University of the State of New York

NEW YORK STATE MUSEUM

FORTY-SIXTH ANNUAL REPORT

OF THE

REGENTS

FOR THE YEAR 1892

TRANSMITTED TO THE LEGISLATURE JANUARY 18, 1893

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No. 39.

IN SENATE,

JANUARY 18, 1893

FORTY-SIXTH ANNUAL REPORT

OF THE

NEW YORK STATE MUSEUM

To the Legislature of the State of New York

I have the honor to submit herewith, pursuant to law, as the 46th annual report of the regents of the University on the New York State Museum the report of the director of the museum with appendices, of the botanist and the entomologist.

ANSON JUDD UPSON

Chancellor

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Lieutenant-Governor, Superintendent of Public Instruction, Regents BOSTWICK, BEACH, COBB, C. E. SMITH, STIMSON

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Director, State Geologist and Paleontologist

FREDERICK J. H. MERRILL, Ph. D. (Columbia)
Assistant Director and Assistant Geologist

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JACOB VAN DELOO - - - - - - *Clerk*

CHARLES W. SAMSON - - - - - - *Page*

NEW YORK STATE MUSEUM.

Report of the Director, 1892.

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REPORT OF THE DIRECTOR.

To the Honorable the Regents of the University of the State of New York:

Gentlemen.— I have the honor to transmit herewith the report of Mr. F. J. H. Merrill, Assistant Director, and of Mr. Wm. B. Marshall, Assistant Zoologist, showing the nature of the work accomplished, the condition of the collections in the zoological department, and the proposed work in other departments in the Museum building on State street.

The Museum collections in geology and palæontology arranged and stored in the State Hall have received especial attention during the past year as the accompanying statements will show. The large amount of material originally collected for use in the preparation of the volumes on Palæontology has, up to this time, remained very nearly in the same condition as when it was transferred from my own premises to the State Hall in 1886, being interrupted only by the selection of collections for schools which have been ordered by the Regents. A statement of the condition of these collections, the number of drawers and boxes occupied by the specimens will be found following the report upon the State Museum by the Assistant Director.

Very respectfully,

JAMES HALL,
Director.

Albany, *December* 10, 1892.

Prof. James Hall, *Director:*

Dear Sir.—I have the honor to submit herewith my report on the work of the New York State Museum for the fiscal year ending September 30, 1892.

Very respectfully yours,

F. J. H. MERRILL,
Assistant Director.

Report of the Assistant Director and Assistant State Geologist.

During the past fiscal year the time of the Assistant Director, in the office, has been chiefly occupied with correspondence relating to the mineral resources of New York State and the collation of data for the preparation of bulletins on the various products. The many inquiries received concerning the location and distribution of minerals emphasize the need for publications on this subject, and the lack of accurate information on many points of interest and importance in this connection indicates the necessity for an economic survey of New York State. With the limited means available, the writer has endeavored to supply the necessary information whenever asked for, and has undertaken a collation of the literature bearing on the mineral wealth of our State, which, if supplemented by field work, will permit the publication of reliable reports on the economic minerals found within our borders. A special bulletin on the salt of New York State has been in preparation for several months and will soon be ready for publication.

In the field but little has been accomplished by the writer in the economic subjects upon which work was begun last year. The pressing necessity for the completion of the geological map of Westchester county, to be embodied in the new geological map of New York State now in preparation by the State Geologist, made it essential to devote to this purpose nearly the whole of the sum of $500 allowed for the expenses of the Assistant Director; consequently, the economic work originally planned for the past season has been delayed.

Some time has been occupied, at the suggestion of the Secretary of the University, in preparation for a course of lectures on geology, with special reference to New York State for University Extension. The writer has also in preparation a brief handbook of New York geology to serve as a guide to the museum collections. Such a work was printed in the Annual Report of the State Museum of Natural History for 1860, but the present state of our knowledge on this subject necessitates extensive revision and amplification of the original pamphlet.

The study of the iron deposits of the eastern Adirondack region and their associated rocks, begun by the writer last year, has been continued by Prof. J. F. Kemp, of Columbia college, who kindly volunteered his services in making a geological map of the Port Henry district. Prof. Kemp's work in this field has been extensive and thorough and an important report will be made. The work of mapping the geology of Westchester county, carried on at intervals from 1884 to 1890 by the writer, and continued by him in 1890 under the auspices of the State Museum with the assistance of Mr. E. M. Blake, has been brought nearly to completion during the past year by the writer and Mr. Heinrich Ries, an efficient volunteer assistant. The boundary lines between the areas of gneiss, schist and limestone have been carefully traced throughout the greater part of the region not previously mapped and the detailed geology has been studied with sufficient care to permit the geology of the county to be mapped on a scale of five miles to the inch. Much petrographic work, however, remains to be done and at least one more season's field work will be necessary to a thorough understanding of the stratigraphic geology of Westchester county.

The work in Zoology has been continued under the direction of the writer by Mr. Wm. B. Marshall on the same lines as during the previous year and is discussed in detail in his report. The collection of fishes being very meager and the alcoholic specimens being in poor condition for popular inspection it seemed desirable to make a new and complete collection of the food fishes of our State. The Assistant Director communicated with the officers of the State Fish Commission on this subject and an immediate promise of material was received and the persons in charge of the various State hatcheries have been directed to supply the Museum with a suite of specimens of the food fishes. The Commission has also promised specimens of fishes not used for food, mollusks and other zoological material. It was found upon investigation that there was no existing catalogue of the fishes of New York State which was reliable in terminology and complete in its scope. The writer has, therefore, undertaken to supply this want by compiling a catalogue which can be printed in our annual report and used as a check list. It is proposed, as soon as the opportunity is offered, to prepare and publish lists of the various groups comprised in the fauna of New York State.

In conclusion, it may be stated that since the close of the fiscal year of 1891–1892 the need for field work to supply information concerning many of the minerals of economic value which occur in New York, has been to some degree met in the work of collecting material for the State mineral exhibit at the World's Columbian Exhibition. As a result of this work we may expect a valuable contribution of material to the collections and publications of the State Museum without additional expense.

Respectfully submitted.

FREDERICK J. H. MERRILL.

REPORT OF THE ASSISTANT ZOOLOGIST.

ALBANY, N. Y., *December* 1, 1892.

JAMES HALL, LL.D., *Director of the New York State Museum:*

DEAR SIR.—The following is a report of the affairs of the Zoological Department of the New York State Museum for the period beginning October 1, 1891, and closing November 30, 1892:

Much the greater portion of my time during the past year has been devoted to the work of rearranging the collections of shells. This work was begun in the winter of 1890, and when the last annual report was prepared most of the species belonging to the families Muricidæ and Tritonidæ had been reidentified and some of them had been labeled and arranged in the exhibition cases. During the last year the Cephalopoda and the Gasteropoda of the families Fusidæ, Buccinidæ, Nassidæ, Turbinellidæ, Volutidæ, Mitridæ. Conidæ, Pleurotomidæ, Marginellidæ, Olividæ and Columbellidæ have been reidentified and many of them have been permanently arranged in cases.

The rearrangement of the shells includes the reidentification of all the specimens contained in the various collections. For this purpose use is made of Tryon's Manual of Conchology. Large and elegant suites of specimens received from the Smithsonian Institution, from the duplicates of the United States Exploring Expedition, from Hugh Cuming, from Dr. Wesley Newcomb, and from other sources, have never been exhibited to the public. The Gould collection, of which only a part was exhibited, and the case containing the Reigen collection of Mazatlan shells, formed the general conchological exhibit. Many species and some genera which are lacking in these collections are represented by specimens in other collections belonging to the Museum. By combining the several collections (exclusive of the Reigen collection, which by terms of gift must be maintained separately) into one general collection, we have been enabled to show at a glance all the species of each genus in our possession.

The careful study of each suite of specimens which is necessary in making a reidentification of the species, has resulted in bringing to light several of Gould's types which heretofore have not been recognized as such. In addition to these the types of several species described by Dr. Philip P. Carpenter have been found in the Gould collection. The "Proceedings of the Zoological Society of London" for the year 1856 contained a paper entitled "Descriptions of Shells from the Gulf of California and the Pacific Coasts of Mexico, by A. A. Gould and P. P. Carpenter." Dr. Gould proposed the names of some of the new species described in this paper, and Dr. Carpenter proposed the names of the remainder. The types of several of these species, which until recently have not been recognized as types, have already been found in our collection and it is probable that we have all of them. They are especially valuable because they have not been figured and in a few cases the species are represented by specimens which are unique.

As reported last year, it is our intention to publish a catalogue of the collection of shells as the work of rearranging it progresses. An appendix to the last annual report contained a catalogue of the family Muricidæ. An appendix to this report contains a catalogue of the families Tritonidæ, Fusidæ, Buccinidæ, Nassidæ, Turbinellidæ, Volutidæ and Mitridæ. Family, generic, subgeneric and specific labels have been printed for the portion of the collection of shells catalogued in this report.

Printed labels have been placed upon the specimens of birds lacking labels, and the sex of the bird has been indicated on the label of each specimen. The entire collection of birds has been renumbered.

Early in the year the skeleton of the Indian elephant "Columbia" was received from Ward's establishment at Rochester, where it had been sent for cleaning and mounting. Owing to lack of space it was impossible to place the specimen with the collection of recent animals upon the fourth floor of the Museum. It was therefore placed upon the third floor, near the mastodon and Irish elk. In order to provide room for the specimen upon this floor it was necessary to remove the entire Rosenbusch collection of rocks and to lessen the width of the aisles between the various cases.

The fact that material properly belonging in the Zoological department is overflowing into other departments, where it can be accommodated only by the removal and storage of equally valuable, though less perishable material, shows that there is imperative need of more space in all departments of the Museum.

The large bison's head which formerly adorned the wall of the entrance hall has been cleaned and mounted upon a walnut shield and placed in one of the exhibition cases. This care and expense was deemed advisable because of the increasing rarity and value of specimens of this character.

The usual amount of cleaning has been done. Each stuffed specimen has been carefully examined and all have been found in good condition and free from insects. The specimens and the cases containing them have been carefully wiped and dusted.

The floors of the large case at the west end of the room, containing the ungulates, and of the three large cases at the east end, containing the rhinoceros, carnivora, etc., have been painted and the walls and ceiling have been kalsomined. This and the removal of the paint from the panes of some of the windows and the substitution of ground glass for the rest of the painted panes have added greatly to the cheerfulness and attractiveness of the floor devoted to zoology.

At various times during the year notes from this department have been published in the "Nautilus," in the "American Naturalist" and in the "Auk." One of the notes published in the last named periodical is reprinted in this report.

Bulletin No. 1 — A preliminary list of New York Unionidæ was published in March, 1892. It contains a list of the species of Unionidæ known by the author to inhabit the State of New York. It is preliminary to a more extended list of all the species known to inhabit the State.

Since the date of the last report the Assistant Zoologist has made addresses on zoological subjects before the Kindergarten Teachers' Association of Albany, before the Dana Society of Natural History of Albany, and at a farmers' institute held at Rhinebeck under the auspices of the New York State Agricultural Society.

A list of the additions to this department will be found in an appendix.

Respectfully submitted.

WM. B. MARSHALL,
Assistant Zoologist.

A specimen of Numenius arquatus, said to have been taken on Long Island, N. Y.*—The collection of the New York State Museum contains a specimen of Curlew labelled "Numenius longirostris, Long-billed Curlew, male, taken on Long Island in 1853." The specimen proves to be a European Curlew (Numenius arquatus). Mr. William Dutcher has compared the specimen with specimens of Numenis arquatus in the American Museum of Natural History in New York City, and says that there is not the slightest doubt that the bird belongs to that species. This being the case, the statement on the label that the bird was taken on Long Island becomes an interesting one. Mr. Brewster, Mr. Ridgway and Dr. Merriam inform me that, so far as they know, the species has never been recorded as occurring in an American locality.

The annual reports of the New York State Museum (or Cabinet) record but three specimens of Long-billed Curlew, Numenius longirostris, as having been received into the State collection, viz., one specimen (without data of any kind) recorded in the 1st Report, p. 17, 1848; one male recorded as part of the De Rham collection, 4th Report, p. 36, 1851; one male recorded in the 7th Report, p. 17, 1854. This last specimen was received in 1853, as it is recorded in "Appendix A. Catalogue of the quadrupeds, birds, reptiles, amphibians, fishes, etc., added to the State Cabinet of Natural History, from January 1st, 1853, to January 1st, 1854."

At the present day there are three specimens in the State collection labelled "Numenius longirostris, Long-billed Curlew," viz., one without data of any kind—corresponding in this respect to the entry in the 1st Report; one in the De Rham collection, marked "male"—corresponding to the entry in the 4th Report; the third is the specimen of Numenius arquatus under consideration and is labelled "Male, taken on Long Island in 1853"—corresponding in sex and date to the entry in the 7th Report. The report contains no record of the locality in which the specimen was taken. The writer does not consider this omission as of any importance except that it may be looked upon as in a measure supporting the supposition that the bird came from some locality within the State of New York. The older Reports of the State

* Reprinted from the Auk, October, 1892.

Cabinet do not contain records of localities for animals, except when the occurrence of a species in a certain locality was considered remarkable. The reports give evidence that the specimen of Numenius arquatus was believed to be the common Long-billed Curlew (Numenius longirostris) known to occur more or less plentifully within the state, so that the locality in which the specimen was taken was not thought worthy of remark.

The writing on the label is apparently very old, and is in the hand of the late John Gebhard, who was curator of the State Cabinet at the time the bird was received. Mr. Gebhard was in the employ of the institution at the time of his death in 1887, in the capacity of guide; and was believed tc be familiar with the history of most of the zoological specimens. About ten years ago the birds and their labels were marked with corresponding numbers. The work was done by Mr. Martin Sheehy, who is still in the employ of the Museum, and at a time when Mr. Gebhard was connected with the institution. On account of the position which he held — that of guide — Mr. Gebhard's eyes were upon the collection almost every day. Under such circumstances it is hardly possible that there could have been any confusion of labels without attracting his attention.—Wm B. Marshall, New York State Museum, Albany, N. Y.

The above notes were read at the last Congress of the American Ornithologists' Union, November, 1891, and the specimen in question was also exhibited. The identity of the specimen being beyond question, the only other point to be decided is, whether the claim that it was taken in North America is well founded. In addition to the facts submitted above by Mr. Marshall, he also found in the Comptroller's office in Albany, a bill made by James A. Hurst, dated June 8, 1853, for certain specimens of mammals, birds, etc., among which is this item, "Long-billed Curlue, male, very fine, $5.00." Mr. Hurst who sold this specimen to the State Museum was in the employ of the State Cabinet at the date of the bill and for many years afterward in the capacity of taxidermist. It is evident neither Mr. Gebhard, the curator, nor Mr. Hurst, the taxidermist, were aware that the specimen added to the collection at the time was the European Curlew, as they labelled it "Long-billed Curlew." If they had been acquainted with its identity, it is fair to assume they would have labelled it correctly, from the greater interest that would have been attached. We can also assume with certainty that Mr. Gebhard, in whose handwriting the label is, when the specimen was purchased, asked the taxidermist, Mr. Hurst, the locality the bird came from, and at the time when the fact was fresh in the mind of Mr. Hurst the locality "Long Island" was added to the record. Mr. Hurst could have had no object in substituting a specimen of the European Curlew for our own form in the New York State collection, as a specimen of the Long-billed Curlew would be much easier to obtain, and further, the cost of a specimen of the European form would have been much greater. That he could have made the substitution knowingly is out of the question, as he was a man of the utmost probity of character and one whose statements could be depended upon implicitly. To further substantiate the fact that this specimen was taken in America it was submitted to Mr. William Palmer, taxidermist of the National Museum, Washington, D. C., and Mr. Jenness Richardson, taxidermist of the American Museum of Natural History, New York, who were present at the Congress, and they without hesitation, after examination, pronounced the specimen to have been mounted from a bird freshly killed and not from a dried skin.—Wm. Dutcher, New York City.

Additions to the Zoological Collections.

Mammals.

From Albany Institute, July, 1891.

Walrus, Trichechus rosmarus, Godm., one tusk.

Sperm Whale, Physeter macrocephalus, Linn, five teeth.

Birds.

Collected by W. B. Marshall:

Wilson's Thrush, Turdus fuscescens Steph., male, Greenbush, N. Y.

Black-poll Warbler, Dendroica striata (Forst.), male and female, Greenbush, N. Y.

Kingbird, Tyrannus tyrannus (Linn.), male, Greenbush, N. Y.

Bluebird, Sialia sialis (Linn.), male, Greenbush, N. Y.

American Redstart, Setophaga ruticilla (Linn.), female, Greenbush, N. Y.

Reptiles and Batrachia.

From Albany Institute, July, 1891:

Box Turtle, Cistudo, Carolina (Linn.), one shell.

Wood Turtle, Chelopus insculptus (LeC.), three shells.

Painted Turtle, Chrysemys picta (Hermann), one shell.

Leather Turtle, Amyda mutica (LeS.), one (stuffed).

Milk Snake, Ophibolus doliatus (Linn.), var. triangulus (Boie), one specimen.

Red-bellied Snake, Storeria occipitomaculata (Storer), Ipswich, Mass., two specimens.

Red-bellied Snake, Storeria occipitomaculata (Storer), Lake George, one specimen.

Newt, Diemyctylus viridescens, Raf., Lake George, eight specimens.

Tiger Salamander, Amblystoma tigrinum (Green), Erie Canal, one specimen.

Donors unknown:

Milk Snake, Ophibolus doliatus, var. triangulus (Boie), Albany, N. Y., one specimen.

Tree Frog, Trachycephalus marmoratus, Bibron, I. of Cuba, one specimen.

Mud Puppy, Necturus maculatus, Raf., Lansingburgh, N. Y., one specimen.

Collected by W. B. Marshall :

Wood Frog, Rana sylvatica, LeC., Kenwood, N. Y., four specimens.

Red Eft, Diemyctylus viridescens, var. miniatus (Raf.), Kenwood, N.Y., one specimen.

Dusky Salamander, Desmognathus fuscus (Raf.), Kenwood, N. Y., five specimens.

From S. S. Smith, Albany, N. Y. :

Two-striped Salamander, Spelerpes bilineatus (Green), Albany, N. Y., one specimen.

Fishes.

From Professor John D. Quackenbos, New York city :

Sunapee Lake Trout, Salvelinus aureolus, Bean., Sunapee Lake, N. H., five specimens.

From Albany Institute, July, 1891 :

Pipe-fish, Siphostoma fuscum (Storer), Sandy Hook, N.J., two specimens.

Donor unknown:

Lump fish, Cyclopterus lumpus, Linn., one specimen.

Crustacea.

From Albany Institute, July, 1891:

Soldier Crab, Gelasimus pugnax, Smith. Sandy Hook, N. J., two specimens.

Balanus sinbinnabulum, Linn., two specimens.

Balanus sp. ? one specimen.

Worms.

Collected by W. B. Marshall:

Trichosoma rubrum, Linton. (Type.) An entozoon taken from the thoracic cavity of a chipping sparrow, shot in Greenbush, May 14, 1892. Described and figured as a new species by Prof. Edwin Linton in the American Naturalist for August, 1892.

From Albany Institute, July, 1891:

Parasite, Livoneca ovalis, Say. From gills of a Rock-fish, two specimens.

MOLLUSCA.

From F. J. H. Merrill:

Shells from Loggerhead Key, Tortugas Is., as follows:

Spirula Peronii, Lam., two specimens.
Cantharus Coromandelianus, Lam., one specimen.
Olivella nivea, Gmel., forty-six specimens.
Olivella foralia, Ducl., thirty specimens.
Columbella mercatoria, Linn., six specimens.
Columbella nitida, Lam., three specimens.
Conus verrucosus, Hwass., ten specimens.
Trivia pediculus, Linn., one specimen.
Trivia quadripunctata, Gray, 120 specimens.
Cerithium eburneum, Brug., one specimen.
Cerithium muscarum, Say, one specimen.
Ovula intermedia, Sowb., one specimen.
Tellina interrupta, Wood, one specimen.
Lucina dentata, Wood, four specimens.

From Bryant Walker, Detroit, Mich.:

Anodonta edentula, Say, Huron R., Ann Arbor, Mich., two specimens.

Anodonta edentula, Say, Betsey lake, Grand Traverse County, Mich., two specimens.

Anodonta edentula, Say, Sheawassee R., Genesee Co., Mich., seven specimens.

Anodonta subcylindracea, Lea, Boardman R., Traverse City, Mich., two specimens.

Anodonta subcylindracea, Lea, Sheawassee R., Genesee Co., Mich., one specimen.

Anodonta subcylindracea, Lea, canal, Connorsville, Ind., two specimens.

Anodonta fragilis, Lam., Susan L., Charlevoix Co., Mich., one specimen.

Anodonta Footiana, Lea, Susan L., Charlevoix Co., Mich., one specimen.

Anodonta Footiana, Lea, Betsey L., Grand Traverse Co., Mich., two specimens.

Anodonta Footiana, Lea, Silver L., Fenton, Mich., three specimens.

From W. G. Mazyck, Charlestown, S. C.:

Unio Santeensis, Lea, Santee River, S. C., twenty specimens.

From Thomas Morgan, Somerville, N. J.:

Anodonta Tryonii, Lea, Raritan River, N. J., one specimen.

From John Ritchie, Jr., Boston, Mass.:

Helix dentifera, Island d'Orleans, Quebec, Can., one specimen.

Voluta Pacifica, Sol., New Zealand, one specimen.

From Dr. S. Hart Wright, Penn Yan, N. Y.:

Unio Simpsonii, B. H. Wright, Lake Woodruff, Fla., four specimens.

Unio Averellii, B. H. Wright, Lake Ashby, Fla., one specimen.

Unio Waltonii, B. H. Wright, Lake Ashby, Fla., one specimen.

Unio Cunninghamii, B. H. Wright, Lake Opopka, Fla., three specimens.

Unio Tryonii, B. H. Wright, Lake Woodruff, Fla., six specimens.

Unio Fryanus, B. H. Wright, Lake Ashby, Fla., six specimens.

Unio Hinckleyi, B. H. Wright, Lake Monroe, Fla., two specimens.

Unio Orcuttii, S. H. Wright, Lake Miakka, Fla., one specimen.

Unio corucus, Gould, Lake Ashby, Fla., two specimens.

Unio curvatus, Lea, North Carolina, one specimen.

From A. A. Hinkley, Dubois, Ill.:

Anodonta subcylindracea, Lea, Kent's Creek, Rockford, Ill., four specimens.

From A. M. Luther, Garrettsville, Ohio:

Unio ellipsis, Lea, Niagara River, one specimen.

From F. R. Latchford, Ottawa, Canada:

Unio luteolus, Lam., Rideau canal, Ottawa, Ont., three specimens.

Unio radiatus, Lam., Cornwall canal, Ont., four specimens.

Unio borealis, A. F. Gray, Ottawa river, Gloucester, Ont., seven specimens.

Unio occidens, Lea, Ottawa river, Ottawa, Ont., two specimens.

Unio pressus, Lea, near Ottawa, Ont., one specimen.

Unio complanatus, Sol., Ottawa River, Ottawa, Ont., one specimen.

Collected by W. B. Marshall:

Vivipara contectoides, Binney, Erie canal, Albany, N.Y., twenty specimens.

Anodonta implicata, Say (embryos from the gills of the parent), Erie canal, Albany, N. Y.

From the Albany Institute, July, 1891:

Murex (Ocinebra) crassilabrum, Gray, Valparaiso, Chile, twelve specimens.

Trophon Geversianus, Pallas, Cape Horn, two specimens.

Monoceros calcar, Martyn, I. of Guafo, Chile, fifty-nine specimens.

Concholepas Peruvianus, Lam., Valparaiso, Chile, twenty-four specimens.

Triton (Priene) scaber, King, Valparaiso, Chile, ten specimens.

Leucozonia cingulifera, Lam., one specimen.
Euthria plumbea, Phil., Cape Horn, five specimens.
Oliva araneosa, Lam., one specimen.
Oliva irisans, Lam., one specimen.
Oliva Peruviana, Lam., I. of Santa Maria, Chile, five specimens.
Oliva Peruviana, Lam. (chestnut phase), coast of Peru, two specimens.
Columbella hæmastoma, Sowb., Galapagos Is., seven specimens.
Columbella Strombiformis, Lam., coast of Peru, nine specimens.
Strombus gibberulus, Linn., one specimen.
Calyptræa (Infundibulum) radians, Gm., I. of Santa Maria, Chile, four specimens.
Crepidula dilatata, Lam., I. of Santa Maria, Chile, two specimens.
Turritella cingulata, Sowb., I. of Santa Maria, Chile, thirteen specimens.
Cerithium asper, Linn., one spec[illegible]
Littorina Peruviana, Lam., twelve specimens.
Littorina, Sp.? one vial.
Planaxis lineatus, Da C., one vial.
Nerita morio, Sowb., two specimens.
Neritina latissima, Brod., four specimens.
Neritina zebra, Brug., one specimen.
Neritina (Clithon) spinosa, Budgin, two specimens.
Navicella Bourbonica, Bory, two specimens.
Phasianella Australis, Gm., two specimens.
Turbo niger, Gray, eighteen specimens.
Turbo petholatus, Linn., one specimen.
Turbo Spenglerianus, Kien., one specimen.
Astralium celatum, Gm., one specimen.
Trochus Sp.? I. of Santa Maria, Chile, five specimens.
Chlorostoma astrum, Less., I. of Santa Maria, Chile, ten specimens.
Chlorostoma quadricostatum, Wood., I of Santa Maria, Chile, five specimens.
Chlorostoma tridentata, Pot. & Mich., I. of Santa Maria, Chile, one specimen.
Haliotis pulcherrima, Martyn, two specimens.
Acmaea viridula, Lam. (var.), I. of Santa Maria, Chile, nineteen specimens.
Patella Magellanica, Martyn, Cape Horn, four specimens.
Patella, Sp.? Coast of Africa, twenty-four specimens.
Patella, Sp.? four specimens.
Patella, Sp.? Coast of Peru, two specimens.
Patella, Sp.? I. of Guafo, Chile, fifteen specimens.

Fissurella maxima, Lam., Valparaiso, Chile, seven specimen.
Fissurella nigra, Less., Valparaiso, Chile, four specimens.
Fissurella crassa, Lam., Valparaiso, Chile, three specimens.
Fissurella picta, Gm., I. of Juan Fernandez, Chile, two specimens.
Fissurella picta, Gm., Valparaiso, Chile, sixteen specimens.
"Chiton squamosus," one specimen.
"Chiton setiger," Valparaiso, Chile, two specimens.
"Chiton granosus," Chile, three specimens.
"Chiton olivaceus," Valparaiso, Chile, two specimens.
"Chiton Peruvianus," Cape Horn, two specimens.
"Chiton elegans," San Blas, Mex., one specimen.
"Chiton elegans," Valparaiso, Chile, two specimens.
"Chiton maginatus," I. of Santa Maria, Chile, three specimens.
Chiton Sp ? Valparaiso, Chile, five specimens.
"Bulla rosea," one specimen.
"Helix Banksii," I. of Santa Maria, Chile, five specimens.
Helix Sp.? four specimens.
Helix Sp.? four specimens.
Helix Sp.? four specimens.
Bulimus erythrostoma, Sowb., Copiapo, Chile, two specimens.
"Bullimus purpurea," two specimens.
Partula Sp.? four specimens.
Partula Sp.? six specimens.
Saxicava Arctica, Linn., one specimen.
Mya arenaria, Linn., one specimen.
Asaphis radiata, Linn., two specimens.
"Sanguinolaria rugosa," Panama, one specimen.
Tellina radiata, Linn., three specimens.
Tellina rugosa, Born., two specimens.
Tellina interrupta, Wood, one specimen.
Trigonia radiata, Sowb., Panama, one specimen.
Macoma Baltica, Linn., three specimens.
Callista maculata, Linn., one specimen.
Dione lupinaria, Less., Panama, one specimen.
Tapes histrionica, Brod. & Sowb., Panama, one specimen.
Isocardia cor,, Linn., one specimen.
Cardium fragum, Linn., two specimens.
Cardium medium, Linn., one specimen.
Cardium muricatum, Linn., one specimen.
"Chama communis," one specimen.
Chama ponderosa, Brod., Panama, one specimen.

"Cardita turgida," Panama, one specimen.
Unio corrugatus, Retz, one specimen.
Unio gracilis, Barnes, one specimen.
Unio plicatus, LeS., Ohio R., near Pittsburg, Pa., one specimen.
Unio trapezoides, Lea., one specimen.
Unio metanevrus, Raf., Monongahela R., near Pittsburg, Pa., one specimen.
Unio cylindricus, Say, one specimen.
Unio crassidens, Lam., Ohio River, one specimen.
Unio ovatus, Say, Ohio R., near Pittsburg, Pa., one specimen.
Unio rubiginosus, Lea., one specimen.
Unio clavus, Lam., Ohio R., near Pittsburg, Pa., one specimen.
Unio ligamentinus, Lam., Ohio R., near Pittsburg, Pa., three specimens.
Unio luteolus, Lam., one specimen.
Unio complanatus, Solander, Connecticut R., Hartford, two specimens.
Unio retusus, Lam., one specimen.
Unio rectus, Lam., Ohio R., near Pittsburg, Pa., one specimen.
Unio Shepardianus, Lea., one specimen.
Unio Anodontoides, Lea., two specimens.
Unio teres, Conr. (= Unio anodontoides, Lea), one specimen.
Unio nasutus, Say, Connecticut R., Hartford, one specimen.
Unio nasutus, Say, Mill R., Conn., one specimen.
Unio purpuratus, Lam., two specimens.
Unio sp.? Bengal, two specimens.
Unio sp.? Bengal, two specimens.
Unio, Bengal, one specimen.
Anodonta cygnea, Lam., Canals, Scotland, one specimen.
Anodonta fragilis, Lam., one specimen.
Anodonta crassa, Swainson, Rio de la Plata, one specimen.
Yoldia Arctica, Gray, Portland, Me., four specimens.
Anomalocardia subrugosa, Sowb., Panama, one specimen.
Mytilus grandis, I. of Santa Maria, Chile, one specimen.
Mytilus Sp.? Panama, one specimen.
"Modiola damissa," three specimens.
Modiola Sp.? 10+ specimens.
Perna ephippium, Sandwich Is., one specimen.
Pinna Sp.? one specimen.
Ostrea crista-galli, four specimens.
Scurria zebrina, Less., I. of Santa Maria, Chile, thirty-nine specimens.

CATALOGUE

OF THE

Families Tritonidæ, Fusidæ, Buccinidæ, Nassidæ, Turbinellidæ, Volutidæ and Mitridæ, in the collections of the New York State Museum, exclusive of the Mazatlan Collection.

FAMILY TRITONIDÆ.

NAME.	Locality.	Collection.	Specimens.
Genus Triton, Montfort.			
Triton Tritonis, Linn	Pacific Ocean	Gould	1
Triton Tritonis, Linn		U. S. Expl. Exped	1
Triton Tritonis, Linn., var. nobilis, Conr		Gould	1
Triton nodiferus, Lam		Gould	1
Triton nodiferus, Lam		H. Cuming	1
Triton nodiferus, Lam., var. Sauliæ	Shimoda, Japan	Gould	1
Triton nodiferus, Lam., var. australis, Lam		Gould	1
Triton subdistortus, Lam	Austialia	Gould	1
Triton fusiformis, Kien	Australia	Gould	1
Subgenus Simpulum, Klein.			
Triton olearium, Linn	Cumana, Venezuela	Gould	1
Triton olearium, Linn		Gould	1
Triton olearium, Linn	Rio Janeiro, Brazil	Smithsonian	1
Triton olearium, Linn			
Triton pilearis, Linn	West Indies	Gould	6
Triton pilearis, Linn	Sandwich Is	Gould	2
Triton pilearis, Linn		U. S. Exp. Exp	5
Triton, pilearis, Linn			8
Triton rubecula, Linn		Smithsonian	2
Triton mundum, Gould = T. gemmatus, Rve	Arctic Ocean	Gould	(Type) 1
Triton gemmatus, Rve	Sandwich Is	Smithsonian	1
Triton ficoides, Rve		Gould	1
Triton chlorostomus, Lam		Gould	5
Triton chlorostomus, Lam	Sandwich Is	Gould	1

FAMILY TRITONIDÆ — (*Continued*).

NAME.	Locality.	Collection.	Specimens.
Subgenus Simpulum, Klein — (*Concluded*):			
Triton chlorostomus, Lam		U. S. Expl. Exped.	1
Triton chlorostomus, Lam			2
Triton corrugatus, Lam		Gould	3
Triton Tranquebaricus, Lam		Gould	1
Triton cingulatus, Lam		Gould	2
Triton Weigmanni, Anton		Gould	2
Triton clandestinis, Lam	Philippine Is	Gould	4
Triton cutaceus, Linn		Gould	2
Triton lignarius, Brod		Gould	1
Triton Spengleri, Lam		Gould	2
Triton Spengleri, Lam	Australia	Dr. Newcomb	1
Triton Spengleri, Lam		U. S. Expl. Exped.	1
Subgenus Cymatium, Bolten.			
Triton femorale, Linn			1
Triton femorale, Linn	West Indies		2
Triton femorale, Linn		Gould	4
Triton femorale, Linn	Key West, Florida	F. J. H. Merrill	1
Triton lotorium, Linn		Gould	1
Triton pyrum, Linn		Gould	1
Subgenus Gutturnium, Adams.			
Triton cynocephalus, Lam		Gould	1
Triton cynocephalus, Lam	Pacific Ocean	Gould	1
Triton cynocephalus, Lam			3

Triton Sinensis, Rve		Gould	1
Triton Sinensis, Rve	China	Smithsonian	1
Triton Sinensis, Rve			1
Triton clavata, Lam		Gould	1
Triton caudatus, Gmel		Gould	3
Triton tripus, Lam		Gould	1
Triton vespaceus, Lam		Gould	1
Triton tuberosum, Linn		Gould	2
Triton tuberosum, Linn		U. S. Expl. Exp	3
Triton tuberosum, Linn	Sandwich Is	Gould	3
Triton tuberosum, Linn			1
Triton tuberosum, Linn	Fejee Is		5
Triton Quoyi, Rve	Australia	Gould	2
Triton Quoyi, Rve	Australia	Smithsonian	1
Subgenus Epidromus, Kien.			
Triton clathratus, Sowb	Philippine Is	Gould	1
Triton distortus, Schub and Wagr	Philippine Is	Gould	1
Triton distortus, Schub and Wagr	Sandwich Is	Gould	5
Triton obscurus, Rve		Gould	2
Triton lanceolatus, Menke		Gould	3
Triton nitidulus, Sowb. var. Ceylonensis, Sowb	Philippine Is	Gould	1
Triton truncatus, Hinds	Philippine Is	Gould	1
Triton siphonatus, Rve		Gould	1
Triton bracteatus, Hinds	Philippine Is	Gould	25
Triton bracteatus, Hinds		Smithsonian	2
Triton bracteatus, Hinds	Sandwich Is		3
Triton digitalis, Rve		Smithsonian	1
Triton parvus, Gld		Gould	10
Triton concinnus, Rve	Philippine Is	Gould	1
Triton decapitatus, Rve	Philippine Is	Gould	1

FAMILY TRITONIDÆ — (*Continued*).

NAME.	Locality.	Collection.	Specimens.
Subgenus Priene, H. & A. Adams.			
Triton cancellatus, Lam	Washington	Smithsonian	3
Triton cancellatus, Lam		U. S. Expl. Exp	2
Triton cancellatus, Lam		Gould	2
Triton scaber, King	Callao, Peru	U. S. Expl. Exp	2
Triton scaber, King	Valparaiso, Chile	Albany Institute	10
Triton scaber, King	Chile	Gould	3
Triton scaber, King		Gould	1
Triton rudis, Brod	Chile	Smithsonian	1
Genus Distorsio, Bolten.			
Distorsio anus, Linn	China	Dr. Newcomb	2
Distorsio anus, Linn			1
Distorsio anus, Linn	Indian Ocean	Gould	3
Distorsio cancellinus, Roissy	China		1
Distorsio cancellinus, Roissy	Ceylon	Smithsonian	1
Distorsio cancellinus, Roissy	Acapulco?	Gould	1
Distorsio cancellinus, Roissy	China	Gould	1
Distorsio cancellinus, Roissy		Gould	4
Genus Ranella, Lam.			
Ranella spinosa, Lam		Gould	1
Ranella foliata, Brod		Gould	5
Ranella margaritula, Desh		Gould	4
Ranella albivaricosa, Rve			2
Ranella subgranosa, Sowb		Gould	5

Ranella subgranosa, Sowb.	East Indies		1
Ranella subgranosa, Sowb.		U. S. Expl. Exp	1
Ranella crassa, Dillw		Gould	3
Subgenus Lampas, Schumacher.			
Ranella lampas, Linn		U. S. Expl. Exp	1
Ranella lampas, Linn		Gould	3
Ranella bufonia, Gmel		Gould	2
Ranella bufonia, Gmel		U. S. Expl. Exp	2
Ranella cruentata, Sowb		Gould	3
Ranella cruentata, Sowb		Smithsonian	1
Ranella Californica, Hinds	Cerros I.	P. P. Carpenter ?	1
Ranella ventricosa, Brod		U. S. Expl. Exp	2
Ranella pustulosa, Rve		Gould	3
Ranella granifera, Lam			1
Ranella granifera, Lam		Gould	2
Ranella affinis, Brod		Gould	6
Ranella affinis, Brod		Smithsonian	3
Subgenus Argobuccinum, Klein.			
Ranella gigantea, Lam		Gould	1
Ranella leucostoma, Lam		Gould	1
Ranella bituberculairs, Lam		Gould	1
Ranella tuberculata, Brod		Gould	8
Ranella tuberculata, Brod		Smithsonian	1
Ranella tuberculata, Brod	Bombay		2
Ranella gyrina, Linn		Smithsonian	1
Ranella gyrina, Linn	Indian Seas	Gould	5
Ranella cuspidata, Rve		Gould	2
Ranella pusilla, Brod		Gould	3
Ranella pusilla, Brod., var. rosea, Rve		Gould	4

FAMILY TRITONIDÆ — (*Concluded*).

NAME.	Locality.	Collection.	Specimens.
Subgenus Argobuccinum, Klein — (*Concluded*):			
Ranella anceps, Lam		Gould	4
Ranella argus, Gm	Pacific Ocean		1
Ranella argus, Gm			1
Ranella argus, Gm		Gould	2

FAMILY FUSIDÆ.

NAME.	Locality.	Collection.	Specimens.
Subfamily Fusinæ.			
Genus Fusus, Lam.			
Fusus proboscidiferus, Lam		Gould	1
Fusus colus, Linn		Gould	2
Fusus laticostatus, Desh	Indian Ocean	Gould	2
Fusus tuberculatus, Lam		U. S. Expl. Exped.	1
Fusus tuberculatus, Lam	Indian Ocean	Gould	3
Fusus tuberculatus, Lam. var. nodosoplicatus, Lam		Gould	1
Fusus perplexus, A. Ad.		Gould	1
Fusus Australis, Quoy		Gould	4
Fusus undatus, Gmel		Gould	2
Fusus polygonoides, Lam		Gould	3
Fusus closter, Phil., ? var. F. distans, Lam	Cumana, Venezuela	Gould	
Fusus Dupetit-Thouarsii, Kien		Gould	3
Fusus cinereus, Reeve		Gould	8
Fusus Syracusanus, Linn	Mediterranean Sea	Gould	1
Fusus turriculus, Kien		Gould	4
Fusus pulchellus, Phil	Mediterranean Sea	Smithsonian	1
Fusus modestus, Gould	Hakodadi, Japan	Gould	(Type) 1
Genus Afer, Conrad.			
Afer afer, Gmel		Gould	1
Genus Clavella, Swainson			
Clavella serotina, Hinds	Nukahiva, Marquesas Is	Gould	1

FAMILY FUSIDÆ — (*Concluded*).

NAME.	Locality.	Collection.	Specimens.
Subfamily Fasciolariinæ.			
Genus Fasciolaria, Lamarck.			
Fasciolaria tulipa, Linn	West Indies		3
Fasciolaria tulipa, Linn			2
Fasciolaria tulipa, Linn	West Indies	J. C. Smock	2
Fasciolaria tulipa, Linn		Gould	4
Fasciolaria tulipa, L., var. distans, Lam	South Carolina	Gould	10
Fasciolaria tulipa, Linn., var. distans, Lam			2
Fasciolaria princeps, Sowb	Mazatlan	Gould	2
Fasciolaria filamentosa, Lam		U. S. Expl. Exp	1
Fasciolaria filamentosa, Lam	West Indies		1
Fasciolaria filamentosa, Lam	Indian Ocean	Gould	1
Fasciolaria filamentosa, Lam		Gould	4
Fasciolaria trapezium, Linn	Ceylon	U. S. Expl. Exp	3
Fasciolaria trapezium, Linn			4
Fasciolaria lignaria, Linn	Mediterranean Sea	Gould	3
Fasciolaria bistriata, Gld. & Cpr	Panama	Gould	(Type) 1
Subfamily Peristerniinæ.			
Genus Peristernia, Mörch.			
Peristernia picta, Rve		Smithsonian	1
Peristernia nassatula, Lam		Smithsonian	1
Peristernia nassatula, Lam	East Indies	Gould	1
Peristernia nassatula, Lam	Indian Ocean	Gould	9
Peristernia spinosa, Martyn		Smithsonian	2
Peristernia incarnata, Desh		Smithsonian	1
Peristernia incarnata, Desh		Gould	4

Peristernia incarnata, Desh., var. elegans, Dkr		Gould	1
Peristernia chlorostoma, Sowb		Smithsonian	3
Peristernia chlorostoma, Sowb	Sandwich Is	Gould	18
Peristernia ustulata, Rve		Gould	2
Genus Latirus, Montfort.			
Latirus polygonus, Gmel		U. S. Expl. Exp	2
Latirus polygonus, Gm		Smithsonian	1
Latirus polygonus, Gm		Gould	1
Latirus polygonus, Gm	Indian Ocean	Gould	3
Latirus gibbulus, Gmel		Gould	1
Latirus infundibulum, Gm		Gould	2
Latirus nodatus, Martyn		U. S. Expl. Exp	1
Latirus nodatus, Martyn		Gould	3
Latirus craticulatus, Linn		Gould	5
Latirus craticulatus, Linn		Smithsonian	1
Latirus craticulatus, Linn	Pacific Ocean		1
Latirus turriculus, Gm		Gould	1
Latirus prismaticus, Martyn		Smithsonian	1
Latirus prismaticus, Martyn		Gould	2
Genus Leucozonia, Gray.			
Leucozonia cingulifera, Lam		Gould	6
Leucozonia cingulifera, Lam		Albany Institute	1
Leucozonia cingulifera, Lam	Panama		2
Leucozonia cingulifera, Lam	West Indies		3
Leucozonia triserialis, Lam	Cape Verde	Gould	2
Leucozonia ocellata, Gm		Gould	3
Leucozonia cingulata, Lam	Mazathan	Gould	7
Subgenus Lagena, Schumacher.			
Leucozonia smaragdula, L		Gould	1

FAMILY BUCCINIDÆ.

NAME.	Locality.	Collection.	Specimens.
Subfamily Melongentiiæ.			
Genus Melongena, Schumacher.			
Melongena patula, Brod. & Sowb	Mazatlan	Gould	2
Melongena patula, Brod		Gould	4
Melongena melongena, Linn	Gulf of Mexico	Gould	4
Melongena melongena, Linn		Gould	4
Melongena melongena, Llnn	Gulf of Mexico		1
Melongena corona, Gm	Gulf of Mexico	Gould	3
Melongena corona, Gm		Gould	9
Melongena galeodes, Lam		Smithsonian	1
Melongena galeodes, Lam		Gould	1
Melongena bucephala, Lam		Gould	6
Melongena pallida, Brod. & Sowb		Gould	4
Melongena fusiformis, Blainv	Callao, Peru	Smithsonian	1
Melongena fusiformis, Blainv		Gould	3
Melongena pugilina, Born			2
Melongena pugilina, Born		U. S. Expl. Exp	1
Melongena pugilina, Born	Tavoy, Burmah	Gould	2
Melongena paradisiaca, Rve		Gould	6
Melongena paradisiaca, Rve	Red Rea	Gould	2
Melongena morio, Linn		Gould	5
Melongena morio, Linn	Africa		1
Genus Hemifusus, Swainson.			
Hemifusus colosseus, Lam	Pacific Ocean		1
Hemifusus ternatanus, Gm		Gould	2

Subfamily Neptuniinæ.			
Genus Neptunea, Bolten.			
Neptunea despecta, Linn	Kamschatka	Gould	3
Neptunea despecta, Linn		Gould	3
Neptunea despecta, Linn., var. fornicata, Lam	Japan	Gould	5
Neptunea lirata, Martyn	Fuca Straits	Gould	4
Neptunea lirata, Martyn		Gould	1
Neptunea decemcostata, Say	Boston Harbor	Gould	3
Subgenus Volutopsis, Mörch.			
Neptunea Norvegica, Cheum		Gould	1
Genus Sipho, Klein.			
Sipho islandicus, Cheum		Gould	5
Sipho Stimpsoni, Mörch		Gould	4
Sipho tortuosus, Rve	Arctic Ocean	Gould	5
Sipho ventricosus, Gray		Gould	1
Sipho Kroyeri, Möller	Behring's Strait	Gould	2
Sipho Kroyeri, Möller		Gould	2
Genus Siphonalia, A. Adams.			
Siphonalia nodosa, Martyn		Gould	2
Genus Fulgur, Montfort.			
Fulgur carica, Gmel			1
Fulgur carica, Gmel	Beaufort, N. C	Gould	4
Fulgur carica, Gmel	North Carolina	Gould	7
Fulgur carica, Gmel		Gould	5
Fulgur carica, Gmel	St. Simon's Sound, Ga	Gould	3
Fulgur perversus, Linn		Gould	1
Fulgur perversus, Linn	Chandeleur Bay, La	Gould	1
Fulgur perversus, Linn	Florida	Gould	5

FAMILY BUCCINIDÆ — (*Continued*).

NAME.	Locality.	Collection.	Specimens.
Subgenus Sycotypus, Browne.			
Fulgur canaliculata, Linn		Gould	6
Fulgur canaliculata, Linn	Beaufort, N. C.	Gould	2
Fulgur canaliculata, Linn	Cape Cod, Mass	Gould	1
Fulgur canaliculata, Linn	Georgia	Gould	3
Fulgur pyrum, Dillw		Gould	1
Fulgur pyrum, Dillw	St. Joseph's Bay, Fla	Gould	1
Fulgur pyrum, Dillw	St. Simon's Sound, Ga	Gould	1
Genus Tudicla, Bolten.			
Tudicla spirilla, Linn		Gould	1
Subfamily Pisaniinæ.			
Genus Pisania, Bivona.			
Pisania pusio, Linn	West Indies		2
Pisania pusio, Linn	Panama	Gould	1
Pisania pusio, Linn		Gould	3
Pisania marmorata, Rve	Sandwich Is	Smithsonian	1
Pisania maculosa, Lam	Mediterranean Sea	Smithsonian	2
Pisania maculosa, Lam	Mediterranean Sea	Gould	24
Pisania cingulata, Rve	Loo Choo Is	Smithsonian	1
Pisania cingulata, Rve		Gould	10
Genus Euthria, Gray.			
Euthria cornea, Linn	Mediterranean Sea	Gould	4
Euthria plumbea, Phil	Orange Bay, Terra del Fuego	Smithsonian	3

Euthria plumbea, Phil.	Cape Horn	Albany Institute	5
Euthria plumbea, Phil.		Gould	1
Euthria lineata, Martyn	New Zealand	Smithsonian	3
Euthria dira, Reeve	Washington	Smithsonian	4
Fissus incisus, Gould=Euthria dira, Rve	Neeah Bay, Washington	Gould	(Types) 2
Genus Cantharus, Bolten.			
Cantharus spiralis, Gray	Madagascar	Gould	1
Cantharus Tranquebaricus, Gm		Smithsonian	1
Cantharus Tranquebaricus, Gm		Gould	1
Cantharus melanostoma, Sowb		Gould	1
Cantharus fumosus, Dillw		Smithsonian	3
Cantharus fumosus, Dillw		Gould	7
Cantharus fumosus, Dillw., var. rubiginosus, Rve		Gould	3
Cantharus D'Orbignyi, Payr	Mediterranean Sea	Gould	5
Cantharus D'Orbignyi, Payr	Mediterranean Sea	Smithsonian	1
Cantharus undosus, Linn		Smithsonian	2
Cantharus undosus, Linn		Gould	6
Cantharus sanguinolentus, Ducl	C. St. Lucas, L. Cal.	Smithsonian	1
Cantharus sanguinolentus, Ducl	Panama	Gould	8
Cantharus gemmatus, Rve	Mazatlan	Gould	2
Cantharus Coromandelianus, Lam		Gould	6
Cantharus elegans, Gray	Mazatlan	Gould	2
Gantharus elegans, Gray		Gould	3
Gantharus variegatus, Gray	Rio Janerio, Brazil	Smithsonian	1
Cantharus variegatus, Gray		Gould	4
Gantharus distortus, Gray	Panama	Gould	1
Subfamily Bucciniinæ.			
Genus Buccinum, Linnæus.			
Buccinum undatum, Linn		Gould	25
Buccinum undatum, Linn	Mediterranean Sea	Gould	5

FAMILY BUCCINIDÆ — (*Continued*).

NAME.	Locality.	Collection.	Specimens.
Genus Buccinum, Linnæus — (*Concluded*):			
Buccinum undatum, Linn	Great Britain	Gould	2
Buccinum undatum, Linn	Great Britain		1
Buccinum undatum, Linn., var. flexuosa	Halifax, N. S	Gould	5
Buccinum undatum, Linn., var. flexuosa		Gould	2
Buccinum undatum, Linn., var. striatum		Gould	2
Buccinum striatum, Sowb	Arctic Ocean	Gould	3
Buccinum glaciale, Linn	Kamtschatka	Gould	4
Buccinum glaciale, Linn	Behring Strait	Gould	3
Tritonium Rodgersi, Gould = Buccinum glaciale, Linn.		Gould	(Types) 2
Tritonium Stimpsoni, Gould = Buccinum glaciale, Linn.	Arctic Ocean	Gould	(Types) 1
Buccinum cyaneum, Brug		Gould	5
Buccinum Humphreysianum, Bennet	Norway	Gould	1
Buccinum Humphreysianum, Bennet		Gould	9
Buccinum Humphreysianum, Bennet	Great Britain	Smithsonian	1
Buccinum (egg-capsules)			2
Genus Volutharpa, Fischer.			
Volutharpa ampullacea, Midd.	Japan	Gould	1
Genus Cominella, Gray.			
Cominella porcata, Gmel	Cape of Good Hope	Gould	3
Cominella porcata, Gmel		Gould	1

Cominella limbosa, Lam	Cape of Good Hope	Smithsonian	4
Cominella limbosa, Lam		Gould	1
Cominella limbosa, Lam., var. lagenaria, Lam.		Gould	4
Cominella papyracea, Brug.		Gould	2
Cominella testudinea, Martyn	New Zealand	Gould	3
Cominella testudinea, Martyn	Cape of Good Hope	Smithsonian	1
Cominella maculata, Martyn	New Zealand	Gould	4
Cominella maculata, Martyn	New Zealand	Smithsonian	1
Cominella maculata, Martyn		U. S. Expl. Exped.	1
Cominella lineolata, Lam	New Zealand	Gould	2
Cominella lineolata, Lam	South Australia	Smithsonian	2
Cominella lineolata, Lam., var. virgata, H. & A. Ad.		Gould	4
Cominella lineolata, Lam., var. virgata, H. & A. Ad.	New Zealand	Smithsonian	1
Cominella costata, Quoy	South Australia	Smithsonian	2
Cominella costata, Quoy	New Zealand	Smithsonian	2
Subfamily Eburniinæ.			
Genus Eburna, Lamarck.			
Eburna Zeylanica, Brug		Gould	1
Eburna lutosa, Lam		Gould	2
Eburna areolata, Lam		Gould	2
Eburna areolata, Lam			1
Eburna spirata, Lam		Gould	2
Subgenus Zemira, H. & A. Adams.			
Eburna Australis, Sowb		Gould	1
Subfamily Photinæ.			
Genus Phos, Montfort.			
Phos senticosus, Linn		Gould	6
Phos plicosus, Dkr		Gould	3

FAMILY BUCCINIDÆ — (*Concluded*).

NAME.	Locality.	Source.	Specimens.
Genus Phos, Montfort — (*Concluded*):			
Phos plicosus, Dkr	Cape of Good Hope	Smithsonian	1
Phos textum, Gmel	Philippine Is	Gould	5
Phos roseatus, Hinds	Philippine Is	Gould	3
Phos roseatus, Hinds		Gould	5
Phos Guadaloupensis, Petit	Cumana, Venezuela	Gould	12

FAMILY NASSIDÆ.

NAME.	Locality.	Source.	Specimens.
Genus Northia, Gray.			
Northia serrata, Dufresne		Gould	1
Genus Truncaria, Adams & Reeve.			
Truncaria modesta, Powis	Santa Barbara, Cal	Gould	3
Genus Bullia, Gray.			
Bullia lævissima, Gmel		Gould	1
Bullia lævissima, Gmel	Cape of Good Hope	Smithsonian	1
Bullia deformis, King	East coast of South America	Gould	2
Bullia deformis, King	Rio Negro, South America	Smithsonian	1
Bullia Mauritiana, Gray	Madagascar	Gould	3
Bullia Mauritiana, Gray	Africa	Gould	1
Subgenus Buccinanops, d'Orbigny.			
Bullia cochlidium, Kien		Gould	4
Bullia cochlidium, Kien	South America	Smithsonian	1
Bullia cochlidium, Kien	Rio Negro, South America	Smithsonian	1
Bullia armata, Gray		Gould	1
Bullia armata, Gray	Rio Negro, South America	Smithsonian	1
Subgenus Pseudostrombus, Klein.			
Bullia melanoides, Desh		Gould	1
Bullia melanoides, Desh	Cochin China	Smithsonian	2
Bullia melanoides, Desh		Smithsonian	1
Bullia polita, Lam	Senegal	Gould	8

FAMILY NASSIDÆ — (*Continued*).

NAME.	Locality.	Source.	Specimens.
Subgenus Pseudostrombus, Klein — (*Concluded*):			
Bullia vittata, Linn	....	Gould	4
Bullia vittata, Linn.	....	Smithsonian	1
Bullia Belangeri, Kien.	....	Gould	1
Genus Nassa, Lamarck.			
Nassa mutabilis, Linn.	Mediterranean Sea	Gould	14
Nassa mutabilis, Linn.	Mediterranean Sea	Smithsonian	1
Nassa coronata, Brug	....	Gould	5
Nassa coronata, Brug	....	Smithsonian	2
Nassa arcularia, Linn	....	Gould	8
Nassa arcularia, Linn	Philippine Is.	Newcomb	2
Nassa arcularia, Linn	....	U. S. Expl. Exped	7
Nassa pulla, Linn	....	Gould	9
Subgenus Arcularia, Link.			
Nassa gibbosula, Linn	....	Gould	9
Nassa Thersites, Burg	....	Gould	10
Nassa Thersites, Burg	Hong Kong, China	Smithsonian	1
Nassa Thersites, Burg	....	Smithsonian	1
Nassa globosa, Quoy	....	....	......
Nassa granifera, Kien	....	Gould	5
Nassa granifera, Kien	....	Smithsonian	1
Subgenus Naytia, H. & A. Adams.			
Nassa glabrata, Sowb	Senegal	Gould	6
Nassa grana, Lam	Mediterranean Sea	Gould	11

Subgenus Alectrion, Montfort.			
Nassa glans, Linn., var. elegans, Kien		Gould	5
Nassa glans, Linn., var. suturalis, Lam	Sandwich Is	Gould	8
Nassa glans, Linn., var. suturalis, Lam		Gould	1
Nassa hirta, Kien		Gould	9
Nassa hirta, Kien	Sandwich Is	Smithsonian	6
Nassa hirta, Kien., var. nodifera, Powis		Gould	2
Nassa monile, Kien		Smithsonian	2
Nassa papillosa, Linn		Gould	4
Nassa papillosa, Linn		U. S. Expl. Exped	1
Subgenus Zeuxis, H. & A. Adams.			
Nassa tænia, Gmel	Australia	Gould	3
Nassa tænia, Gmel	Australia	Smithsonian	1
Nassa canaliculata, Lam		Gould	2
Nassa canaliculata, Lam		Smithsonian	1
Nassa Cuvieri, Payr	Mediterranean Sea	Gould	9
Nassa Cuvieri, Payr	Mediterranean Sea	Smithsonian	2
Nassa exilis, Powis	Peru	Gould	2
Nassa exilis, Powis	Panama	Smithsonian	2
Nassa gaudiosa, Hinds		Smithsonian	2
Nassa elata, Gould = N. gaudiosa, Hinds	West Africa	Gould	(Types) 2
Nassa picta, Dkr		Gould	1
Nassa picta, Dkr	Samoa Is	Smithsonian	1
Nassa corniculum, Olivi		Gould	7
Nassa corniculum, Olivi	Greece	Gould	11
Nassa corniculum, Olivi	Mediterranean Sea	Smithsonian	2
Subgenus Phrontis, H. & A. Adams.			
Nassa luteostoma, Brod. & Sowb		Gould	6
Nassa tegula, Rve	Mazatlan	Gould	3

FAMILY NASSIDÆ — (*Continued*).

NAME.	Locality.	Source.	Specimens.
Subgenus Phrontis, H. & A. Adams — (*Concluded*):			
Nassa tegula, Rve	California	Smithsonian	2
Nassa tegula, Rve	San Diego, Cal	Dr. Webb	3
Nassa tiarula, Kien	Philippine Is	Gould	2
Nassa cinctella, Gould	Pacific Ocean	Gould	(Type) 1
Nassa cinctella, Gld		Smithsonian	1
Nassa miga, Brug		Gould	2
Nassa ambigua, Mont		Gould	34
Nassa crassa, Koch		Gould	2
Nassa vibex, Say		Gould	18
Nassa vibex, Say	Boston, Mass.	Gould	10
Nassa vibex, Say	Florida	Gould	11
Nassa vibex, Say	Rio Janeiro, Brazil	Smithsonian	2
Subgenus Hebra, H. & A. Adams.			
Nassa subspinosa, Lam	China	Gould	16
Nassa subspinosa, Lam		Smithsonian	1
Nassa muricata, Q. & G		Gould	2
Nassa muricata, Q. & G	Samoa Is	Smithsonian	2
Nassa curta, Gould = N. muricata, Q. & G	Samoa Is	Gould	(Type) 1
Subgenus Hima, Leach.			
Nassa stolata, Gmel	Burmah	Gould	8
Nassa stolata, Gmel	Bombay	Smithsonian	1
Nassa Tritoniformis, Kien		Gould	1
Nassa scabriuscula, Powis	Panama	Gould	3
Nassa nodata, Hinds		Gould	6

Nassa nodata, Hinds		Smithsonian	2
Nassa fasciata, Lam		Gould	4
Nassa fasciata, Lam		Smithsonian	1
Nassa dentifera, Powis	"Syndey"	Gould	9
Nassa dentifera, Powis	Callao, Peru	Smithsonian	3
Nassa paupera, Gould		Gould	34
Nassa paupera, Gould	Central Pacific	Smithsonian	1
Nassa dermestina, Gould = N. paupera, Gould		Gould	(Type) 1
Nassa plebecula, Gould = N. paupera, Gould		Gould	(Types) 9
Nassa incrassata, Ström		Gould	21
Nassa incrassata, Ström	Great Britain	Gould	4
Nassa incrassata, Ström	Mediterranean Sea	Gould	71
Nassa incrassata, Ström	Madeira	Smithsonian	2
Nassa incrassata, Ström	Malaga		2
Nassa incrassata, Ström., var. pygmæa, Lam	Great Britain	Gould	3
Nassa incrassata, Ström., var. pygmæa, Lam	Great Britain		13
Subgenus Niotha, H. & A. Adams.			
Nassa albescens, Dkr		Gould	10
Nassa albescens, Dkr	Red Sea	Gould	10
Nassa albescens, Dkr	Akabah, Arabia	Smithsonian	1
Nassa albescens, Dkr	Australia	Smithsonian	1
Nassa albescens, Dkr		Smithsonian	4
Nassa pauperata, Lam		Gould	6
Nassa pauperata, Lam		Smithsonian	1
Nassa Kieneri, Desh		Gould	1
Nassa livescens, Phil	Indian Ocean	Smithsonian	1
Subgenus Tritia, Risso.			
Nassa fossata, Gould	California	Smithsonian	1
Nassa fossata, Gould	Washington	Smithsonian	1
Nassa mendica, Gould	Oregon	Gould	(Types) 5

FAMILY NASSIDÆ — (*Concluded*).

NAME.	Locality.	Source.	Specimens.
Subgenus Tritia, Risso — (*Concluded*):			
Nassa mendica, Gould	Puget Sound	Gould	(Type) 1
Nassa mendica, Gould	Vancouver — California	Gould	(T'p's) 28
Nassa mendica, Gould		Smithsonian	3
Nassa mendica, Gould, var. Cooperi, Forbes	California	Smithsonian	1
Nassa beata, Gould	Loo Choo Is	Gould	(Types) 6
Nassa optata, Gould		Gould	(Type) 1
Nassa spurca, Gould		Gould	(Types) 4
Nassa Gayi, Kien		Gould	3
Nassa Gayi, Kien	Callao, Peru	Smithsonian	2
Nassa Gayi, Kien	Chile	Smithsonian	4
Nassa plicatella, A. Ad		Gould	2
Nassa clathrata, Born		Gould	2
Nassa reticulata, Linn		Gould	8
Nassa reticulata, Linn	Great Britain		2
Nassa trivittata, Say	Chelsea, Mass	Gould	2
Nassa trivittata, Say	New York Bay	Gould	21
Nassa trivittata, Say	South Carolina	Gould	1
Nassa trivittata, Say		Gould	10
Subgenus Ilyanassa, Stimpson.			
Nassa obsoleta, Say	Halifax, N. S	Gould	2
Nassa obsoleta, Say	Boston, Mass	Gould	8
Nassa obsoleta, Say	South Carolina		6
Genus Neritula, Plancus.			
Neritula neritea, Linn	Mediteranean Sea	Gould	150
Neritula neritea, Linn	Mediteranean Sea	Smithsonian	2
Neritula pellucida, Risso	Mediteranean Sea	Gould	13

FAMILY TURBINELLIDÆ.

NAME.	Locality.	Collection.	Specimens.
Genus Turbinella, Lam.			
Turbinella pyrum, Linn	East Indies	Gould	3
Turbinella pyrum, Linn		Gould	1
Turbinella pyrum, Linn	Canton, China		1
Turbinella scolymus, Gmel	Bahamas	Gould	1
Turbinella scolymus, Gmel		Gould	1
Genus Vasum, Bolten.			
Vasum muricatum, Born	Mazatlan	Gould	1
Vasum muricatum, Born		Gould	5
Vasum rhinoceroos, Gmel		Gould	6
Vasum ceramicum, Linn		Gould	3
Vasum ceramicum, Linn		U. S. Expl. Exped	3
Vasum turbinellum, Linn		Gould	4
Vasum turbinellum, Linn		U. S. Expl. Exped	2
Vasum turbinellum, Linn	Pacific Ocean		4

FAMILY VOLUTIDÆ.

NAME.	Locality.	Collection.	Specimens.
Genus Cymbium, Klein.			
Cymbium proboscidale, Lam	Africa	Gould	3
Cymbium Neptuni, Gmel		Gould	2
Genus Melo, Humphrey.			
Melo Indica, Gmel		Gould	1
Melo Indica, Gmel	Indian Ocean	J. C. Smock	1
Melo Indica, Gmel			1
Melo Aethiopica, Linn		Gould	6
Melo diadema, Lam		Gould	4
Melo diadema, Lam	Indian Ocean		1
Genus Voluta, Linnæus.			
Voluta musica, Linn	Marguerite I., W. I.	Gould	7
Voluta musica, Linn		Gould	4
Voluta musica, Linn	Barbadoes		1
Voluta Hebræa, Linn		Gould	1
Section Harpula, Swainson.			
Voluta interpuncta, Mart		Gould	2
Voluta vexillum, Lam		Gould	1
Section Fulgoraria, Schumacher.			
Voluta rupestris, Gmel		Gould	2
Voluta rupestris, Gmel			1

Section Vespertilio, Klein.			
Voluta vespertilio, Linn		Gould	34
Voluta vespertilio, Linn		U. S. Expl. Exped	4
Voluta vespertilio, Linn			2
Voluta nivosa, Lam		Gould	2
Voluta rutila, Brod		Gould	1
Section Aulica, H. & A. Adams.			
Voluta Deshayesii, Rve		Gould	1
Voluta luteostoma, Desh		Gould	1
Voluta imperialis, Lam		Gould	7
Voluta scapha, Gmel	Hakodadi, Japan	Gould	5
Voluta scapha, Gmel		Gould	2
Voluta scapha, Gmel	Philippine Is.		2
Voluta scapha, Gmel			3
Voluta scapha, Gmel		U. S. Expl. Exped	2
Voluta Junonia, Chemn		Gould	2
Voluta flavicans, Gmel		Gould	1
Section Amoria, Gray.			
Voluta undulata, Lam		Gould	1
Voluta zebra, Leach		Gould	1
Voluta prætexta, Rve		Gould	1
Section Alcithoe, H. & A. Adams.			
Voluta Pacifica, Solander	New Zealand	Smithsonian	1
Voluta Pacifica, Solander	New Zealand	U. S. Expl. Exped	2
Voluta Pacifica, Solander	New Zealand	John Ritchie, Jr	1
Section Cymbiola, Swainson.			
Voluta ancilla, Solander	Orange Bay, Terra del Fuego	U. S. Expl. Exped	1

FAMILY VOLUTIDÆ — (*Concluded*).

NAME.	Locality.	Collection.	Specimens.
Section Cymbiola, Swainson — (*Concluded*):			
Voluta Brasiliana, Solander	Brazil	Smithsonian	1
Voluta Brasiliana, Solander	Rio Negro, Patagonia	U. S. Expl. Exped	1
Section Volutella, D'Orbigny.			
Voluta angulata, Swainson		Gould	3
Voluta angulata, Swainson	Brazil	Smithsonian	1
Genus Lyria, Gray.			
Lyria Delessertiana, Petit	Madagascar	Gould	2
Lyria Mitræformis, Lam	Australia	Gould	1

Family Mitridæ.

