. This they lengthen and broaden, but always leaving the bark intact. As a rule, two successive offshoots on the same side of the twig form the termini for one channel. In twigs containing a large number of larvæ scarcely anything will be left beyond a thin covering of bark and thin, irregular partitions within, which separate the larvæ. About the middle of July the larvæ, having blocked up all openings and cracks and the ends of their channels, pass into the pupal stage, which lasts for about two weeks, when the adults appear.

As they are approaching maturity, the larvæ seem to be especially active. It is at this stage of their development that a peculiar clicking sound is to be noticed. particularly so if the infested twigs are brought into a quiet room. One unacquainted with the habits of the insect would not unlikely mistake the noise for the ticking of watches. To produce the sound, the larvæ hold the posterior part of their bodies in a rigid position by means of sharp spines which they thrust into the sides of their channels, while they sway the anterior part from side to side, catching the tips of their mandibles into the woody tissue. This seems to be a quicker method for cutting the small shavings and splinters which are necessary to fill all openings into the channels.

A LIST OF KANSAS HYMENOPTERA.

BY J. C. BRIDWELL, BALDWIN.

Read (by title) before the Academy December 30, 1898.

This list is very far from complete, even in the present limited knowledge of the hymenopterous fauna of the state. I have been unable to secure lists of the Kansas hymenoptera in the collections of the State University, in the National Museum, and in the collections of the American Entomological Society. These would add many species to the list.

The list as it stands is based on the species in the collection of the State Agricultural College—a list of which was very kindly furnished me by Prof. E. E. Faville—and those in my own collection in the museum of Baker University. To these were added a number of species from Cresson's "List of North American Hymenoptera"; from a "List of aculeate Hymenoptera collected in Northwestern Kansas," by Dr. S. W. Williston, published by W. H. Patton in the Bulletin of the United States Geological and Geographical Survey, volume 5, No. 3; and from a "List of Hymenoptera from Barber county, Kansas," by Professor Cragin. The species in this list marked A are in the Agricultural College collection; those marked B are in the Baker University collection and were collected in the vicinity of Baldwin. I owe great thanks to Mr. W. H. Ashmead, of Washington, and Prof. T. D. A. Cockerell, of the New Mexico Agricultural College, for determinations of species and other favors in my work.

TENTHREDINIDAE.

Cimbex americana Leach.	A B
var. laportei St. Farg.	A
var. luctifera Klug.	A
Zarea americana Cress.	A
Acordulecera dorsalis Say.	A B
Schizocera plumiges Klug.	A
Atomacera ruficollis Norton.	B
Hylotoma humeralis Beauv.	A B
Pteronus populi.	A
ventralis Say.	A
robiniae Forbes.	A
vertebralis.	A
Pachynematus auratus.	A
Amauronematus brunneus Nort.	A
Harpiphorus bolli Nort.	A
maculatus Nort.	A
Dolerus abdominalis Nort.	A
aprilis Nort.	B
arvensis Say.	B
bicolor Beauv.	A B
Mesoneura obtusa Klug.	A
Monophadnus bardus Say.	A B
rubi Harris.	A
Hoplocampa halcyon Nort.	A B
bridwelli Ashm. MS.	B
Macrophya albomaculata Nort.	B
externa Say.	B
fulginea Nort.	A
Macrophya intermedia Nort.	A
maura Cress.	B
pannosa Say.	A
pulchella Klug.	B
tibiator Nort.	B
Taxonus albidopictus Nort.	B
sp.	B
Tenthredo rufospectus Nort.	B
Tenthredopsis atroviolacea Nort.	A B
Monoctenus juniperi Marlatt.	A
Macroxyela aenea Nort.	B
ferruginea Say.	A
tricolor Norton.	Cress. List

UROCERIDAE.

Tremex columba L.	A B
var. sericeus Say.	A

CYNIPIDAE.

Ibalia maculipennis Hald.	A
Rhodites bicolor Harris.	A
rosae Lin.	A
Diastrophus nebulosus O. S.	A
Amphibolips coccineæ O. S.	A
confluens Harris.	A
Acraspis pezomachoides O. S.	A
erinacei Walsh.	A
globuli.	A
volucellae.	A
Biorhiza forticornis Walsh.	A

Biorhiza hirta Bass.	A
Holaspis ficigera Ashm.	A
globulus Fitch.	A
mamma Walsh.	A
Dryophanta laurifoliæ Ashm.	A
radicola Ashm.	B
Ceroptres minutissimum Ashm.	A
pisum O. S.	A
Synergus dimorphus O. S.	A
lignicola O. S.	
Encoilidia longicornis Ashm.	B
Cothonaspis erythropus.	A

EVANICIDAE.

Foenus sp.	A
Hyptia reticulata Say.	A

ICHNEUMONIDAE.

Ichneumon brevicinctor Say.	A
caeruleus Cress.	A B
cincticornis Cress.	A
comes Cress.	B
fungor Nort.	B
inurbanus Cress.	B
jucundus Brullé.	A B
laetus Brullé.	A
longulus Cress.	A
merus Cress.	A
orpheus Cress.	A
paratus Say.	A
rubicundus Cress.	A B
signatipes Cress.	A
volens Cress.	A
w-album Cress.	B
Hoplismenus morulus Say.	B
Amblyteles atrocoeruleus Cress.	A
jejunus Cress.	B
rileyi Cress.	A
Trogus exesorius Brullé.	A B
Phaegones exiguus Cress.	A
Centeterus tuberculifrons Prov.	A
Colpognathus hebrus Cress.	B
Herpestomus plutellae Ashm.	B
Phygadenon ovalis Prov.	B
sp.	A
Cryptus americanus Cress.	A
extrematis Cress.	A
proximus Cress.	A
similis Cress.	
Nerostenus thoracicus Cress.	B
sp.	A
Hemiletes sp.	A
Pezomachus pettitii Cress.	B
sp.	A
Ophion bilineatum Say.	A B
Ericospelus purgatum Say.	B
Thyreodon morio Fab.	A
Nototrachys jucundus Say.	A
Exochilum flavicorne Brullé.	A
Anomalon ambiguum Nort.	B
curtum Nort.	A
Agrypon metallicum Nort.	B
Opheltes glaucoptenis L.	A
Paniscus albovariegatus Prov.	B
geminatus Say.	A B
Compoplex sp.	A
Limneria fugitiva Say.	A
Temelucha forbesii (Wied.) Ashm.	B
Cremartus retinae Cress.	B
sp.	A
Mesochorus sp.	A
Plectiscus sp.	A
Porizon hyalinipennis Cress.	A
Thesilochus sp.	A
Eiphosoma texana Cress.	A
Pristomerus sp.	A
Exetastes sp.	A
Ceratosoma sp.	A
Banchus sp.	A
Mesoleptus sp.	A
Mesoleius sp.	A
Tryphon sp.	A
Erromenus sp.	A
Exochoides sp.	A
Exochus sp.	A
Orthocentrus.	
Bassus lætatorius Fab.	B
scutellarius Cress.	B
sychophanta Walsh.	A
Rhyssa atrata Fabr.	A B
lunator Fabr.	A
nortoni Cress.	B
Ephialtes irritator Fabr.	A
Pimpla annulipes Brullé.	A B
conquistor Say.	A
petulca Cress.	B
rufovariata Cress.	A B
Glypta vulgaris Cress.	A
Lampronota sp.	A
Meniscus rufipes Cress.	B
scutellaris Cress.	B
Zorniodes bridwelli Ashm. MS.	B
Labrocysta bimaculata Ashm.	B
Netacoelus laevis Cress.	B

STEPHANIDÆ.

Megischus sp.	A

BRACONIDÆ.

Vipio texanus Cress.	B
Iphiaulax eurygaster Brullé.	B
Melanobracon charus Riley	B
erythrogaster Brullé.	B
orbitalis Cress.	B
rugosiventris Ashm.	B
Bracon mellitor Say.	B
scrutator Say.	A
xanthostigma Cress.	B
vernoniæ Ashm.	B
nigrolineatus Ashm.	B
Glyptomorpha rugator Say.	B
Spathius laflammei Prov.	B
simillima Ashm.	B
sp.	A
Hecabolus sp.	A
Doryctes sp.	A
Hormiopterus fasciatus Ashm.	
Marlatt, Manhattan (Ashm.)	
Rhogas atricornis Cress.	Cragin
intermedius Cress.	B
parasiticus Nort.	B
rileyi Cress.	B
terminalis Cress.	A B
Sigalphus lepturi Ashm.	B
sp.	A
Chelonus basicinctus Prov.	A
electus Cress.	B
insularis Cress.	A
iridescens Cress.	B
sericeus Say.	A B
confusus Ashm.	B
Acogaster sp.	A
Apanteles sp.	A B
Microplitis ceratominae Ril.	Cres. List
sp.	A B
Agathis rubripes Cress.	B
sp.	A
Cremnops haematodes Brullé.	
vulgaris Cress.	
Microdus agilis Cress.	B
annulipes Cress.	A B
earinoides Cress.	A
sanctus Say.	A B
simillimus Cress.	A
Meteorus communus Cress.	B
hyphantriae Riley.	A
vulgaris Cress.	A
Eubadizon sp.	A
Toxoneura viator Say.	B
sp.	A
Gymnoscelus sp.	A
Macrocentrus sp.	A
Zele sp.	A
Deospilus sp.	A
Promachus sp.	A
Opius brunneiventris Cress.	B
Alysia rudibunda Say.	B
Adelura dimidiata.	A
Rhizarcha americana Ashm.	B
Coelinius meromyzae Forbes.	B
Aphidius sp.	A
Lithoplexus sp.	A
Urogaster sp.	B

CHALCIDIDÆ.

Leucospis affinis Say.	A
Eniasa texana Cress.	A
Smicra bioculata Cress.	B
lineata.	A
Spilochalcis delira Cress.	A
microgaster Say.	A
subobsoleta Cress.	A
torvina Cress.	A
Chalcis coloradensis Cress.	A
flavipes.	A
Podagrion mantis Ashm.	A B
Haltichella xanticles Walk.	A
Perilampus cyaneus Brullé.	A
hyalinus Say.	A B
platygaster Say.	A B
triangularis Say.	B
Eurytoma abnormicornis Walsh.	A
auriceps Walsh.	A B
bolteri Riley.	A B
diastrophi Walsh.	A B
gigantea Walsh.	B
seminatrix Walsh.	A B
studiosa Say.	A
succinipedis Ashm.	A
dochasemi.	A
Bruchophagus funebris Howard.	B
Rileya cecidomyae.	A
Decatoma nubilistigma Walsh.	A
simplicistigma Walsh.	A
Isosoma hordei Harris.	A B
charus.	A
secale Fitch.	B
Megastigmus flavipes Ashm.	A
psyllae.	A

Diamorus zabriskii Cress.	A B
Syntomaspis melanocerae Ashm.	B
albitarsis.	A
Torymus cecidomyae Walk.	A
dedignaris.	A
flaviventris.	A
longispinus.	A
magnificus O. S.	A
sackenii Ashm.	B
Orymus labotus Walk.	A
rosae Ashm.	A
ventricosus.	A
Eupelmus allynii French.	A
flavovariegatus.	A
Charitopus magnificus.	A
Ratzeburgia amphicerivora.	A
Encyrtus anasae Ashm.	A
chiloneurus.	A
pachypsyllae Howard.	A
Psilophrys pallipes.	A
Copidosoma intermedium Howard.	A
Comys bicolor Howard.	A
Boccharacis marlatti.	A
Homalotylus aprialis.	A
Coccophagus lecanii Fitch.	A
Aphelinus diaspidis Howard.	A
Tridymus metallicus.	A
Syntasis ficigerae.	A
purpuriventris.	A
Isocratus vulgaris.	A
Merisus destructor Say.	A
Metapalenia spectabilis Walsh.	B
Sphegigaster caeruliventris.	A
aeneiventris.	A
Cyrtogaster xanthopus.	A
Pteromalus nigricornis Prov.	A
puparum L.	A B
bruchivorus.	A
Euplectrus hircinus.	A
Cirrospilus flavicinctus Riley.	A
Elasmus albicoxa Howard.	A
pullatus Howard.	A
nollæ.	A
tischeriae Howard.	A
Sympiesis dolichogaster.	A
nigrifemora.	A
nigripes.	A
quercicola.	A
chenopodii.	A
Hippocephalus multilineatus.	A
Eulophus collaris.	A
Lophocomus verticillatus.	A
Holcopelte violacea.	A
poponoei.	A
Pheurotropis tricincta.	A
Entedon cupricollis.	A
lithocolletidis.	A
Asecodes quercicola.	A
Hadrocystus rhodoboemi Ashm.	B
Chrysocharis albitarsis Ashm.	B
oscinidis.	A
Tetrastichus californica.	A
evorymellae.	A
haemon Walker.	A

PROCTOTRYPIDAE.

Pristocera atra Klug.	A
armifera Say.	A
Sierola sp.	A
Epyris occidentalis Ashmead.	A
rufipes Say.	A
Mesitius vancouverensis Ashm.	A
nevadensis Ashm.	A
minutus Ashm.	A
californicus Ashm.	B
Goniozus cellularis Say.	A
foveolatus Ashm.	A
platynatae Ashm.	A
Gonatopus bicolor Ashm.	A
Anteon rugosus Ashm.	A
poponoei Ashm.	A
Habropelte fuscipennis Ashm.	A
Megaspilus poponoei Ashm.	A
Aphanogmus varipes Ashm.	A
Phanurus ovivorus Ashm.	A
Telenomus nigriscapus Ashm.	A
noctuae Ashm.	A
californicus Ashm.	A
persimilis Ashm.	A
graptae Howard.	A
ichthyurae Ashm.	A
bifidus Riley.	A
podisi Ashm.	A B
Trissolcus euchisti Ashm.	A B
Pentacantha canadensis Ashm. Ashmead, Synopsis Proctotrypidae	
Prosacantha fuscipennis Ashm.	A
sericeus.	A
Hoplogyron sp.	A
Caloteleia marlatti Ashm. Ashmead, Synopsis Proctotrypidae	
Macroteleia macrogaster Ashm.	A
n. sp.	A
Ophistacantha sp.	A
Anteris nigriceps Ashm.	A

Idris læviceps Ashm. A
Scelio hyalinipennis Ashm. A
Amblyaspis occidentalis Ashm. A
Leptacis longiventris Ashm. A
Trisachis rubicola Ashm. B
Polygnotus solidaginis Ashm. A
baccharicola Ashm. A
Isocybus pallipes Say. B
Proctotrypes pallidus Say. A B
caudatus Say. A
rufigaster Prov. A
quadriceps Ashm. A
Leptorhaptus conicus Ashm. B
Pantoclis megaplasta Ashm. Popenoe, Manhattan (Ashm. Syn. Proctotryp.)
Diapria erythropus Ashm. A
virginica Ashm. A
Trichopria sp. A
Monoleta sp. A

PELECINIDAE.

Pelecinus polyurator Drury. A B

CHRYSIDIDAE.

Omalus sp. A
Notozus sp. A
Holopyga ventralis Say. A
Hedychridium dimidiatum Say. A
Hedychrum violaceum Brullé. A
Chrysis clara Cress. A
coerulans Fabr. A
intricata Brullé. A
parvula Fabr. A B
perpulchra Cress. A
texana Gribodo. B
venusta Cress. A
verticalis Patton. A

FORMICIDAE.

Camptonotus herculaneus Lin. A
v. pennsylvanica DeG. B
Formica spp. A B
Lasius alienus Forst. B
spp. A B
Tapinoma sp. A

PONERIDAE.

Ponera sp.
Amblypone sp.

MYRMICIDAE.

Echiton sp. (Labidius). A
Pogonomyrmex occidentalis Cress. A
Myrmica sp. A
Monomorium sp. A
Pheidole sp. A
Myrmecina sp. A
Cremastogaster sp. A

MUTILLIDÆ.

Mutilla hexagona Say. Cragin A
ornativentris Cress. A
sayi Blake. A
scrupea Say. A
oajaca. A
Sphaerophthalma asopus Cress. A
aureola Cress. Crag.
auripilis Blake. A
balteola Blake. A
bioculata Cress. A
californica Rad. A
canadensis Blake. A
caneo Blake. A
castor Blake. Cresson's List
contumax Cress. A
fenestrata St. Farg. Cragin A B
ferrugata Fabr. A B
fulvohirta Cress. A
hector Blake. Cresson's List A
luteola Blake. Cresson's List.
marpesia Blake. Cresson's List
monticola Cress. A
mutata Blake. A
occidentalis Linn. Cragin A B
propinqua Cress. A
pygmaea Blake. A
4-guttata Say. Cragin A
scaevola Blake. A B
simillima Smith. Cragin A B
vesta Cress. A
Photopsis hyalina Blake. A
pallida Blake. A
tapajos Blake. Cragin A
unicolor Cress. Cragin
Myrmosa unicolor Say. A

SCOLIIDAE.

Tiphia inornata Say. Patt., Crag. A B
Paratiphia albilabris Spin. Patton
Myzine confluens Cress. A
interrupta Say. Patton A
sexcincta Fab. Patt., Crag. A B

Scolia bicincta Fab. A B
lecontei Cress. Patton
Elis octomaculata Say. Patton
plumipes Drury. Cragin A
xantiana Sauss. A
atrata. A
4-notata Fabr. B

SAPYGIDAE.

Sapyga 2 spp. B

POMPILIDAE.

Pompilus aethiops Cress. Cragin A B
atrox Dahlb. Cragin A B
biguttatus Fabr. A
cylindricus Cress. A B
ferrugineus Say. A
humilis Cress. A
hyacinthinus Cress. A
ichneumoniformis Patton. Patton
ingenuus Cress. A
interruptus Say. A
marginatus Say. A
maurus Cress. B
philadelphicus St. Farg. A B
subviolaceus Cress. A
tenebrosus Cress. A
tropicus Lin. Cragin A B
willistoni Patton. Patton
Priocnemis conicus Say. A
fulvicornis Cress. Cra. A B
nigripes Cress. A
nothus Cress. A
terminatus Say. A
unifasciatus Say. A
Agenia architecta Say. A
calcarata Cress. A
iridipennis Cress. A
mellipes Say. A
Planiceps concolor Smith. Patton
Aporus fasciatus Smith. A
Ceropales bipunctata Say. A
brevicornis Patton. Patton
elegans Cress. Patton
fulvipes Cress. A
longipes Smith. A
nigripes Cress. A
texana Cress. Patton A
Pepsis formosa Say. Patt., Crag. A
marginata Beauv. B

SPHECIDÆ.

Ammophila aberti Hald. Patton
intercepta St. Farg. Patton, Cragin A B
pictipennis Walsh. A B
procera Klug. Patton
Pelopoeus cementarius Drury. Cragin A B
Chalybion caeruleum Lin. Crag. A B
Chlorion caeruleum Drury. Crag. A B
Isodontia philadelphica St. Farg. A
Sphex ichneumonea Lin. Patton, Cragin A B
pennsylvanica Lin. Cragin A
Harpactopus rufiventris Cress. Patton, Cragin A
Priononyx atrata St. Farg. Patton, Cragin A B

LARRIDAE.

Astata bicolor Say. A
unicolor Say. A
Lysoda triloba Say. A
Larra aethiops Cress. Patton
argentea Beauv. A B
divisa Patton. Patton
quebecensis Prov. B
Tachytes abdominalis Say. A
caelebs Patton. Patton
distinctus Smith. A
elongatus Cress. A
pepticus Say. A
rufofasciatus Cress. A
texanus Cress. Patton
validus Cress. A
minimus. A

BEMBECIDAE.

Sphecius speciosus Drury. A B
Megastizus brevipennis Walsh. Cresson's List, Cragin A
Stizus unicinctus Say. Patton A
Microbembex monodonta Say. Patton
Molendula emarginata Cress. Patton A
speciosa Cress. Patton
ventralis Say. Patton A
signata. A

NYSSONIDAE.

Gorytes sp. A B
Hoplisus rufoluteus Pack. A
Euspongus bipunctatus Say. A B

Alyson melleus Say. A
oppositus Say. A
Paranysson texanus Cress. A
Nysson aurinotus Say. A
opulentus Garts. A

PHILANTHIDAE.

Philanthus albifrons Cress. A
gloriosus Cress. A
inversus Patton. Patton
punctatus Say. A
scutellaris Cress. A
ventilabris Fabr. A
var. frontalis Cress. A
Eucerceris canaliculatus Say. Patton
laticeps Cress. Patton
rubripes Cress. Cress. List
superbus Cress. Patton
unicornis Patton. Patton
zonatus Say. A
Cerceris bicornuta Guer. A
blakei Cress. A
clypeata Dahlb. A
compar Cress. Cresson's List
deserta Say. A
finitima Cress. A
fulvipes Cress. Patton
fumipennis Say. B Greenwood Co. A
kennicottii Cress. A
occipitomaculata Pack. Cresson's List
rufinoda Cress. A
sexta Say. Patton
venator Cress. B Greenwood Co. A
peckhami Ashm. B Greenwood Co.

MIMESIDAE.

Mimesa tibialis Cress. A
Psen sp. A

PEMPHREDONIDAE.

Cemonus inornatus Say. A B
Passaloecus annulatus Say. A
Diodontus americanus Pack. A

CRABRONIDAE.

Trypoxylon clavatum Say. A B
excavatum Smith. B
frigidum Smith. A
politum Say. A B
rubrocinctum Pack. A B
texense Sauss. A

Trypoxylon albopilosum Fox. B
Crabro chrysarginus St. Farg. B
interruptus St. Farg. A B
nigrifrons Cress. B
6-maculatus Say. B
stirpicola Pack. A B
colon Cress. B
Thyreopus sp. A
Anacrabro ocellatus Pack. A
Oxybelus emarginatus Say. A B
4-notatus Say. A

EUMENIDAE.

Zethus sp. B
Eumenes belfragei Cress. Cragin A
bolli Cress. Patton A
fraternus Say. A
Monobia quadridens Lin. A B
Nortonia symmorpha Sauss. A
Odynerus annulatus Say. Patton, Cragin A B
anormis Say. A
arvensis Sauss. Cragin A B
cultus Cress. B
dorsalis Fab. Cragin A B
evectus Cress. Cragin
foraminatus Sauss. A
hidalgi Sauss. Cragin
mohicanus Sauss. B
pedestris Sauss. B
pennsylvanicus. B
saecularis Sauss. B
unifasciatus Sauss. B
vagus Sauss. Patton
venustus. B
Pterochilus 5-fasciatus Say. Pat., Cr. A

VESPIDAE.

Polistes annularis Lin. B
aurifer Sauss. Patton
bellicosus Cress. B
canadensis Lin. B
metricus Say. A
rubiginosus St. Farg. Cragin
texanus Cress. Cragin B
variatus Cress. Pat., Cr. A B
Vespa germanica Fabr. A
maculata Lin. A B
occidentalis Cress. A

ANDRENIDÆ.

Colletes albescens Cress. A
armata Patton. Patton
ciliata Patton. Patton

Colletes inaequalis Say. B
Prosapis modestus Say. B
pygmaea Cress. B
ziziae Robt. (affinis). A
sp. near ziziae Ckll. B
Sphecodes dichroa Smith. B
ranunculi Robt. B
clematidis Robt. B
mandibularis Cress. B
Halictus confusus Sm. B
coriaceus Sm. (subquadratus Sm.) B
disparalis Cr. B
fasciatus Nyl. B
flavipes Fabr. B
fulvipes Smith. B
inconspicuus Smith. B
lerouxii St. Farg. B
ligatus Say. B
var. armaticeps Cr. B
parallelus Say. B
pectoralis Smith. B
stultus Cress. B
albipennis Robt. B
forbesii Robt. B
californicus Ashm. MS. B
missouriensis Ashm. MS. B
Augochlora humeralis Patton. Pat. B
viridula Smith. B
lucidula Smith. Cragin
similis Robt. B
confusa Robt. (purus). A B
Agapostemon radiatus Say. A B
texanus Cress. B
tricolor St. Fg. Crag. A
viridula Fab. B
Andrena bipunctata Cress. B
pulchella Robt. B
cragini Ckll. n. sp. B
kansensis Ckll. n. sp. B
bridwelli Ckll. n. sp. B
imitatrix Cress. B
texana Cress. B
vicina Smith. B
rugosa Robt. B
violae Robt. B
laticeps Prov. B
forbesii Robt. B
erythrogaster Ashm. B
mariae Robt. B
salicinella Ckll. B
geranii Robt. B
Andrena claytoniae Robt. B
sayi Robt. B
Parandrena andrenoides Robt. B
Protandrena cockerelli Dunning. B
(Described from a single male specimen taken in 1894 by the late J. E. Taylor, at Topeka.)
Nomia nortoni Cress.
Cresson's List, Patton, Cragin A B
Eunomia heteropoda Say. A

APIDAE.

Halictodes marginatus Ckll. A B
(Formerly Panurgus. This and P. halictulus Cress. are sexes of one species. — Cockerell.)
Pseudopanurgus aethiops Cress. Crag.
(Formerly Calliopsis.— Cockerell.)
Calliopsis andreniformis Smith. A B
bridwelli Cockerell n. sp. B
coloradensis Cress. Patton, Cragin
Perdita sp. A
Nomada accepta Cress. Cresson's List
bisignata Say. B
gracilis Cress. A
herligbrodtii Cress. A
incerta Cress. A
texana Cress. Patton
Epeolus lectus Cress. Cresson's List
occidentalis Cress. Patton A
remigatus Fab. A
bifasciatus Cress. A B
Melecta interrupta Cress. Cragin A
Bombomelecta thoracica Cress. Patton
Stelis lateralis Cress. B
Coelioxys deplanata Cress. A
8-dentata Say. B
Osmia albiventris Cress. B
lignaria Say. A
simillima Smith. B
Heriades denticulatum Cress. B
carinatum Cress. B
Alcidamea simplex Ckll. (producta). B
Monumetha borealis Cress. A
Anthidium concinnum Cress. A
interruptum Say. Cr. List
maculifrons Smith. A
Lithurgus compressus Smith. A
Megachile brevis Say. A B
deflexa Cress. Cress. List
fortis Cress. Cress. List A
latimanus Say. A
montivaga Cress. A
perbrevis Cress. A

Megachile pruina Smith.	A
relativa Cress.	B
Ceratina dupla Say.	A B
tejonensis Cress.	B
Melissodes afflicta Cress.	A
agilis Cress.	A
atripes Cress.	Cragin
bimaculata St. Farg.	A B
condigua Cress.	Cress. List
confusa Cress.	A
daponsa Smith.	A
menuacha Cress.	Cragin A
obliqua Say.	A B
perplexa Cress.	B
rustica Say.	B
snowii Cress.	A
Synhalonia frater Cress.	B
albata Cress.	Cragin
Diadasia apacha Ckll.	B
enavata Cress.	Cresson's List
Eutechnia taurea Say.	B
Anthophora abrupta Say.	A B
occidentalis Cress.	Cragin A
smithii Cress.	Cragin
walshii Cress.	A
Xylocopa virginica Drury.	A
Centris lanosa Cress.	Cragin
Apathus variabilis Cress.	A B
Bombus bimaculatus Cress.	A
dubius Cress.	Cresson's List
fervidus Fab. (Apathus elatus Fab.)	Cragin A
morrisoni Cress.	A
pennsylvanicus DeG.	Patton, Cragin A B
scutellaris Cress.	Patton, Cragin A B
separatis Cress.	A B
virginicus Oliv.	A B
Apis mellifica Linn.	A B

A FIRST LIST OF THE HYMENOPTEROUS FAMILIES TENTHREDINIDÆ, SIRICIDÆ, CHRYSIDIDÆ, PROCTOTRYPIDÆ, CYNIPIDÆ, CHALCIDIDÆ AND BRACONIDÆ COLLECTED IN NEW MEXICO.

BY T. D. A. COCKERELL, MESILLA PARK, N. M.

Read (by title) before the Academy December 30, 1898.

TENTHREDINIDÆ.

Cimbex americana, Leach. Las Vegas.

Nematoneura malvacearum, Ckll. Mesilla; Albuquerque; Santa Fé. Larvæ on Sphæralcea lobata, Wooton.

Blennocampa populifoliella, Riley MS., Twns. Mesilla Valley (Townsend). This is probably identical with the next, in which case it has priority.

Scolioneura populi, Marlatt. Mesilla Valley.

Taxonus (Strongylogaster) occidentalis, MacGillivray MS. Ruidoso Creek (E. O. Wooton).

Eriocampoides limacina, Retz. (Eriocampa cerasi, Peck). Sante Fé, introduced.

Allantus occidaneus, Cress. Recorded by Cresson.

A. depressus, MacGillivray MS. Ruidoso Creek (E. O. Wooton).

Prof. C. H. T. Townsend has collected many additional species in the White Mountains, N. M.; the collection is as yet only partly worked over, and is not here included.

SIRICIDÆ.

Sirex areolatus, Cresson. Collected by Lewis in northern New Mexico.

Tremex columba, L. Santa Fé, Aug. 10.

CHRYSIDIDÆ.

Notozus versicolor, Nort. Mesilla Valley.

N. marginatus, Patton, det. Fox. At flowers of Isocoma wrightii, Mesilla Park, Sept. 12.

Omalus corruscans, Nort. Reported by Aaron.

Holopyga semirufa, Ckll. Mesilla Valley.

H. ventralis, Say, det. Fox. At flowers of Isocoma wrightii, Mesilla Park, Sept. 11.

Hedychrum violaceum, Brullé. Chaves and El Rito (Townsend). Var. wiltii, Cress., Mesilla Valley.

Chrysis mesillæ, Ckll. Mesilla Valley.

C. cærulans, Fab., var., det. Ashm. Mesilla, June.

C. perpulchra, Cr., det. Ashm. Mesilla, July 21.

C. pacifica, Say. Mesilla Valley (R. R. Larkin).

C. bigeloviæ, Ckll. Mesilla Valley.

C. parvula, Fab., det. Ashm. Mesilla, June 6.

C. texana, Gribodo, det. Fox. At flowers of Isocoma wrightii, Mesilla Park, Sept. 11.

Parnopes festivus, Ckll. Mesilla Valley.

PROCTOTRYPIDÆ.

Pristocera armifera, Say. Mesilla, June 21. Male, det. Ashm.

Goniozus platynotæ, Ashm. Mesilla Valley.

G. cellularis, Say, det. Ashm. Mesilla Park, June 24; also April 16, swept from Sophia halictorum.

Isobrachium rufiventre, Ashm. Las Cruces, June 4.

Trissolcus euschisti, Ashm., det. Ashm. Mesilla, under bark of apple tree, Nov. 11.

Hadronotus mesillæ, Ckll. Mesilla Valley.

Isostasius occidentalis, Ashm. MS. Las Cruces, June.

Acerota cecidomyiæ, Ashm. Las Cruces, June 4.

Platygaster obscuripennis, Ashm. Mesilla Valley (Townsend).

Polygnotus atriplicis, Ashm., det. Ashm. Mesilla Park, bred from galls of Lasioptera willistoni, Ckll.

Diapria californica, Ashm., det. Ashm. Santa Fé, July 5.

CYNIPIDÆ.

Andricus howertoni, Bass., A. recticulatus, Bass., and A. ruginosus, Bass.; collected by Howerton.

A. frequens, Gillette, det. Gillette. Pinos Altos.

Holaspis maculipennis, Gill. Common in the Organ Mts.; the first specimens were collected by R. R. Larkin.

Dryophanta emoryi, Ashm. Silver City (Rusby).

Neuroterus howertoni, Bass. Recorded by Bassett in 1890.

Synergus mexicana, Gill. Mesilla Valley.

Allotria brassicæ, Ashm., det. Gillette. Common on cabbage; Mesilla Park.

Anacharis lamyi, Ashm. (mexicana, Ashm.) Santa Fé. The name mexicana is preoccupied; so I asked Mr. Ashmead to substitute lamyi, after Archbishop Lamy, in whose garden it was found. He kindly agreed to this.

Psilodora impatiens, Say. Common in the Mesilla Valley; also at Santa Fé.

P. erythropa, Ashm., det. Ashm. Mesilla, May 1.

Hexaplasta zigzag, Riley, det. Ashm. Mesilla, May, on Sambucus mexicana.

Figitides atricornis, Ashm. Santa Fé.

F. quinquelineatus, Say.

CHALCIDIDÆ.

Spilochalcis delira, Cress., det. Ashm. Las Cruces, Aug. 24, on Solidago canadensis arizonica.

S. bioculata, Cress., det. Howard. Santa Fé, bred from Philampelus larva on grape.

S. mesillæ, Ckll. Mesilla Valley. The type is in U. S. Nat'l Museum.

Smicra torvina, Cress. Mesilla, June.

Chalcis flavipes, Fb. (ovata, Say). Mesilla Valley, common.

Phasganophora sulcata, Westw., det. Riley. Mesilla Park, on Helianthus, Sept. 8, 1893.

Acanthochalcis nigricans, Cam. Mesilla Park.

Stomatocera rubra, Ashm. Mesilla Park, on Helianthus, Sept. 8, 1893.

Podagrion mantis, Ashm., det. Ashm. Mesilla; parasitic on Stagmomantis.

Orasema mexicana, Ashm. MS. S. Augustine Ranch, Organ Mts., Aug. 29.

O. viridis, Ashm. Albuquerque.

Perilampus platygaster, Say, det. Ashm. Mesilla Park, Sept. 12, on Isocoma wrightii.

P. fulvicornis, Ashm. Mesilla Valley; Las Cruces, June, on a sunflower leaf.

P. hyalinus, Say, det. Ashm. Mesilla Park, May 8, on foliage of poplar.

Elatus sisymbrii, Ashm. Mesilla Valley.

Eurytoma bigeloviæ, Ashm. Mesilla Park, Sept., on Isocoma wrightii.

E. studiosa, Say, det. Dept. Agric. Paraje; bred in April from gall of Lasioptera ephedræ, Ckll.

Systole minuta, Ashm. Las Cruces, June; numerous on green fruits of parsnip.

Bruchophagus funebris, Howard. Organ Mts. (E. O. Wooton).

B. mexicanus, Ashm. Las Cruces. (Townsend).

Monodontomerus montivagus, Ashm. Mesilla Valley, common. I have found it on a wall containing many nests of Podalirius vallorum, Ckll., and believe it is parasitic on that bee.

Torymus cyaneogaster, Ashm., det. Ashm. Mesilla Park, Sept. 11, on Isocoma wrightii.

T. rudbeckiæ, Ashm. Mesilla, June.

Syntomaspis brachyura, Ashm. MS. Santa Fé, on cherry tree, June 26.

Megastigmus nigrovariegatus, Ashm. Santa Fé.

Eupelmus quercus, Ashm. Santa Fé.

E. cyaneiceps, Ashm. Mesilla Park, Sept., on Isocoma wrightii.

E. larreæ, Ashm. MS. Mesilla Valley, on Larrea.

Aphycus ceroplastis, Howard. Mesilla Valley (Ckll.); Silver City (Rusby 1879). Bred from Ceroplastes irregularis, Ckll.

A. texanus, Howard. Mesa E. of Las Cruces, bred from Dactylopius gutierreziæ, Ckll., on Gutierrezia lucida, Greene.

A. cockerelli, Howard. Las Cruces; bred from Lecanium.

A. howardi, Ckll. Mesilla Park; bred from Eriococcus tinsleyi, Ckll.

Ageniaspis fuscipennis, Ashm. MS. Mesilla Valley, on Larrea.

A. morio, Ashm. MS. Mesilla Valley, on Larrea.

Blastothrix longipennis, Howard. Las Cruces, bred from Lecanium robiniarum, Dougl.

Encyrtus aphalaræ, Howard MS. Mesilla Park, bred from Aphalara suædæ, Schwarz MS., on Suæda.

Isodromus secundus, Howard MS. Las Cruces; bred for Chrysopa.

Dinocarsis argenteus, Ashm. MS. Mesilla Park, campus of A. & M. College, June.

Bothriothorax peculiaris, Howard. Santa Fe, bred from syrphid on hop.

B. nigripes, Howard. Mesilla Valley.

Chrysopophagus banksi, Howard. Mesilla Valley, June.

Ectroma americanum, Howard. Mesilla Valley, June.

Pteroptrix flavimedia, Howard. Organ Mts.

Prospalta aurantii, Howard. Mesilla Park; bred from Mytilaspis concolor, Ckll.

Coccophagus flavoscutellum, Ashm. Greenhouse of Exper. Sta., Mesilla Park.

C. lecanii, Fitch. Organ Mts; bred from Pulvinaria marmorata, Ckll.

Tridymus cinctipes, Ashm. MS. Santa Fe, August 8.

Isocratus vulgaris, Walk., det. Howard. Mesilla Park, August 16; bred from Aphis brassicæ on cabbage.

Halticoptera drypatæ, Ashm., det. Ashm. Mesilla Park, April 25, on Sophia halictorum.

Euchrysia hyalinipennis, Ashm, det. Ashm. Mesilla Park.

Amblymerus annulipes, Ashm. MS. Las Cruces, June 4.

Pteromalus puparum, L., det. Ashm. Mesilla Valley, August 8, 1893.

Catolaccus incertus, Ashm. Mesilla, June.

C. anthonomi, Ashm. Las Cruces, June 4.

C. varicolor, Ashm. MS. S. Augustine Ranch, August 29; emerged from a bud of Chilopsis.

C. singularis, Ashm. MS. Santa Fe, end of July.

Meraporus arizonensis, Ashm., det. Ashm. Santa Fé, Aug. 22; parasite of Bruchus on Glycyrrhiza lepidota.

M. calandræ, Howard, det. Howard. Mesilla, Sept. 1.

Pachyneuron texanus, Ashm. MS. Santa Fé, Aug. 8. As the name indicates, this also occurs in Texas (Ashmead litt.).

Euplectrus comstocki, Howard, det. Howard. Mesilla Park, Aug., 1893; reared from lepidopterous larva on cultivated bean.

Solenotus metallicus, Ashm. MS. Las Cruces, June 4.

Chrysocharis vagans, Ashm. MS. Las Cruces, June.

Holcopelte producta, Ashm. Mesilla Valley (Townsend).

Entedon bigeloviæ, Ashm. Ashmead, Tr. Am. Ent. Soc., 1894, gives the locality as Las Cruces. This is an error; the insect was bred from Eurosta bigeloviæ, Ckll., collected as stated by Townsend in Canad. Entom., 1893, p. 48.

Aproctocetus americanus, Ashm. Las Cruces, June.

NOTE.—I will take this opportunity to record Semiotellus clisiocampæ, Fitch, det. Ashm., from El Paso, Tex., July 30, 1893.

BRACONIDÆ.

Vipio uniformis, Cress. (Bracon), det. Ashm. Mesilla Park, April 16, on Sophia halictorum.

Bracon rufovariegatus, Prov., det. Ashm. Mesilla Park, April 12, on Sophia halictorum.

B. nuperus, Cress., det. Ashm. Mesilla Park, April 12, on Sophia halictorum.

B. politus, Prov., det. Ashm. Mesilla Park, Sept. 12, on Isocoma wrightii.

B. dimidiatus, Ashm. MS. Santa Fé, Aug. 1.

B. neomexicanus, Ashm. MS. Mesilla, end of August.

B. trifolii, Ashm., det. Ashm. Mesilla, end of August.

B. lævithorax, Ashm., det. Ashm. Santa Fé, July 9.

Habrobracon niger, Ashm. MS. Las Cruces, at flowers of plum, April 1.

Tropidobracon mexicanus, Ashm. MS. Santa Fé, June 22.

Doryctes radiatus, Cress., det. Ashm. Santa Fé, Aug. 1.

Rhogas atricornis, Cress., det. Dept. Agr. Las Cruces, Aug. 8, on Solanum.

R. nolophanæ, Ashm., det. Ashm. Las Cruces.

R. cockerelli, Ashm. MS. Mesilla, July and Aug. 2. Type in U. S. Nat'l Mus.

R. nigriceps, Ashm., det. Ashm. Mesilla, June 24.

R. stigmator, Say. (Bracon.) Mesilla, June.

R. lectus, Cress., det. Ashm. Bred from a larva on potato (Solanum) sent from Georgetown by O. W. Anthony. The larva had a shiny, pale ochreous head; body with black warts.

R. intermedius, Cress., det. Ashm. Mesilla, at light, May 2.

Chelonus texanus, Cress., det. Ashm. Mesilla Park, at flowers of plum, April 9.

C. cautus, Cress., det. Ashm. Mesilla Park, April 12, on Sophia halictorum.

C. electus, Cress., det. Ashm. Mesilla Park, Sept. 12, on Isocoma wrightii; Mesilla, June 24.

C. mesillæ, Ashm. MS. Mesilla, June 24.

C. lævifrons, Cress. Las Cruces, June.

C. sericeus, Say. Continental Divide, Tenaja (Townsend).

C. filicornis, Cam. Recorded in Cresson's Catalogue of Hymenoptera.

Apanteles neomexicanus, Ashm. MS. Mesilla, end of August.

A. theclæ, Riley, det. Ashm. Mesilla, June, reared from a Lycænid larva.

A. hyphantriæ, Riley, det. Ashm. Mesilla, Sept., parasitic in great numbers on Hyphantria cunea on Populus fremontii. It was observed to attack immature larvæ.

Urogaster carpatus, Say (Apanteles), det. Ashm. Mesilla, end of October.

Protapanteles monticola, Ashm., det. Ashm. Mesilla, May, on Sambucus mexicana.

Microplitis ceratominæ, Riley. Mesilla Valley.

M. mamestræ, Weed. Las Cruces, June 4.

M. nigripennis, Ashm., det. Ashm. Lone Mountain, July 7.

Microdus fulvescens, Cress., det. Ashm. Mesilla Valley: Santa Fé.
M. divisus, Cress., det. Ashm. Mesilla Park, April 16, on foliage of Populus.
Orgilus flaviceps, Ashm. MS. Mesilla, June 24.
Cremnops vulgaris, Cresson. Santa Fé: Mesilla Valley; San Augustine Ranch.
Agathis tibiator, Prov., det. Ashm. Mesilla Park, Sept. 12, on Isocoma wrightii.
Agathirsia neomexicana, Ashm. MS. Mesilla, Aug. 26, hovering over Sphæralcea lobata, Wooton.
Meteorus politus, Prov., det. Howard. Las Cruces, in winter.
M. agrotidis, Ashm. MS. (type from California). Mesilla, June 6, at light.
M. indagator, Riley, det. Ashm. Santa Fé, Aug. 1.
M. vulgaris, Cress., det. Ashm. Mesilla, May: Santa Fé, Sept., bred from Halisidota maculata cocoons.
M. communis, Cress., det. Ashm. Mesilla, April 22, at light.
Aspidogonus (Diospilus) alfalfæ, Ashm. MS. Mesilla, end of August; Las Cruces, September.
Opius nanellus, Ashm., det. Ashm. Las Cruces, August.
Phædrotoma sanguinea, Ashm., det. Ashm. Mesilla; reared from fruit of Solanum elæagnifolium.
Nosopæa polita, Ashm. MS. Las Cruces, June 4.
Lysiphlebus eragrostaphidis, Ashm. Mesilla Park, on Helianthus, Sept. 8, 1893.
Lipolexis rapæ, Curtis, det. Ashm. Santa Fé, July 16.

In addition, the following genera have been taken in New Mexico, but the species have not yet been identified, and are doubtless mostly undescribed: Blacus, Iphiaulax, Scelio, Inostemma, Telenomus, Caloteleia, Labeo, Mesitius, Tetrastichus, Metopon, Liothorax, Metapachis, Decatoma, Trigonura, Leucospis, Ceroptres, Solenaspis, Ptenus.

SOME NOTES ON THE BIRDS OF SOUTHERN KANSAS.

BY J. R. MEAD, WICHITA.

Read before the Academy October 27, 1897.

The writer has observed a rapid decrease in bird life in southern Kansas. Both migratory and summer-resident species, particularly those used for food, are included in this statement, the most noted exceptions being blackbirds and orioles.

At the time of the early settlement of south-central Kansas the great abundance of bird life was a noted feature of the landscape, especially in springtime. Several varieties very numerous in their northward journey were never seen on the return trip. Such was the case with the Eskimo curlew, of which millions passed northward to their nesting grounds, while none ever returned this way. The first birds to appear in the spring were ducks, canvasbacks and redheads coming with the first thaw in February. A little later came gray geese and other ducks; and when the grass had started white geese came in great numbers, a sign that spring would stay. Beautiful white swans also came our way, in both the spring and fall migrations. Then the family of Anatidæ were so numerous that they destroyed whole fields of wheat, and parties of hunters would kill a wagon load in a day, while now they are rarely seen.

Prairie-hens, quite common before the settlement of the country, rapidly increased for a few years, until the building of railroads brought the market hunters. They are now almost exterminated. A migratory movement of both prairie-chickens and quail was noticed.

Wild turkeys, once abundant in the state, are now entirely exterminated. They wandered from place to place through a wide range of country, but were not migratory. Eskimo curlews have not been seen for several years.

Some of our smaller birds are increasing in numbers. Orioles have increased to such numbers that they are a serious nuisance in vineyards and orchards, driving their sharp bills into every ripe apple, peach, or grape that they see. The owner of one vineyard bought 3000 loaded shells at one time, and employed two men constantly to shoot birds. Another used thirty pounds of No. 10 shot in one day, and claimed to have killed bushels of orioles. Others kill many of them by placing poisoned water in their vineyards.

Orioles build their hanging nests in the swaying branches of the numerous cottonwood groves. They commence drifting southward during the latter half of August, stopping at every orchard or vineyard. By the middle of September all have gone south—perhaps to Central America.

For many years I have observed that a number of our migratory birds follow the direction of the Arkansas valley and river, going northwest in the spring and returning southeast in the fall. Crows in great numbers ascend the course of the river in the spring, feeding along the fields as they go, and return late in the fall, gleaning as they leisurely journey. They winter in the country of the black-jack acorns. Who knows where they nest?

Blue jays go southeast about the middle of September in long, straggling flocks. Hawks have their day about the 25th of October, vast numbers passing over in the course of two or three days. They sail slowly along without any attempt at order, and evidently come from great distances, since so many of them alight on trees and fences to rest. Of late years wild geese remain at the north until a severe "norther" drives them south *en masse* in a single night.

Pelicans are the last of the large migrating birds to migrate. They go north about the middle of May, moving along like an army. I have seen three divisions of about 500 each, abreast and in almost perfect line, about 100 yards apart.

It would be interesting to follow our birds to their winter homes, along the Gulf coast, the West Indies, or in Central and South America. In the course of a winter trip to Galveston I saw immense flocks of blackbirds in the timber a hundred miles from the Gulf; but I saw no other land birds except an occasional robin on Galveston island. Texas is as barren of bird life in winter as is Kansas.

A LIST OF BIRDS COLLECTED BY COL. N. S. GOSS IN MEXICO AND CENTRAL AMERICA.

FROM THE COLLECTOR'S NOTES; COMPILED BY D. E. LANTZ, MANHATTAN.

Read before the Academy October 27, 1897.

Colonel Goss made several trips to Mexico and Central America in search of birds. This was in pursuance of his ambition to have his collection contain representatives of every species of North American birds. In December, 1882, he visited Guatemala, and remained in that country for two or three months. He entered the state from the southern coast, at San José, and collected mostly near that town and at Palin, Naranjo, and Amatitlan.

In November and December, 1883, he visited Mexico, collecting mainly at Lerdo and Florido. He also visited Lower California during the following spring.

In December, 1885, he again visited Guatemala, landing at Santa Tomas, on the northeast coast, and collecting for several weeks on the Chocan river at Puerto Barrios and at Santa Tomas. In February, 1886, he made his way northward to Belize, in British Honduras, and spent a short time collecting in that vicinity.

In the early months of 1887, Colonel Goss made a second trip to the Gulf of Honduras, staying for a short time at Puerto Cortez, and collecting mostly at Chaloma, in Spanish Honduras. He then again made his way westward to British Honduras in February, when he collected at Cayo. From this point, guided by Indians, he made a short but laborious trip into the mountains of Guatemala to Yaxa, where he secured the pair of ocellated turkeys which he prized so highly.

In November, 1887, he visited Mexico, on the west coast, collecting at Altata, Limoncito, Rinconada, Culiacan, La Paz, and at San Pedro Martir island, in the Gulf of California. He extended his stay well into the following March. On this trip he succeeded in capturing two apparently new species of boobies: Sula brewsteri and Sula gossii. (The latter was later shown to be identical with Sula nebouxii Milne-Edwards.)

In January, 1889, another visit to Mexico was extended into the southern part. He collected mainly at Coatepec. It was on his return from this trip, while in the City of Mexico, that the colonel was robbed of his collecting gun and the valuable notes which he had made.

His last southern trip was made in December, 1889, and lasted for several weeks. He visited Granada and Los Sabalos, in Nicaragua, and the San Juan valley, in northern Costa Rica.

A detailed list of the species secured, with localities, follows:

1. Tinamus robustus Scl. and Salv. Male and female. Santa Tomas, Guat.
2. Crypturus sallaeii Bonap. 1 male. Naranjo, Guat.
3. Crypturus sallaeii (nob.) 1 male. Coatepec, Mex.
4. Phaeton althereus Linn. 2 males, 1 female. San Pedro Martir Isle, Gulf of Cal.
5. Sula nebouxii Milne-Edwards. Male and female, and 2 eggs. San Pedro Martir Isle, Gulf of Cal.
6. Sula sula (Linn.) Male and female. Belize, Br. Hond.
7. Sula brewsteri Goss. Male and female. San Pedro Martir Isle, Gulf of Cal.
8. Phalacrocorax pencillatus Brandt. 4 specimens. La Paz, Lower Cal.
9. Fregata aquila (Linn.) 1 male, 2 females. Belize, Br. Hond.
10. Carina moschata (Linn.) 1 female. Naranjo, Guat.