NAME.	Locality.	Collection.	Specimens.
Genus Mitra, Lamarck.			
Mitra episcopalis, Linn		Gould	3
Mitra episcopalis, Linn		U. S. Expl. Exped	9
Mitra papalis, Linn		Gould	2
Mitra pontificalis, Lam		Gould	3
Mitra pontificalis, Lam		Smithsonian	1
Mitra cardinalis, Gmel		Gould	3
Mitra cardinalis, Gmel		Smithsonian	1
Mitra propinqua, Sowb		Gould	1
Mitra puncticulata, Lam		Gould	3
Mitra Desetangsii, Kien		Gould	......
Mitra Barbadensis, Gmel	Curaçoa, Venezuela	Gould	7
Mitra Barbadensis, Gmel		Gould	3
Mitra maura, Swains	Chile	Gould	1
Mitra ebenus, Lam		Gould	5
Mitra ebenus, Lam	Mediterranean sea		1
Mitra funerea, Rve		Gould	1
Mitra testacea, Swains		Smithsonian	1
Mitra casta, Lam		Gould	2
Mitra florida, Gould		Gould	(Type) 1
Section Swainsonia, H. & A. Adams.			
Mitra fissurata, Lam		Gould	1
Mitra Olivæformis, Swainson		Gould	2
Mitra oniscina, Lam		Gould	3

FAMILY MITRIDÆ — (*Continued*).

NAME.	Locality.	Source.	Specimens.
Section Scabricola, Swainson.			
Mitra granulosa, Lam		Gould	8
Mitra granulosa, Lam			1
Mitra lens, Wood	Panama	Gould	2
Mitra sphærulata, Mart		Gould	5
Mitra sphærulata, Mart		Smithsonian	1
Mitra texturata		Gould	2
Mitra crenifera, Lam		Gould	2
Mitra gracilis, Rve		Gould	4
Mitra Isabella, Swains		Gould	1
Mitra Isabella, Swains			1
Section Cancilla, Swainson.			
Mitra filaris, Linn	New Caledonia	Gould	6
Mitra filaris, Linn		Smithsonian	1
Mitra flammea, Quoy		Gould	1
Mitra telescopium, Rve			1
Section Chrysame, H. & A. Adams.			
Mitra cucumerina, Lam		Gould	1
Mitra cucumerina, Lam			1
Mitra nucleola, Lam		Gould	5
Mitra tabanula, Lam		Smithsonian	1
Mitra ambigua, Swains	Madagascar	Gould	3
Mitra ambigua, Swains		Smithsonian	1
Mitra aurantia, Gmel		Gould	3

Mitra aurantia, Gmel		Smithsonian	1
Mitra adusta, Lam		Gould	3
Mitra adusta, Lam		Smithsonian	1
Mitra digitalis, Chemn		Gould	3
Mitra ferruginea, Lam		Gould	2
Mitra ferruginea, Lam		Smithsonian	1
Section Strigatella, Swainson.			
Mitra acuminata, Swains		Gould	2
Mitra auriculoides, Rve		Gould	1
Mitra limbifera, Lam	Friendly Is	Gould	1
Mitra limbifera, Lam		Gould	2
Mitra limbifera, Lam		Smithsonian	1
Mitra chrysostoma, Swains		Gould	5
Mitra chrysostoma, Swains			1
Mitra scutulata, Lam		Gould	4
Mitra scutulata, Lam		Smithsonian	1
Mitra retusa, Lam		Gould	3
Mitra retusa, Lam		Smithsonian	1
Mitra litterata, Lam	Red Sea	Gould	4
Mitra litterata, Lam		Gould	7
Mitra litterata, Lam		Smithsonian	3
Mitra paupercula, Linn		Gould	4
Mitra virgata, Rve		Smithsonian	1
Section Zierliana, Gray.			
Mitra Ziervogeliana, Gmel	Mergui, Burmah	Gould	1
Genus Turricula, Klein.			
Turricula sanguisuga, Linn., var. stigmataria, Lam		Gould	5
Turricula sanguisuga, Linn., var. stigmataria, Lam		Smithsonian	1

FAMILY MITRIDÆ — (*Concluded*).

NAME.	Locality.	Collection.	Specimens.
Genus Turricula, Klein — (*Concluded*):			
Turricula melongena, Lam		Gould	2
Turricula melongena, Lam		Smithsonian	1
Turricula costellaris, Lam		Gould	4
Turricula vulpecula, Linn		Gould	10
Turricula vulpecula, Linn		Smithsonian	1
Turricula vulpecula, Linn	South Pacific Ocean		1
Turricula caffra, Linn		Gould	3
Turricula plicata, Lam		Gould	7
Turricula plicata, Lam		Smithsonian	1
Turricula cinctella, Lam		Gould	1
Turricula corrugata, Lam		Gould	3
Turricula corrugata, Lam		Smithsonian	1
Section Costellaria, Swainson:			
Mitra cophina, Gould = Turricula militaris, Rve., var.		Gould	(Types) 2
Turricula cruentata, Chemn		Smithsonian	3
Turricula subulata, Lam		Gould	2
Turricula exasperata, Gmel		Gould	7
Turricula exasperata, Gmel		Smithsonian	2
Section Pusia, Swainson:			
Turricula dermestina, Lam	Sandwich Is.	Gould	6
Turricula dermestina, Lam., var. sanguinea, Rve		Smithsonian	1
Turricula pardalis, Kuster		Smithsonian	2
Turricula microzonias, Lam		Gould	5

Turricula cremans, Rve		Smithsonian	1
Turricula luculenta, Rve		Gould	2
Turricula luculenta, Rve		Smithsonian	1
Turricula patriarchalis, Lam		Gould	2
Turricula porphyretica, Rve		Smithsonian	1
Turricula nodossa, Swains		Gould	5
Turricula nodossa, Swains		Smithsonian	1
Turricula tricolor, Gmel	Mediterranean Sea		1
Genus Cylindra, Schumacher.			
Cylindra nucea, Gronov		Gould	1
Cylindra crenulata, Gmel	Tahiti	Gould	1
Cylindra dactylus, Linn		Gould	2
Cylindra fenestrata, Lam	Tahiti	Gould	1
Genus Imbricaria, Schumacher.			
Imbricaria conica, Schum		Gould	10
Imbricaria conica, Schum		Smithsonian	1
Imbricaria conulus, Lam		Gould	3

Collections of Fossils made for the Palæontology of New York Previous to 1883.

By act of the Legislature, in 1855, there was made for the first time an appropriation for the collection of fossils for use in the preparation of the Palæontology of New York. Previous to that time all the collections for the work had been made at my own expense. The field work of collecting specimens under the act of 1855 was not commenced until 1856. Collections of fossils were continued uninterruptedly for ten years, and with more or less interruption until 1875. From that time onward no systematic collections have been made in this department; the State Geologist, and his assistants, having, from time to time, made small special collections which have been needed in the progress of the work. At the commencement of these collections (in 1856) there was no room in the State Museum building, nor in any other public building, for the disposition of these collections, and in order to provide proper accommodations for the arrangement and use of the material thus acquired, in the preparation of the publications, the State Geologist erected at his own cost, two buildings, one for the reception of the collections as they came in from the field, for the cleaning, ticketing and recording of the specimens. The other building was fitted up with drawers for the proper arrangement of the selected specimens, which were to be used in the illustration of the volumes to be published, and other miscellaneous contributions to Palæontology. As the collections increased, more room was required and more drawers were added, and the entire collection which had been made up to 1878, inclusive, was conveniently housed in these buildings, and made accessible for study. The work of the State Geologist and his assistants, a draughtsman and lithographer, were accommodated in the same buildings. The work in every one of its phases was prosecuted without interruption until 1884, and with interruptions coming from the operation of the law of 1883, until the end of 1885. In the beginning of 1886 the State Geologist was directed to transfer all the specimens in the buildings before mentioned, to the State Hall, conveniences in the shape of drawers having been prepared in the upper story of that building, and storage room in the basement. The collections were packed in boxes, under his personal supervision, and transferred to the State Hall, where, by the order of Chancellor Pierson, they were placed in charge of Mr. Charles E. Beecher; and by the latter and Mr. J. M. Clarke were arranged in drawers as they now remain, in the upper story of the State Hall. From that time (1886) forward the State Geologist has had no official charge, authority or control of these collections, until December, 1891, when the Regents passed the following resolution:

"That the State Geologist and Director of the New York State Museum shall have immediate charge and control of the palæontological collection, the work on the palæontology and the publication of the geological map of the State. He shall be responsible for the proper expenditure of the funds allowed from the usual annual appropriation for palæontology under the direction of the committee, and shall approve before payment all bills relating to the work under his personal charge."

After six years, the collections above described, are by this resolution again placed under my charge and control. Under these circumstances it seems desirable to put upon record some information concerning the nature and amount of the material, and some statement of its present condition.

Therefore during the past season I have had a general inventory of these collections made, and the same is herewith appended. It is shown that the arranged collection occupies five rooms in the upper story of the State Hall, as follows:

In the south room (No. 39) of the building, occupied by Prof. John M. Clarke, the Assistant Palæontologist, there are 188 drawers occupied by tpyes and typical specimens which have been used in the preparation of the preceding volumes of the Palæontology. There are 480 drawers occupied by collections now in use for the preparation of the work on the Palæontology. A partial catalogue of these collections was communicated with my report of last year, including the Crustacea. The work on the catalogue has been continued by Mr. Clarke and a second portion is communicated with this report. It is intended that the work shall be continued during the ensuing year and the result communicated with the next annual report.

In the adjoining room (No. 37) the Devonian corals of the Upper Helderberg limestone occupy 52 drawers. The approximate number of specimens in these drawers will be at least 11,000. Besides the drawers there are several hundred larger and finer specimens of corals arranged upon tables standing in the same room. A block of drawers occupied by

	Drawers.
Hamilton group, Lamellibranchiata	130
Hamilton group, Brachiopoda	30

In the same room with the corals there is one table case containing a remarkably fine collection of Eurypterus and Pterygotus from the water-lime in the neighborhood of Buffalo — forty-nine specimens.

In the central room (No. 35) the drawers are occupied by a serial collection of specimens, beginning with the Potsdam sandstone, and extending to the Oriskany sandstone inclusive. These are occupied as follows:

	Drawers.
Potsdam sandstone	4
Calciferous sandstone	13
Chazy limestone	12
Trenton limestone	105
Hudson river group, Graptolites	58
Hudson river group, miscellaneous	63
Medina sandstone and Clinton group	20
Niagara group of Waldron, Indiana	185
Niagara group of Delphi, Indiana	4
Niagara group of Hamilton, Ontario	16
Water-lime formation of New York	6
Lower Helderberg group	149
Oriskany sandstone	15

The total number of specimens of these several formations arranged in drawers in this room will exceed 37,000.

In the same room are three table cases occupied by fossils of the Niagara group of Waldron, Indiana. These fossils have been made the special subjects of study and illustration in the reports of the Museum. The total number of these typical specimens is about 554.

The adjoining room (No. 33) contains fossils of the following formations:

	Drawers.
Hudson river group, Graptolites	48
Schoharie grit	48
Corniferous limestone, Brachiopoda, Lamellibranchiata, Gastropoda, Cephalopoda and Crustacea	96
Hamilton group, Brachiopoda, Lamellibranchiata, Gastropoda, Cephalopoda, Crustacea and corals	312
Portage group, Brachiopoda, Lamellibranchiata, Bryozoa and land plants	48
Chemung group, Brachiopoda, Lamellibranchiata, Gastropoda, Cephalopoda, Spongiæ and land plants	60
Catskill group, Fossil fishes	2
Carboniferous formation, Bryozoa, Crinoidea and Brachiopoda	4

A block of 160 drawers is occupied partly by Lamellibranchiata of the Hamilton group, and Brachiopoda of the Upper Helderberg, Hamilton and Chemung groups.

Room 31, occupied by the draughtsman, contains a few drawers of types and typical specimens of Bryozoa of the Hamilton group. The remainder of the drawers are occupied by specimens which have been borrowed for use in the Palæontology of New York.

Room 32, occupied as office and working room by the State Geologist and his clerk, contains a range of drawers on the south side of the room, occupied by

	Drawers.
Corniferous limestone, corals	30
Hamilton group, corals and bryozoa	90

A block of drawers in the central portion of the room is partially occupied on the east side by Lamellibranchiata of the Hamilton group, and on the west side by miscellaneous collections, and by collections borrowed for use in the Palæontology of New York.

The total number of drawers occupied as above specified is 3,210, and the estimated total number of specimens is 250,000.

The following is a list of the boxes of fossils in the State Hall belonging to the State Museum:

BASEMENT.

ROOM 1.

Hudson River Group.

	Boxes.
Graptolites	10

Coralline Limestone.

Corals	2

Lower Helderberg Group.

Brachiopoda	1
Slabs	1

Hamilton Group.

Lamellibranchiata	2
Plant remains	8
Brachiopoda	1
Fucoids and casts of mud cracks	1
Miscellaneous	1

Chemung Group.

Brachiopoda. Geological collection	1
Dictyospongidæ	4
Poor and undetermined	1

Miscellaneous.

Van Rensselaer collection	2
School collection No. 8	1

Catskill Group.

Fish remains	1

Coal Measures.

Miscellaneous. Pickett collection	2

Livonia Salt Shaft.

One barrel and 131 boxes	131

ROOM 10.

Black River Group.

Corals	1

Marcellus Shale.

Brachiopoda	3

Hamilton Group.	Boxes.
Brachiopoda	26
Lamellibranchiata	5
Gastropoda	1
Plants	3
Portage Group.	
Plants	1
Geological specimens	1
Upper Chemung Group.	
Brachiopoda	8
Chemung Group.	
Brachiopoda	57
Plants	2
Fish remains	1
Specimens illustrating sections	6
Catskill Group.	
Fish remains	11
Oneonta Sandstone.	
Slabs	1
Old Red Sandstone.	
Fucoids	2
Miscellaneous.	
Fish remains and Crinoids. Gebhard collection	1
Miscellaneous corals; not ticketed	1
Miscellaneous. Lower and Upper Helderberg; not ticketed	1
Fragments of limestone. Kelley's Island	1
Upper Helderberg Group. Lawyersville, N. Y	1
Miscellaneous Geological specimens for examination	1
Minerals for distribution	1
Iron ore and rock specimens. Lake Champlain	1
Serpentine limestone	1
Glaciated surface limestone. Geological collection. Buffalo, N. Y.	1
Vespertine formation; three miles south of Mansfield, Pa	1
Niagara group, Waldron, Indiana	1
Chemung and Catskill fish remains. Tioga county, Pa	1
Tufa collection. Ticket 893	1

BOXES IN THE UPPER STORY OF THE STATE HALL.

Room 31.

Hamilton Group.	Boxes.
Brachiopoda. School collections	4
Lamellibranchiata	1
Upper Chemung Group.	
Brachiopoda	2
Chemung Group.	
Brachiopoda	12
Fish remains	2
Crinoidal remains	1
Miscellaneous	2
Slabs	2
Geological specimens	3
Specimens illustrating geological sections	1
Waverly Sandstone.	
Plants	1
Conglomerate.	
Geological specimens	2
Miscellaneous.	
Tertiary shells	1

Room 33.

Trenton Limestone.	
Orthoceras	3
Trilobites	5
Hudson River Group.	
Graptolites	5

Room 35.

Trenton Limestone.	
School collections, Nos. 1–28	4

Room 37.

Hudson River Group.	
Graptolites and geological specimens	1
Hamilton Group.	
Brachiopoda and corals	2
Lamellibranchiata	1
Corals	2

Genesee Slate.	Boxes.
Brachiopoda	1
Chemung Group.	
Brachiopoda	2
Brachiopoda and corals	2
Geological specimens	1
Catskill Group.	
Geological specimens	1
Carboniferous.	
Crinoids	7
Brachiopoda	1
Lower Carboniferous.	
Brachiopoda	7
Miscellaneous.	
Olenellus quartzite. Stissing Mountain, N. Y.	1
Ohio sandstone. New Providence, Ind	1
Geological sections. Southern-Central N. Y	1

In Rotunda.

Lower Helderberg Group.	
Corals	7
Niagara Group.	
Brachiopoda	1
Upper Helderberg Group.	
Corals	30

On the Top of Cases; South End of Hall. Upper Floor of State Hall.

Upper Helderberg Group.	Boxes.
Corals	21
Hamilton Group.	
Brachiopoda. School collections	1
Miscellaneous	1
Portage Group.	
Plants	1
Upper Chemung Group.	
Brachiopoda	1

Chemung Group.

	Boxes.
Brachiopoda	8
Plant remains	7
Fucoids	1
Fish remains	1
Slabs	2
Corals	1
Dictyospongidæ and Brachiopoda	1
Bryozoa	1
Geological section	1
Rubbish and miscellaneous material	2

Catskill Group.

Section near Lawrenceville, Pa	1

Miscellaneous.

Oneonta sandstone. Plants	1
Albany clays with foot markings and trails	1

TOTAL NUMBER OF BOXES.

	Boxes.
Room 1, basement of State Hall	170
Room 10, basement of State Hall	143
Room 31, upper floor of State Hall	34
Room 33, upper floor of State Hall	13
Room 35, upper floor of State Hall	4
Room 37, upper floor of State Hall	31
Rotunda, upper floor of State Hall	38
Top of cases, south end of hall, upper floor	53
Total	486

During the time I had the management of the Museum, we established machinery for cutting and polishing specimens and for cutting thin slices of rock and fossils for the purpose of microscopic study. While a considerable number of the cuttings were of other objects, much the larger proportion were of Fossil Corals, which were made for the purpose of minute or microscopic study. Of these sections there were over 3,000 specimens recorded (See 37th Museum Report). These specimens have not been in my charge or control for many years, but as they constitute an important part of the collection in Palæontology, they have now come under my direction. On examining these specimens I find that they are becoming injured from exposure and slight decomposition upon some of the surfaces while the Canada balsam by which they are cemented to the glass has in some instances given way. These specimens are very valuable and could not be replaced except by the expenditure of many hundreds of dollars. If they are to be preserved for future use it has become necessary that they should be protected by thin glass plates, which shall cover either the fossil portion or entire surface. To accomplish this will require the services of a person with some knowledge of the subjects which he is handling, and accustomed to delicate manipulation. It is my duty to submit this matter for your consideration and direction.

There are also over 500 sections of the shell of Brachiopoda of which a list is given in the 10th Report of the State Geologist, page 23, and included in the 44th Museum Report.

Some time about the year 1884 or 1885 a considerable number of these sections on glass were arranged for exhibition in the Museum, some of them arranged in frames containing several specimens, for the convenience of handling in examination. A considerable number of the finer and larger specimens, fifty or more, were mounted on blocks and placed in the window recesses in order to show their structure by transmitted light.

This enormous collection of fossils occupying 3,210 drawers, contains at least one quarter of a million of specimens, and the 500 boxes contains at least 50,000 more specimens. The collection was originally commenced in 1856 to furnish material for the preparation of the volumes upon the Palæontology of New York. The amount of material accumulated was much greater than could have been anticipated at the outset, and furnished specimens for study from which the value of the published works was greatly enhanced, and not only this, but the greatly increased amount of material over what had been anticipated, rendered it necessary to increase the number of volumes of that work in order to give a proper illustration of the fossil fauna of the State. At the present time the publication of all the work of this nature contemplated has been provided for, except the two classes of Spongidæ and the Corals. Manuscript for the last volume on the Brachiopoda has been placed in the hands of the printer. During the past years selections of specimens have been made from the collections for use in the Palæontology and in the annual reports of the Museum, and now remain in the Museum collection as types or typical specimens which are accessible for study and comparison. There is therefore no longer need for preserving, in their present accessible condition, the greater part of all these extensive collections.

In 1874 and 1875 more than 20,000 specimens of fossils and minerals were selected for schools, academies and colleges and distributed to these institutions during these and subsequent years. A large number since that time have been selected and distributed, and we have at the present time collections amounting to nearly 5,000 specimens arranged and ready for distribution; but notwithstanding all this, the great collection seems scarcely diminished, and occupying, as it does, all the drawers which we have at our disposal in the Museum, it becomes very desirable to dispose of the specimens, which are absolute duplicates, in such a way that they will not incommode or prevent the accession and arrangement of new material.

I have recommended in the past that the better specimens of all the species should be selected and reserved for the uses of the Museum, for most certainly in the time to come, should the Museum continue to hold any position among similar scientific institutions, there will be a demand for specimens in exchange or for distribution to the higher institutions of learning within the State.

In order to have some idea of the labor required to accomplish such work, I may say that to select, arrange, label and record this great collection, the service of one competent Palæontologist with a helper in the rough work, would be required for a period of at least ten years.

It seems to me that it is quite time the Trustees should take into consideration this condition of affairs, especially since this collection has remained almost dormant since 1886, and our general collections in this department have not kept pace with the progress of investigation since 1876. In 1875 all the collections then arranged in drawers were graded and the quality of the specimens marked and numbered as 1, 2, 3, etc. In the rearrangement of these collections in the State Hall these limitations were not observed, and all the specimens of whatever grade were mingled together in the same drawers.

During the past years only a few collections have been ordered to be distributed to schools, and those have been selected from the drawers containing the entire amount of material of each species. As a matter of course, whether selected by more or less competent hands, the better specimens have gone into these collections, and the inferior have remained in the drawers. If the Museum wishes to preserve the better specimens of this great collection, it is quite time that some efforts be made and some plan devised for selecting the better specimens sufficient to make several first-class collections which might be regarded as the Museum stock, and not to be distributed except to higher institutions where it can be known that advanced students make use of the collection. The inferior material remaining on hand could then be distributed into as many collections as can be made from it, and these collections marked in the order of their quality from one upwards; such collections could then be packed in boxes and arranged in such a way, that, whenever an order should be given for a collection it could at once be filled without interrupting the course of work of the State Geologist or his assistants, and at a great saving of time and expense. Though I have recommended this course before now no action has followed, and I wish to place it on record once more in connection with this schedule of the nature and quantity of the collections remaining in the State Hall.

I beg to say in conclusion that whatever other Museum work may be carried on, there is nothing more important, in my belief, than that which I have recommended in disposing of these collections.

Moreover, if it be the intention of the Trustees that this Museum should retain its character as a scientific institution, and keep up its intercourse with other similar institutions of the country, it will become important that exchanges of specimens be carried on for the benefit of each one participating in the exchange, and for the purpose of giving to students frequenting the Museum an opportunity of studying material obtained from a wider range of country than has been possible thus far with the restrictions imposed upon acquiring collections of this character. Besides this there are other important considerations which should weigh with the Trustees of an institution like that of the State Museum of the State of New York, and instead of leaving these collections dormant for years, they should in some way be made useful.

The publications made as the result of the Geological Survey and from the investigations made in the State Museum of Natural History in past time, have placed before the world a nomenclature which has been generally adopted and incorporated into the scientific literature of all nations. It should be considered a duty to science that collections of our rocks and fossils be deposited in some, at least, of the principal government institutions of Europe, where reference could be had to the objects themselves, as well as to the scientific literature and illustration which has made the names of our geological formations and their contained fossils accessible and understood. In this respect we have not done our duty as an enlightened people who have asked the world to accept a geological nomenclature founded mainly upon the rock formations of the State of New York.

Additions to the Museum Collections, in Geology and Palæontology, made in connection with work on the Geological map.

During the early autumn a new locality of Graptolites was discovered in the vicinity of Hudson, N. Y., on the south-western face of Merino Mountain, and a considerable collection has been made therefrom. The collection amounts to about 1,000 specimens, which have been arranged in drawers in the upper story of the State Hall. The discovery of this locality is interesting as furnishing the same species of Graptolites as those published in Volume I of the Palæontology of New York, in 1847; and the slates are in similar condition. The original specimens were obtained from comparatively small masses and sometimes only a few thin lamina of black slate infolded and incorporated in the contorted and partially altered gray slates of the Hudson River group at the outlet of the Normans Kill. This locality has for many years been inaccessible on account of buildings having been erected on the ground; and no other similar locality had been found preserving the same species in like condition and in slates of the same physical character.

These forms were originally referred to the horizon of the Utica slate, although it was not possible to obtain any exposure showing the actual stratigraphical relations. During later years some question has been raised regarding the correctness of this reference, the suggestion having been made that the inclosed black slates at the Normans Kill might have been derived from an older formation and involved in Hudson shales during their folding and uplifting.

The locality at Hudson presents a clear outcrop in an escarpment, showing the shaly beds in such relations to the upper arenaceous members of the group as to leave no doubt that the strata belong to the Hudson River age, though it can not be proved at the present time that they lie at the base of the formation.

The work on the Geological map has been carried on without especial reference to the collection of fossils, since this work had already been done over the larger part of the country examined. In a comparatively few cases specimens were collected as records of the outcrop and locality, in order that the age of the formation might be determined by the contained fossils.

In the course of the investigations for the Geological map a considerable number of interesting specimens have been obtained, which have been collected for the determination of the age of the outcrops, and the limits of certain formations, especially of the Hamilton, Portage and Chemung groups, and are of interest to the Museum collections. These specimens have been placed in drawers for future study and verification of the age of the exposures as laid down on the map, by their fossil contents. The following lists may be usefully recorded in their geological order:

A specimen of partially altered Hudson River shale from West Park, from strata almost vertical, and containing *Orthis testudinaria*, giving evidence of the age of the formation. The Hudson River shales with Graptolites, outcrop at a point one mile farther south along the line of the railroad, and we have good specimens in the collections made some years ago.

Fossiliferous Shaly lime-stone lying above the Scutella or Becraft limestone near Hudson. This upper shaly limestone was first noticed, and attention called to its occurrence in the neighborhood of Rondout, by Prof. William M. Davis, of Cambridge, Mass., and has now been fully recognized at Becraft's Mountain. Twenty-four specimens.

Specimens of Shaly limestone from a small synclinal outlier near Cornwall. At this place the Pentamerus and associated limestones which form the great escarpment of the Helderberg have become very greatly attenuated, and are standing almost vertically as seen in the railroad cutting near Cornwall. The shaly limestone specimens are from a locality three-fourths of a mile southwest from Cornwall station, and contain the characteristic fossils of that rock. Specimens labeled with locality.

Hamilton group; specimens underlying the Oneonta sandstone.

Hamilton group. North Pitcher, 150 feet above town. Eleven specimens of decomposing calcareous rock, with fossils characteristic of the group.

Hamilton group. Catskill creek. Twelve specimens.

Upper Hamilton group. Thirty specimens collected by Mr. Darton in Gilboa, Schoharie county, N. Y., containing *Spirifer granulifera, Tropidoleptus Scarinatus, trophodonta* and other fossils characteristic of the group.

Hamilton group. Specimens from beds lying beneath the Oneonta sandstone, showing the relations of this sandstone to the Hamilton group as has been before shown and published in our reports.

Upper part of Genesee slate; Styliola layer. Fall brook, south of Geneseo. Two specimens.

From Coneville, two miles north of Manor Kill post-office, Schoharie county. Two hundred feet above Oneonta sandstone. Four specimens of coarse gray sandstone; one specimen containing *Spirifer mesastrialis*, the other with fragmentary fossils. The presence of this fossil would indicate the extension of the Upper Portage or Lower Chemung as far east as the locality cited.

Other specimens having temporary value in the determination of the limits of geological formations for the Geological map are preserved but not here recorded.

Chemung group. Franklin, Delaware county, N. Y. Two specimens containing *Spirifer mesastrialis.*

Chemung group. Sidney, hill above town at railroad station. Three specimens.

Cortland village (south of). Two hundred feet above town. Nineteen specimens. *Atrypa reticularis* having the aspect and expression of the Chemung group form; *Orthis sulcata, Orthis* sp.? of the subgenus Rhipidomella. *Strophodonta perplana* var. *nervosa, Spirifer mesastrialis* and other fossils characteristic of the Lower Chemung group.

School Collections.

During the summer and autumn, Mr. Sheehy and Mr. Van Deloo have selected, arranged and catalogued twenty school collections of the Lamellibranchiata. These are ready for incorporation into any general school collections which may be ordered by the Regents. This work required the selection, arranging and recording of about 1,750 specimens, besides the handling of at least six times as many more specimens, in the selection of these collections. Each one of these collections is accompanied by a catalogue giving the generic and specific names of the fossils. A great deal of miscellaneous work has been necessary in accomplishing the result above stated which is of such a nature that it can not be recorded, but which has nevertheless occupied time.

Mr. William F. Cooper, my private assistant, has selected from the duplicate collections of the several geological formations about twelve hundred specimens, for the Plattsburgh Normal School, which await my examination and revision before being catalogued. This work I expect to be able to do before the first of January.

During the year past 48 boxes of specimens have been sent in from the Livonia salt shaft. These have all been opened and the specimens cleaned, ticketed and recorded. Such specimens as were especially required for the Museum collections have been selected and arranged in drawers which are accessible. The collection has furnished a considerable number of new species of fossils which will at some future time be described and published, and will add to our knowledge of the faunas of the formations passed through in the shaft. The detailed account of the rocks passed through in sinking the shaft will be given under another head, with such other information as may be connected therewith.

At the same time part of the collection for the Batavia Institution for the Blind has been selected, and attention will be given to its completion before the first of January.

The employment of Mr. Emmons by authority of the secretary of the regents, upon the duplicate collections, will secure the distribution and arrangement of a large amount of material into school sets and for preservation in the Museum collections. If his services shall be continued for the coming year we shall have a larger amount of material prepared and ready for distribution into school collections.

I feel that this movement is a step in the right direction and no better service can be rendered to the cause of education and the advancement of science than the distribution of these enormous collections of 300,000 specimens, properly labeled, to the schools and colleges of the State, and to those of other States also under proper regulations. The scientific organizations of this and other countries should not be forgotten; and the State of New York could well afford to distribute these authentically labeled collections of fossils for the advancement of science and the maintenance of her prestige as a patron of scientific investigation and the diffusion of a knowledge of geology of which she has become the index and authority.

MUSEUM PUBLICATIONS.

In this place it seems necessary to make some explanation or apology for the meagerness of scientific contributions to the State Museum reports during the past few years. At the time when I was charged with the care of the State Cabinet collections and the preparation of its reports in 1866, I understood that it would be the object of its trustees to carry out the suggestion made in a resolution passed by the Legislature, April 24, 1865,* and communicated to the Board of Regents, which resolution called upon them for the recommendation of some plan "for placing the State Cabinet of Natural History in the condition required by the present state of science, to maintain it in full efficiency as a museum of scientific and practical geology and comparative zoology, etc." After correspondence with the scientific men of New York and other States, a plan of organization was communicated to the Legislature and its adoption recommended by the regents. From that time forward I felt it my duty to communicate the results of all my investigations to the annual report of that institution. As soon as an organization was effected under the law of 1870, which designated the "State Cabinet of Natural History" as the "State Museum of Natural History," I not only continued to communicate the result of my own investigations, but merged all my own work, and that of my assistants, in the reports upon the State Museum of Natural History, hoping thereby to retrieve, in some degree, the neglect of

* See Senate Document No. 89, 1865.

previous years on the part of those controlling the institution. This plan was continued so long as I remained director of the Museum under the law of 1870, and afterwards as long as practicable while holding the title of director by appointment of the regents. These scientific papers necessarily required illustrations, and so long as I had a draughtsman in my control there was no difficulty in illustrating the papers as they were communicated. Afterwards, having been deprived of the services of a draughtsman by the action of the regents, I incurred expenditures for these illustrations and on the presentation of the bills they were refused payment, although the papers had been prepared without expense to the Museum. In one case, especially, where the author of the paper had spent much time and continued work during several years in an investigation of much scientific interest and importance, the small bill of less than $150 for illustrations was refused payment. Others of less consequence were treated in like manner, and since I could not afford to continue the payment of such expenditures from my own means, I have gradually abandoned the effort to secure scientific contributions to the museum reports. It is well known to your honorable body that I was director of the Museum only in name, and not in fact, and from the time of the passage of the law of 1883, modifying the museum organization, I have had no authority whatever in the management or direction of its affairs, and the expenditure even of small sums of money, which were absolutely necessary, has been visited by reprimand and faultfinding, while my nominal subordinates experienced no such difficulty. Under these circumstances there was no recourse but to ask from the Legislature the means of illustrating my scientific papers.

The provision of the law of 1883, chapter 355,* providing for the publication of handbooks, etc., had been made expressly to meet such requirements, and the annual appro-

* "The trustees of said museum shall be authorized to publish each year the scientific contributions of said staff and such other original scientific contributions as they may deem expedient, which publication shall be in lieu of the reports now required by law from the State Geologist and State Entomologist, and the scientific papers communicated each year to the Legislature along with the annual reports of said trustees; * * * and by means of printed hand-books describing said collections, and in such other ways as may be practicable, to make said museum a means of instruction to the citizens of the State."

"In order to provide for the expense of printing the aforesaid scientific publications and in order to increase the usefulness and efficiency of said museum as aforesaid, the annual appropriation to be made for its maintenance shall be $15,000, to be paid on vouchers approved by said trustees."

priation for the museum maintenance was increased by $5,000 annually. Encouraged by this act I presented several papers* and asked for the means of illustration and publication but they have always been refused, and I have been compelled to the conclusion that the Trustees of the State Museum are either indifferent to its scientific reputation, or that they have some special reason for refusing my contributions. Under these circumstances I have gradually withdrawn from presenting any papers to the museum reports, and those which I had prepared for publication sometime ago have been left untouched until the present year when I asked and obtained from the Legislature the privilege of illustrating the reports of the State Geologist. It is for no other reasons than those above stated that I have felt compelled to avoid any attempt at contributing to the museum publications. I dare say that it has been felt by the trustees that my communications were of too little consequence toward maintaining the museum in that degree of scientific activity recommended by the Board of Regents in 1866. It is certainly a gratification to know that since the period of my taking charge of the museum in 1866, we have secured the passage of a law authorizing the appointment of the State Entomologist and also a recognition of the State Botanist, and the contributions of these officers add largely to the scientific publications and reputation of the State. In concluding my report I have felt it necessary to make this explanation, both for the scientific public and the Trustees of the Museum.

Very respectfully submitted.

JAMES HALL,

Director.

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* I had prepared a Bulletin upon the upper Silurian and Devonian Bryozoa, having personally borne the expense of its preparation nearly to completion, but on presenting the matter to the secretary, in accordance with a previous request from him, it was refused publication. I had begun the preparation of a Bulletin on the Palæozoic Lamellibranchiata, and had published ten plates in the Geologist's Report for 1881, but when I asked for means of finishing my work it was refused.

I had in preparation for many years a memoir, or monograph of the fossil Dictyospongidæ, of which I had published preliminary notices in the annual reports. In January, 1885, I presented to the Regents, at their annual meeting, the material which I had prepared, both in manuscript and drawings, asking to be allowed means of publication. The matter received attention, and the following resolution was passed: *Resolved*, That the monograph of Director Hall on Dictyospongidae be published by the museum as Bulletin No. 1.

When I asked for the means for going on with the work of this monograph it was refused.

REPORT

OF THE

STATE BOTANIST

1892

REPORT.

To the Regents of the University of the State of New York:

Gentlemen.— I have the honor of communicating to you the following report of the work of the Botanist for the year 1892.

Plant specimens have been collected in the counties of Albany, Essex, Hamilton, Herkimer, Jefferson, Oneida, Queens, Rensselaer, Saratoga, Suffolk, Ulster, Washington and Warren.

Specimens have been contributed by correspondents who collected them in the counties of Albany, Chenango, Essex, Onondaga, Rensselaer, Richmond, Queens, Saratoga, Schenectady, Suffolk and Washington.

The whole number of species represented by the specimens added to the State Herbarium during the year is 338. Of these 24 are represented by contributed specimens, 314 by specimens collected by the Botanist. Of the species new to the Herbarium, 81 in all, nine belong to the contributed specimens and 72 to those collected by the Botanist. Of the 81 species, there are 30 of which I find no satisfactory description, and they are, therefore, described as new. These are all fungi, two of which belong to the contributed specimens, 28 to the collected. A list of the species of which specimens have been added to the Herbarium is marked A.

Specimens of plants have been contributed by twenty-three persons. Among these contributions are many specimens of extra-limital species not included in the foregoing enumeration. A list of the names of the contributors and of their respective contributions is marked B.

The record of species not before reported, together with the localities where the specimens were respectively collected, their habitats, remarks concerning them and the descriptions of new species is marked C.

To this is added a record of a few extra-limital species received from correspondents and considered new or worthy of special notice. These descriptions and remarks follow the letter D.

Notes and observations upon species previously reported, together with descriptions of new or interesting forms and varieties of them, are marked E. To this record I have added descriptions of our New York species of Pluteolus and Galera. They are marked F.

That there is a growing demand for a better knowledge of our fungi, especially of those of economic importance, is plainly evident. The frequent inquiries received at the office of the Botanist concerning them, and the numerous specimens sent to him for identification, are an evidence of this fact. The use of the edible fleshy species for food is rapidly on the increase in this country, and yet very many who would gladly avail themselves of the agreeable and nutritious diet afforded by our numerous esculent species are debarred from doing so by a lack of the knowledge necessary for a proper discrimination between the good and the bad or worthless. With this knowledge the fear of being poisoned by the bad would no longer prevent the use of the good. With it many whose circumstances are such as to make it difficult or impossible to procure an adequate supply of animal food might often obtain a very good substitute for it by the slight labor of gathering it in the fields and woods. European works on this subject are not readily available because of their high price and are not generally satisfactory because the species in this country are not wholly the same as in that; or if the price is not great then the deficiency in the number and character of the illustrations is likely to be an objection. In view of these facts it was very gratifying to me to receive from your office directions to prepare for publication full-size colored plates of the edible and poisonous mushrooms of the State, together with brief descriptions and notes. In accordance with these directions thirty-six quarto plates, on which are represented fifty-nine edible species in natural size and color, have been prepared. Also, four plates representing in like manner three poisonous species. In all cases where it is important these plates show both the young and the mature plant and the principal variations in color and shape. Vertical sections of the plants are also depicted in order to show the internal structure and color, to which have been added, for the advantage of students of mycology and others who may be fortunate enough to possess a compound microscope, illustrations of the fruit or spores of each species. These are uniformly magnified 400 diameters.

The manuscript designed to accompany the plates consists of 19 pages of legal note, 123 pages of descriptions and remarks, explanations of the plates and two pages of index.

With these plates and their accompanying explanations, descriptions and remarks, it seems to me to be an easy matter for any one of ordinary intelligence, even though without any experience in such things, to recognize the species illustrated by them. Of the 59 edible species illustrated, 40 at least have been used as food by myself and thus proved to my own satisfaction to be good and safe. Nearly all of the remainder have been proved by friends or correspondents in whom I have full confidence, and the few untried ones are such as are generally recommended as edible by European works on this subject, and such as I would have no hesitation in eating if opportunity should be afforded. A few of the species are such as are not represented in European works or have not been classed as edible in them, but in all these cases they have been proved by actual trial to be worthy of a place among our edible species.

There yet remains in our flora a goodly number of reputed edible species which I have not tried for lack of opportunity, but it is my purpose to test them as fast as opportunity is given. Eight species not included in the illustrations have been tried the past season. It is my purpose to continue the illustration of these, and others as fast as they have been proved, until all our esculent species have been thus represented. The more I experiment in this direction the more firmly I am convinced that the number of really poisonous or dangerous species of mushrooms is very small. Probably there is not a greater percentage of such species among the fleshy fungi than there is of really dangerous or poisonous species among flowering plants. But there are many fungi which, though harmless, are not to be classed as edible, because of their toughness, insipidity, unpleasant flavor or smallness of size.

The plan of putting the illustrations of our edible mushrooms upon charts to be suspended upon the walls of our institutions of learning seems to me to be a good one. In this way the students, by seeing them from day to day, would become familiar with the general appearance of the species, and would recognize them at once if they should see the plants themselves growing in their native places. There would probably be kindled in the minds of some, at least, an earnest desire to know more of these interesting and useful plants, and they would thus be led to acquire a more extended knowledge of them. If the number of our esculent species should be thought too great for such chart representation, any desired number of the more common and important species might be selected for this purpose. If the outlay necessary to place charts in all the district schools should seem too great, they might be placed at first in the high schools and academies by way of experiment.

The vegetation that grows so profusely in the shallow water at the head of Lake Champlain and along its shores and dykes seemed to me to be worthy of examination. This was given early in July. Much of the woody growth consists of willows, of which the most abundant are the black willow, *Salix nigra*, the shining willow, *S. lucida*, the glaucous willow, *S. discolor*, the heart-leaved willow, *S. cordata*, and the brittle willow, *S. fragilis*. All except the last are indigenous species. The green ash, *Fraxinus viridis*, the silver maple, *Acer dasycarpum* and the red maple *A. rubrum*, are also plentiful. Although these are moisture-loving plants, too much water seems to be an injury rather than a benefit to some of them at least. Their roots and the soil in which they grow are submerged much of the time, yet the leaves of many of them are unusually small. This was especially noticeable in the black willow, the shining willow and the heart-leaved willow. Their peculiar habitat seems also to retard development. The reddish-brown color of the young leaves of the heart-leaved willow and the maples was conspicuous even in July. The spiked loosestrife, *Lythrum Salicaria*, an introduced plant which is abundant in the lower part of the Hudson river valley, was growing freely in the margin of the lake. This is a new station for it and the most northern one in the State, though it is said to grow about the quarantine grounds of Quebec. The great bullrush, *Scirpus validus*, the river club-rush, *Scirpus fluviatilis*, and the sweet flag, *Acorus Calamus*, occupy much of the shallow water space, sometimes growing intermingled and again each maintaining exclusive possession over large areas. Such plants as the water persicaria, *Polygonum amphibium*, in which the leaves were often two inches wide and four or five inches long, and the swamp dock, *Rumex verticillatus*, were apparently intent on obtaining as much food as possible from their watery habitat, for they had emitted a dense whorl of rootlets from each of the lower joints of the submerged stem.

Our native wild roses and wild asters have been the source of considerable perplexity to botanists by reason of the variability of the species. Some special attention has been given to these plants the past summer and autumn. Our native roses are easily divided into two groups, one of which is easily recognized by the naked pedicels and receptacles and by the persistent lobes of the calyx; the other, by the glandular pedicles and receptacles and the deciduous lobes of the calyx. The bland or early wild rose, *Rosa blanda*, has hitherto been considered our only representative of the first group, but two roses have been found on the mountains and along the highways in the eastern part of Essex county which correspond to the description of the two western roses, *R. Engelmanni* and *R. Sayi*, which also belong to this group. These have the stems, and usually the branches also, densely clothed with prickles intermingled with some straight slender spines, a feature by which they may at a glance be distinguished from ordinary forms of the bland rose. They scarcely differ from each other except in the form of the fruit which is globose in the specimens referred to Say's rose, and oblong elliptical or ovate in those referred to Engelmann's rose. The bland rose which usually has stems entirely destitute of prickles or spines, sometimes occurs with prickles toward the base of the stems, but I have seen no specimens with spines.

The Carolinian or swamp rose, *Rosa Carolina*, so far as my observation goes, is most satisfactorily recognized by the teeth on the margin of the leaflets. These are decidedly smaller and finer than those of the leaflets of the other species of its group. The stem is sometimes furnished with prickles, sometimes destitute of them. This is the only species of wild rose that I have found in the heart of the Adirondack wilderness. It flowers there about one month later than on Long Island. Of the two remaining species of this group, the shining rose, *Rosa lucida,* and the dwarf rose, *R. humilis*, the extreme forms are easily recognized; the former by its tall stout stem, stout spines and dark-green shining leaves; the latter, by its low slender growth, straight, slender spines, thinner leaves and fewer flowers; but all manner of intermediate forms occur which are very perplexing and which seem to connect the two.

Among our wild asters several interesting forms and varieties have been collected. Some of the most notable of these variations have been found to occur in the prenanthoid aster, *Aster prenanthoides*, a species which seems to have been regarded as quite uniform and fixed in its characters, for only a single variety is mentioned in the North American Flora. In the Catskill mountain region it varies excessively in the size and shape of the leaves, in the number and size of the heads and in their arrangement in panicles and corymbs, in the color of the rays and in the number, length and direction of the branches. The extreme forms, if observed separately, would scarcely be thought to belong to the same species, but they are so connected by intermediate forms that it is dfficult to separate them. A more extended account of these variations will be found in another part of this Report.

Scarcely less remarkable are the variations shown by the low or dwarf goldenrod, *Solidago humilis.* This species, which I have found in the Adirondack region only, occurs on the top of the low rocky ridge on the north shore of Third lake, one of the Fulton chain of lakes. This ridge is known as Bald mountain Its summit is long and narrow and nearly destitute of trees. Here and there the rock is covered with limited areas of thin soil that has accumulated in the depressions and shallow cavities and crevices. In this the dwarf goldenrod grows The elevation, temperature, degree of exposure, moisture and character of the soil are all so uniform over the whole summit that much variation in the character of any plant that might grow there would scarcely be expected. Yet this goldenrod, in this limited area and apparently exposed to the same external conditions, exhibits here four well-marked and quite distinct forms. It certainly looks as if variation does not always depend upon external circumstances.

Some attention has been given to the collection of specimens designed to add to the popular interest in the contemplated exhibit of representative specimens of the Herbarium at the World's Fair. But no official notice of the assignment of space for such an exhibit has yet been received by me, and I have not thought it proper to devote much time to preparation for this exhibit till such notice shall have been received. Inasmuch as the Herbarium is especially rich in specimens of fungi, I have thought it most appropriate to make an exhibit of these plants, and chiefly of those having an economical importance, either by reason of their useful or their noxious character.

Respectfully submitted.

CHAS. H. PECK.

Albany, *December* 12, 1892.

(A.)

PLANTS ADDED TO THE HERBARIUM.

New to the Herbarium.

Papaver somniferum *L.*
Prunus Cerasus *L.*
P. domestica *L.*
Rosa humilis *Marsh.*
R. Sayi *Schw.*
R. Engelmanni *Wats.*
Rubus setosus *Bigel.*
R. Millspaughii *Britton.*
Galium Kamtschaticum *Stell.*
Œnothera Oakesiana *Robbins.*
Chrysanthemum segetum *L.*
Artemisia serrata *Nutt.*
Lactuca hirsuta *Muhl.*
Blephilia ciliata *Raf.*
Polygonum cuspidatum *S. & Z.*
Quercus Brittoni *Davis.*
Scirpus Peckii *Britton.*
Panicum nitidum *Mx.*
P. laxiflorum *Lam.*
Zygodon conoideus *Dicks.*
Tricholoma serratifolium *Pk.*
T. submaculatum *Pk.*
Clitocybe albidula *Pk.*
C. revoluta *Pk.*
Collybia ochroleuca *Pk.*
Mycena rugosa *Fr.*
M. hemisphærica *Pk.*
Entoloma nidorosum *Fr.*
Tubaria canescens *Pk.*
Agaricus subrufescens *Pk.*
Hypholoma aggregatum *Pk.*
Deconica bryophila *Pk.*
D. bulbosa *Pk.*
Coprinus arenatus *Pk.*
Hygrophorus metapodius *Fr.*
Russula adusta *Fr.*
Merulius Corium *Fr.*
M. serpens *Tode.*
Odontia lateritia *B. & C.*
Thelephora subochracea *Pk.*
Corticium Kalmiæ *Pk.*
Exobasidium Vaccinii *Wor.*
Tylostoma mammosum *Fr.*
T. campestre *Morg.*
Lycoperdon hirtum *Mart.*
L. asterospermum *D. & M.*
L. perlatum *Pers.*
L. Curtisii *Berk.*
Didymium proximum *B. & C.*
Physarum contextum *Rost.*
Peronospora Linariæ *Fckl.*
Phyllosticta Dioscoreæ *Cke.*
Phoma vulgaris *Sacc.*
Macrophoma versabilis *Pk.*
Sphæronema Loniceræ *Pk.*
Septoria Trailiana *Sacc.*
Micropera Nemopanthis *Pk.*
Glœosporium Platani *Oud.*
G. phomoides *Sacc.*
G. fructigenum *Berk.*
Cylindrosporium Acori *Pk.*
Urocystis Waldsteiniæ *Pk.*
Cryptospora Gœppertiana *Kuhn.*
Æcidium Lupini *Pk.*
Uredo Chimaphilæ *Pk.*
Cylindrium griseum *Bon.*
C. elongatum *Bon.*
Verticillium sphærophilum *Pk.*
Periconia tenuissima *Pk.*
Zygodesmus fulvus *Sacc.*
Cladosporium Zeæ *Pk.*
Napicladium gramineum *Pk.*
Stilbum madidum *Pk.*
Coremium glaucum *Fr.*
Fusarium viticolum *Thum.*
Lachnella citrina *Pk.*
Anthostoma Ontariense *E. & E.*
Stigmatea Geranii *Fr.*
Massariella Xanthoxyli *Pk.*
Ophiobolus subolivaceus *Pk.*

Not new to the Herbarium.

Anemone Virginiana *L.*
A. nemorosa *L.*
Thalictrum polygamum *Muhl*
Magnolia glauca *L.*
M. acuminata *L.*
Nuphar advena *Ait.*

Nuphar Kalmianum *Ait.*
Arabis hirsuta *Scop.*
A. perfoliata *Lam.*
Nasturtium palustre *DC.*
Barbarea vulgaris *R. Br.*
Lepidium intermedium *Gr.*
Hudsonia ericoides *L.*
Viola sagittata *Ait.*
Arenaria serpyllifolia *L.*
A. Caroliniana *Walt.*
Buda rubra *Dumont.*
Hypericum Ascyron *L.*
Linum striatum *Walt.*
L. Virginianum *L.*
Erodium cicutarium *L'Her.*
Geranium Carolinianum *L.*
Flœrkea proserpinacoides *Willd.*
Vitis æstivalis *Mx.*
Polygala polygama *Walt.*
P. senega *L.*
P. sanguinea *L.*
Lespedeza violacea *Pers.*
Vicia sativa *L.*
V. tetrasperma *L.*
V. Cracca *L.*
V. Caroliniana *Walt.*
Cassia Marilandica *L.*
Prunus maritima *Wang.*
P. Persica *B. & H.*
Rubus neglectus *Pk.*
R. villosus *Ait.*
R. Canadensis *L.*
Rosa blanda *Ait.*
R. lucida *Ehrh.*
Amelanchier Canadensis *T. & G.*
Sedum acre *L.*
Drosera filiformis *Raf.*
Myriophyllum ambiguum *Nutt.*
Lythrum Salicaria *L.*
Epilobium lineare *Muhl.*
E. adenocaulon *Haussk.*
Œnothera fruticosa *L.*
Opuntia vulgaris *Mill.*
Aralia trifolia *D. & P.*
Viburnum cassinoides *L.*
Cornus florida *L.*
Galium pilosum *Ait.*
G. circæzans *Mx.*
G. boreale *L.*
G. trifidum *L.*
Galium triflorum *Mx.*
Solidago bicolor *L.*
S. humilis *Pursh.*
S. uliginosa *Nutt.*
S. rugosa *Mill.*
S. juncea *Ait.*
S. Canadensis *L.*
S. nemoralis *Ait.*
S. lanceolata *L.*
Sericocarpus conyzoides *Nees.*
S. solidagineus *Nees.*
Aster Herveyi *Gr.*
A. corymbosus *Ait.*
A. patens *Ait.*
A. undulatus *L.*
A. cordifolius *L.*
A. lævis *L.*
A. diffusus *Ait.*
A. paniculatus *Lam.*
A. prenanthoides *Muhl.*
A. puniceus *L.*
Erigeron annuus *Pers.*
E. strigosus *Muhl.*
Gnaphalium purpureum *L.*
Artemisia caudata *Mx.*
Senecio aureus *L.*
Cnicus horridulus *Pursh.*
C. pumilus *Torr.*
Hieracium præaltum *Vill.*
H. venosum *L.*
Sonchus asper *Vill.*
Lobelia spicata *Lam.*
Specularia perfoliata *A. DC.*
Campanula rapunculoides *L.*
Rhododendron viscosum *Torr.*
Chimaphila maculata *Pursh.*
Primula Mistassinica *Mx.*
Lysimachia stricta *Ait.*
Anagallis arvensis *L.*
Fraxinus viridis *Mx.*
Asclepias incarnata *L.*
A. verticillata *L.*
Hydrophyllum Canadense *L.*
Verbascum Thapsus *L.*
Linaria vulgaris *Mill.*
Mimulus moschatus *Dougl.*
Limosella aquatica *L.*
Veronica peregrina *L.*
Conopholis Americana *Wallr.*
Lycopus Virginicus *L.*

Scutellaria lateriflora *L.*
S. galericulata *L.*
Plantago major *L.*
P. Rugelii *Dec.*
P. lanceolata *L.*
P. Patagonica *Jacq.*
Chenopodium capitatum *Wats.*
C. Bonus-Henricus *L.*
Rumex Patientia *L.*
R. verticillatus *L.*
R. obtusifolius *L.*
R. Acetosella *L.*
Polygonum lapathifolium *L.*
P. Pennsylvanicum *L.*
P. amphibium *L.*
P. Persicaria *L.*
P. acre *H B K.*
P. cilinode *Mx.*
Euphorbia Presslii *Guss.*
Carya sulcata *Nutt.*
Salix nigra *Marsh.*
S. lucida *Muhl.*
S. fragilis *L.*
S. rostrata *Rich.*
S. petiolaris *Sm.*
S. cordata *Muhl.*
S. myrtilloides *L.*
Chamæcyparis sphæroidea *Spach.*
Aplectrum hiemale *Nutt.*
Spiranthes cernua *Rich.*
S. Romanzoffiana *Cham.*
Pogonia pendula *Lindl.*
Habenaria lacera *R. Br.*
Aletris farinosa *L.*
Iris prismatica *Pursh.*
Sisyrinchium anceps *Cav.*
Clintonia borealis *Raf.*
Lilium Philadelphicum *L.*
Trillium erectum *L.*
Heteranthera graminea *Vahl.*
Juncus marginatus *Rostk.*
J. Greenii *O. &. T.*
J. tenuis *Willd.*
J. Gerardi *Loisel.*
J. pelocarpus *E. Meyer.*
J. articulatus *L.*
J. militaris *Bigel.*
J. acuminatus *Mx.*
J. scirpoides *Lam.*
Cyperus strigosus *L.*
Scirpus maritimus *L.*
S. fluviatilis *Gr.*
S. polyphyllus *Vahl.*
S. silvaticus *L.*
Eriophorum cyperinum *L.*
Scleria pauciflora *Muhl.*
Carex intumescens *Rudge.*
C. lurida *Wahl.*
C. hystricina *Muhl.*
C. scabrata *Schw.*
C. vestita *Willd.*
C. filiformis *L.*
C. lanuginosa *Mx.*
C. stricta *Lam.*
C. torta *Boott.*
C. longirostris *Torr.*
C. arctata *Boott.*
C. Sullivantii *Boott.*
C. granularis *Muhl.*
C. conoidea *Schk.*
C. Hitchcockiana *Dew.*
C. laxiflora *Lam.*
C. digitalis *Willd.*
C. laxiculmis *Schw.*
C. plantaginea *Lam.*
C. eburnea *Boott.*
C. varia *Muhl.*
C. Pennsylvanica *Lam.*
C. communis *Bailey.*
C. vulpinoidea *Mx.*
C. sparganioides *Muhl.*
C. Muhlenbergii *Schk.*
C. cephaloidea *Dew.*
C. cephalophora *Muhl.*
C. echinata *Murr.*
C. canescens *L.*
C. tribuloides *Wahl.*
C. scoparia *Schk.*
C. fœnea *Willd.*
C. silicea *Olney.*
C. straminea *Willd.*
Spartina juncea *Willd.*
S. cynosuroides *Willd.*
Panicum virgatum *L.*
P. dichotomum *L.*
P. Crus-galli *L.*
Setaria Italica *Kunth.*
Anthoxanthum odoratum *L.*
Oryzopsis asperifolia *Mx.*
Muhlenbergia Mexicana *Trin.*

Muhlenbergia silvatica *T. & G.*
M. Willdenovii *Trin.*
Calamagrostis Canadensis *Bv.*
Agrostis alba *L.*
A. scabra *Willd.*
Deschampsia flexuosa *Trin.*
Trisetum subspicatum *Bv.*
Avena striata *Mx.*
Eatonia Pennsylvanica *Gr.*
Eragrostis Frankii *Meyer.*
Poa serotina *Ehrh.*
P. trivialis *L.*
P. debilis *Torr.*
P. alsodes *Gr.*
Glyceria obtusa *Trin.*
G. nervata *Trin.*
G. grandis *Wats.*
G. fluitans *R. Br.*
G. acutiflora *Torr.*
Festuca elatior *L.*
Bromus Kalmii *Gr.*
Elymus Virginicus *L.*
E. Canadensis *L.*
Equisetum limosum *L.*
Asplenium Filix-fœmina *Bernh.*
Aspidium spinulosum *Sw.*
Lygodium palmatum *Sw.*
Botrychium ternatum *Sw.*
Amanita muscaria *L.*
Armillaria mellea *Vahl.*
Tricholoma terreum *Schœff.*
Collybia radicata *Rehl.*
Pholiota discolor *Pk.*
Cortinarius pulchrifolius *Pk.*
Lactarius deceptivus *Pk.*
Polyporus cuticularis *Fr.*
Poria semitincta *Pk.*
Hydnum graveolens *Del.*
Porothelium fimbriatum *Fr.*
Thelephora Cladonia *Schw.*
Hymenochæte tabacina *Lev.*
H. corrugata *Lev.*
Corticium incarnatum *Lev.*
C. radiosum *Fr.*
C. subaurantiacum *Pk.*
Ceratium hydnoides *A. & S.*
Plasmopara viticola *B. & D.*
Monilia fructigena *Pers.*
Macrosporium commune *Rabh.*
Cladosporium herbarum *Lk.*
Cryptospora suffusa *Fr.*

(B.)

CONTRIBUTORS AND THEIR CONTRIBUTIONS.

Mrs. E. G. Britton, New York, N. Y.

Zygodon conoideus *Dicks.*

Mrs. D. B. Fitch, Norwich, N. Y.

Lygodium palmatum *Sw.*

Miss Bessie Grinnan, Madison Mills, Va.

Calostoma Berkeleyi *Mass.*

Rev. J. H. Wibbe, Schenectady, N. Y.

Chrysanthemum segetum *L.*
Artemisia serrata *Nutt.*
Erodium Cicutarium *L'Her*
Mimulus moschatus *Dougl.*
Polygonum cuspidatum *S. & Z.*
Eragrostis Frankii *Meyer.*

Rev. J. L. Zabriskie, Flatbush, N. Y.

Myriophyllum ambiguum *Nutt.*, var. limosum *Torr.*
Limosella aquatic *L.*, var. tenuifolia *Hoffm.*

Geo. F. Atkinson, Auburn, Ala.

Hypocrella tuberiformis *B. & Br.*
Microsphæria calocladophora *Atk.*
Ravenelia Cassiæcola *Atk.*
Uredo Fici *Cast.*
Ramularia areola *Atk.*
Cercospora Bolleana *Speg.*

S. M. Tracy, Starkville, Miss.

Phyllosticta ulmicola *Sacc.*
Vermicularia affinis *S. & B.*
Dinemasporium graminum *Lev.*
Glœosporium nervisequum *Sacc.*
Ustilago Uniolæ *E. & E.*
Uromyces Dactylidis *Ott.*
Puccinia globosipes *Pk.*
P. rubigovera *Wint.*
P. emaculata *Schw.*
P. coronata *Cd.*
P. Conoclinii *Seym.*
P. Anthoxanthi *Fckl.*
Phragmidium speciosum *Fr.*
Ravenelia Cassiæcola *Atk.*
Æcidium Oldenlandianum *E. & T.*
Melampsora Quercus *Schw.*
M. Hydrangeæ *Burr.*
Helminthosporium Ravenelii *B. & C.*
Entyloma Physalidis *Wint.*
Cercospora grisea *C. & E.*
C. gossypina *Cke.*
C. cruenta *Sacc.*
C. macroguttata *Atk.*
C. erythrogena *Atk.*
Erysiphe communis *Fr.*
Microsphæria Alni *Wint.*
Sphærotheca lanestris *Hark.*
Pseudopeziza Medicaginis *Lib.*
Acrospermum compressum *Tode.*

E. C. Howe, Lansingburgh, N. Y.

Carex hystricina *Muhl.*
C. tribuloides *Wahl.*
C. lurida *Wahl.*
Muhlenbergia Mexicana *Trin.*
Agrostis perennans *Tuck.*
A. vulgaris *With.*
Glyceria fluitans *R. Br.*

G. H. Hicks, Agricultural College, Mich.

Excipula Hicksiana *E. & E.*
Morchella bispora *Sor.*
Dendryphium corticola *E. & E.*
Verpa digitaliformis *Pers.*

A. P. Morgan, Preston, Ohio.

Bovista minor *Morg.*
Bovistella Ohiensis *E. & M.*
Hymenochæte purpurea *C. & M.*

M. A. Howe, Berkeley, Cal.

Glœosporium Pteridis *Hark.*

S. H. Burnham, Vaughns, N. Y.

Hypericum pyramidatum *Ait.*
Cuphea viscosissima *Jacq.*
Cardamine pratensis *L.*
Blephilia ciliata *Raf.*
Blitum Bonus-Henricus *Reich.*
Houstonia purpurea *L.*
Aplectrum hiemale *Nutt.*

J. Dearness, London, Can.

Phyllosticta Dircæ *E. & D.*
P. staphylina *D.*
Ceriosporella Dearnessii *E. & E.*
Micropera Fraxini *E. & E.*
Botrytis epichloris *E. & D.*
Puccinia Pimpinellæ *Lk.*
Pezicula carpinea *Pers.*
Melampsori chionea *Fr.*
Anthostomella mammoides *E. & E.*
Melanconis salicina *E. & E.*
Clypeosphæria ulmicola *E. & E.*
Sphærella Epilobii *Sacc.*
Otthia Ostryigena *E. & E.*
Thyridium Americanum *E. & E.*
Cucurbitaria ulmicola *Fckl.*
Diaporthe aliena *E. & E.*
D. tuberculosa *Sacc.*
D. spicata *E. & E.*
D. claviceps *E. & E.*

W. T. Davis, New Brighton, N. Y.

Quercus Brittoni *Davis.*
Q. nigra *L.*
Populus heterophylla *L.*

N. L. Britton, New York, N. Y.

Galium Kamtschaticum *Stell.*
Ranunculus septentrionalis *L.*
Aquilegia vulgaris *L.*
Lepidium Virginicum *L.*
Viola delphinifolia *Le Conte.*
Acer spicatum *Lam.*
A. Pennsylvanicum *L.*

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Geaster argenteus *Cke.*
Ustilago Hordei *K. & S.*
Uromyces Spragueæ *Hark.*
U. Zygadeni *Pk.*
U. Eriogoni *E. & H.*
U. Euphorbiæ *C. & P.*
U. borealis *Pk.*
U. Glycyrrhizæ *R. & M.*
Puccinia Polygoni *Pers.*
P. mirabillissima *Pk.*
P. consimilis *E. & E.*
P. Gayophyti *Pk.*
P. Phragmitis *Korn.*
P. Menthæ *Pers.*
P. Tanaceti *DC.*
P. intermixta *Pk.*
P. rubigovera *Wint.*
P. Grindeliæ *Pk.*
P. Troximontis *Pk.*
P. Balsamorrhizæ *Pk.*
P. Giliæ *Hark.*
P. Malvastri *Pk.*
P. mutabilis *E. & E.*
P. Hieracii *Mart.*
P. Helianthi *Schw.*
P. Jonesii *Pk.*
Phragmidium Potentillæ *Karst*
P. subcorticium *Wint.*
P. Rubi-Idæi *Karst.*
Melampsora Lini *Tul.*
M. farinosa *Schrœt.*
Melampsorella Cerastii *Schrœt.*
Cronartium asclepiadeum *Fr.*
Æcidium Clematidis *DC.*
Æ. Allenii *Clint.*
Æ. Violæ *Schum.*

Rubus Millspaughii *Britton.*
Vicia hirsuta *Koch.*
Zizia aurea *Koch.*
Osmorhiza longistylis *Torr.*
Erigeron bellidifolius *Muhl.*
Senecio aureus *L.*
Tussilago Farfara *L.*

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Æcidium gaurinum *Pk.*
Æ. Convallariæ *Schum.*
Æ. porosum *Pk.*
Æ. Ellisii *T. & G.*
Æ. hemisphæricum *Pk.*
Æ. Thalictri *Grev.*
Æ. monoicum *Pk.*
Æ. Urticæ *Wint.*
Æ. Plantaginis *Ces.*
Æ. Eurotias *E. & E.*
Æ. Cleomis *E. & A.*
Æ. Compositarum *Mart.*
Æ. Pini *Pers.*
Uredo Polypodii *DC.*
Rœstelia cornuta *Fr.*
Cystopus candidus *Lev.*
C. cubicus *DeBy.*
Ramularia arnicalis *E. & E.*
Cercospora Thaliæ *E. & E.*
Peziza scabrovillosa *Phil.*
Mollisia Montanensis *E. & E.*
Lachnella flammea *A. & S.*
Claviceps purpurea *Tul.*
Tapesia fusca *Pers.*
Erysiphe communis *Fr.*
E. graminis *DC.*
E. Cichoracearum *DC.*
Sphærotheca Castagnei *Lev.*
Uncinula Salicis *Wint.*
Physalospora megastoma *Pk.*
P. aurantia *E. & G.*
Rosellinia obliquata *Sacc.*
Teichospora mammoides *E.& E.*
Phyllachora Heraclei *Fr.*
P. Potentillæ *Schw.*
P. Wittrockii *Sacc.*

C. L. Shear, Alcove, N. Y.

Carex intumescens *Rudge.*
C. sparganioides *Muhl.*
C. Sullivantii *Boott.*

Botrychium ternatum *Sw.*
Amanita cæsarea *Scop.*
Urocystis Waldsteiniæ *Pk.*

* The following are specimens of fungi from the collection of the late F. W. Anderson. They were communicated by Prof. Britton.

Mrs. L. L. Goodrich, Syracuse, N. Y.

Flœrkea proserpinacoides *Willd.*

W. Herbst, Trexlertown, Pa.

Phallus Ravenelii *B. & C.* | Queletia mirabilis *Fr.*

W. Falconer, Glen Cove, N. Y.

Agaricus subrufescens *Pk.*

C. F. Millspaugh, Waverly, N. Y.

Cylindrocolla Dendroctoni *Pk.*

John E. Coventry.

A fasciated ear of corn, Zea Mays *L.*

E. H. Savage, Keeseville, N. Y.

Sand incrusted specimen of fungus, Polyporus fomentarius *Fr.*

Prof. James Hall, Albany, N. Y.

Four-headed flower of dandelion, Taraxacum officinale *Web.* on a single stout or fasciated scape.

(C.)

SPECIES NOT BEFORE REPORTED.

Papaver somniferum *L.*

Menands, Albany county. September. Cultivated for ornament but often self-seeding and sparingly escaping from cultivation.

Prunus Cerasus *L.*

Voorheesville and Delmar, Albany county, and Westport, Essex county. The sour cherry is sometimes spontaneous by roadsides and near farm-houses.

Prunus domestica *L.*

Amagansett, Suffolk county. An apparently starved or degenerate form of the cultivated plum grows in sandy soil in this locality. It assumes a straggling bush-like form three to four feet high, or in a few instances six to eight feet. The taller specimens were seen on the north side of the road leading from Amagansett to Easthampton. The leaves on the spurs are about six lines long and three lines broad. Those on the branches are about one inch long and half as wide. On the most thrifty shoots they scarcely exceed one and a half inch in length. Flowers and fruit not seen.

Rosa humilis *Marsh.*

This rose, which had been previously united with *R. lucida*, is considered a distinct species in the last edition of Gray's Manual. Its most prominent distinguishing features are its shorter stems, straight slender spines, narrow stipules and lobed outer sepals. These characters, however, are somewhat variable, so that individuals occur, which connect the two in such a way as to show that they are not very sharply limited. This is the most common species about Albany. It is abundant on Mount Defiance, near Ticonderoga, and is quite variable there. One noteworthy form has the spines nearly wanting, the leaflets numerous and small, generally eight or nine lines long, and the pedicels and calyx tube as glabrous as in *R. blanda*. From *R. blanda* it may be separated by the presence of an occasional spine and by the deciduous sepals. Can it be a cross between *R. blanda* and *R. humilis*, both of which occur in this locality? *R. humilis* appears to be equally at home on rocky, clayey or sandy soil. It is abundant in the eastern part of Long Island.

Rosa Sayi *Schw.*

I refer to this species, specimens collected near Westport, Essex county, in June. The essential characters of the species are shown, but in some cases only partially or slightly. The serrulate teeth of the leaflets are not always present, and their resinous-puberulent character is sometimes very slight. The stems are always very prickly, and often the branches also. The prickles are sometimes intermingled with straight, slender spines, and the stipules, which are either narrow or dilated, are pretty constantly and distinctly glandular-ciliate. The leaflets are more rounded or obtuse at the base than in *R. blanda*, from which it is separated by the characters just mentioned, although its variation from typical *R. Sayi* seems to be in the direction of *R. blanda*. In the Manual the species is credited from Northern Michigan and Wisconsin to Minnesota and Colorado. Possibly it may have been introduced into our locality from the west, but it is well established both north and west from Westport, and has been here many years.

Rosa Engelmanni *Watson.*

Fruiting specimens of a rose very similar to the preceding species were collected several years ago at the base of Mount

Defiance, near Ticonderoga. They differ from *Rosa Sayi* in the shape of the fruit, which is distinctly longer than broad.

Rubus Millspaughii *Britton.*

Avalanche Pass, Essex county. *N. L. Britton.* Morehouseville, Hamilton county. July.

The glabrous character of this species separates it from small forms of *Rubus villosus* var. *frondosus.* The specimen contributed by Professor Britton is wholly without spines, those collected by myself have a few weak spines.

Rubus setosus *Bigel.*

Common in the southern and western part of the Adirondack region. Morehouseville and Lake Pleasant, Hamilton county, Old Forge or "Brown Tract," Herkimer county, and Garoga, Fulton county. July and August.

This plant was previously reported by me as *Rubus hispidus* var. *suberectus*, but later observations led me to the belief that it is a distinct species. Professor Britton agrees with me in this belief, and thinks it belongs to the species under which I have now placed it, and with the originally published description of which it agrees very well, except that its ripe fruit is black instead of red, as in Bigelow's plant. Doctor Torrey, in N. Y. State Flora, regarded Bigelow's plant as a variety of *Rubus hispidus* and abbreviated the description too much to make it satisfactory. The specimen which he placed in the Herbarium as a representative of this plant is clearly a mere form of *R. hispidus.*

R. setosus, as here understood, is quite plentiful in the localities mentioned and evidently delights in the soil of mixed sand and gravel which is common in that region. I observed the past season that it had taken possession of the old neglected garden of Arnold house, Fulton Chain, and was apparently fast overrunning the whole area. It thrives better on dry upland than in wet swampy places, though it occasionally appears in such localities. The old abandoned fields and pastures of the region mentioned are most congenial to it. Unthrifty specimens of it were seen on the summit of Bald mountain near Third lake. In no case have I found it associated with *R. hispidus*, which is strangely absent or scarce in this whole region. The fruit is ripe in August. It is rather small, black when ripe and scarcely inferior in flavor to that of the dewberry, *R. Canadensis*, or of the leafy blackberry and of Millspaugh's blackberry.

Galium Kamtschaticum *Stell.*

Mount Marcy. August. *Britton.* The specimens are in fruit, but no flowers are shown. The species may be distinguished from the glabrous variety of *Galium circæzans* by its long erect pedicels.

Œnothera Oakesiana *Robbins.*

Luzerne, Warren county. This is *Œ. biennis* var. *Oakesiana* Gr.

Chrysanthemum segetum *L.*

Introduced and growing in fields near Niskayuna, Schenectady county. September. *Rev. J. H. Wibbe.*

Artemisia serrata *Nutt.*

Banks of the Mohawk, three miles below the aqueduct and opposite Rock island. August. *Wibbe.*

An introduction from the west.

Lactuca hirsuta *Muhl.*

Rocky hillsides. Whitehall. June.

Blephilia ciliata *Raf.*

Vaughn's, Washington county. *S. H. Burnham.*

Polygonum cuspidatum *S. & Z.*

Banks of the Mohawk below the aqueduct, Schenectady county. August. *Wibbe.* Introduced as an ornamental plant, but sometimes escaping from cultivation.

Quercus Brittoni *Davis.*

Watchogue, Richmond county. September. *W. T. Davis.* Mr. Davis considers this oak to be a hybrid between *Quercus nigra* and *Q. ilicifolia.*

Scirpus Peckii *Britton.*

Lake Pleasant, Hamilton County. August. First collected in this locality in 1875. It was again collected in 1891, but in a new station. It was reported last year under the name *Scirpus polyphyllus* var. *macrostachys.* Professor Britton has recently published it as a distinct species, and as such it is now reported. It certainly is quite distinct from our ordinary forms of *S. polyphyllus.* Specimens sometimes occur in which a cluster of spikelets is borne on a long pedicel issuing from the axil of the uppermost leaf.

Panicum nitidum *Mx.*

Sandy soil near Riverhead. July.

Panicum laxiflorum *Lam.*

With the preceding species. July.

Zygodon conoideus *Dicks.*

Base of a birch tree. Adirondack mountains. *Mrs. E. G. Britton.* The specimen is sterile.

Tricholoma serratifolium *n. sp.*

Pileus fleshy, firm, convex or nearly plane, often irregular, dry silky or flocculose-squamulose, white, often slightly tinged with brown or yellowish-brown in the center, flesh white or whitish, taste at first mild, then acrid; lamellæ broad, close, adnexed, serrate or eroded on the edge, white; stem short, stout, solid, white; spores broadly elliptical or subglobose, .0002 to .00024 in. long, .0002 broad.

Pileus 2 to 4 in. broad; stem about 1 in. long, 3 to 6 lines thick.

Woods. Shokan. September.

This is apparently related to such species as *T. psammopodum* and *T. impolitum,* but distinct from them in color and in the character of the lamellæ.

Tricholoma submaculatum *n. sp.*

Pileus convex or nearly plane, sometimes slightly depressed in the center; glabrous, brownish, sometimes tinged with ferruginous, becoming obscurely spotted with age, flesh white; lamellæ thin, close, white, becoming orange-red or saffron color where wounded or bruised; stem solid, silky-fibrillose, white, often decumbent or radicating at the base; spores minute, broadly elliptical or subglobose, .00016 to .0002 in. long, .00016 broad.

Pileus 1 to 2 in. broad; stem 1 to 3 in. long, 3 to 5 lines thick.

Borders of woods. Shokan. September.

The species may easily be recognized by the obscurely spotted pileus and by the peculiar color assumed by any part of the plant where cut or bruised. The spots indicate an affinity with the tribe Guttata, but inasmuch as the specimens were collected in a dry time, the pileus did not exhibit the moist character to be expected in members of that tribe.

Clitocybe albidula *n. sp.*

Pileus thin, at first convex, then umbilicate or centrally depressed, glabrous, hygrophanous, pale grayish-brown and finely striatulate on the margin when moist, whitish when dry; lamellæ close, adnate or slightly decurrent, dingy-white; stem short, glabrous or slightly pruinose, hollow, colored like the pileus; spores minute, elliptical, .00016 to .0002 in. long, .0001 to .00012 broad.

Pileus about 1 in. broad; stem 1 in. long, 1 to 1.5 lines thick.

Under pine trees. Delmar. September.

Related to *C. candicans*, from which it is distinguished by its more dingy color and by its decided farinaceous odor. The margin of the young pileus is whitened by a pruinosity or a minute white villosity.

Clitocybe revoluta *n. sp.*

Densely cæspitose; pileus convex or nearly plane, glabrous, whitish and slightly striatulate on the margin when moist, white when dry, the thin margin commonly and irregularly revolute; lamellæ thin, narrow, close, adnate or slightly decurrent; stem glabrous, solid when young, stuffed or somewhat hollow when old, whitish; spores subglobose, .00016 to .0002 in. long.

Pileus 1 to 3 in. broad; stem 2 to 3 in. long, 3 to 5 lines thick.

Woods. Alcove, Albany county. September.

This plant forms dense tufts of considerable extent and composed of many individuals. In these tufts the pileus is more or less irregular with the margin wavy and revolute. Occasionally a plant is seen growing apart from the general mass and then its pileus is apt to be regular and the margin horizontal.

Collybia ochroleuca *n. sp.*

Pileus thin, convex, then umbilicate or centrally depressed, glabrous, pale ochraceous, flesh white, taste farinaceous; lamellæ broad, subdistant, rounded behind or emarginate, whitish; stem firm, slender, glabrous, stuffed or hollow, colored like the pileus; spores elliptical, .00024 to .0003 in. long, .0002 broad.

Pileus 6 to 12 lines broad; stem about 1 in. long, 1 line thick.

Woods. Shokan. September. Related to *C. esculenta*, but distinct by its umbilicate or depressed pileus and its farinaceous odor and taste.

Mycena hemisphærica *n. sp.*

Pileus thin, firm, hemispherical, glabrous, hygrophanous, brownish and striatulate when moist, gray or grayish-brown when dry; lamellæ subdistant, arcuate, adnate, livid-white; stem glabrous, hollow, livid-white; spores broadly elliptical, .00016 to .0002 in. long, .00012 broad.

Pileus 5 to 8 lines broad; stem 1 to 1.5 in. long, 1 to 1.5 lines thick.

Mossy prostrate trunks of trees in woods. Fulton Chain. August.

The species belongs to the tribe Rigidipedes. It is distinguished from *M. galericulata* by its hemispherical hygrophanous pileus, the character and color of the lamellæ and by its smaller spores. It is gregarious or subcæspitose in its mode of growth.

Mycena rugosa *Fr.*

Woods. Shokan. September.

Entoloma nidorosum *Fr.*

Woods. Shokan. September.

Our specimens differ from the type in having the stem solid and the lamellæ adnate. For the present I designate them as Var. *solidipes.*

Tubaria canescens *n. sp.*

Pileus very thin, almost membranous, convex, grayish-white or canescent, coated with minute whitish fibrils or appressed tomentum; lamellæ distant, decurrent, cinnamon color; stem slender, whitish, fibrillose, with a white mycelium at the base; spores elliptical, .00024 in. long, .00016 broad, often containing a shining nucleus.

Pileus 2 to 3 lines broad; stem 6 to 8 lines long.

Damp naked soil in woods. Selkirk. July.

This is a very small species closely allied to *Tubaria autochthona*, from which it is separated by the shape and color of the pileus, the decidedly decurrent lamellæ and the fibrillose stem. As in that species, the spores are unusually pale. The dry pileus is distantly sulcate or striate.

Agaricus subrufescens *n. sp.*

Pileus rather thin and fragile, at first deeply hemispherical, then convex or broadly expanded, often wavy or irregular, silky-fibrillose or minutely and obscurely squamulose, varying in color from whitish or grayish to dull reddish-brown, flesh white, unchangeable; lamellæ close, free, at first white or yellowish-white, then pinkish, finally blackish-brown; stem minutely flocculose below the annulus, hollow, white, somewhat thickened or bulbous at the base; the annulus membranous, white, externally flocculose; the mycelium white, forming slender branching root-like strings; spores elliptical, brown, .00024 to .00028 in. long, .00016 to .0002 broad.

Pileus 2 to 4 in. broad; stem 2 to 6 in. long, 4 to 8 lines thick.

Leaf mold. Glen Cove. October. *W. Falconer.* Also cultivated.

In the form of the young pileus and in its color in the reddish tinted specimens, also in the white color of the young lamellæ, this species makes an approach to *A. campestris* var. *rufescens*, but unlike that variety the wounded flesh does not become red. From typical *A. campestris* it differs in many respects — in the thin flesh, the color of the young lamellæ, the character of the stem and its annulus and in its mycelium. It resembles more closely *A. placomyces* and *A. silvaticus*, but from the former it may be separated by the shape of the pileus and the more obscure character of its scales and by its annulus, from the latter, by the color of the pileus and the young lamellæ and also by the annulus, which is externally floccose-squamulose and also not distant as in that species.

Mr. Falconer says that under cultivation it is exceedingly productive, growing equally well in sunshine and in shade, but being fond of warmth. When grown in the dark the color of the pileus is darker than when grown in the light. The mushrooms appear in twenty-four to thirty days after the planting of the spawn, which is about two weeks earlier than in the case of the common mushroom. They have a decided flavor and are good eating. From this it will readily be seen that in productiveness, early appearance and ability to endure warm weather it is an improvement on the common mushroom.

Hypholma aggregatum *n. sp.*

Densely cæspitose; pileus thin, convex or subcampanulate, grayish-white, obscurely spotted with appressed brownish fibrils; lamellæ subdistant, rounded behind, nearly free, at first whitish, then brown or blackish-brown with a whitish edge; stem rather long, hollow, somewhat floccose or fibrillose, white; spores brown, elliptical, .0003 in. long, .00016 to .0002 broad.

Pileus about 1 in. broad; stem 2 to 3 in. long, 1.5 to 2 lines thick.

At the base of trees and stumps in woods. Alcove. Sept.

The cæspitose habit and obscurely spotted grayish-white pileus are marked features of this species. From *H. silvestre* the species may be distinguished by its smaller size, adnexed or nearly free lamellæ, which have no rosy tint, and by its very cæspitose mode of growth.

Deconica bryophila *n. sp.*

Pileus thin, membranous on the margin, subconical, becoming convex or nearly plane, glabrous, hygrophanous, chestnut color or dark brown and striatulate on the margin when moist, creamy-white, grayish-white or pale brown when dry and often distinctly striate on the margin; lamellæ broad, distant, adnate or slightly decurrent, plane or ventricose, at first pale-brown, then purplish-brown; stem slender, slightly silky-fibrillose when young, stuffed or hollow, pallid or brown; spores brown, elliptical, .0003 in. long, .0002 broad.

Pileus 3 to 6 lines broad; stem 8 to 12 lines long.

Sandy soil among mosses. Delmar and Karner. May.

From *D. bullacea*, this species differs in its not viscid pileus and in its distant lamellæ. The chestnut-colored specimens sometimes have the center of the pileus darker than the margin.

Deconica bulbosa *n. sp.*

Pileus submembranous, convex, becoming nearly plane, glabrous, slightly striate on the margin, whitish tinged with brown; lamellæ broad, distant, adnate, purplish-brown; stem slender, firm, hollow, bulbous, both it and the bulb densely grayish-fibrillose: spores purplish-brown, elliptical, .0003 in. long, .0002 broad.

Pileus 3 to 6 lines broad; stem 8 to 12 lines long, scarcely half a line thick.

Dead stems of herbs. Delmar. September.

This small species resembles the preceding one in size, but it differs in its place of growth, its paler color, its bulbous stem and in the grayish fibrils that clothe both stem and bulb.

Coprinus arenatus *n. sp.*

Pileus thin, at first broadly ovate or subhemispherical, soon convex or campanulate, adorned with small white tomentose scales, striate on the margin, whitish or grayish-white, becoming grayish-brown with age; lamellæ broad, crowded, free, grayish-white, soon purplish-brown, finally black, furnished with numerous projecting hyaline cystidia; stem short, equal, glabrous, hollow, white; spores broadly ovate or subglobose, black in the mass, purplish-brown by transmitted light, .0003 to .00035 in. long, .00025 to .0003 broad.

Pileus 1 to 2 in. broad; stem 1 to 2 in. long, 1 to 2 lines thick.

Solitary or gregarious, growing on sandy soil recently overrun by fire. Karner. May.

The mycelium binds the sand together in a globular mass at the base of the stem. The scales of the pileus are easily separable and soon disappear. The marginal striations extend half way or more toward the center. The long cystidia give a peculiar appearance to the lamellæ, and in the fresh plant they may be seen extending across the interspaces. The species belongs to the section Tomentosi and is remarkable for its peculiar habitat.

Hygrophorus metapodius *Fr.*

Woods. Shokan. September. Our specimens were not at all viscid, nor did wounds of the flesh and lamellæ turn red, but in other respects they correspond so well to the figure and description of this species that we dare not separate them.

Russula adusta *Fr.*

Sandy soil in pine woods. Delmar. September.

Closely allied to *R. nigricans*, but differing in its thinner, closer and more decurrent lamellæ, which do not assume a reddish color where wounded. The specimens are commonly smaller than either *R. nigricans* or *R. sordida*, and they are less disposed to turn black in drying.

Merulius Corium *Fr.*

Decorticated wood of deciduous trees. Boiceville, Ulster county. September.

In our specimens the plants are wholly resupinate, slightly reflexed, or they have a well developed pileus. In this case the pileus is villous, concentrically sulcate and white. The hymenium also is somewhat concentrically sulcate. European authors do not agree in their descriptions of the size and shape of the spores of this species. In our specimens they are oblong or lanceolate, .0003 in. long, .00012 broad.

Merulius serpens *Tode.*

Decaying wood and branches. Lake Pleasant. August.

Odontia lateritia *B. & C.*

Interior of prostrate much-decayed trunks of deciduous trees, apparently birch, chestnut and oak. Fulton Chain. August. Shokan. September.

Under their description of this species, Berkeley and Curtis remark that *Phlebia hydnoidea* Schweinitz is apparently the same thing. So far as our specimens are concerned Schweinitz's description is far more complete and satisfactory than that of Berkely and Curtis, although the fungus is more closely allied to Odontia than to Phlebia. It forms extensive patches, creeping over the surface and following the inequalities of the wood. Although the substance is quite thick it is not separable from the matrix.

The color of the fresh plant is a beautiful orange, but it fades in drying so that it may not inaptly be called brick red. The hymenial warts or protuberances are sometimes arranged in lines or series. In drying, the surface becomes more or less chinky so that the protuberances appear to be collected in fascicles.

Thelephora subochracea *n. sp.*

Resupinate, incrusting, running over fallen leaves and twigs and forming suborbicular patches one to three inches broad, thin, tough, dry, pale-ochraceous, sometimes with a slight whitish byssine border.

Woods. Shokan. September.

The specimens have the appearance of some species of Corticium but the dry tough texture indicates a closer relation to Thelephora. They are scarcely in perfect condition.

Corticium Kalmiæ *n. sp.*

Effused, thin, tender, inseparable from the matrix; subiculum and indeterminate margin composed of slender whitish filaments; hymenium glabrous, continuous, yellowish-ochraceous; spores smooth, elliptical, .0004 to .0005 in. long, .00024 to .0003 broad.

Dead stems of mountain laurel, *Kalmia latifolia*.

Shokan. September.

This is apparently related to such species as *C. deglubens* and *C. secedens*, but differing from both of these in its inseparable character.

Exobasidium Vaccinii *Wor.*

Living leaves of bearberry, *Arctostaphylos Uva-ursi*. Riverhead. July.

Tylostoma mammosum *Fr.*

Sandy soil. Delmar. October. A rare species.

Tylostoma campestre *Morg.*

Sandy soil. West Albany. November.

Lycoperdon hirtum *Mart.*

Brewerton and Catskill mountains. This was formerly included by me with *L. atropurpureum*, from which it scarcely differs except in its depressed peridium and cord-like root.

Lycoperdon asterospermum *D. & M.*

North Greenbush and West Albany.

Lycoperdon perlatum *Pers.*

Brewerton, Adirondack and Catskill mountains. August and September. Following the illustrious Fries, I formerly included this with *L. gemmatum*, but it is so well marked by the prevailing form of the peridium and especially by the character of the spines of the cortex that it seems best to consider it a distinct species.

Lycoperdon Curtisii *Berk.*

Ground by roadside. Guilderland. October.

Didymium proximum *B. & C.*

Fallen twigs and leaves of pine. Lake Pleasant. August.

Physarum contextum *Rost.*

Bark of trees. Fulton Chain. August.

Peronospora Linariæ *Fckl.*

Living stems and leaves of Canadian toadflax, *Linaria Canadensis.* Riverhead. July. This fungus is described as pure white, but in our specimens the patches have a dirty-white or grayish hue often with a slight violaceous tint. The long and narrowly obovate conidia are quite characteristic.

Phyllosticta Dioscoreæ *Cke.*

Living leaves of yam, *Dioscorea villosa.* Riverhead. July. Var. *grisea.* Spots gray with a narrow reddish-brown margin; perithecia epiphyllous, numerous, black; spores globose or ovoid.

Phoma vulgaris *Sacc.*

Dead stems of long-fruited anemone, *Anemone cylindrica.* Delmar. June. The spores in our plant are slightly smaller than in the type.

Macrophoma versabilis *n. sp.*

Perithecia scattered, irregular, globose or compressed and hysteriiform, erumpent or subsuperficial, black; spores oblong-elliptical, colorless, .0005 to .0006 in. long, .00025 to .0003 broad; sporophores generally shorter than the spores.

Dead branches and galls of oak, *Quercus ilicifolia.* Karner. May.

Apparently intermediate in character between *M. dryina* and *M. nervisequa*, having spores like those of the former and perithecia somewhat resembling those of the latter.

Sphæronema Loniceræ *n. sp.*

Perithecia numerous, scattered uniformly, small, .009 to .012 in. broad, at first covered by the epidermis, then erumpent, narrowed above into a rostrum about as long as the diameter of the perithecium, black; spores numerous, elliptical or oblong, colorless, .00016 to .0003 in. long, .00008 to .00012 broad, oozing out in wet weather and forming a minute hyaline globule.

Living stems of hairy honeysuckle, *Lonicera hirsuta.* Brownville. June.

This is easily distinguished from *Sphærographium Loniceræ*, which has fusiform curved quadrinucleate spores.

Septoria Trailiana *Sacc.*

Living leaves of self-heal, *Brunella vulgaris.* Menands. August.

Micropera Nemopanthis *n. sp.*

Perithecia densely and prominently cæspitose, minute, black, opening on the application of moisture and revealing the whitish, gelatinous contents; spores subfiliform, curved or sigmoid, tapering toward each end, .0016 to .0024 in. long; sporophores short.

Dead branches of mountain holly, *Nemopanthes Canadensis.* Karner. May.

Glœosporium Platani *Oud.*

Living or languishing leaves of sycamore, *Platanus occidentalis.* Shokan. September.

This is quite distinct from *G. nervisequum*, both in habit and in the size and color of the acervuli.

Glœosporium phomoides *Sacc.*

Fruit of tomato. Menands. September.

Glœosporium fructigenum *Berk.*

On grapes. Menands. September and October.

This is destructive to the fruit, causing it to decay.

Cylindrosporium Acori *n. sp.*

Spots numerous, subelliptical, sometimes confluent, blackish, nuclei minute; spores amphigenous, forming minute tufts, white, oblong or subcylindrical, sometimes narrowed toward one end, .0004 to .0008 in. long, about .00016 broad.

Living or languishing leaves of sweet flag, *Acorus Calamus*. Sandlake. September.

The spots, in size and shape, resemble those of *Uromyces pyriformis*. They are sometimes slightly whitened in the center by the confluence of the tufts of spores.

Urocystis Waldsteiniæ *n. sp.*

Sori large, oblong, following the nerves of the leaf, commonly near the margin and nearly parallel to each other, surrounded by the ruptured epidermis, black; spores not easily separable, three to six or more in a glomerule, the central and peripheral similar, subglobose or elliptical, often angular, .0005 to .0006 inch long, .0004 to .0005 broad, the glomerules very unequal in size and in the number of component spores.

Living leaves of barren strawberry, *Waldsteinia fragarioides*. Alcove. June. *C. L. Shear.*

This species is apparently closely allied to *U. Filipendulæ*. It seems to connect Urocystis with Thecaphora and to be ambiguous between these two genera. When there are but three spores in a glomerule the central one is usually larger than the others.

Specimens of this fungus have also been received from Professor Dearness, of London, Canada.

Cryptospora Gœppertiana *Kuhn.*

Living stems and branches of Canadian blueberry, *Vaccinium Canadense*. Fulton Chain. August. Also on the same host and on swamp blueberry, *Vaccinium corymbosum*. Sandlake. September.

This fungus is destructive to its host. The affected branches appear to live but one year. Their leaves are dwarfed in size or wholly obliterated, the branches themselves are generally unnaturally multiplied, and appear to form tufts or clusters, and they are unusually thick or swollen and their tissues greatly changed. Sometimes they are much twisted, curved or contorted, but more often they are straight and erect. In color they are often reddish-brown or chestnut. I have never seen any fruit on an affected branch.

Æcidium Lupini *n. sp.*

Spots numerous, small, orbicular, at first yellowish-green, becoming purplish-brown with age; spermogones epiphyllous, central; peridia hypophyllous, crowded, short; spores globose, verruculose, orange-yellow, .001 to .0016 in. broad.

Living leaves of common lupine, *Lupinus perennis*. Karner. June.

Uredo Chimaphilæ *n. sp.*

Spots none; sori chiefly hypophyllous, scattered or crowded, a long time covered by the epidermis, yellow or pale-orange; spores narrowly ovate oblong or subelliptical, .001 to .0012 in. long, .0005 to .0007 broad.

Living leaves and flowers of spotted wintergreen, *Chimaphila maculata*. Amagansett. July.

The fungus seems to kill the leaves it attacks.

Cylindrium elongatum *Bon.*

Fallen leaves of chestnut. Shokan. September.

Cylindrium griseum *Bon.*

Fallen leaves of chestnut-oak, *Quercus Prinus*. Shokan. September. Much like the preceding species, but distinguished by its gray color.

Verticillium sphærophilum *n. sp.*

Hyphæ minutely and stellately tufted, white, sparingly branched; branches one to three at a node, rather long, gradually tapering upward; spores elliptical, .0003 in. long, .00015 broad.

On *Hypoxylon coccineum*. Shokan. September.

The Verticillium appears to develop from the ostiola of its host.

Periconia tenuissima *n. sp.*

Effused, forming a thin indefinite purplish-brown downy stratum on the matrix; fertile hyphæ erect, slender, simple, scarcely septate, .011 to .014 in. long, .00015 thick; spores aggregated into a minute head, globose, .0001 to .00012 in. broad, colored like but paler than the hyphæ.

On a thick stratum of mycelium of some wood inhabiting fungus. Adirondack mountains. July.

Zygodesmus fulvus *Sacc.*

Decaying bark of maple, *Acer saccharinum.* Lake Pleasant August.

Cladosporium Zeæ *n. sp.*

Mycelial filaments colorless, branched, creeping among the tissues of the matrix and causing the epidermis to rupture; fertile hyphæ slender, sparingly septate, more or less elongate; densely interwoven and forming a grayish-green velvety stratum; spores very variable, globose elliptical or oblong, .00016 to .0008 in. long, continuous or at length with one to three septa.

Unripened grains of Indian corn, *Zea Mays.* Menands. September.

The species of Cladosporium are generally saprophytes, but this one appears to attack the living tissues of the grain. The kernel ruptures at the apex, revealing its white starchy contents, which are soon overspread by a grayish-green or olivaceous velvety coating of filaments which give a moldy appearance to the exposed surface. The rupture widens and the contents gradually disappear till the grain is deeply excavated. The fungus is a peculiar and apparently an injurious one.

Napicladium gramineum *n. sp.*

Spots brown, soon elongated and confluent, often occupying the whole leaf; tufts minute, punctiform, black, the hyphæ short, crowded, somewhat nodulose above; spores clavate, having one to three septa, .0012 to .0024 in. long, .0004 to .0005 broad.

Living leaves of rough meadow grass, *Poa trivialis.* Delmar. June.

This fungus is evidently a harmful one. It kills the leaves attacked by it. It differs from *N. arundinaceum* in its punctiform habit and narrower spores.

Stilbum madidum *n. sp.*

Stems numerous, sometimes cæspitose, .02 to .03 in. long, white or whitish, glabrous; head minute, subglobose, pellucid-white; spores oblong, often slightly narrowed toward one end, .0005 to .0006 in. long, about .00016 broad.

Sap-moistened cut surface of a birch stump, *Betula lutea.* Lake Pleasant. August.

The mycelium permeates a gelatinous stratum which overspreads the wood. The species is distinguished from *S. macrocarpum* by its white capitulum and more narrow spores.

Coremium glaucum *Fr.*

Fallen acorns. Shokan. September.

This is considered by some to be a mere form of *Penicillium glaucum*, from which it differs in having a stem composed of compacted filaments.

Fusarium viticolum *Thum.*

Grapes. Menands. September.

Our specimens differ from the type in the smaller superficial sporodochia and in the longer and more acutely pointed spores. They constitute a new variety if not a distinct species. For the present I call them var. *uvicolum.* Sporodochia minute, numerous, gregarious, superficial, depressed, flesh-colored; spores narrowly fusiform, generally curved, acute or acuminate, three to five septate, .0016 to .002 in. long.

Lachnella citrina *n. sp.*

Receptacle minute, .02 to .03 in. broad, sessile or with a very short stem, villose-tomentose, citrine-yellow, the hymenium yellow inclining to orange, generally concealed, when dry, by the connivent margin; asci subcylindrical, about .003 in. long; paraphyses filiform, equaling, or a little surpassing the asci; spores oblong or subfusiform, .0004 to .0005 in. long, .00016 broad.

Bark of chestnut trees. Shokan. September.

In some instances the marginal hairs of the cups are white.

Anthostoma Ontariensis *E. & E.*

Dead branches of willow, *Salix discolor*. Karner. May.

In our specimens the stroma is eutypoid rather than valsoid and the spores are a little broader than in the type.

Stigmatea Geranii *Fr.*

Living and languishing leaves of Carolinian cranesbill, *Geranium Carolinianum*. Brownville. June.

Massariella Xanthoxyli *n. sp.*

Perithecia small, .02 to 028 in. broad, immersed in the bark, scattered or subseriate, slightly elevating and at length piercing the epidermis; asci 8-spored; spores crowded or biseriate, at first colorless, then colored, uniseptate, quadrinucleate, oozing out and forming a conical mass, then distinctly uniseptate but not nucleate, .0024 to .0027 in. long, .0005 to .0007 broad.

Dead stems and branches of prickly ash, *Xanthoxylum Americanum*. Mechanicville. May.

In young specimens the bark has a much smoother and cleaner appearance than in old ones. In these it is roughened and stained by the heaps of ejected spores. The young spores have a strong resemblance to those of *Massaria vomitoria*, but the perithecia are much smaller than in that species and the uniseptate mature spores are quite distinct.

Ophiobolus subolivaceus *n. sp.*

Perithecia numerous, depressed, .012 to .014 in. broad, at first covered by the epidermis, then superficial, black; asci clavate or cylindrical; spores slightly curved, gradually narrowed toward each end, yellowish-brown by transmitted light, five-septate, .002 to .0025 in. long, .00016 broad, the third cell slightly swollen.

Dead stems of herbs, apparently of *Thalictrum polygamum*. Mechanicville. May.

This is closely allied to *O. olivaceus*, from which I have separated it because of its superficial perithecia and constantly five-septate spores.

(D.)

EXTRA LIMITAL SPECIES.

The following species of fungi, which are considered new or worthy of mention, have been received from correspondents for identification. They were collected outside the limits of our State and are therefore noticed separately.

Phallus Ravenelii *B. & C.*

Var. *minor*. Plant small, 2 to 3.5 inches high, the part of the veil pendant from the top of the stem about equal to the pileus in length.

Trexlertown, Pennsylvania. *W. Herbst.*

Queletia mirabilis *Fr.*

Spent oak tan bark. Trexlertown, Pennsylvania. August. *Herbst.* So far as I know, this rare and interesting fungus has not before been detected in this country. It has the appearance of a large overgrown species of Tylostoma. The specimens vary from two to six inches long. The peridium or head is globose, and from one to two and a half inches in diameter. The stem is from four to eight lines thick, and externally is very ragged, shreddy and lacerated. It is easily separable from the head, to which it is attached in a kind of socket as in Tylostoma. The genus Queletia is especially distinguished from Tylostoma in having no apical aperture to the peridium. This, when mature, cracks open, either by a single long fissure or by several. The description of the single known species, as given in Sylloge, does not agree fully with our specimens, but these are manifestly the same specifically as a specimen collected in France and communicated to us by Doctor N. Patouillard, who labeled it *Queletia mirabilis* Fr. The dimensions of our specimens considerably exceed those assigned to the species, the spores are smaller and the color of the contents of the peridium is a dull tawny or brownish-ochraceous rather than flavescent or golden yellow, so that I should have considered them a distinct species, or at least a variety, but for their agreement with the specimen from France.

Phoma exocarpina *n. sp.*

Perithecia gregarious, subsuperficial, .014 in. broad, black; spores narrowly elliptical, hyaline, .0003 to .0004 in. long, .00016 broad.

Exocarp of old pignuts, *Carya porcina*. Michigan. May. *G. H. Hicks.*

Macrophoma Philodendri *n. sp.*

Perithecia scattered or gregarious, small, .007 to .014 in. broad, variable in form, thin, erumpent, black, opening by a wide mouth when moist and revealing the white mass of spores within; spores oblong or subcylindrical, colorless, sometimes binucleate, .0006 to .0008 in. long, .00016 to .0002 broad, supported on slender sporophores about equal to the spores in length.

Var. *maculicola*. Perithecia on definite white spots.

Living and dead leaves of *Philodendron pertusum*, growing in a conservatory. Michigan. May. *Hicks.*

Morchella bispora *Sor.*

Var. *truncata*. Pileus broadly rounded or truncate, its costæ slightly prominent, the margin often a little recurved; paraphyses numerous; stem long. Michigan. May. *Hicks.*

Geopyxis Hicksii *n. sp.*

Receptacle about 6 lines broad, infundibuliform, glabrous, brownish, the hymenium adorned with a few costæ radiating from the center; stem slender, from 8 to 12 lines long, scarcely 1 line thick, slightly enlarged above and expanding into the receptacle, brown; asci cylindrical, .0006 to .0008 in. long, .0005 broad; spores elliptical, even, .0005 to .0006 in. long, .0003 to .0004 broad.

Ground. Michigan. May. *Hicks.*

Remarkable for the straight radiating ridges of the hymenium by which the species may easily be recognized.

Urnula Geaster *n. sp.*

Receptacle urceolate or cupulate, 1 to 2.5 inches broad, at length splitting into 4 to 6 rays, narrowed below into a stem-like base 3 to 5 lines thick, externally everywhere clothed with a dense velvety coat of slender, interwoven, minutely papillose brown hairs, flesh white; hymenium white or whitish, .035 in. thick; asci very long, cylindrical, .03 in. long; spores uniseriate, oblong or oblong-fusiform, pointed at each end, colorless, .0025 to .003 in. long, about .0006 broad, often containing a single large nucleus.

Ground. Austin, Texas. November. *L. M. Underwood.*

This species is well marked by its Geaster-like rays, its dense external velvety-tomentose covering, its thick hymenium and its very long spores. These surpass in length the spores of any other species of Urnula known to me.

Diatrypella Underwoodii *n. sp.*

Stroma small, .014 to .028 in. broad, prominent, subsuperficial, convex or subconical, uneven, black; perithecia few, 1 to 3 in a stroma, the ostiola obscure; asci fusiform or subclavate, long-pedicellate, the sporiferous part about .003 in. long, often swollen or irregularly tumid in the middle or at the base, the pedicel nearly as long as the sporiferous part; spores allantoid, .0003 in. long, .0001 broad.

Dead branches of mesquit. Austin, Texas. November. *Underwood.*

Distinguished for its very small verrucose stroma with few perithecia, and for its singularly swollen and irregular asci.

Rhytidhysterium Prosopidis *n. sp.*

Perithecia superficial, very hard when dry, subelliptical or trigonal, black, with very obtuse, thick, involute, crenulate or transversely sulcate-costate labiæ, becoming expanded and softer when moistened, suborbicular, revealing the dingy yellowish-green distinctly margined disk; asci slender, cylindrical, .007 to .008 in. long, .00045 to .0005 broad, eight-spored; spores uniseriate, oblong, sometimes slightly curved, at first colorless and uniseptate, then colored and triseptate, .0008 to .0012 in.

long, .0003 to .0004 broad; paraphyses slightly surpassing the asci, several times forked or multifid at the apex.

Dead branches of mesquit, *Prosopis juliflora.* Austin, Texas. November. *Underwood.*

This species is apparently related to *R. Braziliense,* from which I have separated it because of its more slender asci and smaller spores.

Chætophoma setigera *n. sp.*

Perithecia minute, .003 to .005 in. broad, gregarious, epiphyllous and amphigenous, subglobose, black, seated on a thin effused superficial separable blackish stratum of interwoven filaments and adorned with a few slender erect or divergent black setæ .003 to .0045 in. long; spores numerous, minute, elliptical or oblong, colorless, .00016 to .00024 in. long, .00008 to .0001 broad, often with a minute nucleus at each end.

Living leaves of coast live oak, *Quercus agrifolia.* Berkeley, California. March. *M. B. Howe.*

Cylindrocolla Dendroctoni *Pk.*

(Flora of West Virginia, p. 516.)

Sporodochia minute, forming irregular masses, white or whitish, somewhat waxy; sporophores slender, abundantly branched above, often compacted below into a short stem-like base; spores catenulate, short cylindrical, subtruncate, colorless, .00016 to .0002 in. long, .00008 to .0001 broad.

Dead insects, *Dendroctonus frontalis,* and the inner bark of pine just about them. West Virginia. May. *C. F. Millspaugh.*

The insects are probably killed by the fungus as they lie dead in the furrows which they had excavated in the inner bark of pine trees, *Pinus inops.*

(E.)

NOTES AND OBSERVATIONS.

Anemone Virginiana *L.*

The variety with white obtuse petals was found near Whitehall.

Anemone nemorosa *L.* var. **quinquefolia.**

Common near Delmar, also at Karner. May.

Magnolia glauca *L.*

This small but beautiful tree has long been credited to Long Island, but I have been able to find it in only a single locality. In this place the trees are ten or twelve feet high and very slender, the trunk scarcely exceeding an inch or an inch and a half in diameter. The branches are short, which give the trees a rather strict appearance. The flowers are creamy-white and the fruit globular rather than "oblong." In the N. Y. State Flora its blossoming time is said to be May and June, but the past summer the trees were yet in blossom on the fifteenth of July. It is greatly to be hoped that the owners of the land where these trees grow will not allow them to be destroyed. There are not many of them, and it is possible they may be the only wild representatives of the species in our State.

Arabis perfoliata *Lam.*

This rare plant still exists on the rocky banks of the Black river below Watertown, where it was found more than fifty years ago.

Buda rubra *Dumont.*

Hempstead Plains. July. A small form three or four inches high.

Hypericum Ascyron *L.*

This plant which is not common in our State has been found in Washington county. *Burnham.*

Erodium Cicutarium *L' Her.*

Fields near Schenectady. July. *Wibbe.*

Flœrkea proserpinacoides *Willd.*

Near Syracuse. *Mrs. L. L. Goodrich.*

Vitis æstivalis *Mx.* var. **bicolor** *Le Conte.*

Whitehall. July.

Polygala polygama *Walt.*

West side of Mount Defiance on thin soil covering rocks. June. A form having pale-pinkish flowers was collected near Riverhead; also near Amagansett. July.

Polygala sanguinea *L.*

Alcove. September. A late flowering form springing up in meadows and having the flowers wholly bright-purple. The common form on Long Island, which was in blossom in July, has the flowers greenish-purple.

Vicia sativa *L.* var. **angustifolia** *Ser.*

Adams. June.

Vicia tetrasperma *L.*

Bethlehem. June. This introduced species of vetch is evidently not limited to places near the sea coast as indicated in the Manual.

Vicia Cracca *L.*

Roadsides. Ticonderoga and Brownville. June.

Rosa blanda *Ait.*

Rocky banks of the Black river below Brownville. June. The absence of spines in this species together with its glabrous peduncles and calyx tubes and its persistent sepals, makes it one of the most easily recognizable of our native roses. The stems often have a few prickles toward the base but so far as I have seen they are always glabrous above. The rose found near Westport and which, in this Report I have referred to *R. Sayi*, seems to be intermediate between this species and typical *R. Sayi*. Its fruit is similar to that of *R. blanda*, but its stems and often its branches are very prickly, its stipules which are either narrow or dilated are distinctly glandular-ciliate and its leaflets are more rounded at the base and their serratures occasionally serrulate. The prickly stems usually have slender spines interspersed among the prickles. For these reasons it seems rather to be a variety of *R. Sayi* than of *R. blanda*.

Rosa Carolina *L.*

This is the only wild rose I have found in the heart of the Adirondack wilderness. It occurs along the inlets of Raquette lake and at Forked lake. It is in flower there in August. In one instance a tendency to the formation of double flowers was shown, the blossom having seven petals. The species occurs in all parts of the State. The fine serratures of the leaflets appear to be the most available character for distinguishing this species from its allies. The stems are sometimes very prickly, especially when young.

Rosa lucida *Ehrh.*

"Margins of swamps or moist places" is given in the Manual as the habitat of this species. On Long Island it is not uncommon to find unmistakable forms of it growing in dry places and associated with *R. humilis.* The stout spines, which are either straight or curved, seem to be the most available character by which to distinguish it from *R. humilis*, but it must be confessed that intermediate forms occur which are perplexing. I have not observed prickles on the stem of this species, but they are sometimes present in *R. humilis.*

Amelanchier Canadensis *T. & G.*

A form of variety *rotundifolia*, three to six feet high, occurs in sandy soil near Karner. Variety *oblongifolia* also grows there, but generally with the leaves rounded or broadly oval. A dwarf form also occurs, three or four feet high and having three to six flowers in a raceme. The petals are short and narrow.

Sedum acre *L.*

Very plentiful about Brownville, growing in thin soil covering rocks.

Myriophyllum ambiguum *Nutt.*

Fisher's island, Suffolk county. *Rev. J. L. Zabriskie.* The small variety *limosum.*

Lythrum Salicaria *L.*

Head of Lake Champlain. July.

Cuphea viscossissima *Jacq.*

Vaughn's, Washington county. *Burnham.* This is an extension of its range northward.

Opuntia vulgaris *Mill.*

Specimens of an Opuntia found growing in sandy soil near the mouth of Peconic river, with few or no spines, short leaves and fruit not over an inch long appear to be referable to this species, to which they are referred in the State Flora.

Galium pilosum *Ait.*

A small form six to nine inches high, with short internodes, leaves about half an inch long and flowers crowded in small dense clusters was collected on the north slope of Skylight mountain, one of the Adirondacks. It might be called variety *parvum.*

Galium circæzans *Mx.* var. **glabrum** *Britton.*

Leaves and stems nearly glabrous; corolla glabrous. Whitehall, New Scotland and Sandlake. July.

Solidago bicolor *L.*

A branching form, both of this and its variety *concolor,* is quite common. Each branch is terminated by a spike-like panicle of flowers.

Solidago humilis *Pursh.*

Top of Bald mountain, near Third lake, Herkimer county. Four distinct forms of this species occur in this limited station. First, a very leafy dwarf form, four to six inches high with a short dense panicle one to two inches long. Second, a very leafy form eight to twelve inches high, with an oblong leafy interrupted but dense panicle. The margins of the lower leaves are often wavy toward the base. These forms make a very close approach to the Western var. *nana.* Third, a still taller form in which the stem is less leafy, the leaves are smaller, more narrow and scattered, and the panicle is elongated, narrow and spike-like, but commonly interrupted either in its entire length or toward the base only. This is one to two feet high. The upper leaves are entire, the lower and radical ones more or less bluntly serrate. The stem is either green or purple and is glabrous below. This is the most abundant form. The fourth form is like this in all respects except that it has a broader, more branched panicle. The panicles in all the forms are so glutinous that they adhere to the drying papers when placed in press.

It is a little remarkable that this species should exhibit such a variety of forms in such a limited locality. All the forms appeared to be growing under the same conditions of soil, temperature, moisture and exposure. I suspect this is the plant which in Paine's Catalogue is referred to *Solidago speciosa* var. *angustata.* It is separable from that species by its glutinous panicle, more numerous rays and more narrow radical leaves. A large form of this species was collected on the gravelly bank at the outlet of the Lower Ausable pond. It is apparantly the same as that credited in the Manual to the "base of the White Mountains."

Solidago uliginosa *Nutt.*

In a "beaver meadow" about one mile southeast of the Forge House, Fulton Chain, a singular form of this species grows. The lower branches of the panicle are elongated and appressed, thus causing the panicle to take a pompon shape. In this locality the species was in blossom in August, and did not appear to be any earlier than *Solidago arguta*, *S. Canadensis*, *S. rugosa* and *S. lanceolata*, all of which were in flower there at the same time.

Solidago rugosa *Mill.*

A varietv *pallida*, having both ray and disk flowers a pale creamy yellow color, occurs at Shokan, Ulster county.

Solidago nemoralis *Ait.* var. **elongata** *Pk.*

Abundant about Shokan.

Aster Herveyi *Gray.*

Borders of woods. Blue Mountain lake and Voorheesville. August and September.

In the Manual this is indicated as an "ambiguous species" approaching *A. macrophyllus*. It is indeed liable to be mistaken for that species, at least in some of its forms, if I rightly understand it. In the New York specimens the branchlets and peduncles are glandular-hairy and the involucral scales are glandular and the rays are violet as in *A. Herveyi*, though in some instances the color is pale violet. On the other hand, the leaves are not always lanceolate, but are sometimes ovate and distinctly serrate. They are also rough and rather thick as in *A. macrophyllus*. But this species, as described in the N. Y. State Flora, has a reddish-tawny pappus, while in our violet-rayed specimens the pappus is white or whitish, which is an additional reason for separating them from *A. macrophyllus* if this should prove to be a reliable character. It seems best, therefore, to consider them as a variety of *A. Herveyi*, and to indicate their character thus: *Aster Herveyi* Gr. var. *intermedia* Pk. Branchlets and peduncles glandular-hairy; heads large; rays violet; involucral scales glandular, erect, all or all except the longer and more pointed inner ones, green or with green tips; pappus white or whitish; leaves rather thick and rough, ovate or lanceolate, the lower on naked petioles and more or less cordate, the upper sessile, the radical leaves large, broadly ovate-cordate, rough, on long naked petioles.

Apparently intermediate between typical *A. Herveyi* and *A. macrophyllus.* With this it has probably been confused, but from it it may be separated by the larger heads, color of the rays and pappus and glandular peduncles.

Aster corymbosus *Ait.*

A pale, violet-rayed form with white pappus was obtained at Shokan. In general appearance it is quite like ordinary forms, but the color of the rays and of the pappus indicates a slight variation toward *A. Herveyi.*

Aster cordifolius *L.* var. **lævigatus** *Porter.*

This variety, well-marked and easily recognized, though not indicated in the Manual, extends northward to Shokan, in the Catskill mountains.

Aster lævis *L.*

West Albany. September. A form having rays nearly white. This is apparently the same or nearly the same as the white-rayed form found at Fort Edward by Dr. Vandenburg and mentioned in the Flora of North America. The color of the rays becomes a little more bluish-tinted in drying.

Aster diffusus *Ait.* var. **variifolius** *n. var.*

Heads scattered, mostly on bracted peduncles one-half to one inch long; branches horizontally spreading or slightly ascending; leaves sharply serrate with prominent teeth, varying from very long and narrowly lanceolate to oblong-ovate, acuminate, the broadest ones abruptly narrowed towards the base as if into a widely margined petiole.

Sandlake and Catskill mountains. September.

In the Manual this species is described as having the leaves lanceolate or oblong-lanceolate, the lower somewhat serrate in the middle. In our specimens all the leaves have very distinct serratures and they vary greatly in shape. Because of the scattered heads on long peduncles it seems to connect with *A. Tradescanti*, from which, as well as from *A. diffusus* var. *bifrons*, it differs in the character of its leaves.

Aster prenanthoides *Muhl.*

This species which, in the N. Y. Flora, is credited to the western part of the State only, is abundant and variable in the Catskill mountains. The heads are corymbose or paniculate, the rays are white, bluish-white, violet or blue and the leaves vary from the typical ovate acuminate form with its long abrupt and conspicuously contracted base to a narrowly lanceolate form in which the basal contraction is scarcely noticeable. They vary in length from two and a half to six or seven inches. They are generally distinctly serrate, but in a form which seems sufficiently well marked to merit designation as variety *diffusifolius*, the serratures are less prominent, the leaves are shorter, widest in the middle and less abruptly contracted, so that in shape they are strongly suggestive of those of the ordinary form of *A. diffusus.* The paniculate heads are about three lines high and the scales are less spreading than in the type.

This variety seems to run into *A. prenanthoides* on one hand and into *A. puniceus* on the other. Its agreement with the description of *A. puniceus* var. *lævicaulis* is very close, and I have not referred our specimens to this variety because of the character and arrangement of the hairs of the upper part of the stem and its branches and because of its apparent more close connection with *A. prenanthoides* in habitat size and appearance of the heads and shape of the leaves. The plants were associated in locality with both these species and may perhaps be a cross between them.

Senecio aureus *L.* var. **Balsamitæ** *T. & G.*

Rocky bank of Black river below Brownville. June.

Hieracium præaltum *Vill.*

This troublesome weed, recently introduced into the northern part of the State is rapidly spreading. It was found in three places near Adams, Jefferson county. It is evidently not particular as to soil or surroundings. It grows in sandy, clayey or gravelly soil, in places wet or dry, on naked ground or among grasses and exposed to the full rays of the sun or protected by the shade of trees. It already has a foothold in at least three counties.

Vaccinium stamineum *L.*

The fruit of this species sometimes attains a diameter of five or six lines. Its flavor is similar to that of the cranberry for which it might be made a substitute.

Arctostaphylos Uva-ursi *Spreng.*

Abundant in sandy soil in the eastern part of Long Island.

Primula Mistassinica *Mx.*

This rare and local plant is still an inhabitant of the rocky cliffs along Fish creek above Taberg. Its flowers vary in color from white to pink or lilac.

Phlox divaricata *L.*

Near Sanford's Corners, Jefferson county. June.

Mimulus moschatus *Dougl.*

Near Middle Grove, Saratoga county. July. *Wibbe.*

Conopholis Americana *Wallr.*

Woods near Shokan.

Rumex verticillatus *L.*

Head of Lake Champlain growing in water two or three feet deep and emitting from the submerged joints of the stem numerous rootlets.

Polygonum amphibium *L.*

In the pond and river which form the outlet of the Fulton Chain of lakes, this species forms circular patches, which, from a little distance, might be taken for small islands. The plants are densely matted and in the central part of the patch they rise above the surface of the water and send up erect shoots, thus giving the aspect of an elevation in the center. Contrary to the Manual description, these plants have flower spikes from one to three inches long as in *P. Muhlenbergii.* Nor are these always terminal, for the stem is sometimes prolonged or branched near the top in such a way as to leave the flower spikes lateral or axillary. I label the specimens var. *longispicatum.*

Polygonum acre *H. B. K.*

Sea shore near Amagansett. July. This is a form in which the leaf has a dark colored central spot.

Polygonum cilinode *Mx.*

A small form, variety *erectum*, eight to twelve inches high, was discovered on the top of Bald mountain. Not finding anything on which to climb it assumes an erect mode of growth. It is either simple or sparsely branched. Its behavior is in marked contrast to that of the woodbine, *Cissus Ampelopsis*, another climbing plant, which, when growing in places where it finds nothing on which to climb, trails over the ground.

Aplectrum hiemale *Nutt.*

This rare plant occurs sparingly near Vaughn's, Washington county. *Burnham.*

Habenaria lacera *R. Br.*

Border of woods. Selkirk. July. This is a peculiar form worthy of designation as var. *elongata.* Flower spike eight to ten inches long, bracts narrow, linear-lanceolate, the lower ones much longer than the flowers, segments of the corolla, longer and more slender than usual, the middle segment of the lip linear, scarcely widened at the tip.

Aletris farinosa *L.*

Abundant on Hempstead Plains in open fields. July.

Juncus tenuis *Willd.* var. **secundus** *Engelm.*

Riverhead and Amagansett. July. Blue Mountain lake. August. The branches of the panicle are not always incurved, but the secund capsules give to the plant a very distinct appearance. Var. *congestus*, or its eastern analogue, was collected at Amagansett.

Juncus Greenii *O. & T.*

Riverhead, Amagansett and Hempstead Plains. July.

Juncus militaris *Bigel.*

Near Riverhead. July.

Scirpus polyphyllus *Vahl.*

Shandaken, Ulster county. Some of the plants emit leafy tufts or shoots among the rays after flowering.

Eriophorum cyperinum *L.*

Of var. *laxum* there is a form in which the spikelets are collected or crowded into a more or less dense somewhat gobular head. Blue Mountain slide. August. Sandlake. September. In the Sandlake specimens the spikelets are more tawny in color. It might be called form *condensatum.*

Scleria pauciflora *Muhl.*

Hempstead Plains. July.

Carex intumescens *Rudge.*

In the Manual this is said to have two fertile spikes. Specimens having three fertile spikes were collected at Blue Mountain lake; also in Alcove by Mr. Shear. They do not appear to be very unusual with us.

Carex lurida *Wahl.*

This species usually has but one staminate spike, but Dr. Howe finds, at Lansingburgh, specimens having two; a short one just below the base of the long one. In some instances the short one is pistillate at the apex. Variety *altior* was collected on Montauk Point. Dr. Howe also finds *Carex hystricina* with two staminate spikes. A small form of this species occurs near Adams. It has but one or two small and very short fertile spikes. In the latter case they are often very distant.

Carex torta *Boott.*

Three quite distinct forms of this species grow along Fish creek, near Taberg. In one the fertile spikes are long, loosely flowered at the base, and distant, and the lowest bract is long and leaf-like, much surpassing the spike and nearly equaling the culm in length. In the second the spikes are approximate with the bracts very slender and shorter than the spikes. In the third form the fertile spikes are shorter, about one inch long, more compactly flowered, approximate and erect or merely spreading. All are more or less staminate at the apex and the scale equals or exceeds the perigynium. The bracts are shorter than the spikes. This form approaches *Carex stricta* in appearance and is so well marked that I would call it var. *staminata.*

Carex Hitchcockiana *Dew.*

Slopes of Mt. Defiance. This is a few-flowered form having one to three perigynia in a spike, with the scales barely equaling, or shorter than the perigynia.

Carex Pennsylvanica *Lam.*

This is a very variable species, and some of the forms seem to be worthy of special designation, as forms if not varieties.

Form *bracteata.* Bract of the lowest spike green, elongated, generally exceeding its spike. Oak woods. Voorheesville.

Form *paleacea.* Scale large, ovate-lanceolate, longer than the perigynium. Sandy soil. Karner.

Variety *distans.* Fertile spikes four to eight lines apart. Sandy soil. Lerayville.

Variety *angustifolia.* Leaves very narrow, one-half to two-thirds of a line wide, mostly longer than the culm. Long Island. This appears to be a good variety. By its narrow leaves it approaches *Carex varia* Muhl., but the character of the spikes and of the perigynia require its reference to *C. Pennsylvanica.* Form *bracteata* makes an approach toward *C. communis.*

Carex cephaloidea *Dew.*

Woods near Adams. June. Rare in the eastern part of the State.

Carex canescens *L.*

Montauk Point. July. This is a singular form in which the uppermost spike is wholly staminate or nearly so. I call it var. *staminata.*

Carex fœnea *Willd* var. perplexa *Bailey.*

Rocky hills near Whitehall. July. In our specimens the spikes are distinctly narrowed at the base, the heads are sometimes slightly nodding and the inner face of the perigynium is less prominently nerved. They appear to approach more nearly *C. straminea.*

Carex tribuloides *Wahl.* var. Bebbii *Bailey.*

Lansingburgh. *Howe.* Variety *reducta* Bailey was collected at Blue Mountain lake in a form with the spikes aggregated in an oblong head, an inch or an inch and a half long. It might be called form *aggregata.*

Setaria Italica *Kunth.*

Raquette lake. A dwarf form with spikes scarcely half an inch long, apparently the result of an attempt to cultivate the Hungarian grass in a cold climate and an uncongenial soil.

Agrostis alba *L.* var. minor *Vasey.*

Lansingburgh. *Howe.* A form closely resembling this in external appearance, but having an awn as long as the flower and a palet about one-fourth as long as the flowering glume, was collected at Riverhead. It is well marked by the awn, which rises near the base of the flower and is somewhat bent in the middle, but other forms also have the same kind of an awn, notably the one which in the Flora of New York is referred to *A. stricta.*

Calamagrostis Canadensis *Bv.*

In the Adirondack region this common grass often has the panicle contracted both before and after flowering.

Trisetum subspicatum *Bv.* var. molle *Gr.*

Abundant on the rocky banks of Black river below Brownville. June.

Poa serotina *Ehrh.*

On dry rocky hillsides near Whitehall is a form having panicles of comparatively few two-flowered spikelets.

Glyceria nervata *Trin.*

Woods near Adams. June. This is a leafy form with small green flowers and spikelets for which Dr. Vasey suggests the name var. *parviflora.*

Glyceria grandis *Wats.*

Whitehall. July. A form with green spikelets. It grew in the shade.

Aspidium spinulosum *Sw.*

The typical form of this fern is said to be rare in this country It is very abundant near the top of Blue mountain. August.

Lygodium palmatum *Sw.*

McDonough, Chenango county. *Mrs. D. B. Fitch.* This is the second station in which this fern has been found in our State.

Botrychium ternatum *Sw.*

Alcove. *Shear.* A singular form with two fertile fronds.

Amanita muscaria *L.* var. **alba** *Pk.*

This variety is common about Alcove. *Shear.* It also occurs on Long Island in two forms, the normal one and a smaller one in which the warts of the pileus are evanescent or wanting. Not infrequently it makes a close approach to white forms of *A. pantherina,* in having the upper part of the bulb uniformly margined by the remains of the definitely circumscissile volva, but this margin is more acute than in that species.

Armillaria mellea *Vahl.*

There seems to be no end to the variations of this most poly morphous species. A well marked variety, var. *bulbosa,* has the stem rather short and terminating below in a large bulb. Two patches of this variety were found near Shokan. The plants were growing on the ground under hemlock trees, *Tsuga Canadensis*, and were generally cæspitose. There were scores of these tufts and in all, the plants had bulbous stems. This is the direct counterpart to var. *radicata*, in which the stem ends below in a long root-like point which penetrates the earth deeply, and resembles the tap-root of *Collybia radicata*. Varieties *obscura flava* and *glabra* of Gillet all occur in our State, and to these may be added also var. *albida* Pk. in which the pileus is white or whitish. I have also received from Dr. Taylor of Washington, D. C., and from Dr. Jelliffe of Brooklyn, a densely cæspitose, slender-stemmed form with no annulus, it being evanescent or entirely wanting. This I call var. *exannulata*. It is scarcely distinguishable from *Clitocybe aquatica* Banning, and *Clitocybe monadelpha* Morg., which, I suspect, will yet have to be referred to this species. According to Quelet, *Clitocybe socialis* DC., and *Agaricus gymnopodius* Bull, also probably belong here.

The abortive form often associated with *A. mellea* and in no way distinguishable from the abortive form of *Clitopilus abortivus*, has a farinaceous taste, but this is lost in cooking. When cooked and properly seasoned this abortive form is quite as well-flavored and as good to eat as the normal form.

Armillaria viscidipes *Pk.*

This fine large species was found near Shokan, growing on the banks of a stream. The stem sometimes penetrates the earth quite deeply and the annulus at first conceals the lamellæ.

Tricholoma terreum *Schæff.*

Var. *atrosquamosum* (T. atrosquamosum *Chev.*), occurs near Shokan.

Tricholoma fumescens *Pk.*

Fine specimens of this rare species were found near Shokan. The plants sometimes attain a size considerably larger than the dimensions of the typical form, the pileus being even two or three inches broad and the stem six lines thick. The taste is at first farinaceous; then sweetish. The lamellæ in the dried specimens are almost as black as in mature *Agaricus campester*.

Pholiota discolor *Pk.*

Var. *minor*. Small; pileus 6 to 10 lines broad, chestnut color when young or moist; stem about 1 line thick, at first clothed with whitish fibrils. Among mosses about or on the base of stumps. Shokan. September.

Galera teneroides *Pk.*

This species is not rare in the Adirondack woods. It often grows on decaying wood and branches. The color, though approaching that of *G. tener*, is more dull or brownish both when moist and when dry. The moist pileus is sometimes striatulate almost to the disk.

Agaricus silvicola *Vitt.*

The New York specimens heretofore referred to this species differ in some respects from the European plant if we may rely upon the published descriptions. The stem is quite constantly abruptly bulbous at the base, and the annulus is usually double, the lower or exterior one being of a floccose texture, smaller and split in a radiating manner as in that of *A. arvensis*. The very young lamellæ are also whitish as in that species and wounds or bruises of the flesh are apt to become yellowish, all of which indicate a closer affinity in our plant to *A. arvensis* than to *A. campester*. It seems to me, therefore, that greater scientific accuracy will be attained by referring our plant to *A. arvensis* as a var. *abruptus*, and considering it distinct from the European *A. silvicola*, which is described as having a simple annulus and which is figured as having the stem slightly and gradually thickened at the base. The name *abruptus* will indicate the character of the bulb in our plant. I have made trial of its edible qualities and find it very good eating, though scarcely as highly flavored as the common mushroom.

Psilocybe squalidella *Pk.*

Var. *cæspitosa*. Densely cæspitose; pilei often irregular from mutual pressure, firm but flexible and elastic, pale-alutaceous or watery-brown when moist, ochraceous or reddish-yellow when dry; stem subcartilaginous, somewhat fibrous, stuffed or hollow, frequently wavy, reddish-brown or rufescent, paler at the top, especially when young, usually with a dense whitish or gray villosity at the base.

In wet places. Shokan. September.

The typical form of the species was referred to Hypholoma, but the absence of any well-developed veil and the subcartilaginous texture of the stem indicate that its true place is in Psilocybe, in the vicinity of *P. spadicea.*

Cortinarius pulchrifolius *Pk.*

Delmar and Shokan. September. This rare species, which is well-marked by the peculiar color of the young lamellæ which resembles that of the lamellæ of *Clitocyle laccata* or *C. ochropurpurea*, was discovered on Long Island in 1880, but until this year I had not observed it again. The filaments of the veil are sometimes very copious.

Paxillus involutus *Fr.*

In the uncooked state this fungus has a harsh unpleasant flavor, but it loses this to a great extent in cooking. The flesh also assumes a dark color in cooking, for which reason, together with its want of delicious flavor, I should class it as a second-rate edible species.

Boletus affinis *Pk.*

Sandy soil. Amagansett. July. This has been tested as to its esculent properties. It has an agreeable flavor and is moderately tender. The flesh is white, at first firm but becoming softer with age. The color of the pileus also becomes paler with age.

Polyporus circinatus *Fr.*

Var. *proliferus.* Like the typical form but having one or more pilei developed from the upper surface of the first one. Fulton Chain. August.

Polyporous cuticularis *Fr.*

Standing trunk of maple, *Acer saccharinum.* Shokan. September. The incurved margin of the pileus is a very noticeable and good distinguishing feature of this species.

Polyporus sulphureus *Fr.*

If taken when fresh and young, before the pores have formed, and carefully cooked, this fungus makes a very palatable dish.

Trametis Sepium *Berk.*

This species often occurs in a resupinate form, which, when growing in the woods, is sometimes several inches in extent. The pileate form is generally very narrow though sometimes greatly elongated laterally by the confluence of several individuals.

Stereum complicatum *Fr.*

Var. *laceratum.* Margin of the pileus lacerated or multifid. Shokan. September.

Pterula setosa *Pk.*

Dr. Patouillard has founded a new genus, *Hirsutella*, to which he has transferred this species. He also transfers *Thelephora pedicellata* Schw. to a new genus, *Septobasidium.*

Comatricha aqualis *Pk.*

Mr. Geo. Massee, in his Monograph of the Myxogastres, concludes that the genus Comatricha is so intimately connected with the genus Stemonitis that it is untenable. He therefore places this and other species of Comatricha in Stemonitis. This species is sometimes abundant on decaying wood of sugar maple in the Adirondack forests. The thin fugacious walls of the sporangia have a silvery luster.