11. Heliornis fulica Bodd. 2 males. Puerto Barrios, Guat., and Los Sabalos, Nic.
12. Ajaja ajaja (Linn.) 3 specimens. San Jose, Guat.
13. Guara alba Linn. Male and female. San Jose, Guat.
14. Eurypyga major Hartl. 1 male. Santa Tomas, Guat.
15. Cochlearius zelidoni Ridgw. Pair. San Jose, Guat.
16. Ardea cærulea Linn. 2 males. San Jose, Guat.
17. Ardea virescens frazeri Brewst. Pair. La Paz, Lower Cal.
18. Aramus giganteus (Bonap.) 1 female. Belize, Br. Hond.
19. Rallus beldingi Ridgw. Pair. La Paz, Lower Cal.
20. Arimidis albiventris. 1 male. San Jose, Guat.
21. Porzana leucogastra Ridgw. 1 male. San Juan Valley, Costa Rica.
22. Jacana spinosa (Linn.) 3 specimens. Belize, Br. Hond., and Chaloma, Sp. Hond.
23. Colinus pectoralis. Pair. Coatepec, Mex.
24. Callipepla elegans bensoni Ridgw. Pair. Culiacan and Limoncito, Mex.
25. Meleagris ocellata. Pair. Yaxa, Guat., Mar. 1887.
26. Ortalida leucogastra. Pair. Naranjo, Guat.
27. Ortalis wagleri Gray. 1 female. Limoncito, Mex.
28. Ortalis vetula maccalli Baird. 3 specimens. Chaloma, Sp. Hond., and Rinconada, Mex.
29. Penelope cristata (Linn.) Pair. Naranjo and Santa Tomas, Guat.
30. Crax globicera Linn. Pair. Naranjo and Santa Tomas, Guat.
31. Columba rufina (Temm.) 1 male. San Juan Valley, Costa Rica.
32. Columba flavirostris Wagl. Pair. Naranjo, Guat.
33. Zenaidura macroura (Linn.) 1 male. San Pedro Martir Isle.
34. Leptoptila albifrons (Bonap.) Pair. Amatitlan and San Jose, Guat.
35. Melopelia leucoptera (Linn.) Pair. Culiacan, Mex.
36. Columbogallina passerina (Linn.) Pair. Amatitlan, Guat.
37. Columbogallina passerina pallascens Baird. 2 males. La Paz, Lower Cal.
38. Scardafella inca (Less.) Pair. San Jose, Guat.
39. Geotrygon albifacies. Pair. Coatepec, Mex.
40. Gypagus papa Linn. 1 female. Naranjo, Guat.
41. Granospiza cærulescens nigra (DuBois.) 1 male. Rinconada, Mex.
42. Rupornis griseocauda Ridgw. Pair. Chocan River, Guat., and Cayo, Br. Hond.
43. Spizaetus ornatus (Daud.) 1 male. Chocan River, Guat.
44. Urbitinga onthracina (Licht.) 1 male. Chaloma, Sp. Hond.
45. Accipiter bicolor Vieill. 1 male. Naranjo, Guat.
46. Asturina plagiata Schleigel. 3 specimens. Naranjo, Guat.
47. Herpetotheres cachinnans (Linn.) Pair. Naranjo, Guat.
48. Falco albigularis Daud. Pair. Esquintla and Santa Tomas, Guat.
49. Falco richardsonii Ridgw. Pair. Lower California.
50. Ibycter americanus (Bodd.) Pair. Naranjo, Guat.
51. Polyborus cheriway Jacq. 4 specimens. La Paz, Lower Cal.
52. Pulsatrix torquata (Daud.) 1 female. Puerto Barrios, Guat.
53. Syrnium virgatum Cass. 1 male. Cayo, Br. Hond.
54. Glaucidium phalænoides (Daud.) 1 male. Naranjo, Guat.
55. Ara macao (Linn.) 3 specimens. Naranjo, Guat.
56. Ara militaris (Linn.) Pair. Limoncito, Mex.
57. Conurus petzii (Seibl.) 5 specimens. Naranjo, Guat., and Limoncito, Mex.
58. Conurus holochlorus. 1 female. Rinconada, Mex.

59. Conurus aztec Souance. Pair. Rinconada, Mex.
60. Chrysotis auropalliata (Less.) Pair. Naranjo, Guat.
61. Chrysotis albifrons (Sparr.) 2 males. Naranjo, Guat.
62. Chrysotis albifrons (var.) Pair. Chaloma, Sp. Hond.
63. Amazona oratrix. 1 female. Rinconada, Mex.
64. Amazona autumnalis. Pair. Santa Tomas, Guat.
65. Pionus senilus (Spix.) Pair. Santa Tomas, Guat.
66. Caica hæmatotis Sc. and Salv. 3 specimens. Chocan River and Santa Tomas, Guat.: Cayo, B. Hond.
67. Psittacula cyanopygia Sonance. Pair. Limoncito, Mex.
68. Pteroglossus torquatus Gmel. 3 specimens. Naranjo, Guat.
69. Rhamphastus ariel. Pair. Santa Tomas, Guat.
70. Aulacorhamphus prassinus Licht. 3 specimens. Puerto Cortez, Sp. Hond., and Coatepec, Mex.
71. Crotophaga sulcirostris Swains. Pair. Naranjo, Guat.
72. Piaya cayana Less. Pair. Naranjo, Guat.
73. Geococcyx affinis Hartl. 1 female. Amatitlan, Guat.
74. Bucco dysoni Scl. 2 females. Naranjo and Chocan River, Guat.
75. Galbula melanogenia Scl. 3 specimens. Chaloma, Sp. Hond.
76. Trogon puella Gould. 1 male. Coatepec, Mex.
77. Trogon atricollis Vieill. 1 female. San Juan Valley, Costa Rica.
78. Trogon melanocephalus Gould. Pair. Santa Tomas, Guat., and Rinconada, Mex.
79. Trogon caligatus Gould. Pair. Naranjo, Guat.
80. Ceryle americana septentrionalis (Sharpe). 3 specimens. Palin, San José, and Amatitlan, Guat.
81. Ceryle torquata (Linn.) Pair. Granada, Nic.
82. Ceryle amazona Lath. 2 males. Naranjo and Chocan River, Guat.
83. Ceryle superciliosa (Linn.) Pair. San Jose, Guat.
84. Momotus lessoni Less. 4 specimens. Naranjo and Santa Tomas, Guat.
85. Momotus cæruleiceps Gould. 1 female. Rinconada, Mex.
86. Eumomote superciliaris Jard. and Selby. 3 specimens. Naranjo, Guat., and Granada, Nic.
87. Campephilus guatemalensis Hartl. 1 male, 3 females. Naranjo, Chaloma, and San Juan Valley.
88. Dryobates scalaris bairdi Scl. 4 specimens. Florido, Mex.
89. Dryobates scalaris lucasanus (Xantus.) Pair. La Paz.
90. Dryobates scalaris sinaloensis Ridgw. 1 female. Altata, Mex.
91. Ceophloeus scapularis (Vig.) Pair. Santa Tomas, Guat., and San Juan Valley, Costa Rica.
92. Chloronerpes cabatti (Mahl.) 1 male. Cayo, Br. Hond.
93. Centurus santcruzi. Pair. Palin and Maranjo, Guat.
94. Centurus santicruzi paupera Ridgw. 1 male. Chaloma, Sp. Hond.
95. Melanerpes formicivorus Sw. 1 male, 1 female. Chaloma, Hond., and Coatepec, Mex.
96. Melanerpes aurifrons hoffmanni Cab. Pair. Granada, Nic.
97. Melanerpes uropygialis Baird. Pair. Altata, Mex.
98. Colaptes chrysoides (Malh.) 1 male. Culiacan, Mex.
99. Celeus castaneus Wagl. 1 female. Chaloma, Sp. Hond.
100. Nyctidromus albicollis merrilli (Senn.) 2 specimens. Naranjo and Santa Tomas, Guat.
101. Eugenes fulgens Swains. 2 males, 1 female. Coatepec, Mex.
102. Heliothrix barroti Bourc. 1 male. Cayo, Br. Hond.

103. Chlorostilbon caniveti Less. 1 male. Coatepec, Mex.
104. Lampornis prevosti Less. 2 specimens. Isabella, Br. Hond., and Granada, Nic.
105. Lampornis violacauda. 1 male. Granada, Nic.
106. Uranomitra quadricolor. 1 male. Culiacan, Mex.
107. Uranomitra cyanocephala. 3 specimens. Coatepec, Mex.
108. Agyrtria candida Bourc. 1 female. Cayo, Br. Hond.
109. Trochilus alexandri Bourc. 1 female. Culiacan, Mex.
110. Amazilia cinnamonea Less. 1 male. Granada, Mex.
111. Amazilia fuscicaudata (Fraser.) Pair. Santa Tomas, Guat.
112. Floricola constanti Delattrei. 1 female. Amatitlan, Guat.
113. Floricola delattrei. 1 male. Granada, Nic.
114. Phæthornus longirostris Less. 2 males. Cayo, Br. Hond.
115. Sphenoproctus curvipennis Licht. 1 male. Coatepec, Mex.
116. Campylopterus hemileucurus Licht. 1 female. Coatepec, Mex.
117. Phæochroa roberti Salv. 1 male. Cayo, Br. Hond.
118. Thamnophilus doliatus (Linn.) 3 specimens. Naranjo, Guat., and Granada, Nic.
119. Thamnophilus doliatus var. 1 female. Santa Tomas, Guat.
120. Ramphocænus rufiventris Bp. 1 female. Cayo, Br. Hond.
121. Hypocnemus nævoides Lafr. 1 female. San Juan Valley, Costa Rica.
122. Pithys bicolor Lawr. 1 female. Chaloma, Sp. Hond.
123. Formicarius monileger Scl. 1 female. Cayo, Br. Hond.
124. Drymophila trifasciata Swain. 3 males, 1 female. Santa Tomas and Las Sabalos, Guat.
125. Xenops genibarbis Lafr. 1 female. Santa Tomas, Guat.
126. Sclerurus guatemalensis Hartl. 1 female. Chaloma, Sp. Hond.
127. Synallaxis pudica Scl. 1 male. San Juan Valley, Costa Rica.
128. Synallaxis erythrothorax Scl. Pair. Naranjo, Guat.
129. Sittasomus olivaceus. Pair. Naranjo, Guat.
130. Glyphorhynchus cuneatus Licht. Pair. Coatepec, Mex.
131. Dendrornis eburneisastris. 1 male, 1 female. Chocan River, Guat., and Chaloma, Sp. Hond.
132. Dendrornis lawrenceii costaricensis Rdgw. 1 male, 1 female. San Juan Valley, Costa Rica, and Santa Tomas, Guat.
133. Dendromanes homochrous. 1 male. Naranjo, Guat.
134. Picolaptes compressus. 1 male. Naranjo, Guat.
135. Antilophia galeata. Pair. Santa Tomas, Guat.
136. Chiroxiphia linearis Bonap. 3 females. Naranjo, Guat.
137. Manacus caudei. 2 males, 1 female. Santa Tomas, Guat., and Chaloma, Sp. Hond.
138. Heteropelma veræpacis Scl. 1 male. Chaloma, Sp. Hond.
139. Titrya semifasciata (Spix.) Pair. Naranjo, Guat.
140. Hadrostomus aglaiæ Lafr. 2 females. Limoncito and Coatepec, Mex.
141. Hadrostomus albiventris Lawr. 1 male. Naranjo, Guat.
142. Attila citreopygia Bonap. 1 male, Naranjo, Guat.
143. Tyrannus melancholicus couchii Baird. 1 male. Palin, Guat.
144. Tyrannus crassirostris Sw. 1 male. Culiacan, Mex.
145. Pitangus derbianus (Kaup.) 4 specimens. Amatitlan and Chocan River, Guat., and Altata, Mex.
146. Megarhynchus pitangua (Linn.) 3 specimens. Naranjo, Guat., and Chaloma, Sp. Hond.

147. Myiozetetus texensis (Giraud.) 4 specimens. Palin and Santa Tomas, Guat., and Sabalos, Nic.
148. Myiarchus nuttingi Ridgw. 1 male. Culiacan, Mex.
149. Myiarchus lawrenceii (Giraud). Pair. Palin and Naranjo, Guat.
150. Myiarchus lawrenceii olivaceus. Ridgw. Pair. Altata, Mex.
151. Oncostoma cinereigulare Scl. 1 male. Cayo, Br. Hond.
152. Todirostrum cinereum (Linn.) Pair. Naranjo, Guat.
153. Sayornis saya Bonap. 2 males. Lerdo and Florido, Mex.
154. Contopus pertinax Cab. 1 female. Limoncito, Mex.
155. Muscivora mexicana Scl. 1 male. Santa Tomas, Guat.
156. Myiobius sulphureipygius Scl. 1 female. Cayo, Br. Hond.
157. Pyrocephalus rubineus mexicanus Scl. 4 specimens. Florido and Altata, Mex.
158. Otocoris alpestris chrysolæma (Wagl.) Pair. Florido, Mex.
159. Cyanocitta stellari coronata (Swain.) Pair. Coatepec, Mex.
160. Aphelocoma unicolor Du Bûs. Pair. Coatepec. Mex.
161. Aphelocoma californica hypoleuca Ridgw. Pair. La Paz, Lower Cal.
162. Xanthoura luxuosa (Less.) Pair. Naranjo, Guat., and Coatepec, Mex.
163. Xanthoura luxuosa cyanocapillo Cab. Pair. Santa Tomas, Guat.
164. Cyanolyca beecheyi Vig. Pair. Culiacan, Mex.
165. Cyanolyca melanocyana Hartl. 2 specimens. Palin and Amatitlan, Guat.
166. Cyanolyca ornata Less. Pair. Coatepec, Mex.
167. Psilorhinus mario Wagl. Pair. Rinconada, Mex.
168. Psilorhinus mexicanus Rüpp. Pair. Santa Tomas, Guat.
169. Psilorhinus cyanogenys Sharpe. 1 male. Rinconada, Mex.
170. Calocitta calliei Vig. Pair. Culiacan, Mex.
171. Calocitta formosa Swain. Pair. Naranjo, Guat.
172. Corvus mexicanus Gmel. 1 male. Altata, Mex.
173. Eucorystes wagleri Gray. 1 male. Chocan River, Guat.
174. Gymnostinops montezumæ Less. Pair. Santa Tomas, Guat.
175. Cassiculus melanicterus Bonap. 2 males. Culiacan and Limoncito, Mex.
176. Cassicus prevosti. 2 males, 1 female. Naranjo and Santa Tomas, Guat.
177. Collothens robustus Cab. 1 male. Coatepec, Mex.
178. Sturnella magna neglecta (Aud.) 1 female. Altata, Mex.
179. Icterus melanocephalus Wagl. Pair. Santa Tomas, Guat.
180. Icterus audibonii Giraud. Pair. Coatepec, Mex.
181. Icterus cucullatus Swains. Pair. Limoncito, Mex.
182. Icterus pectoralis Wagl. 1 male. Palin, Guat.
183. Icterus gularis Wagl. 1 male. Amatitlan, Guat.
184. Icterus gularis flammeus. Pair. Rinconada, Mex.
185. Icterus sclateri Cass. 3 males, 1 female. Altata and Culiacan, Mex.
186. Coccothraustes abeillei Less. 1 male. Coatepec, Mex.
187. Carpodacus mexicanus ruberrimus Ridgw. Pair. La Paz, Lower Cal.
188. Spinus psaltria arizonæ (Coues). 1 juv. male. Florido, Mex.
189. Poocætes gramineus confinis Baird. 1 male. Florido, Mex.
190. Spizella socialis arizonæ Coues. Pair. Florido, Mex.
191. Arremonops chloronota Salv. Pair. Cayo, Br. Hond.
192. Hæmophila rufescens Sw. 1 female. Coatepec, Mex.
193. Hæmophila ruficauda Bonap. 1 male. Granada, Nic.
194. Amphispiza bilineata (Cass.) Pair. Lerdo and Florido, Mex.
195. Volitinia splendens Vieill. 1 male. Naranjo, Guat.
196. Pipilo chlorurus (Towns.) 2 males, 1 female. Florido, Altata, and La Paz.

197. Cardinalis cardinalis igneus (Baird.) Pair. Limoncito and Altata, Mex.
198. Pyrrhuloxia sinuata Bonap. Pair. Florido, Mex.
199. Guiraca cærulea (Linn.) 1 juv. male. Amatitlan, Guat.
200. Pheucticus chrysopeplus Vig. 2 males. Culiacan, Mex.
201. Passerina ciris (Linn.) Pair. Naranjo, Guat.
202. Sporophila moreletti sharpei Lawr. 3 specimens.
203. Sporophila corvina Scl. 2 males, 1 female. Chocan River, Guat., and San Juan Valley, Costa Rica.
204. Euphonia elegantissima Bonap. 1 male. Coatepec, Mex.
205. Euphonia affinis Less. 1 male. Belize, Br. Hond.
206. Euphonia hirundinacea Bonap. Pair. Belize, Rinconada, Mex.
207. Euphonia hirundinacea (Nob.) 1 male. Rinconada, Mex.
208. Euphonia gouldi Scl. Pair. Santa Tomas, Guat.
209. Calliste laviniae Cass. 1 male. Santa Tomas, Guat.
210. Tanagra cana Swain. 1 male. Palin, Guat.
211. Tanagra abbas Licht. 3 males. Santa Tomas, Cayo, and Coatepec.
212. Rhamphocœlus passerinii Bonap. 2 males, 2 females. Santa Tomas, Cayo, and Los Sabalos.
213. Phlogothraupis sanguinolenta Licht. 1 male. Coatepec, Mex.
214. Piranga erythromelœna Licht. 1 male. Coatepec, Mex.
215. Phœnicothraupis rubicoides Lafr. Pair. Coatepec, Mex.
216. Phœnicothraupis fuscicauda Cab. Pair. Naranjo, Guat.
217. Phœnicothraupis salvini Berl. Pair. Santa Tomas.
218. Eucometis spodocephala Bonap. 1 male, 1 female. Santa Tomas, Guat., Granada, Nic.
219. Arremon aurantrirostris Lafr. Pair. San Juan Valley, Costa Rica.
220. Saltator atriceps Less. 2 males, 1 female. Cayo, Br. Hond., and Granada, Nic.
221. Saltator grandis Licht. Male and female. Naranjo, Guat., and Cayo, Br. Hond.
222. Saltator plumbeiceps Lawr. 2 females. Limoncito, Mex.
223. Pitylus poliogaster Du Bus. 1 female. Santa Tomas, Guat.
224. Cyclorhis flaviventris Lafr. 1 male. Coatepec, Mex.
225. Capsiempis flavicola Licht. 1 male. San Juan, Costa Rica.
226. Vireo bellii pusillus (Coues.) 1 female. La Paz, Lower Cal.
227. Diglossa baritula Wagl. Pair. Coatepec, Mex.
228. Cœreba cyanea (Linn.) 1 female. Naranjo, Guat.
229. Certhiola mexicana Scl. Pair. Cayo, Br. Hond.
230. Helmitherus vermivorus (Gmel.) Pair. Naranjo, Guat.
231. Dendroica bryanti castaniceps Ridgw. 1 male. San Jose, Guat.
232. Dendroica maculosa Gmel. 1 male. Cayo, Br. Hond.
233. Seiurus noveboracensis notabilis (Grin.) Pair. San Jose and Santa Tomas, Guat.
234. Geothlypis macgillivrayi (Aud.) 1 male. Altata, Mex.
235. Geothlypis palpebralis Ridgw. 1 male. San Juan Valley, Costa Rica.
236. Basileuteris delattrei Bonap. 1 male. Near Granada, Nic.
237. Setophaga miniata (Swains.) 1 male. Coatepec, Mex.
238. Harporhynchus curvirostris Swains. 1 male. Florido, Mex.
239. Harporhynchus curvirostris occidentalis Ridgw. Pair. Altata and Culiacan, Mex.
240. Harporhynchus cinereus (Gamb.) 1 male. La Paz, Lower Cal.
241. Harporhynchus crissalis (Henry.) 1 male. Florido, Mex.
242. Campylorhynchus brunnicapillus Lafr. Pair. Florido, Mex.

243. Campylorhynchus affinis Xantus. Pair. La Paz.
244. Campylorhynchus zonatus (Less.) Pair. Rinconada, Mex.
245. Campylorhynchus capistratus (Less.) Pair. Naranjo, Guat.
246. Campylorhynchus rufinucha (Lafr.) Pair. Rinconada, Mex.
247. Cyphorinus lawrencei Lawr. 1 male. San Juan Valley, Costa Rica.
248. Heterorhina leucosticte (Cab.) 1 male. San Juan Valley, Costa Rica.
249. Heterorhina pusilla Scl. 1 female. Rinconada, Mex.
250. Thryophilus costaricensis Sharpe. 1 male. San Juan Valley, Costa Rica.
251. Thryophilus pleurostictus Scl. 1 male. Granada, Nic.
252. Tryothorus maculispectus Lafr. 1 male. Naranjo, Guat.
253. Auriparus flaviceps (Sund.) 1 male, 2 females. Florido and Altata.
254. Turdus assimilis Cab. 1 female. Coatepec, Mex.
255. Merula tristis Swain. 1 male. Santa Tomas, Guat.
256. Merula grayi Bonap. 2 males, 1 female. Naranjo, Guat., Coatepec, Mex., Granada, Nic.

A REVIEW OF KANSAS ORNITHOLOGY.

BY D. E. LANTZ, MANHATTAN, KAN.

Read before the Academy October 28, 1897.

I. The Bibliography of Kansas Birds.

The following list of publications embraces books and articles containing references to birds found in the state and ornithological articles written by Kansas authors. But few references to fossil forms are included. I have been unable to find complete files of *Forest and Stream;* hence there are probably some omissions of articles from that journal. A number of amateur ornithological publications have not been examined for Kansas materials. With these exceptions, I believe that the list is nearly complete.

The order of arrangement is chronological, showing the gradual development of our knowlege of Kansas birds. Implied references and common names which do not clearly identify the species are not considered as additions to the avifauna of the state.

It is to be regretted that so many of the early explorers of our western country touched only on the eastern border of the state, and gave so meager an account of our birds. Nebraska and Missouri were much more fortunate in this respect, since the Missouri and the Platte rivers became a sort of highway for exploring expeditions and travelers.

The work of compiling the bibliographical references was made more difficult because of the scarcity of materials in our various Kansas libraries to which I might refer. The libraries of the Academy of Science, the State Historical Society, the Agricultural College and the State Library were freely consulted, and I had advice and assistance from Dr. Elliott Coues, of Washington, D. C., and Dr. J. A. Allen, of New York.

1810. Pike, Major Z. M. An Account of an Expedition to the Sources of the Mississippi and through the western parts of Louisiana, to the Sources of the Arkansaw, Kansas, La Platte and Pierre Jaune rivers; performed by order of the government of the United States during the years 1805, 1806, and 1807. And a tour through the interior parts of New Spain, when conducted through these provinces by order of the captain-general, in the year 1807. By Major Z. M.

Pike. Illustrated by maps and charts. Philadelphia: Published by C. & A. Conrad & Co., No. 30 Chestnut street; Somervell & Conrad, Petersburg; Bonsal, Conrad & Co., Norfolk, and Fielding Lucas, jr., Baltimore. John Binns, printer, 1810. One vol., 8vo. Standard edition, 4to, London, 1811. French edition, 2 vols., 8vo, Paris, 1812.

Pike entered Kansas in 1806. No ornithological records of his trip were made, except that his hunters brought in turkeys taken in different parts of the state. This is the first published mention I could find of Meleagris gallopavo for Kansas.

1814. Lewis, M., and Clarke, W. History of the Expedition under command of Captains Lewis and Clarke to the Sources of the Missouri, thence across the Rocky mountains and down the river Columbia to the Pacific ocean. Performed during the years 1804–5–6. By order of the government of the United States. Prepared for the press by Paul Allen, Esquire. In two volumes. Vol. I [II.] Philadelphia: Published by Bradford and Inskeep; and Abm. H. Inskeep, New York. J. Maxwell, printer. 1814. Two vols., 8vo. Vol. I, pp. i–xxviii, 1–470. Maps. Vol. II, pp. i–ix, 1–522. Maps. From vol. II, chapter 7, "A general description of the beasts, birds, plants, etc., found by the party on this expedition," pp. 148–201.

Doctor Coues says that this is the first edition of the authentic narrative. A quarto edition in one volume appeared in London in 1814, and a three-volume edition in 1815. A Dutch edition in three 8vo volumes appeared in Dordrecht in 1816, and a Dublin edition in two volumes in 1817.

The party touched Kansas only on the voyage up the Missouri river. The wild turkey and whippoorwill are mentioned as found in Kansas. Antrostomus vociferus first recorded. Goslings are mentioned as occurring on the Missouri river near the point where St. Joseph is now located. Probably the young of the Canada goose.

1823. Say, Thomas. Account of an Expedition from Pittsburg to the Rocky Mountains, performed in the years 1819 and '20, by order of the Hon. J. C. Calhoun, secretary of war: under the command of Maj. Stephen H. Long. From the notes of Major Long, Mr. T. Say, and other gentlemen of the exploring party. Compiled by Edwin James, botanist and geologist for the expedition. In two volumes, with an atlas. Vol. I. [II]. Philadelphia: H. C. Carey and I. Lea, Chestnut street, 1823. 2 vols., 8vo. Vol. I, 2 p. ii, pp. 1–503. Vol. II, 3 p. ii, pp. 1–442, i–xcviii.

Going westward the main party ascended the Missouri river. A detachment under T. Say ascended the Kansas river as far as the mouth of the Blue and then proceeded in a northeastern direction to join the main expedition on the Missouri. On the return trip a party accompanied by Mr. Say descended the entire course of the Arkansas river in this state.

Notes and descriptions of new species by Thomas Say are scattered throughout the work in the form of foot-notes. A list of the birds seen during the expedition, but without localities, is given, pp. 370–375 of volume I. In the text occur the first notices of the following species as belonging to Kansas:

Corvus corax sinuatus ("Warreruza creek"), Molothrus ater, Haliæetus leucocephalus, Speotyto cunicularia hypogæa, Tympanuchus americanus, Colinus virginianus, Ceryle alcyon, and Corvus americanus. Dolichonyx oryzivorus is also given as seen in great numbers on the Arkansas river August 11. This is probably an error. The bobolink is a very rare summer resident in northern Kansas and the date is too early for the fall migrants. The bird seen was the lark bunting, Calamospiza melanocorys, which at a distance from the observer greatly resembles the bobolink.

1839. TOWNSEND, J. K. Narrative of a Journey across the Rocky Mountains to the Columbia River and a visit to the Sandwich Islands, Chili, etc., with a scientific appendix. By John K. Townsend, member of the Academy of Natural Sciences of Philadelphia. Philadelphia: Henry Perkins, 134 Chestnut street. Boston: Perkins & Marvin — 1839. 8vo, pp. i–viii, 1–352. Contains Appendix: Catalogue of the birds found in the territory of the Oregon, pp. 331–352.

The author was accompanied on this trip by Mr. Thomas Nuttall. The references to Kansas species are incidental and no additions to the list are made.

1839. MAXIMILIAN PRINZ ZU WIED. Reise in Das Innere Nord-America in den jahren 1832 bis 1834. Von Maximilian Prinz zu Wied. Mit 48 Kupfern, 33 Vignetten, veilen Holzschnitten, und einer Charte. Erster Band. [Zweiter Band]. Coblenz, 1839 [1841] Bei J. Hœlscher. 2 vols., 4to. Vol. I, 1839, pp. v–xvi, 1–654. Vol. II, 1841, pp. i–xxiv, 1–688. Separate atlas of folio plates, and one map.

A sumptuous and valuable work, of which only three or four copies are known in America. One of these is in the library of our State Historical Society. A French edition is more common. The author's journey was by way of the Missouri river, both in going westward and returning. The work is rich in observations on the minerals, plants, animals, and Indians of the country. Nebraska and Missouri are each favored with a larger list of birds seen than is our state. New records for Kansas are: Fulica americana, Branta canadensis (breeding, see Lewis and Clarke, 1814), Aix sponsa, Cathartes aura, Circus hudsonius, Aquila chrysaetus, Xanthocephalus xanthocephalus, Spinus tristis, Passerina cyanea, Cardinalis cardinalis, Vireo olivaceus, and Sylvania mitrata.

1840. NUTTALL, T. A Manual of the Ornithology of the United States and of Canada. By Thomas Nuttall, A. M., F. L. S., etc. Second edition, with additions. [Vol. I.] The Land Birds. Boston: Hilliard, Gray & Co. MDCCCXL. [Vol. II.] The Water Birds. [Same imprint and date.] 2 vols., 12mo, pp. —, —, wood cuts.

The citation is from Doctor Coues's Bibliography. I have not handled this edition. It contains the additions to the North American list discovered by Mr. Townsend and Mr. Nuttall in their journey together across the continent.

1840–44. AUDUBON, J. J. The Birds of America, from drawings made in the United States and their territories. By John James Audubon, F. R. S. S. L. & E. [etc.] Vol. I[-VII]. New York: Published by J. J. Audubon. Philadelphia: J. B. Chevalier. 1840[–44]. 7 vols., large 8vo, pp. —, 500 plates.

The appendix to the last volume contains the additions to his former work, of birds noticed in the West by Townsend, Nuttall, Baird, and Audubon. There is implied, but no direct mention of species as found in the territory now included in Kansas.

1844. GREGG, JOSIAH. Commerce of the Prairies, or the Journal of a Santa Fe Trader during eight expeditions across the great western prairies, and a residence of nearly nine years in northern Mexico. Illustrated with maps and engravings. By Josiah Gregg. In two volumes. Vol. I [II]. New York: J. & H. G. Langley, 8 Astor House, 1844. 2 vols., 12mo, pp. —.

Adds to our bird fauna Grus americana and Grus mexicana.

1845. FREMONT, JOHN C. Report of the Exploring Expedition to the Rocky Mountains in the year 1842 and to Oregon and north California in the years 1843–4. By Brev.-Capt. J. C. Fremont, of the topographical engineers, under the orders of Col. J. J. Abert, chief of the topographical bureau. Printed by order of the House of Representatives. Washington: Blair & Rives, printers. 1845. 8vo, pp. 586.

Other editions occur. Fremont twice traversed the northern part of the state from east to west. The only note of interest in this connection is his statement in the narrative that on June 17 he saw on the Kaw river, near its mouth, a large number of bank swallows nesting, and that a snake was killed which had eaten eighteen of the young birds. The identity of the species as Clivicola riparia is unmistakable, since the rough-winged swallow does not breed in large colonies.

1848. Abert, J. W. Notes on a Military Reconnoissance from Fort Leavenworth, in Missouri, to San Diego, in California. By W. H. Emory. Washington: Wendell and Benthuysen, printers. 1848. One vol., 8vo. From appendix No. 6. Notes of Lieut. J. W. Abert, pp. 386–405.

A diary of the journey, with special references to the animals and plants observed. This party traversed the state from east to west in 1846, going by way of the "Santa Fe Trail." Lieutenant Abert added to the Kansas list: Anas carolinensis, Recurvirostra americana, Numenius longirostris, Charadrius dominicus, Ægialitis vocifera, Zenaidura macroura, Elanoides forficatus, Buteo borealis, Conurus carolinensis, Melanerpes erythrocephalus, Colaptes auratus, Chordeiles virginianus, Tyrannus tyrannus, Cyanocitta cristata, Sturnella magna, Sturnella magna neglecta, Icterus galbula, Quiscalus quiscalus æneus, Pipilo erythrophthalmus, Tachycineta bicolor, Mimus polyglottis, Galeoscoptes carolinensis, Harporhynchus rufus, Merula migratoria, Sialia sialis, and a "gray bird," of which he gives us a ready means of identification, as Sayornis phœbe, in his description of its nest.

1849. Parkman, Francis, jr. The California and Oregon Trail, being sketches of prairie and mountain life, by F. Parkman, jr. 8vo., pp. 448. New York, 1849.

Original edition not handled. In the narrative of that part of the journey which took place in Kansas there is mention of the following birds: Quail, whippoorwill, raven, crow, eagle (?), prairie grouse, robin, Baltimore oriole, blue jay, cardinal, blackbird, and a careful statement of the occurrence of the black buzzard, Catharista atrata, observed in company with the turkey buzzard.

1851. Kelley, Wm. An Excursion to California over the Prairie, Rocky Mountains, and Great Sierra Nevada, with a stroll through the diggings and ranches of that country. By William Kelley, J. P. Vol. I [II]. London: Chapman & Hall. 1851. Two vols., 12mo, pp. —.

A journey across Kansas by way of the Kansas river route. A close observer mentions turkeys, ducks (species not given), prairie-hens, paroquets, and an upland snipe which may readily be recognized from the description as Bartramia longicauda.

1851. Harris, Edward. List of Birds and Mammalia found on the Missouri river from Fort Leavenworth to Fort Union at the mouth of the Yellowstone river. From Fifth Annual Report of the Smithsonian Institution for 1850. Washington, 1851. pp. 136–138.

A list of 120 species, of which 24, marked with an asterisk, were observed on the lower part of the river. No definite localities are given, but it is probable that some of these were seen in Kansas. The paroquet was seen above Fort Leavenworth.

1852. Baird, S. F. Special session, March, 1851. Senate, Ex. No. 3. Exploration and Survey of the Valley of the Great Salt Lake of Utah, including a reconnoisance of a new route through the Rocky mountains. By Howard Stansbury, captain corps topographical engineers U. S. army. Printed by order of the Senate of the United States. Philadelphia: Lippincott, Grambo & Co., 1852. 1 vol. 8vo, pp. 487, pll. Contains Appendix C. Birds. By Spencer F. Baird. pp. 314-335. Route through Kansas. Birds casually mentioned in the narrative, but no new ones for the state.

1858. BAIRD, S. F., CASSIN, J., AND LAWRENCE, G. N. 33d Congress, 2d session, House of Representatives, Ex. Doc. No. 91. Reports of Explorations and Surveys to ascertain the most practicable and economic route for a railroad from the Mississippi river to the Pacific ocean, made under the direction of the secretary of war in 1853-6, according to acts of congress of March 3, 1853, May 31, 1854, and August 5, 1854. Vol. IX. Washington: A. O. P. Nicholson, printer. 1858. 4to, subtitled as follows: Explorations and surveys for a railroad route from the Mississippi river to the Pacific ocean. War department. Birds: by Spencer F. Baird, assistant secretary Smithsonian Institution, with the coöperation of John Cassin and Geo. N. Lawrence. Washington, D. C. 1858. pp. i-lvi, 1-1005.

This work is part II of the general report upon the zoölogy of the "Pacific Railroad Routes." (Part I, Mammals, is volume 8 of the series; and parts III and IV, Reptiles and Fishes, are found in volume 10 of the series.)

The authors give a careful review with excellent descriptions of all the species of American birds found north of Mexico which had been recognized up to the date of the report. There are specific references to seventy species found in Kansas by the exploring parties sent out by the government and the Smithsonian Institution. As Kansas then extended westward to the summit of the Rocky mountains and there are numerous errors of record in the tables of this report, it requires great care to determine whether the specimens are really of Kansas origin. The itinerary of each exploring party must be carefully studied, with the maps of that time and of the present for comparison. The government exploring parties which entered Kansas previous to 1858 are as follows:

1804. Lewis and Clarke. Up the Missouri river.

1806. Lieutenant Pike. Entered the state from the east by way of the Osage river. From the Osage village northwest to the Pawnee village on the Republican in Nebraska. Thence south to the Arkansas. Up the Arkansas to Colorado.

1819-20. Major Long. (Route already given.)

1826. Surg. J. C. Brown. Explored the route known later as the Santa Fe trail.

1842-3. Captain Fremont. (Route already mentioned.)

1843. Captain Boone. North from the Cimarron to the Santa Fe trail.

1846. Lieutenant Emory. From Fort Leavenworth south to the Santa Fe trail; then west by the "trail."

1849. Captain Stansbury. From Fort Leavenworth northwest to the Platte.

1851. Captain Pope. East across the state by way of the Smoky Hill and Kansas rivers.

1852. Lieutenant Woodruff. Examined the streams of the state. Map and report were never published.

1853. Captain Gunnison. Westward from the mouth of the Kansas river by way of the Santa Fe trail. A detachment went by way of Fort Riley, and thence south to join the main party.

1855. Lieutenant Ryan. Reconnoissance from Fort Leavenworth to Big Timbers, on the Arkansas.

1855. Major Merrill.

1856. Lieutenant Bryan. Up the Kansas and Republican to Nebraska, and down the Republican and Solomon on the return trip.

The sources from which Kansas specimens were obtained for elaboration in Baird's report were: Captain Gunnison's party, Doctor Kreuzfeldt as naturalist; Lieutenant Warren's party, Dr. F. V. Hayden as naturalist; Lieutenant Bryan's party, W. S. Wood as naturalist; and W. M. F. Magraw's party, Dr. J. G. Cooper as naturalist. Also collections made by Lieut. D. N. Couch at Fort Leavenworth, 1854–'55, and by Dr. W. A. Hammond and Mr. John X. de Vesey at Fort Riley and on the Republican river.

The species added to our list by Baird are: Anas boschas, Ardea egretta, Ardea virescens, Totanus solitarius, Coccygus americanus, Dryobates villosus, Dryobates pubescens medianus, Ceophlœus pileatus, Melanerpes carolinensis, Trochilus colubris, Otocoris alpestris pratincola, Agelaius phœniceus, Icterus spurius, Scoleocophagus cyanocephalus, Calcareus lapponicus, Ammodramus sandwichensis savanna, Ammodramus savannarum passerina, Ammodramus henslowi, Chondestes grammacus,* Zonotrichia querula, Zonotrichia leucophrys, Spizella monticola, Spizella pusilla, Junco hyemalis, Junco hyemalis oregonus, Melospiza lincolni, Spiza americana, Progne subis, Stelgidopteryx serripennis, Ampelis garrulus, Vireo bellii, Dendroica æstiva, Dendroica coronata, Geothlypis formosa, Icteria virens, Setophaga ruticilla, Thryothorus ludovicianus, Sitta carolinensis, Parus bicolor, Parus atricapillus septentrionalis, Polioptila cærulea, Turdus ustulatus swainsonii.

1863. Hayden, F. V. On the Geology and Natural History of the Upper Missouri. From Transactions of the American Philosophical Society. Vol. XII. New series. Philadelphia, 1863. Part III. Zoölogy and Botany. Mammals, pp. 138–151. Birds, pp. 151–176.

Some Kansas references of both mammals and birds.

[1864–66.] Baird, S. F. Smithsonian Miscellaneous Collections. 181. Review of American Birds in the Museum of the Smithsonian Institution. By S. F. Baird. Part I. North and Middle America. [Medallion.] Washington: Smithsonian Institution. [No date on title page: June, 1864, to June, 1866. Issued in sheets and dated by parts as printed.] One vol., 8vo, pp. i–iv, 1–450.

Treats of the families from the Turdidæ to the Laniidæ of the Smithsonian check list then in use. A valuable work, discontinued to allow the author to take up the work on his History of the Birds of North America in collaboration with Doctor Brewer and R. Ridgway. It contains a number of references to Kansas species.

1865. Hoy, Dr. P. R. Journal of an Exploration of Western Missouri, in 1854, under the auspices of the Smithsonian Institution. By P. R. Hoy, M. D. From Smithsonian report for 1864, pp. 431–438.

Contains mention of five species observed in Kansas near the Missouri line: mockingbird, Bell's vireo, wild turkey, whooping crane, and the first positive record of the lark bunting, Calamospiza melanocorys, remarkable for being so far east of the present range of the species.

1865. Coues, Dr. Elliott. Ornithology of a Prairie Journey, and Notes on the Birds of Arizona. From Ibis, 1865, second series, vol. I, pp. 157–165.

Gives a record of about twenty species observed in Kansas in 1864. The earliest record of Larus franklinii, Phalaropus tricolor, Tringa fuscicollis, Ereunetes

* Edwin James, in the London edition of Major Long's report, 1823, intimates that the lark finch, *Chondestes grammacus*, was seen along the Missouri river below the mouth of the Nemaha, but the statement is not positive as to Kansas.

pusillus, Phalænoptilus nuttalli, Chordeiles virginianus henryi, and Spizella pallida.

1866. BAIRD, S. F. The Distribution and Migration of North American Birds. From Am. Journal of Science, vol. 41, 1866, pp. 78–90, 184–192, 337–347.

A carefully written paper, quoted in this connection because of its bearing on the general subject of the geographical relations of our fauna.

1871. COUES, ELLIOTT, M. D. The Yellow-headed Blackbird. From American Naturalist, vol. V, June 1871, p. 91.

Extracts from the author's diary for a part of May, 1864, during the journey through Kansas. Twenty-three species of birds, not mentioned in the article in The Ibis, 1865, already quoted, are here given. First record for Tringa maculata, Myiarchus crinitus, Contopus vireus, Piranga erythromelas, Vireo gilvus, Vireo noveboracensis, Seiurus aurocapillus. The slender-billed nuthatch is also named as occurring near Fort Riley, but this is evidently an error of identity.

1872. SNOW, F. H. A Catalogue of the Birds of Kansas. From Kansas Educational Journal (newspaper) for April, 1872, vol. 8, pp. 376–383.

A defective list of 239 species, some contributed by Dr. T. M. Brewer; breeders marked by an asterisk. This was the list criticized by Doctor Allen and defended by Mr. Brewer in the American Naturalist, vol. 6, pp. 359, 482. This discussion resulted in the addition of many species to the list and the issue of a new and corrected edition of the catalogue.

In this first edition, Professor Snow made the first published record for the state of the following species: Colymbus auritus, Podilymbus podiceps, Urinator imber, Sterna forsteri, Sterna antillarum, Hydrochelidon nigra surinamensis, Phalacrocorax dilophus, Phalacrocorax mexicanus (given as P. d. floridanus), Pelecanus erythrorhynchus, Merganser americanus, Lophodytes cucullatus, Anas strepera, Anas americana, Anas discors, Spatula clypeata, Dafila acuta, Aythya americana, Aythya vallisneria, Aythya marila nearctica, Aythya affinis, Aythya collaris, Glaucionetta clangula americana, Charitonetta albeola, Erismatura rubida, Chen hyperborea, Anser albifrons gambeli, Branta bernicla, Olor columbianus, *Olor buccinator, Botaurus lentiginosus, Ardetta, Botaurus exilis, Ardea herodias, Nycticorax nycticorax nævius, Rallus elegans, Rallus virginianus, Porzana carolina, Philohela minor, Gallinago delicata, *Macrorhamphus scolopaceus, Tringa canutus, Tringa minutilla, Limosa fedoa, Totanus melanoleucus, Totanus flavipes, *Symphemia semipalmata inornata, Tringites subruficollis, Actites macularia, Ægialitis semipalmata, Bonasa umbellus, Ectopistes migratorius, Accipiter velox, Accipiter cooperi, Accipiter atricapillus, Buteo borealis calurus, Buteo borealis harlani, Buteo lineatus, Buteo swainsoni, Buteo latissimus, Archibuteo lagopus sanctijohannis, Falco mexicanus, Falco peregrinus anatum, Falco columbarius, Falco sparverius, Pandion haliæetus carolinensis, Strix pratincola, Asio wilsonianus, Asio accipitrinus, Syrnium nebulosum, Nyctala acadica, Megascops asio, Bubo virginianus, Nyctea nyctea, Coccygus erythrophthalmus, *Sphyrapicus varius, Chætura pelagica, *Tyrannus verticalis, *Contopus borealis, Empidonax pusillus traillii, Empidonax minimus, Pica pica hudsonica, Icterus bullocki, Scolecophagus carolinus, *Pinicola enucleator, *Carpodacus purpureus, *Loxia curvirostra minor, *Loxia leucoptera, *Spinus pinus, Plectrophenax nivalis, Poöcætes gramineus, Zonotrichia albicollis, Spizella socialis, Melospiza fasciata, Melospiza georgiana, Passerella iliaca, Passerella iliaca schistacea, Habia ludoviciana, Passerina amoena, Petrochelidon lunifrons, *Chelidon erythrogaster, Ampelis cedrorum, Lanius borealis, Lanius ludovicianus, Lanius ludovicianus excubitorides, Vireo flavifrons, Mniotilta varia, *Pronotaria citrea, * Helminthophila celata, * Helminthophila peregrina, * Dendroica pennsylvanica, Dendroica dominica albilora, Seiurus motacilla, Geothlypis trichas occidentalis, * Sylvania pusilla, Anthus pennsylvanicus, Thryothorus bewickii, Troglodytes aedon aztecus, Cistothorus stellaris, Cistothorus palustris, Certhia familiaris americana, Parus atricapillus, * Regulus satrapa, Regulus calendula, Turdus mustelinus, and * Turdus fuscescens.

Nineteen of the above, marked with an asterisk, were given on the authority of Dr. T. M. Brewer. Several others reported on the list now under discussion were omitted from his latest list as evident errors and so are not here reported.

1872. ALLEN, J. A. Ornithological Notes from the West. From Am. Naturalist, vol. VI, 1872, pp. 263–275, 342–351, 394–404.

This is a summary of a paper which appeared in Bull. Mus. Comp. Zoölogy, vol. III, pp. 118–183. The first part, pp. 263–275, of the May number of the Am. Naturalist, refers to Kansas. Nearly all the species included in the more formal lists in the bulletin are here given; but some mistakes occurred in the summary, which became the basis for continued errors in the lists of Professor Snow and others. Doctor Allen writes me that he did not meet with either the magpie or the Esquimo curlew in Kansas and that the breeding record for them belongs to Colorado. He also writes that he did not see the red-backed sandpiper and little black rail in Kansas.

This paper in the American Naturalist contains the first record for Ægialites montana, Pediocetes phasianellus campestris, Calcareus ornatus, Rynchophanes maccownii, Peucæa cassini, Habia melanocephala, Helminthophila pinus, Helminthophila ruficapilla, Compsothlypis americana, Dendroica cærulea, and Dendroica blackburnia.

1872. A[LLEN], J. A. Birds of Kansas. From Am. Naturalist, vol. VI, June, 1872, pp. 359–360.

Editorial review of Snow's Birds of Kansas, 1st edition. (A reprint in pamphlet form, 8vo, pp. 8.)

1872. ALLEN, J. A. Notes of an Ornithological Reconnoissance in portions of Kansas, Colorado, Wyoming, and Utah. From Bull. Mus. Comp. Zoölogy, vol. III, no. 6, July, 1872, pp. 113–183. Contains of interest in this connection,—

(1). A List of Birds observed at Fort Leavenworth and Topeka in the spring of 1871. (121 species.)

(2). A List of Birds observed at Fort Hays, May–July, 1871. (61 species.)

(3). A List of Birds observed in northwestern Kansas, December, 1871, and January, 1872. (25 species.)

This paper adds to the Kansas list Empidonax acadicus, Dendroica discolor, and Geothlypis philadelphia.

1872. A[LLEN], J. A., B[REWER], T. M., and SNOW, F. H. Remarks on Snow's Catalogue of the Birds of Kansas. From Am. Naturalist, vol. VI, July, 1872, pp. 482–3.

Brewer defends the list, Allen modifies former criticisms, and Snow announces the addition of 45 species to the list, 21 contributed by Professor Allen, 22 by Professor Baird, one by both Allen and Baird, and one by E. A. Popenoe. The one by Popenoe, Henslow's sparrow, was given by Baird 1858; those by Allen have already been given in this paper, except little black rail, red-backed sandpiper, and Esquimo curlew. Allen now writes that these were errors. Professor Baird's contributions were based mostly on an examination of materials in the U. S. National Museum, and the new ones are as follows:

Merganser serrator, Branta canadensis hutchinsii, Gallinula galeata, Tringa bairdii, Limosa hæmastica, Numenius hudsonicus, Charadrius squatarola, Ægialitis meloda circumcincta, Ictinia mississippiensis, Falco richardsonii, Calcarius pictus, Piranga rubra, Vireo solitarius, Dendroica virens, Dendroica cærulescens, Seiurus noveboracensis, Troglodytes hiemalis, Sitta canadensis, Turdus unalaskæ pallasii.

Of the other three, the black-shouldered longspur is now considered identical with the chestnut-collared longspur, the golden-winged warbler was included on an error of locality, and Doctor Coues writes that Professor Baird was in error when he included the scissor-tailed flycatcher as "taken by Coues at Fort Riley, Kan." Doctor Coues tells me that he never saw a live bird of this species in Kansas or elsewhere.

1872. Snow, F. H. A Catalogue of the Birds of Kansas. Contributed to the Kansas Academy of Science by Frank H. Snow, professor of natural history and meteorology in the University of Kansas, at Lawrence. Second edition, October, 1872. Kansas City: Bulletin steam book and job printers and engravers. 1872. Small 8vo pamphlet, pp. 16.

This edition contains the additions above mentioned, together with the following, new to our fauna: Ardea candidissima and Larus argentatus smithsonianus. The sage cock is omitted, leaving 282 species and races on the list, of which 270 are valid.

The article is reprinted in Trans. Kan. Academy of Science, vol. III, 1873.

1872. Coues, E. Key to North American Birds: Containing a concise account of every species of living and fossil bird at present known from the continent north of the Mexican and United States boundary. Illustrated by six steel plates and upwards of 250 wood cuts. By Elliott Coues, assistant surgeon United States army. Salem: Naturalists Agency. New York: Dodd & Mead. Boston: Estes & Lauriat. 1872. One vol., imp. 8vo, 4 pll., pp. 361–51, pll. 6, fig. 238.

Many Kansas references.

1872. Marsh, O. C. Discovery of a Remarkable Fossil Bird [Hesperornis regalis]. From Am. Journal of Science, vol. III, 1872, pp. 56–7.

1872. Marsh, O. C. Preliminary Description of Hesperornis regalis, with notices of four other new species of Cretaceous birds. From Am. Journal of Science, vol. III, 1872, pp. 360–365.

1873. Snow, F. H. Catalogue of the Birds of Kansas. From Trans. Kan. Acad. of Science, a part of the report of the Kansas State Board of Agriculture for 1872, pp. 375–386. Published in April, 1873. Differs from the pamphlet of Oct. 1872 only in the addition of Colaptes mexicanus, and the reduction of Colaptes hybridus to 40*a* of the list. Total, 282 species.

1873. Snow, F. H. Harlan's Hawk and the Mexican Cormorant. From Am. Nat., vol. VII, pp. 172-3.

1873. C[oues], E. Ornithology of the West. From Am. Naturalist, vol. VII, 1873, pp. 221–223. A review of J. A. Allen's paper in Bull. Mus. Comp. Zoölogy, vol. III, 1872, pp. 113–183.

1873. Marsh, O. C. Fossil Birds from the Cretaceous of North America. From Am. Journal of Science, vol. V, 1873, pp. 161–163.

1874. Coues. Elliott. Department of the Interior. United States Geological Survey of the Territories. F. V. Hayden, U. S. Geologist-in-charge. Miscellaneous Publications—No. 3. Birds of the Northwest: a handbook of the ornithology of the region drained by the Missouri river and its tributaries. By Elliott Coues, captain and assistant surgeon U. S. army. Washington: Government printing office. 1874. 8vo, pp. i–xi, 1–791.

An exceedingly valuable contribution to North American ornithology. Excellent synonymatic lists, useful to every working ornithologist. It contains references to 231 species as occurring in Kansas, quotations being from:

(1). Baird, S. F. Birds of N. America, in vol. IX, P. R. R. Surveys. 1858.

(2). Coues, E. Am. Naturalist, vol. V, 1871, p. 195.

(3). Allen, J. A. Bull. Mus. Comp. Zoölogy, vol. III. 1872.