Trichia reniformis *Pk.*

Bark of striped maple, *Acer Pennsylvanicum.* Fulton Chain. August. A rare but well-marked and very distinct species. The clustered or subcæspitose mode of growth, the brown color of the peridia and the short elaters are peculiar features. It has also occurred at Karner on bark of red maple, *Acer rubrum*

Didymium microcarpum. *Rost.*

An apparent variety of this species has spores a little larger than in the type and on smooth surfaces the stem rises from a circular hypothallus, which is adorned with radiating lines as in *D. radiatum.*

Chrysomyxa Pyrolæ *Rostr.*

Living leaves of *Pyrola chlorantha.* Delmar. June. The uredo form on this host has the sori much more scattered than on the leaves of *Pyrola rotundifolia.*

Plowrightia morbosa *Sacc.*

This noxious fungus is subject to considerable variation in its behavior and in its time of fruiting. Specimens were collected on choke cherry, *Prunus Virginiana*, near Karner, May 16th, in which conidia and ascospores were both present in abundance. Conidia-bearing excrescences were also found which were evidently due to the sowing of spores, as they were alone on branches containing no others. These probably were due to last year's sowing of spores, for if of the present year's sowing they must have developed with unusual rapidity. Specimens of this fungus were also collected on the wild red cherry, *Prunus Pennsylvanica*, on the slopes of Blue mountain. The excrescences were mostly single on the branches and gave no evidence of a disposition to spread by the extension of the mycelium. In many cases the affected branch was already dead or in a dying condition, in which cases there would, of course, be no spread of the disease by the mycelium.

Cryptospora suffusa *Tul.*

Var. *nuda.* Stroma not suffused with a yellowish dust. On dead stems of alder and hazel-nut. Karner and West Albany. The black circumscribing line is also apparently absent in some cases.

(F.)

NEW YORK SPECIES OF PLUTEOLUS.

Pleuteolus *Fr.*

Pileus slightly fleshy, conical or campanulate, then expanded, viscid, the margin at first straight, appressed to the stem; stem subcartilaginous, distinct from the hymenophorum; lamellæ rounded-free. *Hym. Europ.*, p. 266.

This genus corresponds to the genus Pluteus in the pink-spored series. The species are similar in structure to the species of that genus, but they differ somewhat in the character of the stem and in the color of the lamellæ and spores. Its species were separated by Fries from the genus Galera because of their viscid pileus and free lamellæ. I have included in it two species formerly referred to Galera by me. They are *Galera expansa* and *G. callista.* They do not quite fully meet the requirements of the generic character inasmuch as their lamellæ are not entirely free, but in other respects, and especially in the viscid pileus, they agree better with this genus than with Galera. The attachment of the lamellæ to the stem is very slight, but just enough to show the intimate relationship of the two genera.

Synopsis of the Species.

Lamellæ wholly free.. 1
Lamellæ slightly adnexed.................................. 2
1. Plant growing on dung or rich soil .... coprophilus.
1. Plant growing on decaying wood................ reticulatus.
2. Plant growing on damp soil in exsiccated water holes.................................... callistus.
2. Plant growing on decaying wood or rich soil... expansus.

Pleuteolus coprophilus *n. sp.*

Dung-loving Pluteolus.

Pileus thin, submembranous, fragile, conical or campanulate, becoming nearly plane, somewhat viscid when moist, finely striate on the margin, pinkish-grey; lamellæ narrow, crowded, free, pale cinnamon; stem long, straight or somewhat flexuous, hollow, white, sometimes tinged with pink; spores elliptical dark-ferruginous, .0005 to .0006 in. long, about .0003 in. broad.

Pileus 1 to 1.5 in. broad; stem 2 to 3.5 in. long, 1 to 2 lines thick.

Dung heaps. Albany and Warren counties. May and June.

The plants sometimes are cæspitose. The striations of the pileus are similar to those of *Galera lateritia*, from which this species is separated by its more expanded viscid pileus, different color and free lamellæ.

Pluteolus expansus *Pk.*

Expanded Pluteolus.

(*Galera expansa* Pk. Twenty-sixth State Mus. Rep., p. 58.)

Pileus submembranaceous, becoming nearly plane or centrally depressed, viscid, plicate-striate on the margin, brownish-ochraceous, often tinged with yellow, grey, pink or greenish hues; lamellæ narrow, close, rounded behind, slightly adnexed, pale cinnamon or ferruginous; stem rather long, slender, fragile, equal or slightly tapering upward, hollow, faintly striate, pruinose, yellow or greenish-yellow; spores .00045 to .0005 in. long, .00025 to .0003 broad.

Pileus 1 to 1.5 in. broad; stem 3 to 4 in. long, 1 to 2 lines thick.

Decaying wood and rich ground. Onondaga and Rensselaer counties. June to August.

Var. *terrestris*. Pileus grayish-yellow, tinged with green, stem greenish-yellow. Growing on rich or well-manured soil. The plicate striations of the pileus are similar to those of *Galera flava* and *G. coprinoides*. The species has been removed to this genus because of the viscidity of the pileus, nevertheless it must be confessed that such a feature is scarcely satisfactory for generic distinction.

Pluteolus callistus *Pk.*

MOST BEAUTIFUL PLUTEOLUS.

(*Galera callista* Pk. Twenty-sixth State Mus. Rep., p. 59.)

Pileus thin, expanded, subumbonate, smooth, viscid, striatulate on the margin, olivaceous or ochraceous, the umbo bright chestnut color; lamellæ thin, close, ventricose, adnexed, easily separating from the stem, yellowish becoming bright ferruginous; stem equal, hollow, pruinose, yellow; spores elliptical, .00035 to .0004 in. long, .0002 to .00025 broad.

Pileus 6 to 10 lines broad; stem 1 to 1.5 in. long, .5 line thick.

Exsiccated water holes in low swampy woods. Lewis county. September.

This pretty little agaric was discovered in 1872, but has not since been rediscovered. It may, therefore, be regarded as very rare. In the dried specimens the lamellæ are white on the edge, and the pileus has assumed a dull metallic green color. The species is placed in this genus because of its expanded and viscid pileus.

Pluteolus reticulatus *Pers.*

RETICULATED PLUTEOLUS.

(Hym. Europ., p. 266. Sylloge vol. v., p. 859.)

Pileus slightly fleshy, campanulate, then expanded, viscous, reticulate with anastomosing veins, pale violaceous, striate on the margin; lamellæ free, ventricose, crowded, saffron-ferruginous;

stem hollow, fragile, fibrillose, mealy at the top, white; spores elliptical, ferruginous, .0004 to .0005 in. long, .0002 to .00025 broad.

Pileus 1 to 2 in. broad; stem 1 to 2 in. long, 1 to 2 lines thick.

Decaying wood. Cattaraugus county. September.

The specimens which I have referred to this species appear to be a small form with the pileus scarcely more than an inch broad and merely rugose on the disk, not distinctly reticulate as in the type. In the dried specimens the pileus has assumed a dark violaceous color. The dimensions of the spores have been taken from the American plant. I do not find them given by any European author.

NEW YORK SPECIES OF GALERA.

Galera *Fr.*

Veil none or fibrillose. Stem subcartilaginous, continuous with the hymenophorum, tubular. Pileus more or less membranaceous, conical or oval, then expanded, striate, the margin at first straight and appressed to the stem. Lamellæ not decurrent. *Hym. Europ.*, p. 266.

The species of this genus are small and mostly rather fragile. The pileus is thin and when young is conical, oval or bell-shaped, but in some at least, it becomes expanded with age. When young or moist it has a watery, or hygrophanous appearance, and is then either striate or striatulate because of its thinness. The colors are either whitish, yellow, ochraceous, cinnamon or ferruginous in nearly all of our species, but owing to the hygrophanous character these generally become paler in the dry plant. The lamellæ are commonly yellowish, tawny, cinnamon or ferruginous. The stem is slender, often straight, fragile and hollow and colored like the pileus. The genus holds the same place in the ochraceous-spored series that Mycena holds in the white-spored series and Nolanea in the pink-spored series. Some grow on dung or in rich grassy, ground, others are found in woods, either on naked soil or on decaying leaves, wood or branches and others still occur habitually in wet or damp places among Sphagnum or other mosses.

The species have been arranged by Fries in three groups or sections. Of the first section we have six representatives, of the second, three, and of the third, one. An additional section has been formed which contains two species One-half of our twelve species appear to be peculiar to this country.

SYNOPSIS OF THE SPECIES.

Plants growing among mosses 1
Plants not growing among mosses 4
1. Pileus commonly 4 to 6 lines broad 2
1. Pileus commonly 9 to 12 lines broad .... Sphagnorum.
2. Margin of the pileus naked or not fibrillose 3
2. Margin of the pileus adorned with white fibrils... rufipes.
3. Stem pruinose at the top .... Hypnorum.
3. Stem naked at the top .... aquatilis.
4. Plant growing on dung or in grassy places 5
4. Plant growing in uncultivated places 8
5. Pileus plicate-sulcate .... coprinoides.
5. Pileus not plicate-sulcate 6
6. Pileus ferruginous when moist .... ovalis.
6. Pileus paler, yellowish or tawny-cinnamon when moist.. 7
7. Pileus narrowly conical, striate when dry .... lateritia.
7. Pileus broadly conical, not striate when dry .... tener.
8. Plant growing on hulls of buckwheat .... sulcatipes.
8. Plant having some other habitat 9
9. Pileus pale-yellow .... flava.
9. Pileus some other color 10
10. Lamellæ narrow, close .... teneroides.
10. Lamellæ broad, subdistant .... inculta.

CONOCEPHALÆ. Pileus conic-campanulate, hygrophanous, nearly even, when dry sprinkled with soft atoms; stem straight; lamellæ ascending, inserted in the top of the cone, somewhat crowded. Veil none.

Galera lateritia *Fr.*

BRICK-RED GALERA.

(Hym. Europ., p. 267. Sylloge Vol. v, p. 860.)

Pileus thin, narrowly conical or acorn-shaped, often becoming campanulate, hygrophanous, yellowish when moist, whitish or ochraceous when dry, finely striate on the margin; lamellæ narrow or linear, crowded, ascending, nearly free, pale-cinnamon or tawny-ferruginous; stem straight, slender, fragile, hollow, minutely striate, sprinkled with minute mealy particles or clothed with a minute villosity, white; spores elliptical, ferruginous, .0005 to .00055 in. long, .0003 to .00035 broad.

Pileus 6 to 12 lines broad; stem 2 to 3 in. long, scarcely 1 line thick.

Dung or rich grassy ground. Albany and Rensselaer counties. June to September.

This may be separated from the next following species by its more elongated narrowly conical pileus distinctly striate on the margin and by its narrower linear lamellæ. The striations are fine and close and often reach half way to the center of the pileus. In our specimens they are distinct even in the dried plant. We have seen no specimens having the pileus as dark colored as in the Friesian figure of the moist plant, but many of our American agarics are paler or have paler forms than the European figures indicate for the same species. The hygrophanous character of the pileus is less clearly shown than in *Galera tener*. As in that species, there are forms in which both pileus and stem are clothed with a minute downy pubescence. When partly dry the pileus feels sticky when pressed between the thumb and fingers.

Galera tener *Schœff.*

TENDER GALERA.

(Hym. Europ., p. 267. Sylloge Vol. v, p. 860.)

Pileus thin, conical broadly and obtusely conical or campanulate, hygrophanous, pale-ferruginous or tawny-cinnamon color and striatulate when moist, whitish or creamy-yellow when dry, often sprinkled with shining atoms; lamellæ broad, rather close, ascending, adnate, cinnamon color; stem straight, slender, fragile, hollow, somewhat shining, commonly finely striate, colored like the pileus; spores elliptical, dark ferruginous, almost rubiginous, .0005 to .00065 in. long, .0003 to .0004 broad.

Pileus 4 to 10 lines broad; stem 1.5 to 3 in. long, scarcely 1 line thick.

Dung and rich grassy ground. Common. June to September.

This is our most common species of Galera. It sometimes grows in great abundance where cattle have been yarded and in rich lawns or pastures. It is often found growing on dung in company with *Panæolus campanulatus.* It varies much in size. A small form, form *minor*, occurs having the pileus hemispherical and only three or four lines broad.

Var. *pilosella* (*Agaricus pilosellus* Pers.), has both pileus and stem clothed with a minute erect pubescence when moist. A form is sometimes found in which the center of the pileus is brown or blackish-brown.

Galera teneroides *Pk.*

Wood-loving Galera.

(Twenty-ninth State Museum Report, p. 39.)

Pileus thin, campanulate or expanded, hygrophanous, brownish-cinnamon and striatulate when moist, paler when dry; lamellæ narrow, close, yellowish-cinnamon; stem straight, slender, hollow, colored like the pileus; spores nearly elliptical, subluteus, .0003 to .00035 in. long, .00016 to .0002 broad.

Pileus 6 to 12 lines broad; stem 1 to 2 in. long, about half a line thick. Ground, dung and decaying wood and branches in woods. Adirondack mountains and in Albany county. June to September.

This species is closely related to *Galera tener* as may be inferred from the name, but it is nevertheless distinct in its more brown or smoky-tinted color, more expanded mature pileus, more narrow lamellæ and smaller paler spores.

Galera ovalis *Fr.*

Oval Galera.

(Hym. Europ., p. 268. Sylloge Vol. v, p. 862.)

Pileus somewhat membranaceous, oval or campanulate, hygrophanous, brownish-ferruginous and obscurely striatulate on the margin when moist, paler and even when dry, fragile; lamellæ nearly free, very broad, ventricose, ferruginous; stem straight, slender, hollow, slightly striate, colored nearly like the pileus; spores elliptical, dark-ferruginous, .0004 to .0005 in. long, .00025 to .0003 broad.

Pileus 8 to 12 lines broad; stem 3 to 4 in. long, about 1 line thick.

Dung. Albany county. June.

The specimens which I have referred to this species were collected many years ago. I have not found any like them since. They differ from *Galera tener* chiefly in their larger size and darker color, both when moist and when dry. The species is evidently a very rare one.

Galera sulcatipes *Pk.*

SULCATE-STEMMED GALERA.

(Thirty-fifth State Mus. Rep., p. 132.)

Pileus thin, ovate, conical or subcampanulate, hygrophanous chestnut-colored and mostly striatulate on the margin when moist, paler when dry; lamellæ ascending, subdistant, adnate, whitish becoming ferruginous-cinnamon; stem slender, straight or flexuous, equal, hollow, rather tenacious, striate-sulcate, silky, floccose-pruinose toward the base, white; spores elliptical, ferruginous-cinnamon, .00025 to .0003 in. long, .00016 broad.

Pileus 5 to 8 lines broad; stem 1.5 to 3 in. long, about 1 line thick.

Gregarious on a pile of buckwheat bran lying on the ground in woods. Albany county. August.

The white and almost shining stem is striate and silky above, pulverulent or floccose-pruinose toward the base where it generally assumes a greenish-blue color if handled when moist. The pileus fades in drying to subochraceous. The lamellæ are sometimes white on the edge. Found in 1881 but not detected since. A rare species but very distinct in the character of its stem and in its peculiar habitat.

Galera inculta *Pk.*

RUDE GALERA.

(Forty-first State Mus. Rep., p. 69.)

Pileus thin, somewhat fragile, campanulate, then convex or nearly plane, obtuse or rarely with a small umbo, hygrophanous, cinnamon color and striatulate when most, buff color and atomate when dry, sometimes minutely pitted or corrugated, rarely rimose-squamulose; lamellæ broad, subdistant, ventricose, adnexed, white crenulate on the edge, at first pallid, then pale-cinnamon; stem straight or subflexuous, hollow, brittle, slightly silky, reddish-brown, sometimes mealy or pruinose at the top and white-villose at the base; spores subelliptical, pointed at each end, brownish-ferruginous, .0006 to .00065 in. long, .0003 broad.

Pileus 6 to 12 lines broad; stem 1 to 1.5 in. long, .5 to 1 line thick.

Damp ground under willows and alders. Catskill mountains. September.

The moist pileus resembles in color that of the small glabrous striatulate form of *Clitocybe laccata*, the dry one that of *Galera tener*. The specimens were found growing with *Naucoria paludosa*, from which they may be distinguished by the more campanulate pileus, the broader and more distant lamellæ and the larger spores.

Bryogenæ. Pileus membranaceous, campanulate, striate, glabrous, hygraphanous, even when dry, opake, slightly silky; stem thin, lax, flexile; lamellæ broadly and plainly adnate, broad, subdenticulate. Slender, growing among mosses, the veil very fugacious.

Galera aquatilis *Fr.*

Aquatic Galera.

(Hym. Europ., p. 270. Sylloge Vol. v, p. 869.)

Pileus membranaceous, campanulate or convex, glabrous, watery, hygrophanous, pallid-honey color and striatulate on the margin when moist, soft and whitish when dry, often with a yellowish papilla; lamellæ distant, triquetrous, plane, adnate, pallid; stem very long, slender, even, glabrous, whitish or yellowish; spores elliptical, .0004 in. long, .00024 broad.

Pileus to 6 lines broad; stem (in our specimens) 2 to 3 in. long, scarcely 1 line thick.

Among mosses in wet places. Catskill mountains. July. A rare species. In our specimens the stem is less elongated than in the European plant.

Galera Sphagnorum *Pers.*

Sphagnum Galera.

(Hym. Europ., p. 270. Sylloge Vol. v. p. 869.)

Pileus thin, conical convex or expanded, sometimes with a small umbo or papilla, hygrophanous, tawny or subochraceous and usually striatulate on the margin when moist, pale-ochraceous or buff when dry; lamellæ thin, subdistant, tawny-ochraceous;

stem slender, hollow, more or less fibrillose, subflexuous, colored like the pileus; spores elliptical or subovate, .0004 to .0005 in. long, .00025 to .0003 broad.

Pileus 6 to 12 lines broad; stem 2.5 to 5 in. long, 1 to 1.5 lines thick.

In marshes among Sphagnum. Fulton, Rensselaer and Seneca counties and Adirondack mountains. June to August.

This is easily distinguished from *Galera Hypnorum*, to which it has sometimes been subjoined as a variety, by its larger size, more expanded pileus, fibrillose stem and peculiar place of growth. There is a notable form with a well-developed veil which may be designated var. *velata*. Veil white, webby or almost membranous, breaking up on the upper part of the stem and forming floccose scales, often evanescent with age. In this variety the moist pileus is sometimes chestnut color or bay red, being darker than in the ordinary forms of the species. Very often the fibrils of the stem are grouped in flakes or patches in such a way as to give a wavy appearence to the stem itself.

Galera Hypnorum *Batsch.*

Hypnum Galera.

(Hym. Europ., p. 270. Sylloge Vol. v, p. 868.)

Pileus membranaceous, conical or campanulate, obtuse or papillate, glabrous, hygrophanous, watery-cinnamon or subochraceous and striatulate when moist, paler when dry, often fading to yellowish or buff; lamellæ broad, adnate, ventricose, distant, tawny or cinnamon color, often whitish flocculose on the edge; stem slender, hollow, flexuous, smooth, pruinose at the top, commonly colored like the pileus; spores elliptical, .0004 to .0005 in. long, .00024 to .0003 broad.

Pileus 3 to 6 lines broad; stem 1 to 2 in. long, less than a line thick.

Among mosses in woods, either on the ground or on prostrate decaying trunks. Common in hilly or mountainous districts. June to September.

This is a small species but it varies considerably in size and color. Var. *nigripes* has a blackish-brown stem.

Eriodermæ. Pileus submembranaceous, the veil manifest, superficial, separating, at first silky or squamulose, especially on the margin.

Galera rufipes *Pk.*

REDDISH-STEMMED GALERA.

(Forty-second State Mus. Rep. p. 20. Botanist's Edition.)

Pileus campanulate or convex, hygrophanous, reddish-tawny and striatulate when moist, whitened on the margin by the remains of the white fibrillose veil, pale-ochraceous when dry; lamellæ broad, subdistant, emarginate, yellowish or subochraceous, slightly crenulate on the whitish edge; stem slender, hollow, slightly fibrillose below, pruinose at the top, reddish-brown; spores elliptical, subochraceous, .00025 to .0003 in. long, .00016 to .0002 broad.

Pileus 4 to 6 lines broad; stem about 1 in. long, .5 line thick.

Mossy ground in woods. Essex county. September.

This species is easily separated from *Galera Hypnorum* by the whitened fibrillose margin of the pileus and by its smaller spores.

PLICATELLÆ *sec. nov.* Pileus membranous, conical or campanulate, more or less expanded in maturity, plicate-striate.

The two species here described differ so much in the character of the pileus and its striations from the other species of the genus that I have thought it best to institute a new Section for their reception. I find no description of any similar European species. They are probable peculiar to this country.

Galera flava *Pk.*

PALE-YELLOW GALERA.

(Forty-fifth State Mus. Rep., p. 19.)

Pileus membranous, ovate or campanulate, moist or subhygrophanous, obtuse, plicate-striate on the margin, yellow; lamellæ thin, narrow, crowded, adnate, at first whitish, then yellowish-cinnamon; stem equal or slightly tapering upward, hollow, slightly striate at the top, sprinkled with white mealy particles, white or yellowish; spores ovate or subelliptical, brownish-ferruginous, .0005 in. long, .0003 broad.

Pileus 6 to 12 lines broad; stem 2 to 3 in. long, 1 to 1.5 lines thick.

Damp vegetable mold in woods. Tompkins county. July.

This species is well marked by the pale-yellow color of the pileus and its plicate striations which are very distinct even in the dried specimens. They extend half way to the disk or more. When dry the pileus is seen to be sprinkled with shining atoms as in some other species of the same genus. Occasionally the yellow cuticle cracks into squamules or small scales.

Galera coprinoides *Pk.*

COPRINUS-LIKE GALERA.

(Twenty-sixth State Mus. Rep. p. 59. *Agaricus plicatellus* Twenty-ninth Rep. p. 66.)

Pileus membranous, campanulate, soon expanded, often split on the margin, plicate-sulcate to the small even disk, yellowish or ochraceous-yellow; lamellæ narrow, close, rounded behind, colored like the pileus; stem slender, equal, hollow, minutely hairy or pruinose, white; spores elliptical, .00028 to .0003 in. long, .0002 broad.

Pileus about 6 lines broad; stem about 1 in. long, half a line thick.

Grassy ground. Cayuga county. August.

This small plant was discovered in 1872, but I have not found it since. It is manifestly very rare. The structure of the pileus and its plications are strongly suggestive of the character of the pilei of some of the small species of Coprinus, as is indicated by the name.

The name *Agaricus plicatellus* was substituted for *Agaricus coprinoides* when it was found that the latter name had been previously applied to another species, but since the former subgenus Galera has been raised to generic rank it permits the restoration of the original specific name.

REPORT

OF THE

STATE ENTOMOLOGIST

FOR THE YEAR 1892.

REPORT

OF THE

STATE GEOLOGIST

FOR THE YEAR 1892.

1893. 20

REPORT.

To the Regents of the University of the State of New York:

GENTLEMEN.— During the past year as in the preceding years the time of the State Geologist has been largely devoted to the Palæontology of the State of New York, in the selection and preparation of material and general supervision of the work of drawing, lithographing, printing, etc., and in the preparation of material for the annual reports.

During the past year increased duties have been imposed by the passage of a law authorizing the completion of the work on Palæontology, volume VIII, parts 1 and 2, and for the preparation of a geological map of the State, as well as for completing the work upon the Livonia salt shaft; each one of these requiring more or less time of the State Geologist.

After the passage of the law, Chapter 170 of the Laws of 1892 March 21st, work was resumed upon the printing of the Palæontology, volume VIII, part 1, and the volume was issued in July. At a later period the full edition of 3,000 copies was delivered to the custody of the Secretary of the Regents. Since that time work has been continued upon part 2 of volume VIII, and both the manuscript and the plates are in a forward state of preparation, as will be seen by reference under the head of volume VIII.

The work upon the annual report of the State Geologist has been steadily going on in the preparation of text and material for illustration. It is very unfortunate that the reports of last year can not be placed before you in their printed form at this time, but owing to the destruction of the State printing office by fire in September last, the work remains as it was delivered to that office last winter — fortunately the manuscript of the reports of the Museum staff was stored in the vault and escaped injury.

I am informed that owing to the great destruction of printed matter at that time in the office of the State Printer, which it will be necessary to replace, that the work upon the Museum reports of last year can not be taken up for some months to come. It is likely therefore that still greater delay will occur in commencing the printing our reports, and the report of this year will be still further delayed than usual.

The preliminary work in preparation for the engraving of the geological map involved a journey to Washington and another to New York and Philadelphia which occupied a considerable time, but which, through the earnest and persistent efforts of Mr. McGee of the United States Geological Survey, proved successful, and the Regents have in their possession a contract with Messrs. Evan & Bartles of Washington for the engraving of the base for the geological map, and a proposition from Major Powell, Director of the Survey, to furnish, without cost to the State, the color plates. Proof sheets of one half the base map have been received from Washington during the month of November, and proofs of the remaining portions of the State are promised very soon, and will undoubtedly be in hand before the end of the present year. The field work upon the geological map began in early June, and a portion of the State in the Oneonta district was carefully examined by Mr. Darton of the United States Geological Survey, who was joined by the State Geologist towards the conclusion of his work in a final review of the region examined. The result of this work has been the confirmation of certain views relating to the relations of the Oneonta sandstone, Chemung group, and the Catskill group proper, which had been published by the writer many years ago, but which it seemed desirable to review and confirm by fuller examination before the final publication of the geological map of the State. The details of this work will appear further on, accompanied by a map of the region.

The greater part of the autumn, from early September to the middle of November, has been given to field work connected with the geological map and the Livonia salt shaft. It was considered very important that the Helderberg escarpment, which forms such a conspicuous feature in the eastern part of the State from Cherry Valley eastward to Coeymans and southward to Rondout, should be carefully examined and the limits of the several geological formations constituting the mass accurately laid down upon the map. This work has been accomplished and a careful study of the escarpment made by myself and assistant, Mr. N. H. Darton, first, from Howe's Cave, by way of Schoharie, Berne, Knox, the Indian Ladder, etc., to Clarksville. Along this line of observation the rocks of the Lower Helderberg, together with the representatives of the Niagara and Clinton groups, with the waterlime at their base, rest in apparent conformity upon the rocks of the Hudson River group below, which are themselves undisturbed along the eastern and western line to the outcrops and dip gently to the southward between the limits above indicated. The first indication of a disturbance occurs to the north, and northwest of Clarksville, where, following the main line of the escarpment, the rocks of Helderberg dip beneath the surface of the valley, while the base of the formation diverges to the northwestward, ending in a broad promontory known as Stony Hill, leaving a deep indenture suggestive of a partial faulting of the strata along this line of deep erosion. This outlying area has often been taken for a circumscribed outlier of these formations, and on cursory examination presents that aspect. Following the line of outcrop southeasterly from its exposure on Stony Hill the escarpment, which is there obscured by a great accumulation of drift material upon its northern face, gradually becomes conspicuous, and before reaching South Bethlehem, and at that place, also farther to the southeast, this escarpment reaches its greatest elevation and acquires its boldest features. It is in the neighborhood of South Bethlehem also that we first find evidence of the unconformity of the Helderberg rocks and the Hudson River shales where the latter present evidence of having been uplifted, folded or contorted before the superincumbent limestones were deposited. One interesting example in the bank of a small creek presents an exposure of the shales and limestone which shows that the lower beds of the latter, corresponding to the Tentaculite layers of the Lower Helderberg, are infolded with the slate, apparently due to an overthrust fault; the entire exposure presenting the strongest evidence of unconformity.

From the neighborhood of Coeymans to the southward the escarpment of the Lower Helderberg rocks is not so continuous or conspicuous, being interrupted in many places by deep ravines and obscured also by elevations of the Hudson River group, which appear in more or less continuous, or frequently interrupted ridges, and not unfrequently isolated hills, in front of the great escarpment.

In the neighborhood of Catskill, along the Catskill creek, the Lower Helderberg escarpment of Pentamerus limestone, with its associated beds of Waterlime, forms a strong vertical escarpment, while the bed of the creek presents the Hudson River shales extremely folded and lying in almost vertical position.

In the neighborhood of Catskill and Rondout so much excellent work has been done by Prof. William M. Davis, of Cambridge, that it can be safely adopted for use in laying down the geology of that region upon our map, and, in consequence of this, much time was saved in our investigations.

To the southward of Rondout, although these limestones hold their place and even present strong continuous escarpments, they are so much broken and disconnected that they can not be followed with the same facility as to the northward and westward from Catskill.

At Rosendale we find the most southern exposure of these high escarpments of the Lower Helderberg limestones underlaid by a great development of the Waterlime which is here extensively manufactured into hydraulic cement. In the bed and banks of the creek at this place the geological formations are exposed from the Hudson river shales upwards to the Lower Helderberg limestones, and there are certain layers of red and greenish marl and sandstone which apparently represent the Medina sandstone and Clinton group. This is the first exposure observed after leaving Howe's Cave where we have evidence of the presence of any beds representing the Medina sandstone and Clinton group in the lower part of the great escarpment. At Howe's Cave we have an exposure of about thirty feet of shale below the Niagara or Coralline limestone which represents the Clinton group in that locality. At this place the pyritiferous shales of the Clinton group rest directly upon the upper arenaceous-shaly beds of the Hudson River group.

Returning to the neighborhood of Howe's Cave the work on the escarpment was again taken up and continued in a westerly direction. The gradual thinning of the Lower Helderberg mass diminishes the strong feature of the escarpment; the Oriskany sandstone gradually ceases to be a prominent feature and the gradual thinning and final disappearance of the Cauda-galli grit brings the Upper Helderberg limestone into close proximity and final contact with the lower mass, thus becoming the most prominent feature in the escarpment as we go westward. In the earlier general observations and publications upon the geology of New York this condition was not understood, and the great mass of the Lower Helderberg, so prominent along the Hudson river from Rondout north and thence northwest to Schoharie was regarded as the same limestone terrace which extended to Black Rock on the Niagara river. Even more extreme was the opinion published, identifying the great Helderberg terrace and escarpment with the Niagara Falls escarpment. This generalization came from the want of a knowledge of the elements composing this escarpment at any point, and therefore the bolder features only entered into the result. It should be remembered also that this conclusion was reached without any knowledge of the fossil contents of these strata which at that period were little known and not regarded as a necessary element in geologic generalizations.

The elements entering into this escarpment in different points in its extension are somewhat variable. In Schoharie and Albany county are at its base, the Hudson River group either in its horizontal or disturbed condition is succeeded by the representatives of the Clinton, Niagara, Waterlime and the Lower Helderberg mass made up by the Tentaculite limestone, the Pentamerus limestone, Shaly limestone, Upper Pentamerus limestone, or Scutella (Becraft) limestone.

[The report is incomplete at this point for want of illustrative sections and map which will appear in next report.]

However in continuing our investigations to the westward we have proved that the Lower Helderberg limestones in their lower members maintain a greater thickness and are more persistent than we have usually believed. It was formerly supposed from the observations of Mr. Vanuxem that the Lower Helderberg group had its western termination about the longitude of Auburn or the eastern shore of Cayuga Lake, and it is in this neighborhood that Prof. S. G. Williams has shown that the lower members of the group do mingle, and alternate with the Waterlime and the marls of the upper portions of the salt group. At numerous localities similar conditions may be observed where the magnesian sediments of the Waterlime and associated marls have encroached upon the sea bottom in which the lower Helderberg limestone were being deposited and the sediments of these two formations have become mingled or alternated in deposition. At Howe's Cave, Schoharie and other places it is not uncommon to see the dark blue Tentaculite limestone in layers of one-quarter or one-half an inch in thickness alternating with the drab colored Waterlime in laminæ of equal thickness. This alternation continues through several feet of thickness, the blue Tentaculite layers gradually growing thicker and the drab Waterlime proportionally thinner till these beds of passage are passed and we have the Tentaculite limestone gradually passing into thick heavy bedded layers of dark blue limestone, which on polishing becomes a fine black marble. In going farther westward this distinct alternation of beds is not so marked, but instead a gradual mingling of the two sediments while in process of deposition.

In going westward from Cayuga Lake outcrops of the Lower Helderberg have rarely been found showing satisfactory evidences of the age by the presence of fossils through the beds many years ago doubtfully referred to this horizon in Ontario county have proved to be part of the formation. Later evidences coming from the well borings and especially from the excavations of the Livonia salt shaft have shown that the lower members of the Helderberg limestone with its fauna represented in a few of the characteristic fossils extend much further to the westward than we had heretofore supposed.

The results in detail of this geological exploration will be communicated together with the portions of the map in which the limits and extent of the geological formations explored will be laid down.

The collections made at the Livonia salt shaft by Mr. D. D. Luther show very clearly the extension of the Lower Helderberg fauna to that longitude, but thus far no fossils of that age have been found in the material of that horizon brought out from the salt shafts on the west side of the Genesee River. As the natural result of the intermingling of an increased proportion of the argillo-magnesian sediments of the Waterlime epoch with the nearly pure calcareous sediments constituting the fossiliferous Lower Helderberg group the ocean waters became unfit for the support of those forms of life which so abundantly characterize the different members of that group in its more easterly exposures. It is no doubt true that the sediments of that age do extend farther to the westward, but their individuality is lost, the impure magnesian sediment prevailing over the calcareous material of eastern origin, the whole mass becoming of a dirty gray color and quite unfit for the support of life in any kind of organism except perhaps a few seaweeds, or other obscure organic manifestations.

It is in only those parts of the Waterlime group = Rosendale limestone, where these turbid sediments are not deposited, that the characteristicts fauna of that horizon, the Eurypteridæ, flourish, and fossils of this kind are extremely rare, or altogether wanting in the central portion of the State.

The maps, sections and reports of myself and Mr. Darton, assistant geologist, which were originally communicated with this report have been withdrawn since they could not be engraved in time for publication. These will be incorporated with the work of 1893, and be published with the work of the same year.

The report on the Livonia salt shaft, so far as the work had progressed, was also communicated with the present report, but the delay in printing has given time for completing the work upon the shaft and the later observations will be combined with the earlier, making a single report upon the results obtained during the two years of observation, and the collection of material from the several geological formations passed through in the progress of the work. This paper, with its maps, sections of salt wells, etc., will be communicated with the report of the State Geologist for 1893.

PALÆONTOLOGY OF NEW YORK.

VOLUME VIII, PART I.

This volume was issued from the press of Charles Van Benthuysen & Sons in July, 1892, and has met with an appreciative and cordial reception from students of Palæontology and Geology everywhere. As indicated by its title it purports to be "An Introduction of the Study of the Genera of the Palæozoic Brachiopoda," and its scope is therefore somewhat broader than that of previous volumes of this series, which had to deal mainly with the presentation of the various palæozoic faunas of New York in their order of geological sequence or in their biological relations. The work contains xvi — 367 pages of text, accompanied by 42 lithographic and 2 photolithographic plates. The purpose of the work is to give accurate diagnosis and illustrations of each genus with extended bibliography and synonymy, and various observations on structure, affinities and distribution.

The history and plan of the work are set forth in the following manner in the preface:

The completion of the present volume is a partial fulfillment of a promise made at the close of Volume IV of the Palæontology of New York, in 1867. The work is presented to the student with a hope that it may prove a useful contribution to science and a helpful guide in the study of that most abundant and most important class of Palæozoic fossils, the Brachiopoda. Originally intended to form a supplementary part of Volume IV, the subject has expanded to such an extent that two volumes will be required to present the results with a reasonable degree of completeness; and even with this addition some very important matter, as the microscopic shell structure, originally intended for the work, will have to be omitted from these volumes.

The study of the Brachiopoda made necessary in the preparation of Volumes III and IV, and more especially in the latter, had shown the necessity of subdividing many of the older recognized genera, which had become the receptacle for forms having external similarity to the typical members of the several groups, but possessing quite dissimilar internal structure. The natural disinclination to propose new generic terms for members of a class of fossils which had been so widely and thoroughly studied in Europe, operated as a restriction in the erection of new names. However, it became necessary to describe in those volumes and in cotemporary papers some thirty-one new generic forms and to suggest the necessity for farther separation among the heterogenous assemblages. These studies, made with fairly good collections, and ranging through the Silurian and Devonian faunas, could not fail to attract attention to the different external aspects and interior characters of forms known under the same generic terms, and considered as distributed through all the Palæozoic formations. Although the genera thus far proposed had not been based upon a recognition of their appearance and duration in geological time, yet the student could not fail to discover evidences of organic change in this direction. While discussing certain generic and specific forms as characterizing known geological horizons or certain groups of strata, we had not yet taken into consideration the fact that modifications of organic types had been coincident with every change, or progress in geological time. The great law of progress through long intervals had been everywhere recognized in geological science, but just how or in what manner these changes had supervened had rarely been shown in detail. Certain fossil genera have long since been recognized as Silurian, some as Devonian, and others as Carboniferous, but these are never entirely restricted to the formations which they are said to characterize. They have all doubtless been derived from some remote progenitors, and at certain horizons, or throughout certain formations have become so abundant and so fully developed, that they are said to characterize that stage or formation. The most abundant and extravagant forms among fossil organisms can usually be traced to some parent stock of more modest pretensions, and in their early appearance, represented by few individuals.

As stated, the studies of the Brachiopoda to the close of Volume IV of the Palæontology had shown the importance of some investigation which should deal directly with these questions. And moreover the science demanded the results of such an investigation in aid of its future progress.

The original conception and plan of the work which the author had proposed to himself was a very simple one, viz.: to select the earliest representative of a genus in any of the geological formations and to follow it through all its manifestations and modifications in geological time, to its final disappearance; or so far as these modifications should appear in the Palæozoic rocks, to which he had limited his research.* With the knowledge then possessed and with the collections at his disposal he had supposed that the result of such an investigation could be embraced in a supplementary part to Volume IV, and under this title the work was announced. This study was commenced very soon after the publication of that volume and its general plan was carried out so far as the lithographing of about thirty plates, when the farther progress of the work was suspended, to be resumed only in the latter part of 1888.

In the meantime the duties of the author had separated him almost entirely from this work, and owing to changes, over which he had no control, in the organization and management of the State Museum, the collections which he had planned to make for use in its preparation had not been made. The progress in our current knowledge of the subject, and that recorded in the publication of volumes and miscellaneous papers during more than twenty years had been enormous, and the undertaking which had been deemed feasible in 1867, seemed almost beyond attainment in 1888. The work was resumed however, with no other collections immediately available for use, than those upon which it had been commenced. In the original plan four plates were left for the illustration of the Inarticulata; the present volume furnishes ten additional plates, and the illustration of these forms may be regarded as fairly complete, according to our present knowledge.

The plates which were lithographed at the commencement of the work are designated on the upper left-hand margin as

* The difficulty of procuring sufficiently abundant and characteristic collections of the later formations was in itself a sufficient barrier, and the scope of the work did not contemplate the discussion of Mesozoic and later genera, except in an incidental manner.

"Volume IV, Part II." Those lithographed since 1888 are designated as Volume VIII, and while the illustrations of the first named plates are not always arranged as would have been done with later knowledge and more abundant material, it is hoped that the intercalation of the new plates may not seriously interfere with the proper connection and continuity of the work, or with the facility of reference so important to the student. Although the final numbering is XX, the actual number of plates in the volume is forty-two.

The printing of this volume had been completed to the end of the Inarticulata, page 183, in March, 1890, when further progress was suspended, from causes over which the author had no control. The printing was resumed in the autumn of 1890, and the book was in type to page 304 in February, 1891, when its progress was again suspended to be resumed only in April, 1892. This delay in publication, which has not in any way been due to the author, requires an apology to the scientific public; and those authors who may have published papers relating to the Brachiopoda, during 1890 or 1-91 which could not be cited in this volume, will here find the explanation.

At the time this work was commenced the earliest known articulate Brachiopod had been described under the name of Orthis, and without having the knowledge or means to verify or disprove the character of this fossil, the genus Orthis was adopted for the basis of discussion. Had these older forms been better known, the order of the work might have been somewhat modified. The other associated and succeeding genera have been taken up and treated after the same idea as in Orthis; limiting the discussion to those which seem to be a natural result of the modification of certain essential organic features characterizing the earliest forms of the orthoid type.

Following this order and method we pass through all the Orthidæ, the strophemenoid and streptorhynchoid forms in their varied aspect and modification, and through the leptænoid forms to Chonetes and the Productidæ proper, with which the series seems naturally to end.

All the spire-bearing forms, all the Rhynchonellidæ and Pentameridæ as well as the terebratuloid forms have been left out of consideration in the present volume, believing that a more natural and useful classification will be found in the present adopted order and arrangement of the genera. Chapters upon the classification and broader relations of the genera are given at the conclusion of the two principal divisions of the work. The succeeding part ii of volume VIII will embrace the discussion of the genera under the several groups just mentioned, and they will be treated essentially in the same manner as in the present volume. The work on the second part is already far advanced; a large amount of material has been accumulated for study; thirty-six plates have been lithographed, a considerable number of drawings have been made and a large amount of manuscript has been prepared.

During the interval of more than twenty years from its commencement, great progress has been made in the study of both genera and species of the Brachiopoda. The late Thomas Davidson, LL. D., of Brighton, whose life had been devoted to the study of these organisms, living and extinct, made important contributions to our knowledge up to the time of his death in 1885. Essays toward the structure and classification of the genera were made by Zittel, Œhlert and Waagen, and communications of no little importance relating to structural characters of genera and species, appeared from all quarters of the scientific world.

The multiplicity of these communications is indicated in part by the bibliographic tables presented in this volume; they also show the wide-spread interest in the Brachiopoda, not only among students of biology, in their structure, morphology and taxonomy, but among geologists, in their value as stratigraphical indices. American students have heretofore labored under a disadvantage in the irregular diffusion of the literature of the Brachiopoda. Much of the European literature is inaccessible except to those working in the vicinity of extensive libraries; the American literature is so scattered through scientific periodicals, proceedings of various societies, etc., as to be frequently inaccessible. Furthermore, while the more general treatises of Zittel and Œhlert may be in the hands of many, the greatest of all works upon the subject, that of Thomas Davidson, is beyond the reach of but a very few.

With this volume, therefore, is presented, especially to American students, the first part of "An Introduction to the Study of the Genera of the Palæozoic Brachiopoda," a work not conceived upon the plan of any of its predecessors, but designed to set before the student the present condition of our knowledge of these genera, with such discussions and illustration as will serve most to clearly indicate what progress has been made in our knowledge of these organisms and in what directions much still remains to be done.

In the preparation of this work every effort has been made to bring under close and careful scrutiny all obtainable material representing the Brachiopoda. The collections of no single institution or individual could furnish the specimens requisite for this undertaking, and recourse has been had to all sources of material within reach. The collections of private individuals as well as of public institutions have been placed at the disposal of the work, and but for such aid it could not have been presented in a creditable form.

In the body of the work all the palæozoic genera of the Inarticulate Brachipoda are discussed, and of the Articulate genera, the Orthoids, Strophomenoids, Leptænoids and Productoids. The remaining Articulate genera will be considered in the second part of this work. The following list of titles, with reference to the pages of the volume, will indicate the subject-matter. In this list, names of subgeneric value are inset under their proper capital, and undoubted synonyms are in italics.

* This genus has been erected since the first part of this volume was printed.

During the progress of the work it became necessary to introduce descriptions of a considerable number of hitherto undescribed species, which were needed in order to give completeness to the generic discussions and illustrations. These descriptions are included in supplements; one at the completion of the discussions of the Inarticulate Brachiopods, and the other at the close of the book.

The species there described for the first time are:

PALÆONTOLOGY OF NEW YORK.

VOLUME VIII, PART II.

This volume will open with the discussion of the spire-bearing genera of the Palæozoic Brachiopoda, and will include a notice of all genera not mentioned in part 1 of this work. The study of the spire-bearing Brachiopods involves much painstaking and careful mechanical manipulation for the accurate demonstration of their critical characters. The utmost caution is necessary in the discrimination between the *apparent* and the *actual* structure of the delicate internal spiral supports, and the investigation of these groups has, therefore, progressed somewhat less rapidly than that of the others. The work, however, is well forwarded, and at the present time 320 type-written pages of manuscript have been prepared, and 70 pages thereof were delivered to the printer on November 9th, 1892.

The accompanying list will show the number of genera covered by the entire manuscript, and indicate such divisions as it is proposed to recognize in the work, including a certain number of new terms which the necessities of the work have required and which are provisionally employed in the form here used.

Spirifer, Sowerby, 1815.
- Delthyris, Dalman, 1828.
- Trigonotreta, Kœnig, 1825.
- Choristites, Fischer, 1825.
- *Fusella*, McCoy, 1844.
- *Brachythyris*, McCoy, 1844.
- Reticularia, McCoy, 1844.
- Martinia, McCoy, 1844.
- Martinopsis, Waagen, 1883.
- Mentzelea, Quenstedt, 1871.
- Cyrtia, Dalman, 1828.

Metaplasia, nov.

Verneuilia, nov.

Cyrtina, Davidson, 1858.

Syringothyris, Winchell, 1863.

Spiriferina, D'Orbigny, 1847.

Ambocœlia, Hall, 1860.

Athyris, McCoy, 1844.
- *Spirigera*, D'Orbigny, 1847.
- *Euthyris*, Quenstedt, 1871.
- Actinoconchus, McCoy, 1844.
- Seminula, McCoy, 1844.
- Cliothyris, King, 1850.
- Spirigerella, Waagen, 1883.

Kayseria, Davidson, 1882.

Merista, Suess, 1831.
- *Camarium*, Hall, 1859.

Meristella, Hall, 1859.

Dicamara, nov.
Charionella, Billings, 1861.
Pentagonia, Cozzens, 1846.
  Goniocœlia, Hall, 1861.
Meristina, Hall, 1867.
  Whitfieldia, Davidson, 1882.
Whitfieldella, nov.
Camarospira, nov.
Hyattella, nov.
Nucleospira, Hall, 1859.
Retzia, King, 1850.
Eumetria, Hall, 1864.
Hustedia, nov.
Acambona, White, 1862.
Trematospira, Hall, 1857.
Parazyga, nov.
Rhynchospira, Hall, 1859.
Homœospira, nov.
Ptychospira, nov.
Uncinella, Waagen, 1883.
Uncites, Defrance, 1825.
Hindella, Davidson, 1882.
Dayia, Davidson, 1881.
Cyclospira, nov.
Atrypa, Dalman, 1828.
  Spirigerina, D'Orbigny, 1847.
Gruenwaldtia, Tschernyschew, 1885.
Karpinskia, Tschernyschew, 1885.
Atrypina, nov.
Zygospira, Hall, 1862.
Catazyga, nov.
Glassia, Davidson, 1882.
Anoplotheca, Sandberger, 1856.
Bifida, Davidson, 1882.
Anazyga, Davidson, 1882.
Coelospira, Hall, 1863.
Leptocoelia, Hall, 1857.
Clintonella, nov.
Rhynchonella, Fischer, 1809.
  Protorhychonella, nov.
  Orthorhynchula, nov.
  Rhynchotrema, Hall, 1860.
  Stenoschisma, Conrad, 1839.
  Rhynchotetra, Hall, 1879.
  Cyclothyrella, nov.
  Camarotoechia, nov.
  Plethorhynchus, nov.
  Liorhynchus, Hall, 1860.
  Wilsonia (Quenstedt), Kayser.
  Uncinulus, Bayle, 1878.
  Uncinulina, Bayle, 1878.
  Hypothyris (Philips), King, 1850.
  Pugnax, nov.
  Eatonia, Hall, 1857.
  Terebratuloidea, Waagen, 1883.
Rhynchoporina, Œhlert, 1887.
  Rhynchopora, King, 1856.
Camarophoria, King, 1846.
Camarophorella, nov.
Syntrophia, nov.
Camarella, Billings, 1859.
Parastrophia, nov.
Anastrophia, Hall, 1867.
Porambonites, Pander, 1830.
Noetlingia, nov.
Lycophoria, Lahusen, 1885.
Conchidium, Linné, 1760.
Pentamerus, Sowerby, 1813.
Barrandella, nov.
Sieberella, Œhlert, 1887.
Pentamerella, Hall, 1867.
Gypidula, Hall, 1867.
Capellinia, nov.
Branconia, Gagel, 1890.
Clorinda, Barrande, 1879.
Stricklandinia, Billings, 1863.
Amphigenia, Hall, 1867.

The genera remaining for investigation are not numerous and are composed largely of the Terebratuloids. To these are to be added some small groups whose generic relations and broader affinities are somewhat uncertain. The ground to be covered is represented by the following titles:

Stringocephalus, Defrance, 1827.
Terebratula, Müller, 1776.
Dielasma, King, 1859.
Epithyris, King, 1850.
Waldheimia, King, 1850.
Cryptacanthia, White and St. John, 1868.
Hemiptychina, Waagen, 1883.

Centronella, Billings, 1859.
Cryptonella, Hall, 1861.
Scaphiocoelia, Whitfield, 1890.
Hallina, Winchell and Schuchert, 1892.
Rensselaeria, Hall, 1859.
Megalanteris, Suess, 1856.
Notothyris, Waagen, 1883.
Eichwaldia, Billings, 1858.
Aulachorhynchus, Dittmar, 1872.
Richthofenia, Kayser, 1883.
Lyttonia, Waagen, 1883.
Oldhamina, Waagen, 1883.
Almadenia, Pohlig, 1892.

Plates. During the years from 1871 to 1881 eleven plates of Spirifers were lithographed and the entire edition printed in preparation for this work. During the progress of the work on volume VIII, part 1, 1889, five additional plates of this group of fossils were lithographed and printed. Besides these we have now twenty-four plates drawn on stone, some of which have been proved, but none are as yet printed. These together make a total of forty plates which may be regarded as finished for the second part of the volume. For the proper illustration of the work about twenty-five more plates will be required, the drawings for which may now be considered as essentially completed.

GEOLOGICAL MAP OF THE STATE.

A geological map of any country or portion of country is of the first importance to its inhabitants. The limits of rock formations where they contain valuable minerals or otherwise is of importance, and in fact there is no rock formation of any considerable extent but has its economic importance in every country which may come under the domination of civilized man. At the outset there is an effort made to learn the limits and distributions of the rock formations and their mineral contents. Early geological maps of any country are necessarily crude. The accuracy of the geological representation must depend upon the degree of perfection of the geographical or topographical maps which may be used as the base for illustrating the geology. We therefore find that not only the geological maps but also all geographical maps of any country, are, in their inception and early stages crude and incorrect, giving only its larger rivers and higher mountains which are the main features of the country, but much is represented from incomplete exploration or given by inference or imagination. As an illustration of this condition our people are at this moment gathering together all the old maps which can be found in any part of the civilized world relating to

America and the explorations of Columbus, and of the early voyagers who followed him. These maps have gradually become more and more unreliable with progress of time; but it is only in modern times that we have had maps constructed upon careful and reliable surveys, this being equally true of geographical and geological maps. It can not be expected that early efforts in producing geological maps will be more accurate than the geographical maps on which the data were recorded. It is not necessary to make an apology for this state of things; it is an absolutely necessary condition, and the geologists of today who criticise the efforts presented on geological maps of half a century ago, should remember that only a small part of our country has yet been surveyed with sufficient accuracy to record the geological data with a degree of exactness which will enable them to withstand the investigations of the next quarter of a century.

The fundamental topographical as well as the geographical features of the country may be represented in a general way upon the ordinary geographical map, and it is only when we attempt to carry this representation of geological features into detail and to note the minor subdivisions of those rocks which form the salient features of the country that we find the necessity of more accurate geographical maps. In the prevailing activity among scientific men, it is not prudent for any man to represent the limits of geological formations otherwise than from the most careful and critical investigations, leaving untouched and uncolored those portions of country he has not examined, or which cannot be examined with present means, or under existing conditions. Both in geography and geology the temptation always comes to extend the area of our knowledge beyond that which we have actually determined by carefully traversing the country. Both the geographer and the geologist labor under the same difficulties and temptations; each one fearing to leave unrepresented and uncolored any portion of country which he has even but cursorily examined. In the present condition of industrial knowledge, where each rock formation may have an economic value, the presentation of a geological map to the public incurs grave responsibilities, and it will be far better to leave uncolored those portions which can not be satisfactorily represented, than to color in its entirety any map of a state or a portion of a state not critically examined. Moreover, since with ordinary means no one can be absolutely sure of every mile of area, it is far preferable to leave uncolored such portions of the map as are not accurately known. If this could be once generally understood these uncolored portions would represent to the student, areas of country which have not been sufficiently examined to be represented on the map, and that these areas offer opportunities for study and the chances of discovery of new facts. If the community would accept this view of the subject the best geographical map might be colored to indicate the limits of formations as far as accurately known, the other parts being left for investigation, and the results of such investigation published each year, and added to our stock of accurate knowledge by coloring some additional portion of the map. For while it may be said that leaving uncolored some parts of a map is a confession of our ignorance, we may respond that to color every portion of a map is only an attempt to hide our ignorance and a practical deception upon the community.

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The first geological map of the State of New York ever seen by the writer was one accompanying the geological text book published by Amos Eaton in 1830. It is needless to say that this was a crude attempt to recognize in the geological formations over the greater part of the State of New York, an identity with the secondary formations of Great Britain and Europe. It is scarcely necessary to say that such a map could be not only of no value to the student on geology but a constant source of misleading.

Upon the organization of the Geological Survey of the State of New York, one of the first objects sought was maps for laying down the limits of the geological formations. At that time there were no accurate maps except of small parts of country, and the best resource was found in Burr's atlas of the state and county maps of the State of New York. There seems to have been no approximately correct geographical map of the state available for the use of the geologists for recording their observations. At the close of the survey a small map was engraved expressly for the use of the geologists in laying down the limits of the geological formations. This map from the eastern limits of the state adjoining Massachusetts, Connecticut and Vermont to its western extremity was about twenty-eight inches and its extreme limit from north to south along the eastern counties of the state, or from the Canada line to Sandy Hook was two inches less than its extent from east to west, or twenty-six inches. The location of towns, villages, and post offices were doubtless taken from the best maps extant, but these afforded very unsafe guides for locating the outcrops of the geological formations.

However, at the close of the survey the order of sequence among the several formations, with the exception of the crystalline, metamorphic and partially altered rocks of the eastern and northeastern counties of the State, had been determined, and these were laid down upon this map with as much accuracy as the map itself permitted, and this representation has served the purpose of a general guide to the geological structure of the State of New York. This map is still useful in showing the general distribution of the unaltered stratified rocks of the State, but even before it had been published, the geologists having in charge the eastern portion of the State were not so well satisfied with their work that universal agreement could be had upon certain areas of country and no attempt was made to represent the age and relations of certain of the formations on the east side of the Hudson river. The index or legend, and the colors of the area representing the "primary system," were followed by the Potsdam sandstone and thence in regular sequence of the formations from that horizon to the Catskill mountains, or the Catskill group, inclusive. There was no difference in color between the metamorphic rocks of southeastern New York and the older gneisses and granites of the Laurentian area of the Adirondacks in the northeastern part of the State, and of the Highlands of the Hudson River. The metamorphic limestones of the southeastern part of the State, now known to be of older age even than the Potsdam sandstone, were not separated by color from the limestones of the Trenton period and no sandstone older than Potsdam was recognized on the map as published in 1842.

The Catskill group in its western extension was represented as terminating abruptly and the limits between the formations of Chemung and Catskill were considered as trenchant lines, making no allowance for the gradation from one to the other or the intercalation of any other strata. I have already said that even before the final reports of the State geologists were made, and before the map was completed, each one had discovered within the limits of his own district evidences that the geological structure of the State and the relations of the successive formations had not been fully determined; and even at that time a hope was expressed that the State might recognize the necessity of going on with its work to the completion of a geological map which might be worthy of acceptance by the scientific public and by the people of the State as a guide in the study of its geological formations.

At a later period, 1844, Prof. Emmons published an agricultural and geological map of the State to accompany his agricultural reports. This map was published upon the same base as the original geological map of the State. The coloration was almost precisely the same on all parts of the map west of the Hudson river. From the northern limit of the State and the adjacent part of Vermont, extending along the east side of the Hudson river and crossing to the west side below Rhinebeck, a belt of color was introduced to show the supposed limits of the "Taconic system" of rocks, although no mention of the name is made or any indication in the color legend of the map. The map, however, is fully described on page 361 of volume I of the "Agriculture of New York." A description and discussion of the rocks of the Taconic system and of its individual members occupies chapter five, pages 45–112 of the volume. Since 1844 this map has been the only geological map of the State of New York accessible to the student and to the public.

This "agricultural and geological" map of Dr. Emmons, following so soon after the publication of the State map accompanying the reports of the four geological districts, doubtless prevented any immediate effort to secure the means of preparing and publishing a more accurate geological map of the State.

Since this map has been extensively distributed without any accompanying explanation, it may be well to reproduce in this place the original description of Dr. Emmons from the volume cited above.

Description of the Geological Map Accompanying the Report of Dr. E. Emmons.

"This map is a reprint, in the main, of the map which accompanies the first reports. Important additions, however, have been made to it. Parts of Vermont, Massachusetts and Connecticut are now included. In addition to these the range of the Taconic system is colored and made a distinct part of the map. It occupies a belt extending from the Canada line to New Jersey and Tappan bay on the North river, below the Highlands. This system, it will be observed, is divided or split by the primary of the Highlands; the older part passing on the east side intersects the Hudson at Peekskill, and the superior portion passes on the west side and leads off into New Jersey, passing through the county of Orange. The primary rocks of Massachusetts, Vermont and Connecticut, which lie in a position nearly parallel to the Taconic system, are colored with lake, and the Taconic system a drab. By this addition the relative positions of the New York, Taconic and Primary systems of New England are indicated. We may see the great primary nucleus of New England as it disappears beneath the oldest sedimentary rock now known, composing the Taconic system, and the disappearance of the latter beneath the New York system. The New York system continues the superior system until we reach Green bay and the sources of the Menomone river, where the Taconic system once more appears, supporting the lower members of the New York system, and reposing on, and supported by the Primary, as in Massachusetts, Connecticut and Vermont.

"The narrow belt of the Taconic system is a remarkable feature in the geology of this country, it being an immensely thick series, which seems to have been deposited in long and remarkably deep seas that resembled profound clefts in the crust of the earth."

"The different members are not distinguished by colors; the difficulty of locating them with that degree of precision which is required in a map, was considered a sufficient reason for omission. The oldest or inferior member, the gray sandstone or granular quartz, lies upon the primary in the range of Williamstown and Dalton, Massachusetts, and Arlington, Vermont. The Stockbridge limestone forms a belt immediately west, and then there is a belt of silvery talcose slate, or magnesian slate, beyond which the sparry limestone appears in a distinct range, which may be located with some degree of precision, when it is stated that the tunnel of the Great Western railroad passes through it, which is not far from the line bounding New York and Massachusetts. The members are regarded as the inferior rocks of the Taconic system. Still west of them there is a wide belt of Taconic slates, which contains many subordinate beds of limestone and siliceous slate, and which frequently supports the outliers of the lower members of the New York system. The Taconic system, as a whole, may be regarded lithologically as an immense slate system, with subordinate beds of sandstone and limestone, both of which are more largely developed upon its eastern border adjacent to the Primary system."

"The New York system is colored like the former map, which accompanies the volumes already distributed."

Notwithstanding the published discussions, controversial or otherwise, regarding the Taconic system, which were carried on during many years after this publication, no portion of the area described in the map was ever carefully studied or mapped until within recent years. Prof. Dana, Prof. Dwight, Mr. Ford and Mr. Walcott have contributed to our accurate knowledge of this region; so that at the present time comparatively little remains to be done to complete the work.

During the later years also careful geological work has been carried on in New Jersey and in Pennsylvania, and the results in the former are published in a carefully prepared geological map, while in the latter State the final map is in a forward state towards publication.

In the final discussions among the New York geologists preparatory to the publication of the geological map and their final reports, it was discovered that much remained to be done in determining the relations between certain formations everywhere, and more especially in the eastern part of the State. But as only six months were allowed from the time of closing the field work to the presentation of map and reports there was no time or opportunity for review or revision.

The proposition to recognize, upon the map, the Taconic system proposed by Dr. Emmons, was rejected by Mr. Mather and

Mr. Vanuxem, the latter, however, being willing to recognize a series of conglomerates and crystalline rocks of St. Lawrence, Lewis and Jefferson counties which were clearly below the Potsdam sandstone as a distinct group worthy of recognition. The difficulty of the position and surroundings in being compelled to decide questions when the facts were not of common knowledge to the four geologists, rendered the situation embarrassing; and without the time and means for the staff to visit and review the doubtful or disputed points there seemed no other course left but to sanction the map as published. At this distance of time and with the accumulated knowledge coming from all sides, it is easy to criticise the work done upon the geological map published sixty years ago. This map, however, has served as the basis for later work; and supplemented as it was in 1843 by a geological map of the Middle and Western States, published in the Report of the Fourth District, we have had a fairly good basis for work among the Silurian and Devonian rocks of New York and of the States west to the Mississippi valley. This map of 1843 presented the first attempt at a correlation of the rocks of New York, and the east, with those of the west; traced through a thousand miles in extent by their fossil contents, at a time when not a tithe of these fossils had received names, and most of them were entirely unknown in scientific literature or nomenclature. It was an attempt also to carry the nomenclature of the New York system of rocks into the western States, which later investigations in the same direction, have rendered acceptable, and which have become established in the literature of the geological reports of all these States. Crude and imperfect as such a map must necessarily have been, complied from all sources within reach, not always fully authentic; supplemented and verified by some thousands of miles of travel, it has nevertheless, by the testimony of impartial authority served a very useful purpose to the geologists of later years. Nearly sixty years have passed since its publication, its errors have been pointed out sometimes with acerbity, but almost universally treated with leniency, and the map with commendation, as having served a useful purpose in the infancy of our investigations in the Palæozoic rocks of North America.

When placed in charge of the work of the Paælontology of the State in 1843, it was natural that I should desire to rectify any mistakes and misinterpretations of the past by a determination of the fossils of the several formations, and to substantiate the sequence of the formations as proposed in the New York reports by such evidence.

During the earlier examinations of the western portion of the State with the knowledged then possessed, it was naturally inferred that the conglomerates lying upon the hill summits and high grounds of Alleghany, Cattaraugus and Chautauqua counties were of Carboniferous age, and it was only after studying the few fossils found in these strata that they were proved to be of the age of the subjacent Chemung rocks and it was therefore necessary to relegate them to a lower horizon. Therefore the Carboniferous rocks as indicated on the original geological map of the state, except in the case of a small area to the south of the Olean, have been proved to be of the age of the underlying Chemung rocks.

One of the most notable and interesting questions in discussion at the close of the survey, had reference to the Oneonta sandstone and its relations to the Chemung and Catskill groups. In the later discussions upon the subject by the New York State geologists, and in their final meeting to adjust the nomenclature no satisfactory solution of the difficulties surrounding this subject was reached.

The Oneonta and Montrose sandstones of the annual reports of Mr. Vanuxem were in his final report merged in the "Catskill group," and the most characteristic fossil which lies at the base of the Oneonta was designated as *Cypricardites Catskillensis.*

Mr. Mather, in his final report, used the term Catskill Division to include the Montrose and Oneonta sandstones of the annual geological reports and Nos. IX, X, XI and XII of the Pennsylvania geological reports, and gives in great detail an account of the lithological character of the series of strata constituting the the successive terraces of the eastern mountain slope of the Catskills.*

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* *Upper members of the Catskill mountain series of Geological Reports for* 1840 *and* 1841. *Montrose sandstone, and Oneonta sandstone of Geological Reports of New York. Old red sandstone, probably, of Europe. Nos.* 9, 10, 11 *and* 12 *of the Pennsylvania Geological Reports. Old red sandstone, No.* 9 *Mr. Conrad's arrangement.* (Geological Report of New York, 1839 p. 62.) **Final Report First Geological District, page 299. 1843.**

My first examination of the Oneonta region in 1844 disclosed the fact that the Oneonta sandstone, described as lying upon the Chemung group, really rested directly upon the shales of the Hamilton group, and the quarries cited by Vanuxem as containing Chemung fossils really contained only characteristic fossils of the Hamilton group. This erroneous idea of the order of succession had entered into the discussions of the relations of the Hamilton and Chemung groups, and the arenaceous beds of the former group in that region of country had been referred to the age of Chemung group. Farther examination on the hill summit, in the neighborhood of Oneonta, showed very clearly that rocks carrying characteristic Chemung fossils rested directly upon the top of the Oneonta sandstone. In exploring the country further southward and south-eastward, there was found a belt of gray and greenish-gray shale and sandstone carrying Chemung fossils, lying above the Oneonta sandstone, and succeeded above by red marls and gray grits and sandstones which formed a part of the Catskill group in its western extension. Repeated examinations of this region through several years, although cursory in their nature, confirmed these first observations; but it was not until 1870–71 that the country was mapped with anything like accuracy in regard to the relations of these formations. This map, however, was never published, and it remains as a record of the results of field work of 1870, although the work of previous years had been incorporated. Following this period for several years no extended or systematic field work was carried on, and our increasing information was obtained from desultory observations, and the comparison of fossils collected in the region named; but the subject of inquiry was never lost sight of, and scarcely a year passed without adding something to our knowledge or suggesting some new point of inquiry.

In 1880–81 still further progress was made in the investigation of the Oneonta region and the extension of these formations to the east and west. This work, chiefly done by Mr. Andrew Sherwood, under my immediate direction and supervision, confirmed and extended the conclusions reached in 1870, and in previous years. The result of these investigations was recorded upon a post route map of the State, with the following title and legend.

"A preliminary geological map including a part of the Catskill region, the southern part of New York and adjacent parts of Pennsylvania, to show the relations of the Catskill group to the underlying formations of the Chemung group, Oneonta sandstone and portage group; combining all the previous observations with the field work of 1881, by Andrew Sherwood, under the direction of James Hall, State Geologist." This map, like all the preceding records, was never published and still remains in possession of the State Geologist, as a record of field work done and recorded up to the date of 1881. Other maps and portions of maps likewise containing more or less of the records made during all these years remain still in the possession of the State Geologist, and under the present conditions are of no other value than as evidences of progress of work and the dates upon which it was performed.

The following extract from remarks made before the American Institute of Mining Engineers, will give some idea of the progress of the geological map since 1883:

"In 1883 I had combined, upon a small map of the State, the information which we possessed at that time, and communicated the same with my annual report to the Legislature. The report was published in the regular course, but the special appropriation made for the map was vetoed by the Governor.

"Not discouraged by this untoward and unexpected circumstance, work was continued, and every effort made to render the map more complete, preparatory to its communication with the next annual report. I brought together all the information within reach, whether published or unpublished, reviewing and revising, as far as practicable, the work done by myself and assistants in southern and south-eastern New York.

"Up to the autumn of 1884 I had been working alone, and unaided, without any means whatever from the State, to complete the field work, and to bring together the knowledge which we had gained from various sources, and that which I had acquired from my own investigations and from assistants employed on my personal account, with the purpose to embody the whole in a geological map of the State. At this juncture, and having no one to act as cartographer, Major Powell, with characteristic liberality, sent Mr. McGee, the cartographer of the United States Geological Survey, to Albany, and for some weeks we worked together upon the preparation of the map, with the data which had been accumulated, as above stated, and from all other available sources."

As the work progressed, it was found that the base-map previously used was quite inadequate for the purpose of laying down the limits of the geological formations with the necessary degree of accuracy; and a new base was begun and finally constructed under the auspices of the United States Geological Survey office, and under the supervision of Mr. McGee. Upon this map was laid down the geology of the State so far as accurately or approximately determined. The title of this map is:

PRELIMINARY GEOLOGIC MAP

of

NEW YORK,

Exhibting the Structure of the State so far as known.

Prepared under the Supervision

of

JAMES HALL,

STATE GEOLOGIST,

by

W. J. MCGEE.

Scale 1: 300,000.

1885.

To which I have added the following legend:

"Engraved and colored by direction of J. W. Powell, Director of the United States Geological Survey, for the use of the State Geologist of New York, for his report of 1884, being the map referred to in a resolution of the Regents of the University of the State of New York, January 7, 1885, and afterwards communicated to the Legislature in February, 1885, with the annual report of the State Geologist for the year 1884."

This map, in its manuscript form, was brought before the Board of Regents in January, 1885, with the statement that the Director of the United States Geological Survey had offered to co-operate with the State Geologist of New York in the preparation of a geological map of the State. In response to this proposition of Mayor Powell, the following resolution was passed on January 7, 1885:

"*Resolved*, That the Director of the Museum be authorized to arrange with the Director of the United States Geological Survey to co-operate with him in the work of perfecting a geological map of the State of New York, and that in the meantime the director be authorized to transmit a copy of the map in its present state to the Legislature for publication as a preliminary geological map."

A copy of this map was communicated to the Legislature in February, 1885, with my annual report for 1884; and an appropriation was made for its publication, which shared the fate of the preceding one.

Encouraged by the action of the Regents of the University, Mr. McGee, with the approval of Major Powell, began the preparation of a map more elaborate in character, and upon a larger scale, than that already presented to the regents and to the Legislature. It was distinctly understood that this resolution of co-operation contemplated the appropriation of means for carrying on field-work in portions of the State requiring special attention, before we could consistently make use of this map for laying down the limits of the geological formations. But while money was freely spent for almost everything else, none was ever allowed for the geological map to enable co-operation with the Director of the United States Survey, and I was again thrown upon my own resources. In the meantime, however, the work on the base-map was progressing at Washington, though latterly almost abandoned because of the apparent apathy on the part of the State of New York as to the result.

In 1888 the large base map then in preparation under the direction of the United States Geological Survey, was so far advanced that a photographed sheet of the western half of the map was colored and brought before the museum committee of the Regents of the University, and shown to some members of the Legislature in the hope of securing some action towards the publication of the map, but nothing could be accomplished at that time.

This map was presented with the following title, subject to revision.

PRELIMINARY GEOLOGIC MAP
of
NEW YORK,
Exhibiting the Structure of the State so far as known.
Prepared under the Supervision
of
JAMES HALL,
STATE GEOLOGIST,
by
W. J. McGEE.
Scale, 1:300,000.
1888.

The publication of the final geological reports, together with the two geological maps, one accompanying the reports of the four Geological Districts and the other accompanying the reports on Agriculture by Dr. Emmons, stimulated the public, and especially the agricultural public to the study of the geology of the State, and for a time it seemed likely that investigations in geology and its relations to agriculture would be continued by the State Agricultural Society and by local societies, following the example of Albany and Rensselaer counties of twenty years previous.

The following list of publications relating to geological surveys of counties and parts of the state from 1820 to the present time will give the student a reference to sources of information regarding the earlier geological and agricultural work which may not be current in our more recent publications.

GEOLOGICAL SURVEYS AND MAPS OF PARTS OF THE STATE OF NEW YORK.

1820. Amos Eaton and T. Romeyn Beck. Survey of Albany county. (No map.)

1822. J. H. Steel. Geological structure of Saratoga county. (No map.)

1823. Amos Eaton. Geological and agricultural survey of Rensselaer county. (Profiles.)

1824. Amos Eaton. A geological and agricultural survey of the district adjoining the Erie canal, taken under the direction of S. Van Rensselaer. Part 1, rock formations and geological profile extending from the Atlantic to Lake Erie.

1830. Amos Eaton. A geologic text-book accompanied by a geologic map of the State of New York.
1842. E. Emmons. Geology of New York; report 2d district; map of the county of Jefferson, geological map of Clinton county.
1849. Asa Fitch. Survey of Washington county. (Two maps.)
1851. J. Delafield. Survey of Seneca county. (Map.)
1851. G. Evans. Survey of Madison county.
1852. Ledyard Lincklaen. Survey of Madison county. (Map.)
1853. W. C. Watson. Survey of Essex county. (Maps.)
1860. G. Geddes. Survey of Onondaga county. (Maps.)
1862. G. Denniston. Survey of Steuben county.
1863. G. Denniston. Survey of Orange county.
1884. B. H. Wright. Notes on the geology of Yates county. (Map.)
1885. J. M. Clarke. A brief outline of the geological succession in Ontario county. (Map.)
1885. C. E. Hall. Geological map of Essex county.
1888. E. B. Knapp. Onondaga county.

I communicate herewith the report of Professor John M. Clarke, assistant palæontologist, giving an account of the condition of the collection of fossils in the State Hall, and showing the accessions from various sources; and the work which is going on in the arrangement and distribution of this material to which reference has already been made. The most interesting collection is that made by Mr. D. D. Luther, at the Livonia salt shaft, which will give us the exact horizon and the vertical range of species in a section of the strata measuring nearly 1,500 feet. It is hoped that we may be able to give a very complete account of this collection with illustrations, of at least some of the new species, in the report of 1893. Some steps have already been taken in this direction and unless some unforeseen interference shall occur, the entire report upon the Livonia salt shaft in its physical and faunal aspect will be presented in that report.

The collection sent by Mr. Raymour of Kansas City, Missouri, illustrating the fauna of the formations in the towns of Cass and Waverly, Cass county, Indiana, is a very interesting one, the collection containing numerous representatives of the faunas of the Corniferous and Hamilton horizons without any indication that these formations are separated from each other by a change of lithological character or other conditions. For the sake of geologic science it will be an interesting inquiry to determine whether there may not be a line of separation between the two faunas as occurs at the falls of the Ohio, and elsewhere in southern Indiana.

In the report of last year Mr. Clarke communicated a list of the original and illustrated typical specimens of the Palæozoic Crustacea of the collections at the State Hall, making a total of 496 specimens, with citations of all publications where such illustrations have appeared, making a very interesting synopsis which can not fail to be useful to the student.

In the present report Mr. Clarke has continued his list of original and illustrated specimens of the Annelida and Cephalopoda, including 203 original specimens and 402 illustrated typical specimens.

It is a great misfortune that for so many years past we have had no draughtsman connected with the museum staff and have been unable to obtain drawings for illustrating our reports except in the special departments where the appropriation covers such expenditure, while outside of that no illustrations can be furnished. It is quite impossible for any scientific organization to progress without the means for the illustration of the scientific work of its staff.

It is to be hoped that our condition may at some time enable us to prepare and publish an illustrated catalogue of all these fossils, together with those which are to be communicated in the future.

In the south room (No. 39) of the building which is occupied by Prof. John M. Clarke, the assistant palæontologist, there are 188 drawers occupied by types and typical specimens which have been used in the preparation of the preceding volumes of the Palæontology. There are 480 drawers occupied by collections now in use in the preparation of work on the Palæontology. A partial catalogue of these collections was communicated with my report of last year; including the Crustacea. The work on the catalogue has been continued and a second portion is communicated with this report. It is intended, as just mentioned, that the work of preparing this catalogue shall be continued during the ensuing year and the result communicated with the next annual report.

It is a great misfortune that, at the outset of this work, it could not have been carried on in some public building where the gradually accumulating collections of specimens for the Palæontology of the State could be stored or arranged, and where working rooms could have been had for the accommodation of the State Geologist, his draughtsman and assistant.

These conditions, which were not brought about by any action of the State authorities, compelled the State Geologist to erect buildings on his own grounds at his own personal expense, and to arrange in those buildings the material collected for use in the preparation of the work. From the commencement of the work in 1843 to 1856 all the collections of fossils were made at the personal expense of the State Geologist. From and after 1856 provision was made by the Legislature for the collection of specimens in the field, and from this source an enormous amount of material was obtained — material which has greatly expanded the work, and added largely to its value as a contribution to geological science. All the collections thus acquired remained arranged in drawers or otherwise from the commencement of their accumulation till 1886. As the work progressed the types and typical specimens coming from these collections were separated from the mass and kept by themselves, thus remaining in my possession and under my control for thirty years. In 1886 these specimens were removed by order of the Chancellor of the Board of Regents to the State Hall and placed in drawers in a separate room, to which I had no access for two years, and to the drawers containing the specimens I have never had access up to the time of the present writing.

It is a great satisfaction to me that Mr. Clarke has undertaken the task of cataloguing these specimens, with citations of place of publication, locality of the specimens, name of collector and date of collection, which will make the work a valuable book of reference for students in the science. The completion of this work may serve in some measure to set at rest the question as to what has become of the types and typical specimens belonging to the State.

JAMES HALL,
State Geologist.

REPORT

OF THE

ASSISTANT PALÆONTOLOGIST.

1892.

Report of the Assistant Palæontologist.

ALBANY, *December* 1, 1892.

JAMES HALL, LL. D., *State Geologist:*

SIR.—During the past year my time has been largely devoted to the investigations and other work connected with the preparation of the Palæontology of New York, volume VIII, parts 1 and 2, and with the printing of the first of these parts. Your own report contains a detailed statement of what has been accomplished in this direction. It is proper that I should add to the account there given that this work, which involves much laborious and painstaking preparation of specimens to be studied, has contributed directly and largely to the quality of our Museum collections, by bringing into a condition suitable for exhibition or for the studied reserve of the collection, a great number of this abundantly represented group of fossil animals, the Brachiopoda. No attempt has been made during the year to inaugurate any changes in, or make any considerable addition to the exhibition collection in the Geological Hall. All additions to this department are received at the State Hall, where they are studied and, if space permits, placed in drawers; otherwise they are repacked in boxes and stored.

The collection of Lower Silurian fossils purchased in 1890 of the late William P. Rust, of Trenton Falls, has been removed from the drawers which it occupied on the Palæozoic floor of the Geological Hall, and been incorporated with the serial collection of New York fossils in the State Hall, where it has become accessible for study.

Since the completion of the original drawings for the eighth volume of the Palæontology of New York, Mr. Ebenezer Emmons, who had been engaged in that work, has been occupied in the arrangement and condensation of the serial collection, at the same time making up a number of smaller serial collections for distribution among the educational institutions of the State. This work, if carried to completion, will supply us with a limited number of school collections which can be furnished upon demand, and not by the usual laborious process of having to search through the entire collection for the requisite material. Besides this it will also serve the more important purpose of protecting our reserve collection, which has already in some places been encroached upon. This is a vital consideration in view of the fact that of late years field collections, upon which the department must largely depend for its supply of material for the schools, have been almost entirely suspended, while the demand for these school collections has not decreased.

The most considerable and important addition to the palæontological collections during the year has been the material sent in by Mr. D. D. Luther from the salt-shaft near Livonia Station, Livingston county, N. Y., in pursuance of investigations for which a special appropriation was made by the Legislature of 1892. Of this material we have now received in all about 130 boxes, most of them since the beginning of the fiscal year. This material, mainly composed of fossils from the Hamilton, Marcellus, Corniferous, Oriskany and Waterlime formations, has been unpacked, washed, ticketed, critically reviewed, and finally repacked in boxes as our drawer space is now all occupied. A selection however was made of specimens of especial interest, and these occupying about twenty-five drawers, are now in the south-east room on the top floor of the State Hall. This remarkable collection, made from a single and consecutive section of rocks upward of 1,400 feet in thickness, contains a large amount of high grade material and enriches the Museum with many undescribed and rare species of fossils. The supreme interest in this collection rests upon the evidence it affords in regard to the succession of fossil faunas. Consequently I have spent much time in the careful identification of the species from the various horizons. Each specimen bears the record, in feet, of its level or depth from the mouth of shaft, and we are therefore able to summarize the succession of the faunas in this section in such a manner as has probably never before been possible in an equal thickness of the Palæozoic rocks. These data have been brought together on the basis of the geological section prepared by Mr. Luther, which will be communicated with the final report on these investigations. The value of such a communication would be enhanced by the description and illustration of such new or little known species as have been obtained from the shaft. Unfortunately, however, there is at present no portion of the Museum appropriation available for drawing and we are therefore seriously handicapped in any effort to illustrate our collections. It might be suggested that the investment of even a moderate sum for drawing, *pays*, not alone because of the increase in scientific value of the specimens so illustrated, but their intrinsic value is thereby greatly exhanced and the Museum is thus substantially and materially the gainer.

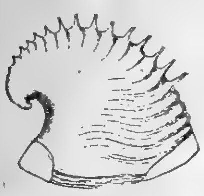
Among the interesting additions to the general collections is a series of fossils from the Corniferous limestone in the towns of Cass and Waverly, Indiana. These have been generously presented to the Museum by Mr. E. H. Raymour, of Kansas City, Mo., in return for identification of species. The assemblage of species is essentially the same in both these localities and comprises an intermixture of forms, which in the New York sections where the faunas are more sharply differentiated, characterize partly the Corniferous limestone, partly the Hamilton shales. The fauna is suggestive of that occurring in the Hydraulic and Encrinal limestones, lying above the Upper Helderberg group at the Falls of the Ohio, but the typical Corniferous limestone species are more abundant. It appears to represent both of the faunas mentioned. The detailed stratigraphy of this region is not reported, but all the material examined from the two localities is identical in lithological structure and fossil contents.

The following is a

LIST OF SPECIES IDENTIFIED:

NAME.	Cass.	Waverly.	Corniferous limestone, N. Y.	Hamilton, N. Y.
Rhynchonella Tethys	*		*	
R. Horsfordi		*		*
Pentamerella arata	*		*	
P. dubia		*		
P. læviuscula	*	*		
Terebratula Harmonia	*	*		
cf. *Lincklæni*		*		*
Camarospira ? eucharis (abundant)	*	*	*	
Athyris spiriferoides		*	*	*
Atrypa reticularis	*	*	*	*
Spirifer fimbriatus	*	*	*	*
Sp. audaculus		*		*
Sp. macronotus or *asper*		*		*
Sp. divaricatus	*	*	*	*
Sp. segmentus	*			
Sp. sp. nov. *	*	*		
Trematospira hirsuta	*	*		*
Stropheodonta inæquistriata	*			*
S. hemisphærica		*	*	
Cyrtina curvilineata		*		
Productella navicella	*	*	*	*
Aviculopecten terminalis	*	*	*	
Conocardium trigonale		*	*	
Cypricardinia indenta		*	*	*
Paracyclas elliptica		*	*	
Platyceras erectum		*	*	
Orthonychia concavum		*	*	
Euomphalus Decewi		*	*	
Bellerophon Pelops		*	*	
Isonema sp. n.		*		
Cyrtonella sp. n. †		*		
Proetus crassimarginatus		*	*	
P. macrocephalus	*	*		*
Phacops cristata var. *pipa*		*	*	

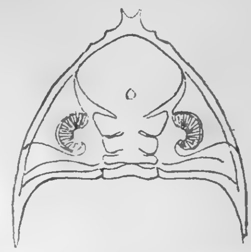
* This is a small shell with low, sparse plications which are prominent at the umbones. The surface is covered with fine, linear, radial striæ, a type of exterior which is rare in the Devonian.



Cyrtonella horrida, sp. nov.

† A species with a sharply carinate nodose dorsum, each node being produced into a stout spine. This is altogether a novel style of ornament among the Bellerophontids. It is interesting to observe that near the aperture where some of the species are broken off, it is very evident that the latter were extensions of the outer shell-layer only, and did not open on the inner surface of the shell.

Some fossil crustacea of considerable interest, and new to our collections, have been received. Prof. J. F. Whiteaves of the Geological Survey of Canada, has sent specimens of his recently-described Phyllopod (?) *Anomalocaris Canadensis*, from the Cambrian fauna of Mt. Stephen, British Columbia. From the Peabody Museum, Yale University, through Prof. C. E. Beecher, we have obtained an interesting series of the Cambrian trilobite, *Ptychoparia Kingi*, numbering about sixty specimens. By purchase the museum secured from Mr. L. G. Rexford, a remarkably fine specimen of *Asaphus maximus*, Locke, from the Hudson River sandstones in the quarries at Rexford Flats, Saratoga county. The fact that fossils have been almost unknown in these rocks renders this large and entire trilobite altogether unique. Principal J. M. Dolph, of Port Jervis, has contributed a series of fossils from the "trilobite ledge" at that place, among them an interesting undescribed species of trilobite with the general aspect of *Dalmanites dentatus*, Barrett, but having the row of marginal spines restricted to the anterior curve of the head, and the spines themselves much produced on the frontal margin.



The cephalon of *Dalmanites Dolphi*, sp. nov.

Types and Typical Specimens.— There has been a prevalent and unwarranted misapprehension, which has sometimes led to misstatements, in regard to the number of *types of fossils* or original specimens from which generic and specific descriptions have been drawn, belonging to the palæontological collections of the Museum. Such specimens form an important element in the scientific valuation of any collection, and, therefore, to have definite information with reference to their number and character, as well as to afford convenient lists for the use of workers both in and out of this Museum, I submitted to you in my last report a detailed inventory of all *types* and *illustrated specimens* of the *Palæozoic Crustacea* in our possession, with a citation of every work in which such illustrations have appeared. This list summarized as follows:

Original specimens	248
Total illustrated specimens	496

Herewith I communicate similar lists covering the *Annelida* and *Cephalopoda*, of which the totals are:

Original specimens	205
Total illustrated specimens	408

It is my desire and intention to continue these lists in future reports, until we have a completed statement of the number of our typical specimens of fossils of all zoological groups.

Respectfully submitted,

J. M. CLARKE,

Assistant Palæontologist.

Additions to the Geological and Palæontological Collections During the Year 1891-92.

By Donation.

	Number of specimens.
The Albany Institute, Albany, N. Y.:	
Collection of Fossils as listed in the Report of the State Geologist for 1890–1, about	500
John Young, Esq., Glasgow, Scotland:	
Athyris trinuclea, Carboniferous limestone, Glasgow	7
E. H. Raymour, Esq., Kansas City, Mo.:	
Platystoma, Corniferous limestone, Hagarsville, Ont.	1
Amphigenia elongata, Corniferous limestone, Hagarsville, Ont	1
Euomphalus Deceive, Corniferous limestone, Cass Co., Ind.	2
Spirifer divaricatus, Corniferous limestone, Cass Co., Ind.	3
S. fimbriatus, Corniferous limestone, Cass Co., Ind.	2
Trematospira hirsuta, Corniferous limestone, Cass Co., Ind.	3
Camarospira eucharis, Corniferous limestone, Cass Co., Ind.	5
Terebratula Harmonia, Corniferous limestone, Cass Co., Ind.	2
Spirifer fimbriatus, Corniferous limestone, Waverly, Ind.	8
Athyris spiriferoides, Corniferous limestone, Waverly, Ind.	2
Atrypa reticularis, Corniferous limestone, Waverly, Ind.	4
Productella navicella, Corniferous limestone, Waverly, Ind.	7
Rhynchonella Horsfordi, Corniferous limestone, Waverly, Ind.	7
Pentamerella læviuscula, Corniferous limestone, Waverly, Ind.	4
P. dubia, Corniferous limestone, Waverly, Ind.,	11
Camarospira eucharis, Corniferous limestone, Waverly, Ind.	23

	Number of specimens.
Terebratula Harmonia, Corniferous limestone, Waverly, Ind	1
T. sp. n., Corniferous limestone, Waverly, Ind	1
T. cf. *Lincklæni*, Corniferous limestone, Waverly, Ind	5
T. ?? Corniferous limestone, Waverly, Ind	5
Bellerophon Pelops, Corniferous limestone, Waverly, Ind	4
Miscellaneous brachiopods, Corniferous limestone, Waverly, Ind	308
lamellibranchs, Corniferous limestone, Waverly, Ind	9
gastropods, Corniferous limestone, Waverly, Ind	57
trilobites, Corniferous limestone, Waverly, Ind	21
crinoids, Corniferous limestone, Waverly, Ind	5
Limestone containing fossils, Corniferous limestone, Cass Co., Ind	50
Stropheodonata inæquistriata, Corniferous limestone, Peru, Ind	2
Camarophoria sp. n., Corniferous limestone, Peru, Ind	8
Terebratula Harmonia, Corniferous limestone, Peru, Ind	1
Cryptonella rectirostra, Hamilton group, Leicester, N. Y.,	2
Spirifer Keokuk ?, Chester group, Valley City, Ill	2
S. perplexus, Coal measures, Kansas City, Mo	3
Athyris subtilita, Coal measures, Kansas City, Mo	2
Athyris, Coal measures, Weston, Mo	32
Productus costatus, Coal measures, Webb City, Mo	1
Orthis resupinata, Coal measures, Webb City, Mo	1
Meekella striatocostata, Coal measures, Weston, Mo	1
Fish remains, Lower Silurian, Cañon City, Cal	18
Prof. Samuel Calvin, Iowa City, Ia.:	
Fossils illustrating section at Littleton, Ia., (See Rept. N. Y. State Geologist for 1890–91)	33
Dr. D. F. Lincoln, Geneva, N. Y.:	
Hyolithes sp. nov., Corniferous limestone, near Geneva, N. Y	1

	Number of specimens.
Orthoceras sp. nov.? Corniferous limestone, near Geneva, N. Y	1
Spirifer sp.? Corniferous limestone, near Geneva, N. Y	1
Chonostrophia reversa, Corniferous limestone, near Geneva, N. Y	1
Lepidodendron sp. nov., Corniferous limestone, near Geneva, N. Y	1
Gyathocrinus sp.? Hamilton group, near Bellona, N. Y	1

Prof. Henry M. Seely, Middlebury, Vt.:

Fossils from the calciferous beds, Fort Cassin, Vt	15
Fossils from the calciferous beds, Providence Island, Vt	4
Fossils from the calciferous beds, Shoreham, Vt	1
Fossils from the calciferous beds, Beekmantown, N. Y	2
Fossils from the Chazy beds, Ferrisburgh, Vt	5
Fossils from the Chazy beds, Sawyer's Bay, Vt	1

George Sisson, Esq., East Berne, N. Y.:

Devonian fossils, Albany county	3

Prof. J. F. Whiteaves, (Geological Survey of Canada), Ottawa:

Anomalocaris Canadensis, Cambrian, Mt. Stephen, B. C	2

Peabody Museum, Yale University (through Prof. C. E. Beecher):

Ptychoparia Kingi, Cambrian, S. E. Nevada	60
Asaphiscus Wheeleri, Cambrian, S. E. Nevada	5

The State Geologist. Trilobites from the Cambrian shales at Ratcliff's Mill, Hanford brook, New Brunswick:

Harttia, *Conocephalites*, *Paradoxides*, *Agnostus*, etc. A list will be given hereafter	60

The Assistant Palæontologist. Etchings from the Hamilton group, Canandaigua Lake, N. Y.:

Bryozoa	149
Brachiopods	745
Pteropods	80
Annelids	69
Trilobites	28

By Exchange.

	Number of specimens.
C. A. Davis, Esq., Alma, Mich.:	
Lot of fossils, Hamilton group, Thunder Bay, Mich.. ...	32
The E. M. Museum of Geology and Ethnology, Princeton, N. J.:	
Slab of *Melonites multipora*	1
Sequoia affinis, Eocene? Florisant, Cal	2
Planera longifolia, Eocene? Florisant, Cal	1
Myricophyllum callicoma, Eocene? Florisant, Cal	1
Glyptostrobus Europæus, Eocene? Florisant, Cal.........	1
Rhus Haydeni, Eocene? Florisant, Cal.................	1
Populus Heeri, Eocene? Florisant, Cal.................	1
Prin. J. M. Dolph, Port Jervis, N. Y.:	
Specimens from the *trilobite ledge*, mostly Trilobites and Brachiopods, Lower Helderberg(?), Port Jervis, N. Y...	913

By Purchase.

L. G. Rexford, Rexford Flats, N. Y.:	
Isotelus maximus? A large and entire individual from the Hudson River sandstone (blue stone), Rexford Flats...	1

By Collection.

Livonia Salt Shaft (D. D. Luther):	
Rocks and fossils from the Hamilton, Upper Helderberg, Lower Helderberg, Oriskany and Onondaga formations. Forty-eight boxes.	
Martin Sheehy and W. F. Cooper:	
Graptolites and Brachiopods from the Hudson River slates at Mt. Merino, 1½ m. S. E. of Hudson, N. Y..........	600
Total specimens (in drawers)......................	3,119
Total boxes..	48

DEPARTMENT OF GEOLOGY AND PALÆONTOLOGY.

List of the Original and Illustrated Specimens in the Palæontological Collections.

PART II.---ANNELIDA AND CEPHALOPODA.

PREPARED BY JOHN M. CLARKE, ASSISTANT PALÆONTOLOGIST.

List of the Original and Illustrated Specimens in the Palæontological Collections.

PART II.

ANNELIDA

EUNICITES, Ehlers. 1868.

Eunicites?

J. M. Clarke, in 6th Annual Report of the New York State Geologist, 1887, p. 30, pl. A 1, fig. 28.

Hamilton group. Canandaigua, N. Y.

J. M. Clarke purchase.

ŒNONITES, Hinde. 1879.

Œnonites.

Ditto in 6th Annual Report of the New York State Geologist, 1887, p. 30, pl. A 1, fig. 29.

Hamilton group. Canandaigua, N. Y.

J. M. Clarke purchase.

ARABELLITES, Hinde. 1879.

Arabellites sp.

Ditto in 6th Annual Report of the New York State Geologist, 1887, p. 30, pl. A 1, fig. 23.

Hamilton group. Canandaigua, N. Y.

J. M. Clarke purchase.

Ditto in 6th Annual Report of the New York State Geologist, p. 30, pl. A 1, fig 24.

Hamilton group. Canandaigua, N. Y.

J. M. Clarke purchase.

Ditto in 6th Annual report of the New York State Geologist, 1887, p. 30, pl. A 1, fig. 25.

Marcellus shale. Canandaigua, N. Y.

J. M. Clarke purchase.

Ditto in 6th Annual Report of the New York State Geologist, p. 30, pl. A 1, fig. 26.

Hamilton group. Canandaigua, N. Y.

J. M. Clarke purchase.

Ditto in 6th Annual Report of the New York State Geologist, p. 30, pl. A 1, fig. 27.

Hamilton group. Canandaigua, N. Y.

J. M. Clarke purchase.

PRIONIODUS, Pander. 1856.

Prioniodus spicatus, Hinde. 1879.

Quarterly Journal Geological Society, vol. 35, p. 361.

Ditto in 6th Annual Report of the New York State Geologist, 1887, p. 30, pl. A 1, fig. 22.

Naples shales. Naples, N. Y.

J. M. Clarke purchase.

POLYGYNATHUS, Hinde. 1879.

Polygnathus serratus, Hinde. 1879.

Quarterly Journal Geological Society, vol. 35, p. 365.

Ditto in 6th Annual Report of the New York State Geologist, 1887, p. 30, pl. A 1, fig. 21.

Naples shales. Naples, N. Y.

J. M. Clarke purchase.

Polygnathus cristatus, Hinde. 1879.

Quarterly Journal Geological Society, vol. 35, p. 366.

Ditto in 6th Annual Report of the New York State Geologist, p. 30, pl. A 1, fig. 20.

Naples Shales. Naples, N. Y.

J. M. Clarke purchase.

Polygnathus solidus, Hinde, 1879.

Quarterly Journal Geological Society, vol. 35, p. 365.

Ditto in 6th Annual Report of the New York State Geologist, p. 30, pl. A 1, fig. 11.

Naples shales. Naples, N. Y.

J. M. Clarke purchase.

Polygnathus tuberculatus, Hinde. 1879.

Quarterly Journal of the Geological Society, vol. 35, p. 366.

Ditto in 6th Annual Report of the New York State Geologist, p. 30, pl. A 1, fig. 17.

Naples beds. Naples, N. Y.

J. M. Clarke purchase.

Ditto in 6th Annual Report of the New York State Geologist, p. 30, pl. A 1, fig. 18.

Naples beds. Naples, N. Y.

J. M. Clarke purchase.

Polygnathus dubius, Hinde. 1879.

Quarterly Journal of the Geological Society, vol. 35, p. 362.

Ditto in 6th Annual Report of the New York State Geologist, p. 30, pl. A 1, fig. 1.

Naples beds. Naples, N. Y.

J. M. Clarke purchase.

Ditto in 6th Annual Report of the New York State Geologist, p. 30, pl. A 1, fig. 2.

Naples beds. Naples, N. Y.

J. M. Clarke purchase.

Ditto in 6th Annual Report of the New York State Geologist, p. 30, pl. A 1, fig. 3.

Naples beds. Naples, N. Y.

J. M. Clarke purchase.

Ditto in 6th Annual Report of the New York State Geologist, p. 30, pl. A 1, fig. 4.

Naples beds. Naples, N. Y.

J. M. Clarke purchase.

Ditto in 6th Annual Report of the New York State Geologist, p. 30, pl. A 1, fig. 5.

Naples beds. Naples, N. Y.

J. M. Clarke purchase.

Ditto in 6th Annual Report of the New York State Geologist, p. 30, pl. A 1, fig. 6.

Naples beds. Naples, N. Y.

J. M. Clarke purchase.

Ditto in 6th Annual Report of the New York State Geologist, p. 30, pl. A 1, fig. 7.

Naples beds. Naples, N. Y.

J. M. Clarke purchase.

Ditto in 6th Annual Report of the New York State Geologist, p. 30, pl. A 1, fig. 8.

Naples beds. Naples, N. Y.

J. M. Clarke purchase.

Ditto in 6th Annual Report of the New York State Geologist, p. 30, pl. A 1, fig. 10.

Naples beds. Naples, N. Y.

J. M. Clarke purchase.

Ditto in 6th Annual Report of the New York State Geologist, p. 30, pl. A 1, fig. 12.

Naples beds. Naples, N. Y.

J. M. Clarke purchase.

Ditto in 6th Annual Report of the New York State Geologist, p. 30, pl. A 1, fig. 13.

Naples beds. Naples, N. Y.

J. M. Clarke purchase.

Ditto in 6th Annual Report of the New York State Geologist, p. 30, pl. A 1, fig. 14.

Naples beds. Naples, N. Y.

J. M. Clarke purchase.

Ditto in 6th Annual Report of the New York State Geologist, p. 30, pl. A 1, fig. 15.

Naples beds. Naples, N. Y.

J. M. Clarke purchase.

Ditto in 6th Annual Report of the New York State Geologist, p. 30, pl. A 1, fig. 16.

Naples beds. Naples, N. Y.

J. M. Clarke purchase.

Ditto in 6th Annual Report of the New York State Geologist, p. 30, pl. A 1, fig. 19.

Naples beds. Naples, N. Y.

J. M. Clarke purchase.

Polygnathus pennatus, Hinde. 1879.

Quarterly Journal Geological Society, vol. 35, p. 366.

Ditto in 6th Annual Report of the New York State Geologist, p. 30, pl. A 1. fig. 9.

Naples beds. Naples, N. Y.

J. M. Clarke purchase.

CORNULITES, Schlotheim. 1820.

Cornulites proprius, Hall. 1876.

Twenty-eighth Annual Report N. Y. State Museum, p. 182.

Palæontology of New York, vol. v, pt. 2. Suppl.=vol. vii, pl. 116, fig. 19.

Niagara group. Waldron, Indiana.

Collected by C. Van Deloo, 1878.

Palæontology of New York, vol. 5, pt. 2. Suppl.=vol. vii, pl. 116, fig. 7.

Niagara group. Waldron, Indiana.

Collected by C. D. Walcott and C. Van Deloo, 1878.

Palæontology of New York, vol. v, pt. 2. Suppl.=vol. vii, pl. 116 fig. 8.

Niagara group. Waldron, Indiana.

Collected by C. D. Walcott and C. Van Deloo, 1878.

Cornulites tribulis, Hall. 1888.

Palæontology of New York, vol. v, pt. 2. Suppl.=vol. vii, p. 20, pl. 116, fig. 30.

Hamilton group. Hopewell, N. Y.

J. M. Clarke purchase.

CEPHALOPODA.

ORTHOCERAS, Breyn. 1732.

Orthoceras laqueatum, Hall. 1847.

Palæontology of New York, vol. i, p. 13, pl. 3, fig. **12.**
Calciferous sandrock. (Locality ?) New York.
Geological Survey collection.

Orthoceras primigenium, Vanuxem. 1842.

Geology of New York, Report Third District, p. 36.

Palæontology of New York, vol. i, p. 13, pl. 3, figs. **11, 11a.**
Calciferous sandrock. Near Fort Plain, N. Y.
Geological Survey collection.

Orthoceras tenuiseptum, Hall. 1847.

Palæontology of New York, vol. 1, p. 35, pl. 7, fig. **6.**
Chazy limestone. Chazy, N. Y.
Geological Survey collection.

Orthoceras fusiforme, Hall. 1847.

Palæontology of New York, vol. i, p. 60, pl. 20, fig. **1.**
Black River limestone. Watertown, N. Y.

Orthoceras coraliferum, Hall. 1847.

Palæontology of New York, vol. i, p. 312, pl. 85, fig. **3.**
Utica slate. Turin, N. Y.
Geological Survey collection.

Palæontology of New York, vol. i, pl. 86, fig. **1c.**
Hudson River group. Lewis county.
Geological Survey collection.

Orthoceras simulator, Hall. 1882.

Eleventh Annual Report State Geologist of Indiana, p. 322, pl. 33, figs. **1, 2.**
Niagara group. Waldron, Indiana.
Collected by C. D. Walcott and C. Van Deloo, 1878.

Orthoceras Amycus, Hall. 1882.

Eleventh Annual Report State Geologist of Indiana, p. 324, pl. 33, figs. **3, 4.**

Niagara group. Waldron, Indiana.

Collected by C. D. Walcott and C. Van Deloo, 1878.

Orthoceras pauciseptum, Hall. 1859.

Palæontology of New York, vol. vii, p. 346, pl. 72, figs. **5a, b.**

Lower Helderberg group (Shaly limestone). Schoharie, N. Y.

J. Gebhard purchase.

Orthoceras arenosum, Hall. 1859.

Palæontology of New York, vol. iii, p. 480, **not figured.**

Oriskany sandstone. Schoharie, N. Y.

J. Gebhard purchase.

Orthoceras masculum, Hall. 1879.

Palæontology of New York, vol. v, pt. 2, p. 238, pl. 78b, fig. **1.**

Schoharie grit. Clarksville, N. Y.

Orthoceras cingulum, Hall. 1879.

Palæontology of New York, vol. v, pt. 2, p. 240, pl. 76, fig. **2.**

Schoharie grit. Schoharie, N. Y.

J. Gebhard purchase.

Palæontology of New York, vol. v, pt. 2, pl. 76, fig. **3.**

Schoharie grit. Schoharie, N. Y.

J. Gebhard purchase.

Orthoceras Pelops, Hall. 1861.

Descr. New Species Fossils, p. 45.

Palæontology of New York, vol. v, pt. 2, 1879, pl. 35a, fig. 6.

Schoharie grit. Schoharie, N. Y.

J. Gebhard purchase.

Palæontology of New York, vol. v, pt. 2, 1879, pl. 35, figs. 2, 2a, 3.

Schoharie grit. The Helderberg, N. Y.

Illustrations of Devonian Fossils, 1876; Cephalopoda, pl. 35, fig. **2.**

Palæontology of New York, vol. v, pt. 2, 1879, pl. 35, fig. **1.**

Schoharie grit. Schoharie, N. Y.

J. Gebhard purchase.

Palæontology of New York, vol. v, pt. 2, 1879, pl. 35a, fig. 5.
Schoharie grit. Knox, N. Y.

Collected by C. Van Deloo, 1862.

Palæontology of New York, vol. v, pt. 2, 1879, pl. 35a, figs. 1, 2, 3.
Schoharie grit. Near Clarksville, N. Y.

Collected by R. P. Whitfield and C. Van Deloo, 1861.

Palæontology of New York, vol. v, pt. 2, 1879, pl. 35a, fig. 4.
Schoharie grit. The Helderberg, N. Y.

Palæontology of New York, vol. v, pt. 2, 1879, pl. 78b, fig. 2.
Schoharie grit. Knox, N. Y.

Collected by C. Van Deloo, 1862.

Orthoceras tantalus, Hall. 1879.

Palæontology of New York, vol. v, pt. 2, p. 241 pl. 35a, fig. 7.
Schoharie grit. Clarksville, N. Y.

Palæontology of New York, vol. v, pt. 2, pl. 35a, fig. 10.
Schoharie grit. Clarksville, N. Y.

Illustrations of Devonian Fossils, 1876; Cephalopoda, pl. 35, fig. 1 (part).
Palæontology of New York, vol. v, pt. 2, pl. 35, fig. 10.
Schoharie grit. Schoharie, N. Y.

J. Gebhard purchase.

Illustrations of Devonian Fossils, 1876; Cephalopoda, pl. 35, fig. 1 (part).
Palæontology of New York, vol. v, pt. 2, pl. 35, figs. 8, 9.
Schoharie grit. Schoharie, N. Y.

J. Gebbard purchase.

Orthoceras fluctum, Hall. 1879.

Palæontology of New York, vol. v, pt. 2, p. 239, pl. 76, figs. 5, 6.
Schoharie grit. Near Clarksville, N. Y.

Palæontology of New York, vol. v, pt. ., pl. 76, figs. 4, 7.
Schoharie grit. Near Clarksville, N. Y.

Orthoceras luxum, Hall. 1876.

Ill. Devon. Fossils, pl. 35, fig. 5.

Palæontology of New York, vol. v, pt. 2, pl. 35, fig. 7.
Schoharie grit. Schoharie, N. Y.

J. Gebhard purchase.

Palæontology of New York, vol. v, pt. 2, pl. 77, fig. 8; pl. 78b, fig. 3.
Schoharie grit. Schoharie, N. Y.

J. Gebhard purchase.

Illustrations of Devonian Fossils; Cephalopoda, pl. 35, fig. 3. (*O. Pelops*).
Schoharie grit. Schoharie, N. Y.

J. Gebhard purchase.

Palæontology of New York, vol. v, pt. 2, pl. 81, fig. 13.
Schoharie Grit. Schoharie, N. Y.

J. Gebhard purchase.

Palæontology of New York, vol. v, pt. 2, pl. 112, fig. 12.
Schoharie grit. Schoharie, N. Y.

J. Gebhard purchase.

Palæontology of New York, vol. v, pt. 2, pl. 112, fig. 13.
Schoharie grit. Schoharie, N. Y.

J. Gebhard purchase.

Palæontology of New York, vol. v, pt. 2, pl. 112, fig. 14.
Schohorie grit. Schoharie, N. Y.

J. Gebhard purchase.

Illustrations of Devonian Fossils; Cephalopoda, pl. 35, fig. 1. (*O. Pelops*).
Palæontology of New York, vol. v. pt. 2, pl. 35, fig. 5.
Schoharie grit. Schoharie, N. Y.

J. Gebhard purchase.

Palæontology of New York, vol. v, pt. 2, pl. 35, fig. 6.
Schoharie grit. Schoharie, N. Y.

J. Gebhard purchase.

Palæontology of New York, vol. v, pt. 2, pl. 76, fig. 1.
Schoharie grit. Near Clarksville, N. Y.

Collected by R. P. Whitfield and C. Van Deloo, 1861.

Palæontology of New York, vol. v, pt. 2, pl. 78, fig. 7.
Schoharie grit. Near Clarksville, N. Y.
Collected by R. P. Whitfield and C. Van Deloo, 1861.

Palæontology of New York, vol. v, pt. 2, pl. 77, fig. 5.
Schoharie grit. Schoharie, N. Y.
J. Gebhard purchase.

Palæontology of New York, vol. v, pt. 2, pl. 77, fig. 6.
Schoharie grit. Schoharie, N. Y.
J. Gebhard purchase.

Palæontology of New York, vol. v, pt. 2, pl. 77, fig. 7.
Schoharie grit, Schoharie, N. Y.
J. Gebhard purchase.

Palæontology of New York, vol. v, pt. 2, pl. 77, fig. 4.
Schoharie grit. Schoharie, N. Y.
J. Gebhard purchase.

Palæontology of New York, vol. v, pt. 2, pl. 77, fig. 1.
Schoharie grit. Schoharie, N. Y.
J. Gebhard purchase.

Palæontology of New York, vol. v, pt. 2, pl. 77, fig. 2.
Schoharie grit. Schoharie, N. Y.
J. Gebhard purchase.

Palæontology of New York, vol. v, pt. 2, pl. 77, fig. 4.
Schoharie grit. Schoharie, N. Y.
J. Gebhard purchase.

Palæontology of New York, vol. v, pt. 2, pl. 78, figs. 5, 6.
Schoharie grit. Schoharie, N. Y.
J. Gebhard purchase.

Palæontology of New York, vol. v, pt. 2, pl. 35, fig. 4.
Schoharie grit. Schoharie, N. Y.
J. Gebhard purchase.

Orthoceras collatum, Hall. 1879.

Palæontology of New York, vol. v, pt. 2, p. 252, pl. 80, fig. 1.
Schoharie grit. Schoharie N. Y.
J. Gebhard purchase.

Orthoceras Zeus, Hall. 1879.

Palæontology of New York, vol. v, pt. 2, p. 235, pl. 75, figs. **1**, **3**.
Schoharie grit. The Helderberg, N. Y.

Palæontology of New York, vol. v, pt. 2, pl. 75, fig. **2**.
Schoharie grit. Near Clarksville, N. Y.
Collected by C. Van Deloo, 1862.

Orthoceras tetricum, Hall. 1861.
Descr. New Species Fossils, p. 45.

Palæontology of New York, vol. v, pt. 2, pl. 80, fig. 2.
Schoharie grit. Near Clarksville, N. Y.
Collected by C. Van Deloo, 1862.

Palæontology of New York, vol. v, pt. 2, pl. 78b, fig. 4.
Schoharie grit. Near Clarksvillle, N. Y.
Collected by C. Van Deloo, 1862.

Palæontology of New York, vol. v, pt. 2, pl. 80, fig. 8.
Schoharie grit. Schoharie N. Y.
J. Gebhard purchase.

Palæontology of New York, vol. v, pt. 2, pl. 80, figs. 5, 6.
Schoharie grit. Near Clarksville, N. Y.
Collected by C. Van Deloo, 1862.

Palæontology of New York, vol. v, pt. 2, pl. 80, fig. 9.
Schoharie grit. Near Clarksville, N. Y.
Collected by C. Van Deloo, 1862.

Orthoceras procerus, Hall. 1876.

Illustrations of Devonian Fossils: Cephalopoda, pl. 35, fig. **4**.
Palæontology of New York, vol. v, pt. 2, pl. 35, fig. **15**.
Schoharie grit. Schoharie, N. Y.
J. Gebhard purchase.

Palæontology of New York, vol. v, pt. 2, pl. 35, fig. 16: pl. 78 A, fig. 1.
Schoharie grit. Schoharie, N. Y.
J. Gebhard purchase.

Palæontology of New York, vol. v, pt. 2, pl. 78 A, figs. 2, 3.
Schoharie grit. Schoharie, N. Y.
J. Gebhard purchase.

Palæontology of New York, vol. v, pt. 2, pl. 78 A, figs. 4, 5.
Schoharie grit. Schoharie, N. Y.

J. Gebhard purchase.

Palæontology of New York, vol. v, pt. 2, pl. 78 A, figs. 6, 7.
Schoharie grit. Schoharie, N. Y.

J. Gebhard purchase.

Palæontology of New York, vol. v, pt. 2, pl. 78 A, fig. 8.
Schoharie grit. Schoharie, N. Y.

J. Gebhard purchase.

Palæontology of New York, vol. v, pt. 2, pl. 79, figs. 5, 6.
Schoharie grit. Schoharie, N. Y.

J. Gebhard purchase.

Palæontology of New York, vol. v, pt. 2, pl. 79, figs. 7, 8.
Schoharie grit. Schoharie, N. Y.

J. Gebhard purchase.

Orthoceras carnosum, Hall. 1879.

Palæontology of New York, vol. v, pt. 2, p. 258, pl. 39, fig. **11**.
Schoharie grit. Schoharie, N. Y.

J. Gebhard purchase.

Orthoceras stylus, Hall. 1879.

Illustrations of Devonian Fossils, 1876; Cephalopoda, pl. 36, fig. 3 (*O. baculum*).
Palæontology of New York, vol. v, pt. 2, pl. 36, fig. **2**; pl. 79, fig. **1**.
Schoharie grit. Schoharie, N. Y.

J. Gebhard purchase.

Illustrations of Devonian Fossils, 1876; Cephalopoda, pl. 36, fig. **4**.
Palæontology of New York, vol. v, pt. 2, pl. 36, fig. 3.
Schoharie grit. Schoharie, N. Y.

J. Gebhard purchase.

Palæontology of New York, vol. v, pt. 2, pl. 79, fig. 3.
Schoharie grit. Schoharie N. Y.

J. Gebhard purchase.

Orthoceras varum, Hall. 1879.

Palæontology of New York, vol. v, pl. 2, p. 259, pl. 79, fig. **2.**
Schoharie grit. Schoharie, N. Y.

J. Gebhard purchase.

Palæontology of New York, vol. v, pt. 2, pl. 79, fig. **4.**
Schoharie grit. Schoharie, N. Y.

J. Gebhard purchase.

Palæontology of New York, vol. v, pt. 2, pl. 112, figs. **5, 6.**
Schoharie grit. Schoharie, N. Y.

J. Gebhard purchase.

Orthoceras pervicax, Hall. 1879.

Palæontology of New York, vol. v, pt. 2, p. 257, pl. 79, figs. **9, 10.**
Schoharie grit. Schoharie, N. Y.

J. Gebhard purchase.

Orthoceras oppletum, Hall. 1879.

Palæontology of New York, vol. v, pt. 2, p. 248, pl. 81, figs. **9, 10, 11.**
Schoharie grit. Schoharie, N. Y.

J. Gebhard purchase.

Palæontology of New York, vol. v, pt. 2, pl. 81, fig. **12.**
Schoharie grit. Schoharie, N. Y.

J. Gebhard purchase.

Palæontology of New York, vol. v, pt. 2, pl. 112, fig. **11.**
Schoharie grit. Schoharie, N. Y.

J. Gebhard, purchase.

Orthoceras vastator, Hall. 1879.

Palæontology of New York, vol. v, pt. 2, p. 243, pl. 78, figs. **1, 2.**
Schoharie grit. Schoharie, N. Y.

J. Gebhard purchase.

Palæontology of New York, vol. v, pt. 2, pl. 78, fig. **3.**
Schoharie grit. Schoharie, N. Y.

J. Gebhard purchase.

Palæontology of New York, vol. v, pt. 2, pl. 78, fig. **4.**
Schoharie grit. Schoharie, N. Y.

J. Gebhard purchase.

Orthoceras pravum, Hall. 1879.

(= *O. tetricum*, Hall, 1861, Descr. New Species Fossils, p. 45.)

Illustrations of Devonian Fossils, 1876; Cephalopoda, pl. 36, fig. **2.**
Palæontology of New York, vol. v, pt. 2, p. 255, pl. 36, fig. **2.**
Schoharie grit. Schoharie, N. Y.

J. Gebhard purchase.

Palæontology of New York, vol. v, pt. 2, pl. 81, fig. **1.**
Schoharie grit. Near Clarksville, N. Y.

Collected by C. Van Deloo, 1862.

Palæontology of New York, vol. v, pt. 2, pl. 81, figs. **2, 5**; pl. 112, fig. **17.**
Schoharie grit. Schoharie, N. Y.

J. Gebhard purchase.

Palæontology of New York, vol. v, pt. 2, pl. 81, figs. **3, 4**; pl. 112, fig. **16.**
Schoharie grit. Schoharie, N. Y.

J. Gebhard purchase.

Palæontology of New York, vol. v, pt. 2, pl. 81, fig. **6.**
Schoharie grit. Schoharie, N. Y.

J. Gebhard purchase.

Palæontology of New York, vol. v, pt. 2, pl. 81, fig. **15.**
Schoharie grit. Schoharie, N. Y.

J. Gebhard purchase.

Orthoceras medium, Hall. 1879.

Palæontology of New York, vol. v, pt. 2, p. 254, pl. 79, figs. **11, 12.**
Schoharie grit. Schoharie.

J. Gebhard purchase.

Orthoceras Thoas, Hall. 1861.

Descr. New Species Fossils, p. 47.

Illustrations of Devonian Fossils, 1876; Cephalopoda, pl. 41, fig. 1; Palæontology of New York, vol. v, pt. 2, 1879, pl. 41, fig. 1.
Corniferous limestone. Schoharie, N. Y.

J. Gebhard purchase.

Illustrations of Devonian Fossils, 1876; Cephalopoda, pl. 41, fig. 2; Palæontology of New York, vol. v, pt. 2, 1888, pl. 41, fig. 2.
Corniferous limestone. Schoharie, N. Y.

J. Gebhard purchase.

Illustrations of Devonian Fossils, 1876; Cephalopoda, pl. 41, fig. 8; Palæontology of New York, vol. v, pt. 2, 1879, pl. 41, fig. 8.
Corniferous limestone. Clarence, N. Y.
Collected by C. A. White, R. P. Whitfield and C. Van Deloo, 1860.

Illustrations of Devonian Fossils, 1876; Cephalopoda pl. 41, fig. 5; Palæontology of New York, vol. v, pt. 2, 1879, pl. 41, fig. 5.
Schoharie grit. Schoharie, N. Y.

J. Gebhard purchase.

Illustrations of Devonian Fossils, 1876; Cephalopoda pl. 41, fig. 3; Palæontology of New York, vol. v, pt. 2, 1879, pl. 41, fig. 3.
Schoharie grit. Schoharie, N. Y.

J. Gebhard purchase.

Illustrations of Devonian Fossils, 1876; Cephalopoda, pl. 41, fig. 6; Palæontology of New York, vol. v, pt. 2, 1879, pl. 41, fig. 6.
Schoharie grit. Schoharie, N. Y.

J. Gebhard purchase.

Palæontology of New York, vol. v, pt. 2, 1879, pl. 78b, fig. 5.
Schoharie grit. Near Clarksville, N. Y.

C. Van Deloo, 1866.

Palæontology of New York, vol. v, pt. 2, 1879, pl. 80, fig. 10.
Schoharie grit. Schoharie, N. Y.

J. Gebhard purchase.

Palæontology of New York, vol. v, pt. 2, 1879, pl. 80, fig. 11.
Schoharie grit. Schoharie, N. Y.

J. Gebhard purchase.

Palæontology of New York, vol. v, pt. 2, 1879, pl. 112, figs. 7, 8.
Corniferous limestone. Caledonia, N. Y.

Collected by C. A. White, 1860.

Orthoceras multicinctum, Hall. 1861.

Descr. New Species Fossils, p. 48.

Fifteenth Annual Report of the New York State Cabinet of Natural History, pl. 7, fig. **3**; Illustrations of Devonian Fossils, 1876; Cephalopoda, pl. 43, fig. **1**; and Palæontology of New York, vol. v, pt. 2, pl. 43, fig. **1**.

Schoharie grit. Schoharie, N. Y.

J. Gebhard purchase.

Fifteenth Annual Report of the New York State Cabinet of Natural History, pl. 7, fig. **2**; Illustrations of Devonian Fossils, 1876, Cephalopoda, pl. 43, fig. **2**; and Palæontology of New York, vol. v. pt. 2, pl. 43, fig. **2**.

Schoharie grit. Schoharie, N. Y.

J. Gebhard purchase.

Illustrations of Devonian Fossils, 1876; Cephalopoda, pl. 43, fig. 3; and Palæontology of New York, vol. v, pt. 2, pl. 43, fig. 3.

Schoharie grit. Schoharie, N. Y.

J. Gebhard purchase.

Orthoceras duramen, Hall. 1886.

Fifth Annual Report of the New York State Geologist, Expl. pl. (117) 1, fig. **1**; Palæontology of New York, vol. v, pt. 2, Suppl.= vol. vii, p. 25, pl. 117, fig. **1**.

Schoharie grit. Near Clarksville, N. Y.

Collected by C. Van Deloo, 1862.

Orthoceras sceptrum, Hall. 1886.

Fifth Annual Report of the New York State Geologist, Expl. pl. (117) 1, fig. **2**; Palæontology of New York, vol. v, pt. 2, Suppl.= vol. viii, pl. 117, fig. **2**.

Upper Helderberg limestone. Cherry Valley, N. Y.

Collected by J. W. Hall, 1877.

Orthoceras inoptatum, Hall. 1879.

Palæontology of New York, vol. v, pt. 2, p. 267, pl. 112, figs. **9**, **10**.

Corniferous limestone. Clarence, N. Y.

Orthoceras profundum, Hall. 1861.

Descr. New Species Fossils, p. 48.

Illustrations of Devonian Fossils, 1876; Cephalopoda, pl. 37, fig. 5.
Palæontology of New York, vol. v, pt. 2, pl. 37, fig. 5.
Corniferous limestone. Black Rock, N. Y.

J. Gebhard purchase.

Orthoceras Thestor, Hall. 1879.

Palæontology of New York, vol. v, pt. 2, p. 302, pl. 82, fig. 18.
Marcellus shales. Schoharie, N. Y.

J. Gebhard purchase.

Orthoceras Marcellense, Vanuxem. 1842.

Geology of New York; Rept. Third Dist., p. 147.

Palæontology of New York, vol. v, pt. 2, p. 278, pl. 83, figs. 10, 12.
Goniatite limestone. Near Manlius, N. Y.

Collected by H. H. Smith, 1873.

Palæontology of New York, vol. v, p. 2, pl. 83, fig. 1.
Goniatite limestone. Near Manlius, N. Y.

Collected by H. H. Smith, 1873.

Palæontology of New York, vol. v, pt. 2, pl. 83, fig. 3.
Goniatite limestone. Marcellus, N. Y.

Collected by C. A. White, 1860.

Palæontology of New York, vol. v, pt. 2, pl. 83, fig. 6.
Goniatite limestone. Near Manlius, N. Y.

Collected by H. H. Smith, 1873.

Palæontology of New York, vol. v, pt 2, pl. 83, fig. 9.
Goniatite limestone. Marcellus, N. Y.

Collected by C. A. White, 1860.

Palæontology of New York, vol. v, pt. 2, pl. 38, fig. 6.
Goniatite limestone. Falls of Oneida Creek, N. Y.

Orthoceras aptum, Hall. 1879.

Palæontology of New York, vol. v, pt. 2, pl. 38, fig. 8.
Goniatite limestone. Near Manlius, N. Y

Orthoceras fustis, Hall. 1879.

Palæontology of New York, vol. v, pt. 2, pl. 83, fig. **11**; pl. 113, figs. **16, 17**.

Goniatite limestone. Schoharie, N. Y.

J. Gebhard purchase.

Orthoceras rudens, Hall. 1886.

Fifth Annual Report of the New York State Geologist, expl. pl. (118) 2, fig. **2**.

Palæontology of New York, vol. v, pt. 2, Suppl.=vol. vii, p. 28, pl. 118, fig. **1**.

Hamilton (?) group. Livingston county, N. Y.

Pickett purchase.

Orthoceras subulatum, Hall. 1843.

Geology of N. Y.; Rept. Fourth Dist., p. 180.

Palæontology of New York, vol. v, pt. 2, pl. 84, fig. 1.

Hamilton group. Pratt's Falls, N. Y.

Collected by C. Van Deloo and H. H. Smith, 1874.

Palæontology of New York, vol. v, pt. 2, pl. 84, figs. 6, 10.

Hamilton group. Pratt's Falls, N. Y.

Collected by H. H. Smith and C. Van Deloo, 1874.

Palæontology of New York, vol. v, pt. 2, pl. 84, figs. 7, 7+.

Hamilton group. Pratt's Falls, N. Y.

Collected by H. H. Smith and C. Van Deloo, 1874.

Palæontology of New York, vol. v, pt. 2, pl. 84, fig. 8.

Hamilton group. Pratt's Falls, N. Y.

Collected by H. H. Smith and C. Van Deloo, 1874.

Palæontology of New York, vol. v, pt. 2, pl. 86, figs. 1, 2.

Hamilton group. Pratt's Falls, N. Y.

Collected by H. H. Smith and C. Van Deloo, 1874.

Orthoceras exile, Hall. 1861.

Descr. New Species Fossils, p. 50.

Fifteenth Annual Report of the New York State Cabinet of Natural History, 1862, p. 78, pl. 8, fig. **5**.

Illustrations of Devonian Fossils, 1876; Cephalopoda, pl. 39, fig. **3**.

Palæontology of New York, vol. v, pt. 2, pl. 39, fig. **3**.

Hamilton group. Cazenovia, N. Y.

L. Lincklaen, donor.

Palæontology of New York, vol. v, pt. 2, pl. 85, fig. 14.
Hamilton group. Norton's Landing, Cayuga Lake.

Collected by J. W. Hall, 1866.

Palæontology of New York, vol. v, pt. 2 pl. 85, fig. 15.
Hamilton group. Norton's Landing, Cayuga Lake.

Collected by J. W. Hall, 1866.

Orthoceras Telamon, Hall. 1879.

Palæontology of New York, p. 291, pl. 83, figs. **3, 4**.
Hamilton group. Canandaigua Lake, N. Y.

Palæontology of New York, pl. 83, fig. **12**.
Hamilton group. Canandaigua Lake, N. Y.

Collected by R. P. Whitfield and J. W. Hall, 1858.

Orthoceras emaceratum, Hall. 1879.

15th Ann. Rept. State Cab., p. 170.

Palæontology of New York, vol. v, pt. 2, pl. 85, fig. 16.
Hamilton group. Jaycox's Run, Geneseo.

Collected by C. Van Deloo, 1865.

Orthoceras Bebryx, Hall. 1876.

Illustrations of Devonian Fossils; Cephalopoda, Expl. pl. 39, fig. **2**.
Palæontology of New York, vol. v, pt. 2, pl. 39, fig. **2**.
Hamilton group. Cazenovia, N. Y.

L. Lincklaen, donor.

Palæontology of New York, vol. v, pt. 2, pl. 38, fig. 10.
Hamilton group. Cazenovia, N. Y.

L. Lincklaen, donor.

Palæontology of New York, vol. v, pt. 2, pl. 83, fig. 14.
Hamilton group. Skaneateles Lake, N. Y.

Collected by G. B. Simpson, 1863.

Palæontology of New York, vol. v, pt. 2, pl. 84, fig. 11.
Hamilton group. York, N. Y.

Collected by C. Van Deloo, 1865.

Orthoceras Eriense,

Illustrations of Devonian Fossils, 1876; Cephalopoda, pl. 40, fig. **4** (*O. robustum*).
Palæontology of New York, vol. v, pt. 2, p. 274, pl. 40, fig. **4**.
Hamilton group. Otisco N. Y.

Palæontology of New York, vol. v, pt. 2, pl. 87, figs. **1**, **2**.
Hamilton group. Shore of Lake Erie.

Orthoceras linteum, Hall. 1879.

Palæontology of New York, vol. v, pt. 2, p. 277, pl. 87, figs. **3**, **4**.
Hamilton group. Near Leonardsville, N. Y.
Collected by F. B. Meek, R. P. Whitfield and C. Van Deloo, 1857.

Orthoceras sp., Hall. 1879.

Palæontology of New York, vol. v, pt. 2, pl. 83, fig. 13.
Hamilton group. Bosanquet, Province of Ontario.
Collected by J. De Cew, 1865.

Orthoceras aulax, Hall. 1879.

Palæontology of New York, vol. v, pt. 2, p. 293, pl. 84, fig. **18**.
Hamilton group. Hamburgh, N. Y.
Collected by J. W. Hall and C. Van Deloo, 1865.

Orthoceras Œdipus, Hall. 1879.

Palæontology of New York, vol. v, pt. 2, p. 294, pl. 37, fig. **6**.
Hamilton group. Geneseo, N. Y.
Collected by C. A. White and C. Van Deloo, 1860.

Palæontology of New York, vol. 5, pt. 2, pl. 82, fig. **17**.
Hamilton group. Jaycox's Run, Geneseo.
Collected by C. Van Deloo, 1865.

Orthoceras crotalum, Hall. 1861.

Descr. New Species Fossils, p. 50.

Illustrations of Devonian Fossils, 1876; Cephalopoda, pl. 42, fig. 12.
Palæontology of New York, vol. v, pt. 2, pl. 42, fig. 12.
Hamilton group. Geneseo, N. Y.
Collected by C. A. White and C. Van Deloo, 1860.

Illustrations of Devonian Fossils, 1876; Cephalopoda, pl. 42, fig. 2.
Palæontology of New York, vol. v, pt. 2, pl. 42, fig. 2.
Hamilton group. Pratts Falls, N. Y.
Collected by G. B. Simpson, 1871.

Illustrations of Devonian Fossils, 1876; Cephalopoda, pl. 42, fig. 7.
Palæontology of New York, vol. v, pt. 2, pl. 42, fig. 7.
Hamilton group. Otisco Lake, N. Y.
Collected by J. W. Hall and G. B. Simpson, 1872.

Illustrations of Devonian Fossils, 1876; Cephalopoda, pl. 42, fig. 6.
Palæontology of New York, vol. v, pt. 2, pl. 42, fig. 6.
Hamilton group. Pratt's Falls, N. Y.
Collected by G. B. Simpson, 1871.

Illustrations of Devonian Fossils, 1876; Cephalopoda, pl. 42, figs. 5, 11.
Palæontology of New York, vol. v, pt. 2, pl. 42, figs. 5, 11.
Hamilton group. Hamilton, N. Y.

Palæontology of New York, vol. v, pt. 2, pl. 82, fig. 1.
Hamilton group. Pratt's Falls, N. Y.
Collected by G. B. Simpson, 1883.

Palæontology of New York, vol. v, pt. 2, pl. 82, fig. 2.
Hamilton group. Delphi, N. Y.
Collected by G. B. Simpson, 1863.

Palæontology of New York, vol. v, pt. 2, pl. 82, figs. 3, 4.
Hamilton group. Pratt's Falls, N. Y.
Collected by H. H. Smith and C. Van Deloo, 1874.

Palæontology of New York, vol. v, pt. 2, pl. 82, fig. 5; pl. 113, figs. 13, 13a.
Hamilton group. Pratt's Falls, N. Y.
Collected by H. H. Smith and C. Van Deloo, 1874.

Palæontology of New York, vol. v, pt. 2, pl. 82, fig. 6.
Hamilton group. Pratt's Falls, N. Y.
Collected by H. H. Smith and C. Van Deloo, 1874.

Palæontology of New York, vol. v, pt. 2, pl. 82, figs 7, 8.
Hamilton group. Pratt's Falls, N. Y.
Collected by H. H. Smith and C. Van Deloo, 1874.

Orthoceras nuntium Hall. 1861.

Descr. New Species Fossils, p. 51.

Illustrations of Devonian Fossils, 1876; Cephalopoda, pl. 43, fig. 10.
Palæontology of New York, vol. v, pt. 2, pl. 43, fig. 10.
Hamilton group. Geneseo, N. Y.
Collected by C. A. White and C. Van Deloo, 1860.

Illustrations of Devonian Fossils, 1876; Cephalopoda, pl. 43, figs. 6, 7.
Palæontology of New York, vol. v, pt. 2, pl. 43, figs. 6, 7.
Hamilton group. Hamburgh, N. Y.

Illustrations of Devonian Fossils, 1876; Cephalopoda, pl. 43, fig. 14
Palæontology of New York, vol. v, pt. 2, pl. 43, fig. 14.
Hamilton group. Geneseo, N. Y.
Collected by C. A. White and C. Van Deloo, 1860.

Orthoceras cœlamen, Hall. 1879.

Illustrations of Devonian Fossils, 1876 ; Cephalopoda, pl. 10, fig. **42**.
Palæontology of New York, vol. v, pt. 2, p. 298, pl. 10, fig. **42**; pl. 82, fig. **16**.
Hamilton group. Muttonville, N. Y.
Collected by C. A. White and C. Van Deloo, 1860.

Palæontology of New York, vol. v, pt. 2, pl. 82, fig. **14**.
Hamilton group. Platt's Falls, N. Y.
Collected by G. B. Simpson, 1871.

Palæontology of New York, vol. v, pt. 2, pl. 82, fig. **15**.
Hamilton group. Pratt's Falls, N. Y.
Collected by G. B. Simpson. 1871.

Orthoceras Ægea, Hall. 1861.

Descr. New Species Fossils, p. 22.

Palæontology of New York, vol. v, pt. 2, pl. 82, fig. **9**.
Hamilton group. Pratt's Falls, N. Y.
Collected by J. W. Hall and G. B. Simpson, 1874.

Palæotology of New York, vol. v, pt. 2, pl. 82, fig. **10**.
Hamilton group. Geneseo, N. Y.
Collected by C. Van Deloo, 1865.

Palæontology of New York, vol. pt. 2, pl. 82, fig. **11**.
Hamilton group. Geneseo, N. Y.
Collected by C. Van Deloo, 1865.

Orthoceras scintilla, Hall. 1879.

Palæontology of New York, vol. v, pt. 2, p. 293, pl. 84, figs. **19, 20**.
Hamilton group. Pratt's Falls, N. Y.
Collected by H. H. Smith and C. Van Deloo, 1874.

Palæontology of New York, vol. v, pt. 2, pl. 84, fig. **21**.
Hamilton group. Pratt's Falls, N. Y.
Collected by H. H. Smith and C. Van Deloo, 1874.

Palæontology of New York, vol. v, pt. 2, pl. 113, fig. **6**.
Hamilton group. Pratt's Falls, N. Y.
Collected by H. H. Smith and C. Van Deloo, 1874.

Palæontology of New York, vol. v, pt. 2, pl. 113, figs. **7, 8, 9**.
Hamilton group. Pratt's Falls, N. Y.
Collected by H. H. Smith and C. Van Deloo, 1874.

Palæontology of New York, vol, v, pt. 2, pl. 113, figs. **10, 11, 12**.
Hamilton group. Pratt's Falls, N. Y.
Collected by H. H. Smith and C. Van Deloo, 1874.

Orthoceras pacator, Hall. 1879.

Palæontology of New York, vol. v, pt. 2, p. 307, pl. 89, fig. **1**.
Portage group. Mt. Morris, N. Y.