(4). Snow, F. H. Birds of Kansas, 2d edition. 1873.

1874. B[ENSON], F. S. The Western Meadowlark (Sturnella neglecta). From Forest and Stream, vol. II, no. 9, p. 134.

1874. SNOW, F. H. Birds of Kansas. From Observer of Nature (newspaper) for April, 1874.

Adds six species to the list of 1872, five of which are first announcements: Colymbus nigricollis californicus, Larus delawarensis, Helmitherus vermivorus, Dendroica striata, and Dendroica maculosa.

1874. WILLISTON, S. W. The Prairie-dog, Owl, and Rattlesnake. From Am. Naturalist, vol. VIII, April, 1874, p. 203.

1874. SNOW, F. H. Birds of Kansas. From Am. Naturalist, vol. VIII, 1874, p. 757.

Same six species given in the citation above.

1874. BAIRD, S. F., BREWER, T. M., and RIDGWAY, R. A History of North American Birds, by S. F. Baird, T. M. Brewer, and R. Ridgway. Land Birds. Illustrated by 64 colored plates and 593 woodcuts. Vol. I[-III]. Boston: Little, Brown & Co., 1874. 3 vols., small 4to., pp —.

Numerous Kansas references.

1874. B[ENSON], F. S. What Some Birds Eat. From Forest and Stream, vol. II, no. 22, July 7, 1874, p. 341.

Observations made in Russell county. Food habits of about thirty-five species. List of birds that eat only insects; also a list of rare birds taken in that locality. Adds to the Kansas list Sterna hirundo, Numenius borealis, Piranga ludoviciana, and Pipilo maculata arctica.

1875. SNOW, F. H. Birds of Kansas. From Transactions Kan. Academy of Science for 1874. pp. 30, 31. Pamph. Topeka, 1875.

Adds nine species to the bird fauna. Six have been cited above. The Bohemian waxwing here given as an addition is based on the Fort Riley specimen taken by Doctor Hammond and reported in Baird, 1858. The new birds are Micropalama himantopus and Calidris arenaria.

1875. SNOW, F. H. Birds of Kansas. From Observer of Nature, vol. II, March 24, 1875.

Contains first record for Ægiothus linaria.

1875. GAUMER, G. F. Ornithological Notes. From Observer of Nature, March 24, 1875.

Notes on several Kansas birds and a list of birds seen March 13, 1875.

1875. SNOW, F. H. New Birds in Kansas. From Am. Naturalist, vol. IX, no. 8, August, 1875, p. 470.

Adds Dendroica palmarum.

1875. MARSH, O. C. Odontornithes or Birds with Teeth. From Am. Naturalist, vol. IX, 1875, p. 625.

Has Kansas references.

1875. SNOW, F. H. A Catalogue of the Birds of Kansas, contributed to the Kansas Academy of Science, by F. H. Snow, professor of natural history and meteorology in the University of Kansas, at Lawrence. Third edition, November, 1875, 8vo, pamph., pp. 14.

Reports the addition of twenty-three species and one variety since the issue of the second edition. Several species and varieties have been dropped. The list now contains 295 species, 136 of which are marked as breeding. The list, really corrected to January 1, 1876, contains the first Kansas record for Ardea cœrulea, Archibuteo ferrugineus, Milvulus forficatus, Sayornis saya, Corvus cryptoleucus, Cyanocephalus cyanocephalus, Coccothraustes vespertinus montanus, Ammodramus leconteii, Junco aikeni, Guiraca cærulea, Salpinctes obsoletus, Myiadestes townsendii, and Sialia arctica.

1876. [ALLEN, J. A.] Editorial notice of Snow's Birds of Kansas, third edition, 1875. From Bull. Nutt. Ornith. Club, vol. I, 1876, p. 47.

1876. [ALLEN, J. A.] Editorial notice of Marsh's "Extinct Birds with Teeth." From Bull. N. O. C., vol. I, 1876, p. 49.

1876. SNOW, F. H. New Kansas Birds. From Observer of Nature, vol. III, no. 6, April 26, 1876.

The eleven species here noted all appear in Snow's third edition, already cited.

[1876.] SNOW, F. H. Catalogue of the Birds of Kansas. From Proceedings of Kansas State Board of Agriculture for 1875, pp. 128–139.

Reprint of Snow's third edition, 1875, without changes.

1878. GOSS, N. S. Breeding of the Duck Hawk in Trees. From B. N. O. Club, vol. III, 1878, p. 32.

1878. SNOW, F. H. Additions to the Catalogue of Kansas Birds. From Transaction Kan. Acad. Science, vol. 6, p. 38.

Adds to the list, Xema sabinii, Chen cærulescens, Nycticorax violaceus, Melanerpes torquatus, Icteria virens longicauda, and Anthus spraguei.

1878. WILLISTON, S. W. On the Adult Male Plumage of Wilson's Phalarope. From Trans. Kan. Acad. Science, vol. 6, p. 39.

1878. COUES, ELLIOTT. Department of the Interior, United States Geological Survey of the Territories. F. V. Hayden, U. S. Geologist-in-charge. Miscellaneous Publications—No. 11. Birds of the Colorado Valley, a repository of scientific and popular information concerning North American ornithology. By Elliott Coues. [Motto.] Part First. Passeres to Laniidæ. Biographical appendix. Seventy illustrations. Washington: Government printing office. 1878. 8vo, pp. i–xvi, 1–807.

Forty-four references to Kansas species.

1879. WILLISTON, S. W. A Fond Foster Father. From Forest and Stream, vol. 11, no. 1, p. 2.

A male cardinal in a cage rears Baltimore orioles.

1879. GOSS, N. S. The True Brant in Kansas. From Forest and Stream, vol. 9, no. 23, p. 430.

Several instances given.

1879. WILLISTON, S. W. A List of Birds of Southern Wyoming. From Forest and Stream, vol. XII, pp. 309, 325, 365, 385.

1879. GOSS, N. S. Bonaparte's Gull in Kansas. From B. N. O. Club, vol. 4, 1879, p. 190.

Larus philadelphia added to list.

1880. JENKINS, JEFF. The Northern Tier, or Life among the Homestead Settlers. By Jeff Jenkins. Topeka, Kan.: Geo. W. Martin, Kansas Publishing House. 1880. 8vo, pp. —.

Chapter 6 treats of northern Kansas birds in a popular but not very accurate manner.

1880. GOSS, N. S. The Black Rail in Kansas. From B. N. O. Club, vol. V, p. 60.

This becomes the first authentic record for Porzana jamaicensis.

1881. GOSS, N. S. Bell's Finch (Amphispiza belli) in New Mexico. From B. N. O. Club, vol. VI, 1881, p. 116.

1881. GOSS, N. S. The White-necked Raven (Corvus cryptoleucus) in New Mexico. From B. N. O. Club, vol. VI, 1881, p. 118.

1881. BLACHLY, DR. C. P. Ornithology of Riley County, Kansas. From Trans. Kan. Acad. Sci., vol. VII, 1881, pp. 105–114.

New to our fauna: Falco rusticolus, and Wright's flycatcher, the latter an error of identification.

1881. GOSS, N. S. Myiodioctes canadensis in Kansas. From B. N. O. Club, vol. VI, p. 246.

A first record.

1881. GOSS, N. S. The Yellow-crowned Night-heron in Kansas. From B. N. O. Club, vol. VI, p. 248.

1882. COOKE, W. W. Bird Migration in the Mississippi Valley. From Forest and Stream, vol. XVIII, p. —.

Not seen by me.

1882. ALLEN, J. A. Nelson's Sharp-tailed Finch. From B. N. O. Club, vol. VII, p. 55.

Reports its capture in Kansas by Colonel Goss. First record for Ammodramus caudacutus nelsoni.

1882. SNOW, F. H. The Snake-bird in Kansas. From B. N. O. Club, vol. VII, 1882, p. 61.

Anhinga anhinga added to list.

1883. GOSS, N. S. Observations of the Nesting Habits of the Guillemots at Bird Rock. From Trans. Kan. Acad. Sci., vol. VIII, 1883, pp. 59–60.

1883. GAUMER, G. F. Notes on Meleagris ocellata Cuv. From Trans. Kan. Acad. of Science, vol. VIII, 1883, pp. 60–62.

1883. GAUMER, G. F. Notes on the Habits of Certain Momotidæ. From Trans. Kan. Acad. of Science, vol. VIII, 1883, pp. 63–66.

1883. COALE, H. K. Troglodytes aedon parkmanni in Kansas. From B. N. O. Club, vol. VIII, 1883, p. 120.

This is not a new record. All the birds of this species in Kansas have since been referred to the form T. aedon aztecus.

1883. Goss, N. S. Occurrence of Northern Phalarope, Audubon's Warbler, and Mocking-bird in Western Kansas. From B. N. O. Club, vol. VIII, p. 186.

First record for Phalaropus lobatus and Dendroica auduboni in the state.

1883. Goss, N. S. A Catalogue of the Birds of Kansas, by N. S. Goss. Published under the direction of the executive council. Topeka, Kan.: Kansas Publishing House, 1883. 8vo, pp. 1–34.

Catalogues 320 species and races, of which 161 breed in the state.

First record for Larus californicus, Anas cyanoptera, Plegadis guarauna, Tantalus loculator, Tringa alpina pacifica, Tympanuchus pallidicinctus, Contopus richardsonii, Otocoris alpestris arenicola, Dendroica vigorsii, Turdus aliciæ, and Centrocercus urophasianus; the last on doubtful authority, and so not counted in this paper.

1883. Lantz, D. E. Useful Birds: Woodpeckers. From Industrialist, vol. IX, p. 15.

1883. Lantz, D. E. The Food of Hawks. From Industrialist, vol. IX, p. 37.

1883. Lantz, D. E. The Prothonotary Warbler. From Ornithologist and Oölogist, vol. VIII, March, 1883, p. 19.

1883. Lantz, D. E. Bell's Vireo. From ibid. vol. VIII, December, 1883, p. 94.

1883. [Allen, J. A.] Editorial notice of Goss's Catalogue of the Birds of Kansas, 1883. From B. N. O. Club, vol. VIII, p. 227.

1883. Cooke, W. W. Bird Migration in the Mississippi Valley. From Forest and Stream, vol. XIX, 1883, Nos. 15, 16, and 20.

1883–'84–'85. Cooke, W. W. Mississippi Valley Migration. From Ornithologist and Oölogist, vols. VIII, IX, X, 1884–'85–'86. Contains much information as to the movements of migratory birds at various Kansas stations.

1884. Goss, N. S. Notes on the Breeding Habits of the American Eared Grebes. From Auk, vol. I, 1884, p. 18. Same article in Trans. Kan. Acad., vol. IX, 1885, p. 31.

1884. Cooke, W. W. The Distribution and Migration of Zonotrichia querula. From Auk, vol. I, October, 1884, pp. 332–7.

1884. Goss, N. S. Birds new to the Fauna of Kansas and others rare in the state. From Auk, vol. I, 1884, p. 100.

Adds to our list Buteo borealis kriderii, Sphyrapicus varius nuchalis, Zonotrichia leucophrys intermedia, and Merula migratoria propinqua.

1884. Goss, N. S. Notes on the Nesting Habits of the Yellow-throated Vireo. From Auk, vol. I, 1884, p. 124.

Same article in Trans. Kan. Acad. Sci., vol. IX, 1885, p. 33.

1884. Goss, N. S. Notes on Phalacrocorax violaceus and on P. v. resplendens. From Auk, vol. I, 1884, p. 163.

1884. Goss, N. S. Capture of Megalestris skua off Cape Cod, Sept. 10, 1884. From Auk, vol. I, p. 395.

1884. Goss, N. S. Capture of Brachyrhamphus hypoleucus on the Coast of Southern California, May 20, 1884. From Auk, vol. I, p. 396.

1884. Baird, S. F., Brewer, T. M., and Ridgway, R. Memoirs of the Museum of Comparative Zoölogy, vols. XII and XIII. The Water Birds of North

America, by S. F. Baird, T. M. Brewer, and R. Ridgway. Issued in continuation of the publications of the California Geological Survey. J. D. Whitney, State Geologist. Boston: Little, Brown & Co. 1884. Two vols., small quarto, pp. —.

Contains some Kansas references.

1884. LANTZ, D. E. The English Sparrow. From Industrialist, vol. IX, 1884, p. 27. Vol. X, p. 11. Vol. XVII, 1892, p. 153.

1884. LANTZ, D. E. The Crow Blackbird or Bronzed Grackle. From Industrialist, vol. X, p. 8.

1884. LANTZ, D. E. The Blue Grosbeak (Guiraca cærulea). From Ornithologist and Oölogist, vol. IX, 1884, p. 19.

1884. LANTZ, D. E. Notes from Manhattan, Kan. From O. and O., vol. IX, 1884, p. 127; also vol. X, 1885, p. 29.

1885. LANTZ, D. E. The Red-bellied Woodpecker. From O. and O., vol. X, 1885, p. 10.

1885. LANTZ, D. E. The Kentucky Warbler. From O. and O., vol. X, 1885, p. 19.

1885. LANTZ, D. E. Kansas Bird Life. From O. and O., vol. X, 1885, p. 52.

1885. LANTZ, D. E. Kansas Birds—Fall Migration. From O. and O., vol. X, p. 72.

1885. LANTZ, D. E. Winter Birds at Manhattan, Kan. From O. and O., vol. X, 1885, p. 84.

1885. LANTZ, D. E. Bird Migration. From Industrialist, vol. XI, p. 39.

1885. LANTZ, D. E. The Song of Cardinalis virginianus. From Auk, vol. II, p. 307.

1885. GOSS, N. S. Observations on Elanoides forficatus and Ictinia subcærulea in Kansas. From Auk, vol. II, 1885, p. 19.

1885. GOSS, N. S. Rare Summer Residents in Kansas. From Auk, vol. II, 1885, p. 113.

1885. GOSS, N. S. Cyanocitta stellari frontalis Nesting in Holes in Trees. From Auk, vol. II, 1885, p. 217.

1885. GOSS, N. S. Wilson's Plover in Nova Scotia. From Auk, vol. II, 1885, p. 221.

1885. GOSS, N. S. Rissa tridactyla kotzebuei in Washington Territory. From Auk, vol. II, 1885, p. 222.

1885. GOSS, N. S. The Black-capped Vireo and Nonpareil in Southwestern Kansas. From Auk, vol. II, 1885, pp. 274, 275.

First report of Vireo atricapillus and Passerina ciris in the state.

1885. GOSS, N. S. Early and Accidental Occurrence of Catharista atrata and Tantalus loculator in Kansas. From Auk, vol. II, 1885, p. 311.

1885. GOSS, N. S. The Little Yellow Rail in Kansas. From Auk, vol. II, 1885, p. 385.

First record of Porzana noveboracensis.

1885. DYCHE, L. L. The Little Yellow Rail (Porzana noveboracensis) in Kansas. From O. and O., vol. X, Nov. 1885, p. 168.

Refers to his capture of a specimen of this bird, the same individual reported by Colonel Goss.

1885. Merriam, Dr. C. Hart. Preliminary Report of the Committee on Bird Migration. From Auk, vol. II, Jan. 1885, pp. 53–65.
Kansas localities referred to.

1885. Kellogg, V. L. Notes on the Water Birds of Emporia, Kan. From O. and O., vol. X, July, 1885, pp. 104, 105.

1885. Kellogg, V. L. Gulls, Terns, and Grebes at Emporia, Kan. From O. and O., vol. X, Oct. 1885, p. 152.

1885. Goss, N. S. The Thick-billed Grebe (Podylimbus podiceps) breeding in Kansas. From Auk, vol. II, 1885, p. 388.

1886. Goss, N. S. Additions to the Catalogue of Kansas Birds. From Auk, vol. III, pp. 112–115.
Adds to the list Fregata aquila, Himantopus mexicanus, Anas fulvigula maculosa, Geococcyx californicus, Bubo virginianus subarcticus, Passerculus sandwichensis alaudinus, and Thryothorus bewicki bairdi (?).

1886. Goss, N. S. Capture of the Scissor-tailed Flycatcher on the Southeast Coast of Florida. From Auk, vol. III, p. 134.

1886. A. O. U. The Code of Nomenclature and Check-list of North American Birds adopted by the American Ornithologists' Union, being the report of the committee of the union on classification and nomenclature. [Motto.] New York. American Ornithologists' Union. 1886. 8vo, pp. — .
Adds to our list Colinus virginianus texanus. Contains specific mention of twenty-seven species as found in Kansas; also of ten fossil species found in western Kansas.

1886. Lantz, D. E. The American Ornithologists' Union. From Industrialist, vol. 12, p. 9.

1886. Lantz, D. E. Our Game Laws. From Industrialist, vol. XII, p. 22.

1886. Dyche, L. L. The Red Crossbill (Loxia curvirostra stricklandi) in Kansas. From Auk, vol. III, Apr. 1886, p. 258.
First record. Remarks by Wm. Brewster.

1886. Lantz, D. E. Mexican Crossbills in Kansas. From O. and O., vol. XI, Apr. 1886, p. 59.

1886. Goss, N. S. The Number of Eggs laid by the Swallow-tailed Kite. From O. and O., vol. XI, Dec. 1886, p. 183.

1886. Goss, N. S. A Revised Catalogue of the Birds of Kansas, with descriptive notes of the nests and eggs of the birds known to breed in the state. By N. S. Goss. Published under the direction of the Executive Council. May, 1886. Topeka: Kansas Publishing House, T. D. Thacher, state printer. 1886. 8vo., pp. i–iv+i, 1–76.
The list follows the nomenclature of the A. O. U. check-list, and embraces 335 species and races, of which 175 are known to breed in the state. Reports of A. O. U. committees are appended.

1886. Breninger, Geo. F. Nest and Eggs of the Short-eared Owl. From O. and O., vol. 11, 1886, p. 167.
Found breeding in Marshall county, Kansas.

1886. Goss, N. S. The Snowy Plover on the Salt Plains of Indian Territory and Kansas. From Auk, vol. III, 1886, p. 409.
Adds Ægialitis nivosa to our list.

1887. Goss, N. S. Additions to the Catalogue of Kansas Birds. From Trans. Kan. Acad. Science, vol. X, p. 28.
All previously reported.

1887. Goss, N. S. Additions to the Catalogue of the Birds of Kansas. From Auk, vol. IV, 1887, pp. 7–11.
Adds Spizella monticola ochracea to our list, and reports several species as breeding. Same article in Trans. Kan. Acad. of Science, vol. X, p. 77.

1887. Goss, N. S. What Constitutes a full Set of Eggs? From Auk, vol. IV, 1887, p. 167.

1887. Ridgway, Robert. A Manual of North American Birds, by Robert Ridgway. Illustrated by 464 outline drawings of the generic characters. Philadelphia: J. B. Lippincott Company, 1887. 8vo, pp. i–xi, 1–631, plates 124.
Has Kansas references.

1887. Lantz, D. E. Report of the Committee on Ornithology. From Annual Report of the Kansas State Horticultural Society, vol. XVI, for 1886, pp. 189–193.

1887. Snow, F. H. On the Discovery of a Fossil Bird Track in the Dakota Sandstone. From Trans. Kan. Acad. Science, vol. X, 1887, p. 3.

1887. Goss, N. S. Mèrganser americana breeding in New Mexico. From Auk, vol. IV, p. 344.

1887. Goss, N. S. Ictinia mississippiensis and Ægialitis nivosa nesting in Southern Central Kansas. From Auk, vol. IV, 1887, pp. 344, 345.
Same article in Trans. Kan. Acad. Science, vol. XI, p. 11.

1888. Goss, N. S. Feeding Habits of Pelecanus erythrorhynchus. From Auk, vol. V, p. 25.
Same article in Trans. Kan. Acad. Science, vol. XI, p. 11.

1888. Goss, N. S. Notes on the Yellow-tailed Cassique (Gymnostinops montezumæ). From Auk, vol. V, p. 27.
Same article in Trans. Kan. Acad. Science, vol. XI, 1889, p. 12.

1888. Cooke, W. W. U. S. Department of Agriculture. Division of Economic Ornithology. Bulletin No. 2. Report on Bird Migration in the Mississippi Valley in the years 1884 and 1885, by W. W. Cooke. Edited and revised by Dr. C. Hart Merriam. Washington: Government Printing Office. 1888. 8vo, pp. 1–313, one map.
Many references to Kansas birds and localities. Part of the body of the report written by Otto Widmann, of St. Louis, Mo., and D. E. Lantz, of Manhattan, Kan.

1888. Snow, F. H. Æchmophorus occidentalis in Kansas. From Auk, vol. V, 1888, p. 201.
First record for this species.

1888. Bennett, A. L. The Surf Scoter (Oidemia perspicillata) in Kansas. From Auk, vol. V, 1888, p. 203.
First record for this species.

1888. Goss, N. S. New and rare birds found breeding on the San Pedro Martir Isle. From Auk, vol. V, 1888, pp. 240–244.

1888. Goss, N. S. How far west has Anas obscura been found? From Auk, vol. V, 1888, p. 444.

1888. Evermann, B. W., and Jenkins, O. P. Ornithology from a Railroad Train. From O. and O., vol. XIII, May. 1888, p. 65.

Notes of a journey from Indiana to Guaymas, Mex., with some Kansas observations *en route*.

1888. Hartzell, L. B. Nesting of the Burrowing Owl. From O. and O., vol. XIII, June, 1888, p. 85.

1889. Goss, N. S. Additions to the Catalogue of the Birds of Kansas, with notes on their habits. From Auk, vol. VI, April, 1889, pp. 122.

Same article in Trans. Kan. Acad. Sci., vol. XI, 1889, p. 60. Adds Picicorvus columbianus to our list.

1889. Goss, N. S. The Anhinga (Anhinga anhinga). From Trans. Kan. Acad. Sci., vol. XI, 1889, p. 58.

1889. Goss, N. S. The Double-crested Cormorant (Phalacrocorax dilophus). Ibid. p. 59.

1889. Snow, F. H. Three new Kansas Birds. Trans. Kan. Acad. Sci., vol. XI, p. 62.

Refers to species already reported.

1889. Lantz, D. E. The Harrier or Marsh Hawk. From the Industrialist, vol. XV, p. 21.

1889. Lantz, D. E. The Icteridæ. From Report of Standing Committee on Ornithology, in Report of Kan. State Hort. Society, vol. XVIII, 1889–'90, pp. 219–224.

1889. Lantz, D. E. List of Birds Beneficial to Horticulturists. Ibid. pp. 224–5.

1889. Barrows, Walter B. U. S. Department of Agriculture. Division of Economic Ornithology and Mammalogy, Bulletin No. 1. The English Sparrow (Passer domesticus) in North America, especially in its relations to agriculture. Prepared under the direction of Dr. C. Hart Merriam, ornithologist, by Walter B. Barrows, assistant ornithologist. Washington: Government Printing Office, 1889.

Kansas references and contributions.

1890. Dwight, J., jr. The Horned Larks of North America. From Auk, vol. VII, 1890, pp. 138–158, map.

Adds to Kansas fauna Otocoris alpestris leucolæma based on winter specimens from Manhattan and Fort Riley.

1890. Kellogg, V. L. Summer Birds of Estes Park [Colo.] From Trans. Kan. Acad. Sci., vol. XII, pp. 86–90.

1890. Kellogg, V. L. Some Notes on the Mallophaga (bird-lice). Trans. Kan. Acad. Sci., vol. XII, pp. 46–48.

1890. Goss, N. S. The Mottled Duck in Kansas. From Auk, vol. VII, p. 88.

Adds to our list Anas fulvigula maculosa, previously reported as Anas fulvigula.

1890. Goss, N. S. Phalænoptilus nuttalli nitidus breeding in Kansas. Ibid. p. 286.

First record for the state.

1890. Goss, N. S. Additions to the List of Kansas Birds. From Trans. Kan. Acad. Sci., vol. XII, 1890, p. 24.

Same bird mentioned above and little brown crane, Grus canadensis.

1890. Goss, N. S. Correction to Catalogue of Kansas Birds. From ibid. p. 60. Same article in the Auk, vol. VIII, 1891, p. 116.

1890. Goss, N. S. Second Occurrence in Kansas of White-faced Glossy Ibis. From ibid. p. 61.

Same article in the Auk, vol. VIII, 1891, p. 112.

1890. Lantz, D. E. Injury to Grapes by Birds. From the Industrialist, vol. XV, p. 105.

1890. Lantz, D. E. Habits of the Barred Owl. From the Auk, vol. VII, 1890, p. 286.

1891. Lantz, D. E. Report of the Standing Committee on Ornithology. From Second Biennial Report of Kansas State Horticultural Society, vol. XVIII, appendix, p. 16.

1891. Goss, N. S. History of the Birds of Kansas. By N. S. Goss. Illustrating 529 birds. Topeka, Kan.: Geo. W. Crane & Co., printers and binders. 1891. Royal 8vo, pp. 692+1 l, and 35 photogravure full-page plates.

Three hundred and forty-three species and races are described, all previously reported. Sage grouse and shore lark eliminated from the list.

1891. Peabody, Rev. P. B. A Probable Addition to the Avifauna of Kansas. From O. and O., vol. XVI, 1891, p. 14.

Barrow's golden-eye, an error of identification, which Mr. Peabody corrects in the following number of O. and O., p. 25.

1891. Peabody, Rev. P. B. A Plea for Nest Collecting. From O. and O., vol. XVI, 1891, p. 98.

1891. A[llen], J. A. Goss's History of the Birds of Kansas. From Auk, vol. VIII, 1891, p. 228.

Editorial review.

1891. [Anonymous.] Obituary notice of Col. N. S. Goss. From Auk, vol. VIII, 1891, p. 245.

1891. [Editorial.] Goss's History of the Birds of Kansas. From O. and O., vol. XVI, 1891, p. 176.

A review.

1892. Peabody, Rev. P. B. A Dip into the January Ornithologist and Oölogist. From O. and O., vol. XVII, 1892, p. 39.

1892. Peabody, Rev. P. B. Where the Mississippi Kites Fly. Ibid. p. 168.

1892. Williston, S. W. Kansas Pterodactyls. From Kansas University Quarterly, vol. I, 1892, pp. 1–14, vol. II, 1893, pp. 79–82.

1892. Snow, F. H. The Pacific Eider in Kansas. From Auk, vol. IX, 1892, p. 198.

First record for Somateria v-nigra.

1892. BENDIRE, CHAS. Smithsonian Institution. United States National Museum. Special Bulletin No. 1. Life Histories of North American Birds, with special reference to their breeding habits and eggs, with twelve lithographic plates. By Charles Bendire, captain U. S. army (retired), honorary curator [etc.] Washington: Government Printing Office. 1892. 4to, pp. i–viii, 1–446, pll. 12.

Kansas references to twenty-five species and notes by Kansas observers.

1893. COLLETTE, A. M. Two Rare Birds of Kansas. From Trans. Kan. Acad. Sci, vol. XIII, 1893, p. 29.

Refers to glossy ibis and Clarke's nutcracker.

1893. COLLETTE, A. M. Nesting of the Pied-billed Grebe. Ibid. p. 49.

1893. HASBROUCK, E. M. Evolution and Dichromatism in the genus Megascops. From Am. Naturalist, vol. XXVII, 1893, pp. 521–533, 638–649.

1893. KELLOGG, V. L. The Road-runner in Kansas. From Auk, vol. X, 1893, p. 364.

Its occurrence in Comanche county noted.

1893. LANTZ, D. E. Ionornis martinica in Kansas. From Auk, vol. X, 1893, p. 300.

First record for this species.

1894. KELLOGG, V. L. Notes on Kansas Birds. From Auk, vol. XI, 1894, p. 260.

A notice of Menke's Birds of Finney County, announcing that four of them are new to our fauna. Real additions are: Carpodacus mexicanus frontalis and Hesperocichla nævia.

1894. LANTZ, D. E. Harris's Sparrow. From Industrialist, vol. XX, p. 125.

1894. MENKE, H. W. Birds of Finney County, Kansas. From Kansas University Quarterly, vol. III, Oct. 1894, pp. 129–136.

A local list of 166 species, including the European house sparrow. He adds to the Kansas fauna the three species already reported to the Auk by Mr. Kellogg.

1894. COALE, H. K. Ornithological Notes of a Flying Trip through Kansas, New Mexico, Arizona, and Texas. Auk, vol. XI, 1894, p. 216.

A few notes at Fort Leavenworth and Fort Riley.

1895. BURNS, FRANK L. Bulletin No. 5. The Wilson Ornithological Chapter of the Agassiz Association. The American Crow (Corvus americanus), with special reference to its nest and eggs. By Frank L. Burns. Oberlin, Ohio. March 15, 1895. small 8vo pamph., pp. 1–41.

1895. LANTZ, D. E. Bird Notes for the Season. From Industrialist, vol. XX, p. 125.

1895. LANTZ, D. E. The Blue-gray Gnatcatcher. From Industrialist, vol. XXI, p. 41.

1895. BENDIRE, C. Smithsonian Institution. United States National Museum. Special Bulletin [No. 3]. Life Histories of North American Birds, from the Parrots to the Grackles, with special reference to their breeding habits and eggs. By Charles Bendire, captain and brevet major, U. S. A. (retired), with seven lithographic plates. Washington: Government Printing Office. 1895. 4to, pp. i-viii, 1–518, plates 7.

Specific mention of thirty-seven species as found in Kansas.

Some notes by Kansas observers.

1895. A. O. U. Check-list of North American Birds, prepared by a committee of the American Ornithologists' Union. Second and revised edition. New York: American Ornithologists' Union. 1895. 8vo, pp. xi + 372.

Specific mention of many Kansas species.

1895. WILLISTON, S. W. Notes on the Mandible of Ornithostoma. From Kansas University Quarterly, vol. IV, 1895, p. 61.

1896. LANTZ, D. E. An Annotated List of the Birds found near Manhattan, Kan. From Trans. Kan. Acad. Science, vol. XIV, 1896, pp. 116–123. A local list of 240 species and races, of which 100 species have been found breeding, while a number of others are supposed to breed.

1896. LANTZ, D. E. Notes on Loxia curvirostra stricklandi. Ibid. p. 124.

1896. WILLISTON, S. W. On the Skull of Ornithostoma. From Kan. University Quarterly, vol. IV, April, 1896, p. 195.

1896. WILLISTON, S. W. On the Dermal Covering of Hesperornis. Ibid. vol. V, July, 1896, p. 53.

1897. LANTZ, D. E. Notes on Phalænoptilus nuttalli nitidus. From Trans. Kan. Acad. Science, vol. XV, 1897.

1897. KELLOGG, VERNON L. Additions to Goss's Revised Catalogue of the Birds of Kansas. From Trans. Kan. Acad. Sci., vol. XV, 1897.

No species not previously reported.

1897. LANTZ, D. E. Birds of Western Uplands. From Western Homes, vol. I, Oct. 1897, pp. 30–33.

1897. AUDUBON, MARIA R. Audubon and his Journals, by Maria R. Audubon, with zoölogical and other notes, by Elliott Coues. Vol. I. [II]. New York: Charles Scribner's Sons, 1897. 2 vols., 8vo, pp. i–x, 532, 554, nine facsimile diplomas, etc.

Among these interesting journals is the account of his journey up the Missouri river in May, 1843. Interesting observations and collections were made above Fort Leavenworth and near St. Joseph on the west side of the river. At least sixty-four species of birds are mentioned as observed in Kansas, among them being Bell's vireo and Harris's finch, sp. nov. Other birds are referred to in general terms, as, blackbird, grebe, swan, etc., with no means of positive identification.

RECAPITULATION.

Year.	Authority reporting.	No. added.	Total on list.
1810....	Z. M. Pike	1	1
1814....	Lewis and Clarke	1	2
1823....	Thomas Say	8	10
1839....	Prince Maximilian of Wied	12	22
1844....	Gregg	2	24
1845...	Fremont	1	25
1848....	Lieutenant Abert	26	51
1849....	Francis Parkman	1	52
1851....	Kelly	1	53
1858....	Baird. P. R. R. reports	42	95
1865....	Doctor Hoy	1	96
1865....	Doctor Coues. Ibis	7	103
1871....	Doctor Coues. American Naturalist	7	110
1872....	Professor Snow. 1st edition, April	106	216

Year.	Authority reporting.	No. added.	Total on list.
1872....	Snow. Same edition, on authority of Brewer	19	235
1872....	Allen, in American Naturalist for May	11	246
1872....	Allen, in Bull. M. C. Zoöl. for July	3	249
1872....	Snow, on authority of Baird. American Naturalist	19	268
1872....	Snow. 2d edition of catalogue, usually cited 1873	2	270
1873....	Snow. Transactions Board of Agriculture	1	271
1874....	Snow. Observer of Nature	5	276
1874....	Benson. Forest and Stream	4	280
1875....	Snow, in various papers	4	284
1875....	Snow. 3d edition, correct to Jan. 1, 1876	13	297
1878....	Snow	6	303
1879....	Colonel Goss	1	304
1880....	Goss	1	305
1881....	Doctor Blachly	1	306
1881....	Goss	1	307
1882....	Allen, on authority of Goss	1	308
1882....	Snow	1	309
1883....	Goss	2	311
1883....	Goss, 1st edition of catalogue	10	321
1884....	Goss, Auk, vol. I	4	325
1885....	Goss, Auk, vol. II	2	327
1885....	Goss, on authority of Dyche	1	328
1886....	Goss, Auk, vol. III, p. 112	7	335
1886....	Dyche	1	336
1886....	A. O. U. Check-list	1	337
1886....	Goss, Revised Catalogue	..	337
1886....	Goss, Auk, vol III, p. 409	1	338
1887....	Goss, Auk, vol. IV, p. 7	1	339
1888....	Snow, Auk, vol. V	1	340
1888....	Bennett, Auk, vol. V	1	341
1889....	Goss, Auk, vol. VI, p. 122	1	342
1890....	Dwight, Auk, vol. VII.	1	343
1890....	Goss, Auk, vol. VII, p. 286	1	344
1890....	Goss, Trans. Kan. Acad. Science	1	345
1891....	Goss, History of Kan. Birds	..	345
1892....	Snow, Auk, vol. IX	1	346
1893....	Lantz, Auk, vol. X	1	347
1894....	Kellogg, on authority of Menke	2	349

II. An Historical List of Kansas Birds.

In the following list, I have, to some extent, made use of the zone names proposed by the United States Biological Survey. (Year book of the Department of Agriculture for 1894.) Briefly stated, there are three primary life regions recognized in the North American continent—boreal, austral, and tropical. The boreal region is divided into three well marked zones stretching in irregular lines across the continent—the arctic zone, the Hudsonian zone, and the Canadian zone. The austral region is similarly divided into three transcontinental zones—the transition zone, the upper austral zone, and the lower austral zone. The tropical region enters the United States at only three points—in southern

Florida, southern Texas, and the lower Colorado valley in western Arizona, and in southeastern California.

The boundaries of these zones have not yet been fully determined, so that any attempt to apply them to the various species in describing their geographical distribution must as yet appear crude; but the advantages of recognizing a general system like the one proposed are so great, that I could not refrain from partially using it.

1. 1. Æchmophorus occidentalis (Lawr.) Western Grebe. Accidental in Kansas. A western species, ranging from Lower California and Mexico to the British provinces and eastward to the mountains. Breeds throughout its normal range. One specimen, a young male, was taken on the Kansas river at Lawrence, November 3, 1887, and reported to the Auk of April, 1888, by Prof. F. H. Snow.

2. 3. Colymbus auritus (Linn.) Horned Grebe. Migratory; rare. Breeds in northern United States and British America. Snow, 1872, and all subsequent lists.

3. 4. Colymbus nigricollis californicus (Heerm.) American Eared Grebe. Migratory; rare in eastern Kansas; more frequent in the western counties, where it may breed. First reported from the state by Professor Snow, in Observer of Nature, April, 1874. Snow's Catalogue, 1875.

4. 6. Podilymbus podiceps (Linn.) Pied billed Grebe. Chiefly migratory; common. A few breed in the state in suitable localities and favorable seasons. Snow, 1872. Found breeding at Emporia, May 26, 1885, by Bennett and Kellogg.

5. 7. Gavia imber (Gunn). Loon. Migratory; not common. Breeds in northern United States and British provinces. Snow, 1872.

6. 51a. Larus argentatus smithsonianus (Coues). American Herring Gull. Migratory; rare. Snow, 1873.

7. 53. Larus californicus (Lawr.) California Gull. Migratory; rare. Goss, 1883. Taken by him in Reno county, October 20, 1880.

8. 54. Larus delawarensis (Ord). Ring-billed Gull. Migratory; rather common. Snow, 1875. Taken at Lawrence, April, 1873, by N. J. Stephens.

9. 59. Larus franklinii (Sw. & Rich.) Franklin's Gull. Migratory; common. Coues, 1865, in the Ibis.

10. 60. Larus philadelphia (Ord). Bonaparte's Gull. Migratory; not common. Goss, 1879. Taken April 18, 1879. B. N. O. C., vol. 4, p. 190. Taken also at Manhattan, April 7, 1890.

11. 62. Xema sabinii (Sab.) Sabine's Gull. An accidental visitant; very rare. Snow, 1878. A specimen taken by Peter Long at Humboldt, September 21, 1876.

12. 69. Sterna forsteri (Nutt.) Foster's Tern. A common migrant. May breed in the state. Snow, 1872.

13. 70. Sterna hirundo (Linn.) Common Tern. Migratory; rare. Listed by Snow, first and second editions, but eliminated from the third edition. Reported from Russell county by F. S. Benson in 1874. Forest and Stream, vol. 2, p. 341. Goss, 1883.

14. 74. Sterna antillarum (Less.) Least Tern. Summer resident; rare. Ranges throughout the greater part of the United States and the southern part of the British provinces, breeding in the greater part of its range, but chiefly in

the south. Snow, 1872. Found breeding on the Cimarron river, in Kansas, by Colonel Goss.

15. 77. Hydrochelidon nigra surinamensis (Gmel.) Black Tern. Summer resident; rare; in migration, common. Breeds from Kansas northward into British America. Snow, 1872.

16. 118. Anhinga anhinga (Linn.) Anhinga. A rare visitant in summer. Belongs to the lower austral and tropical regions of the United States and southward. Taken twice in Kansas—in the Solomon valley, August, 1881, by C. W. Smith, of Stockton, and on Crooked creek, Meade county, May 1, 1888, by Daniel Lambert, of Wilburn, Ford county. First reported by Snow, 1882, B. N. O. C., vol. VII, p. 61.

17. 120. Phalacrocorax dilophus (Sw. & Rich.) Double-crested Cormorant. Migratory; not rare. Breeds in the Canadian zone, west to the mountains. Snow, 1872.

18. 121. Phalocrocorax mexicanus (Brandt). Mexican Cormorant. A rare visitant. Belongs to the tropical region. A single specimen was captured at Lawrence, April 2, 1872, by Geo. D. Allen, and reported by Professor Snow in his first edition as P. floridanus; corrected in the second edition.

19. 125. Pelecanus erythrorhynchus (Gmel.) American White Pelican. A common migrant. May rarely breed in the state, but thus far reports of their breeding have not been verified. They nest on the islands in the rivers and lakes of the northern United States and British America. Snow, 1872.

20. 128. Fregata aquila (Linn.) Man-o'-War Bird. Accidental in the state. They inhabit the tropical seacoasts, mostly north of the equator; somewhat common on the coasts of the lower austral zone; accidental in Ohio, Nova Scotia, and Kansas. Taken at Downs by Frank Lewis, August 16, 1880. Reported by Goss. Auk, vol. III, p. 112.

21. 129. Merganser americanus (Cass.) American Merganser. A winter sojourner: rather common. Breed chiefly north of the United States, except in the mountain ranges. Snow, 1872.

22. 130. Merganser serrator (Linn.) Red-breasted Merganser. A rare winter visitant. Breeds in the boreal region, chiefly in the Hudsonian and arctic zones. Its winter range extends throughout the greater part of the United States. Snow, second edition, 1872, on authority of Baird.

23. 131. Lophodytes cucullatus (Linn.) Hooded Merganser. A rare resident; common in migration. Ranges over nearly the whole of North America, breeding from Kansas northward along the inland streams and lakes. Snow, 1872.

24. 132. Anas boschas (Linn.) Mallard. A rare resident; abundant in migration, often found on open streams in midwinter. Ranges over the whole of North America, breeding chiefly northward. Baird, 1858.

133. Anas obscura (Gmel.) Black Duck. Migratory, if it occurs. A bird of the eastern parts of North America, not common west of the Allegheny mountains and rare west of the Mississippi. Snow, 1872, and all later catalogues; but evidence of its occurrence in Kansas is entirely wanting, and it should be dropped from our list.

25. 134a. Anas fulvigula maculosa (Senn.) Mottled Duck. Not common; may breed. Habitat, Texas north to Kansas. Specimens of this duck taken in Kansas have been mistaken for the black duck. Goss, 1886. Entered as A. fulvigula.

26. 135. Chaulelasmus streperus (Linn.) Gadwall. A rare summer resident: common in migration. Ranges over the northern hemisphere, breeding mostly in the northern parts. Snow, 1872.

27. 137. Mareca americana (Gmel.) Baldpate. A rare summer resident; common in migration. Nearly the same range as the preceding species. Snow, 1872.

28. 139. Nettion carolinensis (Gmel.) Green-winged Teal. An abundant migrant, sometimes wintering in Kansas. Breeds chiefly north of the United States and winters on the southern borders and in Central America, Mexico, and Cuba. Abert, 1848.

29. 140. Querquedula discors (Linn.) Blue-winged Teal. A summer resident in suitable localities, but chiefly migratory; abundant. Ranges over North America to about latitude 60 north, but is not common west of the Rocky mountains. Breeds mostly in the upper austral and transition zones. Snow, 1872.

30. 141. Querquedula cyanoptera (Vieill.) Cinnamon Teal. Rather common in the western counties, but rare in eastern Kansas. A western species which is rare east of the plains. Breeds mostly within the United States. Goss, 1883.

31. 142. Spatula clypeata (Linn.) Shoveler. A rare summer resident: common in migration. Ranges over the northern hemisphere, breeding on this continent, from Texas to Alaska. Snow, 1872.

32. 143. Dafila acuta (Linn.) Pintail. Migratory; common. Breeds in the boreal region and transition zone, north of the United States. An early migrant: February or March. Snow, 1872.

33. 144. Aix sponsa (Linn.) Wood Duck. A summer resident, becoming less common as the larger timber disappears from our streams. Ranges over the temperate parts of North America and breeds throughout its range. Nests in hollow trees. Maximilian, 1839.

34. 146. Aythya americana (Eyt.) Red-head. A common migrant. Breeds mostly north of the United States. Snow, 1872.

35. 147. Aythya vallisneria (Wils.) Canvas-back. Migratory: some years common; others absent. An early migrant; February. Breeds mostly in boreal America. Snow, 1872.

36. 148. Aythya marila (Linn.) American Scaup Duck. Migratory; rare. Ranges over North America, but breeds in the boreal parts. Snow, 1872.

37. 149. Aythya affinis (Eyt.) Lesser Scaup Duck. Migratory; much more common than the last. Belongs to North America in general, but breeds north of the United States. Snow, 1872.

38. 150. Aythya collaris (Donov.) Ring-necked Duck. A common migrant. Ranges the whole of North America, but breeds chiefly in the transition zone. Snow, 1872.

39. 151. Clangula clangula americana (Bonap.) American Golden-eye. migratory; rare. North America in general, but breeds chiefly north of the United States. Snow, 1872.

40. 153. Charitonetta albeola (Linn.) Buffle-head. Migratory; sometimes common. Ranges North America in general. Breeds from northern United States to the arctic circle. Snow, 1872.

41. 166. Oidemia perspicillata (Linn.) Surf Scoter. A rare visitor. Ranges over all of North America, but chiefly along the seacoasts. Breeds far north. A single specimen was taken on the Kansas river near Lawrence, October 29, 1887, by Mr. A. L. Bennett, of Emporia. Reported by him. Auk, vol. V, 1888, p. 203.

42. 161. Somateria v-nigra Gray. Pacific Eider. Accidental in Kansas. Taken near Lawrence by A. L. Weidman, 1892, and reported by Professor Snow. Auk, vol. IX, p. 198.

43. 167. Erismatura rubida (Wils.) Ruddy Duck. A rare summer resident; common in migration. Ranges throughout North America but breeds chiefly northward. Snow, 1872.

44. 169. Chen hyperborea (Pall.) Lesser Snow Goose. Abundant in migration. Inhabits western North America east to the Mississippi valley. Breeds far north. Snow, 1872.

45. 169.1. Chen cærulescens (Linn.) Blue Goose. A rare migrant. Inhabits the interior of North America east of the Rocky mountains. Breeds on the shores of Hudson bay. Snow, 1878.

46. 171a. Anser albifrons gambeli (Hartl.) American White-fronted Goose. Common in migration. Breeds far north, and retires south to Mexico and Cuba in winter. Snow, 1872.

47. 172. Branta canadensis (Linn.) Canada Goose. Once summer resident; now a common migrant. A few remain in winter unless ice covers all our rivers. They breed from about latitude 40 northward to the Arctic ocean. Lewis and Clarke met with many goslings, probably of this species, on the Missouri river above the present city of Atchison. Maximilian, prince of Wied, found the Canada goose breeding near the same place in 1834. First reported from the state by Maximilian, 1839.

48. 172a. Branta canadensis hutchinsii (Sw. & Rich.) Hutchins's Goose. Migratory; common. Habits and distribution similar to the Canada goose, except that this species breeds further north than the last mentioned. Snow, 1872, on authority of Baird.

49. 173. Branta bernicla (Linn.) Brant. A rare accidental migrant. Its usual range is near the Atlantic coast. It breeds within the arctic circle. There have been several authentic instances of its occurrence in this state. Snow, 1872.

50. 180. Olor columbianus (Ord.) Whistling Swan. Migratory; rare. Ranges the whole of North America, breeding far northward. Snow, 1872.

51. 181. Olor buccinator (Rich.) Trumpeter Swan. Migratory; more common than the last named. Habits and range the same, except that it breeds farther south. Snow, 1872.

52. 187. Plegadis guarauna (Linn.) White-faced Glossy Ibis. A rare visitor. A bird of the western slope, first taken near Lawrence by W. L. Bullene in the fall of 1879. Reported to Colonel Goss by Professor Snow. First published report seems to be in Goss's Catalogue, first edition, 1883. Other captures have been at Wichita, October 17, 1890, by Doctor Mathews, and near McPherson, April 29, 1891, by J. W. Blair.

53. 188. Tantalus loculator (Linn.) Wood Ibis. Irregular summer visitor; rare. A bird of the tropical and lower austral regions, occurring casually in the

upper austral zone. Reported to Colonel Goss in the spring of 1883, by Dr. Geo. Lisle, as occurring near Chetopa. Observed by Doctor Watson at Ellis, March 26, 1885. Goss, 1883.

54. 190. Botaurus lentiginosus (Montag.) American Bittern. Summer resident; not uncommon. Ranges over all of temperate and tropical North America. Breeds in marshes and swamps, nesting on the ground. Snow, 1872.

55. 191. Ardetta exilis (Gmel.) Least Bittern. Summer resident; not rare. Ranges over all of temperate North America and tropical America south to Brazil. Nests in dense swamps. Snow, 1872.

56. 194. Ardea herodias (Linn.) Great Blue Heron. Summer resident; common along our streams. Ranges over all of North America except the treeless regions. Builds its nest in trees, usually in communities. Snow, 1872.

57. 196. Ardea egretta (Gmel.) American Egret. A summer visitor; not rare. Ranges from the British provinces in the north to Chili in the south. Breeds in the United States chiefly in the lower austral zone. Young birds in July and August wander up our rivers further north, but they soon retire to their tropical winter home. Baird, 1858.

58. 197. Ardea candidissima (Gmel.) Snowy Heron. A summer visitor; not rare. Arrive from the south in July and August and stay but a short time. Nest chiefly in the warmer parts of North America, the summer visitors at the north being flocks containing mostly young birds in first plumage. First taken by E. U. Prentice, at Topeka, August 15, 1872. Reported by Snow, 1873.

59. 200. Ardea cærulea Linn. Little Blue Heron. A summer visitor; rare. After nesting in tropical and lower austral zones, the families, old and young together, often wander northward for a short time. They are very rare west of the Mississippi valley. First taken in Kansas by Colonel Goss, at Neosho Falls, and reported by Snow, 1875.

60. 201. Ardea virescens (Linn.) Green Heron. Summer resident; common. Their summer range seems to extend to most parts of the northern United States and into southern Canada. They winter in the Southern states and southward. Baird, 1858.

61. 202. Nycticorax nycticorax nævius (Bodd.) Black-crowned Night Heron. Summer resident; not very common because the state has few marshy districts suitable for their feeding-grounds. They range over nearly the whole of America, except the arctic regions, and breed in their favorite haunts throughout their United States range. Snow, 1872.

62. 203. Nycticorax violaceus (Linn.) Yellow-crowned Night Heron. Summer resident; rare. Range over tropical and subtropical America. Breed northward to about 40° north latitude and wander casually further north. Taken by Colonel Goss, April 17, 1878, and reported by Professor Snow, 1878.

63. 204. Grus americana (Linn.) Whooping Crane. Migratory; irregular, but usually rare. They were much more abundant before the settlement of the state. Its range is east of the Rocky mountains and mostly in the great interior valley. Breeds from latitude 40° north to Great Slave lake. Gregg, 1844. Abert, 1848.

64. 205. Grus canadensis (Linn.) Little Brown Crane. Migratory; rather common. Ranges and breeds farther north than the last species, and is more frequent nearer the coast. Goss, 1890.

65. 206. Grus mexicana (Müll.) Sandhill Crane. Migratory; common. Ranges through the lower and upper austral and transition zones, from the Mississippi westward to the Pacific coast. Breeds throughout its range. Gregg, 1844.

66. 208. Rallus elegans (Aud.) King Rail. Summer resident; common in the few marshes of the state. Ranges throughout the upper and lower austral zones as far west as the mountains. Breeds in this range. Occurs casually in the transition zone. Snow, 1872.

67. 212. Rallus virginianus (Linn.) Virginia Rail. Summer resident; rare. Common in migration. Its geographical range is temperate North America, and southward in winter. Nests in marsh lands. Snow, 1872.

68. 214. Porzana carolina (Linn.) Sora. Summer resident; rare. Abundant in migration. Inhabits the whole of temperate North America, breeding mostly in the northern parts. Retires to Central and South America during the winter. Snow, 1872.

69. 215. Porzana noveboracensis (Gmel.) Yellow Rail. A rare summer resident. Ranges over the greater part of North America, except the arctic region and the mountains. First taken in Kansas by Prof. L. L. Dyche near Lawrence, April 18, 1885. Goss, 1886.