Palæontology of New York, vol. v, pt. 2, pl. 89, fig. **3**.
Portage group. Mt. Morris, N. Y.

Palæontology of New York, vol. v, pt. 2, pl. 89, fig. **5**.
Portage group. Near Ithaca, N. Y.
Collected by C. Van Deloo, 1874.

Palæontology of New York, vol. 5. pt. 2, pl. 89, fig. **6**.
Portage group. Ithaca, N. Y.
Collected by C. Van Deloo, 1874.

Orthoceras Thyestes, Hall. 1879.

Palæontology of New York, vol. v, pt. 2, p. 306, pl. 88, fig. **2**.
Portage group. Near Watkins, N. Y.
Pickett purchase.

Orthoceras Atreus, Hall. 1879.

Palæontology of New York, vol. v, pt. 2, p. 305, pl. 88, fig. **1**.
Portage group. Roger's Bridge, Genesee River.

Orthoceras Bebryx, var. *Cayuga*, Hall. 1879.

Palæontology of New York, vol. v, pt. 2, p. 276, pl. 86, fig. **3**.
Chemung group. Ithaca, N. Y.
Collected by J. W. Hall and C. Van Deloo, 1866.

Palæontology of New York, vol. v, pt. 2, pl. 86, fig. **4**.
Chemung group. Ithaca, N. Y.
Collected by J. W. Hall and C. Van Deloo, 1866.

Palæontology of New York, vol. v, pt. 2, pl. 86, fig. **5**.
Chemung group. Ithaca, N. Y.
Pickett purchase.

Orthoceras consortale, Hall. 1886.

Fifth Annual Report of the New York State Geologist. Expl. pl. (118) 2, figs. **3, 4, 5**.
Palæontology of New York, vol. v, pt. 2, Suppl. =vol. vii, p. 29, pl. 118, figs. **3. 4, 5**.
Chemung group. Panama, N. Y.
Collected by James Hall, 1870.

Orthoceras expositum, Hall. 1886.

Fifth Annual Report of the New York State Geologist. Expl. pl. (118) 2, fig. **2**.
Palæontology of New York, vol. v, pt. 2, Supp. =vol. vii, p. 29, pl. 118, fig. **2**.
Chemung group. Canton, Penn.
Collected by A. Sherwood.

Orthoceras palmatum, Hall. 1879.

Palæontology of New York, vol. v, pt. 2, p. 312, pl. 90, fig. **9, 10**.
Chemung group. Southern New York.

Orthoceras Leander, Hall. 1879.

Palæontology of New York, vol. v, pt. 2, p. 309, pl. 90, figs. **6, 7**.
Chemung group. Near Ithaca, N. Y.
J. W. Hall and C. Van Deloo, 1866.

Orthoceras Demus, Hall. 1879.

Palæontology of New York, vol. v, pt. 2, p. 311, pl. 90, fig. **1.**
Chemung group. Philipsburgh, N. Y.

Palæontology of New York, vol. v, pt. 2, pl. 90, fig. **5.**
Chemung group. Ithaca, N. Y.
Collected by J. W. Hall and G. B. Simpson 1870.

HORMOCERAS, Stokes. 1838.

Hormoceras filosum, Hall. 1847.

Palæontology of New York, vol. i, p. 55, pl. 15, fig. **1c.**
Black River limestone. Watertown, N. Y.

Hormoceras tenuifilum, Hall. 1847.

Palæontology of New York, vol. i, p. 55, pl. 14, figs. **1, 1a, 1b.**
Black River limestone. Watertown, N. Y.
Albany Institute donor, 1892.

Hormoceras? gracile, Hall. 1847.

Palæontology of New York, vol. i, p. 58, pl. 17, fig. **3.**
Black River limestone. Watertown, N. Y.
Albany Institute donor, 1891.

Hormoceras remotiseptum, Hall. 1850.

Third Report on New York State Cabinet of Natural History, p. 173, pl. 4, fig. **3.**
Trenton limestone. Watertown, N. Y.
Geological Survey collection.

ENDOCERAS, Hall. 1847.

Endoceras longissimum, Hall. 1847.

Palæontology of New York, vol. i, p. 59, pl. 18, fig. **1, 1a.**
Black River limestone. Watertown, N. Y.
Albany Institute donor, 1891.

Endoceras duplicatum, Hall. 1847.

Palæontology of New York, vol. i, p. 219, pl. 55, fig. **1.**
Trenton limestone. Middleville, N. Y.
J. Gebhard purchase.

Endoceras proteiforme, var. *lineolatum*, Hall. 1847.

Palæontology of New York, vol. i, p. 211, pl. 45, figs. **4, c, d.**
Trenton limestone. Middleville, N. Y.

GOMPHOCERAS, Sowerby. 1839.

Gomphoceras clavatum, Hall. 1876.

Ills. Dev. Fossils; Exp. pl. 47, figs. 12, 13.

Palæontology of New York, vol. v, pt. 2, pl. 93, fig. 2.
Schoharie grit. Schoharie, N. Y.

J. Gebhard purchase.

Palæontology of New York, vol. v, pt. 2, pl. 93, fig. 3.
Schoharie grit. Schoharie, N. Y.

J. Gebhard purchase.

Gomphoceras rude, Hall. 1879.

Palæontology of New York, vol. v, pt. 2, p. 327, pl. 93, fig. **1.**
Schoharie grit. Schoharie, N. Y.

J. Gebhard purchase.

Gomphoceras cruciferum, Hall. 1879.

Palæontology of New York, vol. v, pt. 2, p. 328, pl. 93, fig. **4.**
Schoharie grit. Schoharie, N. Y.

J. Gebhard purchase.

Gomphoceras Illænus, Hall. 1879.

Palæontology of New York, vol. v, pt. 2, p. 322, pl. (Suppl. = vol. vii) 122, fig. **6.**
Schoharie grit. Schoharie, N. Y.

J. Gebhard purchase.

Gomphoceras fax, Hall. 1879.

Palæontology of New York, vol. v, pt. 2, p. 321, pl. (Suppl. = vol. vii) 122, fig. **5.**
Schoharie grit. Schoharie, N. Y.

J. Gebhard purchase.

Gomphoceras beta, Hall. 1861.

Descr. New Species Fossils, p. 44.

Fifteenth Report on the New York State Cabinet of Natural History, p. 72, pl. 7, fig. **1**; Illustrations of Devonian Fossils, 1876; Cephalopoda, pl. 47, fig. **5**; Palæontology of New York, vol. v, pt. 2, pl. 46, fig. 4.

Schoharie grit. Schoharie, N. Y.

J. Gebhard purchase.

Illustrations of Devonian Fossils, 1876; Cephalopoda, pl. 47, fig. 6; Palæontology of New York, vol. v, pt. 2, pl. 46, fig. 5.

Schoharie grit. Schoharie, N. Y.

J. Gebhard purchase.

Gomphoceras absens, Hall. 1876.

Illustrations of Devonian Fossils, 1876; Cephalopoda. Expl. pl. 47, figs. **7**, **8**; Paleontology of New York, vol. v, pt. 2, pl. 46, figs. **8**, **9**.

Schoharie grit. Schoharie, N. Y.

J. Gebhard purchase.

Palæontology of New York, vol. v, pt. 2, Suppl. (= vol. vii), pl. 122 fig. 1.

Schoharie grit. Schoharie, N. Y.

J. Gebhard purchase.

Palæontology of New York, vol. v, pt. 2, Suppl. (= vol. vii), pl. 122, fig. 2.

Schoharie grit. Schoharie, N. Y.

J. Gebhard purchase.

Illustrations of Devonian Fossils, 1876, Cephalopoda. Expl. pl. 47, figs. 7, 8; Palæontolology of New York, vol. v, pt. 2, Suppl. (= vol. vii), pl. 122, fig. 3.

Corniferous limestone. Clarence Hollow, N. Y.

Gomphoceras mitra, Hall. 1879.

* Palæontology of New York, vol. v. pt. 2. Suppl. (= vol. vii), pl. 121, fig. **3**.

Corniferous limestone. Columbus, Ohio.

Gomphoceras eximium, Hall. 1879.

14th Rept. N. Y. State Cab. Nat. Hist., p. 109.

*Palæontology of New York, vol. v. pt. 2, Suppl. (= vol. vii), pl. 121, fig. 2.
Corniferous limestone. Columbus, Ohio.

Gomphoceras impar, Hall. 1879.

*Palæontology of New York, vol. v, pt. 2, p. 232, Suppl. (=vol. vii), pl. 121 A, fig. 1.
Corniferous limestone. Columbus, Ohio.

Gomphoceras solidum, Hall. 1879.

Palæontology of New York, vol. v, pt. 2, p. 338, pl. 93, fig. 9.
Goniatite limestone. Manlius, N. Y.
L. Lincklaen, donor.

Gomphoceras oviforme, Hall. 1860.

13th Rept. N. Y. State Cab. Nat. Hist., p. 105.

Illustrations of Devonian Fossils, 1876; Cephalopoda, pl. 45, figs. 1, 2,
Palæontology of New York, vol. v, pt. 2, pl. 45, figs. 2, 3.
Goniatite limestone. Schoharie, N. Y.
J. Gebhard purchase.

Illustrations of Devonian Fossils, 1876; Cephalopoda, pl. 47, figs. 3, 4.
Palæontology of New York, vol. v, pt. 2, pl. 46, figs. 6, 7.
Goniatite limestone. Schoharie, N. Y.
J. Gebhard purchase.

Palæontology of New York, vol. v, pt. 2, pl. 94, fig. 6.
Goniatite limestone. choharie, N. Y.
J. Gebhard purchase.

Palæontology of New York, vol. v, pt. 2, pl. 94, fig. 7.
Goniatite limestone. Schoharie, N. Y.
J. Gebhard purchase.

Gomphoceras poculum, Hall. 1879.

Palæontology of New York, vol. v, pt. 2, p. 340, pl. 93, figs. 7, 8.
Hamilton group. Cazenovia, N. Y.

Gomphoceras raphanus, Hall. 1879.

Palæontology of New York, vol. v, pt. 2, pt. 347, pl. 94, figs. **2, 3.**
Hamilton group. Pratt's Falls, N. Y.
Collected by H. H. Smith and C. Van Deloo, 1874.

Palæontology of New York, vol. v, p. 2, pl. 94, fig. **4.**
Hamilton group. Pratt's Falls, N. Y.
Collected by H. H. Smith and C. Van Deloo, 1874.

Palæontology of New York, vol. v, pt. 2, pl. 94, fig. **10.**
Hamilton group. Pratt's Falls, N. Y.
Collected by G. B. Simpson, 1871.

Gomphoceras sp. Hall. 1876.

Illustrations of Devonian Fossils, 1876; Cephalopoda, pl. 60, fig. **7.**
Palæontology of New York, vol. v, pt. 2, pl. 60, fig. **7.**
Hamilton group. Skaneateles Lake, N. Y.
Collected by J. W. Hall and G. B. Simpson, 1872.

Gomphoceras planum, Hall. 1879.

Palæontology of New York, vol. v, pt. 2, p. 352, pl. 57, figs. **1, 2.**
Hamilton group. Borodino, N. Y.
W. Emmons, donor.

Gomphoceras manes, Hall. 1879.

Palæontology of New York, vol. v, pt. 2, p. 339 and Suppl. 1888, p. 34, pl. 123, fig. **2.**
Genesee slate. South of Alden, N. Y.

Gomphoceras Ajax, Hall. 1879.

Palæontology of New York, vol. v, pt. 2, p. 350, pl. 94, fig. **8.**
Portage group. Penn Yan, N. Y.
Geological Survey collection.

Gomphoceras tumidum, Hall. 1879.

Palæontology of New York, vol. v, pt. 2, p. 351, pl. 95. fig. **5.**
Chemung group. New Albion, N. Y.
Collected by C. Van Deloo, 1863.

Palæontology of New York, vol. v, pt. 2, pl. 95, fig. **2.**
Chemung group. Near Ithaca, N. Y.
Collected by J. W. Hall and C. Van Deloo, 1866.

Palæontology of New York, vol. v, pt. 2, pl. 95, fig. **3**.
Chemung group. Near Ithaca, N. Y.
Collected by J. W. Hall and C. Van Deloo, 1866.

Gomphoceras nasutum, Hall. 1886.

Fifth Annual Report of New York State Geologist. Expl. pl. 120 (4), figs. **5, 7**.
Palæontology of New York, vol. v, pt. 2, Suppl. (= vol. vii) p. 34, pl. 120, figs. **5, 7**.
Chenango group. Belmont, N. Y.
Collected by A. Sherwood, 1871.

Gomphoceras potens, Hall. 1879.

Palæontology of New York, vol. v, pt. 2, p. 351, pl. 122, fig. **8**.
Waverly group. Medina, Ohio.
Collected by C. A. White, 1861.

CYRTOCERAS, Goldfuss. 1832.

Cyrtoceras filosum, Emmons. 1842.

* Geology of New York; Report on the Third District, p. 392, fig. **4**.
Palæontology of New York, vol. i, p 390, pl. 41, fig. **3a**.
Trenton limestone. Watertown, N. Y.

Cyrtoceras macrostomum, Hall. 1847.

* Palæontology of New York, vol. i, p. 194, pl. 42, fig. **1b**.
Trenton limestone. Mineral Point, Wis.

Cyrtoceras eugenium, Hall. 1861.

Descr. New Species Fossils, p. 42.

Fifteenth Annual Report on the New York State Cabinet of Natural History, p. 70, pl. 9, fig. **1**.
Illustrations of Devonian Fossils, 1876; Cephalopoda, pl. 46, figs. **5, 6**.
Palæontology of New York, vol. v, pt. 2, pl. 47, figs. **5, 6**.
Schoharie grit. Schoharie, N. Y.
J. Gebhard purchase.

Illustrations of Devonian Fossils, 1876; Cephalopoda pl. 46, fig. 7.
Palæontology of New York, vol. v, pt. 2, pl. 47, fig. 7.
Schoharie grit. Schoharie, N. Y.
J. Gebhard purchase.

Palæontology of New York, vol. v, pt. 2, pl. 17, fig. 16.
Schoharie grit. Schoharie, N. Y.
J. Gebhard purchase.

Palæontology of New York, vol. v, pt. 2. pl. 96, fig. 1.
Schoharie grit. Schoharie, N. Y.
J. Gebhard purchase.

Palæontology of New York, vol. v, pt. 2, pl. 96, fig. 2.
Schoharie grit. Schoharie, N. Y.
J. Gebhard purchase.

Palæontology of New York, vol. v, pt. 2, pl. 96, fig. 3.
Schoharie grit. Clarksville, N. Y.
Collected by C. Van Deloo, 1862.

Palæontology of New York, vol. v, pt. 2, pl. 96, fig. 4.
Schoharie grit. Schoharie, N. Y.
J. Gebhard purchase.

Palæontology of New York, vol. v, pt. 2, pl. 96, fig. 5.
Schoharie grit. Schoharie, N. Y.
J. Gebhard purchase.

Palæontology of New York, vol. v, pt. 2, pl. 96, figs. 6, 7.
Schoharie grit. Schoharie, N. Y.
J. Gebhard purchase,

Palæontology of New York, vol. v, pt. 2, pl. 96, figs. 8, 9 ; pl. 97, fig. 11.
Schoharie grit. Schoharie, N. Y.
J. Gebhard purchase.

Palæontology of New York, vol. v, pt. 2, pl. 96, fig. 10.
Schoharie grit. Schoharie, N. Y.
J. Gebhard purchase.

Palæontology of New York, vol. v, pt. 2, pl. 96, fig. 11.
Schoharie grit. Schoharie, N. Y.
J. Gebhard purchase.

Cyrtoceras æmulum, Hall. 1879.

Palæontology of New York, vol. v, pt. 2, p. 271, pl. 97, fig. 1.
Schoharie grit. Schoharie, N. Y.
J. Gebhard purchase.

Palæontology of New York, vol. v, pt. 2, pl. 97, fig. **2.**
Schoharie grit. Schoharie, N. Y.
J. Gebhard purchase.

Palæontology of New York, vol. v, pt. 2, pl. 97, fig. **3.**
Schoharie grit. Clarksville, N. Y.
Collected by C. Van Deloo, 1862.

Palæontology of New York, vol. v, pt. 2, pl. 97, figs. **4, 5.**
Schoharie grit. Schoharie, N. Y.
J. Gebhard purchase.

Palæontology of New York, vol. v, pt. 2, pl. 97, fig. 6.
Schoharie grit. Schoharie, N. Y.
J. Gebhard purchase.

Palæontology of New York, vol. v, pt. 2, pl. 97, figs. **8, 9.**
Schoharie grit. Schoharie, N. Y.
J. Gebhard purchase.

Cyrtoceras Jason, Hall. 1861.
Descr. New Species Fossils, p. 43.

Illustrations of Devonian Fossils, 1876; Cephalopoda, pl. 52, fig. **1.**
Palæontology of New York, vol. v, pt. 2, pl. 50, fig. **1.**
Schoharie grit. Schoharie, N. Y.
J. Gebhard purchase.

Illustrations of Devonian Fossils, 1876; Cephalopoda, pl. 52, fig. **2.**
Palæontology of New York, vol. v, pt. 2, pl. 50, fig. **2.**
Schoharie grit. Schoharie, N. Y.
J. Gebhard purchase.

Palæontology of New York, vol. v, pt. 2, Suppl. (=vol. vii, 1888), pl. 124, fig. 7.
Schoharie grit. Clarksville, N. Y.

Cyrtoceras morsum, Hall. 1861.
Descr. New Species Fossils, p. 43.

Fifteenth Annual Report on the New York State Cabinet of Natural History, 1862, p. 71, pl. 9, fig. **6.**
Illustrations of Devonian Fossils, pl. 46, figs. **3, 4.**
Palæontology of New York, vol. v, pt. 2, pl. 47, figs. **3, 4.**
Corniferous limestone. Schoharie, N. Y.
J. Gebhard purchase.

Cyrtoceras citum, Hall. 1879.

Palæontology of New York, vol. v, pt. 2, p. 372, pl. 51, figs. **1, 2.**
Corniferous limestone. Schoharie, N. Y.

J. Gebhard purchase.

Palæontology of New York, vol. v, pt. 2, pl. 51, fig. **3.**
Corniferous limestone. Schoharie, N. Y.

J. Gebhard purchase.

Palæontology of New York, vol. v, pt. 2, Suppl. (= vol. vii, 1888), pl. 124, fig. **1.**
Corniferous limestone. Falkirk, N. Y.

Collected by C. D. Walcott and C. Van Deloo, 1878.

Palæontology of New York, vol. v, pt. 2, Suppl. (= vol. vii, 1888), pl. 124, fig. 2.
Corniferous limestone. Falkirk, N. Y.

Collected by C. D. Walcott and C. Van Deloo, 1878.

Palæontology of New York, vol. v, pt. 2, Suppl. (= vol. vii, 1888) pl. 124, fig. 2.
Corniferous limestone. Cayuga, Ontario.

Collected by C. D. Walcott, 1878.

Cyrtoceras (*Gomphoceras*) *metula*, Hall. 1861.

Descr. New Species Fossils, p. 44.

Palæontology of New York, vol. v, pt. 2, pl. 111, fig. **11.**
Upper Helderberg limestone. Littleville, N. Y.

Collected by C. Van Deloo, 1878.

Cyrtoceras (*Gomphoceras ?*) *formosum*, Hall. 1879.

Palæontology of New York, vol. v, pt. 2, p. 362, pl. 95, figs. **8, 9.**
Hamilton group. Dresden, N. Y.

PHRAGMOCERAS, Broderip. 1839.

Phragmoceras expansum, Hall. 1852.

Palæontology of New York, vol. ii, p. 337, pl. 77A, figs. **2a, b.**
Palæontology of New York, vol. v, pt. 2, 1879, pl. 46, figs. **10, 11.**
Coralline limestone. Schoharie, N. Y.

J. Gebhard purchase.

Phragmoceras, Hall. 1852.

(*P. corallophilum*, nom. propos.)

Palæontology of New York, vol. ii, p. 351, pl. 78, fig. **3a.**
Coralline limestone. Schoharie, N. Y.

J. Gebhard purchase.

Palæontology of New York, vol. ii, pl. 78, fig. **3b.**
Coralline limestone. Schoharie, N. Y.

J. Gebhard purchase.

GYROCERAS, DeKoninck. 1844.

Gyroceras spinosum, Conrad. 1840.

Geol. Surv. N. Y.; Pal. Dept.; 3d Ann. Rept., p. 206.

Illustrations of Devonian Fossils, 1876; Cephalopoda pl. 50, fig. **3.**
Palæontology of New York, vol. v, pt. 2, pl. 48, fig. **3.**
Schoharie grit. Schoharie, N. Y.

J. Gebhard purchase.

Illustrations of Devonian Fossils, 1876; Cephalopoda, pl. 50, fig. **5.**
Palæontology of New York, vol. v, pt. 2, pl. 48, fig. **2.**
Schoharie grit. Schoharie, N. Y.

J. Gebhard purchase.

Illustrations of Devonian Fossils, 1876; Cephalopoda, pl. 50, fig. **2.**
Palæontology of New York, vol. v, pt. 2, pl. 48, fig. **1.**
Schoharie grit. Schoharie, N. Y.

J. Gebhard purchase.

Illustrations of Devonian Fossils, 1876; Cephalopoda, pl. 30, fig. **1.**
Palæontology of New York, vol. v, pt. 2, pl. 48, fig. **5**; pl. 99, fig. **7**.
Schoharie grit. Schoharie, N. Y.

J. Gebhard purchase.

Illustrations of Devonian Fossils, 1876; Cephalopoda, pl. 46, fig. **8.**
Palæontology of New York, vol. v, pt. 2, pl. 47, fig. **8.**
Schoharie grit. Schoharie, N. Y.

J. Gebhard purchase.

Palæontology of New York, vol. v, pt. 2, pl. 99, figs. 1, 2.
Schoharie grit. Schoharie, N. Y.

J. Gebhard purchase.

Palæontology of New York, vol. v, pt. 2, pl. 98, figs. 1, 2.
Schoharie grit. Clarksville, N. Y.

Collected by R. P. Whitfield and C. Van Deloo, 1861.

Illustrations of Devonian Fossils, 1876; Cephalopoda, pl. 51, fig. 1.
Palæontology of New York, vol. v, pt. 2, pl. 49, fig. 1.
Schoharie grit. Schoharie, N. Y.
J. Gebhard purchase.

Illustrations of Devonian Fossils, 1876; Cephalopoda, pl. 50, fig. 4.
Palæontology of New York, vol. v, pt. 2, pl. 48, fig. 4.
Schoharie grit. Schoharie, N. Y.
J. Gebhard purchase.

Palæontology of New York, vol. v, pt. 2, pl. 99, fig. 3.
Schoharie grit. Schoharie, N. Y.
J. Gebhard purchase.

Palæontology of New York, vol. v, pt. 2, pl. 99, figs. 4, 7.
Schoharie grit. Schoharie, N. Y.
J. Gebhard purchase.

Palæontology of New York, vol. v, pt. 2, pl. 99, figs. 5, 6.
Schoharie grit. Schoharie, N. Y.
J. Gebhard purchase.

Palæontology of New York, vol. v, pt. 2, pl. 99, fig. 8.
Schoharie grit. Schoharie, N. Y.
J. Gebhard purchase.

Gyroceras validum. Hall, 1876.

Illustrations of Devonian Fossils; Cephalopoda, pl. 51, fig. 2.
Palæontology of New York, vol. v, pt. 2, pl. 49, fig. 2.
Schoharie grit. Schoharie, N. Y.
J. Gebhard purchase.

Palæontology of New York, vol. v, pt. 2, pl. 100, fig. 1.
Schoharie grit. Knox, N. Y.
Collected by C. Van Deloo, 1862.

Gyroceras paucinodosum. Hall, 1876.

Illustrations of Devonian Fossils; Cephalopoda. Expl. pl. 35, figs. 1, 2, 3, 4.
Palæontology of New York, vol. v, pt. 2, p. 380, pl. 54, figs. 1, 2, 3, 4.
Corniferous limestone. Cherry Valley, N. Y.
Collected by C. A. White, 1860.

Gyroceras laciniosum. Hall, 1879.

Palæontology of New York, vol. v, pt. 2, p. 376, pl. 52A, fig. **8**.
Corniferous limestone. Schoharie, N. Y.

J. Gebhard purchase.

Gyroceras Matheri. Conrad (sp.), 1840.

Geol. Surv. N. Y.; Pal. Dept., 3d Ann. Rept., p. 206.

Illustrations of Devonian Fossils, 1876; Cephalopoda, pl. 56, fig. **3**.
Palæontology of New York, vol. v, pt. 2, pl. 55, figs. **3, 4**.
Corniferous limestone. Schoharie, N. Y.

J. Gebhard purchase.

Palæontology of New York, vol. v, pt. 2, pl. 55, fig. 5.
Corniferous limestone. Clarksville, N. Y.

Gyroceras Nereus, Hall. 1861.

Descr. New Species Foss., p. 39.

Palæontology of New York, vol. v, pt. 2, Suppl. (=vol. vii, 1888), pl. 124, fig. 4.
Corniferous limestone. Cherry Valley, N. Y.

Gyroceras Cyclops, Hall. 1861.

Descr. New Species Foss., p. 40.

Palæontology of New York, vol. v, pt. 2, pl. 102, fig. 1.
Corniferous limestone. Clarksville, N. Y.

Gyroceras undulatum, Vanuxem. 1842.

Geol. Surv. N. Y.; Rept. 3d Dist., p. 139, fig. 2.

Illustrations of Devonian Fossils, 1876; Cephalopoda, pl. 56, fig. 1.
Palæontology of New York, vol. v, pt. 2, pl. 53, fig. 1.
Corniferous limestone. Cherry Valley, N. Y.

Collected by C. A. White, 1860.

Illustrations of Devonian Fossils; Cephalopoda, pl. 56, fig. 2.
Palæontology of New York, vol. v, pt. 2, pl. 53, fig. 2.
Corniferous limestone. Schoharie, N. Y.

J. Gebhard purchase.

Palæontology of New York, vol. v, pt. 2, pl. 53, fig. 3.
Corniferous limestone. Cherry Valley, N. Y.

Collected by C. A. White, 1860.

Palæontology of New York, vol. v, pt. 2, pl. 53, figs. 5, 6.
Corniferous limestone. Cherry Valley, N. Y.
Collected by C. A. White, 1860.

Palæontology of New York, vol. v, pt. 2, pl. 54, fig. 5.
Corniferous limestone. Cherry Valley, N. Y.
Collected by C. A. White, 1860.

Gyroceras trivolve, Conrad. 1840.

Geol. Surv. N. Y.; Pal. Dept.; 3d Ann. Rept., p. 206.

Illustrations of Devonian Fossils, 1876; Cephalopoda, pl. 54, figs. **4**, **5**; pl. 56, fig. **4**.
Palæontology of New York, vol. v, pt. 2, pl. 52, figs. **1**, **2**, **3**.
Corniferous limestone. Schoharie, N. Y.
J. Gebhard purchase.

Palæontology of New York, vol. v, pt. 2, pl. 52 A, fig. 4.
Corniferous limestone. The Helderberg, N. Y.

Palæontology of New York, vol. v, pt. 2, pl. 52 A, fig. 5.
Corniferous limestone. The Helderberg, N. Y.

Illustrations of Devonian Fossils, 1876; Cephalopoda, pl. 54, figs. **1**, **2**, **3**.
Palæontology of New York, vol. v, pt. 2, pl. 52 A, figs. **1**, **2**, **3**.
Corniferous limestone. Schoharie, N. Y.
J. Gebhard purchase.

Palæontology of New York, vol. v, pt. 2, pl. 52, fig. 4.
Corniferous limestone. Schoharie, N. Y.
J. Gebhard purchase.

Palæontology of New York, vol. v, pt. 2 pl. 52, fig. 5.
Corniferous limestone. Schoharie, N. Y.
J. Gebhard purchase.

Palæontology of New York, vol. v, pt. 2, pl. 52 A, fig. 6.
Corniferous limestone. Cherry Valley, N. Y.

Gyroceras transversum, Hall. 1860.

13th Rept. N. Y. State Cab. Nat. Hist., p. 104.

Illustrations of Devonian Fossils, 1876; Cephalopoda, pl. 57, figs. **1**, **2**.
Palæontology of New York, vol. v, pt. 2, pl. 67, figs. **1**, **2**.
Goniatite limestone. Near Manlius, N. Y.

Illustrations of Devonian Fossils, 1876; Cephalopoda, pl. 57, figs. **3, 4;** Palæontology of New York, vol. v, pt. 2, pl. 57, figs. **3, 4.**
Goniatite limestone. Near Manlius, N. Y.

Genus LITUITES, Montfort. 1808.

Lituites convolvans ?, Hall. 1847.

Palæontology of New York, vol. i, p. 53, pl. 13, fig. **2a.**
Black River limestone. Watertown, N. Y.

Albany Institute donor.

Lituites undatus, Hall. 1847.

Palæontology of New York, vol. i, pt. 52, pl. 13, figs. **1a, 1b.**
Black-River limestone. Watertown, N. Y.

Albany Institute donor.

NAUTILUS, Breyn. 1732.

Nautilus Oceanus, Hall. 1879.

Transactions of the Albany Institute, vol. x. Abst. p. 19, **not fig'd.**
Eleventh Annual Report of the Indiana State Geologist, 1882, p. 325, **not fig'd.**
Niagara group. Waldron, Ind.

Nautilus liratus, Hall. 1860.

13th Rept. N. Y. State Cab. Nat. Hist., p. 104.

Illustrations of Devonian Fossils, 1876; Cephalopoda, pl. 60, figs. **8, 9.**
Palæontology of New York, vol. v, pt. 2, pl. 60, fig. **8, 9.**
Gonialite limestone. Schoharie, N. Y.

J. Gebhard purchase.

Nautilus liratus, var. *juvenis*, Hall. 1579.

Illustrations of Devonian Fossils, 1876; Cephalopoda, pl. 57, figs. **5, 6.**
Palæontology of New York, vol. v, pt. 2, p. 411, pl. 56, figs. **5, 6.**
Hamilton group. Cazenovia, N. Y.

Geological Survey collection.

Nautilus subliratus, Hall. 1879.

Illustrations of Devonian Fossils, pl. 58, fig. **5.**
Palæontology of New York, vol. v, pt. 2, pl. 57, fig. **5.**
Hamilton group. Skaneateles Lake, N. Y.

Collected by G. B. Simpson, 1863.

Nautilus maximus, Conrad. 1838.

Geol. Surv. N. Y.; Pal. Dept., First Ann. Rept., p. 117.

Illustrations of Devonian Fossils, 1876; Cephalopoda, pl. 64, fig. 1.
Palæontology of New York, vol. v, pt. 2, pl. 64, fig. 1.
Hamilton group. Madison county, N. Y.

Geological Survey collection.

Nautilus magister, Hall. 1879.

Palæontology of New York, vol. v, pt. 2, p. 422, pl. 107, figs. 6, 7.
Hamilton group. Hamburgh, N. Y.

Collected by C. A. White, 1860.

Illustrations of Devonian Fossils, 1876; Cephalopoda, pl. 63, fig. 1.
Palæontology of New York, vol. v, pt. 2, pl. 108, figs. 1, 2.
Hamilton group. Hamburgh, N. Y.

Collected by C. A. White, 1860.

Palæontology of New York, vol. v, pt. 2, pl. 107, fig. 1.
Hamilton group. Hamburgh, N. Y.

Collected by C. A. White, 1860.

Palæontology of New York, vol. v, pt. 2, pl. 105, fig. 1.
Hamilton group. Leonardsville, N. Y.
Collected by F. B. Meek, R. P. Whitfield and C. Van Deloo, 1857.

Palæontology of New York, vol. v, pt. 2, pl. 107, fig. 8.
Hamilton group. Hamburgh, N. Y.

Collected by J. W. Hall and C. Van Deloo, 1869.

Nautilus oriens, Hall. 1876.

Illustrations of Devonian Fossils; Cephalopoda, expl. pl. 61, fig. 1.
Palæontology of New York, vol. v, p. 420, pl. 61, fig. 1.
Hamilton group. Richmondville, N. Y.

J. Gebhard purchase.

Palæontology of New York, vol. v, pt. 2, pl. 105, fig. 2.
Hamilton group. Richmondville, N. Y.

J. Gebhard purchase.

Illustrations of Devonian Fossils; Cephalopoda, pl. 64 A, fig. 1.
Palæontology of New York, vol. v, pt. 2, pl. 106; fig. 8; Suppl. (= vol. vii, 1888), pl. 126, fig. 2.
Hamilton group. Richmondville, N. Y.

J. Gebhard purchase.

Nautilus subliratus, Hall. 1876.

Illustrations of Devonian Fossils; Cephalopoda, expl. pl. 58, figs. **3**, **4**.

Palæontology of New York, vol. v, pt. 2, pl. 57, figs. **6**, **7**.

Hamilton group. Earlville, N. Y.

Geological Survey collection.

Illustrations of Devonian Fossils; Cephalopoda, pl. 58, fig. **1**.

Palæontology of New York, vol. v, pt. 2, pl. 57, fig. **3**.

Hamilton group. Earlville, N. Y.

Geological Survey collection.

Illustrations of Devonian Fossils; Cephalopoda, pl. 58; fig. **2**.

Palæontology of New York, vol. v, pt. 2, pl. 57, fig. **4**.

Hamilton group. Earlville, N. Y.

Geological Survey collection.

Nautilus Hyatti, Hall. 1886.

* Fifth Annual Report of the New York State Geologist, Expl. pl. (126) 11, fig. **1**.

* Palæontology of New York, vol. v, pt. 2, Suppl. (=vol. vii, 1888), p. 37, pl. 126, fig. **1**.

Hamilton group. Cumberland, Md.

Nautilus acrœus, Hall. 1879.

Palæontology of New York, vol. v, pt. 2, p. 417, pl. 110, figs. **3**, **4**, **5**.

Hamilton group. Near Bridgewater, N. Y.

Collected by F. B. Meek, R. P. Whitfield and C. Van Deloo, 1857.

Nautilus bucinum, Hall. 1876.

Illustrations of Devonian Fossils; Cephalopoda, pl. 60, fig. **4**.

Palæontology of New York, vol. v, pt. 2, pl. 60, fig. **4**; pl. 106, fig. **6**.

Hamilton group. Solsville, N. Y.

Geological Survey collection.

Palæontology of New York, vol. v, pt. 2, pl. 109, fig. 1.

Hamilton group. Canandaigua Lake, N. Y.

Collected by R. P. Whitfield and C. Van Deloo, 1862.

Palæontology of New York, vol. v, pt. 2, pl. 109, fig. 6.

Hamilton group. Delphi, N. Y.

Collected by H. H. Smith and C. Van Deloo, 1873.

Palæontology of New York, vol. v, pt. 2, pl. 107, figs. 2, 3.
Hamilton group. Pratt's Falls, N. Y.

Palæontology of New York, vol. v, pt. 2, pl. 106, fig. 7.
Hamilton group. Cazenovia, N. Y.
Palæontology of New York, vol. v, pt. 2, pl. 109, fig. 2.
Hamilton group. Cazenovia, N. Y,

Collected by James Hall, 1862.

Palæontology of New York, vol. v, pt. 2, pl. 106, figs. 4, 5.
Hamilton group, Cazenovia, N. Y.

Illustrations of Devonian Fossils, 1876; Cephalopoda, pl. 60, figs. 1, 2, 3.
Palæontology of New York, vol. v, pt. 2, pl. 60, figs. 1, 2, 3.
Goniatite limestone. Schoharie, N. Y.

J. Gebhard purchase.

Nautilus (Discites) Marcellensis, Vanuxem. 1842.

Geology of New York; Report on Third District, p. 146, fig. 2.
Palæontology of New York, vol. v, pt. 2, pl. 109, fig. 10.
Goniatite limestone. Manlius, N. Y.

Geological Survey collection.

Illustrations of Devonian Fossils, 1876; Cephalopoda, pl. 65, fig. 1.
Palæontology of New York, vol. v, pt. 2, pl. 65, fig. 1.
Goniatite limestone. Near Manlius, N. Y.

Palæontology of New York, vol v, pt. 2, pl. 109, figs. 9, 12.
Goniatite limestone. Schoharie, N. Y.

J. Gebhard purchase.

TROCHOCERAS, Hall. 1852.

Trochoceras Gebhardi, Hall, 1852.

Palæontology of New York, vol. ii, p. 335, pl. 77, fig. 2.
Coralline limestone. Schoharie, N. Y.

J. Gebhard purchase.

Palæontology of New York, vol. 4, pl. 77 A, fig. 17.
Coralline limestone. Schoharie, N. Y.

J. Gebhard purchase.

Trochoceras turbinatum, Hall. 1852.

Palæontology of New York, vol. ii, p. 336, pl. 77, fig. **1**.
Coralline limestone. Schoharie, N. Y.

J. Gebhard purchase.

Trochoceras Barrandii, Hall. 1879.

Palæontology of New York, vol. v, pt. 2, p. 398, pl. 111, fig. **10**.
Schoharie grit. Schoharie, N. Y.

J. Gebhard purchase.

Palæontology of New York, vol. v, pt. 2, pl. 111, fig. **8**.
Schoharie grit. Clarksville, N. Y.

Palæontology of New York, vol. v, pt. 2, pl. 111, fig. **9**.
Schoharie grit. Schoharie, N. Y.

J. Gebhard purchase.

Trochoceras eugenium, Hall. 1861.

14th Rept. N. Y. State Cab. Nat. Hist., p. 108.

Illustrations of Devonian Fossils, 1876; Cephalopoda, pl. 59, fig. **9**.
Palæontology of New York, vol. v, pt. 2, pl. 59, fig. **11**.
Schoharie grit. Schoharie, N. Y.

J. Gebhard purchase.

Illustrations of Devonian Fossils, 1876; Cephalopoda, pl. 48, fig. 3.
Palæontology of New York, vol. v. pt. 2, pl. 58, fig. 3.
Schoharie grit. Schoharie, N. Y.

J. Gebhard purchase.

Illustrations of Devonian Fossils, 1876; Cephalopoda, pl. 48, fig. 4.
Palæontology of New York, vol. v, pt. 2, pl. 58, fig. 4.
Schoharie grit. Schoharie, N. Y.

J. Gebhard purchase.

Trochoceras Pandion, Hall. 1876.

Illustrations of Devonian Fossils; Cephalopoda, pl. 48, fig. **7**.
Palæontology of New York, vol. 5, pt. 2, pl. 58, fig. **7**.
Schoharie grit. Schoharie, N. Y.

J. Gebhard purchase.

Illustrations of Devonian Fossils; Cephalopoda, pl. 48, fig. **8**.
Schoharie grit. Schoharie, N. Y.

J. Gebhard purchase.

Illustrations of Devonian Fossils; Cephalopoda, pl. 48, fig. **9**.
Palæontology of New York, vol. v, pt. 2, pl. 58, fig. **9**.
Schoharie grit. Schoharie, N. Y.

J. Gebhard purchase.

Palæontology of New York, vol. v, pt. 2, pl. 111, fig. 3.
Schoharie grit. Schoharie, N. Y.

J. Gebhard purchase.

Trochoceras Biton, Hall. 1879.

Palæontology of New York, vol. v, pt. 2, p. 395, pl. 111, fig. **7**.
Schoharie grit. Near Clarksville, N. Y.

Collected by C. Van Deloo, 1862.

Trochoceras discoideum, Hall. 1861.

Descr. New Species Foss., p. 36.

Illustrations of Devonian Fossils, 1876; Cephalopoda, pl. 59, fig. **6**.
Palæontology of New York, vol. v, pt. 2, pl. 59, fig. **8**.
Schoharie grit. Schoharie, N. Y.

J. Gebhard purchase.

Trochoceras expansum, Hall. 1879.

Palæontology of New York, vol. v, pt. 2, p. 402, pl. 111, fig. **5**.
Schoharie grit. Schoharie, N. Y.

J. Gebhard purchase.

Trochoceras obliquatum, Hall. 1876.

Illus. Dev. Foss. Expl., pl. 48, fig. 5.

Palæontology of New York, vol. v, pt. 2, pl. 111, figs. 1, 2.
Schoharie grit. Schoharie, N. Y.

J. Gebhard purchase.

Trochoceras Clio, Hall. 1861.

14th Rept. N. Y. State Cab. Nat. Hist., p. 108.

Illustrations of Devonian Fossils, 1876; Cephalopoda, pl. 59, fig. **4**.
Palæontology of New York, vol. v, pt. 2, pl. 59, fig. **1**.
Schoharie grit. Schoharie, N. Y.

J. Gebhard purchase.

Illustrations of Devonian Fossils, 1876; Cephalopoda, pl. 59, figs. **1, 2**.
Palæontology of New York, vol. v, pt. 2, pl. 59, figs. **1, 2**.
Schoharie grit. Schoharie, N. Y.

J. Gebhard purchase.

Palæontology of New York, vol. v, pt. 2, pl. 59, fig. 4.
Schoharie grit. Schoharie, N. Y.
J. Gebhard purchase.

Illustrations of Devonian Fossils, 1876; Cephalopoda, pl. 59, fig. 7.
Palæontology of New York, vol. v, pt. 2, pl. 59, fig. 9.
Schoharie grit. Schoharie, N. Y.
J. Gebhard purchase.

Palæontology of New York, vol. v, pt. 2, pl. 111, fig. 6.
Schoharie grit. Clarksville, N. Y.

Trochoceras ? (*Gonioceras ?*) *pandum*, Hall. 1879.

Palæontology of New York, vol. v, pt. 2, p. 403, pl. 111, figs. 4.
Schoharie grit. Schoharie, N. Y.
J. Gebhard purchase.

Palæontology of New York, vol. v, pt. 2, Suppl. (= vol. vii, 1888), pl. 117, figs. 3, 4.
Schoharie grit. Knox, N. Y.
C. Van Deloo, 1862.

Palæontology of New York, vol. v, pt. 2, Suppl. (= vol. vii, 1888), pl. 117, fig. 5.
Schoharie grit. Near Clarksville, N. Y.
Collected by C. Van Deloo, 1862.

GONIATITES, De Haan. 1825.

Goniatites Vanuxemi, Hall. 1879.

Illustrations of Devonian Fossils, 1876; Cephalopoda, pl. 69, fig. 6.
Palæontology of New York, vol. v, pt. 2, pl. 69, fig. 6.
Goniatite limestone. Manlius, N. Y.
Geological Survey collection.

Illustrations of Devonian Fossils, 1876; Cephalopoda, pl. 69, figs. 3, 4.
Palæontology of New York, vol. v, pt. 2. Suppl. (vol. vii), pl. 127, figs. 5, 6.
Goniatite limestone. Manlius, N. Y.
Geological Survey collection.

Illustrations of Devonian Fossils, 1876; Cephalopoda, pl. 69, fig 5.
Palæontology of New York, vol. v, pt. 2, pl. 69, fig. 5.
Goniatite limestone. Manlius, N. Y.
Geological Survey collection.

Illustrations of Devonian Fossils, 1876; Cephalopoda, pl. 68, figure; Palæontology of New York, vol. v, pt. 2, pl. 68, figure.
Goniatite limestone. Fenner, N. Y.

L. Lincklaen, donor.

Palæontology of New York, vol. v, pt. 2, Suppl. (= vol. vii, 1888), pl. 127, fig. 4.
Goniatite limestone. Schoharie, N. Y.

J. Gebhard purchase.

Goniatities Vanuxemi, var. *nodiferus*, Hall. 1886.

Fifth Annual Report of the New York State Geologist. Expl. pl. 127 (12), fig. 7.
Palæontology of New York, vol. v, pt. 2, Suppl. (= vol. vii, 1888), p. 39, pl. 127, fig. 7.
Marcellus shales. Cox's Falls, near Cherry Valley, N. Y.

Collected by J. W. Hall, 1877.

Goniatites discoideus, Hall. 1860.

13th Rept. N. Y. State Cab. Nat. Hist., p. 97.

Illustrations of Devonian Fossils, 1876; Cephalopoda, pl. 71, fig. 1; Palæontology of New York, vol. v, pt. 2, pl. 71, fig. 1.
Tully limestone. Smith's ledge, Otisco, N. Y.

Geological Survey collection.

Illustrations of Devonian Fossils, 1876; Cephalopoda, pl. 71, figs. 8, 9; Palæontology of New York, vol. v, pt. 2, pl. 71, figs. 8, 9; pl. 74, fig. 4.
Goniatite limestone. Manlius, N. Y.

Illustrations of Devonian Fossils, 1876; Cephalopoda, pl. 71, fig. 4; Palæontology of New York, vol. v, pt. 2, pl. 71, fig. 4; pl. 74, fig. 3.
Goniatite limestone. Manlius, N. Y.

Illustrations of Devonian Fossils, 1876; Cephalopoda, pl. 71, figs. 5, 6; Palæontology of New York, vol. v, pt. 2, pl. 71, figs. 5, 6.
Goniatite limestone. Manlius, N. N.

Goniatites plebeiformis, Hall. 1879.

Palæontology of New York, vol. v, pt. 2, p. 44, pl. 110, fig. 3.
Marcellus shales. Cherry Valley, N. Y.

Collected by J. W. Hall, 1877.

Palæontology of New York, vol. v, pt. 2, pl. 110, fig. **4.**
Marcellus shales. Cherry Valley, N. Y.
Collected by J. W. Hall, 1877.

Palæontology of New York, vol. v, pt. 2, pl. 110, fig. **5.**
Marcellus shales. Cherry Valley, N. Y.
Collected by J. W. Hall, 1877.

Palæontology of New York, vol. v, pt. 2, pl. 110, fig. **6.**
Marcellus shales. Cherry Valley, N. Y.
Collected by J. W. Hall, 1877.

Palæontology of New York, vol. v, pt. 2, pl. 110, fig. **7.**
Marcellus shales. Cherry Valley, N. Y.
Collected by J. W. Hall, 1877.

Palæontology of New York, vol. v, pt. 2, pl. 110, fig. **8.**
Marcellus shales. Cherry Valley, N. Y.
Collected by J. W. Hall, 1877.

Palæontology of New York, vol. v, pt. 2, pl. 110. fig. **9.**
Marcellus shales. Cherry Valley, N. Y.
Collected by J. W. Hall, 1877.

Goniatites unilobatus, Hall. 1874.

Descr. New Species Gonatitidæ, p. 1.

Illustrations of Devonian Fossils, 1876; Cephalopoda, pl. 71, figs. **15, 16**; Palæontology of New York, vol. v, pt. 2, p. 438, pl. 71, figs. **15, 16.**

Hamilton group. Norton's Landing, Cayuga Lake, N. Y.

Goniatites amplexus, Hall. 1886.

Fifth Annual Report of the New York State Geologist, Expl. pl. (127) 12, fig. **1.**

Palæontology of New York, vol. v, pt. 2. Suppl. (=vol. vii), p. 39, pl. 127, fig. **1.**

Tully limestone. Lodi Landing, Seneca Lake, N. Y.

Goniatites uniangularis, Conrad. 1842.

Jour. Acad. Nat. Sci. Phila. vol. 8, p. 268, pl. 16, fig. 4.

Palæontology of New York, vol. v, pt. 2, Suppl. (=vol. vii, 1888), pl. 127, fig. 10.

Hamilton group. Pratt's Falls, N. Y.

Illustrations of Devonian Fossils, 1876; Cephalopoda, pl. 72, figs. 6, 7.
Palæontology of New York, vol. v, pt. 2, pl. 72, figs. 6, 7.
Portage group. Mt. Morris, N. Y.

Geological Survey collection.

Goniatites complanatus, Hall, var. *perlatus*, Hall. 1876.

Discr. New species Goniatitidæ, p. 1.

Illustrations of Devonian Fossils, 1876; Cephalopoda, pl. 70, fig. 12.
Palæontology of New York, vol. v, pt. 2, pl. 70, fig. 12.
Portage group. Near Homer, N. Y.

Geological Survey collection.

Goniatites Patersoni, Hall. 1860.

Thirteenth Rept. N. Y. State Cab. Nat. Hist., p. 99.

Illustrations of Devonian Fossils, 1876; Cephalopoda, pl. 72, fig. 5
Palæontology of New York, vol. v, pt. 2, pl. 72, fig. 5.
Portage group. Portageville, N. Y.

Geological Survey collection.

Goniatites sinuosus, Hall. 1843.

Geol. N. Y.; Rept. 4th Dist., p. 243, fig. 6.

Illustrations of Devonian Fossils, 1876; Cephalopoda, pl. 70, fig. 13;
Palæontology of New York, vol. v, pt. 2, pl. 70, fig. 13.
Lower Chemung group. Ithaca, N. Y.

Geological Survey collection.

Illustrations of Devonian Fossils, 1876; Cephalopoda, pl. 70, fig. 14;
Palæontology of New York, vol. v, pt. 2, pl. 70, fig. 14.
Lower Chemung group. Truxton, N. Y.

Geological Survey collection.

Illustrations of Devonian Fossils, 1876; Cephalopoda, pl. 70, fig. 15;
Palæontology of New York, vol. v, pt. 2, pl. 70, fig. 15; pl. 74, fig. 11.
Lower Chemung group. Ithaca, N. Y.

Collected by J. W. Hall and C. Van Deloo, 1866.

Goniatites Chemungensis, Vanuxem. 1842.

Geology of New York; Report on the Third Geological District, p. 182, fig. 1; Illustrations of Devonian Fossils, 1876; Cephalopoda, pl. 60, fig 9; Palæontology of New York, vol. v, pl. 69, fig. 9; pl. 74, fig. 6.

Chemung group. Near Owego, N. Y.

Geological Survey collection.

Goniatites Chemungensis, var. *æquicostatus*, Hall. 1874.

Descr. New Species Goniatitidæ, p. 3.

Illustrations of Devonian Fossils, 1875; Cephalopoda, pl. 69, fig. **10**.
Palæontology of New York, vol. v, pt. 2, pl. 69, fig. **10**.
Chemung group. Western New York.

Goniatites simulator, Hall. 1874.

Descr. New Species Goniatitidæ, p. 2.

Illustrations of Devonian Fossils, 1876; Cephalopoda, pl. 69, figs. **1, 2**.

Palæontology of New York, vol. v, pt. 2, pl. 69, figs. **1, 2**; pl. 74, fig. **8**.

Chemung group. Near Ithaca, N. Y.

Goniatites peracutus, Hall. 1876.

Illustrations of Devonian Fossils, Cephalopoda, pl. 69, fig. **8**; Palæontology of New York, vol. v, pt. 2, pl. 69, fig. **8**; pl. 74. fig. **13**.

Chemung group. Cornell's quarry, Ithaca, N. Y.

Collected by J. W. Hall and C. Van Deloo, 1866.

Summary.

Annelida.

Total types	1
Total figured specimens	33
Total figures	33

Cephalopoda.

Total types	205
Total figured specimens	408
Total figures	487
Casts of types	4

Notes Upon Two Boulders of a Very Basic Eruptive Rock from the West Shore of Canandaigua Lake; and their Contact Phenomena Upon the Trenton Limestone.

By Prof. B. K. Emerson, Amherst College.

[Communicated for the report of the State Geologist.]

The rocks described below were sent to me by Prof. John M. Clarke with the following note:

"Specimens and sections marked:

"1 and 2. Boulder of Trenton limestone from southern part of town of Canandaigua, N. Y., on west shore of lake.

"1. Limestone at contact with dyke.

"2. Dyke.

"x. Fragments of limestone.

"3 and 4. Boulder of eruptive, including small masses of sandstone from same locality, about forty rods from other boulder.

"These are the only rocks of this character I have seen in the drift of western New York."

The specimens had been sawed and broad surfaces polished, and this greatly facilitated their study. Slides of an unusual size were also sent, showing abundantly all the different types present.

The specimen numbered 1—"limestone at contact with dyke"—is a dull black, aphanitic, trap-like rock, effervescing slowly with acid and showing minute pyrite grains and pale green, distant porphyritic spots on the polished face.

The largest spots reach the size of a pin-head. With the pocket lens the thin sections show thickly and evenly disseminated elongate blades of red brown color, with irregular ends and black, shapeless ore grains and plates, and the porphyritic spots seem to be mainly marked by the absence of the brown blades and the greater amount and larger size of the black grains, and to be composed of interlaced, colorless and elongate plates.

When examined with the microscope the red brown blades seem to be goethite. They are wholly without pleochroism and, under the microscope, have the same red brown shade as the Lake Superior goethite, and also have the parallel extinction of the rhombic forms. They resemble in shape, size and distribution the actinolite described below from other contact products. The rounded black ore grains are, at least in part, magnetite, as the magnet abstracts fine grained ore from the powder. Dark grains of black ore are inclosed within the goethite blades.

The colorless fresh ground is made up of interlaced plagioclase plates which show few and interrupted twin lamellæ. They present both the albite and pericline systems of twinning, and are often marked by undulose extinction. The maximum angle of extinction is 18° on a side and the feldspar may be near labradorite. Crystals, where the broad, twinning bands extinguish uniformly with sharp border, adjoin those where the undulose extinction completely blurs the outlines of the separate bands, and this is in a wholly massive rock which shows not the slightest trace of strong crushing, or of any force acting upon it from without.

The clear spaces are mostly aggregates of feldspar plates like those in the general ground, with many rounded grains of black ore scattered in irregular masses, but with traces of octahedral form, or blades having exactly the same shape, size and distribution as the goethite blades, but being now black and made up of a close set or congeries of minute black grains. Here the goethite blades have probably been changed to magnetite. Some of the clear spaces are made up of a mottled network of indeterminate fibers, with a soft aggregate polarization, which suggests a fine grained muscovite growth. The whole rock is a very fresh and very curious goethite-magnetite-plagioclase contact rock.

Specimen No. 2, marked "Dyke," with which the above rock was in contact, is a black basic eruptive rock like that at Thetford, Vt. The phenocrysts of black basaltic hornblende, 2–4 mm. across, are as perfectly shaped, seen on the polished face, as those from Bohemia, and larger ones, 10–15 mm. across, appear in the fractured surface of the same rock. With a lens the large hornblendes at one end of the slide are seen to be large perfect crystals, and to pass, toward the other end, into more and more corroded forms, until at last only traces remain, while a nearly colorless to greenish pyroxene, faintly brown toward the border, appears with about the same size as the hornblendes, and increases in number of crystals as the hornblende disappears, and incloses many unoriented fragments of the latter. The pyroxene is a sharp angled crystal, and in one of the greenish centers polarizes at an angle of 34° with c, and the brown border at 42°.

Rounded colorless spots full of round ore grains, seem to be minute inclosures of the contact rock described above. They give aggregate polarization.

The large hornblendes, under the microscope, are very fresh, and have a deeper colored border where they have been corroded. These remnants are often included, wholly or partly, in the large fresh pyroxenes, but without crystalline orientation. In one curious case a large pyroxene, cut at about right angles to the prism, has one quadrant of its surface replaced by the fragment of a hornblende crystal, whose outside faces very nearly continue the proper boundary of the pyroxene crystal, while its inside face, that is, the face by which it is grown together with the pyroxene, is a fracture. Its outside faces, moreover, have the deeper resorption color, while this is lacking on the inside face. There is an entire lack of orientation, the vertical axis of the hornblende about coinciding with one of the horizontal axes of the pyroxene. The pyroxenes are thus plainly later than the hornblendes, and a second, much smaller generation of pyroxenes occurs in well formed elongate crystals surrounded by a heavy border of black grains.

The rock shows distinctly an interstitial amorphous ground mass, full of minute, short, straight, brightly polarizing rods. These may probably be pyroxene, and a few larger but still minute rods, raveled at the ends, may also be of the same character. They do not show twin striation and have too bright polarization colors to be plagioclase. The ground is so full of the shapeless grains of black ore, that, in the thick slides studied, the presence of plagioclase could not be made certain. The rock is thus almost a pure pyroxenite. The magnetite scattered through the mass is surrounded by a broad border of deep red color where the glassy ground mass had dissolved the iron in part and become ferruginous. This is not the case in the colorless inclosures mentioned above.

Some portions of this ground mass polarize in broad irregular patches with bluish colors like nepheline, but these patches are not to be distinguished from the rest in ordinary light.

Specimen "X," marked "Fragments of Limestone," is a large piece of dark unaltered Trenton limestone,* with white crinoid stems, and the

* [Note.—This limestone, away from the contact surfaces with the eruptive, is exceedingly tough, and though traces of fossils are plainly evident, identifiable forms are to be seen only where the rock has weathered to a thin and very soft argillaceous crust. The following species will serve to determine the geological age of the rock: *Calymene senaria*, Conrad, *Strophomena subtenta*, Conrad, *Plectambonites sericea*, Sowerby. J. M. Clarke.]

rock remains sensibly unaltered and the white crinoid stems unchanged to within an inch of the large hornblende crystals of the eruptive rock. A narrow layer of hornstone forms the intermediate band by which they are firmly united into one mass.

Specimen No. 3, marked "Boulder of eruptive rock including small masses of sandstone," is a still more remarkable rock. It also closely resembles the rock from Thetford, Vt., and shows great splendent, black hornblendes above an inch in length, with rounded outlines from resorption in the magna. It includes many superficially rusted sandstone inclosures, but the eruptive rock is very fresh. The ferruginous character and the coarse grain of the inclosures suggest that they may have come from the Oneida sandstone. The slides were all cut from the vicinity of the different small inclosures which swarm in the rock, and show only few brown hornblendes. These are greatly corroded by the magma. One large greenish pyroxene appears having a very narrow pale brown border. Several small olivine crystals appear in the slide.

Fragments of a pistachio-green carbonate, a half-inch long, appear among the inclosures, and, as it is freshly and coarsely crystalline, seems to be a secondary formation. It gives slight effervescence with cold acid, abundant with hot acid, a strong reaction for iron, and is apparently siderite. It is peculiar in showing a strong dichroism, lemon green parallel to the horizontal, and colorless parallel to the vertical axis. In the slides which are very thick some places retain their green color almost unchanged through a complete revolution, and these show the negative uniaxial ring system with several rings as in calcite, and as the light vibrates thus parallel to the horizontal axes there would of course be no dichroism. In other sections which show by their cleavage that they are cut parallel to the vertical axis, the dichroism is as stated above.

In another large piece from the last boulder, one side is the fresh large grained eruptive rock with small sandstone inclosures, and this fresh eruptive rock graduates in two or three inches into an equally firm and fresh looking rock which contains, in a dark green ground-mass, scattered large rounded isolated hornblendes, pyroxenes and fragments of the eruptive rock, and many small inclosures of sandstone and limestone, and secondary grains of deep green calcite. The green groundmass is, under the microscope, a complete felt of actinolite needles. It would be an actinolite schist except that it has not been made schistose by pressure. The matted actinolite needles show faint pleochroism, and extinguish at 26°–30°, and in many places project finely into the calcite-filled cavities.

The fragments of the original lava are little altered. The hornblendes are either not at all, or but slightly bleached at their border.

In one case a hornblende has changed to a matted mass of actinolite. The pyroxenes are not changed. Small olivines are changed to fibrous matted serpentine. In one case deep brown geniculate rutiles are perched upon the actinolite and enveloped in the calcite.

It is interesting to see this actinolite felt cementing minute fragments of the lava and separate crystals of the basaltic hornblende and pyroxene. The abundance of calcite favors the process and the lime feldspars and actinolite have crystallized abundantly under circumstances which permitted the simultaneous crystallization of calcite and left the amorphous ground mass and the primary constituents of the lava quite intact.

Several years ago I described some contact rocks and dyke rocks resembling these, from the border of a great dyke of elæolite-syenite in the north of New Jersey, and a comparison of these rocks led me to suspect the presence of nepheline in these specimens, but I could not find it with certainty.

Mr. J. F. Kemp has described* a remarkable erratic from Aurora, Cayuga Co., N. Y., which is of exactly the same character as the rock here described, except that it is not accompanied by contact forms.

It is there assigned to the nepheline-bearing dyke rocks free from olivine, to which the name *fourchite* has been given, although no nepheline has been found in the rock. Some of the slides examined by me would admit of this assignment. In others several olivine crystals occur in a single slide, and the rock would then be called *monchiquite*, or since both forms contain hornblende, they would be called hornblende fourchite or hornblende monchiquite, according to the same rather overloaded nomenclature.

Prof. Kemp surmises that his rock may have come from the Archæan areas to the north. From the present occurrence a nearer source of both erratics is probable.

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* American Journal of Science, Vol. XXIII, Chap. III, 1882, p. 302.

The Devonian Section of Central New York Along the Unadilla River.*

By Charles S. Prosser.

[Communicated for the report of the State Geologist]

The Unadilla section of the New York middle and upper Devonian † is located about midway between the meridians of 75° and 75° 30′ W. Long. from Greenwich, or between 1° 30′ and 2° E. Long. from Washington.

The section commences in Paris township, Oneida county, and follows the Unadilla valley southward through portions of Madison, Chenango and Otsego counties to New Berlin, Chenango county. At this village the Unadilla valley is left and the hills which form the watershed between the Unadilla and Susquehanna rivers are crossed to Oneonta and Otego in Otsego county. The termination of the section is south of the Susquehanna river on the high hills of Delaware county.

The Corniferous limestone which gives a somewhat marked physical character to the region, so that its general easterly and westerly direction is readily followed, is made the geologic base of this general section. The rock is massive and not easily affected by weathering, a fact shown by the bold escarpments of the hills whose summits and slopes are often covered with angular fragments of the limestone.

Numerous articles have been written describing the effect of the Corniferous and other similar limestones upon the overlying soil. Some authors hold the opinion that the fertility of the soil is largely due to the underlying limestone; while another view is "that soils are so far removed from their parent rock, that the one upon which they

* The greater portion of this paper was originally presented to the Faculty of Cornell University as a thesis for the degree of M. S.

† In a paper on "The Classification of the Upper Devonian," by Dr H. S. Williams, this section received the number X on the chart of the "Meridional sections of the Upper Devonian deposits of New York, Pennsylvania and Ohio." Proc. Am. Assoc. Adv. Sci., vol. xxxiv, see page 225: also Fifth Ann. Rept. U. S. Geol. Survey, p. 52; and Smithsonian Ann. Rept., 1883, p. 79.

now repose can not give us much light or information of their nature or composition."* However all the hills in this region, especially the steep slopes and summits where the soil is only two or three feet in thickness, are more fertile when the Corniferous limestone is the underlying rock than tho-e hills farther south where the soil is underlain by Hamilton shales and sandstones.

The "blue limestone" as it is locally designated is darker than in Western New York (see specimens from Batavia and Le Roy of the Genesee section †) and the exposures of the Unadilla section are probably darker in color than those farther east. Vanuxem said in his final report, referring to the Third Geological District of the State survey, "the color of the rock [Corniferous limestone] is more dark at the west than the east end of the district,"‡ while the Unadilla section is approximately half way between the eastern and western limits of that district. The difference in color might possibly be explained by a greater deposition of carbonaceous matter in this portion of the formation than in that farther east or west, which would correspond roughly to the greatest thickness of the overlying Marcellus shale. §

The first local station examined was Chapman's Quarry, No. 469A,‖ in Paris township, Oneida county, which is nearly one mile north of Babcock Hill and a little more than that distance southeast of Cassville. The rock is massive, weathering but slightly, not enough to injure its durability, and five feet out of an exposure of six feet is worked and used for building and flagging stones. The strata of massive stone are from two to ten inches in thickness, generally separated by shaly layers containing fossils. The fossils, which are mostly Brachiopods, fragments of Crustacea, segments of Crinoid stems, and few, if any Corals, are rare in the upper strata of massive stone, and near the bottom of the quarry appear to be confined to the shaly layers. Two layers of hornstone, each about $5\frac{1}{2}''$ in thickness separated by $11''$ of compact limestone are near the top of the quarry. In these layers of hornstone, fossils are quite common, especially *Atrypa reticularis*, Linné. When the rock is freshly broken there is a noticeably strong petroleum odor.

The complete fauna of No. 496A, is given below.

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* Emmons in Agri. N. Y., vol. i, p. 218; also see p. 176, and Geol. N. Y., Pt. IV, p. 170.

† Proc. Am. Assoc. Adv. Sci., vol. xxxiv, p. 221.

‡ Geol. N. Y., Pt. III, p. 140; also see Agri. N. Y., vol. i, p. 178.

§ Geol. N. Y., Pt. III, pp. 147–8; and Pt. IV, p. 179.

‖ The numbers of the stations have been assigned by the U. S. National Museum, where the material upon which this report is based will eventually be deposited.

Atrypa reticularis, Linné.*

Leptæna rhomboidalis, Wahlenberg.

Leptocœlia acutiplicata, Conrad.

Orthis lenticularis, Vanuxem.

Chonetes sp. Small forms not having the specific characters well defined.

Chonetes acutiradiata, Hall (?).

Smaller than the specimens figured in Pal. N. Y., vol. iv, pl. 20, fig. 5; but with the general proportion and markings of those specimens.

Spirifer raricosta, Conrad.

Stropheodonta nacrea, Hall.

Lingula sp.

Fragment of a *Trilobite.*

Segments of *Crinoid* stems.

Between Chapman's quarry and Babcock hill are several exposures one of which had formerly been worked for a quarry.

The last considerable outcrop noticed is No. 496 B, a few rods east of Babcock Hill postoffice. There is exposed $4\frac{1}{2}'$ of massive stone and near the bottom are two hornstone layers separated by 11″ of limestone. Above the massive stone are alternating strata of thin limestones and shales, among which are two hornstone layers separated by a 6″ limestone. This quarry has not been worked for some years and the elevation agrees approximately with that of No. 496 A. The two most abundant fossils are the same as for △ 496 A:

Atrypa reticularis, Linné.

Leptæna rhomboidalis, Wahlenberg.

In addition to the fauna of 496 A, the following species were found in 496 B:

Rhynchonella Horsfordi, Hall (?).

Stropheodonta sp. A convex form with produced hinge line.

The exposures of Babcock Hill and vicinity have long been regarded as typical Corniferous limestone of Oneida county.

If the fauna of the Corniferous limestone at Le Roy, Batavia and other places in western New York be compared with that of the Unadilla section, the abundance of corals in the former and the absence of them in the latter will be noticed as the distinguishing feature. There are no large exposures south of Babcock Hill for a distance of several miles along the range of hills on the eastern side of the valley.

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* The species enumerated in the lists of fossils of this paper, are arranged approximately according to their relative abundance at each station; the one named first being the most abundant.