70. 216. Porzana jamaicensis (Gmel.) Black Rail. A rare summer resident. Belongs to temperate North America, except the mountains; south to Chili. Taken at Neosho Falls by Colonel Goss, May 3, 1879. Nest with eight eggs found at Manhattan, June, 1880. Goss, 1880.

71. 218. Ionornis martinica (Linn.) Purple Gallinule. A very rare visitant. Found in the southeastern part of the United States, casually north to New York and Massachusetts, and west to Kansas. Only one record for this state—Manhattan, April 14, 1893. Lantz, Auk, vol. X, 1893.

72. 219. Gallinula galeata (Licht.) Florida Gallinule. A rare summer resident. Ranges over tropical America and temperate North America. Breeds in the Southern states, but chiefly in the Mississippi valley, between latitudes 40 and 50 . Snow, 1872, on authority of Baird.

73. 221. Fulica americana (Gmel.) American Coot. Summer resident, not uncommon where there are ponds. An abundant migrant. Ranges over the whole of North America, except the arctic regions, and south to the northern part of South America. Maximilian, 1839.

74. 223. Phalaropus lobatus (Linn.) Northern Phalarope. A rare migrant. Breeds in the arctic regions—Greenland, Iceland, Alaska, and the northern parts of Asia and Europe. South in winter to Central America. Goss, 1883. B. N. O. C., vol. VIII, p. 186.

75. 224. Phalaropus tricolor (Vieill.) Wilson's Phalarope. A rare summer resident; common in migration. Ranges north to the middle of the British provinces and south to Brazil. Breeds chiefly in the interior and north of Kansas. Colonel Goss found them nesting on Crooked creek in Meade county. Coues, 1865. Ibis, vol. I, second series.

76. 225. Recurvirostra americana (Gmel.) American Avocet. A rare summer resident in western Kansas. Common in migration throughout the state. In summer, ranges north to the borders of the arctic region, breeding from Texas

northward to the limits of its range, chiefly on the high interior plains. In winter it retires southward to the Central American states. Abert, 1848.

77. 226. Himantopus mexicanus (Müll.) Black-necked Stilt. A rare summer resident in western Kansas. Ranges in summer through the lower austral, upper austral, and transition zones, reaching the Canadian zone. Breeds chiefly in the interior parts of its range. Rare on both coasts, except in Florida. Winters southward to the equator. Seen by W. H. Gibson near Lakin, on the Arkansas river, June, 1881. Goss, 1886.

78. 228. Philohela minor (Gmel.) American Woodcock. An occasional summer resident; not uncommon in eastern Kansas during migration. Eastern United States, north to Canada, and west to the plains. Breeds throughout its range. At Manhattan, I have seen three specimens, in February or November, during a residence of nineteen years. Colonel Goss found them breeding near Neosho Falls in 1874. Snow, 1872.

79. 230. Gallinago delicata (Ord). Wilson's Snipe. Migratory; common. Ranges the whole of North America, breeding mainly north of latitude 42°. South in winter to central and northern South America. Snow, 1872.

80. 232. Macrorhamphus scolopaceus (Say). Long-billed Dowitcher. Migratory: common. North America, except the northeastern part. Breeds in the arctic zone. South in winter to northern South America. Snow, 1872, on authority of Brewer.

81. 233. Micropalama himantopus (Bonap.) Stilt Sandpiper. A rare migrant. Ranges over eastern North America to the Rocky mountains. South in winter to Brazil. Breeds in the far north. Taken at Lawrence, September, 1874, by Wm. Osburn. Also taken by Colonel Goss on several occasions. Snow, 1875.

82. 234. Tringa canutus (Linn.) Knot. Migratory; rare. A bird of wide range. In summer, found chiefly along the seacoasts of the northern hemisphere: in winter, nearly throughout the southern hemisphere. Breeds mostly in the arctic zone. Colonel Goss says: "Two specimens shot in the spring of the year, at Neosho Falls, by Col. W. L. Parsons, are the only ones to my knowledge captured or seen in the state." Birds of Kansas, p. 167. Snow, 1872. [?]

83. 239. Tringa maculata (Vieill.) Pectoral Sandpiper. Migratory; abundant. Ranges the greater part of America, but breeds chiefly in the arctic and Hudsonian zones. Coues, 1871.

84. 240. Tringa fuscicollis (Vieill.) White-rumped Sandpiper. A common migrant. Range and breeding area the same as the last named. Coues, 1865.

85. 241. Tringa bairdii (Coues). Baird's Sandpiper. Migratory; common. Ranges over the greater part of America, being more common in the interior parts. Breeds along the arctic shores, and retires south in winter to the Argentine Republic and Chili. Snow, 1872, on authority of Baird.

86. 242. Tringa minutilla (Vieill.) Least Sandpiper. Migratory: very common. Ranges over the whole of America, breeding in the arctic and Hudsonian zones. Snow, 1872.

87. 243a. Tringa alpina pacifica (Coues). Red-backed Sandpiper. A rare migrant. Ranges over the whole of North America and eastern Asia. Breeds in the arctic regions. First reported from Kansas by Snow, on authority of Dr. J. A. Allen; but Doctor Allen now writes me that he took this species only in

the Great Salt Lake valley, and not in Kansas. Colonel Goss met with it in this state, and reported it on his own authority. Goss, 1883.

88. 246. Ereunetes pusillus (Linn.) Semipalmated Sandpiper. A migrant: not common. A bird of the eastern United States, west to the Rocky mountains: south in winter to the West Indies and South America. Breeds in the arctic and Hudsonian zones. Coues, 1865.

89. 248. Calidris arenaria (Linn.) Sanderling. Migratory: very rare. A bird very widely distributed on both continents. Breeds in the arctic regions. Only one record of its occurrence in Kansas. Taken at Lawrence, October 7, 1874, by W. E. Stevens, and reported by Professor Snow, 1875.

90. 249. Limosa fedoa (Linn.) Marbled Godwit. Migratory: common. It inhabits nearly all of North America, breeding chiefly in the transition zone and northward. Winters southward to Cuba and Central America. Snow, 1872.

91. 251. Limosa hæmastica (Linn.) Hudsonian Godwit. Migratory: rare. Ranges over the greater part of America, but breeds in the arctic zone. Snow, 1872, on authority of Baird.

92. 254. Totanus melanoleucus (Gmel.) Greater Yellow-legs. A common migrant. Ranges over nearly the whole of America. Breeds mostly in the Hudsonian, Canadian and transition zones. Snow, 1872.

93. 255. Totanus flavipes (Gmel.) Yellow-legs. An abundant migrant. Ranges over North America. Breeds in the northern part of the transition zone and in the boreal zones. Occurs south in winter to the Argentine Republic. Snow, 1872.

94. 256. Helodromus solitarius (Wils.) Solitary Sandpiper. A common migrant. Ranges over temperate North America, breeding in the northern part. South in winter to Peru and Brazil. Baird, 1858.

95. 258a. Symphemia semipalmata inornata (Brewst.) Western Willet. Not common. Probably breeds in western Kansas. A western subspecies which ranges east to the Mississippi valley and south Atlantic states. Breeds throughout its United States range, but chiefly westward. Winters in Mexico. Snow, 1872. Reported as the Willet, the subspecies not having been recognized until recently.

96. 261. Bartramia longicauda (Bechst.) Bartramian Sandpiper. An abundant summer resident. Belongs to eastern and central North America, west to Utah. Winters south to the equator. Breeds from southern Kansas north to the edges of the arctic zone. Kelly, 1851.

97. 262. Tryngites subruficollis (Vieill.) Buff-breasted Sandpiper. A rare migrant. Inhabits all of North America, especially the interior. Breeds in the Arctic zone. Winters south to the Argentine Republic. Snow, 1872.

98. 263. Actitis macularia (Linn.) Spotted Sandpiper. A common summer resident: abundant in migration. Ranges throughout North America; breeding from the upper austral zone northward to the arctic coast. Winters in South America. Snow, 1872.

99. 264. Numenius longirostris (Wils.) Long billed Curlew. A rare summer resident: common in migration. Inhabits temperate North America: breeding from the Gulf of Mexico northward through the transition zone. Winters in Mexico, the West Indies, and Central America. Allen found it breeding in western Kansas. Abert, 1848.

100. 265. Numenius hudsonicus (Lath.) Hudsonian Curlew. A rare migrant.' Found in nearly all parts of America, breeding from the northern part of the United States to the arctic coast. Winters mostly south of the United States. Snow, 1872, on authority of Baird.

101. 266. Numenius borealis (Forst.) Eskimo Curlew. An abundant migrant, but rarely seen in fall migration. They belong rather to eastern North America, breeding far northward; south in winter to Patagonia. Allen, 1872, in American Naturalist. But Doctor Allen says that the record was made in error; consequently, the earliest authentic record of its occurrence in Kansas becomes Benson, 1874, Forest and Stream, vol. 2.

102. 270. Charadrius squatarola (Linn.) Black-bellied Plover. A rare migrant. They range over both continents, but mostly in the northern hemisphere. They breed in the far north and winter near the equator. Snow, 1872, on authority of Baird.

103. 272. Charadrius dominicus (Müll.) American Golden Plover. A common migrant. Range the greater part of America; breed in the arctic regions; winter south to Patagonia. Not common west of the Rocky mountains. Abert, 1848.

104. 273. Ægialitis vocifera (Linn.) Kill-deer. A common summer resident; abundant in migration. Inhabits all of temperate North America; breeding throughout this range. During the winter it retires south to the Gulf coast, California, Mexico, and beyond. Arrives from the south very early in the spring. Abert, 1848.

105. 274. Ægialitis semipalmata (Bonap.) Semipalmated Plover. Migratory; not very common. Ranges through all of North America, breeding far northward. Winters from California and the Gulf coast south to Brazil. Snow, 1872.

106. 277a. Ægialitis meloda circumcincta (Kidw.) Belted Piping Plover. Migratory; rare. They range over the Mississippi valley north to Winnipeg. Breed from Nebraska northward. Snow, 1872, on authority of Baird. Colonel Goss had no record of their actual capture in Kansas.

107. 278. Ægialitis nivosa (Cass.) Snowy Plover. A summer resident in southwestern Kansas. A western species, ranging north to northern California and east to Kansas, Oklahoma, and Texas. Winters in South America. Goss, 1886. Taken by him on the south line of Comanche county. "Auk," vol. III, p. 409.

108. 281. Ægialitis montana (Towns.) Mountain Plover. A common summer resident in the western half of the state. Belongs to western North America, ranging east to middle Kansas, Texas, and Dakota, and north to British America. Breeds on the plains. Winters in the southern United States and southward. Allen, 1872.

109. 289. Colinus virginianus (Linn.) Bob-white. Resident; abundant in the eastern half of the state and becoming more plentiful westward. A bird of the eastern United States, ranging west to Dakota, Kansas, and Texas. Say found them on the Arkansas river (Long's Report, 1823), but it is possible that his birds may have been the next form. Maximilian, 1839, and Parkman, 1849, reported them in eastern Kansas.

110. 289b. Colinus virginianus texanus (Lawr.) Texas Bob-white. Resident; possibly still occurs in southwestern Kansas. Inhabits northeastern Mex-

ico and western Texas, north to Kansas. The evidence of its occurrence in Kansas rests upon the two specimens in the United States National Museum, taken by Dr. Elliott Coues on the Republican river, May 27, 1864. Goss, "Birds of Kansas," 1891, p. 222. A. O. U. Check-list, 1886.

111. 300. Bonasa umbellus (Linn.) Ruffed Grouse. A resident in eastern Kansas before the settlements; now very rare. A pair wintered on Cedar creek, north of Manhattan, a few years since, but were shot by a farmer in the early spring. Snow, 1872.

112. 305. Tympanuchus americanus (Reich.) Prairie Hen. Formerly abundant and still moderately common in the middle section of the state. Decreasing in numbers, because of their wanton destruction by gunners, and more especially because of the annual burning of old pastures, when either the eggs or young birds are destroyed. These birds are migratory in the north, but in Kansas they do not move many miles from their breeding-grounds. Say, 1823.

113. 307. Tympanuchus pallidicinctus (Ridgw.) Lesser Prairie Hen. A rare resident in southern Kansas. This species has a limited range in Kansas, the Indian Territory, Oklahoma, and western Texas. A pair taken at Neosho Falls is in the Goss collection. Goss, 1883.

114. 308b. Pediœcetes phasianellus campestris (Ridgw.) Prairie Sharp-tailed Grouse. Resident in the western part of the state: common. This subspecies belongs to the plains and prairies east of the Rocky mountains. It ranges east almost to the Mississippi, north to the British possessions, and south to New Mexico. Allen, 1872.

115. 310a. Meleagris gallopavofera (Vieill.) Wild Turkey. An abundant resident of the state when first settled. It is now very rare, occurring only in the hilly parts of southwest Kansas. Found in the state by nearly all the early explorers. Pike, 1810; Lewis and Clarke, 1814; Say, 1823; Maximilian, 1839.

116. 315. Ectopistes migratorius (Linn.) Passenger Pigeon. A rare summer resident. Colonel Goss found them breeding occasionally in the Neosho valley. This species, once so abundant all over eastern North America, is now nearly extinct. Snow, 1872.

117. 316. Zenaidura macroura (Linn.) Mourning Dove. An abundant summer resident. Found in all of temperate North America, breeding throughout the United States, and retiring southward somewhat in winter. A few remain through the winter even in northern Kansas. Abert, 1848.

118. 325. Cathartes aura (Linn.) Turkey Vulture. Summer resident; abundant. Sometimes seen in winter. A widely distributed American bird, breeding from the northern limits of the transition zone south to Patagonia. Maximilian, 1839.

119. 326. Catharista urubu (Vieill.) Black Vulture. Summer resident: rare. It was undoubtedly common in the state before the settlement, and especially in the years when buffalo were slaughtered in large numbers. Parkman saw them in company with the turkey vulture. California and Oregon Trail, 1849. Seen at Chetopa, 1882, by Dr. Geo. Lisle. Taken at Ellis, March 27, 1885, by Dr. Lewis Watson.

120. 327. Elanoides forficatus (Linn.) Swallow-tailed Kite. An irregular summer resident of eastern Kansas. Rather common in the wooded parts of the lower austral zone, but rare in the upper austral. Retires southward in winter. Abert, 1848.

121. 329. Ictinia mississippiensis (Wils.) Mississippi Kite. A summer resident in southwest Kansas. Rare in the other parts of the state. Breeds in the lower austral zone. Occurs casually further north: south to Central America. Found breeding on the Medicine river, in Barber county, by Colonel Goss, in the spring of 1887. Snow, 1872, on authority of Baird.

122. 331. Circus hudsonius (Linn.) Marsh Hawk. A common resident. Probably the most abundant as well as the most useful of our hawks. Inhabits the whole of North America. South in winter to Panama. Breeds from the lower austral zone northward to the arctic zone. Maximilian, 1839.

123. 332. Accipiter velox (Wils.) Sharp-shinned Hawk. A rare winter sojourner; common in migration. Not positively known to breed in this state, although they have been found nesting in Texas. Breed chiefly in the transition zone and northward. South in winter to Panama. Snow, 1872.

124. 333. Accipiter cooperi (Bonap.) Cooper's Hawk. Resident; common in summer and found in winter. Range over all of temperate North America, wintering southward to southern Mexico. Breed in most of the wooded parts of the United States. Snow, 1872.

125. 334. Accipiter atricapillus (Wils.) American Goshawk. A rare winter visitant. Belongs to northern and eastern North America: west to the Rocky mountains. Breeds in the Canadian and Hudsonian zones. Snow, 1872.

126. 337. Buteo borealis (Gmel.) Red-tailed Hawk. A common resident. Belongs to eastern North America, extending westward to the plains. A beneficial hawk, as are all the Buteos. Abert, 1848.

127. 337a. Buteo borealis kriderii (Hoopes). Krider's Hawk. Probably a resident in western Kansas; rare. A bird of the plains, ranging from southern Texas to Minnesota. First taken in Kansas, near Wallace, October 12, 1883, by Colonel Goss, who reported it in the Auk, vol. 1, 1884, p. 100.

128. 337b. Buteo borealis calurus (Cass.) Western Red-tail. An irregular winter sojourner; usually rather common. Belongs to western North America, ranging eastward into Kansas and Missouri during the winter. Snow, 1872.

129. 337d. Buteo borealis harlani (Aud.) Harlan's Hawk. A rare visitant. There are specimens in the university museum and the Goss collection taken in the state. It has been captured at Manhattan, Lawrence, and Neosho Falls. Is probably more common than has been supposed, since it cannot easily be distinguished from the western red-tail and the rough-legged hawks when seen at a distance. Snow, 1872.

130. 339. Buteo lineatus (Gmel.) Red shouldered Hawk. A common resident in the eastern counties of the state. Ranges over eastern North America, from the Gulf to Nova Scotia, and westward to the edge of the plains. Snow, 1872.

131. 342. Buteo swainsoni (Bonap.) Swainson's Hawk. Resident; very rare in the eastern part of the state, not uncommon in middle Kansas, and common further west. A bird of western North America which sometimes ranges eastward to Illinois and Wisconsin. It occurs north to the limits of forests and south to the Argentine Republic. Snow, 1872.

132. 343. Buteo latissimus (Wils.) Broad-winged Hawk. A rare summer resident in eastern Kansas. Belongs to eastern North America, ranging north to Quebec and Manitoba, west to the edge of the plains, and south in winter nearly to the equator. Snow, 1872.

133. 347a. Archibuteo lagopus sanctijohannis (Gmel.) American Rough-legged Hawk. A common winter sojourner. Inhabits the whole of North America north of Mexico, but breeds chiefly north of the United States. Snow, 1872.

134. 348. Archibuteo ferrugineus (Licht.) Ferruginous Rough-leg. Resident; rather common in western Kansas, rare in the eastern part. Inhabits western North America, north to the Saskatchewan and south to Mexico; east to Iowa and Texas. Snow, 1875. Taken by Doctor Watson at Ellis, July, 1875. Colonel Goss found them breeding near Wallace, May 27, 1883.

135. 349. Aquila chrysaëtus (Linn.) Golden Eagle. A very rare resident; rather common as a winter sojourner. Occurs throughout the northern parts of the northern hemisphere: south on this continent to Mexico. Breeds mainly in the mountains. Maximilian, 1839.

136. 352. Haliaetus leucocephalus (Linn.) Bald Eagle. A rare resident; rather common in the winter. Inhabits all of North America, including Greenland and the Aleutian islands. Formerly its nests were not uncommon in Kansas. Say, 1823.

137. 354. Falco rusticolus (Linn.) Gray Gyrfalcon. An accidental winter visitor. A bird of the far north. The only specimen known from Kansas was taken near Manhattan, December 1, 1880, by Mr. A. L. Runyan. Reported by Doctor C. P. Blachly in Transactions Academy of Science, vol. VII, 1881, p. 105.

138. 355. Falco mexicanus (Schl.) Prairie Falcon. A rare resident; more frequent in the western part of the state. A western species which ranges east to the plains, casually to Illinois, and south into Mexico. Snow, 1872.

139. 356. Falco peregrinus anatum (Bonap.) Duck Hawk. Resident; not common. Its breeding range includes mainly the upper austral, transition, and Canadian zones. In winter it passes southward, even to southern South America. The birds noticed in Kansas during the winter are probably from the far north, and not the individuals that breed here. Allen found it nesting in Kansas. American Naturalist, vol. VI. Snow, 1872.

140. 357. Falco columbarius (Linn.) Pigeon Hawk. An uncommon migrant and winter sojourner. Colonel Goss shot a specimen at Neosho Falls as late as June 10. Ranges the whole of North America, breeding chiefly in north British America, but found nesting in many localities within the United States. Winters in the southern part of the United States and southward nearly to the equator. Snow, 1872.

141. 358. Falco richardsonii (Ridgw.) Richardson's Merlin. Rare in eastern Kansas; not uncommon in western Kansas; migratory. Ranges from the Mississippi river to the Pacific ocean and from Mexico to the arctic shores. More common in the interior. Snow, 1872, on authority of Baird.

142. 360. Falco sparverius (Linn.) American Sparrow Hawk. An abundant resident. Inhabits the whole of temperate North America, ranging south in winter to northern South America. The winter specimens in Kansas are probably birds that breed far to the north. Snow, 1872.

143. 364. Pandion haliaetus carolinensis (Gmel.) American Osprey. Summer resident; not common. Ranges North America in the breeding season from the lower austral zone to the edge of the arctic zone, south to South America in winter. Snow, 1872.

144. 365. Strix pratincola (Bonap.) American Barn Owl. Resident; rather common. Inhabits the greater part of the United States; more common in the South. Found also southward through Mexico. Nest usually in holes in the high, sandy banks of our rivers and creeks. Snow, 1872.

145. 366. Asio wilsonianus (Less.) American Long-eared Owl. A common resident. Is found in all of temperate North America: south into Mexico. Not many of the birds winter in Kansas. Snow, 1872.

146. 367. Asio accipitrinus (Pall.) Short-eared Owl. Resident; not common. Common in migration. Found over the whole American continent and in many parts of the eastern hemisphere. Breed from the Gulf states northward to within the arctic circle. Found nesting at Neosho Falls and at Beattie, in Kansas. Snow, 1872.

147. 368. Syrnium nebulosum (Forst.) Barred Owl. Resident: common. A bird of eastern North America, occurring north to New Brunswick and Manitoba, west to western Kansas, south to Georgia and northern Texas. Replaced westward by the form S. occidentale. Snow, 1872.

148. 372. Nyctale acadica (Gmel.) Saw-whet Owl. A winter sojourner; not rare. Ranges the United States and the southern part of the British provinces from the Atlantic to the Pacific; on the eastern coast, south to Pennsylvania; in the western mountains, south into Mexico. Breeds mainly in the northern part of its range, except in the mountains. Snow, 1872.

149. 373. Megascops asio (Linn.) Screech Owl. A very common resident. Belongs to the eastern part of temperate North America, south to Georgia, and west to the plains. Breeds throughout its range. Snow, 1872.

150. 375. Bubo virginianus (Gmel.) Great Horned Owl. A common resident. Inhabits eastern North America, west to the plains, south through eastern Mexico to Costa Rica. Snow, 1872.

151. 375a. Bubo virginianus subarcticus (Hoy). Western Horned Owl. A rare resident in western Kansas. Belongs to the western United States; north into British America, south over the higher plateaus of Mexico, and east to western Kansas and Texas. Taken by Colonel Goss, in Rawlins county, October 29, 1885, and reported by him in the Auk, vol. III, p. 112.

152. 376. Nyctea nyctea (Linn.) Snowy Owl. Winter sojourner; not very common except in the more severe winters. Belongs to the extreme north of both continents, moving southward in the winter. In North America it occurs as far south as the Carolinas and northern Texas. Snow, 1872.

153. 378. Speotyto cunicularia hypogæa (Bonap.) Burrowing Owl. Summer resident; abundant in the middle and western parts of the state. The birds may winter in southern Kansas, but in the northern part of the state they rarely appear in spring until the latter part of April. These owls are resident in the southern part of their range, which embraces the western part of North America from the northern United States southward to Guatemala. Say, 1823.

154. 382. Conurus carolinensis (Linn.) Carolina Paroquet. Formerly an abundant resident in the eastern parts of the state. Now extinct in Kansas. Still found in small flocks in southern Florida and the Indian territory. Abert, 1848.

155. 385. Geococcyx californicus (Less.) Road-runner. An occasional visitant in the western part of the state; may possibly breed. This bird belongs to

the western plains of the United States and to central and northern Mexico. Seen in southwest Kansas, in September, 1884, by Mr. Chas. Dyer. Goss, 1886. Auk, vol. III, p. 112.

156. 387. Coccyzus americanus (Linn.) Yellow-billed Cuckoo. A common summer resident. Habitat, eastern North America, west to the edge of the great plain, north to about latitude 47°, and south to Costa Rica. Winters in the southern part of this area. Breeds throughout its range as far south as Cuba. Baird, 1858.

157. 388. Coccyzus erythrophthalmus (Wils.) Black-billed Cuckoo. A summer resident, much less common than the last species. Belongs to eastern North America, north to Nova Scotia and Manitoba, west to the foot-hills of the Rocky mountains: south in winter to northern South America. Snow, 1872.

158. 390. Ceryle alcyon (Linn.) Belted Kingfisher. A common summer resident, sometimes remaining all the winter. Inhabits the whole of North America: south in winter to Panama and the West Indies. Say, 1823.

159. 393. Dryobates villosus (Linn.) Hairy Woodpecker. Resident; not uncommon. Inhabits the middle parts of the United States, from the eastern coast to the base of the Rocky mountains. Breeds throughout its range. Baird, 1858.

160. 394c. Dryobates pubescens medianus (Swains.) Downy Woodpecker. Resident: abundant. Inhabits the middle and northern parts of North America, from the Atlantic to the Rocky mountains; casually further west. Breeds throughout its range. Baird, 1858.

161. 402. Sphyrapicus varius (Linn.) Yellow-bellied Sapsucker. A rare migrant. Inhabits North America north and east of the Rocky mountains, breeding from the northern parts of the United States northward: ranges south in winter through the Southern states, Mexico, West Indies, and Guatemala. Snow, 1872, on authority of Brewer.

162. 402a. Sphyrapicus varius nuchalis (Baird). Red-naped Sapsucker. A rare migrant in western Kansas. The bird belongs to the Rocky mountains, from the northern boundary of the United States south into Mexico. Breeds in the mountains up to 12,000 feet. Colonel Goss met with this species near Wallace on two occasions, first in October, 1883. "Auk," vol. I, p. 100. Goss, 1884.

163. 405. Ceophlœus pileatus abieticola (Bangs). Pileated Woodpecker. Resident along heavily timbered streams, each year decreasing in numbers; rare. Belongs to the heavily wooded parts of the eastern United States and British provinces. Baird, 1858.

164. 406. Melanerpes erythrocephalus (Linn.) Red headed Woodpecker. A common summer resident. Belongs to the eastern United States, westward to the Rocky mountains and occasionally beyond. Breeds mostly in the northern part of this range and winters in the South. Abert, 1848.

165. 408. Melanerpes torquatus (Wils.) Lewis's Woodpecker. A casual visitor in western Kansas. Inhabits the western United States, east to the Black Hills and western Texas. Taken at Ellis by Doctor Watson. May 6, 1878: also taken in Finney county by Menke, April 23. 1893. Snow, 1878. Transactions Kansas Academy of Science, vol. VI, p. 38.

166. 409. Melanerpes carolinus (Linn.) Red-bellied Woodpecker. Resident; common. Inhabits the eastern United States to the base of the Rocky moun-

tains. Rare in Florida, southern Texas, and the New England states. Not migratory. Baird, 1858.

167. 412. Colaptes auratus luteus (Bangs). Flicker. Resident; common. Inhabits the eastern United States and British America; north to Hudson bay and west to the Rocky mountains; Alaska. Abert, 1848.

168. 413. Colaptes cafer (Gmel.) Red-shafted Flicker. Resident in western Kansas; common in winter throughout the state. A bird of the western United States, except the northwest coast and southern California; south into southern Mexico. Snow, 1873; Benson, 1874.

169. 417. Antrostomus vociferus (Wils.) Whippoorwill. A rare summer resident; common in the eastern counties in migration. Belongs to the eastern United States and British America, north to Nova Scotia and Manitoba, west to the plains; south in winter to Guatemala. Lewis and Clarke, 1814. Implied also in Goss's Narrative, 1809. Parkman, 1849.

170. 418. Phalænoptilus nuttalli (Aud.) Poor-will. A common summer resident. Inhabits the western United States, east into Iowa and Missouri; south into Mexico. Coues, 1865.

171. 418a. Phalænoptilus nuttalli nitidus (Brewst.) Frosted Poor-will. A summer resident; not rare. Taken at Neosho Falls, 1881, by Colonel Goss; also near Manhattan, where three fully identified sets of their eggs have been found. Goss, 1890. "Auk," vol. VII, p. 286.

172. 420. Chordeiles virginianus (Gmel.) Night Hawk. A common summer resident in the eastern half of the state; replaced in the western part by the next form. Its geographical range includes eastern North America, north to Hudson bay, west to the edge of the great plains; south in winter to the West Indies, Central America, and northeastern South America. Abert, 1848.

173. 420a. Chordeiles virginianus henryi (Cass.) Western Night Hawk. A comman summer resident in western Kansas. Belongs to the western United States; south in winter into Mexico. Coues, 1865. Ibis.

174. 423. Chætura pelagica (Linn.) Chimney Swift. Summer resident; abundant in eastern Kansas, and increasing in numbers westward. Belongs to eastern North America, north to Labrador and Manitoba, west to the edge of the plains; south in winter through Mexico. Snow, 1872.

175. 428. Trochilus colubris (Linn.) Ruby-throated Humming-bird. Summer resident; not common. Abundant in migration in eastern Kansas. Belongs to eastern North America, west to the plains, north to the Hudsonian zone; south in winter to Cuba and Mexico. Baird, 1858.

176. 443. Milvulus forficatus (Gmel.) Scissor-tailed Flycatcher. Summer resident in southern Kansas; common. Belongs to eastern Mexico and the southwestern United States (Texas, Indian Territory, Oklahoma, south Kansas, southern Missouri, etc.); south in winter to Costa Rica. The first authentic record for Kansas is its capture at Neodesha, May 13, 1875, by Colonel Goss. The specimens seen by Say on the Arkansas river were noted a short distance south of the Kansas line. The report by Snow, 1872, on authority of Baird, that this species was taken near Fort Riley by Doctor Coues was based upon some error. Doctor Coues writes me that he never saw a live scissor-tailed flycatcher anywhere. Snow, 1875.

177. 444. Tyrannus tyrannus (Linn.) Kingbird. An abundant summer resident. Belongs to temperate North America; not common west of the Rocky mountains. Ranges south in winter to the equator. Abert, 1848.

178. 447. Tyrannus verticalis (Say). Arkansas Kingbird. A common summer resident in the western half of the state. Belongs to the western United States, east to the eastern border of the great plains; south in winter to Guatemala. Snow, 1872, on authority of Brewer.

179. 452. Myiarchus crinitus (Linn.) Crested Flycatcher. An abundant summer resident in eastern Kansas. Inhabits the eastern United States and British America, to New Brunswick and Manitoba, west to the plains; south in winter to Costa Rica. Coues, 1871.

180. 456. Sayornis phœbe (Lath.) Phœbe. A common summer resident in eastern Kansas. Ranges over eastern North America, north to New Brunswick and Manitoba, west to eastern Colorado, south to Cuba and eastern Mexico. Winters from the Gulf coast southward. Abert, 1848.

181. 457. Sayornis saya (Bonap.) Say's Phœbe. Summer resident in western Kansas; common. A bird of the western United States, north to the Saskatchewan, east to Dakota and middle Kansas, south into middle Mexico. First taken in Kansas by Prof. E. A. Popenoe, July, 1875, in Rooks county. Snow, 1875.

182. 459. Contopus borealis (Swains.) Olive-sided Flycatcher. Summer resident; rare. In migration, not common. Belongs to northern North America. Ranges south in winter along the mountains to Costa Rica. Found breeding by Colonel Goss near Wallace, May 27, 1883. Snow, 1872, on authority of Brewer.

183. 461. Contopus virens (Linn.) Wood Pewee. A common summer resident in the wooded parts of the state. Belongs to eastern North America, ranging north to New Brunswick and Manitoba, west to the edge of the plains; south in winter through eastern Mexico to Panama. Coues, 1871.

184. 462. Contopus richardsonii (Swains.) Western Wood Pewee. A rare summer resident in western Kansas. Belongs to western North America, ranging north to British Columbia and Manitoba, east to Nebraska and Texas; south in winter to Costa Rica. This species was included in Snow's first and second editions, but evidently upon unsufficient evidence, for it was omitted from the third edition, 1875. Goss, 1883.

185. 465. Empidonax acadicus (Gmel.) Acadian Flycatcher. A summer resident in eastern Kansas; not rare in suitable localities. A bird of the eastern United States, ranging north to Manitoba, west to the plains, and south in winter to northern South America. Allen, 1872. Bull. Mus. Comp. Zoöl.

186. 466a. Empidonax pusillus traillii (Aud.) Traill's Flycatcher. Summer resident; not common. In migration, common. Inhabits eastern North America to the plains, north to Manitoba; south in winter nearly to the equator. Found breeding in Marshall county by Geo. F. Breninger. Snow, 1872.

187. 467. Empidonax minimus (Baird). Least Flycatcher. A common migrant in eastern Kansas. Its geographical range is eastern temperate North America, west to the base of the Rocky mountains; south in winter to Panama. Snow, 1872.

188. 474a. Otocoris alpestris leucolæma (Coues). Pallid Horned Lark. A winter sojourner; common during extremely cold weather. A northern race,

which is found so far south only in winter. Its inclusion on the Kansas list is based upon numerous specimens taken at Manhattan, and upon some Fort Riley specimens in the National Museum. Dwight, 1890. The Auk, vol. VII, p. 138.

189. 474b. Otocoris alpestris praticola (Hensh.) Prairie Horned Lark. Resident in eastern Kansas; common. Inhabits the upper Mississippi valley and region of the Great Lakes, west to central Dakota, Nebraska, and Kansas; south in winter nearly to the Gulf. Baird, 1858.

190. 474c. Otocoris alpestris arenicola (Hensh.) Desert Horned Lark. Resident in middle and western Kansas: common. Inhabits the great plains, Rocky mountains, and great basin, north into the British provinces, south to about latitude 34°. Goss, 1883.

191. 475. Pica pica hudsonica (Sab.) American Magpie. Once a rare resident; now a rare fall and winter visitant. Inhabits western North America, except California; north to Alaska, east to edge of the plains, south to Arizona. The evidence upon which Colonel Goss included it as a former resident is given in his catalogue, 1886, page 35. Doctor Allen says that he did not find this species breeding in Kansas, as reported by Snow in the second edition of his catalogue. Doctor Allen's record was for Colorado, and was inadvertently given by him as for Kansas. Snow, 1872.

192. 477. Cyanocitta cristata (Linn.) Blue Jay. Resident; abundant in summer, and hardly common in winter. Found in wooded portions of the state and about plantations; rare in western Kansas. Inhabits the eastern United States, except Florida, north to the Hudsonian zone, west to the plains. Winters from about latitude 40° southward to the Gulf. Abert, 1848.

193. 486. Corvus corax sinuatus (Wagl.) American Raven. Formerly a resident: now probably only a rare visitant in the state. A bird of the West, from British Columbia south to Guatemala. Say, 1823.

194. 487. Corvus cryptoleucus (Couch). White-necked Raven. A rare resident in western Kansas; common in late fall and winter, but decreasing in numbers as the settlements increase. Its geographical range includes the southwestern United States and northern Mexico; east to western Texas, Oklahoma, and Kansas; north to Colorado, southern Utah, and southern California. Breeds throughout its range. Taken by H. H. Wright, in Phillips county, July 28, 1875. Snow, 1875.

195. 488. Corvus americanus (Aud.) American Crow. An abundant resident in the timbered parts of the state. In winter, it sometimes collects in large roosts in eastern Kansas. Its geographical range includes the timbered sections of North America, from the Hudsonian zone to Mexico. Say, 1823.

196. 491. Picicorvus columbianus (Wils.) Clark's Nutcracker. An accidental visitant. The bird belongs to the mountainous coniferous forests of western North America, from Arizona north to Alaska. Their occurrence in Nebraska, Dakota, and Kansas is accidental. Taken near the south line of Marshall county, August 13, 1888, by Chas. Netz. Also taken on the Neosho river, October 9, 1891, by R. Evans (Collette). Goss, 1889. Auk, vol. VI, p. 123.

197. 492. Cyanocephalus cyanocephalus (Wied.) Piñon Jay. A rare visitant. Three specimens were captured near Lawrence by Stephens and Challis, October 23, 1875. A bird of the western mountains, ranging from British America south into Mexico. Snow, 1875.

198. 494. Dolichonyx oryzivorus (Linn.) Bobolink. A very rare summer resident; common in migration. Belongs to eastern North America, ranging north to the Hudsonian zone, west to the high plains; south in winter to South America. Say, 1823 (probably an error). Snow, 1872.

199. 495. Molothrus ater (Bodd.) Cowbird. An abundant summer resident. Breeds throughout the lower austral, upper austral, and transition zones. Ranges south in winter to southern Mexico. Say, 1823.

200. 497. Xanthocephalus xanthocephalus (Bonap.) Yellow-headed Blackbird. Summer resident; not uncommon in western Kansas; common throughout the state in migration. It ranges through western North America from the central Mississippi valley west to the Pacific coast; south into Mexico and Cuba. Probably nests in suitable localities—marshes—throughout its United States range. Maximilian, 1839.

201. 498. Agelaius phœnicius (Linn.) Red-winged Backbird. An abundant summer resident. Seen rarely in winter. Inhabits temperate North America, except western Mexico and the lower Colorado valley, north to Great Slave lake, south to Costa Rica. Baird, 1858.

202. 501. Sturnella magna (Linn.) Meadow-lark. Resident; abundant in the eastern part of the state. Inhabits eastern North America, north to Nova Scotia and Ontario, west to the plains. Breeds throughout this range. Abert, 1848.

203. 501b. Sturnella magna neglecta (Aud.) Western Meadow-lark. Resident; abundant in middle and western Kansas. The bulk of the species move southward in winter. A bird of western North America, north to British Columbia and Manitoba, east to Kansas and Nebraska, south to southern Mexico. Abert, 1848.

204. 506. Icterus spurius (Linn.) Orchard Oriole. An abundant summer resident. Belongs to the eastern United States, ranging west to the foot-hills of the Rocky mountains; south in winter to Panama. Baird, 1858.

205. 507. Icterus galbula (Linn.) Baltimore Oriole. A common summer resident. Ranges over eastern North America, north to New Brunswick and Manitoba, west to the foot-hills of the Rocky mountains; south in winter to Panama. Abert, 1848.

206. 508. Icterus bullocki (Swains.) Bullock's Oriole. Summer resident; extremely rare. Included in this list on the statement of Dr. S. W. Williston that he captured this species while collecting in western Kansas, the skins being given to the museum of Yale. This species has been included in all former catalogues of Kansas birds on the authority of Professor Snow's first list. Professor Snow included it in his third edition, 1875. on the authority of Doctor Williston, but did not so credit it. Meanwhile, the entire lack of authentic specimens taken in the state had made Colonel Goss and others reluctant to include the bird in catalogues. The record of its occurrence at Manhattan, in 1883, as given in Professor Cooke's Migration in the Mississippi Valley, was an error of identity, which was duly corrected; but in some manner it crept into the final report. This is a western species which sometimes ranges east to Dakota, Kansas, and western Texas; south in winter to central Mexico. I permit Snow, 1872, to stand.

207. 509. Scolecophagus carolinus (Müll.) Rusty Blackbird. A winter sojourner; rare except in the eastern counties. Belongs to eastern and northern

North America. Breeds over the greater part of British America (except British Columbia). South in winter to the Gulf of Mexico. Snow, 1872, on authority of Doctor Brewer.

208. 510. Scolecophagus cyanocephalus (Wagl.) Brewer's Blackbird. An occasional resident in western Kansas. Migratory throughout the state; common. Has been seen in winter. A western species; north to the Saskatchewan, east to Minnesota and Texas; south in winter to Mexico. Baird, 1858.

209. 511b. Quiscalus quiscula æneus (Ridgw.) Bronze Grackle. An abundant summer resident; occasional in winter. A bird of the Mississippi valley, north to Hudson's bay and the Saskatchewan, west to the Rocky mountains; south to the Gulf coast in winter; occasional east of the Alleghenies. Abert, 1848.

210. 514a. Coccothraustes vespertinus montanus (Ridgw.) Western Evening Grosbeak. A rare winter visitant. Belongs to western North America, north to British Columbia and the Saskatchewan, east to the eastern edge of the great plains. Breeds mainly in the north and in the mountains. Taken by Doctor Watson, at Ellis, in November, 1875. Snow, 1875.

211. 515. Pinicola enucleator canadensis (Cab.) Pine Grosbeak. A rare winter visitant. Inhabits the Hudsonian and Canadian zones of North America and the northern parts of the eastern hemisphere. South in winter through the transition zone, and casual in the upper austral zone. Snow, 1872, on authority of Doctor Brewer.

212. 517. Carpodacus purpureus (Gmel.) Purple Finch. A rare winter sojourner; common in eastern Kansas during migration. Inhabits eastern North America, north to Labrador and the Saskatchewan, west to the high plains; winters in the Southern states. Breeds in the transition zone and northward. Snow, 1872, on authority of Brewer.

213. 519. Carpodacus mexicanus frontalis (Say). House Finch. A rare resident. A specimen from a flock of fifteen was captured by Mr. H. W. Menke in Finney county, January 5, 1892. A western and southwestern species, which does not range far east of the foot-hills of the Rocky mountains, north to southern Wyoming, south into Mexico. Kellogg, 1894. Auk, vol. XI, p. 260.

214. 521. Loxia curvirostra minor (Brehm.) American Crossbill. A rare winter visitant; irregular. Widely distributed in North America, but chiefly east of the plains. Breeds in the transition zone and northward. Snow, 1872, on authority of Doctor Brewer.

215. 521a. Loxia curvirostra stricklandi (Ridgw.) Mexican Crossbill. Winter sojourner: irregular—some winters common. First taken at Lawrence, November 13, 1885, by Prof. L. L. Dyche. Taken also, during the same month, at Manhattan and Emporia. The geographical range of this subspecies includes Kansas, Colorado, New Mexico, Arizona, and the highlands of Mexico. Seen at Wallace, Kan., in July, by Prof. E. A. Popenoe. Dyche, 1886.

216. 522. Loxia leucoptera (Gmel.) White-winged Crossbill. A very rare winter visitant. Belongs to northern North America, breeding mostly in the boreal zones, but to some extent in the transition; south in winter to about latitude 38°. Snow, 1872, on authority of Brewer.

217. 528. Acanthis linaria (Linn.) Red-poll. A rare winter visitant. Seen at Neosho Falls in 1861 by Colonel Goss, and taken at Manhattan in 1881 by Dr.

C. P. Blachly. A far northern species, found in both hemispheres. In America it ranges south in winter into the northern and middle United States. Snow, 1875 (said to have been taken in Kansas by Mr. Trippe and by Professor Knox).

218. 529. Astragalinus tristis (Linn.) American Goldfinch. Resident; abundant in winter: common in summer. Belongs to the whole of temperate North America. Nests from southern Kansas northward. Maximilian, 1839.

219. 533. Spinus pinus (Wils.) Pine Siskin. An irregular winter sojourner; some winters abundant. Inhabits temperate North America. Breeds mainly in the transition zone. South in winter to the Gulf coast and the mountains of northern Mexico. Snow, 1872.

220. 534. Passerina nivalis (Linn.) Snowflake. A rare winter visitant. Inhabits northern North America, breeding in the arctic zone; south in winter to the northern United States; casually to Kansas and southern Illinois. Snow, 1872.

221. 536. Calcarius lapponicus (Linn.) Lapland Longspur. An abundant winter sojourner. Inhabits the arctic zone in summer; south in winter to about latitude 35°, chiefly east of the Rocky mountains. Baird, 1858.

222. 537. Calcarius pectus (Swains.) Smith's Longspur. A common winter sojourner in some parts of Kansas. Inhabits the interior of North America, breeding from northern Manitoba to the arctic coast, and passing southward in winter to Illinois and Texas. Snow, 1872, on authority of Baird.

223. 538. Calcarius ornatus (Towns.) Chestnut-colored Longspur. Resident in middle and northwest Kansas; common. In winter common over the entire state. Breeds from our latitude on the plains northward to Saskatchewan; south in winter to the high plateaus of Mexico. Allen, 1872.

224. 539. Rhyncophanes maccownii (Lawr.) McCown's Longspur. A winter sojourner in the western half of the state; common; occasional further east. Inhabits the great plains, breeding from northern Nebraska and Wyoming northward to the Saskatchewan; south in winter into western Texas and Mexico. Allen, 1872.

225. 540. Pooecetes gramineus (Gmel.) Vesper Sparrow. A rare summer resident; common in migration in eastern Kansas. Inhabits eastern North America north to Nova Scotia and the Saskatchewan, west to the plains. Breeds from Virginia, Kentucky and Kansas northward. Snow, 1872.

226. 542a. Ammodramus sandwichensis savanna (Wils.) Savanna Sparrow. Abundant in migration; sometimes winters in southeastern Kansas. Inhabits eastern North America, west to the plains, south in winter to the Gulf states. Breeds from about latitude 40° northward. Baird, 1858.

227. 542b. Ammodramus sandwichensis alaudinus (Bonap.) Western Savanna Sparrow. Migratory; not uncommon in the western part of the state. Probably breeds. A bird of western North America, east to Manitoba; south in winter to Mexico. Breeds from Colorado northward to the arctic. Reported breeding in western Texas (Lloyd). Goss, 1886. Taken by him in McPherson county, October 14, 1885.

228. 546. Ammodramus savannarum passerinus (Wils.) Grasshopper Sparrow. An abundant summer resident. Belongs to the eastern United States and southern Canada, west to the high plains; south in winter to the Gulf states, eastern Mexico, Cuba, etc. Baird, 1858.

229. 547. Ammodramus henslowii (Aud.) Henslow's Sparrow. A rare summer resident. Belongs to the eastern United States, north to southern New England and Ontario, west to the plains; winters in the southern United States. Baird, 1858. Taken by Professor Popenoe at Topeka, 1872.

230. 548. Ammodramus leconteii (Aud.) Leconte's Sparrow. A common migrant; occasionally winters in southern Kansas. A bird of the central plains, north to Manitoba; south in winter to Texas and the Gulf coast. Breeds from Dakota and Minnesota northward. First taken October 4, 1875, by W. H. Challis at Lawrence. Snow, 1875.

231. 549a. Ammodramus nelsoni (Allen). Nelson's Sparrow. A rare summer resident. A bird of the eastern United States, found chiefly in the interior. In migration it frequents the wet marsh lands of the Atlantic coast. Taken October 17, 1881, in McPherson county, by Colonel Goss. Allen, 1882, B. N. O. C., vol. VII, p. 55.

232. 552. Chondestes grammacus (Say). Lark Sparrow. An abundant summer resident. Inhabits the Mississippi valley, north to Manitoba, west to the plains, east to Indiana and Kentucky; south to the Gulf coast in winter. Baird, 1858.

233. 553. Zonotrichia querula (Nutt.) Harris's Sparrow. An abundant winter sojourner in eastern Kansas; rare in western Kansas. Ranges from the Mississippi river westward to the edge of the high plains, south to northern Texas, north to Manitoba, and northwest to the Rocky mountains. Breeding range not known. Taken by Audubon near Leavenworth in 1843. Baird, 1858.

234. 554. Zonotrichia leucophrys (Forst.) White-crowned Sparrow. Migratory; common. May rarely winter in southern Kansas. Ranges over the greater part of North America, breeding north and westward of the great lakes, and southward in the high mountain ranges of the great plateau. Winters in the Southern states and Mexico. Taken by Audubon near Leavenworth. Baird, 1858.

235. 554a. Zonotrichia leucophrys intermedia (Ridgw.) Intermediate Sparrow. Migratory; common. Migrates about two weeks later than Z. leucophrys. Belongs to western North America, from the plains to the Pacific, from Mexico to Alaska. Breeds in Alaska and the Mackenzie river basin, also southward in the mountains. First taken in the state at Manhattan, October 9, 1883, by D. E. Lantz; a few days later at Wallace, by Colonel Goss. Goss, 1884. Auk, vol. I, p. 100.

236. 558. Zonotrichia albicollis (Gmel.) White-throated Sparrow. A common migrant in eastern Kansas. Belongs to eastern temperate North America, breeding from the northern United States northward through the Canadian and Hudsonian zones, west to the plains, south to the Gulf coast. Noticed by Audubon near Leavenworth, 1843. Snow, 1872.

237. 559. Spizella monticola (Gmel.) Tree Sparrow. An abundant winter sojourner in eastern Kansas. Inhabits eastern North America, north to the edge of the arctic zone, west to the plains, south to the Gulf states. Breeds in the Canadian and Hudsonian zones. Baird, 1858.

238. 559a. Spizella monticola ochracea (Brewst.) Western Tree Sparrow. A winter sojourner in the western half of the state. Belongs to western North America. Ranges from Arizona and New Mexico to Alaska, breeding in the

northern part of its range and in the high mountains southward. Taken at Wallace, October 14, 1883, by Colonel Goss. Goss, 1887.

239. 560. Spizella socialis (Wils.) Chipping Sparrow. A common summer resident in eastern Kansas. A bird of eastern North America, west to the Rocky mountains, south to eastern Mexico. Breeds chiefly in the upper austral and transition zones. Snow, 1872.

240. 561. Spizella pallida (Swains.) Clay-colored Sparrow. Migratory; common throughout the state. Belongs to the interior of North America, from the Mississippi to the base of the Rocky mountains. Breeds from Dakota and Iowa northward to the Saskatchewan. Winters in Mexico. Coues, 1865.

241. 563. Spizella pusilla (Wils.) Field Sparrow. A common summer resident in eastern Kansas. Belongs to the eastern United States and southern Canada, west to the plains, south to the Gulf coast. Breeds throughout most of its range, but chiefly in the upper austral and transition zones. Baird, 1858.

242. 566. Junco aikeni (Ridgw.) White-winged Junco. A rare winter visitant in the western part of the state. A bird of the Rocky mountains in Colorado and Wyoming; casually east on the plains in winter to middle Kansas and Oklahoma. Taken November 8, 1875, at Ellis, by Doctor Watson. Snow, 1875.

243. 567. Junco hyemalis (Linn.) Slate colored Junco. An abundant winter sojourner. A bird of northern North America; south in winter to the Gulf and casually west of the plains. Breeds from Maine northward to the edge of the arctic zone, and southward in the higher Appalachian mountains. Baird, 1858.

244. 567a. Junco hyemalis oregonus (Towns.) Oregon Junco. A common winter sojourner. Belongs to the Pacific coast region, breeding from the higher mountains of southern California northward to Alaska. In winter it spreads eastward over the central part of the United States. Baird, 1858.

245. 578. Peucaea cassini (Woodh.) Cassin's Sparrow. A summer resident over the western half of the state; rather common. Ranges from central Kansas southward and westward through Texas, New Mexico, and Arizona, into northern Mexico. Allen, 1872.

246. 581. Melospiza fasciata (Gmel.) Song Sparrow. A not uncommon winter sojourner; common in migration; rare in western Kansas. Belongs to the eastern United States and British America, west to the foot-hills of the Rocky mountains. Breeds from about latitude 41° northward and southward in the Allegheny mountains. Snow, 1872.

247. 583. Melospiza lincolni (Aud.) Lincoln's Sparrow. A common migrant. Observed in Kansas by Audubon, 1843. Ranges over all of North America. Breeds in the transition zone and boreal regions; south in winter to Panama. Baird, 1858.

248. 584. Melospiza georgiana (Lath.) Swamp Sparrow. A rare winter sojourner in southeastern Kansas. In migration, common in the eastern part of the state: rare westward. Belongs to eastern North America; north to the Hudsonian zone, west to the plains, south to the Gulf coast. Breeds chiefly in the transition and Canadian zones. Snow, 1872.

249. 585. Passerella iliaca (Merr.) Fox Sparrow. A common winter sojourner in eastern Kansas; rare westward. Inhabits eastern North America, north to the edge of the arctic zone, west to the plains and Alaska. Winters in

the central and southern United States. Breeds in the Canadian and Hudsonian zones. Snow, 1872.

250. 585c. Passerella iliaca schistacea (Baird). Slate-colored Sparrow. A rare winter visitant in western Kansas. Belongs to the Rocky mountains and great basin, north to British America. Snow, 1873.

251. 587. Pipilo erythrophthalmus (Linn.) Towhee. Resident in eastern Kansas. Common in summer and not rare in winter. Belongs to the eastern United States, west to the plains; south in winter to the Gulf coast. Breeds chiefly in the upper austral and transition zones. Abert, 1848.

252. 588. Pipilo maculatus arcticus. (Swains.) Arctic Towhee. A winter sojourner: not rare: common in migration. A bird of the plains, north to the Saskatchewan, west to the foot-hills, east to eastern Kansas and Nebraska: south in winter to Texas. Breeds from Dakota northward. Benson, 1874.

253. 593. Cardinalis cardinalis (Linn.) Cardinal. Resident; common in the timbered parts of the state. Belongs to the eastern United States; rare north of latitude 41°: west to the plains. south to Gulf coast. Breeds throughout its range. Maximilian, 1839.

254. 595. Habia ludoviciana (Linn.) Rose-breasted Grosbeak. Summer resident in eastern Kansas: common and increasing in numbers from year to year. A bird of eastern North America: north to Nova Scotia and the Saskatchewan, west to the plains, and south in winter nearly to the equator. Breeds in the upper austral, transition, and Canadian zones. Snow, 1872.

255. 596. Habia melanocephala (Swains.) Black-headed Grosbeak. A summer resident in the western half of the state; common. Inhabits the western United States, east to middle Nebraska, Kansas, and Texas; south in winter into Mexico. Breeds from the Mexican border northward. Allen, 1872.

256. 597. Guiraca cærulea (Linn.) Blue Grosbeak. A common summer resident in middle Kansas. A southern species, ranging in summer through the upper and lower austral zones, west to eastern Colorado and western Texas; south in winter to Cuba and southeastern Mexico. Breeds throughout its United States range. Snow, 1875, on authority of Doctor Watson, of Ellis.

257. 598. Cyanospiza cyanea (Linn.) Indigo Bunting. A common summer resident in eastern Kansas; rarer westward. Belongs to the eastern United States; north into Canada, west to the plains; south to Cuba, eastern Mexico, and Central America. Breeds chiefly in the upper austral and transition zones. Maximilian, 1839.

258. 599. Cyanospiza amœna (Say). Lazuli Bunting. A rare summer resident in western Kansas. Inhabits the western United States, east to the plains; south in winter into Mexico. Breeds throughout its range in the United States. Snow, 1872, on authority of Doctor Brewer.

259. 601. Cyanospiza ciris (Linn.) Painted Bunting. Summer resident in southern Kansas. Common in the gypsum hills and along timbered streams. Belongs to the south Atlantic and Gulf states; south in winter to Panama. Breeds chiefly in the lower austral zone. Taken by Colonel Goss in Comanche county, May, 1885, and reported by him in the Auk, vol. II, p. 274.

260. 604. Spiza americana (Gmel.) Dickcissel. An abundant summer resident in eastern Kansas; not common in the western part. Belongs to the eastern United States; north to New England and Dakota, west to the Rocky

Mountains, south to northern South America. Breeds chiefly north of the Gulf states. Baird, 1858.

261. 605. Calamospiza melanocorys (Stejn.) Lark Bunting. Summer resident; common in western Kansas. Found by Doctor Hoy near the eastern line of the state in 1854. A bird of the plains, from western Minnesota, middle Nebraska, Kansas, and Texas, west to the mountains. In winter, southwest to Mexico, Arizona, and southern California. Breeds from middle Kansas northward to southern Assiniboia. Hoy, 1864.

262. 607. Piranga ludoviciana (Wils.) Louisiana Tanager. A rare visitant to western Kansas during migration. Inhabits the western United States, from the high plains west to the Pacific; south to Mexico, in winter to Guatemala. Breeds in the mountains. Taken at the mouth of the Saline river by F. S. Benson, 1874; also taken in Finney county in 1893 by H. W. Menke. Benson, 1874.

263. 608. Piranga erythromelas (Vieill.) Scarlet Tanager. A common summer resident in the wooded parts of the state. Inhabits eastern North America, north to Canada and Manitoba, west to the plains; south in winter to the equator. Breeds throughout its United States range. Coues, 1871.

264. 610. Piranga rubra (Linn.) Summer Tanager. A summer resident; common in southeastern Kansas. Belongs to the eastern United States, north to latitude 40°; south in winter through eastern Mexico to northern South America. Breeds throughout its United States range. Snow, 1872, on authority of Baird.

265. 611. Progne subis (Linn.) Purple Martin. An abundant summer resident. Belongs to the whole of temperate North America; south in winter to southern Mexico. Breeds throughout the austral zones. Baird, 1858.

266. 612. Petrochelidon lunifrons (Say). Cliff Swallow. Summer resident; common in some localities. Ranges over nearly all of North America; south in winter to Brazil and Paraguay. Breeds from northern Mexico to the arctic zone. Snow, 1872.

267. 613. Hirundo erythrogaster (Bodd.) Barn Swallow. Summer resident; once rare, now abundant. Ranges North America in general, but breeds chiefly in the settled parts north of the Gulf states; south in winter to South America. Snow, 1872, on authority of Brewer.

268. 614. Tachycineta bicolor (Vieill.) Tree Swallow. A rare summer resident; common in migration. Ranges the whole of North America, wintering from the Gulf states southward to Panama. Breeds from Kentucky and Kansas northward to the arctic zone. Abert, 1848. Noticed by Audubon near Fort Leavenworth, 1843.

269. 616. Clivicola riparia (Linn.) Bank Swallow. An abundant summer resident. Inhabits the northern hemisphere; in America, south to the equator. Breeds in the United States and northward. Winters south of the United States. Fremont, 1845.

270. 617. Stelgidopteryx serripennis (Aud.) Rough-winged Swallow. A common summer resident. Inhabits the United States in summer, except the northern parts and much of New England; south in winter to Panama. Breeds chiefly in the two austral zones. Baird, 1858.

271. 618. Ampelis garrulus (Linn.) Bohemian Waxwing. A rare winter visitant. Belongs to the boreal regions of both hemispheres. Breeds in the far

north: wanders south in winter irregularly to the middle parts of the United States. Taken by Doctor Hammond, at Fort Riley; by Wm. Wheeler, at Ottawa, November, 1875; and three specimens from a large flock, by D. E. Lantz, at Manhattan, December 6, 1879. Baird, 1858.

272. 619. Ampelis cedrorum (Vieill.) Cedar Waxwing. Resident; rare. In migration irregular, but usually common. In summer it ranges over the greater part of North America: south in winter to Central America. Breeds throughout its summer range, but chiefly north of latitude 40°. Snow, 1872.

273. 621. Lanius borealis (Vieill.) Northern Shrike. A rather common winter sojourner throughout the state. Belongs to northern North America; south in winter to the middle United States. Snow, 1872.

274. 622. Lanius ludovicianus (Linn.) Loggerhead Shrike. A rare visitor from the south. The geographical range usually given to this species is Florida, the Carolinas, and the Gulf states east of Texas. Ridgway contends that it regularly occurs as far north as southern Illinois. The only record for Kansas is Snow, 1872, who says: "Several typical specimens of this southern form have been taken."

275. 622a. Lanius ludovicianus excubitorides (Swains.) White-rumped Shrike. Summer resident: common. Belongs to the central United States, north to Assiniboia; southwesterly to Lower California and the table lands of Mexico. Rare east of the Alleghenies. Snow, 1872.

276. 624. Vireo olivaceus (Linn.) Red-eyed Vireo. Summer resident: common along our wooded streams. Belongs chiefly to the eastern part of the austral region, west to the Rocky mountains; south in winter to northern South America. Maximilian, 1839.

277. 627. Vireo gilvus (Vieill.) Warbling Vireo. Summer resident; common in eastern Kansas. Found along streams, in parks, orchards, and other plantations. Inhabits North America from Mexico to the Hudsonian zone, breeding from the lower austral zone northward. Coues, 1871.

278. 628. Vireo flavifrons (Vieill.) Yellow-throated Vireo. Summer resident in eastern Kansas; not so common as either of the two species already mentioned. A bird of the eastern United States and southern Ontario, west to the plains: south in winter to Costa Rica. Breeds from the southern edge of the lower austral zone northward through its range. Snow, 1872.

279. 629. Vireo solitarius (Wils.) Blue-headed Vireo. A rare migrant. Belongs to eastern North America, north to Hudson bay and Great Slave lake, west to the plains; south in winter to Guatemala. Breeds chiefly north of the United States. Snow, 1872, on authority of Baird.

280. 630. Vireo atricapillus (Woodh.) Black-capped Vireo. A common summer resident in the gypsum hills in southern Kansas. Inhabits the southern part of the great plains, north into southern Kansas; south in winter into Mexico. Taken in Comanche county, May 11, 1885, by Colonel Goss. Goss, 1885. Auk, vol. II, p. 274.

281. 631. Vireo noveboracensis (Gmel.) White-eyed Vireo. A common summer resident in eastern Kansas. Belongs to the eastern United States; west to the plains; south in winter to Guatemala. Resident in the Bermudas. Breeds throughout its United States range. Coues, 1871.

282. 633. Vireo bellii (Aud.) Bell's Vireo. An abundant summer resident. Inhabits the middle parts of the United States, from Illinois and Minnesota west to the foot-hills: south in winter to southern Mexico. Breeds from Texas northward in its range. Named after Bell, one of Audubon's hunters, who discovered it near Leavenworth in 1843. Baird, 1858.

283. 636. Mniotilta varia (Linn.) Black and White Warbler. Summer resident in eastern Kansas: rare; common in migration. Inhabits eastern North America, north to Hudson's Bay, west to the plains: south in winter to Central America. Breeds from the Gulf coast northward. Snow, 1872.

284. 637. Protonotaria citrea (Bodd.) Prothonotary Warbler. Summer resident: common along wooded streams in eastern Kansas. Belongs to the eastern United States, but chiefly to the Mississippi valley: north to Illinois, Iowa, and Nebraska, casually to Minnesota and Ontario: west to the plains: south to Cuba and Central America. Breeds throughout its United States range. Snow, 1872.

285. 639. Helmitherus vermivorus (Gmel.) Worm-eating Warbler. A rare summer resident in eastern Kansas. Belongs to the eastern United States; north through the upper austral zone, west to western Nebraska and Texas, south to the West Indies and Panama. Breeds in the upper and lower austral zones. Taken at Lawrence, May 6, 1873, by Miss Yeagley. Snow, 1874.

286. 641. Helminthophila pinus (Linn.) Blue-winged Warbler. Summer resident in eastern Kansas: rare; common in migration. Ranges through the eastern United States, north to New England, the Great Lakes, and Minnesota, west to middle Nebraska and Texas: south in winter to Guatemala. Breeds in the United States. Allen, 1872.

287. 645. Helminthopila ruficapilla (Wils.) Nashville Warbler. Migratory; not common. Belongs to eastern temperate North America, west to the great plains; south in winter to Gautemala. Breeds from the northern United States northward. Allen, 1872.

288. 646. Helminthopila celata (Say). Orange-crowned Warbler. A common migrant. Belongs to northern North America: rare in the northeastern United States: common in the Middle states and the Mississippi valley: winters in the Southern states and eastern Mexico. Breeds from Assiniboia northward to the arctic. Snow, 1872, on authority of Brewer.

289. 647. Helminthophila peregrina (Wils.) Tennessee Warbler. A common migrant in eastern Kansas. Belongs to eastern temperate North America, west to the foot-hills of the Rocky mountains: rare east of the Alleghenies: south in winter to northern South America. Breeds from the northern United States northward to Great Slave lake. Snow, 1872, on authority of Brewer.

290. 648. Compsothlypis americana (Linn.) Parula Warbler. A rare summer resident in eastern Kansas: common in migration. Inhabits eastern North America, north to Canada, west to the foot-hills: south in winter to Panama. Breeds from the Gulf states northward, chiefly north of latitude 40 . Allen, 1872.

291. 652. Dendroica æstiva (Gmel.) Yellow Warbler. Summer resident: abundant in the eastern part of the state, less common westward. Belongs to the whole of North America. Breeds from northern Mexico northward into the arctic zone. Winters south into South America. Baird, 1858.

292. 654. Dendroica cærulescens (Gmel.) Black-throated Blue Warbler. A rare migrant. Some doubt has existed as to the propriety of including this spe-

cies in Kansas lists. Snow included it in his second edition on authority of Baird. Goss omitted it from all the editions of his catalogue. Doctor Hoy found it near the Kansas line in western Missouri. In the absence of authentic earlier specimens, we have the record of its capture in Finney county, October 17, 1891, by H. W. Menke, so that there is a strong probability that the Baird record is correct. Snow, 1872, on authority of Baird.

293. 655. Dendroica coronata (Linn.) Myrtle Warbler. A rare winter sojourner; common in migration. Inhabits all of North America, but chiefly east of the Rocky mountains. Breeds from the northern United States northward to the arctic zone. Ranges from the middle United States southward to Panama in winter. Baird, 1858.

294. 656. Dendroica auduboni (Towns.) Audubon's Warbler. A rather common migrant in western Kansas. Inhabits western North America, north to British Columbia, east to central Kansas and Texas, south to Guatemala. Breeds in the mountains throughout its United States range. Goss, 1883. B. N. O. C., vol. VIII, p. 186.

295. 657. Dendroica maculosa (Gmel.) Magnolia Warbler. A rare migrant. Inhabits eastern North America, north to Hudson's bay, west to the foot-hills of the Rocky mountains; south in winter to Costa Rica and the West Indies. Breeds north of the United States. Taken in Marshall county by W. J. McLaughlin. Snow, 1874.

296. 658. Dendroica cærulea (Wils.) Cerulean Warbler. A common summer resident in eastern Kansas. Belongs to the eastern United States and southern Canada, west to the plains; south in winter to Panama. Breeds from the Gulf northward, chiefly in the interior. Allen, 1872.

297. 659. Dendroica pennsylvanica (Linn.) Chestnut-sided Warbler. A rare migrant. Belongs to eastern North America, north to Canada, west to the plains; south in winter to Panama. Breeds in the northern part of the upper austral and in the transition zones. Taken at Leavenworth, in May, 1871, by Prof. J. A. Allen, and at Topeka, May 2, 1873, by Prof. E. A. Popenoe. Snow, 1872, on authority of Brewer.

298. 661. Dendroica striata (Forst.) Black-poll Warbler. A common migrant. Belongs to eastern and northern North America, north to the arctic, west to the Rocky mountains and Alaska, south to Panama. Breeds from northern New England northward and westward. Snow, 1874.

299. 662. Dendroica blackburniæ (Gmel.) Blackburnian Warbler. A rare migrant. Belongs to eastern temperate North America, west to the plains, south to South America. Breeds from the northern United States northward to the Hudsonian zone. Allen, 1872.

300. 663a. Dendroica dominica albilora (Baird). Sycamore Warbler. A rare summer resident in eastern Kansas. Ranges through the Mississippi valley in summer, north to northern Illinois, west to eastern Kansas and Texas; south in winter to Guatemala. Breeding range not well known. Snow, 1872, on authority of Brewer.

301. 667. Dendroica virens (Gmel.) Black-throated Green Warbler. Migratory; not very common. Belongs to eastern temperate North America, west to the plains; south in winter to Panama. Breeds from the northern United States northward. Snow, 1872, on authority of Baird.

302. 671. Dendroica vigorsii (Aud.) Pine Warbler. A rare migrant. Ranges over eastern North America, north to Canada and Manitoba, west to the plains; south to the Gulf states, Bahamas, and Bermudas. Breeds nearly throughout its range. Goss, 1883.

303. 672. Dendroica palmarum (Gmel.) Palm Warbler. A rare migrant in eastern Kansas. Inhabits the interior of North America, north to Great Slave lake, east to the Alleghenies, south to the Gulf coast, west to the plains. Breeds north of the United States. Taken at Topeka, May 8, 1875, by Prof. E. A. Popenoe. Snow, 1875.

304. 673. Dendroica discolor (Vieill.) Prairie Warbler. A rare summer resident in eastern Kansas. Belongs to the eastern United States, north to southern New England and Michigan, west into Nebraska and Kansas, south to Florida and the West Indies. Breeds throughout its United States range. Allen, 1872.

305. 674. Seiurus aurocapillis (Linn.) Oven-bird. Summer resident in eastern Kansas; not rare. Common in migration. Inhabits eastern North America, north to Hudson bay and Alaska, west to the foot-hills of the Rocky mountains; south in winter to the West Indies and Central America. Breeds from southern Kansas and Virginia northward. Coues, 1871.

306. 675a. Seiurus noveboracensis notabilis (Grinn.) Grinnell's Water-thrush. A rare migrant. A bird of western North America, chiefly found in the interior, east into the Mississippi valley, north to the arctic regions; south in winter to Guatemala. Breeding range not known. Snow, 1872, on authority of Baird.

307. 676. Seiurus motacilla (Vieill.) Louisiana Water-thrush. A common summer resident in eastern Kansas. Inhabits the eastern United States, north to southern New England and Minnesota, west to the edge of the plains. Winters in the Gulf states, West Indies, Mexico, and Central America. Breeds througout its United States range. Snow, 1872.

308. 677. Geothlypis formosa (Wils.) Kentucky Warbler. A common summer resident in eastern Kansas. Belongs to the eastern United States, mostly west of the Alleghenies, north to southern New England and Wisconsin, west to the plains; south in winter to the West Indies and Central America. Breeds in all its United States range. Baird, 1858.

309. 679. Geothlypis philadelphia (Wils.) Mourning Warbler. A rare migrant. Belongs to eastern North America, west to the plains; south in winter to Panama. Breeds in the transition zone and northward. Allen, 1872.

310. 681a. Geothlypis trichas occidentalis (Brewst.) Western Yellow-throat. A common summer resident in parts of the state. Belongs to the western United States, east to the Mississippi river, north to British America; south to Guatemala. Breeds in its United States range. Snow, 1872.

311. 683. Icteria virens (Linn.) Yellow-breasted Chat. Summer resident in eastern Kansas; abundant. Belongs to the eastern United States, north to southern New England, Ontario, and Minnesota, west to the edge of the plains; south in winter to Guatemala. Breeds throughout its United States range. Baird, 1858.

312. 683a. Icteria vireus longicauda (Lawr.) Long-tailed Chat. Summer resident in western Kansas; not uncommon. Inhabits the western United

States, east to the eastern edge of the great plains: south into Mexico. Breeds in its United States range. Taken by Dr. S. W. Williston, on the Smoky Hill river in western Kansas, May, 1877. Snow, 1878.

313. 684. Wilsonia mitrata (Gmel.) Hooded Warbler. Summer resident in eastern Kansas; not common. Habitat, the eastern United States, north to Connecticut, New York, and Iowa, west to eastern Nebraska, Kansas, and Texas; south to the West Indies and Central America. Breeds in its United States range. Maximilian, 1839. Also observed in Kansas by Audubon and Allen.

314. 685. Wilsonia pusilla (Wils.) Wilson's Warbler. A common migrant. Inhabits eastern and northern North America, north to Hudson bay and Alaska, west beyond the Rocky mountains: south in winter to Panama. Breeds from the northern United States northward, and southward along the high Rocky mountains. Snow, 1872, on authority of Brewer.

315. 686. Wilsonia canadensis (Linn.) Canadian Warbler. A rare migrant in eastern Kansas. Belongs to eastern North America, north to Newfoundland, southern Labrador, and Lake Winnipeg, west to Minnesota, eastern Nebraska, and Texas: south in winter nearly to the equator. Breeds from Wisconsin and Massachusetts northward. Goss, 1881.

316. 387. Setophaga ruticilla (Linn.) American Redstart. A common summer resident in eastern Kansas; abundant in migration. Range about the same as that of Wilson's warbler. Breeds from the Gulf states northward. Baird, 1858.

317. 697. Anthus pensylvanicus (Lath.) American Pipit. A common migrant. Inhabits all of North America. Breeds from Labrador to the arctic coast: also above timber line in the mountains. Winters from the Gulf states southward to Guatemala. Snow, 1872.

318. 700. Anthus spragueii (Aud.) Sprague's Pipit. Migratory; rare in eastern Kansas, common in the western part of the state. Belongs to the interior plains of North America, east to eastern Nebraska and Kansas, north to the Saskatchewan, south to southern Mexico. Breeds from central Dakota northward. Goss, 1883.

319. 703. Mimus polyglottis (Linn.) Mocking-bird. A common summer resident. Inhabits the United States, north to Massachusetts and southern Iowa. Breeds throughout its United States range. Retires southward in winter to southern Mexico. Abert, 1848.

320. 704. Galeoscoptes carolinensis (Linn.) Catbird. Summer resident; common. Abundant in the eastern part of the state. Inhabits eastern North America, north through the transition zone, west beyond the Rocky mountains, south to Panama. Breeds from the Gulf coast northward. Abert, 1848.

321. 705. Harporhynchus rufus (Linn.) Brown Thrasher. Summer resident: abundant. Its numbers in the west are limited by the sparseness of timber and other plantations; increasing. Has about the same summer range as the catbird. Winters from the Gulf coast northward to about latitude 37°. Abert, 1848.

322. 715. Salpinctus obsoletus (Say). Rock Wren. Summer resident in middle and western Kansas; not uncommon. Has been observed in Morris and Riley counties. Belongs to the arid regions of the western United States, north to British Columbia, east to middle Kansas and Texas; south through Mexico to

Guatemala. Breeds throughout its range. Taken in Rooks county, July 5, 1875, by E. A. Popenoe. Snow, 1875.

323. 718. Thryothorus ludovicianus (Lath.) Carolina Wren. Resident in eastern Kansas. Once abundant, but fast becoming rare. Belongs to the eastern United States, north to New England and Nebraska, west to the plains, south into northeastern Mexico. Breeds and winters nearly throughout its range. Baird, 1858.

324. 719. Thryomanes bewickii (Aud.) Bewick's Wren. A very rare summer resident. Belongs to the eastern United States, north to New Jersey and Minnesota, west to eastern Nebraska and Texas, wintering in the Southern states. Breeds throughout its range. Snow, 1872, on authority of Doctor Brewer.

325. 719b. Thryomanes bewickii leucogaster (Salv. and Godw.) Baird's Wren. Resident in middle southern Kansas; summer resident to the north line of the state. Belongs to the southwestern United States and northeastern Mexico. Breeds throughout its range. Goss, 1886.

326. 721b. Troglodytes aëdon azteeus (Baird). Western House Wren. A common summer resident. Belongs to the western United States, except the Pacific coast, east to Illinois; south to Vera Cruz, Mexico. Breeds throughout its United States range. Snow, 1872.

327. 722. Anothura hiemalis (Vieill.) Winter Wren. A rare winter sojourner. Belongs to eastern North America, west to the Rocky mountains, south into the Gulf states. Breeds from the northern United States northward, and winters south of its breeding range. Snow, 1872, on authority of Baird.

328. 724. Cistothorus stellaris (Licht.) Short-billed Marsh Wren. A rare summer resident. Belongs to the eastern United States and southern Canada, west to the plains. Breeds chiefly north of the latitude of Kansas. Winters in the Gulf states. Snow, 1872.

329. 725. Cistothorus palustris (Wils.) Long-billed Marsh Wren. A rare summer resident; more common in migration. Belongs to temperate eastern North America, west to the Rocky mountains. Winters in the Gulf states. Breeds throughout its range. Snow, 1872.

330. 726. Certhia familiaris fusca (Barton). Brown Creeper. A common winter sojourner in wooded sections of Kansas. Belongs to eastern North America, west to the plains, south into the Gulf states. Breeds from the northern United States northward. Snow, 1872.

331. 727. Sitta carolinensis (Lath.) White-breasted Nuthatch. Resident; common in wooded parts of the state. Inhabits the eastern United States and southern British America, west to the Rocky mountains. Resident and breeding throughout its range. Baird, 1858.

332. 728. Sitta canadensis (Linn.) Red-breasted Nuthatch. A rare migrant; possibly a winter sojourner. Belongs in summer to the Hudsonian, Canadian and transition zones. Ranges in winter also over the upper and lower austral zones. Two specimens seen in twenty years at Manhattan. Snow, 1872, on authority of Baird.

333. 731. Parus bicolor (Linn.) Tufted Titmouse. Resident; abundant in wooded parts of the state. Inhabits the eastern United States, north to

Nebraska and New Jersey, west to the edge of the plains, south to the Gulf coast. Resident throughout this range. Baird, 1858.

334. 735. Parus atricapillus (Linn.) Chickadee. Resident; common in eastern Kansas. Inhabits eastern North America, north to the Arctic regions, west to the plains, south to Pennsylvania and southern Missouri. Resident throughout its range.

335. 735a. Parus atricapillus septentrionalis (Harris). Long-tailed Chickadee. Resident; common throughout the state where there is timber. In the eastern part the last form predominates; in middle Kansas this form is more common. Inhabits the Rocky Mountain region, north to the Hudsonian zone, west to the great basin, east into Missouri, south to New Mexico. Breeds throughout this range. Baird, 1858.

336. 748. Regulus satrapa (Licht.) Golden-crowned Kinglet. A rare winter sojourner; common in migration. Belongs to eastern and northern North America. Breeds from the extreme northern United States northward. Winters in the eastern United States and southward to Guatemala. Snow, 1892, on authority of Brewer.

337. 749. Regulus calendula (Linn.) Ruby-crowned Kinglet. An occasional winter sojourner; very common in migration. Ranges over nearly the whole of North America, north to the arctic coast, south to Guatemala. Breeds in the higher mountains from Arizona northward, and in boreal America. Snow, 1872.

338. 751. Polioptila cærulea (Linn.) Blue-gray Gnatcatcher. A common summer resident in eastern Kansas; in migration found throughout the state. Inhabits the United States, chiefly south of about latitude 40°. Winters in the Gulf states and southward to Guatemala and the West Indies. Breeds from Cuba northward through its range. Baird, 1858.

339. 754. Myiadestes townsendii (Aud.) Townsend's Solitaire. An occasional fall and winter visitant from the west. Belongs to the mountain regions of the western United States, north to British Columbia, east to Dakota, Kansas, and Texas. Taken at Ellis, October 27, 1875, by Doctor Watson. Two records for Manhattan. Snow, 1875.

340. 755. Hylocichla mustelina (Gmel.) Wood Thrush. An abundant summer resident, rapidly extending its range westward as orchards and plantations increase. Belongs to the eastern United States, north to Massachusetts, Ontario, and Wisconsin, west to the plains; south in winter to Cuba and Guatemala. Breeds throughout its United States range. Snow, 1872.

341. 756. Hylocichla fuscescens (Steph.) Wilson's Thrush. A rare migrant in eastern Kansas. Belongs to the eastern United States and Canada; north to Newfoundland and Manitoba, west to the plains, south to the Gulf states and the West Indies. Breeds from about latitude 41° northward. Snow, 1872, on authority of Brewer.

342. 757. Hylocichla aliciæ (Baird). Gray-cheeked Thrush. Migratory; not uncommon. Belongs to eastern and northern North America, west to the Rocky mountains, Alaska, and eastern Siberia. Winters south of the United States to Panama. Breeds chiefly in the Hudsonian and arctic zones. Goss, 1883.

343. 758a. Hylocichla ustulata swainsonii (Cab.) Olive-backed Thrush. A common migrant. Inhabits eastern North America, north to the arctic zone,

west to the western base of the Rocky mountains, and northwest to Alaska: south in winter to northern South America. Breeds north of the United States, except in the high mountains southward. Baird, 1858.

344. 759b. Hylocichla unalaskæ pallasii (Cab.) Hermit Thrush. Migratory; rare. Inhabits eastern North America, north to the arctic zone, west to the plains, south to the Gulf states. Breeds from the northern United States northward. Allen, 1872: also, Snow, 1872, on authority of Allen and Baird.

345. 761. Merula migratoria (Linn.) American Robin. Resident; abundant and increasing in numbers westward. Its abundance in winter seems to depend largely upon the food-supply: hackberries, grapes, moonseed, bittersweet, ampelopsis, and other berries. Belongs to the eastern and northern United States, west to the plains: south in winter to eastern Mexico. Breeds from the Gulf states northward to the arctic zone. Abert, 1848.

346. 761a. Merula migratoria propinqua (Ridgw.) Western Robin. An occasional visitant in western Kansas. Ranges over the western United States, north to British Columbia, east to western Kansas and Nebraska, south over the table-lands of Mexico. Breeds mostly north of Mexico. Taken by Colonel Goss at Wallace, October 12, 1883. Goss, 1884. Auk, vol. I, p. 100.

347. 763. Hesperocichla nævia (Gmel.) Varied Thrush. A rare visitant from the west. Ranges over western North America, from the Rocky mountains to the Pacific, and from the Yukon to the Colorado. Winters in the United States. Accidental in the Mississippi valley and the Atlantic states. Taken by H. W. Menke, October 17, 1891, in Finney county. Kellogg, 1894. A specimen in the museum of the State Agricultural College is probably erroneously labeled as from Kansas.

348. 766. Sialia sialis (Linn.) Bluebird. Resident in eastern and middle Kansas. A rare summer resident in western Kansas, decreasing in numbers. Inhabits the eastern United States and southern British America, west to the base of the Rocky mountains. Winters in the middle states and southward to Cuba. Breeds throughout its United States range. Abert, 1848.

349. 768. Sialia artica (Swains.) Mountain Bluebird. A common winter sojourner in western Kansas, rarer in eastern Kansas. Belongs to western North America, north to Great Slave lake, east to Dakota and Texas, south into Mexico. Breeds in the mountains. Taken by Doctor Watson at Ellis, October 26, 1875. Seen by the writer as far east as Vinland, Douglas county. Snow, 1875.

ADDITIONAL.

350. 416. Antrostomus carolinensis (Linn.) Chuck-will's-widow. Very rare. Probable summer resident. On June 12, 1898, Dr. R. Matthews, of Wichita, found a specimen of this species on the Arkansas river several miles south of Wichita. There was no doubt of the identity of the specimen, which was submitted to Professor Snow for examination.

351. 283. Arenaria interpres (Linn.) Turnstone. Very rare in migration and summer visitant. The only record of its capture in Kansas was made by Mr. F. E. Forbes, of Topeka, who captured a fine male specimen on the Kansas river, August 16, 1898. He has the specimen in his collection.

ANTROSTOMUS CAROLINENSIS.

BY R. MATTHEWS, WICHITA.

Read December 29, 1898.

Sunday, June 12, 1898, I was in the woods along the Arkansas river, three miles south of Wichita. A bird flew from the ground in dense underbrush, and I recognized it as a whippoorwill. The first impulse was to shoot it; but instantly recognizing by its actions that it had eggs or young, I set myself to find the nest. I did not succeed in finding it. I went away and returned in an hour, still finding the bird in the same locality. I made another unsuccessful search for the nest, and left again.

In a couple of hours I came back again, and approaching with great caution, I was delighted to see the bird rise from the identical spot again. This time I searched diligently, but without success. So, as I could not return again, I shot the bird, took it home, skinned and stuffed with cotton, and tried to identify by Goss's "Birds of Kansas." The bird would not identify, but by an inference seemed to be *Antrostomus carolinensis.*

I afterward proved this to be the case by Coues's "Key to the Birds of North America." When I was satisfied I sent the skin to Professor Snow for his opinion, and received this from him: . . . "You are correct as to the identity. . . . It is not recorded that it has been taken in Kansas before."

Unfortunately the cat tore this specimen to pieces so it could not be mounted. There were left the upper half of the head, both wings, one leg and one foot entire, and a few tail and other feathers. These I sent to Professor Snow.

WERE QUAILS NATIVE TO KANSAS?

BY J. R. MEAD, WICHITA.

Read before the Academy December 30, 1898.

Bob-white, *Colinus virginianus;* Texas bob-white, *Colinus virginianus texanus.*

In Colonel Goss's "Birds of Kansas," page 222, he says:

"I have been informed by military men and hunters that bob-whites were occasionally seen on the Cimarron river, south of Fort Dodge, from 1862 to 1866. This was long before our birds, in following up the settlements, had reached the central portion of the state, and it is safe to conclude that the birds found there were of this variety."

"This southwestern race, as a bird of western Kansas, rests on two specimens in the United States National Museum, collected May 27, 1864, by Dr. Elliott Coues, on the Republican river, in the northwestern part of the state."

It would be presumption in me to correct so eminent an authority as Colonel Goss, our lamented friend and brother. Perhaps my opportunities of observation in some instances were better than his.

I went upon the plains of western Kansas in 1859, and lived along with nature as it came from the hand of the Creator for ten years; and among other things I found quail, "bob-whites," the same as I had killed in hundreds in Iowa and Illinois, but smaller, along the timbered streams where thickets afforded protection. They were not numerous; a covey here and there. Half a dozen coveys might be seen in a day's tramp along the Saline or Smoky Hill or their branches.

I saw them in 1859 in the heart of the buffalo range, and every year since. They were more plentiful along the southern border of the state and in the Indian territory, where shelter was better. On account of their many enemies—wildcats sneaking upon them both night and day, coyotes and skunks destroying their nests, hawks watching for them, and the terrific fires which sometimes swept through the thickets in which they lived, blizzards burying them deep in the crusted snow, they could not exist except in sheltered thickets. They were very wild, always flying when approached. I do not remember of seeing one on the ground, and I noticed that they were considerably smaller than the quails of Iowa.

In the same localities were considerable numbers of prairie-hens and sharp-tailed grouse.

Bob-whites rapidly increased with the settlement of the country. Whether they are descended from the original stock of the country I cannot say: but, from the fact that our quails are considerably smaller than the Iowa bird, I think most of them are.

FELIS CONCOLOR.

BY J. R. MEAD, WICHITA.

Read December 30, 1898.

Felis concolor, locally known as mountain lion, panther, cougar, puma, and perhaps other names, was occasionally found in central Kansas in its first settlement: was common along the southern line of the state, yet more common in the Indian territory, now known as Oklahoma. Its habitat was along the timbered streams and the prairies and hills adjacent.

In the fall of 1859 the writer noticed skeletons of buffalo calves, some recently killed and partly eaten, in a heavily timbered bend of the Solomon river a few miles above its mouth. Later, the Sac and Fox Indians on their annual fall hunt camped in that bend, and with the aid of their dogs killed an immense panther. I did not measure the skin, but it was the largest of many that the writer obtained from the Indians in subsequent years. In 1865 the writer saw one on the White Water in Butler county, close to Mean's ranch, where Towanda now stands. It came out of the tall grass, close to where my children were playing in the road, and leisurely bounded along to the bluff to the east.

In the winter of 1864 the writer rode almost onto a very large male lion lying at length upon the prairie some three miles south of the junction of the Medicine Lodge and Salt Fork rivers, near the great salt plain. His color harmonized so completely with the dead, brown buffalo-grass that he was not observed until I was almost onto him. He was not disposed to move from his position, and not having my rifle with me I rode around him at a distance of fifty feet and talked to him, but could not induce him to move, except his eyes and head, which followed my every movement. A bunch of wild horses near by in a ravine may have been his quest. I rode away, leaving him to his meditations.

In March, 1868, near a spring surrounded by trees, south of the Canadian river, I saw the skeletons of seven antlered deer within a radius of 200 feet. They had been food for panthers, I suppose.

Deer were their principal food, springing upon them from a tree over a trail; or, more frequently, still-hunting them—sneaking upon them in the grass as a cat does a mouse. We once found a deer freshly killed and covered with leaves, its neck bitten through and skin torn by sharp claws—cached for a future meal.

These notes were suggested by my friend, Professor Dyche, asking if I had ever heard a panther "scream," stating that in his large experience as a hunter he had never met a man who had, and regarded the "scream" as a myth. I can answer most emphatically that I have.

In January, 1868, during extreme cold and heavy snow, I was camped, in the winter, near the mouth of Turkey creek, on the Cimarron river. About ten o'clock one night two panthers came close to the camp, less than 100 yards, and, lifting up their voices, let loose the most unearthly, blood-curdling screams it was ever my good fortune to hear. Lobo, the big buffalo wolf, has a deep, profound, musical howl, which can be heard for miles over the silent, frozen plains; and their music has lulled me to sleep as I lay wrapped in my blankets in the snow: but the unearthly scream of a panther close at hand will almost freeze the blood in one's veins, and for an instant paralyze almost any form of man or beast. My horses and mules tied to the wagon usually paid no attention to wild animals: but on this occasion they trembled like a leaf. Some Indian women and children were sitting around their camp-fires. They screamed and ran into their lodges. The few Indian men seized their weapons. I distinctly remember being astonished myself.

The next morning it was snowing. I took my trusty friend and companion, my rifle, and waded through the snow to a dense body of post-oak timber, half a mile distant. Underneath the interlocking branches of the timber was a thicket of brush and greenbriers. I soon found the fresh tracks of two large panthers and followed their tracks through and under the brush and vines and between the tree trunks for an hour, always close to them, sometimes within two rods. I could not see them, as the falling snow covered the brush and vines, completely shutting out the sight of anything more than a rod distant. They could easily have sprung upon me from either side or behind. I failed to get sight of them.

In all my experience, I never knew any wild animal to attack a person unless wounded and crowded upon. Panthers frequently killed and ate Indians' horses and the Indians hunted and killed them with the aid of dogs.

A panther's scream heard in the wilderness on a still night is an experience never to be forgotten. The memory of it will stay with one to the end.

Mr. William Matthews, of Wichita, my former partner on the plains and the original "Buffalo Bill," who spent more than twenty years on the plains and mountains as hunter, trapper, guide, scout, and trader, from the head waters of the Missouri river to the Gulf, commencing in 1848, tells me that he has killed twenty or thirty of the animals; that he has often heard them scream, and describes it as similar to my experience. He says that they have other tones of voice to suit the occasion, as other cats have, and that a mountain lion is a distinct variety of *Felis concolor* — has a short body, and heavy, stout legs, while a panther has a long body and shorter, lighter limbs. He says that both varieties were more numerous in the vicinity of the Wichita mountains than in any other locality. He never knew one to attack a person.

SOME NATURAL-HISTORY NOTES OF 1859.

BY J. R. MEAD, WICHITA.

Read December 30, 1898.

Lobo, the mountain wolf, locally known on the plains as "big gray," were congeners and associates of the buffalo, and lived almost exclusively upon them. Each wolf would kill in the course of a year, it is fair to assume, a dozen buffalo, many of them calves; but they, with equal facility, could kill the strongest bull, and did, whenever appetite and circumstances made it most convenient.

Prior to our time Indians did not kill wolves; none died but from old age. I have killed numbers whose teeth were entirely gone, except a few black stumps. Such could not kill game for themselves, but ate that killed by others. Each female brought forth and reared from three to eight young; a buffalo but one. By all the known rules of mathematics the wolves should in course of centuries increase until in one season they would devour every one of the six million buffalo who once roamed the plains.

Will some naturalist please solve the mystery — why they did not?

Hunters with strychnia finally exterminated the wolves, myself and men killing some 5000 of them. They never molested people.

There were red foxes living on the plains with the wolves, called "swifts" from their remarkable speed. They lived in pairs; not more than two found together. No other foxes were found on the plains. They were unlike the timber foxes.

Black wolves were found in the eastern part of the Indian territory, but not on the plains.

Coyotes were not the same as the prairie-wolf found east of the Missouri river.

A few black bear were found in Comanche county, nesting in the gypsum caves.

Black and gray lynx were occasionally met with, and several varieties of wildcats — some with tails half as long as domestic cats, some with no more tail than a rabbit, some with long legs and short bodies, others with very long bodies and very short legs. Prairie-dogs, rabbits, and turkeys were their favorite and common food.

Hedgehogs, locally called porcupines, were very common on the streams between the Saline and Solomon. They subsisted on the bark and buds of trees, climbing trees with ease. As they could not run, their method of defense was striking a horizontal blow with their tails with sufficient force to drive their quills into the stock of a rifle. They nested under shelving rocks where such could be found, and brought forth two at a litter.

Fox-squirrels abounded along the Solomon, Saline, and their tributaries; no other tree squirrels were noticed.

Marten were rare.

No mink were on the plains before the settlement of the country, but became very plentiful shortly after. Now they are rare.

Badgers were only occasionally met with.

I remember of killing but one woodchuck, on Spillman's creek, a branch of the Saline.

The large two-striped skunks flourished everywhere; there were none of the small spotted variety.

Beaver were very numerous, cutting down cottonwood trees three feet in diameter, but preferring young trees and brush.

Otter were common.

Felis concolor were rarely met.

Black-tailed deer were numerous in winter in the hills between the Saline and Solomon, going in bunches of three or four to twenty or thirty. I suppose they came down from the foothills of Colorado to winter, as I did not see them in summer.

White-tailed deer were numerous in the hills about the forks of the Solomon and the hilly country of Barber and Comanche counties, and occasionally found elsewhere.

Antelope were abundant everywhere, in summer, migrating south in winter to the Staked Plains.

Elk were quite numerous, especially along the Smoky Hill, Saline, and Solomon, and in Barber county and south in the territory. I saw a band of over 500 cross the Saline where the town of Lincoln now stands, going south; have killed them on Solomon, Saline, Smoky Hill, Arkansas, and Medicine Lodge rivers. They were found at all seasons of the year, but more numerous in summer and fall. I do not know their migratory habits.

Prairie-dogs were innumerable. The divide between Saline and Solomon in Ellsworth county and west was a continuous dog town for miles; and, as a considerable portion of this locality was underlaid with horizontal beds of shale or limestone near the surface, it was a mystery where they got water. Not a drop could be found within several miles and none by digging above the rock, and not a particle of dew fell for weeks in the heat of summer. The scant grass was dry enough to burn an hour before sunrise; and I was forced to the conclusion that in this instance nature had constructed an animal capable of living for long periods of time without water. My pen cannot describe the extreme heat and drought which sometimes prevailed on these bare uplands during July and August. Prairie-dogs, except a few remnants, disappeared. The foot of the buffalo was necessary for their existence. As soon as the ground ceased to be tramped hard and the grass and weeds grew they perished.

With the buffalo also disappeared the countless flocks of ravens, a beautiful glossy bird, larger and much handsomer and smarter than the crow.

Bald eagles were numerous, especially along the southern border. Many of them and thousands of ravens were killed by eating our baits or the viscera of wolves we had poisoned.

Magpies were common between Saline and Solomon, and prairie-chickens and sharp-tailed grouse common in the buffalo range.

Turkeys were abundant on every creek, and bob-white common in dense thickets.

Most of these birds and animals are practically extinct. A few wolves remain, and quail have largely increased.

ADDITIONAL NOTES ON THE TIMBERED MOUNDS OF THE KAW RESERVATION.

BY C. N. GOULD, WINFIELD.

Read before the Academy October 28, 1897.

During the past year considerable study has been given to the ruins in the Kaw reservation and Cowley county, Kansas, concerning which a paper was read at the last meeting of the Academy. As was set forth in that paper, a number of flat-topped hills in the above-mentioned locality are covered with excavations and piles of loose stones, evidently quarried by human agency.

Acting on the suggestion of Doctor Williston, a careful search was made for flint implements, with the result that more than 100 imperfect implements, or rejects, have been found. They vary in size from three to eight inches in length, and from one and one-half to four inches in breadth, and weigh from three ounces to one and one-half pounds. In shape they are usually oval and twice as long as broad, ends roundish or pointed, with usually a cutting edge chipped on all sides. They are nearly always broken, either laterally or longitudinally, but rarely diagonally: very often a corner will be broken off. One or two specimens are nearly perfect and are probably completed implements that have been lost.

The excavations are in some instances nearly filled up, but quite a number may be noticed that are a foot or more in depth. The piles of debris are from one to three feet high, and consist of irregular flakes of flint, round nodules, and broken fossiliferous limestone.

The hills are situated at the extreme summit of the Flint Hills, and no more flint is to be found this side of the Rocky mountains. The localities may be conveniently grouped under two heads: First, the Kaw reservation, or the Timbered Mounds proper: and second, the Maple City locality. The first is south of Meyers creek and east of Little Beaver, in the Kaw reservation, from six to twelve miles nearly south of Maple City, Kan. It is here the quarries were first studied, and here most of the excavations seem to have been made; but singularly enough very few rejects have been found here. The second locality is in and around Maple City. Most of the rejects have been found on the farms of Mr. H. Ferguson and Mrs. Geo. Sutton. Some interesting localities are found three to four miles north of Maple City.

The foundations of edifices mentioned in the last paper are still being studied, but it is now believed that they were quite local, and possibly temporary structures for the convenience of the workmen.

Nothing is more reasonable than to suppose that the tribes of the plains journeyed eastward until they arrived at the first flint that could be worked with ease, and here stopped and fashioned their implements.

The descriptions of "An Ancient Quarry in Indian Territory," by William Henry Holmes, published as a bulletin of the American Bureau of Ethnology in 1894, will, to a very large extent, apply to the quarries under consideration, except that the pits are not so deep as those described in the report. The rejects pictured in Mr. Holmes's paper are very like those found at Maple City.

THE NATURAL-HISTORY POSSIBILITIES OF BELVIDERE, KAN., AND VICINITY.

BY C. N. GOULD.

To the student of natural history there is no more interesting locality than the country surrounding Belvidere. Nestled among the low, rounded hills of the upper Medicine valley, the little village is indeed picturesque. The gentle slopes covered with cattle, the broad, fertile valley, the rushing stream, clear with the sparkling water from the hills, the clumps of elms and cottonwoods fringing its banks; and over all the grim old sentinel, Osage rock, standing eternal as the hill of which it forms a part, all combine to render the scene unforgotten.

Here have the great men of Kansas science labored. Professor St. John, Robert Hay, Colonel Goss, and others who have gone to complete their investigations in the great unknown have here spent weeks in research. Chancellor Snow found meteorites here. Professor Cragin traveled over these hills and wrote his famous paper "A Study of the Belvidere Beds." Professor Smyth collected here for the National Herbarium at Washington. Professor Hill came from Washington, Professor Prosser from New York, and Professor Ward from the Smithsonian Institution. Each of these testifies to the wealth of material to be found in the vicinity. Doctor Williston has here found bones of extinct reptiles. Professors Hitchcock and Failyer came here from Manhattan; one to collect rare plants, the other to analyze water from the medicinal springs of the Indians.

The problematic Red Beds are well developed a few miles down the river. Upon these the Comanche Cretaceous lies unconformably. This apparently grades upward through a series of transition beds into the true leaf-bearing Dakota sandstone, which in turn is covered with the Loup Fork Tertiary and Pleistocene. In the line of paleontology few localities yield a greater diversity of fossils. Professor Hill, in 1894, first found dicotyledonous leaves in the Cheyenne sandstone, and Professor Ward, in his two summers in the field, has discovered scores of species; Professors Cragin and Hill have collected numerous invertebrates from the Kiowa shales. Doctor Williston finds saurian, crocodile, and fish bones in this horizon. Insects have also been found in the shales. On the hills and in the Medicine valley bones of Pleistocene mammals are to be found.

The botany is excellent. Professor Ward has found the Texas mesquite on the hills and the soapberry on the creeks. The ornithologist will be interested in such birds as the Mississippi kite and the scissor-tail flycatcher; and the entomologist will here find insects galore.

On the Osage rock are pictographs left by the Indians, and on the cañon walls in the vicinity may be found records engraven of deeds of daring and bravery. Old settlers will tell of implements and traces of dwellings found along the creeks and in the ravines, and over all hang the mystic traditions of Indian battles and cavalry raids.

The work of a lifetime lies within the hills surrounding the valley. Much has been done, but more remains to be done. Fortunate will he be who in this region devotes himself to the task of learning nature's secrets.

ON THE FINDING OF FOSSIL INSECTS IN THE COMANCHE CRETACEOUS OF KANSAS.

BY C. N. GOULD.

During the summer of 1897, while in the employ of the state university, the writer was visited at Belvidere, Kan., by Dr. S. W. Williston. We drove some five miles southeast to the Black hills (Stokes hill of Cragin), and visited the locality where Prof. Robert T. Hill and the writer first found dicotyledonous leaves in the summer of 1894. Doctor Williston remarked that the presence of fossil vegetation would indicate that insects might be found in the vicinity. An hour or so was spent in looking over the various shale beds but nothing of importance was discovered.

A few days after, while collecting shells in the vicinity, some shale was found which apparently contained traces of insects' wings. They were sent to Doctor Williston, who forwarded them to Professor Scudder, of Harvard University, the best authority on fossil insects in America. Professor Scudder identified the material as insects, but stated that on account of the poor state of preservation he could not be sure of genus or species. These are, so far as known, the first fossil insects discovered in the state.

The locality is about one-fourth of a mile south of the natural corral, on the ranch of Mr. Frank Abell. The horizon is Hill's No. 6, or Prosser's No. 11. (See the University Geological Survey of Kansas, Vol. 2, p. 121.) The material is described as "very black, sleek, argillaceous shale, 'paper shales' of Hill, sparingly fossiliferous in the lower part." It is immediately above Cragin's Champion shell bed, which is well developed in the locality. Persistent work in the shales will doubtless reveal an interesting fauna.

APPENDIX.

ACCESSIONS TO THE LIBRARY

FROM JANUARY 1, 1897, TO DECEMBER 31, 1898.

BY B. B. SMYTH, LIBRARIAN.

Dimensions of books when given are in centimetres, breadth and length; when not given are usually octavo, or about 14–15 x 20–23 centimetres.

AMERICA (UNITED STATES).

ALABAMA.

UNIVERSITY.—*Geological Survey of Alabama, Eugene A. Smith, Ph. D., State Geologist:*
Report on the valley regions of Alabama, by Henry McCalley, assistant state geologist: Part I. The Tennessee valley region, xvii + 436 pp.; 9 pll.; 4 sections. Part II. The Coosa valley region, xii + 862 pp.; 25 pll.; 14 figs. Structure section in pocket at end of book.

CALIFORNIA.