About one and one-half miles northeast of Bridgewater village, Oneida county, is a steep hill, No. 497A, which gives but a few unimportant exposures. The surface stone, which by its angularity indicates no great transportation, enables one to construct a rough section of the hill in connection with the few exposures *in situ.* Near the foot of the hill and in the valley are limestone boulders in which *Atrypa reticularis* Linné and *Leptæna rhomboidalis* Wahlenberg are common. These are evidently from the Corniferous limestone which underlies the valley and may extend some distance up the hill. Fragments of argillaceous black shale containing very few fossils are common over most of the hill.

In a little exposure of black argillaceous shale, No. 497A′, almost at the foot of the hill was found a single fair specimen of *Liorhynchus* which is probably a flattened *L. limitaris*, Vanuxem, although the form is similar to young specimens of *L. multicosta*, Hall. (See Pal. N. Y., vol. iv, pl. 56, fig. 26.)

In addition were found several fragments evidently of the same species, with a fragment of a *Conularia.* Farther up the hill among loose fragments are specimens very closely allied to *Liorhynchus limitaris*, Vanuxem.

Near the summit of the hill in iron-stained shales, No. 497A″, more arenaceous and coarse than those described above, which with reasonable certainty were not distant from similar shales *in situ*, were found:

Spirifer mucronatus, Conrad.

Liorhynchus, sp. Small specimens between *L. limitaris*, Vanuxem and *L. multicosta*, Hall.

Liorhynchus multicosta, Hall. A dorsal valve with seven plications on the fold.

Chonetes sp.

Nuculites triqueter, Conrad (?).

Crinoid stems.

Among the loose specimens from other parts of the hill are the following additional species:

Athyris spiriferoides, Eaton (?).

Chonetes setigera, Hall (?).

Conularia sp.

The section compiled from the above data seems to be as follows: The Corniferous limestone of Babcock Hill forms possibly the base of the hill, but does not extend far up its sides. The greater part of the hill is composed of Marcellus shales, while the summit is capped by Hamilton shales. Although all the fossils found in 497A″ have been found in the Marcellus with one exception, yet the lithologic similarity of these shales to those of typical Hamilton, farther south, apparently supports the last statement. Quite probably if there were opportunity for better study of the section, the upper shales would prove to be transitional from the typical Marcellus to typical Hamilton.

Nearly one mile southwest of West Winfield, Herkimer Co., on the north side of the highway from West Winfield to Bridgewater, Oneida Co., is △ 497B. A small brook has exposed some shales in addition to those on the hillside. Locally this station is known as the "coal mine," from the fact that some years ago a considerable excavation was made in the vain hope of finding coal, the search for which was confined to a stratum of Marcellus shale at the foot of the hill on the western bank of the brook, where it is massive when taken out, but upon weathering splits up finely. The shale is quite black, has a brownish-black streak and contains *Styliola fissurella*, Hall, in great abundance. Diligent search failed to reveal any trace of coal either in the rock or its joints. The lowest exposures of 497 B′, in the brook just above the highway, contain the following species:

Coleolus aciculum, Hall (?).
Lunulicardium fragile, Hall (?).
Goniatites sp.

The fossils are rare in these exposures and imperfectly preserved.

A little higher in the "coal mine" 497 B″, are:

Styliola fissurella, Hall. This species is very abundant. Plant stems, common.
Goniatites discoideus, Hall.
Coleolus aciculum, Hall (?).

An exposure of thin arenaceous shales near the summit of the hill, 497 B‴, one hundred feet higher than B′, contains a few fossils. The most common is a small *Liorhynchus*, probably *L. limitaris*, Vanuxem. There was also found a *Styliola* (?) and, rarely, fragments of other fossils.

The lower shales of △ 497 B are somewhat calcareous, thin layers of calcite frequently occurring in the joints of the rock, while those near the top of the hill are arenaceous. The hill is evidently composed of Marcellus shales, although the upper part might more properly be considered as transitional from the Marcellus to the Hamilton. This is the most southern typical exposure of Marcellus shale noticed in the Unadilla section.

△ 498 A is a section of Markham Mountain, a high hill on the eastern side of the Unadilla river, in Plainfield, Otsego Co. The "mountain" is only a short distance southeast of Unadilla Forks and approximately 3.2 miles southwest of △ 497B. A circuitous roadway leads from the village to the top of the "mountain" and some distance up the hill, by the roadside, is the lowest exposure 498A′. The rocks are thin, arenaceous shales, breaking up very irregularly, and iron-stained when weathered. The lithologic appearance of these shales is similar to those of △ 497A². The fauna is as follows:

Liorhynchus multicosta, Hall.

Numerous specimens of the typical Hamilton form, also smaller forms apparently similar to the specimen figured by Prof. Hall as "a young individual" of this species. (See Pal. N. Y. vol. iv., pl. 56, fig. 26.)

Ambocœlia umbonata, Hall.

One specimen shows both concentric and radiating striæ, while four internal impressions of the dorsal valve have a median depression extending from the umbo to the front of the valve.

Chonetes sp. Small specimens (with one exception) imperfectly preserved; probably *C. setigera*, Hall or *C. lepida*, Hall.

Paracyclas lirata, Conrad.

Nuculites oblongatus, Conrad.

Nuculites triqueter, Conrad.

Orbiculoidea sp.

Several fragments which have not been identified with certainty.

A ledge on the western side of the "mountain" forms a bluff near the summit and this has been called 498A². There are from 50′ — 75′ of arenaceous shales and sandstones. The strata at the base of the ledge are of considerable thickness and one compact sandstone stratum 8″ in thickness would apparently make a fair quarry stone. Weathering, however, indicates the presence of iron. The layers higher in the bluff are thin and irregular and in view of the large amount of "stripping" that the quarrymen would be obliged to do, it is not probable that a profitable quarry could be opened. The sandstones and arenaceous shales do not contain an abundant fauna, either in reference to numbers or species, as may be inferred from the following list:

Rhynchonella congregata, Conrad (?).

The specimens are mostly internal impressions, common in occasional layers of arenaceous shale. Unadilla Forks is one of the localities given by Prof. Hall for the above species.

Spirifer medialis, Hall (?).

Only imperfect specimens.

Spirifer granulifer, Hall.

In loose specimens of calcareous rock, which may be fragments from what Prof. Hall calls "calcareo-arenaceous bands*" were found numerous specimens of apparently typical *Rhynchonella congregata*, Conrad. In association with the preceding species are specimens of a smaller *Rhynchonella*, which may be the young of *R. congregata*, Conrad, but resembles closely *R. prolifica*, Hall. *Spirifer medialis*, Hall occurs with the *Rhynchonellas*. *Spirophyton velum*, Vanuxem was noticed in loose sandstone slabs.†

△ 498 B is an exposure in a brook on the western side of the Unadilla river, about one mile southwest of Unadilla forks in Brookfield, Madison county. The rocks are shales which contain more arenaceous than argillaceous material. Fossils are not abundant. The fauna is :

Chonetes coronata, Conrad.

Liorhynchus multicosta, Hall.

Paracyclas lirata, Conrad. Several of the specimens very much distorted by pressure.

Spirifer mucronatus, Conrad. Small specimens of evidently this species.

Palæoneilo constricta, Conrad.

Coral.

Athyris spiriferoides, Eaton.

Rhynchonella sp.——

Tropidoleptus carinatus, Conrad. (?)

Upon first examination this specimen was identified as *Chonetes mucronata*, Hall, but more careful study seems to confirm the above determination. Apparently no trace of cardinal spines is preserved, and near the margin the impression shows the presence of pustules. About ten of the central striæ bifurcate near the margin of the shell. The resemblance of *C. mucronata*, Hall, to the young of *T. carinatus*, Conrad was noticed by Prof. Hall.‡

Chonetes sp.

Pleurotomaria.

Fragments of some other species.

A short distance south of Lloydsville hamlet in Plainfield, Otsego co., and one+mile south of 498 A. is 498 D. There is an exposure of 20′ of shales in the bed and by the side of a small creek. These shales are not coarse but split up into irregular fragments. About 10′ from

* Pal. N. Y., vol. iv, p. 342.

† See Geol. Rep't 3d Dist. N. Y., pp. 176, 177: also 16th Ann. Rep't. N. Y. State Cab. Nat. Hist., pp. 80, 82.

‡ Pal. N. Y., vol. iv, p. 125.

the base is a coarser layer in which *Spirifer mucronatus*, Conrad, is abundant. The shales contain the following species:

Spirifer mucronatus, Conrad.
Liorhynchus multicosta, Hall.
Athyris spiriferoides, Eaton.
Ambocœlia umbonata, Conrad.
Orthis Vanuxemi, Hall (?).
Orthoceras. Fragments of large and small forms.
Nucula (?).
Grammysia.
Panenka retusa, Hall (?).
Nuculites oblongatus, Conrad.
Conularia undulata, Conrad (?).
Atrypa reticularis, Linné (?).

A small specimen, probably the young of the above species (see Pal. N. Y., vol. iv, pl. 53, Fig. 3).

About one mile south of 498 D, and east of Leonardsville is a ledge of arenaceous, coarse shales some 8′ in thickness. The exposure is on the hill-side east of the river and highway, and is called 498 E. Fossils are not common, all of the following species being rare:

Spirophyton velum, Vanuxem.
Segments of crinoid stems.
Rhynchonella Sappho, Hall (?).
Paracyclas lirata, Conrad (?).
Leptodesma Rogersi, Hall.

A half mile further south, a small creek affords another exposure of nearly 12′. South of the creek near the first cross-road leading eastward, is 498 F. The rock consists of coarse, arenaceous shale, very similar in lithologic appearance to 498 E, but contains more fossils. The altitude of these shales is higher than that of 498 E.

The fauna is as follows:

Spirifer mucronatus, Conrad.
Ambocœlia umbonata, Conrad.
Rhynchonella. Specimens too imperfect for specific identification.
Tropidoleptus carinatus, Conrad. Small specimen, but evidently young of this species.
Rhynchonella prolifica, Hall (?).
Paracyclas lirata, Conrad.
Grammysia.
Microdon (*Cypricardella*) *bellistriatus*, Conrad.

Bellerophon patulus, Hall (?).

Doubtfully referred to this species from the resemblance of the specimen to fig. 10, pl. 24, pt. ii, vol. v, Pal. N. Y.

Near the top of the hill, fully 100′ higher than the preceding section, is an exposure of arenaceous shale, 498 G. The shale, however, is more argillaceous and somewhat more fossiliferous than that of 498 F. The fossils identified are:

Rhynchonella Sappho, Hall.

Thoracic segments of a large *Trilobite*, probably *Homalonotus DeKayi*, Green.

Rhynchonella congregata, Conrad.

Spirifer sp.

Nucula Randalli, Hall.

498 H is about one mile south of Leonardsville, on the eastern side of the Unadilla river, and in Brookfield, Madison Co. These layers, commencing somewhat farther north than the village and extending more than a mile along the eastern side of the hill, are composed of coarse, arenaceous shales, which tend to pass into thin sandstones of some little thickness and uniformity. At the place particularly examined (498 H) there is an exposure of coarse shales and thin sandstones 20′ in thickness, similar in lithologic appearance to those of 498 E, F and G on the opposite side of the river, and also to 498 A^2, the upper exposure of Markham mountain at Unadilla Forks. The only abundant fossil in these coarse shales is *Grammysia alveata*, Conrad. The following fossils were collected:

Grammysia alveata, Conrad. Quite a large number of specimens from the coarse, arenaceous shales.

Rhynchonella congregata, Conrad (?).

Rhynchonella Sappho, Hall (?).

Spirifer mucronatus, Conrad.

Ambocœlia umbonata, Conrad.

Liopteria sp. Type of *L. Rafinesquii*, Hall, and *L. DeKayi*, Hall. (See Pal. N. Y., vol. v, pt. I, pl. 20, figs. 7 and 17.)

Several specimens belonging to the *Pectenidæ*, but not perfect enough to admit of certain identification.

Tropidoleptus carinatus, Conrad.

Spirophyton velum, Vanuxem.

A single specimen of *Crania* or *Orbiculoidea*.

On a provisional list a fragment of a *Trilobite*, probably *Homalonotus DeKayi*, Green, is mentioned but, upon a re-examination of the fauna the specimen has not been found.

One half-mile southwest of the sandstone cliffs forming 498 H are Button Falls in Button Creek. The cascade 50′ or 60′ in height is composed of two falls and is just below the highway leading from the "river-road" up the hill. The bluish argillaceous shales of this station, 498 I′, are irregular in fracture and upon the whole not very fossiliferous. In the cliff at the foot of the falls and also in the bed of the creek is a stratum which contains abundant fossils. *Liorhynchus multicosta*, Hall, is very abundant in this stratum, the shale in places being almost entirely composed of these shells, many of which are very much distorted. In the creek below both the first and second falls are "pot-holes" one of which is four feet in depth and two feet in diameter. The fauna so far as identified is as follows:

Liorhynchus multicosta, Hall.
Ambocœlia umbonata, Conrad.
Nuculites triqueter, Conrad.
Nuculites oblongatus, Conrad.
Rhynchonella Sappho, Hall.
Spirifer medialis, Hall (?). Small forms.
Chonetes.
Nucula bellistriata, Conrad.
Homalonotus DeKayi, Green. Segments.
Phacops rana, Green.
Productella.
Tellinopsis subemarginata, Conrad.
Palæoneilo constricta, Conrad.
Grammysia.

Above the falls for one-quarter of a mile, the bed of the creek is composed of shale which has been worn very smooth by the water. Somewhat farther up the creek are ledges on the right hand or eastern side which have been called 498 I². The lithologic character of these upper shales is similar to those of 498 I¹. Fossils are not abundant except in the lower part of the bluff. The following species have been identified:

Ambocœlia umbonata, Conrad.
Tentaculites.
Chonetes scitula, Hall.

The number of striæ (50 ±) and general proportions agree in the main with the figures of this species, with the exception of one specimen which is larger than any of the forms figured.

Phacops rana, Green.
Productella.
Nuculites oblongatus, Conrad.

Tropidoleptus carinatus, Conrad.

Orthoceras crotalum, Hall (?).

Grammysia.

Pholadella radiata, Conrad.

Chonetes (?) *mucronata*, Hall. Possibly *Tropidoleptus carinatus*, Conrad, but I am quite sure that on one side are the proximal ends of two spines.

Chonetes deflecta, Hall (?). This specimen may be *C. mucronata*, Hall, but it is considerably larger than the figured specimens of that species, and apparently agrees well with the figures of *C. deflecta*, Hall. However, Prof. Hall writes that *C. deflecta*, Hall, may be, perhaps, only another phase of *C. mucronata*, Hall.*

Goniatites. Simply a fragment.

Ptilodictya (*Stictopora*). sp. Fragment.

Chonetes. Apparently young of *C. coronata*, Conrad. (See Pal. N. Y., vol. iv, pl. 21, Fig. 10 a, b.)

Two + miles down the river from 498 I, and three-fourths of a mile from West Edmeston is an exposure of shales in Ordway creek, which has been numbered 498 K. The most abundant fossil is *Nyassa arguta*, Hall. The fauna in full is given below:

Nyassa arguta, Hall.

Orthis. Specimens very imperfectly preserved in a thin sandstone stratum.

Nuculites triqueter, Conrad.

Modiella pygmaea, Conrad.

Palæoneilo constricta, Conrad.

Rhynchonella. Small specimens and specific characters not well defined.

Chonetes.

Athyris spiriferoides, Eaton.

Spirifer.

Pterinea flabella, Conrad.

Liopteria DeKayi, Hall (?).

Homalonotus DeKayi, Green.

In the thin sandstone, as is also

Spirophyton velum, Vanuxem.

Quite extensive collection of fossils was made at different places in Brookfield, Madison county, and the following lists will give a good idea of the middle Hamilton fauna of Central New York. 499 A, on the summit of Beaver hill, one and one-half miles east of Brookfield,

* Pal. N. Y., vol. v, p. 126.

is the highest outcrop east of Beaver creek, the aneroid barometer reporting it as 540′ above the Unadilla river at Leonardsville, or 370′ above the village of Brookfield. The rock is a gray, arenaceous shale, weathering to a brownish color, and is laminated, some of the layers being smooth and of regular thickness, so that it is apparently a good flagging stone. The fossils are rare, only two species being found :

Stropheodonta perplana, Conrad.
Chonetes coronata, Conrad (?).

No. 499 B. A line of ledges on Beaver hill, south-east of Brookfield. The rock consists of arenaceous shales, in which fossils are not very common, except in a thin layer near the bottom of the exposure.

Fauna of 499 B.

Rhynchonella congregata, Conrad (?).
Stropheodonta perplana, Conrad.
Spirifer mucronatus, Conrad.
Spirifer granulifer, Hall.
Vitulina pustulosa, Hall.
Terebratula sp.
Paracyclas lirata, Conrad.
Pterinea flabellum, Conrad.

No. 499 C. Exposure of shales by side of highway, a short distance west of Brookfield. The rocks are fissile, black, argillaceous shales, which upon weathering split up into very small fragments. The shales are quite fossiliferous, containing mostly Lamellibranch shells; but a thin layer contains large numbers of *Liorhynchus multicosta*, Hall.

Fauna of No. 499 C.

Liorhynchus multicosta, Hall.
Ambocœlia umbonata, Conrad.
Chonetes coronata, Conrad.
Rhynchonella prolifica, Hall (?).
Rhynchonella congregata, Con. (?).
Nuculites oblongatus, Conrad.
Nuculites triqueter, Con. (?).
Nucula lirata, Con. (?).
Pleurotomaria, sp.
Goniatites, sp.

No. 499 D. Ledges along the banks of a branch of West Creek, near M. Kenyon's farm, one mile west of Brookfield. At the base is a fissile argillaceous shale, which decomposes readily upon exposure to the air and is highly fossiliferous, containing many Lamellibranchs. A short distance farther up the creek, and ten feet higher are arenaceous shales, considerably iron stained, containing principally *Chonetes.* Above these shales are the fine argillaceous ones again.

Fauna of No. 499 D.

Ambocœlia umbonata, Conrad.
Rhynchonella prolifica, Hall.
Chonetes, sp.
Productella, sp.
Nuculites oblongatus, Conrad.
Nuculites triqueter, Con. (?).
Nucula bellistriata Con. (?).
Grammysia sp.
Orthoceras sp.
Goniatites sp.
Dumb-bell fucoid.

No. 499 F. Exposures on West Creek, southwest of Brookfield. At the base of the section (F′) ten feet of coarse argillaceous shales, which on weathering split up into rather large pieces. The fossils are not so abundant as in the finer shales, but the species are mainly the larger forms. The list for No. 499 F′ is:

Nucleospira concinna, Hall.
Ambocœlia umbonata, Conrad.
Athyris spiriferoides, Eaton.
Liorhynchus multicosta, Hall (?).
Spirifer medialis, Hall (?).
Orthis cf. Penelope, Hall.
Rhynchonella prolifica, Hall.
Actinopteria decussata, Hall.
Nuculites Nyssa, Hall.
Modiomorpha complanata, Hall.
Pterinea flabellum, Conrad.
Nyassa arguta, Hall (?).
Grammysia sp.
Platyceras sp.
Pleurotomaria sp.
Orthoceras sp.

For 100′ the bank is covered by drift and soil, then there is an exposure of coarse arenaceous shales and thin sandstones which has been worked to some extent as a quarry. *Tropidoleptus carinatus*, Con. is very abundant and the complete fauna of No. 499 F″ is as follows:

Tropidoleptus carinatus, Conrad.
Nucleospira concinna, Hall.

Spirifer mucronatus, Conrad.
Orbiculoidea Seneca, Hall (?).
Stropheodonta perplana, Conrad.
Ambocœlia umbonata, Conrad.
Terebratula Lincklæni, Hall.
Rhynchonella Sappho, Hall.
Orthis Vanuxemi, Hall.
Productella sp.
Chonetes sp.
Cypricardinia indenta, Conrad.
Paracyclas lirata, Conrad.

Farther up West creek than No. 499.F are ledges near the side of the creek. At the base are rather fine arenaceous shales (No. 499.E[1]), which are fossiliferous.

Fauna of No. 499. E[1].

Ambocœlia umbonata, Conrad.
Vitulina pustulosa, Hall.
Spirifer mucronatus, Conrad.
Spirifer medialis, Hall.
Rhynchonella prolifica, Hall.
Rhynchonella Sappho, Hall, or *congregata* Con.
Terebratula Lincklæni Hall (?).
Chonetes sp.
Productella sp.
Orbiculoidea sp.
Paracyclas lirata, Conrad.
Palæoneilo emarginata. Conrad.
Nucula Randalli, Hall.
Nyassa arguta, Hall.
Grammysia sp.
Orthoceras sp.

A little higher an exposure of coarse arenaceous shales, 6′ 9″ in thickness, containing fossils characteristic of the coarse Hamilton shales.

Fauna of No. 499, E[2].

Stropheodonta perplana, Conrad.
Rhynchonella prolifica, Hall.
Nucleospira concinna, Hall.
Spirifer medialis, Hall.
Ambocœlia umbonata, Conrad.
Terebratula Lincklæni, Hall (?).

Productella sp.
Paracyclas lirata, Conrad.
Pterinea flabellum, Conrad.
Actinopteria decussata, Hall.
Grammysia magna, Hall.
Schizodus ellipticus, Hall (?).
Glyptodesma erectum, Conrad.
Grammysia arcuata, Conrad.
Nyassa arguta, Hall.
Aviculopecten sp.

Near the above locality on a branch of the West creek are coarse, arenaceous shales, forming a ledge 20′ high. Fossils are not very common, and the upper layer is a smooth stratum four inches thick, which would make a thin flagstone.

Fauna of No. 499 E³.

Spirifer granulifer, Hall.
Rhynchonella Sappho, Hall.
Rhynchonella prolifica, Hall (?).
Stropheodonta perplana, Conrad.
Tropidoleptus carinatus, Conrad.
Paracyclas lirata, Conrad.
Palæoneilo emarginata Con. (?).
Pterinea flabellum, Conrad.

No. 499, G. Exposures of coarse, arenaceous shales on Quaker Hill, about four miles southwest of Brookfield. Near the top of the hill are very coarse shales to thin sandstones, in which a small quarry was opened.

Fossils are not abundant and the list is as follows :

Spirifer medialis, Hall. In one layer a large number of specimens which apparently belong to this species. There are a few which have a sinus in the fold and a small fold in the bottom of the sinus.

Spirifer mucronatus, Conrad.
Tropidoleptus carinatus, Conrad.
Ambocœlia umbonata, Conrad.
Chonetes, sp.
Modiomorpha subalata, Conrad.

500, A¹. Exposures by highway about one and one-half miles from North Brookfield on road from North Brookfield to Brookfield. At this locality there is a small quarry where building stone has been quarried. At the base is five feet of massive, bluish gray sandstone which shows no tendency to split into regular layers. Above the sandstone is five feet, principally of coarse arenaceous shales, but with more argillaceous shales on top.

Fauna of No. 500, A^1.

Rhynchonella Sappho, Hall.

Rhynchonella congregata, Con. (?).

Chonetes coronata, Conrad.

Lingula ligea, Hall (?).

Orbiculoidea grandis, Van. (?).

Spirifer medialis, Hall.

Spirifer mucronatus, Hall.

Modiomorpha complanata, Hall.

Grammysia bisulcata, Con. (?).

Goniophora hamiltonensis, Hall.

Cimitaria recurva, Conrad.

Tentaculites attenuatus, Hall.

Orthoceras constrictum, Con. (?).

Crinoid stems.

Southeast of 500 A^1 and 200′ higher on the hillside is an exposure of 10′ of coarse, arenaceous shales. Fauna of 500 A^2.

Spirifer medialis, Hall.

Rhynchonella contracta, Hall (?).

Rhynchonella Sappho, Hall (?).

Crinoid stems.

500 C.— Gorton Lake, three and one-half miles from Brookfield, occupies a depression near the top of the high hills in that part of the township. At a short distance from the lake, in the outlet is a cascade giving an exposure of eighty feet, consisting mostly of soft, dark argillaceous shales. In the bed of the creek, C^2, just above the falls, is a stratum rich in fossils, both as to number of specimens and species. *Spirifer mucronatus*, Conrad, is very common; *Nucleospira concinna*, Hall, quite abundant with nicely preserved specimens; and *Paracyclas lirata*, Conrad, also quite common. In a stratum of the thin black shales, C^1, about half way down the ravine the following species occur:

Spirifer mucronatus, Conrad, very common.

Ambocœlia umbonata, Conrad.

Nucleospira concinna, Hall, abundant.

Orbiculoidea Doria, Hall.

Orthoceras subulatum, Hall, more common than in any other locality of this region.

Phacops rana, Green, several good specimens.

Paracyclas lirata, Conrad, very abundant, well preserved with considerable variation in the form of the shell.

The complete list of fossils is as follows:

1. *Stropheodonta perplana*, Conrad.
2. *Athyris spiriferoides*, Eaton.
3. *Spirifer medialis*, Hall.
4. *Spirifer mucronatus*, Conrad.
5. *Spirifer granulifer*, Hall.
6. *Rhynchonella prolifica*, Hall.
7. *Orbiculoida Doria*, Hall.
8. *Ambocœlia umbonata*, Conrad.
9. *Nucleospira concinna*, Hall.
10. *Vitulina pustulosa*, Hall.
11. *Chonetes coronata*, Conrad (?).
12. *Orthoceras constrictum*, Conrad.
13. *Orthoceras subulatum*, Hall.
14. *Orthoceras nuntium*, Hall.
15. *Paracyclas lirata*, Conrad.
16. *Grammysia bisulcata*, Conrad (?).
17. *Actinopteria decussata*, Hall.
18. *Pterinea flabellum*, Conrad.
19. *Phacops rana*, Green.
20. *Homalonotus DeKayi*, Green.
21. *Favosites Hamiltoniæ*, Hall.
22. *Palæoneilo constricta*, Conrad.
23. *Nuculites oblongatus*, Conrad.
24. *Tellinopsis subemarginata*, Conrad.
25. *Nucula Randalli*, Hall.
26. *Nyassa arguta*, Hall (?).
27. *Nuculites triqueter*, Conrad.
28. *Nucula bellistriata* Con. (?).

No. 500. E. An exposure of shales in the bed of a small brook e short distance north of North Brookfield. The lower layers (E^1) ara medium coarse arenaceous shales in which *Ambocœlia umbonata* Conrad, occurs abundantly in thin layers, but other fossils are rare. The fauna of No. 500. E′ is as follows:

Ambocœlia umbonata, Conrad.
Productella Shumardiana, Hall.
Productella truncata, Hall.
Rhynchonella prolifica, Hall (?).
Paracyclas lirata, Conrad.

Nucula Randalli, Hall.

A little farther up the brook the shales are finer, more argillaceous and contain a larger number of fossils.

The fauna of No. 500. E² is:

Ambocœlia umbonata, Conrad:
Tropidoleptus carinatus, Conrad.
Rhynchonella polifica, Hall.
Spirifer mucronatus, Conrad.
Grammysia, sp.
Homalonotus DeKayi, Green.

501. C. Exposures along the outlet of the "Lake Swamp" in the southwestern part of Brookfield. At the foot of the falls are 6′ of argillaceous shales (C¹) in which *Tropidoleptus carinatus*, Conrad, occurs. Above these argillaceous shales are 24′ of coarse arenaceous shales, which form the falls. Fossils are not common, but the following species were obtained in No. 501 C²:

Tropidoleptus carinatus, Conrad.
Spirifer medialis, Hall.
Ambocœlia umbonata, Conrad.
Chonetes coronata, Conrad.
Chonetes deflecta, Hall (?).
Palæoneilo constricta, Conrad.
Nuculites oblongatus, Conrad.
Grammysia bisulcata, Con. (?).
Homalonotus DeKayi, Green.
Dalmanites sp., border of pygidium.

From the arenaceous shales above the falls (C³) the following species were obtained:

Ambocœlia umbonata, Conrad.
Chonetes scitula, Hall.
Spirifer mucronatus, Conrad.
Chonetes coronata, Conrad.
Chonetes deflecta, Hall (?).
(?) *Cryptonella planirostra*, Hall.
Nucula bellistriata, Conrad.
Palæoneilo constricta, Conrad.
Nuculites oblongatus, Conrad.
Nuculites triqueter, Con. (?).
Grammysia sp.
Pleurotomaria capillaria, Con. (?).
Loxonema delphicola, Hall (?).

Phacops rana, Green.

No. 501 D^1. Exposures on lot No. 6, near the top of one of the highest hills in southwestern Brookfield. The rocks consist of coarse arenaceous shales, alternating with more argillaceous shales which contain many specimens of *Chonetes coronata*, Conrad. The following species were collected at this locality:

Chonetes coronata, Conrad.
Tropidoleptus carinatus, Conrad.
Spirifer medialis, Hall.
Spirifer mucronatus, Conrad.
Chonetes coronata, Con. var. syrtalis Con.
Ambocœlia umbonata, Conrad.
Rhynchonella congregata, Conrad (?).

A half mile further north by the roadside and near the top of the hill are arenaceous shales, not so coarse as those of D^1, which contain an abundance of fossils in some layers. The following species were collected at No. 501 D^2.

Tropidoleptus carinatus, Conrad.
Spirifer medialis, Hall, one specimen with a groove in the mesial fold.
Spirifer granulifer, Hall (?).

501 A. Exposures on Beaver Creek, near the boundary between Brookfield and Columbus. A small quarry has been opened in this rock, but not worked to any extent. The rock consists entirely of an argillaceous, fine grained sandstone which weathers to a yellowish-brown, in some cases breaking up into quite regular blocks, which can be used for rough building purposes. The rock is evenly bedded in layers from ½-inch to a foot or more in thickness. Some of the strata are very fossiliferous, a single stratum of the lower layers, A^1, containing the following species in great abundance:

Spirifer medialis, Hall.
Rhynchonella prolifica, Hall.
Streptorhynchus Chemungensis, Conrad.

In the layers fifteen feet higher A^2, several species were found which were not noticed in the lower, as:

Tropidoleptus carinatus, Conrad.
Spirifer granulifer, Hall.
Ambocœlia umbonata, Conrad.

On a single slab six inches square are good specimens of *Tropidoleptus carinatus*, Conrad; *Spirifer medialis*, Hall; *Rhynchonella prolifica*, Hall, and *Streptorhynchus Chemungensis*, Conrad

The complete fauna of 501 A^1 and A^2 is:

Tropidoleptus carinatus, Conrad.
Streptorhynchus Chemungensis, Conrad.
Spirifer medialis, Hall.
Spirifer granulifer, Hall.
Spirifer mucronatus, Hall (?).
Rhynchonella prolifica, Hall.
Ambocœlia umbonata, Conrad.
Tentaculites alternatus, Hall.
Cypricardinia indenta, Conrad (?).
Actinopteria decussata, Hall.
Crinoid stems.

Station 502 A is one and one-half miles south of West Edmeston in Edmeston, Otsego county. A small run, Burdick's, cuts through the soil and to some extent into the rocks, affording exposures well up the hill. The lowest exposure, 502 A^1, is only a few rods east of Mr. Burdick's farm house. The rock is a rather coarse arenaceous shale in which fossils are common. The following species have been identified:

Spirifera medialis, Hall. The specimens are all small.
Actinopteria Boydi, Conrad (?).
Leptodesma Rogersi, Hall (?).
Stropheodonta perplana, Conrad.
Goniatites.
Spirifer mucronatus, Conrad.
Rhynchonella.
Nyassa arguta, Hall.
Orthoceras.

A short distance up the creek is a cliff of shales, 502 A^2, slightly more argillaceous than A^1. Fossils are not common, all the following species being rare:

Rhynchonella; small forms.
Spirifera medialis, Hall (?).
Lunulicardium fragile, Hall (?).
Tellinopsis subemarginata, Conrad.
A specimen belonging to the *Pectinidæ*.

502 A^3 are thin arenaceous shales, quite regularly bedded. Some of the layers contain black clay pebbles. Fossils are more abundant than in A^2. The fauna is:

Rhynchonella.

The specimens are common, but they are all small. It is possible that all of them may be the young of *R. congregata*, Conrad. Several of the specimens appear to have the proportions of small *R. eximia*, Hall (see Pal. N. Y., vol. iv, pl. 55, fig. 1). Others are nearer young *R. prolifica*, Hall, having about sixteen plications, and are without a marked sinus and fold, a fact noticed by Prof. Hall in young specimens of this species (see Pal. N. Y., vol. iv, p. 343).

Liorhynchus multicosta, Hall.

Segments of *crinoid* stems.

Ambocœlia umbonata, Conrad.

Palæoneilo emarginata, Conrad.

Tropidoleptus carinatus, Conrad.

In the upper part of the creek are cliffs of 20′ and falls, which have been called 502 A⁴. The shales are arenaceous, some layers quite regular, and micaceous; generally with fossils, but these are for the most part small forms. The following species from this exposure have been identified:

Rhynchonella congregata, Conrad (?).

A majority of the specimens appear to be nearer *R. congregata*, Conrad, than any other figured forms. Some small specimens which are probably the young of the above resemble small *R. prolifica*, Hall. It is extremely difficult to determine with precision the specific identity of many of the *Rhynchonellas* in the eastern Hamilton.

Spirifer medialis, Hall.

Small specimens of the above species.

Nucula bellistriata, Conrad.

Ambocœlia umbonata, Conrad.

Leptodesma Rogersi, Hall (?).

The wing of the specimens does not appear to be as mucronate as in the figured forms of this species. In this respect they agree more closely with the short forms of the Chemung, *L. sociale*, Hall, particularly with a specimen from Broome county. (See Pal. N. Y., vol. v, pt. I, I, pl. 21, fig. 33.) However, *L. Rogersi*, Hall, is given as abundant in the Hamilton group, and specimens are mentioned from Norwich, Chenango county, and Leonardsville, Madison county. (See Pal. N. Y., vol. V, pt. I, I, p. 177.)

Chonetes scitula, Hall.

Productella.

Liorhynchus multicosta, Hall.

Paracyclas lirata, Conrad.

Goniatites.

Tentaculites.

Goniophora carinata, Conrad.

Tropidoleptus carinatus, Conrad.

Grammysia.

Nuculites oblongatus, Conrad.

Palæoneilo emarginata, Conrad.

Orthoceras. Only a fragment.

Lunulicardium fragile, Hall.

Plant stems.

"Dumb-bell" fucoid or concretion.

Three + miles south of 502 A, or one mile north of south Edmeston is station 502 B. The outcrop consists of arenaceous moderately coarse shales in the bed and side of a small stream. Some of the strata are very fossiliferous, containing a large number of *Rhynchonellas* and *Spirifer Tullius*, Hall. The complete fauna is given below:

Rhynchonella.

The specimens are numerous and there are apparently forms which are clearly *R. Sappho*, Hall; others that agree with *R. congregata*, Conrad; while there are intermediate forms among the above species.

Spirifer Tullius, Hall.

Fenestella.

Spirifer granulifer, Hall.

The external impression of one specimen showing the fine interrupted striæ upon the strong plications; a character not often seen, according to Prof. Hall. (See Pal. N. Y., vol. iv, p. 224.)

Nuculites triqueter, Conrad.

Pterinea flabella, Conrad.

Tropidoleptus carinatus, Conrad.

Glyptodesma erectum, Conrad.

Nuculites oblongatus, Conrad.

Stropheodonta demissa, Conrad (?). Imperfect specimen.

Chonetes lepida, Hall (?).

Sphenotus solenoides, Hall.

The posterior portion of the specimen is well marked by the vascular lines and the anterior end is long: two characters which Prof. Hall says distinguish this species. (See Pal. N. Y., vol. v, pt. i, ii, p. 399.)

Liopteria Rafinesquii, Hall (?).

The specimen is not perfect but apparently similar to a form from Leonardsville, N. Y., referred to the above species by Prof. Hall. (Se Pal. N. Y., vol. v, pt. i, i, pl. 88, fig. 28.)

Spirifer mucronatus, Conrad.

Palæoneilo emarginata, Conrad.

Phacops rana, Green.

Grammysia.

Pterinopecten (?).

Three-fourths of a mile to the south almost directly east of South Edmeston, near the top of the high hill, is an exposure of coarse arenaceous shales called 502 C. This outcrop is considerably higher in actual elevation than the one just described. The fauna is as follows:

Spirifer granulifer, Hall. This species with the following one is abundant in this exposure.

Tropidoleptus carinatus, Conrad.

Stropheodonta perplana, Conrad.

Schizodus appressus, Conrad.

Palæoneilo emarginata, Conrad.

Crinoid stems.

Modiomorpha mytiloides, Conrad.

Glyptodesma erectum, Conrad (?).

Spirophyton velum, Vanuxem.

Phthonia sectifrons, Conrad.

Bellerophon.

Two specimens belonging to the *Pectinidæ*, but generic characters very imperfectly preserved.

On the same hillside not far from the station just described, southeast of South Edmeston and just north of a small brook, is a series of ledges. The lithologic characters are the same as for 502 C. The lower ledges have been called 502 D^1 and the species named below have been identified.

Chonetes coronata, Conrad.

There are specimens beside those which are clearly *C. coronata*, Conrad, corresponding closely to those figured by Prof. Hall, as the young of this species. (See Pal. N. Y., vol. iv, pl. 21, fig. 10 a, b). The internal impressions of the small forms are pitted in the same manner as the larger specimens.

Tropidoleptus carinatus, Conrad.

Crinoid segments,

Chonetes scitula, Hall.

Spirifer medialis, Hall (?).

These are small specimens which may be *S. Tullius*, Hall, instead of the above.

Productella dumosa, Hall (?).

Ambocœlia umbonata, Conrad.

Spirifer fimbriatus, Conrad.

Nucula bellistriata, Conrad.

Palæoneilo muta, Hall.

This specimen referred to is probably a variety of this species; the lamellose concentric striæ are coarser and the posterior extremity narrower than in the specimens figured.

Pleurotomaria capillaria, Conrad.

Coleolus tenuicinctus, Hall.

The higher exposures were called 502 D², and the following species were obtained:

Spirifer granulifer, Hall.

Tropidoleptus carinatus, Conrad.

Rhynchonella.

Small form of *R. congregata*, Conrad, or *R. prolifica*, Hall.

Spirifer medialis, Hall (?). Imperfect specimens.

Homalonotus DeKayi, Green. Segments only.

Pleurotomaria capillaria, Conrad.

Parts of *Crinoid* stems.

Liopteria DeKayi, Hall (?).

Modiomorpha concentrica, Conrad (?). Only a fragment.

The above fauna shows that 502 D² is a continuation of 502 C; *Spirifer granulifer*, Hall, and *Tropidoleptus carinatus*, Conrad, being very abundant in both stations.

Three miles south of station 502 D a series of cliffs were examined on the eastern bank of the Unadilla river. This station 503 A is in the northwestern corner of Pittsfield township opposite the upper river bridge and one mile northeast of New Berlin village, Chenango county.

Below the highway just at the river's edge is a bluish-gray sandstone 30″ in thickness, with coarse arenaceous shales above. The only fossil found here, 503 A¹, was a single large perfect specimen of *Chonetes coronata*, Conrad.

Just above the highway are moderately thin arenaceous shales cleaving with some regularity, containing very few fossils. Those found in these shales 503 A² are so fragmentary that a specific identification is difficult. The most common forms are *Grammysia*, and several fragmentary specimens agree quite closely with *G. bisulcata*, Conrad. Also several imperfect specimens of *Chonetes* were found.

Then comes a 10″ bluish-gray sandstone, 503 A³, without any fossils so far as noticed, and above the sandstone rather thin arenaceous shales, 503 A⁴, in which fossils are common. The fauna of 503 A⁴ is given below:

Chonetes scitula, Hall.

This species is very abundant in these shales.

Tropidoleptus carinatus, Conrad.
Leptodesma Rogersi, Hall (?).
Palæonelio constricta, Conrad.
Prothyris lanceolata, Hall.
Spirifer Tullius, Hall (?).
Nucula lirata, Conrad.
Spirifer. Imperfect specimens resembling *S. mucronatus*, Conrad.
Nuculites triqueter, Conrad.
Goniatites.

A specimen belonging to the *Pectinidæ*, but in too imperfect a condition to admit of further identification.

Above A^4 is 20′ that is covered by and soil, then are ledges of shales and thin sandstones or very coarse shales. The lower shales, 503 A^5, are the coarser, consisting of arenaceous, blocky shales some of which are quite fossiliferous. The upper shales of the cliff are thin and arenaceous, somewhat evenly bedded and similar to those of 503 A^4. Fossils are common and in places abundant in both A^5 and A^6.

From the lower shales and the debris at the foot of the cliff, the following species were obtained:

Chonetes coronata, Conrad.
Ambocœlia umbonata, Conrad.
Tropidoleptus carinatus, Conrad.
Nuculites oblongatus, Conrad.
Segments of *Crinoid* stems.
Spirifer Tullius, Hall.
Spirifer fimbriatus, Conrad.
Plant stems.
Spirifer granulifer, Hall (?).
Streptorhynchus Chemungensis, Conrad.
Nucleospira concinna, Hall.
Palæoneilo emarginata, Conrad.
Grammysia.
Leda diversa, Hall.
Nuculites triqueter, Conrad.
Schizodus. Only a portion of the specimen.
Chonetes mucronata, Hall.

From 503A^6, in which the fossils are more abundant than in A^5, the species named below have been identified:

Chonetes scitula, Hall.
Tropidoleptus carinatus, Conrad.
These two species are very common.

Ambocœlia umbonata, Conrad.

Nuculites oblongatus, Conrad.

Spirifer. Small specimens, part of them resembling *S. Tullius*, Hall, and the others *S. mucronatus*, Conrad.

Terebratula Lincklœni, Hall (?).

Palœoneilo constricta, Conrad.

Nuculites triqueter, Conrad.

Chonetes coronata, Conrad.

Pholadella radiata, Conrad.

Nucula bellistriata, Conrad.

Nucula lirata, Conrad.

Orthonota undulata, Conrad.

Leptodesma Rogersi, Hall.

Coleolus tennicinctus, Hall.

Spirifer fimbriatus, Conrad (?). Internal impression and considerably worn so that the characters are not clear.

Three miles southeast of 503 A, by the highway between the villages of New Berlin and Morris, are a series of outcrops, which have been called 503 B. These ledges begin near the foot of the long hill, the first a half mile or more beyond Fink's sawmill. The rock consists of rather coarse, blue, argillaceous shales, weathering greenish, alternating with thin, fine-grained sandstones, and all iron-stained after weathering. Fossils are extremely rare, none being found in the exposures which were hastily examined.

A mile farther up the hill from 503 B, north of the highway and just above a small creek, is an old quarry, not worked at present. This exposure, 503 C, is considerably higher than 503 B. The quarry stone is a blue, fine-grained sandstone, weathering to a brown, showing the presence of considerable iron. Thin sandstones and argillaceous shales, similar to those of 503 B, lie above the massive stone which forms the lowest exposures in the quarry. The only fossils found in the quarry were fragments of plant stems in a poor sandstone of the upper part. In the soil just above the rock were large, flat angular stones containing numerous fossils. These slabs had been probably carried but little distance from their place of occurrence. The fossils are mostly Spirifers and Rhynchonellas, but weathering and other causes have nearly obliterated the finer characters. *Chonetes* and fragments of Lamellibranch shells were also noticed.

503 D is a small exposure by the roadside at almost the summit of the hill, and one-fourth of a mile from the quarry. These shales are

bluish, mostly arenaceous, but some are argillaceous in composition. Fossils are common, the fauna being as follows:

Rhynchonella congregata, Conrad.

Part of the specimens are clearly of this species, while others have the more angular plications of *R. Sappho*, Hall; but Prof. Hall says: "The surface plications appear to be more angular in specimens from the arenaceous beds; and the casts of the interior of some specimens which I have referred to this species present distinctly angular plications." *

All of the above specimens with angular plications are from arenaceous shale.

Spirifer mucronatus, Conrad.

Chonetes.

Small forms which have about the same number of striæ as *C. lepida*, Hall, while in general proportions they are closely allied to *C. setigera*, Hall.

Chonetes scitula, Hall.

Liorhynchus multicosta, Hall.

Actinopteria Boydi, Conrad (?).

The specimens are hardly as wide in proportion to their height as most of the figured forms of the above species.

Spirifer sp. Large form with sinus and fold striated by fine plications.

Leptodesma.

Paracyclas lirata, Conrad.

One mile from 503 D, on the eastern slope of the hill, and lower is another little cliff by the roadside, 503 E. In a coarse arenaceous blue shale were found:

Spirifer mucronatus, Conrad.

Chonetes lepida, Hall (?).

Liorhynchus multicosta, Hall.

Rhychonella congregata, Conrad.

Productella.

In the above shale the fossils are common. A few feet lower is a blue thin-bedded, fine-grained sandstone quite similar to the quarry stone of 503 C.

Two and one-fourth miles from 503 E, just across the township line in the northern part of Morris county and one and one-half miles north-east of Morris village is an outcrop

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* Pal. N. Y., vol. iv, p. 342.

of coarse arenaceous shales much iron-stained after weathering. This ledge is called 504 A, and in lithologic character resembles 503 E, although lower in actual elevation. The lower part of the exposure contains numerous fossils, the fauna being given below:

Spirifer mucronatus, Conrad.
Tropidoleptus carinatus, Conrad.
Paracyclas lirata, Conrad.
Rhynchonella congregata, Conrad (?).
Chonetes.
Spirifer. Fragment of a large one.
Orbiculoidea (?).
Modiomorpha.

Several specimens belonging to the *Aviculidæ*, but so imperfectly preserved that their identification is difficult. In a brook not far from 504 A, but considerably lower, is a cliff of 15′, 504 B, just below a sawmill. The rocks are coarse, blue arenaceous shales alternating with thin, blue sandstones which weather to a brown. No fossils were found, and the general appearance of this outcrop is similar to those of stations 503 B and C, up the lower two-thirds of the long Pittsfield hill.

One mile east of Morris village, near the highway leading from Morris to West Laurens, is 504 C. This exposure is three miles from 504 B, in a small stream flowing into Butternut creek from the southeast, and not very far up the hill. The lower layers in the creek are blue, arenaceous shales with a 14″ sandstone for the top. A little farther up the creek a quarry has been opened, and 5′ out of the 10′ exposed is quarry stone. The good stone is a blue sandstone which weathers to a brown and is used for building stone. A single imperfect specimen of a large *Spirifer* was found in the sandstone.

Up the hill from 504 C, the soil covers the rocks deeply, affording but small exposures. Two miles from 504 C and about one-half mile west of West Laurens, in the creek, is a small outcrop of blue arenaceous shale and thin sandstone called station 505 A. No fossils were found.

One half-mile southwest of West Laurens station 505 B, in a little run is an exposure of argillaceous shale somewhat regularly bedded, which weathers to a greenish tint. A few fossils were found. Several imperfect specimens of a small *Grammysia* and a single *Palæoneilo*, which is either *P. constricta*, Conrad, or *P. maxima*, Conrad. This is the last exposure of fossiliferous shales noticed before the red and gray shales and sandstones of the Oneonta group are reached.

A little higher than 505 B, capping the top of that hill and forming all the high land between Butternut creek and the Susquehanna river are red shales and sandstones alternating with gray shales and sandstones.

At Oneonta, in the Susquehanna river valley, is an excellent opportunity to study the transition from the fossiliferous rocks up into the barren reds and grays of the Oneonta sandstone formation. A short distance west of the village is the Anthony White quarry, which exposes 15′ of bluish sandstone separated by shaly layers into three strata.

Fauna of No. 507 B[1].

1. *Spirifer mesastrialis*, Hall (a).*

   A good many specimens show fine striæ very distinctly, and also irregular perforations in the shell substance, which are probably the borings of some parasite.

2. *Spirifer mucronatus*, Conrad (rr).

   A single ventral valve, with quite long mucronate extremities, seventeen plications on each side, and a distinct fold in the bottom of the sinus.

3. *Chonetes deflecta*, Hall (aa).

   About 26 striæ, cardinal angles flattened and smooth, quite gibbous.

4. *Rhynchonella Stephani*, Hall (c).
5. *Spirifer ziczac*, Hall (?) (rr).

   Impression of dorsal valve showing about six plications, with mesial depression in the fold.

6. *Rhynchonella Sappho*, Hall (rr).
7. *Tropidoleptus carinatus*, Conrad (rr).
8. *Nucula bellistriata*, Con. var. (a).

   The specimens are all smaller than those figured in the Palæontology of New York; but they have the fine striæ and general form of this species.

9. *Palæoneilo maxima*, Con. (c).
10. *Microdon* (*Cypricardella*) *bellistriatus*, Con. (r).

    The striæ are finer than those of the typical Hamilton specimens, but similar to those from Ithaca and Port Crane, Broome county, New York.

11. *Goniophora carinata*, Conrad (rr).
12. *Nyassa arguta*, Hall (r).

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*a = abundant. c = common. r = rare. aa = very abundant. cc = very common. rr = very rare.

13. *Paracyclas lirata*, Conrad (c).
14. *Glyptodesma erectum* (rr).
15. *Tellinopsis subemarginata*, Con. (rr).
16. *Nuculites oblongatus*, Con. (rr).
17. *Modiomorpha concentrica*, Con. (rr).
18. *Grammysia magna*, Hall (rr).
19. *Grammysia bisulcata*, Con. (rr).
20. *Cimitaria recurva*, Con. (?) (rr).
21. *Nuculites triqueter*, Con.
22. *Microdon* (*Cypricardella*) *gregarius*, Hall.
23. *Leptodesma Rogersi*, Hall.
24. *Liopteria De Kayi*, Hall.
25. *Orthonota undulata*, Conrad.
26. *Microdon* (*Cypricardella*) *complanatus*, Hall.
27. *Coleolus tenuicinctus*, Hall (?) (a).
28. *Tentaculites attenuatus*, Hall var. (rr).

    The specimens have the irregular transverse striae of the above species, but the size of *T. bellulus*, Hall.

29. *Pleurotomaria subemarginata*, Con. (aa).
30. *Homalonotus De Kayi*, Green (rr).
31. *Lepidodendron Gaspianum*, D'n (rr).

The rocks from which the above fauna came belong in Conrad's Oneonta group (not Vanuxem's Oneonta sandstone, which is above, forming the upper part of the hill), and were correlated quite accurately by Vanuxem, who stated that he supposed them to belong to the Ithaca group.*

In the western part of the village is a small creek and along its banks are exposures of this same zone. The lowest shales in the creek (507 F^1) contain the following species:

1. *Spirifer mesastrialis*, Hall (c).
2. *Chonetes deflecta*, Hall (?) (rr).
3. *Rhynchonella Stephani*, Hall (r).
4. *Nucula bellistriata*, Con. var. (c).
5. *Grammysia bisulcata*, Con. (rr).

Farther up the creek along the old raceway the following species were obtained:

1. *Spirifer mesastrialis*, Hall (r).
2. *Chonetes deflecta*, Hall (a).

* Geol. N. Y., pt. iii, p. 192. The clause reads: "The base of which [hill] is composed of rocks which I have supposed to belong to the Ithaca group."

3. *Rhynchonella* sp., part of the specimens are like *R. Stephani*, Hall, but there are small ones similar to the small forms of *R. eximia*, Hall.
4. *Microdon* (*Cypricardella*) *bellistriatus*, Con. (rr). The Ithaca form.
5. *Paracyclas lirata*, Con. (r).
6. *Nuculites oblongatus*, Con. (rr).
7. *Nucula bellistriata*, Con. var. (rr).
8. *Palæoneilo maxima*, Con. (rr).
9. *Tellinopsis subemarginata*, Con. (rr).
10. *Goniophora carinata*, Con. (rr).

Near Otego, eight miles down the Susquehanna river from Oneonta, the highest beds of the fossiliferous zone below the Oneonta sandstone are exposed and the following species were obtained:

1. *Nuculites oblongatus*, Con.
2. *Modiomorpha concentrica*, Con.
3. *Paracyclas lirata*, Con.
4. *Prothyris lanceolata*, Hall.
5. *Rhynchonella eximia*, Hall.
6. *Spirifer mesastrialis*, Hall.
7. *Spirifera mesacostalis*, Hall (?)
8. *Palæoneilo muta*, Hall.
9. *Nuculites cuneiformis*, Con.
10. *Microdon* (*Cypricardella*) *tenuistriatus*, Hall.
11. *Tropidoleptus carinatus*, Con.
12. *Coleolus aciculum*, Hall.
13. *Productella speciosa*, Hall, small variety.

At Schenevus, fifteen miles up the river from Oneonta, in the bluish shales near the foot of the high hill south of the village the following species were collected :

1. *Spirifer Tullius*, Hall.
2. *Microdon* (*Cypricardella*) *bellistriata*, Con.
3. *Modiella pygmæa*, Con,
4. *Tropidoleptus carinatus*, Con,
5. *Nuculites oblongatus*, Con. var.
6. *Phacops rana*, Green.
7. *Orthoceras cœlamen*, Hall.
8. *Rhodea pinnata*, Dn.
9. *Spirifer mucronatus*, Con.
10. *Grammysia subarcuata*, Hall.

11. *Chonetes coronata*, Con.
12. *Palæoneilo emarginata*, Con. (?).
13. *Nucula corbuliformis*, Hall (?).

The stratigraphic results of this study may be summarized in the following manner :

The Unadilla section commences in Corniferous limestone at Paris Hill, and the last exposures of the limestone are seen just east of Babcock Hill P. O. station, 496 B.

The high hill north-east of Bridgewater, station 497 A, is composed principally of Marcellus shales, with transitional shales forming the summit of the hill. A statement similar to the above may be made in regard to the low hill, 497 B, south-west of West Winfield, which is the most southern exposure of typical Marcellus shale.

At Unadilla Forks undoubted Hamilton shales and sandstones are found on Markham mountain. From the last station to 583 A in the northeastern part of Pittsfield, near New Berlin village, there is an alternation of coarse or fine shales with thin sandstones, all containing characteristic eastern Hamilton faunas. The fossils are not so abundant either in number of species or specimens as in the Cayuga section of the Hamilton. The rock is also much more arenaceous in the Unadilla section, very little of the shale being so fine or argillaceous as that of Cayuga lake. The encrinal limestone of the Hamilton, the Tully limestone and the Genesee shale were not seen, although Vanuxem mentioned Genesee shale at New Berlin.*

The fossiliferous outcrops in the river valley at New Berlin were regarded by the State Geologist of that district as the easternmost Hamilton exposure; the higher rocks being considered by him as the equivalent of the Portage and Ithaca groups.†

Succeeding the New Berlin fauna, station 503 A, there is a considerable thickness of blue shales and sandstones which are almost non-fossiliferous. In places the sandstone attains a thickness and regularity of bedding sufficient for quarrying. These shales and sandstones form all the long Pittsfield hill, except its summit or include stations 503 B and C, and probably 504 B and C of Morris township. This zone is regarded by the writer as the eastern continuation of the Sherburne sandstones and shales of the Annual Report.‡

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* Geol. N. Y. Pt. iii, p. 292.

† *Ibid*, p. 292.

‡ N. Y. Ann. Geol. Rep't, 1840, p. 381; Geol. N. Y. Pt. iii, pp. 170–2 and 292–3. Since this thesis was written I have published articles confirming this correlation. See Proc. Am. Assoc. Adv. Sci. vol. xxxvi, p. 210; also Am. Jour. Sci. vol. xlvi, p. 212.

Above the barren measures is a zone containing abundant fossils, which has been called the "*Paracyclas lirata*" stage of the middle Devonian fauna as traced above the horizon of the Genesee shale.*

Stations 503 D. and E. and 504 A. are in this zone, but it is much better exposed in the Susquehanna river valley near Oneonta. This zone is evidently the Oneonta group of Conrad,† while Vanuxem regarded it as belonging to the Ithaca group.‡

Later writers regard all of these upper shales and sandstones, to the grays and reds above, as forming the closing part of the Hamilton group,§ or at least as containing "modified stages of the Hamilton fauna.‖

Following the "*Paracyclas lirata* stage" are the red and gray sandstones and shales of Vanuxem's Oneonta or Montrose group.¶ This group or stage of rocks forms all of the high land between Butternut creek and Otego river; between Otego river and the Susquehanna river and the high hills south of the Susquehanna river.

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* Proc. Am. Assoc. Adv. Sci., vol. xxxiv, p. 225; also chart.

† N. Y. Ann. Geol. Rept., 1841, pp. 31, 50 and 53.

‡ Geol. N. Y., Pt. III, p. 192.

§ Science, vol i, p. 290 (Dec. 11, 1880); Pal. N. Y., vol. v, Pts. I, II, pp. 517-518.

‖ Proc. Am. Assoc. Adv. Sci., vol. xxxiv, pp. 225, 233-234, and chart.

¶ N. Y. Ann. Geol. Rept., 1840, p. 381. See also Proc. Am. Assoc. Adv. Sci., vol. xxxiv, pp. 225, 226, 233, 234, and chart.

REPORT

OF THE

STATE ENTOMOLOGIST

For the Year 1892.

1893. 37

CONTENTS.

APPENDIX.

REPORT.

OFFICE OF THE STATE ENTOMOLOGIST,
ALBANY, *December* 10th, 1892.

To the Regents of the University of the State of New York:

GENTLEMEN.— I have the honor of presenting to your Board my Ninth Report on the Injurious and Other Insects of the State of New York, embracing some of the studies and observations of my department during the current year.

The year has been one of remarkable exemption from insect injuries, as the result, beyond question, of meteorological conditions unfavorable to the multiplication of our more common insect pests. This has been particularly noticeable in the very few complaints that have been received of injuries to fruits—certainly not one-fifth of the average of preceding years. While this, in part, may be ascribed to the better knowledge of methods of dealing with the enemies of fruits to which our fruit-growers are becoming educated, and to the rapidly growing use of insecticides and spraying implements, certain it is that several of our more noxious insects, which almost annually are the cause of serious injury, did not present themselves in sufficient number to call for active operations against them. Thus, apple trees for the most part, escaped their customary early spring visitation of the aphis, *Aphis mali*. The cherry-tree aphis, *Myzus cerasi*, was not prevalent. The orchard tent-caterpillar, *Clisiocampa Americana*, was far less abundant than in preceding years. Not a single communication came to me relating to the operations of the eye-spotted bud-moth, *Tmetocera ocellana*, which had been exceedingly destructive in 1891, and a general cause of complaint from the orchardists of Western New York. The pear-tree Psylla, *Psylla pyricola*, which threatened, in its excessive increase, to extend its destruction to pear trees in the Hudson river valley to other portions of the State, has not, during the past season, inflicted any appreciable harm.

No very severe attacks have been reported to me upon either garden or field crops. No complaint has reached me of injury to any of our grains from the grain aphis, *Siphonophora avenæ*, although again appearing in Columbia county, nor did the hop-vine aphis, *Phorodon humuli*, very materially affect the yield of our hop yards. The year has further been an exceptional one in that no new insect pest of marked economic importance has come under my notice calling for special investigation. Several of the minor attacks to which my attention has been drawn, will be noticed in the "Notes for the Year," to follow.

It was hoped that time would have been found to enable me to complete for publication some studies commenced in former years, but this has been prevented by a serious and protracted illness. I have also reason to regret that owing to this illness, I was compelled to cancel a number of engagements for addressing the farmers and fruit-growers of our State and scientific bodies, during the winter months. While the work of this Department would be largely extended and promoted by attendance at such meetings, it would at the same time make ample returns to your entomologist in information that he could not as well obtain through any other means.

The addition to the State Collection for the year has been over 2,500 specimens. Memoranda commenced on April 1st, show the number of specimens collected by me, 2,419. Of these 2,323 have been labeled and 1,411 mounted.

The Contributors to the Collection number fifty-three. A list of their contributions is appended to this Report. The customary list of the publications of the entomologist during the year, embracing thirty-three titles, accompanied with brief summaries of contents, will also be found in the Appendix.

The additional room and cases for which arrangements had been made, as stated in my report for 1891, have not yet been provided. This want has interfered with and impeded work which has been commenced in the classification of the biological material, both dry and in alcohol, and which is not at present conveniently accessible for reference or for study.

Respectfully submitted.

J. A. LINTNER.

GENERAL NOTES FOR THE YEAR.

In the absence of any serious outbreak of insect injury during the year, the following notes on some of the more common species that are with us in greater or less abundance annually, may be put on record.

The fall tent-caterpillar, *Hyphantria cunea* (Drury), has been noticeably abundant in various parts of the State — in Oswego county and elsewhere.

The injury to the foliage of the elm and horse-chestnut trees on the streets of Albany by the caterpillar of the white-marked tussock-moth, *Orgyia leucostigma* (Sm.-Abb.), which has been remarked upon in preceding reports, was again quite serious during the past summer. The falling to the pavement of the tips of the elm twigs, consequent on the girdling of the stem by the young larvæ for food, was not nearly as abundant as that noticed in 1883 (see *Second Report on the Insects of New York*) and in some subsequent years, nor was the insect so generally distributed throughout the city. But in certain localities, at about the time of cocoon spinning, the caterpillars could be seen by hundreds on the sidewalls of corner houses, as upon my own residence shaded by several large elms. A row of tall elms opposite had the foliage so severely eaten during the months of June and July as no longer to serve the purpose of shade, and not to be recognizable as elms at a short distance from them. Several horse-chestnut trees in the vicinity were entirely defoliated, except that portions of the larger ribs were left uneaten.

The *Dryocampa rubicunda* (Fabr.) caterpillar very seldom appears in harmful numbers in New York or the eastern States, but an exceptional occurrence of it was reported from Monticello, Sullivan county, N. Y., on the grounds of Mr. John D. Lyons, where a number of soft maple trees, which had been set out by him a few years, before, were completely defoliated by it during the summer. In several of the western States, as notably in Kansas, Missouri, and Nebraska, the soft maples planted as shade trees in cities are annually almost stripped of their foliage.*

* Bulletin No. 14, vol. iii, 1890, of the Agricultural Experiment Station of Nebraska, pp. 54-59.

The cabbage Plusia, *Plusia brassicæ* (Riley), which is so great a pest to cabbage growers in the southern States, but is by no means common in the State of New York (see *Second Report on the Insects of New York*), has been complained of as giving much trouble in a green-house at Garden City, L. I., N. Y. Rev. Dr. Cox has written of it: "The caterpillar specially affects young parsley, but will also feed continuously on heliotrope, pelargium, and, in fact, on almost any green thing."

The canker-worm, *Anisopteryx vernata* (Peck), was so abundant in some orchards in Monroe county as to have nearly destroyed the foliage. Orchards in Cooperstown, Otsego county, were so despoiled by the caterpillars as to present the appearance of having been scorched and shriveled by fire.

The apple-worm of the codling-moth, *Carpocapsa pomonella*, was less injurious than usual throughout most of the State. An extensive fruit-grower and nurseryman of Rochester has written me of it: "Codling-moths in our orchards were almost extinct, it being difficult to find an apple with the larva or its burrows in it. I can not account for this, as ordinarily they are very abundant with us."

Although I have stated that nothing had been reported to me of injuries from the eye-spotted bud-moth, *Tmetocera ocellana* (Schiff.), during the year, I have since learned, on special inquiry, that it has been continuing its ravages in Western New York, without diminution, but rather on the increase, and that it threatens to become a permanent pest.

The cow-horn fly, *Hæmatobia serrata* R. Desv., the introduction of which into New York was announced in my preceding report, has during the year become generally distributed over the State. It is known to me to occur in forty-four of the sixty counties, and with scarcely a doubt is present in each one. The rapidity with which this insect has spread throughout the country is almost, or quite, without a parallel in the histories of our imported pests. First known in the United States only six years ago, it has at the present time become an annoying pest to cattle in New England, Florida, Mississippi, Kansas, and many of the intermediate States, and in Canada from the western part of the Province almost to Quebec.

Severe injuries to potatoes and to strawberry plants from the white grub of, probably, *Lachnosterna fusca* (Fröhl.), were reported from Cattaraugus county. Examples, for identification, of *Lachnosterna tristis* (Fabr.) were received from Mr. J. S. Smart, of Cambridge, Washington county, which had appeared in large companies in the month of May in localities in the neighborhood and devoured the foliage of trees, showing a preference for the sugar maples.

The elm tree beetle, *Galerucella Xanthomelæna* (Schr.), or *G. luteola* Mull., as we may, in obedience to the law of priority be obliged to call it, has not, so far as we know, reached Albany in its steady northward progress. It is said to have done much damage to elms in Dutchess county in June.

One of the Chrysomelid flea-beetles, *Systena frontalis* (Fabr.), was observed as quite destructive to the foliage of the gooseberry at the Geneva Agricultural Experiment Station, early in August. It is believed that this is the first time it has been found to attack the gooseberry.

The Colorado potato beetle, *Doryphora decemlineata* (Say), although twenty years have passed since it first entered the State of New York, is still continuing with us,— less abundantly in some years than in others, but always in sufficient numbers to call for protection from its destructiveness by the use of Paris green or London purple. Spraying or sprinkling the vines with one of the arsenites is now quite generally practiced throughout the State. During the year it has been reported as doing much damage in Chautauqua and Albany counties, but perhaps not greater than in other counties where no mention of its injuries has been made. In its progress northwardly the insect has reached Prince Edward Island, in the Gulf of St. Lawrence, north latitude 46½ degrees, and has caused great damage to the potato crop the present year.

The plum curculio, *Conotrachelus nenuphar* (Herbst), was quite harmful to plums in Orange and other of the Hudson river counties, and in Monroe county about Rochester.

The little Curculionid beetle, *Otiorhynchus ovatus* (Linn.), for some unexplained reason, frequently intrudes in large numbers in dwelling-houses. In August, examples for name were received from Moriches, Long Island, where they were infesting a house to the extent of being an annoyance to the household. For notice of some similar occurrences see my 2d Report, page 51, 4th Report, page 14, and 6th Report, page 107; also *Insect Life*, v, page 46. The insect is known to be very destructive to the plants that it attacks, but as it is strictly phytophagic, no fear need be entertained of injury from its presence in houses.

The grass crop was materially injured in some of the western counties of the State by an unusual number of "grasshoppers" (locusts), probably *Melanoplus femur-rubrum* (De Geer), and allied species.

Some alarm was excited in portions of Columbia county by an early appearance of multitudes of young "grasshoppers" while snow was yet on the ground. It was feared that their abundance at this time betokened an excessive multiplication as the season advanced. The insect, from examples received, was ascertained to be the young of "the green-striped locust," *Chortophaga viridifasciata* (De Geer). A notice of it and of its occasional winter appearances is contained in this report.