BERKELEY.—*University of California:*
Annual report of secretary to board of regents for the year ending June 30, 1897, 132 pp. 1898, 147 pp.
Bulletin of the department of geology. Vol. II, No. 4, pp. 109–118.
Register of the University of California, 1896–'97, 317 pp.

SACRAMENTO.—*California State Mining Bureau, J. J. Crawford, State Mineralogist:*
Bulletin No. 11, 72 pp.; 11 pl.; 8 figs.; 6 sketch maps. No. 12. Chart showing, by counties, the mineral productions of the state of California for the year 1896, by A. S. Cooper.
Thirteenth report of the state mineralogist, 725 pp.; 32 pl.; 43 figs.; 1 map.

SAN FRANCISCO.—*California Academy of Sciences:*
Proceedings, second series, vol. VI, 1896, 587 pp.; 75 litho. pll.; 5 figs.
Third series, botany, vol. I, Nos. 1–5, 182 pp.; 36 pll.
Third series, geology, vol. I, Nos. 1–4, 160 pp.; 20 pll.; 6 figs.
Third series, mathematics-physics, vol. I, Nos. 1–4, 46 pp.; 4 figs.
Third series, zoology, vol. I, Nos. 1–10, 370 pp.; 20 colored pll.; 2 diagrams.
Occasional papers, V. The reptiles of the Pacific coast and great basin, by John Van Denburgh, 236 pp.; numerous figures.

Technical Society of the Pacific Coast:
Transactions, July, 1895, to December, 1896, 118 pp.; many figures.

COLORADO.

COLORADO SPRINGS.—*Colorado College:*
Colorado College Studies, vol. VII, 48 pp.

DENVER.—*Colorado Scientific Society:*
Bulletins: No. 10, 6 pp. No. 11, 7 pp.
The nature of the chemical elements, by Chas. S. Palmer, 3 pp. Argon and helium in the periodic sequence, by C. S. Palmer, 7 pp.; 1 table.
Magnetic concentration applied to sulphide ore, by G. M. Gouyard, 11 pp.
A recent assay balance, by L. S. Austin, 6 pp.; 3 figs.
The Oscuro mountain meteorite, by R. C. Hills, 4 pp.; 2 pll.
Ferric sulphate in mine waters, and its action on metals, by L. J. W. Jones, 9 pp.
Some products found in the hearth of an old furnace at Truro, Cornwall, by Wm. P. Headden, 11 pp.

An olivinite dike of the Magnolia district and the associate picrotitanite, by M. C. Whitaker, 14 pp.

A mineralogical mistake, by P. H. van Diest, 6 pp.; 1 pl.

Proceedings, vol. V, 1894, 1895, and 1896, 257 pp.; 9 pl.; 1 map.

CONNECTICUT.

MERIDEN.—*Meriden Scientific Association:*

Transactions, vol. VII, 8 pp. Vol. VIII, 52 pp.

DISTRICT OF COLUMBIA.

WASHINGTON.—*Biological Society of Washington:*

Proceedings, vol. XI, 1897, xii + 292 pp.; 4 pl.; 15 figs. Vol. XII, 1898, 196 pp.; 2 pl.; 20 figs.

Chas. W. Smiley, Publisher:

The American Monthly Microscopical Journal, containing contributions to biology. Vol. XVIII, 1897, 397 pp.; 37 illustrations. Vol. XIX, 1898, 208 pp.; —ills.

United States Civil Service Commission:

Fourteenth report of the United States civil service commission, July, 1896—June, 1897, 562 pp.

U. S. Department of Agriculture, James Wilson, Secretary:

Annual reports of the Department of Agriculture for 1897, 226 pp. Contains reports of the chiefs of divisions. For 1898, 212 pp.

Circulars: Nos. 3, 6,'7.

Special report on the beet-sugar industry in the United States, 240 pp.

Year-book of the department for 1896, 686 pp.; 7 pll.; 164 figs. 1897, 792 pp.; 40 pll.; 45 figs.

Division of Agricultural Soils, Milton Whitney, Chief of Division:

Bulletins: Nos. 6-14.

Farmers' bulletins: Nos. 60, 82.

Division of Agrostology, F. Lamson-Scribner, Chief of Division:

Bulletins: Nos. 4-15.

Circulars: Nos. 4-8.

Farmers' bulletins: Nos. 31, 50, 58, 66, 72.

Bureau of Animal Industry, D. E. Salmon, Chief:

Twelfth and thirteenth annual reports, for 1895 and 1896, 362 pp.; 28 pll.; 4 figs.; bound in cloth. Fourteenth report, for 1897, 727 pp.; 6 pll.; 51 figs.

Bulletins: Nos. 15-21.

Circulars: Nos. 5-22.

Farmers' bulletins: Nos. 42, 49, 51, 55, 63, 64, 71.

National and state dairy laws, compiled and abstracted by R. A. Pearson, pp. 531.

Division of Botany, Frederick V. Coville, Botanist:

Bulletins: Nos. 13-21.

Circulars: Nos. 8-15.

Contributions from the United States National Herbarium, vol. V, Nos. 1-3.

Farmers' bulletin: No. 86.

Reports: Nos. 8 and 9.

Report of the botanist for 1897, 6 pp.

Division of Biological Survey, C. Hart Merriam, Chief:

Bulletins: Nos. 8-11.

Farmers' bulletin: No. 54.

North American fauna: No. 13.

Division of Chemistry, Harvey W. Wiley, Chemist:

Bulletins: Nos. 13, 49, 50, 51, 53, 54, 55.

Circular: Nos. 3 and 4.

Farmers' bulletins: No. 52.

Division of Entomology, L. O. Howard, Entomologist:

Bulletins: Nos. 3-16, new series.

Circulars: Nos. 13-36, second series.

Farmers' bulletins: Nos. 45, 47, 70, 80.

Technical series: Nos. 5-7.

Office of Experiment Stations, A. C. True, Director:

Bulletins: Nos. 34-46, 48-50, 52-54.

Circulars: Nos. 32-38.

Experiment station records: Vol. VII, 1896. Nos. 7-12, pp. 535-1092. Vol. VIII, 1896-'97, Nos. 3-12, pp. 177-1128. Vol. IX, 1897-'98, Nos. 1-11, 1198 pp. Vol. X, 1898, Nos. 3-5, 500 pp.

Farmers' bulletins: Nos. 41, 44, 46, 48, 56, 60, 61, 62, 65, 69, 73, 74, 76, 78, 79, 81, 84, 85.

Report of the director of the office of experiment stations for 1898, by A. C. True, pp. 103-126.

Fiber investigations, Charles Richards Dodge, special agent in charge.

Reports: Nos. 9-11.

Forestry Division, B. E. Fernow, Chief:

Bulletins: Nos. 14-16, 18, 19-21.

Circulars: Nos. 16-20.

Farmers' bulletin: No. 67.

Senate document: No. 40.

Section of Foreign Markets:

Bulletins: Nos. 7-13.

Circulars: Nos. 7-20.

Division of Pomology, H. E. Van Deman, Chief of Division:

Bulletins: Nos. 5 and 6.

Circulars: Nos. 1-7, 10.

Division of Publications, George Wilson Hill, Chief of Division:

Bulletins: Nos. 2-4.

Library bulletins: Nos. 18, 19, 20, 21, 22, 23.

The department of agriculture and its work, 12 pp.

Office of Road Inquiry, Roy Stone, Special Agent:

Bulletins: Nos. 16 and 19.

Circulars: Nos. 19-31.

Division of Statistics:

Manual of instruction to crop correspondents, by Henry A. Robinson, 23 pp.

Bulletins: Nos. 10-15.

Circulars: Nos. 1-8.

Miscellaneous circular: No. 3.

Reports: Nos. 133-155, new series.

Division of Vegetable Physiology and Pathology, B. T. Galloway, Chief of Division:

Bulletins: Nos. 12, 13, 14, and 16.

Farmers' bulletins: Nos. 53, 68.

Proceeding of the national convention for the suppression of insect pests and plant diseases by legislation, held at Washington, D. C., March 5 and 6, 1897, by B. T. Galloway.

Weather Bureau, Willis L. Moore, Chief of Bureau:

Bulletin No. 20.

Monthly weather review, 24x29 cm., by Prof. Cleveland Abbe, editor, October to December, 1896, pp. 395-496; 26 charts. 1897, 579 pp.; 75 charts. 1898, 605 pp.; 125 charts.

Some climatic features of the arid regions, by Willis L. Moore, 19 pp.; 3 charts; 2 figs.

Report of the chief of the weather bureau for 1897, by Willis L. Moore, 28 pp.

United States Department of the Interior— U. S. Bureau of Education, William T. Harris, Commissioner:

Report of the commissioner for the year 1895-'96, vol. I, part I, lxxv+965 pp.

United States Geological Survey, Chas. D. Walcott, Director:

Seventeenth annual report, 1895-'96. Part I, xxii+1076 pp.; 67 pll.; topographic map in pocket.

Part II—Economic geology and hydrography, xxv+864 pp.; 77 pll.; 74 figs.

Part III—Mineral resources of the United States, by David T. Day, metallic products and coal, 542 pp. Non-metallic products, except coal, pp. 543-1058.

Bulletins: No. 84. A synopsis of American fossil Brachiopoda, including bibliography and synonymy, by Chas. Shuchert, 464 pp.; 6 figs.

No. 88. The Cretaceous foraminifera of New Jersey, by Rufus Mather Bagg, jr., 89 pp.; 6 pll.

No. 89. Some lava flows on the western slope of the Sierra Nevada, California, by F. Leslie Ransome, 74 pp.; 11 pll.

No. 127. Catalogue and index of contributions to North American geology, 1731-1891, by N. H. Darton, 1045 pp.

No. 130. Bibliography and index of North American geology, paleontology, petrology, and mineralogy for 1892-'93, by Fred Boughton Weeks, 210 pp.

No. 133. Contribution to the Cretaceous paleontology of the Pacific coast: the fauna of the Knoxville beds, by Timothy W. Stanton, 132 pp.; 20 pll.

No. 135. Bibliography and index of North American geology, paleontology, petrology, and mineralogy for 1894, by Fred Boughton Weeks, 141 pp.

No. 136. The ancient volcanic rocks of South Mountain, Pennsylvania, by Florence Bascom, 124 pp.; 28 pll. (2 col'd).

No. 137. The geology of the Fort Riley military reservation and vicinity, Kansas, by Robert Hay, 34 pp.; 8 pll.; 4 figs.

No. 138. Artesian-well prospects in the Atlantic coastal plain region, by Nelson Horatio Darton, 232 pp.; 19 pll.; 8 figs.

No. 139. Geology of the Castle Mountain mining district, Montana, by W. H. Weed and L. V. Pirsson, 164 pp.; 17 hf.-t. pll.; 11 figs.

No. 140. Report of progress of the division of hydrography for the calendar year 1895, by F. H. Newell, 356 pp.

No. 141. The Eocene deposits of the middle Atlantic slope in Delaware, Maryland, and Virginia, by William Bullock Clark, 167 pp.; 40 pll.

No. 142. A brief contribution to the geology and paleontology of northwestern Louisiana, by T. Wayland Vaughan, 65 pp.; 4 pll.

No. 143. Bibliography of clays and the ceramic arts, by John Casper Branner, 114 pp.

No. 144. The moraines of the Missouri Coteau and their attendant deposits, by James Edward Todd, 69 pp.; 21 pll.; 3 figs.

No. 145. The Potomac formation in Virginia, by William M. Fontaine, 147 pp.; 13 figs.

No. 146. Bibliography and index of North American geology, paleontology, petrology, and mineralogy for 1895, by Fred Boughton Weeks, 130 pp.

No. 147. Earthquakes in California in 1895, by Chas. D. Perrine, 22 pp.

No. 148. Analyses of rocks and analytical methods U. S. Geological Survey, 1880-1896, by F. W. Clarke and W. F. Hillebrand, 306 pp.

No. 149. Bibliography and index of North American geology, paleontology, and mineralogy for the year 1896, by F. B. Weeks, 152 pp.

No. 150. The educational series of rock specimens collected and distributed by the United States Geological Survey, by Joseph Silas Diller, 400 pp.; 47 pll.; 18 figs.

No. 151. The lower Cretaceous gryphæas of the Texas region, by Robert T. Hill and T. Wayland Vaughan, 66 pp.; 35 pll.; 2 figs.

No. 152. Catalogues of the Cretaceous and Tertiary plants of North America, by Frank Hall Knowlton, 247 pp.

No. 153. A bibliographic index of North American Carboniferous invertebrates, by Stuart Weller, 653 pp.

No. 154. A gazetteer of Kansas, by Henry Gannett, 246 pp.

No. 155. Earthquakes in California in 1896 and 1897, by Chas. D. Perrine, 45 pp.

No. 156. Bibliography and index of North American geology, paleontology, petrology, and mineralogy for 1897, by F. B. Weeks, 130 pp.

Smithsonian Institution, S. P. Langley, Secretary:

Annual report for 1895, 837 pp.; 74 pll. 1896, 727 pp.; 61 pll.; 1 map.

The Smithsonian Institution: History of the first half century, by George Brown Goode, 856 pp.; 25 engravings.

Memoir of George Brown Goode, by S. P. Langley, 30 pp.

Smithsonian contributions to knowledge, 25 x 33 cm., unbound. No. 1125. An investigation on the influence of the vital resistance of animals to the micro-organisms of disease brought about by prolonged sojourn in an impure atmosphere, by D. H. Bergey, 10 pp.

1126. A determination of the ratio (x) of the specific heat (s) at constant pressure and at constant volume for air, oxygen, carbon dioxide, and hydrogen, by O. Lummer and E. Pringsheim, 29 pp.; 1 pl.

Smithsonian miscellaneous collections: No. 1035. Mountain observatories in America and Europe, by Edward S. Holden, 77 pp.; 25 figs.

1038. Smithsonian physical tables, prepared by Thomas Grey, 301 pp.

1039. Virginia cartography, a bibliographical description, by P. Lee Phillips, 85 pp.

1071. Air and life, by Henry de Varigny, 69 pp.

1072. The atmosphere in relation to human life and health, by Francis Albert Rolla Russell, 148 pp.

1073. The air of towns, by Dr. J. B. Cohen, 41 pp.; 23 pll.; 2 figs.

1075. The constants of nature, part V: A recalculation of the atomic weights, by Frank Wigglesworth Clarke, 370 pp.

1077. Equipment and work of an aero-physical observatory, by Alexander McAdie, 30 pp.

1081. International exchange list of the Smithsonian Institution, 310 pp.

1084. Bibliography of the metals of the platinum group, 1748-1896, by James Lewis Howe, 318 pp.

1087. A catalogue of earthquakes on the Pacific coast, 1769-1897, by Edward S. Holden, 253 pp.

1090. Review and bibliography of the metallic carbides, by J. A. Mathews, 32 pp.

1093. A catalogue of scientific and technical periodicals, etc., by Henry Carrington Bolton, 1247 pp.

Smithsonian Institution—Bureau of Ethnology, J. W. Powell, Director:

Annual reports of the director, 21 x 29 cm., bound in olive-green cloth. Fourteenth report, for the year 1892–'93. Part I, lxi+638 pp.; 84 pll.; 55 figs. The Menominee Indians, by Walter James Hoffman, pp. 1–328; pll. I–XXXVII; figs. 1–55. The Coronado expedition, 1540–'42, by George Parker Winship, pp. 329–613; pll. XXXVIII–LXXXIV.

Part II, pp. 639–1136; 38 pll.; 49 figs. The ghost-dance religion and the Sioux outbreak of 1890, by James Mooney, pp. 643–1110; pll. LXXXV–CXXII; figs. 56–104.

Fifteenth report, for the year 1893–'94, 366 pp.; 125 pll.; 48 figs. Stone implements, by W. H. Holmes; the Siouan Indians, by W J McGee and James Owen Dorsey; Tusayan Katcinas, by J. W. Fewkes; Casa Grande ruin, by Cosmos Mindeleff.

Sixteenth report, for the year 1894–'95, 326 pp.; 81 pll.; 83 figs. Primitive trephining in Peru, by M. A. Muniz and W J McGee; cliff ruins of Canon de Chelly, Ariz., by Cosmos Mindeleff; day symbols of the Maya year, by Cyrus Thomas; Tusayan snake ceremonies, by J. W. Fewkes.

Smithsonian Institution—U. S. National Museum, G. Brown Goode, Assistant Secretary in Charge:

Bulletins: Nos. 39, part L; 47, parts I–III; 49.

Proceedings: Vol. XIX, 864 pp.; 68 pll.; numerous figures. Vol. XX, 932 pp.; 97 pll.; 149 figs.

Reports of the U. S. National Museum, bound in black cloth. For the year ending June 30, 1894, xxvi+1030 pp.; 57 pll.; 850 figs. For the year ending June 30, 1895, xx+1080 pp.; 113 pll.; 382 figs.

Report upon the condition and progress of the U. S. National Museum during the year ending June 30, 1896, by G. Brown Goode, 284 pp.

An account of the United States National Museum, by F. W. True, pp. 289–324.

United States Navy Department—U. S. Naval Observatory:

Report of the superintendent, R. L. Phythian, for the fiscal year ending June 30, 1898, 19 pp.

United States Treasury Department—U. S. Coast and Geodetic Survey, T. C. Mendenhall, Superintendent:

Report of the superintendent, 23 x 29 cm., bound in black cloth, for the year ending June 30, 1896. Parts I and II, 722 pp.; 6 diagrams; 6 maps; 4 charts.

ILLINOIS.

CHICAGO—*Chicago Academy of Sciences:*

Geological and natural history survey, Bulletin No. II. The Pleistocene features and deposits of the Chicago area, by Frank Leverett, 86 pp.; 4 pll.; 8 figs.

Public Libraries:

Edited by M. E. Ahern, library bureau (monthly). Vol. II, Nos. 6–10, 1897, 524 pp. Vol. III, 1898, 442 pp.

Field Columbian Museum:

Publication 17. Ornithological series, vol. I, No. 2. Catalogue of a collection of birds obtained by the expedition into Somaliland, by D. G. Elliot, pp. 29–67.

Publication 18. Geological series, vol. I, No. 2. Observations on Popocatepetl and Ixtaccihuatl, with a review of the geographic and geologic features of the mountains, by Oliver C. Farrington, pp. 71–120; pll. VII–XVIII.

Publication 21. Anthropological series, vol. II, No. 1. Observations on a collection of Papuan crania, by George A. Dorsey, with notes on preservation and decorative features, by William H. Holmes, pp. 1–48; 11 pll.; 22 figs.

Publication 22. Zoological series, vol. I, No. 8. List of fishes and reptiles obtained by Field Columbian Museum East African expedition to Somaliland in 1896, by S. E. Meek, pp. 49–184; 1 pl.

Publication 23. Anthropological series, vol. II, No. 2. A bibliography of the anthropology of Peru, by George A. Dorsey, pp. 185–206.

Publication 24. Report series, vol. I, No. 3. Annual report of the director for the year 1896–'97, pp. 207–256; 14 pll.

Publication 25. Botanical series, vol. I, No. 1. Contribution III to the coastal and plain flora of Yucatan, by Charles Frederick Millspaugh, pp. 345–410.

Publication 26. Zoological series, vol. I, No. 9. List of a collection of shells from the Gulf of Aden, by Dr. W. H. Dall, pp. 187–189.

Publication 27. Zoological series, vol. I, No. 10. Lists of species of mammals, principally rodents, obtained by W. W. Price, Dr. S. E. Meek, G. K. Cherrie, and E. S. Thompson, in the states of Iowa, Wyoming, Montana, Idaho, Nevada, and California, with descriptions of new species, by D. G. Elliot, pp. 193-221.

Publication 28. Anthropological series, vol. II, No. 3. Ruins of Xkichmook, Yucatan, by Edward H. Thompson, pp. 213-226; pll. XII-XXVII; figs. 23-36.

Publication 29. Annual report of the director to the board of trustees for the year 1897-'98, pp. 263-343; pll. XV-XXVIII.

Second annual exchange catalogue, for the year 1897-'98, 41 pp.

University of Chicago:

Annual register, July, 1896-July, 1897, 444 pp. July, 1897-July, 1898, 480 pp.

Contributions from the Hull botanical laboratory, V. Contribution to the life-history of *Lilium philadelphicum*, by John M. Coulter, Charles J. Chamberlain, and John H. Schaffner, from Botanical Gazette, pp. 412-452; pll. XXXII-XXXIX.

Development of the stamens and carpels of *Typha latifolia*, by John H. Shaffner, from Botanical Gazette, pp. 93-102; pll. IV VI.

University of Chicago, Department of Geology:

Journal of Geology, semiquarterly, 16x23 cm., about 112 pages each. Vol. V, 1897, 860 pp.; numerous figures and sketches. Vol. VI, 1898, 876 pp.; numerous figures.

PEORIA.—*Fred Boettger:*

Sixth report of the state entomologist on the noxious and beneficial insects of the state of Illinois, 174 pp.; 30 figs.

ROCK ISLAND.—*J. A. Udden:*

Report Illinois board world's fair commissioners, 1893, 757 pp.; many illustrations. Soils of Illinois, by Frank Leverett, pp. 77-92. Report on the examination of some soils from Illinois, by Milton Whitney, pp. 93-114. A geological section across the northern part of Illinois, by J. A. Udden, pp. 117-154. Geological section, St. Louis to Shawneetown, by J. M. Nickles, pp. 155-223. Archæology, by Wm. McAdams, pp. 227-307.

A brief description of the section of Devonian rocks exposed in the vicinity of Rock Island, Ill., with a statement of the nature of its fish remains, by J. A. Udden, pp. 93-95. Description of a Devonian Ichthyodorulite, *Heteracanthus uddeni*, n. sp., from Buffalo, Iowa, by Josua Lindahl, pp. 96-98; 1 pl.

The mechanical composition of wind deposits, by Johan A. Udden, 69 pp.; several figures.

Loess as a land deposit, by J. A. Udden, pp. 6-9. (From Bull. Geol. Soc. Am., vol. IX, 1897.)

Augustana College:

Library publications, No. 1. The mechanical composition of wind deposits, by Johan August Udden, 69 pp.; several figures.

SPRINGFIELD.—*Illinois State Museum of Natural History, Wm. F. E. Gurley, State Geologist:*

Bulletins: No. 12. New species of crinoids, cephalopods and other palaeozoic fossils, by S. A. Miller and Wm. F. E. Gurley, 69 pp., 5 pll.

URBANA.—*Illinois State Laboratory of Natural History, S. A. Forbes, Director:*

Biennial report of the biological experiment station, 1895-'96, 35 pp.; 20 pll.

Bulletins: Vol. V, article 1. Plankton studies: Methods and apparatus in use in plankton investigations at the biological experiment station, by C. A. Kofoid, pp. 1-26; pll. I-VII.

Art. 2. North American fresh-water Cyclopidæ, by Ernest A. Forbes, pp. 27-82; pll. VIII-XX.

Art. 3. North American species of Diaptomus, by F. W. Schacht, pp. 97-208; pll. XXI-XXXV.

Art. 4. North American Centropagidæ, by F. W. Schacht, pp. 225-269.

Art. 5. *Pleodorina illinoiensis*, from the plankton of the Illinois river, by C. A. Kofoid, pp. 273-293; pll. XXXVI and XXXVII.

Art. 6. List of the Protozoa and Rotifera of the Illinois river, etc., by Adolph Hempel, pp. 301-388.

S. A. Forbes, State Entomologist:

Eighteenth report on the noxious and beneficial insects of Illinois, by S. A. Forbes, 1891-'92, 171 pp.; 15 pll.

Nineteenth report, 1893-'94, 206 pp.; 13 pll. The Mediterranean flour moth, by W. G. Johnson, 65 pp.; 7 figs.

Twentieth report, 1895-'96, 112 pp.; 10 pll. The white pine chermes, by E. L. Storment.

INDIANA.

BROOKVILLE.—*Brookville Society of Natural History:*

Bulletins: No. 1, 45 pp. Stone mounds on the Whitewater, by E. R. Quick. Observations on faunal changes, by A. W. Butler. The flora of Franklin county, by O. M. Meyncke. Microscopical notes, by E. G. Grahn. Land and fresh-water mollusca observed in Franklin county, Indiana, by D. R. Moore and A. W. Butler. Two hours among the fossils of Franklin county, by D. R. Moore.

No. 2, 51 pp. Lists of fishes, birds, reptiles, plants, fossils, corals, etc., of Franklin county, Indiana, by Everman, Butler, Meyncke, etc.

INDIANAPOLIS.—*Department of Geology and Natural Resources:*

Twenty-first annual report, W. S. Blatchley, state geologist, 718 pp.; 39 pll.; 6 maps; numerous figures.

Twenty-second annual report, 1197 pp.; 20 pll.; 2 litho. maps; numerous figures.

Indiana Academy of Science:

Proceedings for 1894, 182 pp.; 6 figs. Proceedings for 1895, 296 pp.; 14 pll.; 1 map. Proceedings for 1896, 312 pp., numerous figures and maps. Proceedings for 1897, 274 pp.

IOWA.

AMES.—*Iowa Academy of Science* (see Des Moines).

DES MOINES.—*Iowa Academy of Sciences:*

Proceedings, vol. IV, 1896, 241 pp.; 26 pll.

Proceedings for 1897, vol. V, 247 pp.; 16 pll.; 16 figs.

Iowa Geological Survey:

Annual report, 1897, with accompanying papers, 427 pp.; 32 pll.; 13 figs.; 7 maps.

IOWA CITY.—*Iowa Academy of Sciences* (see Des Moines.)

State Historical Society:

Documentary material relating to the history of Iowa, No. 3, edited by Benjamin F. Shambaugh, pp. 45–76; No. 4, pp. 77–99; Nos. 9, 10, 11, vol. II, pp. 1–100; No. 12, vol. II, pp. 101–144.

Iowa Historical Record, quarterly, vol. XIII, Nos. 1, 2, 3, and 4, 1897, 192 pp.; steel engravings of John James Dyer, James M. Elson, L. Robinson, L. B. Patterson, and Jennette Robertson Higley. Vol. XIV, Nos. 1, 2, 3, 1898, 336 pp.; steel engravings of Austin Corbin, Agnes McCully Parvin, and Henry Dodge.

KANSAS.

ATCHISON.—*E. B. Knerr, Ph. D.:*

Midland College Monthly, 1897.

BALDWIN.—*Baker University:*

Baker University Quarterly, vol. II, No. 1, 23 pp. Catalogue of Baker University library, 112 pp.

EMPORIA.—*State Normal School:*

Annual catalogue, 1896–'97, 123 pp.

LAWRENCE.—*E. H. S. Bailey, Ph. D., Kansas State University:*

On the composition of the Louisville mineral water, by E. H. S. Bailey, 4 pp. (From Kan. Univ. Quar., vol. XI, No. 3, July, 1897.)

E. Haworth:

Mineral resources of Kansas, by E. Haworth, 98 pp.; 18 pll.

Experimental Station, F. H. Snow, Director:

Annual report of the director for the year 1896–'97, 39 pp.; 5 pll.

S. J. Hunter, University of Kansas:

The Coccidæ of Kansas, by S. J. Hunter, 15 pp.; 7 pll. (Kan. Univ. Quart., vol. VIII, No. 1.)

Bulletin of the department of entomology, October, 1897, 11 pp.; 5 pll.; January, 1898, 62 pp.; 7 figs.

University of Kansas:

Catalogue of the university for the year 1896–'97, 162 pp.; 1 half-tone plate.

Catalogue of the school of fine arts for 1897–'98, 41 pp.; 1 half-tone plate.

Catalogue of the school of law for the year 1896–'97, 22 pp.

Catalogue of the school of pharmacy for the collegiate years 1896–'97 and 1897–'98, 32 pp.; 4 pll.

University of Kansas Geological Survey, Erasmus Haworth, Geologist:

University geological survey of Kansas, vol. II, 19x25 cm., 318 pp.; 48 pll.; 13 figs. Physiography of western Kansas, by Erasmus Haworth, pp. 1–50; pll. I–VIII; fig. 1. The upper Permian and the lower Cretaceous, by Charles S. Prosser, pp. 51–194; pll. IX–XXIV; figs. 2–9. The upper Cretaceous of Kansas, by W. N. Logan, with an introduction by E. Haworth, pp. 195-234; pll. XXV-XXXIV; fig. 10. The Kansas Niobrara Cretaceous, by S. W. Williston, pp. 235-246; pl. XXXV. Physical properties of the Tertiary, by E. Haworth, pp. 247-296; pll. XXXVI-XLVIII. The Pleistocene of Kansas, by S. W. Williston, pp. 297-308.

Vol. III, 19 x 25 cm., 347 pp.; 30 pll.; 57 figs. Special report on coal, by Erasmus Haworth, assisted by W. R. Crane. Part I. Stratigraphy of the Kansas coal measures, by Erasmus Haworth, pp. 9-105; pll. I-XXX; 3 figs. Part II. Geography and detailed stratigraphy of the Kansas coal measures; description of mines, mining methods, and mining machinery; chemical and physical properties of Kansas coals; output and commerce; mining directory; and mining laws, by W. R. Crane, pp. 108-336; pll. XXXI-LXX; 54 figs.

Vol. IV. Paleontology. The extinct vertebrates of Kansas, by Prof. S. W. Williston, 594 pp.; 120 pll.; 6 figs.

The Kansas University Quarterly, vol. VI, series A. Science and mathematics, 210 pp.; 21 pll. *Diptera brasiliana*, part IV, by S. W. Williston, pp. 1-12. Restoration of *Oreodon culbertsonii* Leidy, by Alban Stewart, pp. 13-14; pl. I. Gypsum in Kansas, by G. P. Grimsley, pp. 15-28; pll. III-VI; 6 figs. On the chemical composition of some Kansas gypsum rocks, by E. H. S. Bailey and W. M. Whitten, pp. 29-31. Restoration of Ornithostoma (Pteranodon), by S. W. Williston, pp. 35-52; pl. II. Notice of some vertebrate remains from the Kansas Permian, by S. W. Williston, 53-56; 4 figs. A new Plesiosaur from the Kansas Comanche Cretaceous, by S. W. Williston, pp. 57-60. Types of projective transformations in the plane and in space, by H. B. Newson, pp. 63-70; pl. VII. A new explosive compound formed by the action of liquid ammmonia upon iodin, by Hamilton P. Cady, pp. 71-76. The effect of magnetism upon the spectral lines of sodium, by A. St. C. Dunstan, M. E. Rice, and C. A. Kraus, pp. 77-88, 4 figs. Results of windmill tests, by E. C. Murphy, pp. 89-94; 2 figs. Brachysaurus, a new genus of Mosasaurs, by S. W. Williston, pp. 95-98; pl. VIII. On the extremities of Tylosaurus, by S. W. Williston, pp. 99-102; pll. IX-XII. Two new species of Asilids from New Mexico, by Barnum Brown, p. 103. Restoration of Kansas Mosasaurs, by S. W. Williston, pp. 108-110; pl. XIII. Salicylic acid and calcium sulphite as preservaties of cider, by E. H. S. Bailey and Chas. M. Palmer, pp. 111-116. On the composition of the Louisville mineral water, by E. H. S. Bailey, pp. 117-120. The myology of the hind limb of the raccoon, by R. C. Gowell, pp. 121-126; pll. XIV-XVI. Notes on the osteology of *Bison antiquus* Leidy, by Alban Stewart, pp. 127-136; pl. XVII. New species of the syrphid genera *Mixogaster* Macq. and *Ceria* Fabr., by Paul Hugo Isidor Kahl, pp. 137-146. The Permian and Upper Carboniferous of southern Kansas, by Charles S. Prosser, pp. 149-176; pl. XIX. Range and distribution of the Mosasaurs, with remarks on synonymy, by S. W. Williston, pp. 177-183; pl. XX. Some new cirriped crustaceans from the Niobrara Cretaceous of Kansas, by W. N. Logan, pp. 187-190. Power of a twelve-foot "power," windmill, by E. C. Murphy, pp. 191-200; 6 figs. On new canonical forms of the binary, quintic, and sextic, by Bessie E. Growe, pp. 201-204. On the action of sulphuric acid upon strychnine, in the separation of this alkaloid from organic matter, by E. H. S. Bailey and Wm. Lange, pp. 205-208. A new Labyrinthodont from the Kansas Carboniferous, by S. W. Williston, pp. 209 and 210; pl. XXI.

Vol. VI, Nos. 1-4, series B, philology and history, pp. 1-180, 1 pl.

Vol. VII, Nos. 1, 2, series A, science and mathematics. Experiments in judging the distance of sound, by C. E. Shutt, pp. 1-8. Experiments in judging the direction of sound, L. D. Ikenberry and C. E. Shutt, pp. 9-16. New corals from the Kansas Carboniferous, by J. W. Beede, pp. 17 and 18. A geological map of Logan and Gove counties, by Geo. I. Adams, pp. 19 and 20. A contribution to the knowledge of the icthyic fauna of the Kansas Cretaceous, by Alban Stewart, pp. 21-30; pll. I and II. Alternating currents in Wheatstone's bridge, by M. E. Rice, pp. 31-36. Adulterations of buckwheat flour sold in the Lawrence market, by Marshall A. Barber, pp. 37-40; pll. III and IV. The designing of cone pulleys, by W. K. Palmer, pp. 41-75. Kinoplasm and nucleolus, by W. C. Stevens, pp. 76-85. Physiography of southeastern Kansas, by George I. Adams, pp. 86-102.

MANHATTAN.—*Kansas State Agricultural College:*

Annual report of the experiment station of the Kansas State Agricultural College, 1897, pp. 1-20.

Catalogue of Kansas State Agricultural College, 1896-'97, 96 pp.; numerous plates.

Bulletins: No. 65. Grafting the apple, pp. 1-18; pll. I-VII.

No. 66. Kansas weeds, IV—fruits and seeds, pp. 19-54; pll. I-XVII.

No. 67. Steer-feeding experiments, VI, pp. 55-74.

No. 68. Soil moisture, pp. 75-102; pll. I-IX.

No. 70. Vegetable growing, pp. 135-162; 5 pll.

No. 71. Experiments with wheat, pp. 163-174.

No. 72. Growth of young stock, pp. 175-180.

No. 73. Fruit notes, pp. 181-194.

No. 74. Experiments with oats, pp. 195-212.

No. 75. Root development, pp. 213-228; 6 pll.

No. 76. Kansas weeds, V—propagation, pp. 1-23; pll. I-XII.

No. 77. Some insects injurious to the orchard, pp. 25-62; 32 figs. Also spray calendar, March, 1898.

No. 79. Bovine tuberculosis, pp. 83-109; 7 figs.

No. 80. Sixth report on Kansas weeds—distribution and other notes, pp. 113-164; pll. XIII-XXVIII.

No. 81. Feed and care of the dairy cow, 38 pp.

The Industrialist, vol. XXIII, 24x40 cm., weekly, Nos. 1-13, pp. 181-232.

Vol. XXIV, 15x23 cm., monthly, 720 pp.; several plates.

Flora of Kansas, by A. S. Hitchcock, 12 pp.

A. S. Hitchcock, Author:

Cryptogams collected in the Bahamas, etc., by Albert S. Hitchcock, pp. 111-120. (From Ninth Ann. Rep. Mo. Bot. Garden.)

Native agricultural grasses of Kansas, 29 pp.; 15 pll.

Les Onotheracees du Kansas, E. U. A. Extrait du Monde des Plantes, 19x27 cm., pp. 141-151.

ROCKPORT.—*Elam Bartholomew, Author:*

New Kansas fungi, by Ellis and Bartholomew.

TOPEKA.—*Adjutant-General of the State of Kansas:*

Annual report, 1898, 150 pp. Roster of volunteer troops of state in Spanish-American war, 1898, 48 pp.

State Board of Agriculture:

Report for the quarter ending March, 1898, 200 pp.; 1 map.

Biennial report, vol. XVI, 1897-'98, bound in cloth, F. D. Coburn, secretary, 840 pp.

State Board of Health, H. Z. Gill, Secretary:

Laws governing the practice of medicine in the state of Kansas, also rules of the state board of health, and annual report of the secretary, 47 pp.

Twelfth annual report of the state board of health, 1896, Thos. Kirkpatrick, M. D., secretary, 162 pp.

Thirteenth annual report of the state board of health, 1897, H. Z. Gill, M. D., secretary, 207 pp.

Fourteenth annual report, 1898, H. Z. Gill, M. D., secretary, 196 pp.

State Board of Irrigation Survey and Experiment:

Report for 1895 and 1896, 24 pll.; 20 figs.

State Board of Railroad Commissioners:

Fourteenth annual report, for the year 1896, 339 pp.; with map of Kansas.

Fifteenth annual report, for the year 1897, 313 pp.; with map of Kansas.

Secretary of State:

House journal, 1897, 1480 pp.

Senate journal, 1897, 1343 pp.

Laws of Kansas, 1897, 545 pp.

Public documents, vol. I, 1895-'96. Vol. II, 1895-'96.

State Horticultural Society, William H. Barnes, Secretary:

Annual reports, 1897, 100 pp; 1898, 100 pp.

State Librarian:

Annual report, 1897, James L. King, librarian, 50 pp.

State Superintendent of Public Instruction:

Kansas school laws, Wm. Stryker, state superintendent, 1897, 175 pp.

State Treasurer:

Eleventh biennial report of state treasurer, 45 pp.

J. W. Beede, Author:

Spirifer cameratus, by J. W. Beede, 3 pp.; 1 pl.

New corals from the Kansas Carboniferous, by J. W. Beede, 2 pp. (Kans. Univ. Quart., vol. VII, Nos. 1 and 2, Jan. 1898, series A.)

G. P. Grimsley, Author:

The study of natural palimpsests, by G. P. Grimsley, 21 pp.

Gypsum in Kansas, pamph., 14 pp.; 6 pll.

T. B. Jennings, Weather Observer:

Bulletin No. 24 of national weather bureau, 70 pp.

John MacDonald, Editor:

Western School Journal, 20 x 25 cm. Vol. XXIV, 1897, 284 pp.; XXV, 1898, 300 pp.

E. A. Popenoe:

Smithsonian contributions to knowledge, 222. Tables and results of the precipitation in rain and snow, by Charles A. Schott, 173 pp.; numerous charts and diagrams.

William Smith, sr., M. D.:

Art of war in Europe in 1854-'55-'56, by Maj. R. Delafield, 277 pp.; numerous maps and plates. Bound.

Geological survey of Illinois, A. H. Worthen, director. Vol. I, geology, 504 pp.; 10 pll. Bound in green cloth.

Vol. II, paleontology, 470 pp.; 50 pll. Bound in green cloth. Contains descriptions of vertebrates, by J. S. Newberry and A. H. Worthen, pp. 1-140; descriptions of invertebrates from the Carboniferous system, by F. B. Meek and A. H. Worthen, pp. 145-423; the fossil plants of Illinois, by Leo Lesquereux, pp. 427-470.

Vol. III, geology and paleontology, 571 pp.; 25 pll.; 10 figs.

Vol. IV, geology and paleontology, 508 pp.; 31 pll.

Vol. V, geology and paleontology, 619 pp.; 32 pll.

Vol. VI, geology and paleontology, 532 pp.; 33 pll.; map of Illinois geological survey in pocket at end of book.

U. S. geological survey of Montana, Idaho, Wyoming, and Utah, 1872, by F. V. Hayden, U. S. geologist, 844 pp.; 80 pll.; 5 maps; 3 diagrams.

U. S. geological and geographical survey of Colorado and adjacent territory, 1874, by F. V. Hayden, U. S. geologist, 508 pp.; 77 pll.; numerous figures.

B. B. Smyth, Author:

The buried moraine of the Shunganunga. From Trans. Kans. Acad. Sci., xv, pp. 95-104; plate.

Alton H. Thompson, D. D. S., Author:

Ethnology of the teeth, pamph., 13 pp.

Manual of comparative dental anatomy for dental students, by Alton Howard Thompson, D. D. S., 176 pp.; 34 figs.; bound in cloth.

WICHITA.—*Fairmount College:*

Second annual catalogue, for the collegiate year 1896-'97, 55 pp.

Third annual catalogue, for the collegiate year 1897-'98, 56 pp.

The Sunflower, a monthly college paper, 19x28 cm., about 111 pp. per year.

LOUISIANA.

NEW ORLEANS.—*Louisiana Historical Society:*

Publications of the Louisiana Historical Society, vol. I, part IV, 1896, 32 pp.; 14 pll. The mounds of Louisiana, by George E. Beyer.

J. C. Smith, New Orleans:

Publications of the Louisiana Historical Society; vol. I, part IV, 1896, 32 pp.; 14 pll.

The sporular development of *Amoeba villosa*, Leidy, by J. C. Smith, pp. 69-73. (Reprint from Trans. 20th Ann. Meet. Am. Micro. Soc., 1897).

Notices of some undescribed infusoria from the infusorial fauna of Louisiana, by J. C. Smith, pp. 55-68; 1 pl. (Reprint from Trans. Am. Micro. Soc., 1897).

BATON ROUGE.—*State Experiment Station, Wm. C. Stubbs, Director:*

Bulletin No. 51. Cattle-tick and Texas fever, pp. 230-282; 6 pll.

Preliminary report (part IV) on the bluff and Mississippi alluvial lands of Louisiana, by W. W. Clendenin, pp. 260-290.

MAINE.

AUGUSTA.—*State Board of Agriculture:*

Board bulletins: No. 1. The farm garden, 40 pp. No. 2. Good roads, 40 pp. No. 3. Our song birds, 40 pp. No. 4. Stock husbandry, 40 pp. No. 5. The farmers' market, 26 pp. No. 6. Poultry and fruit, 23 pp. No. 7. Library number, 34 pp. No. 8. Sheep husbandry, 40 pp. No. 9. Silos and ensilage, 96 pp.

PORTLAND.—*Portland Society of Natural History:*

Journal, vol. I, No. 1, 1864, 63 pp.; 10 pll.; 104 figs.

Proceedings, 1862, vol. I, part 1, 96+xiv pp.; 1 pl.; 1 map. Part 2, 1869, 212 pp.; 3 pll.

Vol. II, part 4, 1897, 137 pp.; 1 pl. Contains: The sharp-tailed sparrows of Maine, by Arthur H. Norton, pp. 97-104. The foraminifera of the marine clays of Maine, by Frank S. Morton, pp. 105-122; 1 pl. Second supplement to the Portland catalogue of Maine plants by Merritt Lyndon Fernald, pp. 123-137.

MARYLAND.

BALTIMORE.—*Johns Hopkins University:*

Circulars, 24x30 cm. Nos. 128 to 138. 180 pp.

MASSACHUSETTS.

BOSTON.—*American Academy of Arts and Sciences:*

Proceedings, vol. XXXII, January to July, 1897, pp. 121-385. Vol. XXXIII, July, 1897, to May, 1898, 512 pp. Vol. XXXIV, 1898, Nos. 1-7, 148 pp. No. 1. On the thermal conductivities of certain poor conductors — I, by B. O. Pierce and R. W. Willson, pp. 3-56. No. 2. The contact-potential between metals and and fused salts, and the dissociation of fused salts, by Clarence McCheyne Gordon, 59-68. No. 3. On fluctuations in the composition of natural gas, by Francis C. Phillips, pp. 71-83. No. 4. Some electro-chemical and thermochemical relations of zinc and cadmium amalgams, by Theodore William Richards and Gilbert Newton Lewis, pp. 87-99. No. 5. Trinitrophenylmalonic ester, second paper, by C. Loring Jackson and J. I. Phinney, pp. 103-115. No. 6. On the action of sodic ethylate on tribrom-dinitrobenzol, by C. Loring Jackson and Waldemar Koch, pp. 119-135. No. 7. On certain derivatives of symmetrical trichlorbenzol, by C. Loring Jackson and F. H. Gazzolo, pp. 139-148.

Boston Society of Natural History:

Proceedings, vol. XVIII, Nos. 1-9, April, 1897—June, 1898, 264 pp. Notes on the mammals of Ontario, by Gerrit S. Miller, jr., pp. 1-44. Proceedings of annual meeting, May 5, 1897, pp. 45-72. The role of water in growth, by C. B. Davenport, pp. 73-84; 8 figs. The Harvard geographical models, by William Morris Davis, with a note on the construction of the models, by G. C. Curtis, pp. 85-110; 4 pll. *Clymene producta*, sp. nov., by Margaret Lewis pp. 111-115; 2 pll. A contribution to the petrography of the Boston basin, by Theodore G. White, pp. 117-156; 5 pll. The land mammals of peninsular Florida and the coast region of Georgia, by Outram Bangs, pp. 157-235. The genus *Antennaria* in New England, by Merritt L. Fernald, pp. 237-249. Notes on a Carboniferous boulder train in eastern Massachusetts, by Myron L. Fuller, pp. 251-264; 1 map.

Massachusetts State Board of Agriculture:

Report on the extermination of the gypsy moth, pp. 1-48; 9 pll. (1 colored). Appendices, pp. 49-85.

Report on the extermination of the gypsy moth, January, 1898, 138 pp.; 5 pll. (1 colored).

Massachusetts Horticultural Society, Robert Manning, Secretary:

Transactions of the Massachusetts Horticultural Society for the year 1895, part III, pp. 351-421. List of accessions to the library.

For the year 1896, part II, 283 pp., reports.

For the year 1897. Tropical horticulture, by George Lincoln Goodale, pp. 13-19. The structure and classification of mushrooms, by Hollis Webster, pp. 20-28. The chrysanthemum, by Edmund M. Wood, pp. 28-43. Plant beauty, by Henry T. Bailey, pp. 43-46. The sweet pea, by Rev. W. T. Hutchins, pp. 46-64. Some phases of market-gardening, by T. Greiner, pp. 64-77. Good food from the garden, by Miss Anna Barrows, pp. 77-88. Horticulture in Canada, by Prof. William Saunders, pp. 88-106. Soils and potting, by T. D. Hatfield, pp. 107-116. The spread of plant diseases, by Dr. Erwin F. Smith, pp. 117-133.

Schedule of prizes offered by the Massachusetts Horticultural Society for the year 1897, 45 pp.

CAMBRIDGE.—*Gray Herbarium of Harvard College:*

Contributions from the herbarium, new series, vol. XXXIII. No. 17. Revision of the North American and Mexican species of *Mimosa*, by B. L. Robinson, pp. 305-331. Revision of the North American species of *Neptunia*, by B. L. Robinson, pp. 331-334.

No. 25. Revision of the Mexican and Central American species of *Galium* and *Relbunium*. Diagnoses of new and critical Mexican phanerogams, by J. M. Greenman, pp. 455-489.

New species and extended ranges of North American Caryophyllaceæ, by B. L. Robinson, pp. 165-171; 1 pl.

A case of ecblastesis and axial prolification in *Lepidium apetalum*, by B. L. Robinson, pp. 209-212; 1 pl.

Some new and noteworthy plants of the northwest, by J. M. Greenman, pp. 261-269.

Some reasons why the Rochester nomenclature cannot be regarded as a consistent or stable system, by B. L. Robinson, pp. 437-445.

A new species of *Apios* from Kentucky, by B. L. Robinson, pp. 450-453.

Merritt L. Fernald, Author:

Antennaria plantaginea and *A. parlinii*, by M. L. Fernald, 4 pp.; 1 pl.

Notes upon some northwestern Castilleias of the parviflora group, by M. L. Fernald, pp. 41-51.

Museum of Comparative Zoology at Harvard College:

Annual reports of the curator, for 1896-'97, 44 pp.; 1897-'98, 44 pp.

Bulletins: Vol. XXVIII, No. 4. A visit to the Great Barrier reef of Australia in the steamer "Croydon" during April and May, 1896, by Alexander Agassiz, pp. 95-148; 42 pll.

No. 5. The geological history of the Isthmus of Panama and portions of Costa Rica, by Robert T. Hill, pp. 151–285; 19 pll.

Vol. XXX. No. 4. On the color and color patterns of moths and butterflies, by Alfred Goldsborough Mayer, pp. 169–256; 10 pll.

No. 5. The mesenteries and siphonoglyphs in *Metridium marginatum* Milne-Edwards, by G. H. Parker, pp. 259–272; 1 pl.

No. 6. Photo-mechanical changes in the retinal pigment cells of Palæmonetes, and their relation to the central nervous system, by G. H. Parker, pp. 275–300; 1 pl.

Vol. XXXI, No. 1. Contributions to the morphology of the Turbellaria. On some Turbellaria from Illinois, by W. McM. Woodworth, pp. 1–16; 1 pl.

No. 2. On the relations of certain plates in the Dinichthyids, with descriptions of new species, by C. R. Eastman, pp. 19–41; 5 pll.

No. 3. Trichonympha and other parasites of *Termes flavipes*, by James F. Porter, pp. 47–68; 6 pll.

No. 4. Variations in the brachial and lumbro-sacral plexi of *Necturus maculosus* Raf., by F. C. Waite, pp. 71–92; 2 pll.

No. 5. Reports on the dredging operations off the west coast of Central America to the Galapagos, to the west coast of Mexico, and in the Gulf of California, in charge of Alexander Agassiz, carried on by the U. S. Fish Commission steamer "Albatross," during 1891, Lieut.-Com. Z. L. Tanner, U. S. N., commanding. XXII. The Isopoda, by H. J. Hansen, pp. 95–129; 6 pll.; 1 chart.

No. 6. The thoracic derivatives of the post-cardinal veins in swine, by G. H. Parker and C. H. Tozier, pp. 133–143.

No. 7. The segmentation of the nervous system in *Squalus acanthias*, by H. V. Neal, pp. 148–294; 9 pll.

Vol. XXXII, No. 1. Studies from the Newport marine laboratory, communicated by Alexander Agassiz. No. XLI. On Dactylometra, by Alexander Agassiz and Alfred Goldsborough Mayer, pp. 1–11; 13 colored pll.

No. 2. On some Medusæ from Australia, by Alexander Agassiz and Alfred Goldsborough Mayer, pp. 15–18; 3 pll.

No. 3. The Gordiacea of certain American collections, by Thomas H. Montgomery, jr., pp. 23–59; 15 pll.

No. 4. Some Planarians from the Great Barrier reef of Australia, by W. McM. Woodworth, pp. 63–67; 1 pl.

No. 5. Preliminary report on the Echini, by Alexander Agassiz, pp. 71–86; 13 pll.; 1 chart.

No. 6. The nervous system of *Nereis virens* Sars, by J. I. Hamaker, pp. 89–124; 5 pll.

No. 7. On remains of *Struthiolithus chersonensis* from northern China, by C. R. Eastman, 144 pp.; 1 pl.

E. L. Mark:

Contributions from the zoological laboratory of the museum of comparative zoology at Harvard College. Studies on the central and peripheral nervous systems of two polychæte annelids, by Margaret Lewis, pp. 225–267; 8 pll.

SALEM.—*Essex Institute:*

Vol. XXVII, bulletins Nos. 7–12. The lumbar curve in some American races, by George A. Dorsey, pp. 53–73. The flora of colonial days, by Miss Mary T. Saunders, pp. 74–88. Prehistoric relics from Beverly, by John Robinson, pp. 89–91; 2 pll. Botanical notes, by Rev. Wm. P. Alcott, pp. 92–94. On a new genus and two new species of macrurous crustacea, by J. S. Kingsley, pp. 95–99; 1 pl. The nasal organs of *Pipa americana*, by Irving Reed Bancroft, pp. 101–107; 2 pll. Supplementary report on the mineralogy and geology of Essex county, by John H. Sears, pp. 109–112. Sandstone dikes accompanying the great fault of Ute pass, Colorado, by W. O. Crosby, pp. 113–146; 1 pll.

Vol. XXVIII, Nos. 1–6. Annual meeting, May 18, 1896, 56 pp.

Nos. 7–12. The photograph and skeleton of a native Australian, by George A. Dorsey, pp. 57–69; 2 pll. Some resources for protection, by Rev. William P. Alcott, pp. 71–76. Roger Williams in Salem, by Mrs. Henry M. Brooks, pp. 77–86. The chondrocranium in the Ichthyopsida, by Guy Monroe Winslow, pp. 87–141; 4 pll.

Vol. XXIX, Nos. 1–6. Annual meeting, May 17, 1897, 49 pp.

Vol. XXX, Nos. 1–12, 149 pp. The first half century of the Essex Institute, 100 pp.

TUFTS COLLEGE.—*Tufts College Library:*

Tufts College studies No. V. The chondrocranium in the Ichthyopsida, by Guy M. Winslow, pp. 148–201 pll. I–IV.

MICHIGAN.

AGRICULTURAL COLLEGE.—*Michigan Agricultural College:*

Calendar for 1897.

Michigan Agricultural College Experiment Station:

Botanical department bulletins: No. 1. Study of beans and peas before and after sprouting, by W. J. Beal, 8 pp.; 12 figs.

No. 2. Study of wheat and buckwheat before and after sprouting, by W. J. Beal, pp. 11-15; figs. 13-22.

No. 3. A study of the seeds of timothy and red clover before and after sprouting, by W. J. Beal, pp. 19-23; figs. 23-32.

No. 4. Observations on the leaves of clovers at different times of day, by W. J. Beal, pp. 27-31; figs. 33-43.

Report of the botanical department for the year closing June 30, 1897, by W. J. Beal, pp. 48-59.

ANN ARBOR.—*University of Michigan:*

Latitude of the Detroit observatory, by Ludovic Estes, 54 pp.

The toxic products of the bacillus of hog-cholera, by Frederick G. Novy, 23 pp.

The actions of some inorganic cyanides upon chlorocaffeine. by M. Gomberg, pp. 403-420.

DETROIT.—*Public Library:*

Seventh annual report of the library commission, for the year 1887, 26 pp.

Eighth annual report, 1888, 24 pp. Ninth, 1889, 26 pp. Tenth, 1890, 23 pp. Eleventh, 1891, 22 pp. Twelfth, 1892, 27 pp. Thirteenth, 1893, 26 pp. Fourteenth, 1894, 24 pp. Fifteenth, 1895, 27 pp. Sixteenth, 1896, 27 pp. Seventeenth, 1887, 24 pp.

MINNESOTA.

MINNEAPOLIS.—*Geological and Natural History Survey of Minnesota, N. H. Winchell, State Geologist:*

Twenty-third annual report, 1894, 255 pp.

University of Minnesota—Agricultural Experiment Station:

Bulletins: No. 47, July, 1896. Flax, pp. 1-30; 5 figs.

No. 50. Division of animal husbandry: Fattening lambs and wethers in winter, pp. 511-560; figs. 204-206.

No. 52, December, 1896. Variety tests in 1896, pp. 419-440; several figures.

No. 53, June, 1897. Effects of the rotation of crops upon the humus content and the fertility of soils, 35 pp.

No. 54, September, 1897. Human food investigations, pp. 36-90; 7 figs.

No. 57. Fattening lambs in winter, pp. 417-467.

No. 58. Fattening steers in winter, pp. 469-509.

No. 60. Beef cattle and swine, 54 pp.; 4 figs.

No. 61. Butterflies and moths, pp. 55-333; 237 figs.

Otto Lugger, Entomologist of State Experiment Station:

Third annual report, for the year 1897, by Otto Lugger, 296 pp.; 187 figs.

Conway MacMillan, State Botanist:

Minnesota botanical studies, bulletin No. 9. Part IX, pp. 601-701; 9 pll. A contribution to the life-history of *Pilina Diluta* Wood and *Stigeoclonium flagelliferum* Kg., by Josephine E. Tilden, 607-635; pll. XXXI-XXXV. Pollination and reproduction of *Lycopersicum esculentum*, by Bruce Fink, pp. 636-643. A rearrangement of the North American Hyphomycetes, I, by Roscoe Pound and Frederic E. Clements, pp. 644-673. On the stem anatomy of certain Onagraceæ, by Francis Ramaley, pp. 674-690; pll. XXXVI-XXXVIII. A new hypnum of the section Caliergon, by J. M. Holzinger, pp. 691-692; pl. XXXIX. Contribution to a knowledge of the lichens of Minnesota, I, by Bruce Fink, pp. 693-701.

Parts X and XI, pp. 703-1043; pll. XL-LXXX. Lichens of Minneapolis, Bruce Fink, pp. 703-725. N. A. Hyphomycetes, 726-738. Coscinodon in Minnesota, J. M. Holzinger, pp. 753-759. Plants of the Hawaiian islands, A. A. Heller, pp. 760-922. Symbiosis, by Albert Schneider, pp. 923-948. Distribution of plants at Lake of the Woods, Conway MacMillan, pp. 949-1023. The alkaloids of veratrum, Geo. B. Frankforter, pp. 1024-1043.

Part XII, pp. i-xii, 1045-1081. Contains title-page, table of contents, and index.

Second series, part I, June 15, 1898, 68 pp. Lichens, fresh-water algæ and other flora of Minnesota, by Fink, Tilden, Heller, Holzinger.

MISSOURI.

COLUMBIA.—*Missouri Agricultural Experiment Station:*

Bulletins: No. 34, April, 1896. Manures and fertilizers, 35 pp.; 2 figs.

No. 35, July, 1896. The wooly-aphis of the apple, 61 pp., several figures.

No. 37, January, 1897. Texas fever, pp. 81-139; several figures.

No. 38, April, 1897. Winter protection of the peach. Peach growing in Missouri, pp. 140-164, 6 figs.

No. 39, July, 1897. Influence of width of tire on draft of wagons, pp. 165-206; 14 figs.

No. 40, October, 1897. The sugar-beet, 16 pp.; 1 fig.

No. 41. The San Jose scale in Missouri, pp. 17-35; 8 figs.

No. 42. A new orchard pest; the fringed-wing apple-bud moth, pp. 36-53; 10 figs.

No. 43. Winter forcing of asparagus in the open field, and the asparagus culture for Missouri, pp. 54-68; 5 figs.

JEFFERSON CITY.—*Geological Survey of Missouri. Chas. R. Keyes, State Geologist:*

Missouri geological survey, 17x25 cm., vol. X, 1896, physical features, by C. F. Marbut, 533 pp.; 22 pll.; 24 figs.

Vol. XI, 1896, clay deposits, by H. A. Wheeler, 622 pp.; 39 pll.; 15 figs.

State Horticultural Society:

Fortieth annual report of the State Horticultural Society, by L. A. Goodman, secretary, 409 pp.; 6 pll.

ST. LOUIS.—*Academy of Science of St. Louis:*

Transactions. Vol. VII. No. 11. Flexure of telescopes, by Milton Updegraff, pp. 243-272.

No. 12. Geometrical properties of the lines of force, by Wm. H. Roever, pp. 273-298; 7 figs.

No. 13. Results of double-star observations with the equatorial of the Morrison observatory, by Henry S. Pritchett, pp. 299-312.

No. 14. North American bees, descriptions and synonyms, by Charles Robertson, pp. 313-356.

No. 15. Relations of the Devonian and Carboniferous in the upper Mississippi valley, by Charles R. Keyes, pp. 357-370.

No. 16. Critical notes on the Muricidæ, by Frank Collins Baker, pp. 371-392.

No. 17. Plants collected in the district of Cienfuegos, province of Santa Clara, Cuba, in 1895-'96, by Robert Combs, pp. 393-491; pll. XXX-XXXIX.

No. 18. An unusual phyto-bezoar, by William Trelease, pp. 493-497; pl. XL.

No. 19. A contribution to the herpetology of Missouri, by Julius Hurter, pp. 499-503.

No. 20. Title-page, prefatory matter and index from July 1, 1894, to Dec. 31, 1897, pp. lxxviii+505-518.

Vol. VIII, No. 1. A method of measuring the pressure at any point on a structure due to wind blowing against that structure, by Francis E. Nipher, pp. 1-24; pll. I and II.

No. 2. The trees of St. Louis as influenced by the tornado of 1896, by Hermann von Shrenk, pp. 25-41; pll. III-IX.

No. 3. New or little known North American bees, by Charles Robertson, pp. 43-54.

No. 4. Ecological plant geography of Kansas, by A. S. Hitchcock, pp. 55-69.

No. 5. The molluscan fauna of western New York, by Frank Collins Baker, pp. 71-94; pl. X.

No. 6. The efficiency of gearing under friction, by Calvin M. Woodward, pp. 95-105.

Mercantile Library Association:

Fifty-second annual report, 1897, 79 pp.

Missouri Botanical Garden, Wm. Trelease, Director:

North American Lemnaceæ, by Charles Henry Thompson, 22 pp., 4 pll.

J. B. S. Norton, Author:

Coloring matter of Borraginaceæ, and herbarium notes, by J. B. S. Norton, pp. 149-157; pll. XLVI-L.

MONTANA.

BOZEMAN.—*J. W. Blankinship:*

A precise criterion of species. I. The general method, by C. B. Davenport, pp. 1-6. II. Specific *vs.* individual characters, by J. W. Blankinship, pp. 6-10.

NEBRASKA.

LINCOLN.—*University of Nebraska, Agricultural Experiment Station:*

Bulletins: No. 44. Experiments in the culture of the sugar-beet in Nebraska, by H. H. Nicholson and T. L. Lyon, pp. 109-125.

No. 45. The rainfall of Nebraska, by G. D. Swezey and Geo. A. Loveland, pp. 129-177.

No. 47. Serum therapy in hog-cholera, by A. T. Peters, pp. 47-67.

No. 48. Windbreaks, by Fred W. Card, pp. 69-96.

No. 49. Suggestions for chicory culture, by T. L. Lyon, pp. 199-404.

No. 50. Notes on pruning, by Fred W. Card, pp. 1-10.

No. 51. Observations on the codling-moth, by F. W. Card, 50 pp.

No. 52. Corn-stalk disease, by A. J. Peters, 62 pp.

No. 53. A preliminary report on experiments with forage crops, by T. L. Lyon, pp. 65-76.

No. 54. The effect of certain methods of soil treatment upon the corn crop, by T. L. Lyon, pp. 77-89.

University of Nebraska:

University studies, vol. II, No. 2, pp. 81-176; 18 pll. History of the study and report of progress in the study of Daimonelix, by Erwin Hinckley Barbour, pp. 81-124; 18 pll. Notes on the chemical composition of the silicious tubes of the devil's corkscrew, Daimonelix, by Thomas Herbert Marsland, pp. 125-130. On the continuity of chance, by Ellery W. Davis, pp. 131-146. The Bacon-Shakespeare controversy—a contribution, by Carson Hildreth, pp. 147-162. Generalization and economic standards, by W. G. Langworthy Taylor, pp. 163-176.

Erwin H. Barbour, Lincoln:

Additional notes on the new fossil, Daimonelix, by Erwin Hinckley Barbour, 16 pp.; 12 pll.

Is Daimonelix a burrow, by Erwin Hinckley Barbour, 10 pp.; 1 pl.

Notes on a new order of gigantic fossils, by Erwin Hinckley Barbour, 23 pp.; 6 pll.; 18 figs.

NEW JERSEY.

NEW BRUNSWICK.—*New Jersey Microscopical Society:*

Abstract of the minutes from April, 1871, to June, 1894, 57 pp.

Part II. Abstract of the minutes from October 22, 1894, to April 26, 1897, 36 pp.

NEW MEXICO.

MESILLA PARK.—*T. D. A. Cockerell, Author:*

A new scale-insect of the genus Lecanium, by T. D. A. Cockerell.

A new weasel from New Mexico, by C. M. Barber and T. D. A. Cockerell.

New or little-known bees from Washington state, by T. D. A. Cockerell.

Three new Aleurodidae from Mexico, by T. D. A. Cockerell.

Bulletins: No. 24. Life zones in New Mexico, by T. D. A. Cockerell, 44 pp.

No. 28. Life zones in New Mexico, II: The zonal distribution of coleoptera, by T. D. A. Cockerell, pp. 135-179.

NEW YORK.

ALBION.—*Frank H. Lattin, Publisher:*

The Oologist, 1895, Nos. 6, 7, 10, 11; pp. 100-122, 126-167.

Walter F. Webb, Publisher:

The Museum, vol. III, Nos. 3-12, 1897, pp. 35-192. Fracture and displacement of rocks, by C. O. Ormsbee, pp. 44 and 45. X-ray photography, by William Newell, pp. 55 and 56. Indiana notes, by A. J. Reynolds, pp. 76, 103-105, 132 and 133. Black-crowned night heron, by F. Henry Yorke, pp. 105 and 106. The cliff dwellings, by C. N. Stark, pp. 167-169. Nesting habits of Krider's hawk, by R. M. Anderson, pp. 188-190.

Vol. IV, 194 pp. Some North American mammals, by Walter F. Webb, pp. 5-8. Two New Zealand parrots, by J. Maughan, pp. 19 and 20. Mitchell's cave, by P. M. Van Epps, pp. 35-38, 57-61. Migration of birds at Sequin lighthouse, by Herbert L. Spinney, pp. 67-70. Bumblebees and foxgloves, by Ernest W. Vickers, pp. 70 and 71. Pileated woodpeckers in Mahoning county, Ohio, pp. 92-94. Fresh-water pearls in the United States, by Geo. F. Kunz, pp. 150-154, 183 and 184.

BUFFALO.—*Buffalo Society of Natural Sciences:*

Bulletins: Vol. I, Nos. 2-4; pp. 41-289; 11 pll. Descriptions of new species of fungi, by Chas. H. Peck, pp. 41-72. Contributions to a knowledge of North American moths, by Aug. R. Grote, pp. 73-94; 2 pll. A study of North American Noctuidæ, by Aug. R. Grote, pp. 95-128. Descriptions of Noctuidæ, principally from California, by Aug. R. Grote, pp. 129-155. Statistics and distribution of North American lichens, by Henry Willey, pp. 161-167. Kleiner Beitrag zur Kenntniss einiger Nordamerikanischer Lepidoptera, von Aug. R. Grote, pp. 168-174. Contribution to the geology and physical geography of the lower Amazonas, by Ch. Fred. Hartt, pp. 201-235. On the Devonian brachiopoda of Erere, province of Para, Brazil, by Richard Rathbun, pp. 236-261. Notes on the species of Pasimachus, by John L. Le Conte, pp. 266-273.

Vol. II, Nos. 1-4, 319 pp.; 3 pll. List of the Noctuidæ of North America, by Aug. R. Grote, pp. 1-77; 122-126; 209-223; 301-312. Catalogue of the coleoptera from the region of

Lake Pontchartrain, La., by S. V. Summers, pp. 78-99. Catalogue of Boleti of New England, with descriptions of new species, by Chas. C. Frost, pp. 100-105. Descriptions of new Noctuidæ, by H. K. Morrison, pp. 109-117. Observations on North American moths, by Leon F. Harvey, pp. 118-121; 270-284. Land and fresh-water shells of the state of New York, by James Lewis, pp. 127-142. Notes on American lepidoptera, with descriptions of twenty-one new species, by Aug. R. Grote, pp. 145-163. Determination of the species of moths figured in the "Natural History of New York," by Aug. R. Grote, pp. 164-168. A list of the Leptidæ, Mydaidæ and Dasypogonina of North America, by Ch. R. Osten-Sacken, pp. 169-187. On allied species of Noctuidæ inhabiting Europe and North America, by A. R. Grote, pp. 193-200; 313-314. On *Atticus (Samia) columbia* and its parasites, by H. A. Hagen, pp. 201-208. Check-list of North American sphinges, by A. R. Grote, pp. 224-228. Synonymic list of the butterflies of North America north of Mexico, by Samuel H. Scudder, pp. 233-269. Synopsis of the discomycetous fungi of the United States by M. C. Cooke, pp. 285-300.

Vol. IV, Nos. 1-5, 290 pp.; 3 pll.; 1 map. List of the coleoptera observed and collected in the vicinity of Buffalo, by F. Zesch and O. Reinecke, pp. 2-16; 1 pl. On certain fossils of the water-lime group near Buffalo, by Julius Pohlman, pp. 17-22; 41-46. Notes on the larvæ of some local Pterophoridæ, by David S. Kellicott, pp. 47-52. The plants of Buffalo and vicinity, by David F. Day, pp. 65-255.

Vol. V, Nos. 1-5; 266 pp.; 3 pll. New genera and species of fossils from the Niagara shale, by E. N. S. Ringueberg, pp. 5-22. Fossils from the water-lime group near Buffalo, N. Y., by Julius Pohlman, pp. 22-32; 1 pl. Nidification of birds on the St. Clair flats, by J. H. Langille, pp. 33-39. *Nonagria subcarnea*, n. s., by D. S. Kellicott, pp. 40-44. The gape-worm of fowls (*Syngamus trachealis*): The earth-worm (*Lumbricus terrestris*), its origin and host, etc., by D. H. Walker, pp. 47-71: 1 pl. Ventriloquial and imitative power of birds, by E. E. Fish, pp. 72-80. Native and naturalized plants of Buffalo and its vicinity (second supplement), by David F. Day, pp. 85-96. The Mills collection of fresh-water sponges, by David S. Kellicott, pp. 99-104. List of the macro-lepidoptera of Buffalo and vicinity, by Edward P. Van Duzee, pp. 105-163. A list of hemiptera of Buffalo and vicinity, by Edward P. Van Duzee, pp. 167-201. Descriptions of some new North American homopterous insects, by E. P. Van Duzee, pp. 205-216. A preliminary review of the North American Delphacidæ, by E. P. Van Duzee, pp. 225-261.

HAMILTON.—*Colgate University, Department of Geology:*

Circulars of information, courses of instruction, etc., 1895-'96, 18 pp. 1896-'97, 16 pp.

ITHACA.—*Cornell University—Agricultural Experiment Station:*

Bulletins.

Announcement of the New York State College of Forestry, 40 pp.

M. V. Slingerland, Cornell University:

Bulletin No. 124. The pistol-case-bearer in western New York, by M. V. Slingerland, 17 pp.

No. 126. The currant-stem girdler and the raspberry-cane maggot, by M. V. Slingerland, 60 pp.

No. 133. The army-worm, by M. V. Slingerland, pp. 233-258; 2 pll.; several figures.

No. 142. The codling-moth, by M. V. Slingerland, 69 pp.

NEW BRIGHTON.—*Natural Science Association of Staten Island:*

Proceedings, vol. VI, Nos. 3-16, pp. 11-56.

NEW YORK.—*Linnæan Society of New York:*

Abstract of the proceedings for the year ending March 9, 1897. The fishes and brackish waters in the vicinity of New York city, by Eugene Smith, 56 pp.

Abstract of proceedings for the year ending March 8, 1898. The frogs and toads found in the vicinity of New York city, by W. L. Sherwood, 27 pp.

New York Academy of Sciences:

Annals. Index to vol. IX, pp. 705-712.

Vol. X, Nos. 1-12; 292 pp.; 5 pll. The nature and origin of stipules, by A. A. Tyler, pp. 1-49; pll. I-III. The ascidian half-embryo, by Henry E. Crampton, jr., pp. 50-57; pll. IV and V. The Rutherfurd photographic measures of sixty-five stars near 61 Cygni, by Herman S. Davis, pp. 58-122. The parallax of 61^1 Cygni, deduced from the Rutherfurd photographic measures, by H. S. Davis, pp. 122-160. The Rutherfurd photographic measures of thirty-four stars near "Bradley 3077," by H. S. Davis, pp. 161-187. The Praesepe group; measurement and reduction of the Rutherfurd photographs, by Frank Schlesinger, pp. 189-286.

Vol. XI, parts I and II, 292 pp.; 34 pll.; 24 figs. Considerations on cell-lineage and ancestral reminiscence, based on a re-examination of some points in the early development of annelids and polyclades, by E. B. Wilson, pp. 1-27; figs. 1-7. An "X-ray detector" for research purposes, by C. C. Trowbridge, pp. 29-38; figs. 8-11. The use of the fluoroscopic screen in connection with Roentgen rays, by C. C. Trowbridge, pp. 39-44; figs. 12-14. On hypertrophied scale leaves in *Pinus ponderosa* by Francis E. Lloyd, pp. 45-51; pll. I. Notes on Block island, by Arthur Hollick, pp. 55-88; pll. II-IX. The use of the Dudley "stremmatograph" in determining stresses in rails under moving trains, by P. H. Dudley, pp. 89-116. Appendix, 31 pp. Part II. Descriptions of Devonian crinoids and blastoids from Milwaukee, Wis., by Stuart Weller, pp. 117-126; pl. XIV. The eparterial bronchial system of mammalia, by Geo. S. Huntington, pp. 127-176; pll. XV-XXVIII. The debt of the world to pure science, annual address of retiring president, by J. J. Stevenson, pp. 177-192. Description of some marine nemerteans of Puget sound and Alaska, by B. B. Griffin, pp. 193-218; figs. 15-24. An important instance of insect coalescence, by H. E. Crampton, jr., pp. 219-224. The Northrop collection of crustacea from the Bahamas, by W. M. Rankin, pp. 225-258; pll. XXIX and XXX. On a collection of crustacea from Puget sound, by W. T. Calman, pp. 259-292, 4 pll.

Transactions, vol. XVI, 402 pp.; 38 pll. The glacial or post-glacial diversion of the Bronx river from its old channel, by J. F. Kemp, pp. 18-24. Adaptation of the shell of Placuanomia to that of Saxidomus, with remark on shell and adaptation in general, by Bradney B. Griffin, pp. 71-81. Notes on the geology of the Bermudas, by John J. Stevenson, pp. 96-124. The Cretaceous clay marl exposure at Cliffwood, N. J., by Arthur Hollick, pp. 124-136; 4 pll. Notes upon the distribution and habits of some Puget sound invertebrates, by N. R. Harrington and B. B. Griffin, pp. 152-165. The mountains and Tertiary valleys of eastern Columbia, by Francis Child Nicholas, pp. 166-181; 1 pl. The new Flicker photometry, by F. L. Tufts, pp. 190-212. On nereids commensal with hermit crabs, by N. R. Harrington, pp. 214-222; 3 pll. The Lancashire coal-field, by Herbert Bolton, pp. 224-251. The Batesville sandstone of Arkansas, by Stuart Weller, pp. 251-282; 3 pll. Description of new species of Hydreionocrinus from the coal measures of Kansas, by Stuart Weller, pp. 372-374; 1 pl.

New York Botanical Garden:

Bulletin of the New York Botanical Garden, vol. I, No. 2, 85 pp.; 1 large map. Vol. I, No. 3, pp. 86-170; 2 pll.; 1 map.

Arthur Chamberlain, Editor:

The Mineral Collector, vol. III, Nos. 11 and 12, pp. 161-190; 2 pll. Vol. IV, No. 1, 17 pp.

Torrey Botanical Club:

Bulletin, vol. XXIV, 1897, 592 pp.; 34 pll.; numerous figures.
Vol. XXV, 1898, 650 pp.; 30 pll.

POUGHKEEPSIE.—*Vassar Brothers Institute:*
Transactions, 1894-'96, 310 pp.

ROCHESTER.—*Geological Society of America:*
Bulletin, vol. IX, pp. 183-210; 1 pl.

NORTH CAROLINA.

BILTMORE.—*Biltmore Herbarium:*
Alphabetical catalogue of the plants of western North Carolina, 28 pp.

CHAPEL HILL.—*Elisha Mitchell Scientific Society:*

Journal for the fourteenth year, 1897. Part I, 36 pp. Contains, besides other articles, the oxalates of zirconium, by F. P. Venable and Chas. Baskerville, pp. 4-31. The glabrous-leaved species of asarum of the southern United States, by W. W. Ashe, pp. 31-36. Part II, 83 pp. A revision of the atomic weight of zirconium, by F. P. Venable, pp. 37-45. Notes on Darbya and Buckleya, by W. W. Ashe, pp. 46-51. *Robinia boyntonii*, sp. nov., by W. W. Ashe, pp. 51-55. Notes on North Carolina minerals, by J. H. Pratt, pp. 61-83.

Vol. IV, part 1, 1898, 75 pp. The nature of the change from violet to green in solutions of chromium salts, by F. P. Venable and F. W. Miller, pp. 1-17. Nesting habits of some southern forms of birds in eastern North Carolina, by T. Gilbert Pearson, pp. 17-22. The dichotomous group of *Panicum* in the eastern United States, by W. W. Ashe, pp. 22-62. Natural science of the ancients as interpreted by Lucretius, by F. P. Venable, pp. 62-75.

NORTH DAKOTA.

FARGO.—*North Dakota Agricultural Experiment Station:*

Annual reports, 1897, 51 pp.; 5 figs. 1898, 83 pp.; 1 fig.

Bulletins: No. 28. Grain rations for fattening sheep, pp. 165-184.

No. 29. A study of methods of cultivation, pp. 185-209.

No. 30. Preliminary report upon the selection of potatoes for planting, pp. 210-243; 16 figs.

No. 31. Experiment station notes, pp. 247-262.

No. 32. Chemical studies, pp. 267-279.

OHIO.

COLUMBUS.—*John H. Schaffner, Ph. D.:*

Observations on the nutations of *Helianthus annuus*, by John H. Schaffner, pp. 395-403. A convenient washing apparatus, 1 p. A permanent stain for starch, 1 p. General methods in botanical microtechnique, 3 pp.

W. A. Kellerman Ph. D.:

Systematic check-list of the plants of Ohio, 65 pp.

GRANVILLE.—*Denison University:*

Bulletin of the scientific laboratories, vol. IX, part II, 40 pp.; 4 pll.; 1 fig. Vol. X, memorial volume, 90 pp., illust. Vol. XI, 1898, art. 1. Preglacial drainage near Cincinnati, by Gerard Fowke, 10 pp.; 1 pl. Art. 2. Paleontology of the corniferous rocks of Ohio, by J. A. Bownocker, 30 pp.; 7 pll. Art. 3. New Mexico bees, by T. D. A. Cockerell, 30 pp.

OBERLIN.—*Oberlin College:*

Laboratory bulletin No. 6. A preliminary list of the birds of Okanogan county, Washington, by William L. Dawson, pp. 168-182.

No. 7. The genus *Uncinula*, by Prof. F. D. Kelsey, 15 pp.; numerous figures.

No. 8. The Oberlin grackle roost, by Lynds Jones, pp. 39-56.

Laboratory bulletin No. 9, 9 pp.; 1 pl. The effect of bloom on the transpiration of leaves, by Roberta Reynolds. A new species of pyrenomycete parasitic on an alga, by H. L. Jones. List of Ohio plants not recorded in the latest state catalogue, by H. L. Jones. Unusual forms of maple seedlings, by H. L. Jones.

Bulletins of Wilson ornithological chapter of Agassiz Association. Vol. IV, Nos. 13-27, pp. 13-84. The Oberlin grackle roost, by Lynds Jones, pp. 39-56. Vol. V, 84 pp.

WOOSTER.—*Ohio Agricultural Experiment Station:*

Bulletins: No. 73. Investigation of plant diseases in forcing-house and garden, pp. 221-246; 4 pll.; 5 figs.

No. 74. Fifteenth annual report, for 1896, pp. xliii+247-268.

No. 75. Beet-sugar production, 32 pp.; 5 figs.

No. 76. Potatoes, pp. 33-48.

No. 77. The chinch-bug and other destructive insects, pp. 33-52; 11 figs.

No. 78. Corn, pp. 53-96.

No. 79. Some diseases of orchard and garden fruits, with spray calendar supplement, pp. 97-141, 9 pll.; 10 figs.

No. 80. The maintenance of fertility, pp. 142-175; 1 pl.

No. 81. The San Jose scale in Ohio, pp. 180-212; 2 pll.; 10 figs.; 1 map.

No. 82. Field experiments with wheat, pp. 213-235.

No. 83. A first Ohio weed manual, pp. 219-400; 71 figs.; 2 tables.

No. 84. Sixteenth annual report, for 1897, pp. lxvii+401-408.

No. 85. Strawberries, 24 pp.; 3 pll.

No. 86. The story of the lives of a butterfly and a moth, pp. 25-33; several figures.

No. 87. The periodical cicada, pp. 34-68; 1 pl.; 11 figs.

No. 88. Cooperative experiments made by the Ohio agricultural students' union in 1896, pp. 69-97.

No. 89. Prevalent diseases of cucumbers, melons, and tomatoes, pp. 98-122; 3 pll.

No. 90. Sugar-beet investigations in 1897, pp. 123-162; 6 maps.

No. 91. The lung- and stomach-worms of sheep, pp. 163-178.

No. 92. Experiments in spraying peach trees, pp. 179-268; 12 pll.

No. 93. The home mixing of fertilizers, pp. 269-289.

No. 94. The maintenance of fertility, pp. 291-326.

No. 95. Seventeenth annual report, for 1898, pp. xxii+327-350.

OREGON.

SALEM.—*Oregon State Board of Horticulture:*

Report of the secretary, by John Minto, secretary, 24 pp.

PENNSYLVANIA.

PHILADELPHIA.—*Academy of Natural Science of Philadelphia:*

Proceedings, 1898, parts I and II, January to September, pp. 10-424; 18 pll. The plants of Lewis and Clarke's expedition across the continent, 1804-1806, by Thomas Meehan, pp. 12-49. New and little-known bees from Washington state, by T. D. A. Cockerell, pp. 50-56. Synopsis of the recent and Tertiary Psammobiidæ of North America, by W. H. Dall, pp. 57-62. The summer birds of Susquehanna county, Pennsylvania, by Francis R. Cope, jr., pp. 76–88. Volcanic rocks of mesozoic age in Pennsylvania, by E. Goldsmith, pp. 90 97, 4 pll. Contributions to the herpetology of Sao Paulo, Brazil, I, by Dr. H. von Ihering, pp. 101–109. Observations on errant frustules of *Eunotia major*, by T. Chalkley Palmer, pp. 110–119. Notes on Alaskan water birds, by Alvin Seale, pp. 126–140. Odonata (dragon flies) from the Indian ocean and from Kashmir, collected by Dr. W. L. Abbott, by Philip P. Calvert. pp. 141–154. Diptera collected by Dr. A. Donaldson Smith in Somaliland, eastern Africa, by Chas. W. Johnson, pp. 157–164. The Muscidæ collected by Dr. A. Donaldson Smith in Somaliland, Garry De N. Hough, pp. 165–187. Notes on the fossil walrus of eastern North America, by Samuel N. Rhoads, pp. 196–201. Birds observed in central California in the summer of 1893, by John Vandenburgh, pp. 206–218. Revision of the North American slugs: Binneya, Hemphillia, Hesperarion, Prophysaon, and Anadenulus, by Henry A. Pilsbry and E. G. Vanatta, pp. 219–261; 8 pll. Materials toward a natural classification of the cylindrelloid snails, by Henry A. Pilsbry and E. G. Vanatta, pp. 264–286; 2 pll. List of bats collected by Dr. W. L. Abbott in Siam, by Gerrit S. Miller, jr., pp. 316–325. Descriptions of five new phyllostome bats, by Gerrit S. Miller, jr., pp. 326–337. Notes on arctic red-backed mice, by Gerrit S. Miller, jr., pp. 358–367. Botanical observations on the Mexican flora, especially on the flora of the valley of Mexico, by John W. Harshberger, pp. 372–413. Fossil mollusks and diatoms from the Dismal Swamp, Virginia and North Carolina; indication of the geological age of the deposit, by Lewis Woolman, with notes on the diatoms, by Charles S. Boyer, pp. 414–428.

American Philosophical Society:

Proceedings, vol. XXXVI, 1897, 499 pp.; 13 pll. No. 154. The species of the genus *Melanoplus*, by Samuel H. Scudder, pp. 5–35. The finding of the remains of the fossil sloth at Big Bone cave, Tennessee, in 1896, by Henry C. Mercer, pp. 36–70; 26 figs. A new paleozoic vertebrata from Illinois, Ohio, and Pennsylvania, by E. D. Cope, pp. 71–90; 3 pll. The genesis and chemical relations of petroleum and natural gas, by Samuel P. Sadtler, pp. 93–102. On the nature and origin of petroleum, by S. F. Peckham, pp. 103–112. A suggestion as to the origin of Pennsylvania petroleum, by David T. Day, pp. 112–115. On the genesis of natural gas and petroleum, by Francis C. Phillips, pp. 116–121. On the occurrence of petroleum in the cavities of fossils, by Francis C. Phillips, pp. 121–126. On the composition of American petroleum, by Charles F. Mabery, pp. 126–140.

No. 155. The insulating medium surrounding a conductor, by Edwin J. Houston and A. E. Kennelly, pp. 141–175. Relation of the pentagonal dodecahedron found near Marietta, Ohio, to Shamanism, by J. Cheston Morris, pp. 179–183. Australian rock carving, by R. H. Mathews, pp. 195–208; 1 pl. The transitive substitution groups that are simply isomorphic to the symmetric or the alternating group of degree six, by G. A. Miller, pp. 208–215. Geology of the paleozoic area of Arkansas south of the novaculite region, by George H. Ashley, pp. 217–318; 4 pll.

No. 156. A geological reconnaissance of the coal-fields of the Indian Territory, by Noah Fields Drake, pp. 326–419. The span of life, by Robert P. Field, pp. 420–424. The survival of the mediæval art of illuminative writing among Pennsylvania Germans, by Henry C. Mercer, pp. 424–433; 5 pll. The variation of terrestrial latitude, by C. L. Doolittle, pp. 434–438. The measurement of thought as function, by Daniel G. Brinton, pp. 438–440. Some results of the Norwegian polar expedition, 1893–'96, by Dr. Fridtjof Nansen, pp. 442–454. Remarks on polar expedition, by Com. George W. Melville and Prof. Angelo Heilprin, pp. 454–464. Rock carvings and paintings of the Australian aborigines, by R. H. Mathews, pp. 466–478; 1 pl. The Passamaquoddy wampum records, by J. Dyneley Prince, pp. 479–495. The ethnic affinities of the Guertares of Costa Rica, by Daniel G. Brinton, pp. 496–499.

Vol. XXXVII, No. 157, 107 pp. The altitude of the aurora above the earth's surface, by Cleveland Abbe, pp. 1–7. Description of four new species of Rocinela, by Harriet Richardson, pp. 8–17. Specializations of the lepidopterous wing, by A. Radcliffe Grote, pp. 17–43; 3 pll. An old broadside, with reference to the throne of congress, by J. F. Sachse, pp. 45–51; 2 pll. Initiation ceremonies of Australian tribes, by R. H. Mathews, pp. 54–73; 1 pl. Preliminary note on the selenodont artiodactyls of the Uinta formation, by W. B. Scott, pp. 73–81. Notes on Kansan drift in Pennsylvania, by Prof. Edward H. Williams, jr., pp. 84–77. The genesis of bitumens, by S. F. Peckham, pp. 108–113. Draft of the declaration of independence, by I. Minis Hays, pp. 88–107; 3 pll.

Transactions, vol. XIX, new series, 1898, part II, pp. 199–272; 13 pll. Some experiments with the saliva of the Gila monster (*Heloderma suspectum*), by John Van Denburgh, pp. 199–220. Results of recent researches on the evolution of the stellar systems, by T. J. J. See, pp. 221–235; 2 pll. On the Glossophaginæ, by Harrison Allen, pp. 237–266; 10 pll. The skull and teeth of *Ectophylla alba*, by Harrison Allen, pp. 267–272; 1 pl.

SOUTH DAKOTA.

RAPID CITY.—*South Dakota School of Mines:*

Notes on the geology and mineral deposits of the Black Hills, by Cleophas O'Harra, 28 pp.; 6 pll. Mining geology and mining, by A. Forsyth. 12 pp.; 2 pll.

TENNESSEE.

KNOXVILLE.—*University of Tennessee:*

University of Tennessee Record, Nos. 1-7. 405 pp.

NASHVILLE.—*State Board of Health:*

Bulletins, vol. XII, Nos. 6-12, pp. 81-192. Vol. XIII, Nos. 1 and 2, 32 pp.

TEXAS.

AUSTIN.—*Texas Academy of Science:*

Transactions, vol. I, No. 5, 1896, 126 pp. Molecular theories of organic reproduction, by Dr. Edmund Montgomery, pp. 1-17. The criterion for two-term prismoidal formulas, by George Bruce Halsted, pp. 19-24. On the theory of the prismoid, by Herman Kinklin, pp. 24-32. Prismoidal formulæ, with special derivation of two-term formulæ, by Thomas U. Taylor, pp. 33-55. The culture given by science, by George Bruce Halsted, pp. 57-59. Are we conscious automata? by Edmund Montgomery, pp. 65-80. Economy of good roads, by Thomas U. Taylor, pp. 82-94.

Vol. II, No. 1, 1897, 107 pp. Aural perception by the blind, by Drs. S. E. Mezes and H. L. Hilgartner, pp. 1-5. The economics of concentrated capital, by Maj. C. E. Dutton, pp. 7-20. Vertical curves for railways, by J. C. Nagle, pp. 21-28. Experiments with X-rays upon the blind, by Drs. H. L. Hilgartner and E. F. Northrup, pp. 29-31. On the biogeography of Mexico and the southern United States, by C. H. Tyler-Townsend, pp. 33-86. Some Texas oil horizons, by E. T. Dumble, pp. 87-92. Texas Permian, by W. F. Cummins, pp. 93-98. Science on the conduct of life, by George Bruce Halsted, pp. 99-104.

VERMONT.

BURLINGTON.—*University of Vermont and State Agricultural College:*

Bulletins: No. 53. The pollination of plums, pp. 47-65; 6 figs.
No. 56. Orange hawkweed or "paint-brush," 15 pp.; 5 figs.
No. 57. Analysis of commercial fertilizers, pp. 19-31.
No. 60. Insects of the year, 16 pp.; 5 figs.
No. 61. Hardy apples for cold climates, pp. 21-32; 6 figs.
No. 62. Home-grown grapes in Vermont, pp. 37-44; 10 figs.
Nos. 63, 64, 65. Analyses of commercial fertilizers, pp. 47-124.
Report of the horticulturist, pp. 87-132; 12 pll.
Eleventh annual report, 401 pp.; 10 pll.; 4 figs.

WASHINGTON.

SPOKANE.—*L. K. Armstrong, Publisher:*

Mining, a monthly magazine.

WISCONSIN.

MADISON.—*Wisconsin Academy of Sciences, Arts, and Letters:*

Transactions, vol. XI, 1896-'97, 576 pp.; 50 pll. The methods of science as being in the domain of logic, by J. J. Blaisdell, pp. 49-65. Floral structure of some Gramineæ, by Herman F. Lueders, pp. 109-111; 1 pl. Some uses of the low potential alternating current in a chemical laboratory, by Milo S. Walker, pp. 114-118. The forms spontaneously assumed by folk-songs, by John Comfort Fillmore, pp. 119-126. Second supplementary list of parasitic fungi of Wisconsin, by J. J. Davis, pp. 165-178. On the limnetic crustacea of Green Lake, by C. Dwight Marsh, pp. 178-224; 10 pll. Transcendental space, by Charles H. Chandler, pp. 239-248. Aluminium alcoholates, by Orin Edson Crooker, pp. 255-260. Codfish, by James Davie Butler, pp. 261-273. Plankton studies on Lake Mendota—II: The crustacea of the plankton from July, 1894, to December, 1896, by E. A. Birge, pp. 274-448; 28 pll. The real singularities of harmonic curves of three frequencies, by Etting H. Comstock, pp. 452-464. Earth movements, by C. R. Van Hise, pp. 465-516.

Wisconsin Geological and Natural History Survey:

Bulletin No. 1. Economic series No. 1. On the forestry conditions of northern Wisconsin, by Filibert Roth, 78 pp.; 1 map.

Bulletin No. 2. Scientific series No. 1. On the instincts and habits of the solitary wasps, by George W. Peckham and Elizabeth G. Peckham, 245 pp.; 2 col'd pll.; 12 uncol'd.

MILWAUKEE.—*Public Museum of the City of Milwaukee:*

Fourteenth annual report of the board of trustees, September 1, 1895, to August 31, 1896, 64 pp.

Fifteenth annual report, September 1, 1896, to August 31, 1897.

CANADA.

CHICOUTIMI.—*V.-A. Huard, Publisher:*

Le Naturaliste Canadien, vol. XXIV, September-December, 1897. Le Nord de la vallee du lac St.-Jean, par P.-H. Dumais, pp. 129–133; 162–166; 182–186. Curiosites vegetales, par Henri Tielemans, pp. 133–36. Quelques insects a combattre, par J.-C. Chapais, pp. 145–150. L'Abbe Provancher, par V.-A. Huard, pp. 178–182.

Vol. XXV. Les noces d'argent du "Naturaliste," par L'Abbe Huard, pp. 1–4, 17–21. Le nord de la vallee du lac St.-Jean, par P.-H. Dumais, pp. 4–8, 22–26, 38–42. La tuberculose en Canada, par. V.-A. Huard, pp. 8–12. Quelques apercus sur la geologie du Saguenay, par P.-H. Dumais, pp. 105–109; 137–140; 172–175. L'Abbe Provancher, par V.-A. Huard, pp. 34–37; 52–56; 82–86; 115–118; 133–136; 168–172. Les hemipteres au parlement du Canada, par V.-A. Huard, pp. 49–52. Excursion en Egypte, par F. Gasnault, pp. 11; 56–60; 72–75; 86–90; 101–104; 119–123; 151–156.

HALIFAX, N. S.—*Nova Scotia Institute of Natural Science:*

Proceedings and transactions, vol. IX, part 3, pp. xciv+219–290. Proceedings, pp. lxxix-xciv. On the relation of the physical properties of aqueous solutions to their state of ionization, by Prof. J. G. MacGregor, pp. 219–245. Some analysis of Nova Scotia coals and other minerals, by E. Gilpin, pp. 246–254. Notes on Nova Scotian zoology, by Harry Piers, pp. 255–267. Phenological observations, Canada, 1896, by A. H. MacKay, pp. 268–274. Supplementary note on Venus, by A. Cameron, pp. 275–278. The rainfall in 1896, by F. W. W. Doane, pp. 279–290.

HAMILTON, ONT.—*Hamilton Association:*

Journal and proceedings, 1896–'97. No. XIII, 142 pp. Lake Medad and the Kwina-ni-binah collection of Indian relics, by J. O. McGregor, pp. 14–17. Notes on the recent additions to Ontario palæontology, by Col. C. C. Grant, pp. 20-37. The mineral of our local rocks, by C. C. Grant, pp. 38–43. The function of poetry, by F. F. MacPherson, pp. 46–56. The dynamics of social peril, by J. T. Barnard, pp. 57–66. The battle of Stoney Creek, pp. 79–92. Flora of Hamilton district, by J. M. Dickson and A. Alexander, pp. 95–127. List of local fossils not previously reported, by C. C. Grant, pp. 128–136.

1897–'98, No. XIV, 128 pp. Natural history notes, by Wm. Yates, pp. 72–86. Geological notes, by Col. C. C. Grant, pp. 89–100. The lost Atlantis, by Col. C. C. Grant, pp. 101–116.

MONTREAL, QUE.—*Geological and Natural History Survey of Canada* (see Ottawa, Ont.)

Royal Society of Canada:

Proceedings and transactions, second series, vol. II, 1896. Section I. Litterateur Francaise, histoire, archeologie, etc., p. 168. Section II. English history, literature, archæology, etc., p. 289. The voyages of the Cabots in 1497 and 1498, by Samuel Edward Dawson, pp. 3–30. Death of Sir Humphrey Gilbert, pp. 33–40. The ancient literature of America, by John Campbell, pp. 41–68. Aerolites and religion, by Arthur Harvey, pp. 69–76. Foot-notes to Canadian folk-songs, by William Wood, pp. 77–126. Last years of Charles de Biencourt, by Doctor Patterson, pp. 127–130. The philology of the Ouananiche, by E. T. D. Chambers, pp. 131–140. Some contributions to Canadian constitutional history, by J. G. Bourinot, pp. 141–174. Place-nomenclature of New Brunswick, by William F. Ganong, pp. 175–288. Section III. Mathematical, physical and chemical sciences, 211 pp.; 15 pll. Presidential address, by H. T. Bovey, pp. 3–24. Mechanism for describing conic sections, by J. J. Guest, pp. 25–36; figs. 1–8. On some measurements of the temperature of the river water opposite Montreal, made during the winter with a differential platinum thermometer, by Howard T. Barnes, pp. 37–44. The determination of the coefficient of discharge for sharp-edged orifices, by J. T. Farmer, pp. 45–64; 6 diagrams. On the calculation of the conductivity of electrolytes, by Prof. J. G. MacGregor, pp. 65–82. The unification of civil, nautical and astronomical time, by G. E. Lumsden, pp. 83–90. The distribution of aerolites in space, by Arthur Harvey, pp. 91–108. Observations of soil temperatures with electrical resistance thermometers, by Hugh L. Callendar and C. H. McLeod, pp. 109–117; pll. I–IV. An investigation to determine the relative efficiencies of multiple-expansion engines, by A. L. Mellanby, pp. 127–149; pll. V–XIII. Symbolic use of Demoivre's theorem, by Professor Dupuis, pp. 167–170. Some experiments on the X-rays, by John Cox and Hugh L. Callendar, pp. 171–188; pll. XIV and XV. Section IV. Geological and biological sciences, 211 pp. The functional development of the cerebral cortex in different groups of animals, by Wesley

Mills, pp. 3-18. The psychic development of young animals and its physical (somatic) correlation with special reference to the brain, by Wesley Mills, pp. 19-32. The generic characters of the North American Taxacea and Coniferæ, by D. P. Penhallow, pp. 33-57; pll. I-VII. Contribution to the Pleistocene flora of Canada, by D. P. Penhallow, pp. 59-78. Additional notes on fossil sponges and other organic remains from the Quebec group at Little Metis, on the lower St. Lawrence, by Sir J. William Dawson, pp. 91-122; pll. I-IV; 32 figs. Past experiences and future prospects of fruit-growing in the Canadian northwest, by William Saunders, pp. 131-136. Palæozoic outliers in the Ottawa river basin, by R. W. Ells, pp. 137-150. Notes on some of the fossil organic remains comprised in the geological formations and outliers of the Ottawa palæozoic basin, by Henry M. Ami, pp. 151-158. Some observations tending to show the occurrence of secular climatic changes in British Columbia, by G. M. Dawson, pp. 159-166. Coal-mining in Pictou county, by E Gilpin, jr., pp. 167-180; 1 map. Sponges from the Atlantic coast of Canada, by Lawrence M. Lambe, pp. 181-211; pll. I-III.

Vol. III, 1897, Proceedings, pp. i-clxxvii; 10 pll. Section II, 450 pp. Canada during the Victorian area: a historical review, by J. G. Bourinot, pp. 3-38; 20 pll. Notes on the cosmogony and history of the Squamish Indians of British Columbia, by Prof. C. Hill-Tout, pp. 85-90. The cartography of the province of New Brunswick, by William F. Ganong, pp. 313-450; 5 pll. Section III, 77 pp.; 6 pll. On some measurements of the temperature of the Lachine rapids made during the winter of 1896-'97 with a differential platinum thermometer, by Howard T. Barnes, pp. 17-30. Character and progress of the tides in the gulf and river St Lawrence, by W. Bell Dawson, pp. 51-68; 5 pll. Section IV, 203 pp.; 17 pll. A review of Canadian botany from 1800-1895, part II, by D. P. Penhallow, pp. 3-56. On the genus *Lepidophloios* as illustrated by specimens from the coal formation of Nova Scotia and New Brunswick, by Sir J. William Dawson, pp. 57-78; 14 pll. The Bay of Fundy trough in American geological history, by Professor Bailey, pp. 107-116. Notes on the Archæan of eastern Canada, by R. W. Ells, pp 117 124. Upon raised peat bogs in the province of New Brunswick, by W. F. Ganong, pp. 131 159. Studies on Cambrian faunas, by G. F. Matthew, pp. 165-203; 4 pll.

Natural History Society of Montreal:

Canadian record of science, vol. VII, No. 4, pp. 203-265; several figures. Note on cryptozoon and other ancient fossils, by Sir William Dawson, pp. 203-219; 1 fig. A few notes on Canadian plant lore, by Carrie M. Derick, pp. 220-227. The anorthosite of the Rainy Lake region, by Prof. A. P. Coleman, pp. 23 325. The structure of Europe, by Prof. Edward Suess, pp. 235-246. Geological report and map of the district about Montreal, by John A. Dresser, pp. 247 255. Four meteorological charts in back of book.

OTTAWA, ONT.—*Department of Agriculture:*

Statistical year-book of Canada, compiled by George Johnson, for 1896, 477 pp.; 1897, 554 pp.

Geological and Natural History Survey of Canada, G. M. Dawson, Director:

Vol. VIII, 1895, G. M. Dawson, director, 1006 pp.; 18 pll.; 6 maps. Report on the country between Athabasca lake and Churchill river, by J. Burr Tyrrell and D. B. Dowling, pp. 1-120 D; 3 pll.; 1 map. Report on the geology of a portion of the Laurentian area lying to the north of the island of Montreal, by Frank D. Adams, pp. 1-184 J; 11 pll.; 2 maps. Report on explorations in Labrador peninsula, by A. P. Low, pp. 1-387 L; 4 pll. Report of section of chemistry and mineralogy, by G. C. Hoffman, pp. 1-59. Mineral statistics and mines, by E. D. Ingall, pp. 1-103.

Maps, in folio, of Labrador peninsula, southwest sheet, southeast sheet, northwest sheet, and northeast sheet.

Vol. IX, 1896, 816 pp.; 20 pll.; 5 maps. Report of the Doobaunt, Kazan and Ferguson rivers and the northwest coast of Hudson bay, by J. B. Tyrrell, pp. 1-218 F; 11 pll.; 3 maps. Report on the geology of the French river sheet, Ontario, by R. Bell, pp. 1-29 I; 1 map. Report on a traverse of the northern part of the Labrador peninsula from Richmond gulf to Ungava bay, by A. P. Low, pp. 1-43 L; 4 pll. Report on the geology of southwest Nova Scotia, by L. W. Bailey, pp. 1-154 M; 5 pll.; 1 map. Report of the section of chemistry and mineralogy, by G. C. Hoffmann, pp. 1-53. Section of mineral statistics and mines, by E. D. Ingall, pp. 1-169 S.

Contributions to Canadian palæontology, vol. I. Report on the invertebrata of the Laramie and Cretaceous rocks of the vicinity of the Bow and Belly rivers and adjacent localities in Northwest territory, by J. F. Whiteaves, 89 pp.; 11 pll.

Vol. II, part I. Canadian fossil insects, by Samuel H. Scudder, 66 pp.; 5 pll. Contributions to the micro-palæontology of the Cambro-Silurian rocks of Canada, by Arthur H. Foord, 26 pp.; 7 pll. Part II. On some polyzoa (bryozoa) and ostracoda from the Cambro-Silurian rocks of Manitoba, by E. O. Ulrich, 27–57; 2 litho. pll. Palæozoic fossils, by E. Billings, 144 pp.; 9 pll.; numerous figures.

Vol. III, part I. George M. Dawson, director. On some new, imperfectly characterized or previously unrecorded species of fossils from the Guelph formation of Ontario, by J. F. Whiteaves, 43 pp.; 8 pll.; 4 figs. Part II. Revision of the fauna of the Guelph formation of Ontario, with descriptions of a few new species and systematic list, with references, of the fossils of the Hudson river or Cincinnati formation at Stony mountain, Manitoba, by J. F. Whiteaves, pp. 45–128; 7 pll. Part III. The fossils of the Galena-Trenton and Black river formations of Lake Winnipeg and its vicinity, by J. F. Whiteaves, pp. 129–242; 7 pll.

Maps, in folio, of Labrador peninsula — southwest sheet, southeast sheet, northwest sheet, northeast sheet.

Ottawa Field Naturalists' Club:

The Ottawa Naturalists' Monthly, vol. X, Nos. 10–12, pp. 185–232. The living chimæra and its egg, by Prof. E. E. Prince, pp. 185–189. Ottawa spiders and mites, by W. Hague Harrington, pp. 190 and 191. Clouds, by J. A. Dresser, pp. 192–196. The barren lands of Canada, by G. M. Dawson, pp. 201–207. The Labrador area, by A. P. Low, pp. 208–216. Hymenoptera parasitica-proctotrypidæ, by W. Hague, pp. 217–219. Stephanoceros, by Walter S. Odell, pp. 219–22.

Vol. XI, Nos. 1–11; pp. 1–208. Contribution to the palæontology of the Post-Pliocene deposits of the Ottawa valley, by Henry M. Ami, pp. 20–26. "Weather," by Otto J. Klotz, pp. 45–61. Carp culture, by J. Craig, pp. 65, 66. Fruit-growing in Canada, by John Craig, pp. 73–93. The pelican (*Pelecanus erythrorhynchos* Gmelin), by Prof. Edward E. Prince, pp. 98–101. On the composition of Canadian virgin soils, by Frank T. Shutt, pp. 106–108. *Filaria oculi* — a parasite in the eye of the horse, by Dr. A. G. Hopkins, pp. 113–114. Notes on Ottawa birds, by W. T. Macoun, F. A. Saunders, Miss G. Harmer, and H. B. Small, pp. 116–122. The cryptogamic flora of Ottawa, by Prof. John Macoun, pp. 129–140, 161–172, 193–204. Notes on the birds of the Magdalen islands, by Rev. C. J. Young, pp. 145–158. Recent conclusions in Quebec geology, R. W. Ells, pp. 173–176. Geological formations, by R. W. Ells, pp. 177–189,

Vol. XII, Nos. 4–8, 1898, 160 pp. The cryptogamic flora of Ottawa, by Prof. John Macoun, pp. 25–32; 49–56; 93–100. The Cretaceous of Athabasca river, by J. B. Tyrrell, pp. 37–41. Vegetation in the Bermudas, by H. B. Small, pp. 101–104; 109–114; 153–157. On some fossil cephalopoda, by J. F. Whiteaves, pp. 119–127. Change of function in fishes' fins, by Prof E. E. Prince, pp. 129–132.

Ottawa Literary and Scientific Society:

Transactions, No. 1, 1897–'98, 87 pp. The fur seal of the North Pacific, by J. M. Macoun, pp. 63–74. Utilization of moss lands, by Thomas MacFarlane, pp. 79–87.

TORONTO, ONT.—*Canadian Institute:*

Proceedings I, part 1, Nos. 1 and 2, 72 pp. The dwarf domestic animals of pygmies, by R. G. Haliburton, pp. 3–7. The gametophyte of *Botrychium virginianum*, pp. 8–10. The histology and physiology of the gastric glands, by R. Bensley, pp. 11–16. The Panis — a historical outline of Canadian Indian slavery in the eighteenth century, by James Cleland Hamilton, pp. 19–27. A probable solution of the secondary undulations found upon self-recording tide gauges, by Napier Denison, pp. 28–31. Somes lapsed names in Canadian local nomenclature, by Rev. Henry Scadding, pp. 33–38. The origin of the Salishan tribes of British Columbia and Washington, by John Campbell, pp. 39–50. Moss litter, by Thomas W. Gibson, pp. 91–54. The Great Lakes as a sensitive barometer, by Napier Denison, pp. 55–63. Mineralogical notes on Sudbury anthracite, by G. R. Mickle, pp. 64–66.

Proceedings, new series, vol. I, No. 6, pp. 119–135. The anatomy of the orang-outang, by A. Primrose, pp. 119–121. The transportation question, by J. S. Willison, pp. 122–133. The origin of ocean tidal secondary undulations, by F. Napier Denison, pp. 134, 135.

Transactions, vol. V, part 2, May, 1898, pp. 167–368; 10 pll. The Denes of America identified with the Tungus of Asia, by Rev. John Campbell, pp. 167–224. Spatial thresholds of colors and their dependency on contrast, by W. B. Lane. pp. 225–242. Joseph Brant in the American revolution, by Captain Ernest Cruikshank, pp. 243–264. The gametophyte of *Botrychium virginianum*, by Edward C. Jeffrey, pp. 265–294; 4 pll. The Picts, by Rev. Neil MacNish, pp. 295–304. The function of indirect vision and the use of colored and smoked eye-glasses, by A. Kirschmann, pp. 305–310. Counting and time reckoning, by John Thorburn, pp. 311–324. Late formations and great changes of level in Jamaica, by J. W. Spencer, pp. 325–357; 7 pll. Resemblances between the declivities of high plateau and those of submarine Antillean valleys, by J. W. Spencer, pp. 359–368.

Supplement to vol. V, part 1, plates to accompany Doctor Maclean's paper on picture writing of the Blackfeet.

WINNIPEG, MAN.—*Historical and Scientific Society of Manitoba:*

Annual report for the year 1896, 24 pp. Annual report for the year 1897, 22 pp.

Transactions, No. 41. Surface geology of the Red river, by George Bryce, 7 pp.

No. 49. The Lake of the Woods, by George Bryce, 17 pp.; 3 pll.

No. 50. Farm life in the Selkirk colony, by Rev. R. G. MacBeth, 4 pp.

No. 51. The game birds of Manitoba, by Geo. E. Atkinson, 21 pp.; 6 figs.

No. 52. Sketch of the life and discoveries of Robert Campbell, by George Bryce, 18 pp.; 8 figs.

MEXICO.

MEXICO.—*Academia Mexicana de Ciencias Exactas, Fisicas y Naturales:*

Anuario, ano II, 1896, 228 pp.; 12 pll.

Resena, 1898, 15 pp.

Instituto Geologico de Mexico:

Boletins, Nums. 5 y 6. Bosquejo geologico de Mexico, 270 pp.; 5 pll.

Nums. 7, 8, y 9. El mineral de Pachuca, 1897, 184 pp.; 14 pll.

Num. 10. Bibliografia geologica y minera de la Republica Mexicana, 160 pp.

L'Observatoire Meteorologique Central de Mexico:

Ensayo practico de repoblacion de bosques, por Mariano Barcena, 12 pp.

Boletin de agricultura, mineria e industrias, 15x21 cm, ano VI, num. 4-12, 1896-'97, a total of 1732 pp.; many tables.

Ano VII, nums. 1-12, 1897-'98, total of 1863 pp.; many tables.

Boletin mensual, 22x32 cm. Enero, 1897 — Diciembre, 1897, 175 pp. Enero, 1898 — Marzo, 1898, 44 pp.

Resumenes mensuales de las observaciones meteorologicas, 28 pp.

Sociedad Mexicana de Historia Natural:

La Naturaleza, periodico cientifico, publicado bajo la direccion del Sr. Dr. Manuel M. Villada, tomo II, num. 12, pp. 509-528.

Tomo III, nums. 1 y 2, 128+24 pp.; 8 pll.

Sociedad Cientifica "Antonio Alzate":

Memorias y Revista, tomo X, numeros 1-12, 488 pp.

Tomo XI, 1897-'98, 450 pp.; Revista, 58 pp.

WEST INDIES.

HAVANA, CUBA.—*Dr. Antonio Gordon, Universite de la Havane:*

El tabaco en Cuba, por Dr. D. Antonio de Gordon y de Acosta, 85 pp.

La viabilidad legal y la fisiologica, por D. Antonio de Gordon y de Acosta, 42 pp.

Discurso conmemorativa de la fundacion de la real academia de ciencias medicas, fisicas y naturales, por Dr. D. Antonio de Gordon y de Acosta, 1897, 17 x 25 cm., 56 pp.

La inspeccion medica oficial en nuestras escuelas, por el Dr. D. Antonio de Gordon y de Acosta, 61 pp.

La legislacion del seguro de vida ante la medicina forense, por el Dr. Antonio de Gordon y de Acosta, 42 pp.

KINGSTON, JAMAICA.—*Botanical Department of Jamaica:*

Bulletins, edited by William Fawcett, vol. IV, 1897, Nos. 1-12, 309 pp.; vol. V, 1898, 238 pp.

SOUTH AMERICA.

ARGENTINA.

BUENOS AIRES—*Museo Nacional, Prof. Dr. Carlos Berg, Director:*

Anales, 18 x 27 cm., tomo V (ser. 2a, T. II), 347 pp.

Sociedad Cientifica Argentina:

Anales, 17 x 23 cm., tomo XLIII, 1897, 320 pp.; tomo XLIV, 1897, 416 pp.

Tomo XLV, 1898, 288 pp. Tesoro de catamarquenismos, por Samuel A. Lafone Quevedo (continuacion), pp. 14-30; 79-99; 172-181; 268-278.—Indice general de los anales de la sociedad cientifica Argentina (tomos I a XL, inclusive), por el Dr. Juan Valentin, 168 pp.

Tomo XLVI, 1898, 416 pp.; 3 pll. Tesoro de catamarquenismos, por Samuel A. Lafone Quevedo, pp. 33-48; 92-109; 159-179; 344-362.

LA PLATA.—*Museo de la Plata:*

Revista, 18 x 28 cm., tomo VIII, 459 pp.; 63 pll.; 1 large colored map.

Dr. Florentino Ameghino:

Notas sobre cuestiones de geologia y paleontologia Argentinas, por Dr. Florentino Ameghino, 35 pp.

Sur l'evolution des dents des mammiferes, por Florentino Ameghino, 139 pp.

La Argentina al traves de las ultimas epocas geologicas, por Florentino Ameghino, 35 pp.

Premiere notice sur le *Neomylodon listai*, un representant vivant des anciens Edentes Gravigrades fossiles de l'Argentine, por Florentino Ameghino, 8 pp.

Sur les ongules fossiles de l'Argentine (examen critique de l'ouvrage de M. R. Lydekker: "A study of the extinct ungulates of Argentina"), por Florentino Ameghino, 111 pp.

BRAZIL.

RIO DE JANEIRO.—*Sociedad do Geographia do Rio de Janeiro:*

Revista, tomo XII, 1896 e 1897, 81 pp.

Dr. Domingos Freire:

Memoire sur la bacteriologie, pathogenie, traitement et prophylaxie de la fievre jaune, par le Dr. Domingos Freire, 162 pp.; 2 pll.

PARA.—*Museu Paraense de Historia Natural e Ethnographia:*

Boletim, vol. II, nos. 1-3, 1897, 396 pp.; 11 pll.

S. PAULO.—*Museu Paulista, publicada por Dr. H. von Ihering:*

Revista, vol. III, 568 pp.; 7 pll. As aves do estado de S. Paulo, por H. von Ihering, pp, 113-476.

CHILE.

SANTIAGO.—*El Instituto de Hijiene de Santiago, Dr. F. Puga Borne, Director:*

Boletin, ano 1, nums. 1-6, 94 pp.

Revista Chilena de hijiene, 17x26 cm., tomo III, 1896-'97, numeros 9-13, pp. 1-501.

Revista, tomo IV, cuaderno 1, 1898, 153 pp.; 5 pll.

Sesiones del Consejo de Hijiene Publica, 18x27 cm. Ano de 1896, 281 pp. Ano de 1897, 311 pp.

Societe Scientifique du Chili:

Actes, 20x26 cm., tome VI, 1896, cxxviii+43-119 pp.

Tome VII, 1897, xlviii+352 pp.; 8 pll.

GUIANA, BRITISH.

GEORGETOWN, DEMERARA.—*William Chalmers, Crown Surveyor:*

Geological Survey of British Guiana.

URUGUAY.

MONTEVIDEO.—*Museo Nacional de Montevideo:*

Anales, 20x30 cm. Las gramineas uruguayas (continuacion), por Prof. J. Arechavaleta, pp. 453-581; 12 pll.

Tomo II, fasc. VIII. Flora uruguaya, por Prof. J. Arechavaleta, pp. 23-85.

Tomo III, fasc. IX. Las gramineas uruguayas, por J. Arechavaleta, pp. 87-121. Flora uruguaya, por J. Arechavaleta, pp. 49-96. Fasc. X. Flora uruguaya, por J. Arechavaleta, pp. 97-160.

VENEZUELA.

CARACAS.—*El Ministero de Instruccion Publica:*

Revista, ano IV, Nos. 46-54, Enero—Setiembre, 1897, 576 pp.

AUSTRALIA.

NEW SOUTH WALES.

SYDNEY.—*Department of Mines and Agriculture:*

Annual report for the year 1897, 215 pp.; 17 pll.; numerous figures.

Memoirs of the geological survey of the New South Wales, 24x30 cm. Palæontology. No. 4. The fossil fishes of the Hawkesbury series at Gosford, by Arthur Smith Woodward, 55 pp.; 10 pll.

Memoirs—paleontology, No. 6. Descriptions of the palæozoic fossils of New South Wales, by the late L. G. de Koninck, 298 pp.; 24 pll.

Mineral resources, No. 1. Notes on chromic iron ore, by J. E. Carne, 16 pp.

No. 2. Notes on the occurrence of tungsten ores in New South Wales, by J. E. Carne, 8 pp.

No. 4. Notes on the occurrence of bismuth ores in New South Wales, by J. A. Watt, 11 pp.

Records of the geological survey of New South Wales, 18x24 cm. Contains numerous geological, palæontological and mineralogical articles. Vol. V, 1896-'98, 204 pp., 19 pll.

Vol. VI, part I, 75 pp.; 10 pll. Notes on the geology and mineral deposits of portions of western Australia, by E. F. Pittman, pp. 1-17. Notes on the country rock of the Kalgoorlie gold-field, western Australia, by George W. Card, pp. 17-42; pll. I-III. Additions to the Permo-carboniferous flora of New South Wales, No. 2, by W. S. Dun, pp. 46-51; pl. VI. On stolzite and a new mineral, respite, from Broken Hill, by Dr. C. Hlawatsch, pp. 51-61; p. VII. On the structure and method of presentation of *Receptaculites australis* Salter, by R. Etheridge, jr., and W. S. Dun, pp. 62-75; pll. VIII-X.

QUEENSLAND.

BRISBANE.—*Royal Society of Queensland:*

Proceedings, vol. XII, 111 pp.; 8 pll. Contains: The geological structure of extra-Australian artesian basins, by A. Gibb Maitland. New native medicinal plants of Queensland, by Joseph Lauterer. Micro-organisms from the Brisbane air, by A. Jefferis Turner, etc.

Vol. XIII, 102+xxxiii pp.; 2 pll. Ethnography of leprosy in the far east, by S. B. J. Skertchly, pp. 1-22. Social and individual nomenclature among certain north Queensland aboriginals, by Walter E. Roth, pp. 39-50; 1 pl. Descriptions of Queensland lepidoptera, by Thomas P. Lucas, pp. 59-86. List of butterflies of the Brisbane district, by Rowland Illidge, pp. 89-102.

VICTORIA.

MELBOURNE.—*Department of Mines, Hon. Henry Foster, Minister:*

Annual report of the secretary for mines, 1896, 21x33 cm., 71 pp.; numerous illustrations, maps, etc.

Annual report of the secretary for 1897, 69 pp.; 27 pll.

EUROPE.

AUSTRO-HUNGARY.

BRUNN, MORAVIA.—*Naturforschende Verein in Brunn:*

Verhandlungen, Band XXXIV, 1895, 368 pp. Band XXXV, 1896, 267 pp.

Band XIV. Bericht der meteorologischen Commission des Naturforschenden Vereins in Brunn, Ergebnisse der meteorologischen Beobachtungen im Jahre 1894, mit 175 seiten; 6 karten.

XV. Bericht der meteorologischen Commission des Naturforschenden Vereins in Brunn, Jahre 1895, 167 seiten; 5 karten.

BUDAPEST, HUNGARY.—*Magyarhoni Foldtani Tarsulat (Hungarian Geological Society):*

Foldtani Kozlony, 18x27 cm., Band XXXVII, 1897, 512 pp.; 4 pll. Band XXXVIII, 1898, 384 pp.

GRATZ, STYRIA.—*Franz H. Ascher, Editor:*

Montan Zeitung, 26x35 cm., IV Jahrgang, Nos. 10-24; pp. 181-484. V Jahrgang, Nos. 1-22, pp. 1-490.

PRAG, BOHEMIA.—*Konigl. Boehmische Gesellschaft der Wissenschaften—Mathematisch-naturwissenschaftliche Classe:*

Jahresbericht fur das Jahr 1896, 56 pp.

Jahresbericht fur das Jahr 1897, 68 pp.

Sitzungsberichte fur 1896, I. 468 pp.; 18 litho. pll.; numerous figures. II, 511 pp.; 11 pll.; numerous figures.

Sitzungsberichte fur 1897, I, 661 pp.; 24 pll. II, 579 pp.; 18 pll.

WIEN (VIENNA), AUSTRIA.—*Kaiserliche Akademie der Wissenschaften:*

Anzieger, 16x24 cm., 1897, Nos. I-XXVII, 267 pp.; 1898, Nos. I-VIII, 60 pp.

BELGIUM.

BRUXELLES.—*Societe Belge de Geologie, de Paleontologie, et de Hydrologie:*

Bulletins, 16x24 cm. Tome IX, annee 1895, xliv+214+466+47 pp.; 15 pll. Tome X, annee 1896, pp. 160+32; 2 pll. Tomee XI, annee 1897, 144 pp; 2 pll.

Sa Societe Linncenne de Bruxelles:

Bulletin, 18x28 cm., 23me annee, Nos. 3-9; 48 pp. 24me annee, No. 1, 8 pp.

Societe Royale de Botanique de Belgique:

Bulletin, tome trente-cinquieme, 1897, 325+59 pp. Tome trente-sixieme, 1898, 217+278 pp.

LIEGE.—*La Societe Geologique de Belgique:*

Annales, tome XXII, 1894-'97, pp. 28+cxli; 1 pl. Tome XXIII, 1895-'97, bulletin et liste des membres, pp. 26+cc; 2 pll.

FRANCE.

BEAUVAIS.—*Charles Janet, Auteur:*

Etudes sur les Fourmis, les Guepes et les Abeilles, par Charles Janet. Note 14, 99 pp. Note 15, pp. 302-323; 1 pl. Note 16, 36 pp.; 10 figs.

Les habitations a bon marche dans les villes de moyenne importance, par Charles Janet, 18 pp.; 1 pl.

Notice sur les travaux scientifiques, par M. Charles Janet, 94 pp.; 105 figs.

Sur l' emploi de desiuences caracteristiques dans les denominations des groupes establis pour les classifications zoologiques, par Charles Janet, pp. 5-12.

Sur les limites morphologiques des anneaux du tegument et sur la situation des membranes articulaires chez les Hymenopteres arrives a l'etat d'imago, par Ch. Janet, 4 pp.; 3 figs.

Sur une cavite du tegument servant, chez les Myrmicinæ, a etaler, au contact d l'air, un produit de secretion, par Ch. Janet, 4 pp.

BORDEAUX.—*Societe Linneenne de Bordeaux:*

Proces-verbaux, Vol. LII, 124 pp.

CAEN.—*L'Academie Nationale des Sciences, Artes et Belle-Lettres de Caen:*

Memoires, 1897, 21+359 pp. Part I.

La Societe Linneenne de Normandie:

Bulletin, annee 1896, xcvi+181 pp. 1897, xcvi+261 pp.

CHERBOURG.—*Societe Nationale des Sciences Naturelles et Mathematiques du Cherbourg:*

Memoires, tome XXX, 16x25 cm., 1896-'97, 384 pp.

LA ROCHELLE.—*L'Academie de la Rochelle—Societe des Sciences Naturelles de Charente-Inferieure:*

Annales de 1897. Flore de France, tome IV, por G. Rouy et J. Foucaud, 295 pp.

MARSEILLE.—*Societe de Horticulture et de Botanique de Marseille:*

Revue Horticole—Journal des travaux, vol. 43me, 1897, 212 pp. Vol. 44me, Jan.—June, 1898, 106 pp.

METZ, LORRAINE.—*L'Academie de Metz:*

Memoires, XXV annee, 1897, xxxvii+246 pp.

PARIS.—*Museum d' Histoire Naturelle:*

Bulletin, 1897, nos. 1-8, 401 pp. 1898, nos. 1-5, 244 pp.

Ministere de l' Agriculture:

Bulletin, 18x28 cm., quinzieme annee, No. 2, pp. 189-319.

Societe de Geographie:

Bulletin, tome XVII, 3[e] trimestre, 1896, pp. 269-407; 1 pl.

TOULOUSE.—*L'Academie des Sciences et Belles-Lettres de Toulouse:*

Memoires, tome VIII, 1896, 654 pp.; 2 pll. Tome IX, 1897, 532 pp.; 3 pll.

GERMANY.

BERLIN, PRUSS.—*Botanischer Verein der Provinz Brandenburg:*

Verhandlungen, XXXVIII Jahrgang, 1896, lxxx+220 pp.

XXXIX Jahrgang, 1897, cxxi+118 pp.

Entomologischer Verein in Berlin:

Berliner Entomologische Zeitschrift, XLI Band, 1896, Hefts 2-4, 29+79+414 pp.; pll. IV-IX.

XLII Band, 1897, 27+444 pp.; 2 pll., one colored.

XLIII Band, 1898, Hefts 1 und 2, 228 pp.

Deutsche geologische Gesellschaft:

Zeitschrift, XLVIII Band, 1896, 4 Heft., pp. 743-1017; 10 pll.; 4 maps. XLIX Band, 1897, 949 pp.; 24 pll. L Band, 1898, 448 pp.; 15 pll.

BONN, PRUSS.—*Naturhistorischer Verein der preussischen Rheinlande:*

Verhandlungen, Jahrgang 53, zweite halfte, 1896, seiten 149-372; 2 taf.

Jahrgang 54, erste halfte, 1897, 346 pp.; 3 taf.

Niederrheinischer Gesellschaft fur Natur- und Heil-kunde zu Bonn:

Sitzungsberichte, 1896, 2 halfte, seite 105-182; 1897, 230 seite, 1 taf. litho., 58x56 cm.

BREMEN, GER.—*Naturwissenschaftlicher Verein:*

Abhandlungen, Band XIV, 1897-'98, Hefts 2 und 3, pp. 177-520; 5 pll.; 8 figs. Beitrage zur nordwestdeutschen Volks- und Landes-kunde, zweite Heft, 1897, pp. 81-189; 3 pll.

CHEMNITZ, SAX.—*Naturwissenschaftlicher Gesellschaft zu Chemnitz:*
Dreizehnter Bericht, umfassend die Ziet vom Juli 1892 bis December 1895, c+143 pp.; 9 tafeln.

DRESDEN, SAX.—*Naturwissenschaftlicher Gesellschaft "Isis in Dresden":*
Sitzungsberichte und Abhandlungen, 1896, Juli bis December, pp. 24+82; 1 taf. 1897, 43+103 pp.; 3 taf. Jahrgang, 1898, Januar bis Juni, 60 pp.; 1 pl.

FRANKFURT-A-ODER.—*Naturwissenschaftlicher Verein des Reg.-Bez. Frankfurt:*
Helios, 1897, 112 pp.; 1898, 88 pp.
Societatum Litteræ, 1897, 192 pp.; 1898, Nos. 1-4, 80 pp.

GIESSEN, HESSE.—*Naturforscher Gesellschaft:*
Bericht 32, 1897, 240 pp.

GORLITZ. PRUSS.—*Naturforschende Gesellschaft:*
Abhandlungen, XXII Band, 1898, 469 pp.

HALLE-A-SAALE.—*Kaiserliche Leopoldinisch-Carolinische Deutsche Akademie der Naturforscher:*
Leopoldina, 24 x 32 cm., 32, 1896. 192 pp.; 33, 1897, 192 pp.; 34, 1898, 176 pp.
Nova Acta, 24 x 32 cm., Band 65, 1896, 400 pp.; 18 tafeln. Band 66, 1896, 332 pp.; 24 tafeln. Band 67, 1896, 395 pp.; 7 tafeln.

HAMBURG, GER.—*Naturwissenschaftlicher Verein in Hamburg:*
Abhandlungen, Band XV, 1897, 143 pp.; 4 pll.
Verhandlungen, 1896, 57 pp.; 1897, 57 pp.

HANNOVER, PRUSS.—*Naturhistorische Gesellschaft zu Hannover:*
Festschrift zur Feier des 100 jahrigen, 1797-1897, 183 pp. Jahresbericht 44-47, 244 pp.; 9 pll.
Flora der Proviuz Hannover, von W. Brandes, 542 pp.
Katalog der systematischen Vogelsammlung des Provinzial-Museums in Hannover, 106 pp.
Katalog der Vogelsammlung aus der Proviuz Hannover, 24 pp.
Verzeichnis der Provinzial-Museum zu Hannover, 30 pp.

KIEL, PRUSS.—*Naturwissenschaftlicher Verein fur Schleswig-Holstein:*
Schriften, Band XI, 1897, 216 pp.

LEIPZIG, SAX.—*Koniglich-Sachsische Gesellschaft der Wissenschaften—Mathematisch-Physische Classe:*
Berichte u. die Verhandhungen, Band XLVIII, 1896, parts 4-6, 361-719 pp. Band XLIX, 1897, 747+xxiv pp.; 3 tafeln. Band LX, 1898, Hefts 1-5, 294 pp.
Sachregister fur 1897, 181 pp.
Naturwissenschaftlicher Verein fur Sachsen und Thuringen:
Zeitschrift fur Naturwissenschaften, LXIX Band, 1896, pp. 145-477; 1 taf. LXX Band, 1897, 464 pp.; 2 taf. LXXI Band, 1898, 1-3 Heft, 256 seite; 8 fig.

MAGDEBURG, PRUSS.—*Naturwissenschaftliche Verein:*
Jahresbericht und Abhandlungen, 1896-'98, 209 pp.; 20 pll.

MUNSTER, PRUSS.—*Westfalischer Provinzial-verein fur Wissenschaft und Kunst:*
Jahresbericht, XXIV, 1896-'97, lxviii + 219 pp.; 2 pll.; XXV, 1897 und '98, lxii + 211 pp.

NUREMBURG, BAV.—*Naturhistorische Gesellschaft:*
Abhandlungen, Band X, 1896; 217 seiten, 3 tafeln und 3 bildern. Jahresbericht fur 1896, 58 pp.
Abhandlungen, XI Band, 130 pp.; 14 pll. Jahresbericht fur 1897, 83 pp.

OSNABRUCK, PRUSS.—*Naturwissenschaftlicher Verein zu Osnabruck:*
Elfter Jahresbericht, fur das Jahre 1895 und 1896, xli + 192 pp. Beitrag zur Flora Osnabrucks, von G. Mollmann, 67-192.
Zwolfter Jahresbericht, fur das Jahre 1897, xxxii + 117 pp. Diluvialstudien, von Dr. J. Martin, 117 pp.; 1 pl.

REGENSBURG, BAV.—*Konigl. botanischen Gesellschaft in Regensburg:*
Katalog der Bibliothek, 1896, 40 pp.
Naturwissenschaftliche Verein zu Regensburg:
Berichte, VI Heft, fur die Jahre 1896-'97, 83 pp.

WIESBADEN, PRUSS.—*Nassauischen Verein fur Naturkunde:*
Jahrbucher, Jahrgang 50, 1897, lxxxiv + 250 pp.; 1 taf. Jahrgang 51, 1898, lxii+294 pp.

GREAT BRITAIN.

BELFAST, IREL.—*Belfast Natural History and Philosophical Society:*
Report and proceedings for the session of 1896-'97, 77 pp.; 1 map.

BIRMINGHAM, ENG.—*The Mason Science College:*
Calendar, 1897-'98, 529 pp.

DUBLIN, IREL.—*Royal Dublin Society:*
Scientific proceedings, vol. VIII, part 5, pp. 375-508; 5 pll. The distribution of drift in Ireland in its relation to agriculture, by J. R. Kilroe, pp. 421-431; 1 pl. The geographical distribution of dragon flies, by George H. Carpenter, pp. 439-468; 2 pll.
Scientific transactions, 22x28 cm., 1896-'97, vol. VI, Nos. 1-13, 328 pp.

EDINBURGH, SCOT.—*Royal Botanical Society:*
Proceedings.

Royal Society of Edinburgh:
Proceedings, vol. XXI, sessions 1895-'96—1896-'97, 549+xl pp.; 14 pll.

GLASGOW, SCOT.—*The Philosophical Society of Glasgow:*
Proceedings, vol. XXVII, 1895-'96, 213 pp.; 6 pll.
Vol. XXVIII, 1896-'97, 359 pp. The pollution of Scottish rivers, by John Glaister, pp. 50-95. Sound and speech waves, by John M. Kendrick, pp. 201-235.
Vol. XXIX, 1897-'98, 374 pp.

LIVERPOOL, ENG.—*Liverpool Geological Association:*
Journal, vol. XVI, 1895-'96, 44 pp. Notes on the glacial deposits near Wavertree, by William Owen, pp. 6-14.

Liverpool Geological Society:
Proceedings, vol. VIII, part I, 1896-'97, 152 pp.; 10 pll.

LONDON, ENG.—*Royal Botanical Society of London:*
Quarterly Record, 1896-'97, pp. 105-184.

Geological Society of London:
Abstracts of proceedings, session 1896-'97, Nos. 663-679, 125 pp.; 1897-'98, 122 pp.
Geological literature added to the geological society's library during the year ending December 31, 1896, 207 pp.

MANCHESTER, ENG.—*Manchester Literary and Philosophical Society:*
Memoirs and proceedings, vols. 41 and 42.
Vol. 42, part IV, 130 pp.; 2 pll. Hymenoptera orientalia, by Peter Cameron, 84 pp.; 1 pl. On the physical basis of physical events, by Prof. Michael Foster, 46 pp.; 1 pl.
Part V, memoirs, 26 pp.; 1 pl. Contribution to our knowledge of the marine fauna of the Falkland islands, by Edith M. Pratt, 26 pp.; 1 pl. Proceedings, 52 pp.

PENZANCE, ENG.—*Royal Geological Society of Cornwall:*
Transactions, vol. XII, parts II and III, 184 pp.; 6 pll.

ITALY.

BOLOGNA.—*R. Accademia della Scienze dell Instituto di Bologna:*
Memorie delle Scienze Naturali, 23x30 cm., serie V, tomo V, 1895-'96, 384 pp.; 14 pll. Tomo VI, 1896-'97, 318 pp.; 13 pll.
Rendiconto, delle R. Accademia delle Scienze del 'Instituto di Bologna, nuova serie; vol. I (1896-'97), Fasc. 1-4, 303 pp.

CATANIA.—*Accademia Gioenia di Scienze Naturali in Catania:*
Bullettino delle Sedute, Fasc. 32-38, 1895, 154 pp.; 1 pl. Fasc. 46, 1897, 39 pp. Fasc. 53-55, 64 pp.

MILAN.—*Societa Italiana di Scienze Naturali:*
Atti, vol. XXXVI, 1897, Fasc. 3, 4, 187-381+92 pp.; 3 pll. Vol. XXXVII, 1898, Fasc. 1-3, 296 pp.; 2 pll. Memorie, 22x28cm., tomo VI, 1897, La Pietra da Cantoni di Rosignano e di Vignale, Dott. G. de Alessandri, 100 pp.; 2 litho. pll.; 1 geological map, 42x36 cm.

PADUA.—*R. Accademia di Scienze, Lettre ed Arti in Padova:*
Atti e Memorie, vol. XII, 1896, 380 pp.; XIII, 1897, 352 pp.

PALERMO.—*R. Orto Botanico di Palermo:*
Bollettino, vol. I, Fasc. 2-4, pp. 41-196. Appendices, pp. 8-30; 2 pll.
Vol. II, 191 pp.; 13 pll. Contribuzioni alla Biologia vegetale, edite da Antonino Borzi.

PISA.—*Societa Toscana di Scienze Naturali:*
Vol. X, 1895-'96, pp. 122-292. Vol. XI, 10 pp.; XII, pp. 12-55.

ROMA.—*Accademia Pontificia de Nuovi Lincei:*
Atti, anno L, 1897, 150 pp.; LI, 1898, 122 pp.

R. Comitato Geologico d'Italia:
Bollettino, anno 1896, Nos. 3 and 4, pp. 231-475; 2 pll.; several figures.

SIENA.—*Sigismondo Brogi, Direttore:*
Avicula, 18 x 26 cm., 60 pp.
Bollettino del Naturalista, anno XVII, 1897, 144 pp. Anno XVIII, 40 pp.
Revista Italiana di Scienze, anno XVII, 152 pp. Anno XVIII, 44 pp.

TURIN.—*R. Accademia delle Scienze di Torino:*
Atti, vol. XXXII, 1896-'97, 1106 pp.; 7 pll. Vol. XXXIII, 1897-'98, 1066 pp.; 10 pll.
Osservazioni meteorologiche, anno 1896-'97, 54 pp. Anno 1897-'98, 53 pp.

NETHERLANDS.

HELDER.—*Nederlandsche Dierkundige Vereeniging:*
Tijdschrift, 16x24 cm., 2de serie, Deel V, Aflevering 1-4, 300+cxvii pp.; 4 pll.
Deel VI, Aflevering I, 118+xviii pp.; 3 pll. Untersuchungen ueber das Ovarium der Selachier, von A. H. Schmidt, pp. 1-108; 3 pll.
Catalogus der Bibliotheek, same size, 174 pp.

NORWAY.

CHRISTIANIA.—*Videnskabs Selskabet i Christiania* (Academy of Science of Christiania):
Forhandlinger for 1896. No. 1. Geological notes from the region to the north of the Faemund lake, by Hans Reush, 42 pp. No. 2. Geological notes from Telemark, Inner-Hardanger, Numedal and Hallingdal, by Hans Reush, 102 pp. Nos. 3 to 8, 204 pp.
Forhandlinger for 1897. No. 1, 18 pp. No. 2, 42 pp.

K. Norske Frederiks Universitet (Royal Norwegian University):
Jahrbuch des Norwegischen Meteorologischen Instituts, 25x32 cm., fur 1893, 109 pp. 1894, 109 pp. 1895, 109 pp. 1896, 120 pp. 1897, 120 pp. Heraus gegeben, von Dr. H. Mohn.
Beskrivelse af en Raekke Norske Bergarter, af Dr. Th. Kjerulf, 91 pp.
Fauna Norvegiæ, vol. I. Descriptions of the Norwegian species at present known belonging to the suborders Phyllocarida and Phyllopoda, by G. O. Sars, 140 pp.; 20 pll. (colored and uncolored).
Norronaskaller. Crania antiqua in parte orientali Norvegiæ meridionalis inventa, af Justus Barth, 197 pp.; 10 pll.
Meteorologische Iagttagelser i Norge, af H. Mohn, 21 pp.; 1 pl.

STAVANGER.—*Stavanger Museum:*
Aarsberetning for 1896, 58 pp.; 1 pl. Aarsberetning for 1897, 67 pp.; 2 pll.

TRONDHJEM—*Kongelige norske Videnskabers Selskab* (Royal Norwegian Academy of Sciences):
Skrifter, 15x24 cm., 1896, 8 papers in English, Norwegian, Swedish, and German, xxxii+417 pp.; 2 pll. The reproductive organs in *Turnerella septentrionalis*, etc., by M. Foslie, 8 pp. (English).
Skrifter, 1897, 6 papers in English, Swedish, and Norwegian, 386 pp.; 2 pll. On some Lithothamnia, by M. Foslie, 20 pp. (English).

RUSSIA.

HELSINGFORS, FINL.—*Finska Vetenskaps Societeten* (Scientific Society of Finland):
Acta Societatis Scientiarum Fennicæ, 23x29 cm., tomus XXI, 1896, 644 pp.; 9 pll. Tomus XXII, 1897, 1017 pp.; 6 pll. Tomus XXXIII, 1897, 940 pp.; 36 pll.; 70 tables.
Ofversigt af F. V. S. Forhandlingar, 14x22 cm., vol. XXXVIII, 1895-'96, xx+281 pp.; 1 pl.
Ofversigt af F. V. S. Forhandlingar, vol. XXXIX, 1896-'97, xxi+329 pp.; 7 pll.

Societas pro Fauna et Flora Fennica:
Acta, vol. XIII, 1897, 482 pp. Vol. XIV, 1897-'98, 392 pp.; 4 pll.
Meddelanden, vol. XXII, 1896, 117 pp. Vol. XXIII, 1898, 198 pp.

Societe des Sciences de Finland—Institut Meteorologique Central (Central Meteorological Institute of the Finnish Scientific Society):
Meteorological observations made at Helsingfors, 25x35 cm., all tables. Resume des annees 1881-'90, 28 pp. Observations made in the year 1896, 122 pp.

KAZAN, RUSS.—*Fiziko-Mathematicheskago Obshestva pre Imperatorskome Kazanskome Universitete* (Physico-Mathematical Society of the Imperial University of Kazan):

Bulletin, 16x24 cm., second series, tome V, No. 4, 1896, pp. 145–184, 45–64, 1–16. Tome VI, 1896, 340 pp.; 1 pll. Tome VII, 1897, 570 pp.; 2 pll. Tome VIII, 1898, Nos. 1–3, 380 pp.

ST. PETERSBURG, RUSS.—*Geological Committee of Russia:*

Bulletins, 16x24 cm., vol. XV, Nos. 5–9, 1896, pp. 147–258, 27–105. Supplement, 224 pp. Vol. XVI, 1897, 160+290 pp.; 4 maps. Supplement, vol. XVII, 1899, Nos. 1–5, 70+250 pp; 1 map.

Memoirs of the Geological Committee, 25x32 cm., vol. XIV, No. 2, 1896. Hydro-geological survey in the government of Cherson, by Dr. N. Sokolova, 295 pp.; 1 map. No. 4, 1896. Geological sketch of the glacial districts of Teberda and Chalta, in the Caucasus, by Prof. J. W. Musketova, 67 pp.; 2 maps. No. 5, 1896. General geological chart of Russia, 27 pp.; 1 map.

Vol. XV, No. 2, 1896. General geological chart of Russia, quadrangle 72, Vladimir, Nizhni-novgorod, by N. Sibirtseva, 284 pp.; 1 map, 64x90 cm.

Vol. XVI, No. 1, 1898. General geological chart of Russia, quadrangle 127, Permo-carboniferous fossils, by A. Stukenberg, 362 pp.; 5 pll. of 230 figs.

Imperatorskoy Akademia Nauke (Imperial Academy of Sciences):

Bulletin, 21x30 cm. Fifth series, vol. V, 1896, 76+396 pp. Vol. VI, 1897, 60+546 pp. Vol. VII, Nos. 1 and 2, 1897, 18+214 pp.; 2 pll.

Memoirs, Physico-mathematic class, 25x34 cm., vol. XLII, No. 13, 1895. Scientific expedition to the new Siberian islands, by Baron Edouard V. Toll, 86 pp.; 7 pll. No. 14, and last, 1897, "Chudaidat," a Jewish tale of Bucharest, in the original Hebrew, by Carl Salemann, 56 pp. Eighth series, vol. V, 1897, 720 pp.; 9 pll.; 2 maps. Vol. VI, Nos. 1–10, 1898, 582 pp.; 28 pll.

Memoirs, Historico-philologic class, 20x30 cm. Eighth series, vol. I, Nos. 3–6, 1897, 315 pp.; 17 steel engravings.

Imperatorskago Mineralogicheskago Obzhestva (Imperial Mineralogical Society):

Memoirs, 16x25 cm., vol. XXXII, 1896, 540 pp., 1 map, and 15 beautiful lithograph plates, containing about 250 figures of paleozoic fossils, by Dr. Georg Gurich. The book is printed in German.

Vol. XXXIII, 1895, part II, 200 pp.; 4 litho. pll. of paleozoic fossils. Vol. XXXIV, 1895–'96, 360 pp.; 6 litho. pll.; 1 map. Vol. XXXV, 1897, part I, 178 pp.; 9 litho. pll.

Imperial Mineralogical Society:

Materials for Russian geology, tome XVIII, 264 pp., 6 pll., and 1 geological chart. Register, 1898, 90 pp.

SPAIN.

BARCELONA.—*Real Academia de Ciencias y Artes:*

Boletin, 23x28 cm., Nos. 15–20, 1897–'98, pp. 263–438.

Memorias, 23x28 cm. Tomo II, 1897–'98, pp. 139–229.

Pliocene deposits of the plain of Barcelona, by Dr. Jaime Almera, pp. 81–104; figs. 11–16.

Fauna Salobre Tortonense de Villaneuva y Geltru, por el Dr. D. Jaime Almera y D. Arturo Bofill y Poch, 16 pp.; 2 pll.

Declinacion Magnetica en la Peninsula Iberica, por Don Rafael Pardo de Figueroa, pp. 1–8.

Nomina del personal Academico, 1898, 9x16 cm., 104 pp.

MADRID.—*Real Academia de Ciencias, Fisicas y Naturales de Madrid:*

Memorias, 20x30 cm. Tomo XVII, 1897, 806 pp.; 24 pll.; 2 maps. Exposicion y discusion de las principales clasificaciones publicadas acerca de los Mamiferos, pp. 73–806; 24 pll.

Discursos del Excmo. Sr. D. Praxedes Mateo Sagasta, 66 pp.

SWEDEN.

STOCKHOLM.—*Entomologiska Foreningen i Stockholm* (Entomological Society of Stockholm):

Entomologisk Tidskrift, arg. XVIII, 1897, 264 pp.; 2 colored, 3 uncolored plates. Arg. XIX, 1898, hefts 1–4; 206 pp.; 3 pll.

Kongliga Svenska Vetenskaps Akademien (Royal Swedish Academy of Sciences):

Bihang till K. S. V. A. Handlingar, division I, mathematics, astronomy, mechanics, physics, meteorology, and kindred subjects. Blue covers. Vol. XXI, 1896, five papers in Swedish and German, 149 pp.; 1 pl.

Vol. XXII, 1897, eight papers in Swedish, German, and French, 246 pp.; 2 pll.

Vol. XXIII, 1898, six papers in German, French, and Swedish, 252 pp.; 9 pll.

Division II, chemistry, mineralogy, geognosy, physical geography and kindred studies.

Yellow covers. Vol. XXI, 1896, eight papers in English, German, and Swedish, 191 pp.; 16 pll. Contributions to the chemistry of the elements of rare earths, by O. Petterson, 16 pp.; 2 pll.

Vol. XXII, 1897, four papers in Swedish, 90 pp.; 2 pll.

Vol. XXIII, 1898, six papers in German and Swedish, 140 pp.; 3 pll.

Division III, botany. Green covers. Vol. XXI, 1896, fourteen papers in Swedish, German, English, and French, 634 pp.; 17 pll. On recent fresh-water diatoms from Lule Lappmark in Sweden, by Astrid Cleve, 45 pp.; 2 pll. (English).

Vol. XXII, 1897, twelve papers in Swedish, German, and English, 358 pp.; 17 pll. Diatoms from Baffin's bay and Davis strait collected by M. E. Nilsson, and examined by P. T. Cleve, 22 pp.; 2 pll. (English).

Vol. XXIII, 1898, with thirteen papers in German and Swedish, 407 pp.; 25 pll.

Division IV, zoology, biology, etc. Brown covers. Vol. XXI, 1896, eight papers in English, German, and Swedish, 278 pp.; 25 pll. On remains of Cyathaspis from the Silurian strata of Gottland, von G. Lindstrom, 15 pp.; 2 pll. (English).

Vol. XXII, 1897, six papers in Swedish, English, German, and French, 326 pp.; 10 pll. Linnean type-specimens of birds, reptiles, batrachians and fishes in the zoological museum of the University of Upsala, by E. Lonnberg, 45 pp. (English).

Vol. XXIII, 1898, seven papers in French, German, and Swedish, 223 pp.; 15 pll.

Ofversigt, 53d year, 1896, many short papers, Swedish, German, etc., 721 pp.

Ofversigt, 54th year, 1897, many short papers in Swedish, German, etc., 654 pp.

UPSALA.—*Kongliga Upsala Universitet* (Royal University of Upsala):

Arsskrift, 16x24 cm., 1896. Jurisprudence, 92 pp. Medicine, 137 pp.; 106 figs. Philosophy, 68+53 pp.; 3 pll. Program, 1896, pp. 167–274. Review of the university, 1895 and 1896, 102 pp.

Festskrift Wilhelm Lilljeborg, zoological studies, 360 pp.; 18 pll.

Festskrift med Anledning af Konung Oscar II's Tjugofemars Regeringsjubileum den 18 September, 1897, 541 pp.; 3 litho. pll.; many figs.

SWITZERLAND.

BASEL.—*Naturforschende Gesellschaft in Basel:*

Verhandlungen, 14x22 cm., Band XI, 1897, Heft 3, pp. 421–527; 1 pll.

Band XII, Heft 1, 1898, 148 pp.; 1 pl.

BERN.—*Naturforschende Gesellschaft in Bern:*

Mittheilungen aus dem jahre 1893, xix+236 pp.; 4 pll.

Mittheilungen aus dem jahre 1894, xxiv+303 pp.; 5 pll.

Mittheilungen aus dem jahre 1895 xviii+205 pp.; 4 pll.; 1 map.

Mittheilungen aus dem jahre 1896, xviii+294 pp.; 4 pll.

GENEVA.—*Societe de Physique et d'Histoire Naturelle:*

Compte Rendu des Seances, vol. XIII, 1896, 100 pp. Vol. XIV, 1897, 71 pp. Vol. XV, 1898, 59 pp.

NEUCHATEL.—*Societe Neuchateloise de Geographie:*

Bulletin, 16x24 cm. Tome IX, 1896–'97, 264 pp.; 3 pll. Tome X, 1898, 517 pp.; 5 pll.

SCHAFFHAUSEN.—*Schweizerische Entomologische Gesellschaft* (Swiss Entomological Society):

Mittheilungen, vol. —.

ST. GALLEN.—*St. Gallische Naturwissenschaftliche Gesellschaft:*

Bericht, 14x21 cm., 1895–'96, 418 pp.

MISCELLANEOUS.

NEW YORK, N. Y.—*The Electrical Review Publishing Company, Chas. W. Price, Editor:*

Electrical Review, a weekly journal of electrical and scientific progress, 29x40 cm., finely illustrated. Vol. XXX, 1897, 384 pp.; XXXI, 1897, 400 pp.; XXXII, 1898, 432 pp.; XXXIII, 1898, 416 pp,

Besides the above books and regular exchanges, catalogues of scientific books are received regularly from the following publishing houses and booksellers:

Joseph McDonough, 53 State street, Albany, N. Y.

Walter F. Webb, Albion, N. Y.

Charles E. Lauriat, 301 Washington street, Boston, Mass.

A. S. Clark, 174 Fulton street, New York, N. Y.

Harper Bros., New York, N. Y.

Appleton & Co., New York, N. Y.

Dodd, Mead & Co., 149 Fifth avenue, New York, N. Y.
P. Blakiston, Son & Co., Philadelphia, Pa.
Bernard Quaritch, 15 Piccadilly, London, Eng.
Dulau & Co., 37 Soho square, London W., Eng.
Francis Edwards, 83 High street, Marylebone, London W., Eng.
John H. Knowles, 15 Rush Hill Road, Lavender Hill, London S. W., Eng.
Kegan Paul, Trench, Trubner & Co., Paternoster House, Charing Cross Road, London, Eng.
J. B. Balliere & Fils, 19 Rue Hautefeuille, Paris, France.
Ch. Chadenat, 17 Quai des Grands Augustins, Paris, France.
Paul Parey, Hedemanstrasse 10, Berlin S. W., Germany.
Mayer & Muller, Markgrafenstrasse 51, Berlin W., Germany.
"Der Mechaniker," Potsdamerstrasse, Berlin W., Germany.
H. W. Schmidt, Halle a Saale, Germany.
Oswald Weigel, Konigsstrasse 1, Leipzig, Germany.
Ludwig Rosenthal, Munich, Bavaria.

And others.

The following books have been added to the library by purchase:

Cassino's Scientists' International Directory.
The Century Dictionary and Cyclopedia, 10 volumes, ¾ levant.
The World's History, illuminated, 8 volumes, cloth.
Illustrated Flora of the Northern States and Canada, Britton & Brown, 3 volumes.

These books are only for reference and will not be loaned out.

Other books are loaned out to members of the Academy on receipt of the necessary postage, which can be learned by correspondence with the librarian.

INDEX.

SUGGESTION.

Persons friendly to the Academy, having a surplus of scientific books, or of natural history or scientific specimens, desiring to put them to good use so that the greatest number of people might be benefited by them, would do well to donate them to the Kansas Academy of Science, at Topeka. The Academy will pay freight and give the donors credit in placing them on exhibition in the state museum.

B. B. SMYTH, *Curator*.

Date Due