As a possible addition to the faunal list of our drinking waters may be named a species of Ephemera — one of the "day-flies." Several examples of it were received in April from Professor G. C. Hodges, of the Utica Academy, with the information that they had been taken from a water-filter in Utica. From a notice contained in the Utica Observer of April 25th, it appears that the filter was one that was connected with a fountain on a lawn. The little orifices through which the water escaped having become clogged, the cap was taken off, and, on examination, a large accumulation of the May-fly larvæ was found. Two days thereafter the same trouble recurred, and with the same results. Some of the larvæ were sent to Washington for comparison, where they were identified as, in all probability, belonging to the genus *Ephemera*, but as there were no named larvæ of the family *Ephemeridæ* in the collections of the National Museum, no more definite determination could be made.

Among other living forms which in previous years have come under my observation as having been drawn from water-faucets in dwelling-houses in Albany where their occurrence might have been inconvenient if not dangerous, are examples of *Gordius*, or the so-called "hair-snake," a blood leach of considerable size, and a specimen of the large intestinal worm, *Ascaris lumbricoides* with several inches in convoluted form of its extruded ovaries crowded with its countless eggs (now in the collection of the New York State Museum).

INJURIOUS INSECTS.

Anthrenus scrophulariæ (Linn): **Attagenus piceus** (Oliv.).

Two Carpet Beetles.

(Ord. COLEOPTERA: Fam. DERMESTIDÆ.)

LINNÆUS: Faun. Suec., 1761, p. 429 (*Dermestes*); Syst. Nat., 1767, i, pars ii, p. 568. 1 (*Byrrhus*).

FABRICIUS: Syst. Ent,, 1775, p. 61. 2; Spec. Ins., i, 1781, p. 70. 2; Mant. Ins., i, 1787, p. 39. 2 (*Dermestes*); Syst. Eleuth., 1801, p. 107.

LAMARCK: Hist. Nat. An. Sans. Vert., iv, 1835, p. 724.

MELSHEIMER: in Proc. Acad. Nat. Sci. Phil., ii, 1844, p. 117 (describes *A. thoracicus*, now regarded as a variety of *A. scrophulariæ*).

LECONTE: in Proc. Acad. Nat. Sci. Phil., vii, 1854, p. 112 (describes *A. flavipes* and *A. lepidus* and *A. thoracicus*, now regarded as varieties of *A. scrophulariæ*); in Proc. Acad. Nat Sci. Phil., 1876, p. 195 (occurrence at Albany); in Bull. G.-G. Surv. Terr., ii, 1879, p. 503 (Rocky Mts. at 6,000 ft. altitude).

LINTNER: in The Argus [Albany, N. Y.], Oct. 21, 1876; in Schenectady Union, Oct. 21, 1876; in Trans. N. Y. St. Agr. Soc., xxxii, for 1872–1876, p. 236; in Count. Gent., May 31 and June 7, 1877, xlii, pp. 347, 363; in *id.*, Aug. 2, 1877, p. 491, c. 2–4 (stages, history, remedies, attraction to flowers, etc.); Entomolog. Contrib., iv, June, 1878, pp. 15–23, figs. a–d; in Amer. Nat., xii, Aug., 1878, pp. 536–544, figs. 1a, b, c, d; in Count. Gent., Sept. 12, 1878, xliii, p. 583, c. 2, 3; in Proc. Albany Institute, ii, 1878, pp. 310–313; in Count. Gent., Aug. 7, 1879, p. 503, c. 4; in Thirtieth Rept. N. Y. St. Mus. Nat. Hist., 1879, pp. 127–135 (general account); in Johnson's Nat. Hist., ii, 1880, p. 651, figs. a–d (brief notice of stages, etc.); First Rept. Ins. N. Y., 1880, pp. 9, 10, fig. 5 (brief notice); in Count. Gent., Aug. 23, 1883, xlviii, p. 681, c. 2 (its food and remedies); in Amsterdam Daily Democrat, July 21, 1884, p. 3, c. 3, 4 (habits, remedies, etc.); in Count. Gent., Aug. 14, 1884, xlix, pp. 676, 677, c. 4, 1 (history, habits, transformations, remedies, and preventives); in American Cyclopedia, iv, 1883, p. 797; Second Rept. Ins. N. Y., 1885, p. 46 (mention); Fifth Rept. Ins. N. Y., 1889, pp. 267, 268, fig. 38 (habits and as a museum pest); Sixth Rept. Ins. N. Y., 1890, p. 118, fig. 11 (Adalia mistaken for it); in Count. Gent., Aug. 21, 1890, lv, p. 662, c. 3 (remedies); Seventh Rept. Ins. N. Y., 1891, p. 335 (introduction).

Saunders: in Rept. Ent. Soc. Ont. for 1878, pp. 33–35, fig. 14 (from Lintner in Amer. Nat.).

Hagen: in Proc. Bost. Soc. Nat. H., xx, 1878, p. 57 (noticed as a museum pest); in Canad. Entomol., x, 1878, p. 161 the same with figures, in Rept. Ent. Soc. Ont. for 1879, pp. 30, 31, fig. 1; in Boston Journal for July 15, 1879.

Riley: in N. Y. Tribune, Dec. 1, 1878 (ravages and remedies, figs.) *id.*, for Dec. 4, 1878 (food-habits, and spread); in Amer. Entomol., iii, 1880, pp. 53–55, fig. 15 (trapping the beetle); in Insect Life, ii, 1889, pp. 127–130, fig. 19 (general account).

Jayne: in Proc. Amer. Phil. Soc., xx, 1882, p. 369, figs. 66, 69 (descriptions).

Apgar: in Science, for Nov. 21, 1884, iv, p. v (unaffected by Naphthaline).

Weed: in Prairie Farmer, Sept. 10, 1887, p. 582, c. 2 (ravages in Michigan).

Hamilton: in Trans. Amer. Ent. Soc., xvi, 1889, p. 129 (its varieties).

Fernald: Bull. No. 5, Hatch Exp. St. Mass., July, 1889, pp. 3–6, fig. 1.

Beutenmüller: in Journal N. Y. Microscop. Soc., vii, 1891, p. 14 (bibliography of early stages).

Dermestes piceus Olivier: Entomol., ii, 1790, p. 10, pl. 1, fig. 4 *a*, *b*; Encyc. Method. Hist. Nat Ins., vi, 1790, p. 267.

Dermestes megatoma Fabricius: Ent. Syst. Supp., 1798, p. 71. 1; Syst. Eleuth., i, 1801, p. 313. 5.

Attagunus spurcus LeConte: in Proc. Acad. Nat. Sci. Phil., vii, 1854, p. 109.

Attagenus dichrous LeConte: in Proc. Acad. N. S. Ph., viii, 1854, p. 110.

Attagenus rufipennis LeConte: in Proc. Acad. Nat. Sci. Phil., 1859, p. 71.

Attagenus sp.? Walsh: in Pract. Entomol., i, 1866, p. 34 (in feathers).

Attagenus megatoma. Provancher: Pet. Faun. Ent. Can.,— Coleop., 1877, p. 305.

Attagenus megatoma. Hagen: in Proc. Bost. Soc. N. H., xx, 1878, pp. 56, 61 (as a museum pest).

Attagenus megatoma. Lintner: in Count. Gent., xliv, 1879, p. 503 (feeds on carpets; *id.*, xlvii, 1882, p. 567, c. 2 (description); Ent. Contrib., iii, 1882, p. 64 (remedy); Second Rept. Ins. N. Y., 1885, pp. 46–48 (general notice of habits, etc.).

Attagenus megatoma. Riley: in Amer. Nat., xvi, 1882, p. 1019 (causes felting); in Rural New Yorker, Oct. 14, 1882, xli, pp. 699, 700 (felting); in Amer. Nat., xvii, 1883, p. 790.

Attagenus piceus Jayne: in Proc. Amer. Philos. Soc., xx, 1882, p. 355 (description), p. 374, pl. 1, figs. 22, 23 (antennæ).

Attagenus megatoma. Dimmock: in Cassino's Stand. Nat. Hist., ii, 1884, p. 378 (feather felting).

Attagenus piceus. Henshaw: List. Coleop. N. A., 1885, p. 54, No. 3434.

Attagenus piceus. Fernald: in Bull. 5. Hatch Agr. Exp. St., July, 1889, p. 6.

Attagenus piceus Hamilton: in Trans. Amer. Ent. Soc., xvi, 1889, p. 129 (distribution).

Attagenus megatoma. Riley-Howard: in Insect Life, ii, 1890, pp. 317–318 (feather felting); in *id.*, iii, p. 170 (in houses).

Attagenus piceus. Riley–Howard: in Insect Life, iii, 1890, p. 34 (incr. and inj. in Washington); pp. 65, 66 (injuring carpets); *id.*, iv, 1892, p. 345 (abundance and injury in Illinois), p. 404 (feather felting).

Attagenus piceus. Beutenmuller: in Journ. N. Y. Microscop. Soc., vii, 1891, p. 14 (bibliography of larval descriptions).

Both of the above-named insects have been briefly noticed in former reports, but so frequent are the inquiries received in relation to them and so serious the injuries that they inflict, that some additional notes on them may be acceptable and prove of service.

The publication of a Bulletin, to contain all that seemed desirable for practical purposes and of interest to know, which could serve as a convenient reply to the many inquiries made, has been in contemplation for some time, but it still awaits the leisure for its preparation. In the meanwhile the bibliography herewith presented should be of service to those desiring to learn more of its history and habits.

Some Features of Anthrenus scrophulariæ

In the accompanying diagrammatic drawings (after Jayne) representing the markings of the beetle as seen from above, *a* is that of the typical *scrophulariæ*. In comparison with Figure 2, reproduced from former reports, it more faithfully represents the hundreds of examples that have come under my observation, in the extended white marginal bordering of the thorax; while the white spots near the outer border of the wing-cover are too sharply defined and fail to connect with the red projections from the sutural line so as to form the irregular transverse bands. It should be remembered that the line (sutural) along the joining of the wing-covers and its three inward projections are orange-red, and a striking characteristic of the species. There are, however, marked differences in ornamentation, which are to some extent local: two varieties bear the name of var. *flavipes* LeConte, (shown at *b* in Figure 1), and var. *thoracica* Mels., at *c*. At *d*, the 11-jointed clubbed antenna is represented, by means of which it may be separated from the other species of the genus.

Fig. 1.—Anthrenus scrophulariæ: *a*, the typical form; *b*, var. flavipes; *c*, var. thoracicus; *d*, the 11-jointed antenna.

Fig. 2.—Anthrenus scrophulariæ. (From Riley.)

Ignorance Respecting the Carpet Beetles.

Almost every newspaper published in the United States has contained some account of the dreadful "carpet beetle" or "buffalo bug," giving its habits, describing its appearance, often accompanied by figures representing its different stages; still, there are many who are not able to distinguish it from a harmless lady-bug when they find the two in intimate association in rooms where carpets and clothing are evidently suffering from "carpet bug" attack.

The following letter, from Poughkeepsie, N. Y., in which this ignorance is displayed, is one of many of a similar tenor:

I herewith send you a small vial containing what is believed to be the carpet-bug in two, perhaps three, forms of its existence. The creature is giving us much trouble and injuring valuable property. If you can aid in identifying the animal, and in stopping its ravages, you will confer a great favor on many sufferers.

The little lady-bug has been found in great numbers about our dwellings, and in such relation to injured carpets, etc., as to create the belief that it is the veritable carpet-bug; but if I am right in supposing that the insect I send you is the "real, Simon-pure" little pest, then the pet lady-bug has been more "sinned against than sinning." E. L. B.

Larval features of the two Insects.

The vial contained a specimen of the veritable carpet bug, which has become such a formidable household pest, but in its larval stage only — not in subsequent forms of its existence. In company with it was another larva and two perfect beetles. The larva of the obnoxious *Anthrenus scrophulariæ* was the one of an oval form, and clothed with stiff bristles standing out from it. It has received (perhaps in California, where it first became known in this country,) the name of the "buffalo-bug," from a fancied resemblance in its large and hairy front, to that animal.

The other larval form — of a reddish-brown color, with appressed hairs — long, slender, tapering to its tail, and ending in a pencil of hairs,— is also a carpet-bug, and the earlier stage of the two black beetles which were sent with it. It was for a long time known to science as *Attagenus megatoma* (Fabr.), but a few years since was found to have been earlier described by Olivier under the specific name of *piceus*.

Attagenus piceus detected as a Carpet pest.

At the time of my detection of the Anthrenus carpet bug at Schenectady, the larva of *A. piceus* was associated with it. It was at first supposed that it was drawn to the borders of carpets to feed upon the dead bodies of flies and other insects that collected there, in accordance with the general habits of the *Dermestidæ.* Subsequently I have reared it upon pieces of carpets, and complaints have been received from Boston and elsewhere of its carpet-eating propensities. It may possibly prove to be almost as destructive to carpets as the *A. scrophulariæ*, for there can not be much doubt that its food is the same, and that it multiplies with equal rapidity.

Its Abundance.

Already in some houses it has become the more numerous. In my own residence the beetle has fallen under my observation, on window panes, thrice as often as its prettily ornamented rival. As it will assuredly ere long win a notoriety for itself, a common name will have to be selected for it, now that we have two "carpet-bugs", comparatively "new," both being beetles in their perfect form. Until a better name shall be found, this may be known as "the black carpet-beetle."

Description of the Beetle.

A brief description may be of value for its identification. It measures 0.15 to 0.18 inch in length. In outline it is elongate-oval, twice as long as it is wide, and rather flattened. Its head is small and so bent downward as hardly to be seen from above in cabinet specimens, but extended, and with its antennæ conspicuous, when walking; both it and the prothorax are black. The wing-covers are more or less reddish, finely punctured, with a short gray pubescence in fresh examples under a magnifier. The legs and the antennæ are reddish; the latter terminating in a large ovate club, the last joint of which is grayish. Abdomen beneath, brown with short ochreous-yellow hairs. Legs brown. Outlines of the beetle and of its antennæ are given in Figure 3.

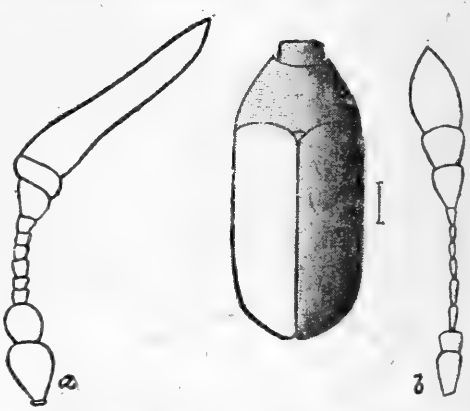

Fig. 3.—Attagenus piceus; *a*, antenna of male; *b*, antenna of female. (After Jayne.)

Food of the Larva of Attagenus Piceus.

This insect by no means confines itself in feeding to woolens, but like others of the *Dermestidæ,* its larva feeds largely upon dried animal matter. In the notice of "*Attagenus megatoma,*" in the *Second Report on the Insects of New York,* 1885, pp. 46-48, its occurrence in hair-cloth furniture is mentioned, and the suspicion is expressed that it eats lace curtains and other cottons, and that its range of food may embrace "hair, furs, cotton, linen, and wool." Even *Anthrenus scrophulariæ*, which in this country is hardly known except as a woolen pest, is developing a fondness for insects in collections, while in Europe it is recorded as eating furs, hides, leather, dried plants, animal collections, "all kinds of collections of natural objects, and victuals."*

Dr. Hagen in his interesting paper on "Museum Pests, observed in the Entomological Collection at Cambridge," mentions the species as "exceedingly dangerous" to the collection.**

Feather-felting by Attagenus piceus.

Professor Riley has recorded an instance of a remarkable felting of the inside of a pillow case with the soft parts of the chicken feathers with which it had been filled, through the feeding operations of this insect. The short, downy particles which had been stripped off were found inserted by their basal ends, the barbs of which would be caught by the repeated shakings and firmly anchored. "The felting was remarkably dense, evenly coating the whole surface of the ticking, and greatly resembling in softness, smoothness, and color the fur of a mole."† Another similar occurrence was related by Dr. Horn, and a specimen "resembling fine plush" exhibited to the American Entomological Society.‡

Remedies for the Carpet Beetles.

The best remedies for the two carpet beetles are, frequent searches for their larvæ in their haunts and crushing them, and the application of kerosene or benzine to the places where the eggs and young larvæ occur. The favorite locality for the *A. scrophulariæ*, as is probably known to most housekeepers by this time, is beneath the borders of carpets, and in the floor joinings underneath. These crevices should first be thoroughly treated with kerosene, and then closed with putty, or a packing saturated with kerosene. The crevices beneath the base boards should also be closed; by these means the retreat and escape of the larvæ will be almost entirely prevented, when the borders of the carpet are lifted for a thorough search for the larvæ, as should by all means be done, from time to time, in an infested house. The examina-

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* Hagen: in *Canadian Entomologist*, x, 1878, pp. 161, 162.

***Proceedings of the Boston Society of Natural History*, xx, 1878, p. 61.

† *American Naturalist*, xvi, 1882, p. 1018.

‡ *Transactions of the American Entomological Society*, x, 1883, p. xvii.

tion will be more convenient and productive of better results if the carpet is left unnailed.

Possibility of Freeing Infested Houses from the Insect.

That freeing a house from the presence of this exceedingly annoying and destructive pest, is not a hopeless task, will appear from the account given by a correspondent of her successful campaign against it. The prefatory reference to her first acquaintance with the insect is of sufficient interest to quote, particularly as it gives an earlier time by several years for its observation in this country than had been previously recorded.*

How a House was Freed from A. scrophulariæ.

In November, 1883, Mary E. Clark, of New York city, wrote to me as follows:

It may not be uninteresting to you if I add my mite to the information already gained in regard to these insects. I first heard of them about twenty years ago at which time they were quite domesticated in parts of Montgomery county, Penn. The people called them "woolly-heads," and one who lived there described them to me as looking like a little piece of black wool. A few years later — I think about 1868— when visiting a friend on Long Island, I saw quite a number of them: they had made their appearance only a short time previously, and before their presence was known had made great havoc with the carpets.

My own experience with them began last year. We moved to our present abode in April, and it was not until every carpet had been put down and the house settled that I was aware that we had such unwelcome guests. I was not long in observing their habit of running into any crack or crevice that presented itself, and also running along the joints of the floors, and our warfare against them was directed toward these joints. In the closets we stopped up every nook on the walls; every crevice under the base boards, and filled up the joints of the floor; then we laid down oil-cloth, and kept a plentiful supply of camphor in the closets. I am happy to say that we have had no trouble with them since so doing.

Fortunately, we had put paper under all the carpets, so we felt that they were in a measure, at least, protected, but I found them continually, just under the edges of the carpet. As far as possible, we filled up the crevices under the baseboards and I used benzine very plentifully all the summer, saturating the borders of the carpets every two weeks

* Examples of it, labeled *Anthrenus lepidus*, in the cabinet of Dr. LeConte had been received from Oregon "in 1871 or 1872." Dr. Hagen had heard of its operations in Buffalo, N. Y., in 1872. The first notice of its injuries was seen by me in 1874, and in 1876, examples were taken in my house at Schenectady, N. Y., and the new household pest brought to public notice. Its earlier observation in Pennsylvania accords with the statement made to me some time ago by a gentleman living in that State (the time and place have escaped my memory), that he had reason to believe that he was chargeable with its introduction into this country in a trunk which was found to contain them on his return from Europe.

and killing all I saw in the meantime. Last spring we varnished the cracks of the floors, and in some cases, where they were very open, covered them with strips of thin muslin stuck down with the varnish; we again put paper under the carpets, as we had found it such protection the previous year. I have found the various insect powders of no use whatever when the insect is in the larval state: whether or not it has any effect on the beetle I can not say; but this I can state,— that our unceasing warfare has not been in vain, for I have, during the past summer, seen only single ones where last year I found scores.

The Two-spotted Lady-bug, mistaken for the Anthrenus Beetle.

"The little lady-bug" mentioned in the inquiry from Poughkeepsie as occurring in great numbers in association with the carpet beetles, is the two-spotted lady-bug, *Adalia bipunctata* (Linn.). It has frequently been mistaken for the carpet-beetle, and has come to an untimely end in consequence — in some instances having been collected on dust-pans and burned. It is unfortunate that such mistakes should occur, since it is to this insect more than to any other that we are often indebted for deliverance from a plant-louse infestation of fruit-trees, shrubs, and flowers. It has no resemblance whatever to the carpet-beetle, than which it is many times larger (see figures of the two in my 6th Report); the only reason for confusing it with the carpet pest is that it enters dwelling-houses in the autumn for passing the winter (the only one of the lady-bugs having this habit), and is frequently to be met with collected in corners underneath the carpets, or creeping or flying about when fires have been made in rooms ordinarily cold. It seems strange that, in this enlightened age, any household could be found in which none of its members could recognize so typical a lady-bird as the *Adalia* and know of its entire harmlessness. The lady-birds are quite common insects: they are attractive in their bright shining colors and conspicuous maculation; their form is peculiar — "gotten up," as a reportorial wit has recently expressed it, "on the architectural lines of a split pea;" for centuries they have been cherished objects of admiration in the countries of the Old World, where peculiar associations or superstitions have been connected with them. From some one of these has doubtless been borrowed the motherly couplet that all of us have heard in our childhood and have ourselves uttered when some one of these pretty creatures had run up to finger-tip and was about to unfold its wings for flight:

Fig. 4.—The two-spotted lady-bug *Adalia bipunctata* (after Emmons).

Lady-bird, lady-bird, fly away home,
Your house is on fire, your children will burn.

Tenebrio obscurus Fabr.

The American Meal-worm.

(Ord. Coleoptera: Fam. Tenebrionidæ.)

Fabricius: Ent. Syst., i, pars i, 1792, p. 111. 5.
Westwood: Classif. Insects, i, 1839, p. 318 (larva and habits).
Curtis: Farm Insects, 1860, p. 334.
Walsh: in Pract. Entomol., ii, 1866, p. 34 (brief notice).
Provancher: Pet. Faun Ent. Canada — Coleop., 1877, p. 448 (description).
Le Baron: 4th Rept. Ins. Ill., 1874, p. 123, f. 57 (figure only).
Gissler: in Bull. Brook. Ent. Soc., i, 1878, p. 87 (of the larva).
Riley: in Amer. Naturalist, xvii, 1883, p. 547 (number of molts).
Lintner: in Count. Gent., lvii, 1892, p. 501 (habits, remedies, etc.).
Beutenmüller: in Journ. Microscop. Soc., vii, 1891, p. 41 (bibliography of early stages).

Although rather a common insect, very little seems to have been written of it by our economic entomologists, as appears from the quite limited bibliography presented above.

Examples of it were recently received from Buckland, Virginia, asking for information of their habits, as they had appeared in large numbers in a granary where wheat was stored.

The Larva and the Beetle.

It is greatly to be regretted that so few of our Coleoptera have been described, and of those few, many have been done in so general terms and so indifferently that they do not serve the purpose of identification. I am not aware of any description of *T. obscurus*. It may be said of it, as aid to its recognition when met with in the localities where it is apt to occur, that it is about an inch long, cylindrical, smooth, of an ochreous or pale-brown color, and with three pairs of legs on its front or thoracic segments, and that it has much the appearance of the common wire-worm. But this would apply equally well to several other species of the family of *Tenebrionidæ*.* The larva is shown at *a* in Figure 5.

Perhaps the best specific characters in the larval *Tenebrio* are to be found in their pygidium — the designation of the upper part of the last abdominal segment. Mr. C. F. Gissler, *loc. cit.*, has given some study to the larvæ of the *Tenebrionidæ*, indicating pygidial differences between them. Of *T. obscurus* he finds: "Pygidium comparatively

* See the excellent and greatly needed remarks made by one of our able Coleopterists, Mr. E. A. Schwarz, on many of the published "descriptions of Coleopterous larvæ which are wholly wanting in either popular or scientific value," in the *Canadian Entomologist*, xxiv, 1892, page 223.

small, cordiform, with two minute articulated spines on each side, a little behind the middle, a median longitudinal groove, one lateral punctured notch, and two terminal small, suddenly turned-up hooks." A figure is also given of the "pygidium of Tenebrio," presumably of *T. obscurus*, which would seem to imperfectly illustrate the text, unless for "punctured notch" we read "punctured spot." The two terminal hooks, according to Westwood, distinguish the larva of this species from that of *T. molitor* (see Westwood, *loc. cit.*).

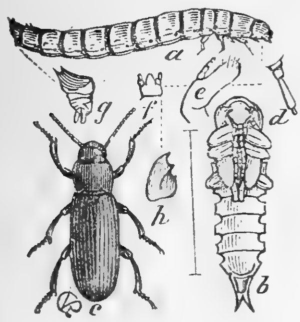

FIG. 5.—The meal worm, TENEBRIO OBSCURUS: *a*, larva; *b*, pupa; *c*, imago; *d*, antenna of larva; *e*, maxilla; *f*, labrum; *g*, terminal segment. (From Riley.)

The beetle, described in general terms, which should suffice for its recognition when taken in connection with its figure herewith given, is over a half inch in length, narrow, of a dull, opaque, black color above, with the underside, the feet and antennæ chestnut-brown. The thorax is subquadrate. The elytra, or wing-covers, are closely punctured with sixteen depressed longitudinal lines, the intervals of which are angulated. The legs are stout; the hinder feet are four-jointed — the others are five-jointed.

Its Habits.

The name of the "American meal-worm" has been given to this insect to distinguish it from a closely resembling species, *Tenebrio molitor*, which has been introduced from Europe and has become much more common with us than the native one. It is the more injurious of the two, as it prefers for its food dry and sound flour, while *T. molitor* is more frequently found in that which has become damp or otherwise damaged. *T. obscurus* is said to feed sometimes on animal matter. Both of the species infest granaries, mills, and farm houses, and are justly regarded as very troublesome pests when they have gained a lodgment, it being a difficult task to exterminate them.

Remedy.

The best remedy for this, as for most of the other stored grain insects, as *Silvanus Surinamensis* (Linn.), *S. cassiæ* Reiche, *S. advena* (Waltb.), *Calandra granaria* (Linn.), *C. oryzæ* (Linn.), *C. remotepuncta* Gyll., *Tribolium ferrugineum* (Fabr.), *Sitotroga cerealella* (Oliv.), and others, is found in the use of bisulphide of carbon. The infested grain should be inclosed in a tight bin, and for each one hundred pounds, one ounce of the bisulphide of carbon may be placed in any convenient open vessel on top of the grain. It need not be inserted therein, as has been directed by some writers, for the heavy vapor (about two and one-half times heavier than common air) will descend and permeate the mass and destroy the insect life — the beetle, the larvæ, or the eggs deposited on the grain. After a day or two the bin may be opened for the offensive odor to escape, and no injury will have been done to the grain, either for flouring, for feeding, or for seed.

It would be well in all cases where badly infested grain has been treated in the above manner, especially when it is to be converted into flour, to remove the dead insects by sifting or otherwise, as it is believed that bad results have followed the use of flour into which the elytra and dead bodies of the infesting insects had been ground up.

In consideration of the explosive nature of bisulphide of carbon, it is proper always to accompany the recommendation of its use with the caution that a light or fire should never be brought near it.

Pollenia rudis (Fabr.).

The Cluster Fly.

(Ord. DIPTERA: Fam. MUSCIDÆ.)

FABRICIUS: Ent. Syst., iv, 1794, p. 314. 9 (as *Musca rudis*).
MACQUART: Hist. Nat. Ins.— Diptères, ii, 1835, p. 269 (as *Pollenia*).
ROB. DESVOIDY: Hist. Dipt. Env. Paris, ii, 1863, p. 600.
LOEW: in Amer. Journ. Sci.-Arts, 2d ser., 1864, xxxvii, pp. 318, 321 (introduced from Europe).
HARRIS: Entomolog. Corr., 1869, p. 336 (as *Musca familiaris*).
OSTEN-SACKEN: Cat. Dipt. N. Amer., 1878, p. 160.
MANN: in Psyche, iii, 1882, p. 378 (habits).
DALL: in Proc. U. S. Nat. Mus., v, 1884, p. 635 (habits).
RILEY: in Amer. Naturalist, xvii, 1883, pp. 82, 83; in Proc. U. S. Nat. Mus., v, 1884, pp. 637, 638 (habits, synonymy, etc.).
MARLATT: in Insect Life, iv, 1891, p. 153 (killed by fungus).
LINTNER: in Count. Gent., lvii, 1892, p. 358 (general notice).
RILEY-HOWARD: in Insect Life, v, 1893, p. 263 (in Illinois, habits, remedy, etc.).

Pollenia rudis (the *Musca rudis* of Fabricius) was known and name given to it in Europe a century ago. When it was introduced into this country is not known, but commercial intercourse may have brought it at any time either in its larval or perfect stages. Dr. Loew, in an article in Silliman's Journal of Science, in 1864, mentions it in a list of species of flies known to be common to Europe and America. Of these, a number are believed to have first made their appearance on the Pacific coast and gradually to have worked their way to the Atlantic States. Presuming the *P. rudis* to

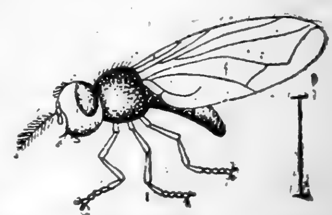

FIG. 6.— The cluster fly, POLLENIA RUDIS. (After Macquart.)

have been one of these, it would account for the absence of any early notice of its peculiar habits in hibernation that would naturally have attracted observation to it.

What the Fly Is.

The fly has been sent to me on several occasions during late years, with inquiry if it was the common house-fly, and telling of its abundance or strange conduct that drew attention to it.

While belonging to the same family with *Musca domestica*, viz., the *Muscidæ*, and to the ordinary observer bearing a general resemblance to it in size and appearance, a comparison of the two would show marked differences between them. *P. rudis* may be recognized by its sluggish movements when on or about the windows, as if partially stupefied; a somewhat larger size than *M. domestica;* its black thorax (in fresh examples) covered with rather closely appressed tawny-colored hairs, sometimes inclining to a green shade; its grayish abdomen marked above with two black quadrate spots on each segment, and a black edging to the segment; and its black legs. See fig. 7.

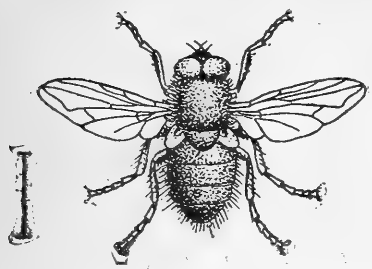

FIG. 7.—The cluster fly, POLLENIA RUDIS. (Original)

So little was known of the insects of our country fifty years ago that it is not surprising that among the manuscript material left by Dr. Harris, there should be found descriptions of the two above-named species, under the names of *Musca harpyia* and *Musca familiaris,*—the former since recognized as the common house-fly, and the latter the cluster fly.

When with progress in entomology it was found necessary to subdivide the old genera of Linnæus, Fabricius, etc., the genus of *Pollenia* (suggested by the pollen of flowers) was founded by R. Desvoidy in 1830 for those Muscids having, among other features, the thorax covered with a down-like clothing, classing them as "*Muscidæ tomentosæ.*" *P. rudis* was named as the type of the genus, which included about twenty European species. Of North American species, Osten Sacken (1878) has named but one other *Pollenia, P. vespillo,* occurring in Nova Scotia.

Its Common Name.

The popular name of the "cluster fly" has been given to this insect in consideration of its habit of leaving the flowers, fruits, branches or trees, walls, etc., upon which it is often to be seen during the summer months, and entering dwelling-houses in the autumn, for hibernation, where it gathers at times in large clusters on the walls and ceilings, and especially in the corners that they form.

What Has Been Written of Its Habits.

Not having at hand the writings of Desvoidy, Meigen, and other European entomologists who have written of this insect, I am not able to state what has been narrated by them of its habits. Our own literature relating to it is quite limited.

A note of two pages on "Cluster Flies" is contained in the *Proceedings of the U. S. National Museum* for 1883, vol. v, by W. H. Dall, based on specimens of the insect received from the vicinity of Geneva, N. Y., where it was reported as a great nuisance in the country houses. They were said to have first appeared in that locality about thirty years before. In the meantime they had increased until they had become a serious annoyance to housekeepers, as they intruded into places where flies do not ordinarily take up their abode, as "in beds, in pillow-slips, under table covers, behind pictures, in wardrobes, nestled in bonnets and hats, under the edge of carpets," and in many other unusual and unexpected places. A window-casing removed, disclosed "a solid line of them from top to bottom." Their preference seemed to be for a clean, dark chamber seldom used, where they were wont to gather in large clusters about the ceilings. It is also stated of them that they sometimes suspend themselves from the cornice of a room in large clusters like swarming bees, which could be brushed bodily into a vessel of boiling water: this statement, however, we can not vouch for, and it needs verification.

To Professor Dall's notice, Professor Riley has contributed about all of the scientific knowledge we have of the fly, including the several names under which it has been known during the last hundred years, together with some additional notes of its habits. A note by Professor Riley on "The Cluster Fly," in the American Naturalist, *loc. cit.*, may also be consulted.

Mr. B. P. Mann has recorded in *Psyche*, for August, 1882, its occurrence in Maine, where the flies are reported as having the habit of burrowing into homespun yarn and the goods of loose texture made therefrom, to feed, as was supposed, on the greasy matter that remained in them. They were thought, also, to cut the threads.

Although the fly appears to have obtained a wide distribution in this country, the above are the only notices that I find of attention having been drawn to its habits of congregating in houses in large companies. I am able to add two other instances of the kind, with the probability of a third.

The Fly Observed in St. Lawrence County, N. Y.

In a visit made to Hammond, St. Lawrence Co., during the first week of October, 1883, for observations on a remarkable occurrence of the chinch-bug, large clusters of the fly were seen in the corners of the walls and ceiling of a second floor bedroom of the farm house that I occupied. They were in irregular black masses, each consisting of several hundreds of individuals. A few were found to have hidden away within the bedding. The weather at the time was quite cold, and frosts prevailed during the nights.

A Pest in a House at Palenville, N. Y.

Last spring, about the middle of April, a lady brought to me examples of flies taken in her house at Palenville, Greene Co., N. Y., where they were abounding in most disagreeable numbers. They were found in every room, and all her efforts to destroy or eject them had been fruitless. They were recognized as the cluster fly, and pyrethrum powder was recommended for killing them. The powder was used after the manner directed, and proved entirely effective. Dustpanfuls, as I was afterwards informed, of their dead bodies were swept up and burned.

Another Spring Appearance of the Fly.

A number of years ago — somewhere about 1875 — when residing in Schenectady, N. Y., upon returning from church one morning, the windows of a ground-floor front room with a sunny exposure, were found to be so thickly dotted with flies as to arrest the attention of passers-by. They were ejected by brushing from the panes as speedily as possible, without examination; but recalling their features and movements, it is hardly possible that they could have been any other species than this Pollenia. At that time it was unknown to us by name.

Its Entrance in Dwellings and Departure.

It would appear, from this and the preceding account, to be the habit of the fly, to emerge in company from their winter retreat on some warm day in early spring, unlike their method of entering in the autumn, when they steal in singly, one by one, even with closed windows and doors, and during successive weeks or months.

Since first observing the fly, a few years ago, it has been a regular visitant to my office on the fourth floor of the Capitol. It does not collect in clusters, but each year in October and November, individuals to the number, perhaps, of from thirty to fifty may be seen resting on, or slowly walking over, the lower portion of the window frame or pane. Several specimens in the State Collection bear the late date of December 3d. Referring to my notes of the present year, I find: "September 29th, a number of *Pollenia rudis* on the window of my office." A few individuals had been seen some days earlier.

Other Species that Hibernate Within Doors.

There are a number of other Diptera that avail themselves of the shelter and comfort of our dwellings for their protection and repose during the months of autumn and winter. A German author, as quoted by Riley, records the swarming of two other species of *Pollenia*, viz., *P. atramentaria* and *P. vespillo*, in the same building for several successive years.

Mr. B. P. Mann (*loc. cit.*) has written: "I remember that during one or two years, at a certain season, which, as far as my recollection serves me, was in April, I noticed numerous specimens of *Microdon globosus*, a syrphid fly, issue from a nail-hole in a plastered wall of an apartment in a dwelling house, as though the flies had passed the winter within the walls of the house."

The many interesting features attending the in-door hibernation of one of the *Oscinidæ* — *Chlorops prolifica* of Osten Sacken, have been presented at considerable length in my Fourth and Seventh Reports. This species, however, has not yet become a common nuisance, disagreeable as it may be to the inmates of the house that it selects for its annual winter abode, as we know of its occurrence in only three localities in the United States.

Baron Osten Sacken has kindly contributed to the Fourth Report above referred to (page 72) several notices of assemblages of one or more species of *Chlorops* (they were not authoritively determined) within occupied buildings in Europe, for hibernation: In one instance it was estimated that eighteen millions of one species had gathered, in September, on the ceiling of a botanical conservatory in Warsaw.

It is quite probable that numbers of the common house-fly (females) pass the winter within the houses that they have been previously occupying, hidden away within crevices about the windows, but it is not recorded that they ever assemble in companies at such times, either for warmth or from social instinct.

Early Stages of Pollenia rudis.

It is not known that the early stages of this insect have been observed in this country, or minutely anywhere. R. Desvoidy has given the general statement of the European Pollenias, that their eggs are laid in decomposing animal and vegetable matter. According to Macquart, their larvæ develop in the manure pile and cow droppings—"sans le ferrier et les bouzes."

Description of the Fly.

The description of this fly, left in MS. by Dr. Harris under the name of *Musca familiaris*, as previously referred to, is as follows:

Head somewhat prominent in front, of a dirty yellow or tawny color with a silky lustre, and distinct black bristles; eyes in the male connivent above, in the female distant, with an interposed, oblong, black spot, furcate above and below, antennæ blackish, with the articulations piceous or ferruginous. Thorax black, covered with a close, dirty yellow or fulvous, coarse pubescence, with remote, curved, black bristles. Wings at the articulations and extreme base, ferruginous. Winglets and poisers white. Legs rusty black, with black hairs. Abdomen with distant, curved, black bristles, in both sexes cinereous, with a silky lustre, each segment with two quadrate black spots, and widely edged with black, varying in situation and degree, according to the incidence of the light.

This species, not uncommon in houses in summer, nearly disappears when the more abundant *M. harpyia* [*domestica*] appears.

Remedies.

Whenever this fly intrudes in such number as to render its destruction desirable, this can readily be accomplished by the use of pyrethrum. If they are gathered in clusters, the insecticide may be conveniently thrown upon them with a powder bellows. Should they be scattered throughout the room, the powder may be distributed through the atmosphere of the apartment, first closing the windows and doors, and driving up the flies that they may be brought more directly under its influence.

That the pyrethrum is effective against these flies, notwithstanding a statement that has been made to the contrary, is shown from the note received from my Palenville correspondent, to whom its use in her emergency had been recommended:

"I send my kindest thanks for the advice which has cleared my house of its army of flies. I used the pyrethrum with bellows, and send you a trophy of its success. We swept up dustpanfuls of them, and are now entirely free from their annoying presence."

Killed by a Fungus.

Mr. C. L. Marlatt, of the Entomological Division, U. S. Dept. Agriculture, at Washington, in recording, in *Insect Life* (*loc. cit.*) an extraordinary mortality among flies observed by him on the grounds of the Agricultural Department, in the autumn of 1891, states, that among the large number of dead flies that were thickly covering the underside of the leaves and were fastened by a fungus growth — often as many as eight or ten flies on a single leaf — most of them were *Pollenia rudis*. The fungus was not, as was at first supposed, the common fungus of the house-fly, viz., *Empusa muscæ*, which is not uncommon in houses on windows, etc., during the late summer and early autumn, but was determined as a species recently described by Dr. R. Thaxter, as *Empusa Americana*, which, so far as known, occurs only out-doors, on vegetation, etc.

Murgantia histrionica (Hahn.).

The Harlequin Cabbage-bug.

(Ord. Hemiptera: Subord. Heteroptera: Fam. Pentatomidæ.)

A correspondent from New Jersey sends examples of insects which are for the first time injuring his cabbages that have been put out for seed (not noticed on others). They were recognized as the insect above named, upon which an article giving description, life-history, habits, and other details relating to it, together with the accompanying illustration, is contained in my First Report.

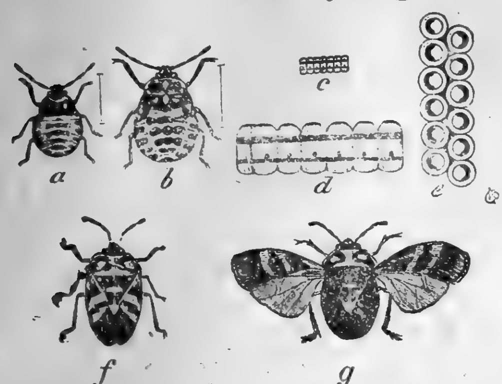

Fig. 8.—The Harlequin cabbage-bug. Murgantia histrionica: *a* and *b*, the larva and pupa, enlarged; *c*, the eggs, natural size; *d*, side view of the eggs showing the bands; *e*, end view of same, showing the lid for the escape of the larva; *f*, the adult insect; *g*, the same, with expanded wings. (From Riley.)

The steady progress northward of this cabbage pest is of interest not only to entomologists, but particularly to cabbage growers in New York and elsewhere not far removed from the northern boundary of its present operations.

From Texas, where it was first observed about twenty-five years ago as severely injuring the cabbage crop, it has been slowly and steadily extending eastward and northward, with an annual progression that within a few years will, in all probability, carry it into and over New York and the New England States, and other States lying in the same parallels of latitude. It was operating in Southern California several years ago. It had previously been reported from Delaware, in the latitude of the southern line of Pennsylvania, but this is the first instance, to my knowledge, of its recognition in New Jersey, and therefore worthy of special note.

As Professor Smith has not included the species in his recent "*Catalogue of the Insects of New Jersey*," published in 1890, it certainly has not as yet become common or notably injurious to cabbage culture in the State. Woodbury, whence the insects came, is in the southwestern portion of the State, a few miles south of Philadelphia.

The date at which they were received leaves in doubt whether they were hibernated individuals, or if they were matured forms of the first spring brood (other broods follow through the summer). In the warmer climate of Texas, eggs are deposited as early as the last of February. The development of the insect is remarkably rapid, for under favorable conditions the period from the deposit of the eggs to the appearance of the mature form may be less than three weeks.

Remedies.—So destructive to cabbage and so difficult to combat is this insect, that its advance northward into territory yet unoccupied by it should be resisted by every means that can be efficiently employed, and by hand-picking when every other remedy seems to fail The arsenites are powerless against it, as it belongs to the suctorial class which feed through a beak and not with biting jaws. Experiments that I have made with pyrethrum and hellebore have shown but transitory effects, and fail to kill. Kerosene emulsion would probably prove equally valueless. In my First Report, before cited, the following recommendations were made, as the best methods known for attacking it: 1. Sprinkling with hot water of as high a temperature as the plants will bear. 2. Trapping with leaves plucked from the plants and spread on the ground, beneath which the bugs will retire on cold nights, and where they may be found in the morning and killed. 3. Burning the waste leaves, stalks, and weeds in the autumn, in which many of the adult insects pass the winter. 4. Destroying the first brood in the early spring by crushing the eggs. These may easily be found on the leaves, as they are conspicuous from their beautiful ornamentation, being white, tinged with green apically, surrounded by two sharply defined black bands of which the upper one is the broader, and having the apex bordered upon its depressed lid with a black crescent. The eggs are placed on end on the leaves fastened to one another, and often arranged in two rows of six each. With this description of the eggs, they can be easily recognized, and not mistaken for any others. 5. The hibernating bugs, when first resorting to the plants for oviposition, should be picked off by hand, or if too abundant for this, which they seldom are at this time, as many that go into winter quarters fail to survive its rigors and the enemies to which they are exposed, they may be knocked off the plants with a stick into a pan of water and kerosene.—(*Country Gentleman* of June 9, 1892.)

A new remedy.—Mr. H. E. Weed, Entomologist of the Mississippi Agricultural Experiment Station, premising that "there is but one efficient remedy for this insect, which is to destroy the brood which lives over winter" before their oviposition, has proposed a method which he has found successful in controlling "by far the worst cabbage pest of the South." It certainly gives promise of being the most simple and effective method yet discovered. Mr. Weed recommends that a row of mustard or radish plants be run on the sides or through the middle of the cabbage patch or field, and as the Murgantia will be drawn to these in preference to the cabbage,—when they have collected thereon, they may be killed by the application of kerosene. It does not appear from Mr. Weed's report that the hibernating individuals were killed by this method. He states:

Our present crop of cabbage was put into the field early in March, and at the same time a row of radishes was planted through the middle of the patch. The radishes were well grown by the time the second brood of bugs [the first spring brood] had hatched, and nearly all the insects found their way to the radishes, where they were killed by spraying with kerosene. At this date, June 15, hardly a single bug is to be found in this patch, while cabbage planted in other parts of the grounds are badly infested. (*Bulletin No.* 21 *of the Mississippi Agricultural Experiment Station*, June, 1892.)

Unless there should be no survivors of the radish feeders which might transmit, through heredity, an especial fondness for that plant to their successors, it would seem to be desirable that only mustard, if equally attractive, should be used as a bait. We have no knowledge that *M. histrionica* has been reported as a radish pest, although long known to feed on it and on other Cruciferæ, but another member of the genus, probably *M. munda* Stal, has recently appeared in that role, in California (*Insect Life*, iv, 1891, p. 83).

Psylla pyricola (Foerster).

The Pear-Tree Psylla.

(Ord. Hemiptera : Subord. Homoptera : Fam. Psyllidæ.)

Foerster : in Verhandl. d. naturh. ver. d, preuss. Rheinlande, v. 1848, p. 77.

Harris : Treat. Ins. New Engl., 1852, pp. 201–204; Ins. Inj. Veg., 1862, pp. 231–234 (early observations, habits, description, etc.).

Fitch : in Trans. N. Y. St. Agricul. Soc., xvi, 1856, p. 353; 3d–5th Repts. Ins. N. Y., 1859, p. 35 (brief mention).

Uhler : in Rept. Commis. Patents for 1860. 1861, p. 314 (discovered in U. S.).

Packard : Guide Study Ins., 1869, p. 53 (mention) ; Entomol. Begin., 1888, p. 82 (mention).

Walsh-Riley : in Amer. Entomol., i, 1869, p. 225 (mention, in Eastern States).

LeBaron : 2d Rept. Ins. Ill., 1872, pp. 134–136, figures (injuries in Illinois).

Glover ; in Rept. Commis. Agr. for 1876. 1877, pp. 33, 34, fig. 36 (description, localities, etc.).

Thomas : in 7th Rept. Ins. Ill., 1878, p. 73, fig. 12 (mention); in 8th Rept. do., 1879, p. 13, fig. 2, pp. 16–17 (general account, remedies, etc.).

Barnard : in Proc. Amer. Assoc. Adv. Sci., xxviii, 1880, pp. 478–486, plate (as *P. pyrisuga*).

Ashmead : in Canad. Entomol., xiii, 1881, p. 220 (questions Kollar's account of habits).

Riley : in Proc. Amer. Assoc. Adv. Sci., xxxii, 1884, p. 319 (mention); in Proc. Biolog. Soc. Wash., 1884, p. 69 (referred to *pyricola* of Foerster); in Insect Life, v, 1892, p. 103 (synonym).

Loew : in Neue Beiträge, zur Kenntniss der Psylliden–Verh. Wien Zool.-Bot., Gesell., xxxvi, 1886, p. 154.

Comstock : Introduc. Entomol., 1888, p. 171 (brief reference).

Saunders : Ins. Inj. Fruits, 1889, pp. 145, 146, figs. 151, 152.

LINTNER: in Count. Gent., lvi, 1891, pp. 317, 374, 637; in Canad. Entomol., xxiii, 1891, p. 230 (in Hudson river valley); in Science, xix, 1892, p. 343; 8th Rept. Ins. N. Y., 1893, p. 219.

RILEY-HOWARD: in Insect Life, iv, 1891, pp. 127–9 (description and habits from Loew), p. 225 (occurrence in New York); *id.*, v, 1893, p. 200 (is undoubtedly *P. pyricola* of Foerster), pp. 226–230 (observations of Mr. Slingerland, and dimorphism).

POWELL: in Orange County Farmer, May 21, 1891 (brief notice).

FISHER: in New Engl. Homestead, Dec. 5, 1891; in Bull. No. 17, Hatch Agr. Exp. St., 1892, p. 24 (habits and remedy).

LODEMAN: in Garden and Forest, v, 1892, p. 285 (brief notice of habits, etc.).

SLINGERLAND: in Count. Gent., lvii, 1892, p. 629; in Canad. Entomol., xxiv, 1892, p. 207 (injuries, broods, remedy); in Insect Life, v, 1892, pp. 100–103 (description, transformations, remedies, etc.); Bull. 14, Cornell Univ. Agr. Exp. St., Oct., 1892, pp. 159–186, 7 figs. (full account).

SMITH: in Canad. Entomol., xxiv, 1892, p. 207 (copper and London purple spraying for it); Insect Life, vi, 1893, p. 192 (injuries and spread in New Jersey).

Until within a few years the pear tree has been remarkably free from insect attack — the amount of injury from such source being probably less than five per cent of that to which the apple tree has been subjected. Recently two pests have forced themselves upon the notice of pear-growers, which have already inflicted serious losses, and threaten, unless arrested, greatly to interfere with the cultivation of this most excellent and prized fruit. Of these, the pear midge, *Diplosis pyrivora* (noticed in the preceding Report), which was introduced in this country about the year 1880, has not become broadly distributed, and has not occasioned much trouble except in western Connecticut and in portions of the Hudson river valley.

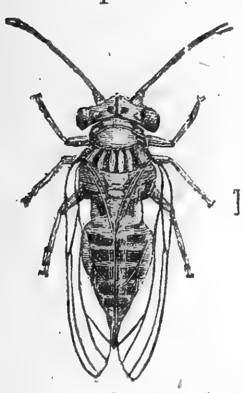

FIG. 9.— The pear-tree Psylla, PSYLLA PYRICOLA, male.

The pear-tree Psylla is also an introduced insect, which has been with us for a number of years — how long, is not known, but long enough to have carried it into some of our western States. It has, at times, multiplied exceedingly in particular localities and become very destructive, as notably in the summer of 1891, in the Hudson river valley, in association with the pear midge. Fortunately, however, after continuing its injuries for a few years, its excessive multiplication seems to operate as a check to its further increase, and to consign it for another term of years to insignificance in numbers and comparative harmlessness.

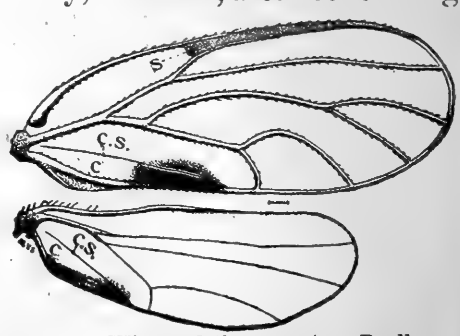

FIG. 10.— Wings of the pear tree Psylla; *c*, clavus; *c. s.*, claval suture; *s*, stigma.

Through the kindness of Mr. M. V. Slingerland, of the Cornell University, Ithaca, N. Y., we are enabled to present the excellent figures of the insect in its immature and perfect stages which illustrate this notice. Figure 9 represents the insect in its perfect winged stage; in Figure 10 the venation and markings of the wings are shown, greatly enlarged; Figure 11 gives enlargements of the head and antennæ, showing the two characteristic bristles at the tip of the antenna.

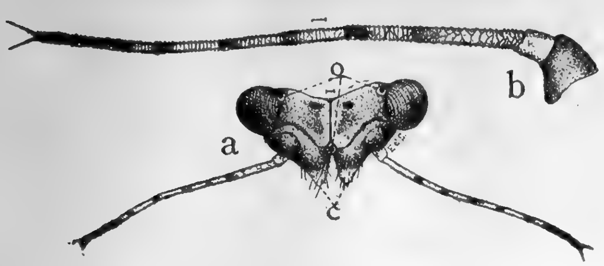

Fig. 11 — Head of the pear-tree Psylla: *a*, front view; *b*, antenna greatly enlarged; *c*, frontal cones; *o*, ocelli.

The Family Psyllidæ.

The family to which this species belongs is nearly related to the Aphides (*Aphididæ*), or plant-lice, coming next to it among the Homoptera in classification, but are stouter forms and of firmer texture. In general appearance the winged insects look like miniature Cicadas. Their head is broad, short, generally triangular in front, where it is cleft or bilobed with the lobes projecting conically forward; the eyes are large and project from the sides, with three simple eyes or ocelli in a triangle on top of the head; the antennæ are rather long, slender, and thread-like, usually ten-jointed and terminate in two small bristles — a distinguishing characteristic of the family; the beak is short, three-jointed and arises from between the fore-legs, and is fitted with a groove for securing it. The wings are sub-leathery or transparent, large, the front pair with the midrib three-branched, and these again bifurcating (see Figure 10); in repose they are placed over the abdomen in a steep roof; the hind wings have a few longitudinal and delicate veins. The abdomen of the female ends in a short conical ovipositor. The legs are fitted for leaping, having the thighs (femora) thick and the hindmost shanks (tibiæ) armed with spines; the feet (tarsi) are two-jointed. In their ability to leap, as also in their feeding habits, they resemble the smaller leaf-hoppers of the grapevine and rose.

The larvæ have a broad head, flat body, rounded abdomen, with the antennæ at first one-jointed. Some species are covered with a cottony secretion, or they may be naked, or covered with a honey-dew as in the pear-tree Psylla. The pupæ are distinguishable by their stouter forms and the projecting wing-pads on their sides.

Earliest Notice of the Pear Psylla in the United States.

According to Dr. Harris, this insect was observed by Dr. Ovid Plumb, of Salisbury, Conn., "in the spring of 1833, on some imported pear trees which had been set the year before. These trees, in the autumn after they were planted, wore an unhealthy aspect, and had patches of a blackish rust upon their branches. During the second summer, the trees died; and other trees on which this same rusty matter was found, proved to be infested with the same insects."

Whether the insect had appeared in the United States prior to this is not definitely known, yet there is reason to believe that it may have been operating in the State of New York as early as in 1824, if not in the preceding century.

In an article on "Pear-Tree Blight" by Dr. J. J. Thomas, in the Cultivator for June, 1850, vii, p. 204, it is stated that Mr. E. J. Genet had written expressing his belief that the disorder was caused by an insect observed by him, and operating in the following manner: At a little before midsummer, in the absence of dew for several nights, liquid drops could be seen falling from a pear tree, which was subsequently found to proceed from minute aphides thickly covering the shoots or branches, and which had at first escaped notice from the indentity of their color with that of the pear bark. They continued for about ten days, and then disappeared. The varnish which these insects exuded was regarded as poisonous to the tree.

Mr. Genet states that the same disorder had appeared on the banks of the Hudson in 1780–1793, and in 1802–1807. As these attacks may not have been seen by the writer, it is not improbable that they were the true "pear blight." "In 1824," Mr. Genet writes (probably from personal observation), "the same disorder prevailed, and lasted four years. In 1846 we were once more suffering from the same cause, and our pear trees are still prostrated by its fatal attacks. This disease has been called by some 'fire-blight.' One writer says it is produced by the *Aphis lunata*, a small insect covered by fine, white wool, but the insect which came under my observation is very different in every characteristic — so small as to escape observation in the first stage, and so similar to a fly at maturity as to mislead an inattentive observer."

As the insect, from characters given, could not have been the common and well-known apple-tree aphis, there can hardly be a doubt of its having been the pear-tree Psylla. Its introduction may easily have occurred as early as 1824, as pear-trees had been imported by nurserymen for thirty years prior to that date.*

Dr. Harris' attention was first drawn to the Psylla in 1848 by Dr. Plumb, through a communication published in the *American Agricul-*

* See article on "Early Pear Importations" in the *Country Gentleman* for December 1, 1892 page 907, where importation of pear-trees as early as in 1794 is recorded, and of other fruit-trees in the first decade of the present century, which, doubtless, "would easily be the means of mporting such noxious insects as infested them."

turist for January, 1849, page 29. In this Dr. Plumb states that he had lost several hundred young pear-trees between the years 1834 and 1838. It was not from the pear blight, which first shows itself in the leaves. But in this attack the bark turns black, sometimes commencing in July, more often in August, and then again not until September. It had not troubled him since 1838 until the present (1848), when he believed that he had found the cause of the trouble in an insect which he observed on the affected trees in September, although they might have been there earlier. None were seen on the trees not affected. They looked to him like aphides, and jumped like fleas. Specimens were taken from his trees about the middle of November, and sent to Dr. Harris.

From Dr. Harris' reply, published with the above, we learn that the specimens received were in the winged state, both males and females. From their injured condition and changed colors in drying, he was unable to name the species, but thought it probable that they were the *Psylla pyri* of Europe. Their habits and transformation not unlikely would be found to be similar to those given by European writers; these are quoted by Dr. Harris, including the remedies recommended by Kollar, substantially as given in the "Insects of New England" and later editions of the same. The letter of reply concludes with the following description of the specimens received from Dr. Plumb:

Description by Dr. Harris of the Psylla.

The insects were of a brownish color, with transparent wings, marked by a few dark veins. Each measured one-tenth of an inch or rather more, from the forehead to the tips of the closed wings. The front of the head is notched in the middle. The eyes are large and prominent, and with the thorax resemble somewhat in form those of our common cicada. The antennæ are longer than the body, slender, or threadlike, and are tipped at the end with two little bristles. The body of the female is pointed at the end, and is more of a reddish hue than that of the male.

In 1857, Dr. Harris saw the living insects on the trees at Salisbury. Of these he has written: *" On the 23d of July, I saw these insects on the trees, some already provided with wings, and others advancing toward maturity. The young ones [pupæ] were of a dull orange-yellow color. They were short, and were obtuse behind, and had little wing-scales on the sides of their bodies [omitting what is given above of the winged forms]; the head and thorax were brownish-orange, and the hind body greenish. Their four ample wings were * * * * colorless * * * * * The European, *P. pyri*, is said to vary in

* *Insects of New England*, 1852, p. 203. *Insects Injurious to Vegetation*, 1862, p. 232.

color at different ages, and in different seasons of the year, being of a dull crimson color, shaded with black in the spring, when it comes forth to lay its eggs. Not having seen any of our pear-tree *Psyllæ* in their spring dress, I can not say whether they agree with those of Europe in being of the same crimson color at this season of the year."

The Pyslla Referred to P. pyricola.

In the bibliography herewith given, all of our earlier writers have accepted it as probably identical with the *Psylla pyri* of Europe, with the sole exception of its description and illustration by Dr. Barnard under the name of *P. pyrisuga.* Dr. Riley, I believe, was the first to detect specific characters separating it from that species, and to refer it to *P. pyricola* — one of the three closely allied species which attack and injure the pear tree in Europe, of which, according to Dr. Loew, "*P. pyrisuga* Foerster is found throughout Central Europe in large numbers annually, and is a great pest; *P. pyri* Linn. is comparatively rare, appearing in small colonies, but is widely distributed; *P. pyricola* Foerster occurs in some localities in large numbers, particularly infesting dwarf pears, and often occasions considerable damage."*

In his reference to *P. pyricola* Dr. Riley states: "This is the Pear-tree Psylla of our Northern and Western States, and its reference to Foerster's species is made after comparisons with European specimens received from Meyer-Dür and Lichtenstein."†

The identity of our species with any of the European has been questioned by some of our writers, but for the present, at least, we must accept Dr. Riley as authority, he having recently, in reply to inquiry made, written me even more explicitly than quoted above: "The common pear-tree Psylla of New York and Massachusetts is unquestionably *P. pyricola* Foerst., and agrees perfectly with European specimens sent me by Dr. Loew."

Its Recent Multiplication in the Hudson River Valley.

Like many other of our insect pests, the Pear-tree Psylla, from time to time, and for a longer or shorter term of years, is favored with conditions peculiarly fitted to its increase, which are again followed by corresponding periods of almost entire exemption from its presence. Thus, according to Dr. Plumb, it was not noticeably present in his orchards for the ten years following the year 1838, previous to which it had annually been very destructive.

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* From an abstract by Riley-Howard in *Insect Life*, iv, 1891, p. 127, from Dr. Loew, *loc. cit.*

† *Proceedings of the Biological Society of Washington*, ii, 1884, p. 69.

Up to the year 1891, the insect was known to me only by name. In the spring of that year I first made its acquaintance, after the manner related below in the *Country Gentleman*, of April 16th.

Eds. Country Gentleman.— A gentleman has sent to me from Athens, N. Y., a package of pear twigs taken from his orchard, which are quite blackened with what he calls "honey-dew." Many other orchards in Greene county are affected in the same manner. Mention was made of this peculiar appearance at the Farmers' Institute recently held at Coxsackie [March 20th]. As it was thought that it might possibly have some connection with the fungus disease known as "apple-scab," which occurs upon the fruit and leaves and also on the twigs of the apple and the pear, infested twigs have been, by request, sent to Albany for examination.

The blackening is apparently of the same kind as that which we find upon hop leaves, elm leaves and other foliage which have been infested with plant-lice, the excretion from which, known as "honey-dew," has collected upon the upper surface of the leaves — at first of a limpid appearance, but in drying and with age becoming blackened. Subsequently a fungus growth usually occurs on the surface of the honey-dew and increases the blackness. The fungus is present in the examples received, as detected by State Botanist Peck, but as it is of a harmless kind, being superficial only and not penetrating the bark, neither it nor the dried honey-dew on which it rests can be of any particular injury to the trees.

It is desirable, however, that the cause of the honey-dew should be removed. The insect that excretes so large a quantity can not be otherwise than injurious. I know of no aphis (plant-louse) that infests the pear in sufficient numbers to produce such a deposit. It is probable that examination during the month of May will show the presence, in association with fresh honey-dew of an allied insect, known as the pear-tree Psylla (*Psylla pyri*), which is known in some localities to infest the twigs of the pear in large numbers, and, by sucking the sap, to occasion a large flow of the honey-dew. It has not been observed in this vicinity, but watch will be kept for it and, if discovered in its nefarious work, recommendation will be made of the best way to meet it.*

*In a communication made to the Country Gentleman of May 7th, 1891, and copied in my Eighth Report on the Insects of New York, some larvæ on apple twigs, received from Wayne county, in the western part of New York, were identified by me as *Psylla pyri*. They were thought to be identical with larvæ that had been sent to me a few days earlier, on apple blossom buds, from Ghent, Columbia county, N. Y.

The above identification should not have been made, or doubt should have been expressed, for, from having had only the larvæ before me, it is by no means certain that they may not have belonged to some other species, as *Psylla mali* or *Ps. pyrisuga*. It is sufficiently difficult to disinguish these Pyrus-infesting Psyllids in their final winged stage.

Early in June, in a visit made to the orchards of Mr. Cole, at Catskill, Greene Co., N. Y., to observe the attack of the pear midge, which had just been brought to notice (see *Eighth Report Insects of New York*), it was learned that the pear Psylla had been extremely abundant with him for the preceding four years, and had seriously affected the bearing of his trees. That they had been very numerous was evident from the appearance of some of the larger trees, the terminal branches of which looked as if they had been coated with a black paint. A few of the insects were observed at this time on the wing, but, later in the year, according to Mr. Cole, clouds of them would rise up in the air if a limb was shaken. The branches would be so covered with honey-dew as to smear the hands and sleeves of the men gathering the fruit.

About the middle of June the insect was seen prosecuting its destructive work at Ghent, Columbia county, N. Y.: in the extensive orchards of Mr. G. T. Powell, larvæ, pupæ, honey-dew, and the winged insects abounded. Of the latter a dozen or more could be seen at one time feeding from the foot-stalks of a leaf or young pear, extracting its sap, and, of course, producing blight. If a small tree was shaken, thousands would take wing, circle about the branches for a short time, and then again settle upon the leaves. A correspondent of the *Rural New Yorker*, who visited the orchards of Mr. Powell in August, has given the following sad account of their appearance :

From the beautiful apple orchards we strolled to the pear orchards, and here was a sight to make one cry. He has about three thousand pear trees, half of them in full bearing, but a pest has struck them this season, which has made the orchards a picture of desolation. Last year the pear-tree Psylla appeared, but were not numerous enough to do any appreciable damage. This season they reappeared in force, and have converted his beautiful orchards into a most distressing scene. Mr. Powell's most vigorous efforts, seconded by the wisdom of the State Entomologist, were powerless to check the ravages of this pest, though they hope another season to be more successful. Possibly the pests may not reappear another season, as they come and go mysteriously. But they have done their work most effectually this season, and instead of twelve hundred barrels of fine pears which he had counted on, he will barely have one hundred. (*Rural New Yorker*, August 29th, 1891, page 624.)

Similar conditions presumably prevailed in a large number, if not in most, of the pear orchards of Greene and Columbia counties, judging from other reports that came to me.

A severe attack was also reported, in June, by Professor C. H. Peck, on some young pear trees in his garden, at Menands, in Albany county. It continued through the summer into the autumn, causing considerable damage to the foliage of the infested trees.

Distribution.

As already stated, the pear-tree Psylla is known to have occurred at Salisbury, Conn., in 1833, and it was probably operating in an eastern county in New York in 1824. At the time that Dr. Harris wrote of it — in 1852 — it was known to him "in the western part of Connecticut and Massachusetts, particularly in the valley of the Housatonic, and in the adjoining counties of Dutchess and Columbia in New York."

Little is known of the extent of its eastern distribution in the New England States. Mr. T. S. Gold found it "several years ago" in West Cornwall, Conn., ten miles south-east of Salisbury. Coe Brothers first noticed it in their pear orchards at Meriden, New Haven county, Conn., ten or fifteen years ago, where it has been quite destructive in certain years. Mr. Fisher has had the opportunity of studying its habits at Fitchburg, in northern Massachusetts, nearly one hundred miles from Salisbury. That it is rather a local insect would appear from the statement that it is not known to the Messrs. Coe in any other portion of the State, and furthermore, that it has not appeared in a young pear orchard (set out in 1881), which is only a half-mile distant from their badly infested orchards.

Along the Hudson river valley it has been injurious in Rensselaer, Columbia, Dutchess, Greene, and Albany counties. Its presence has not been reported in the extreme south-eastern counties of New York, nor is it known to Dr. J. B. Smith to occur in the State of New Jersey.* In Central New York, Mr. M. V. Slingerland has been able to make valuable studies upon it at Ithaca, Tompkins county. In Western New York it must occur sparingly, if at all, for Mr. E. P. Van Duzee, who has been giving careful study to the Hemiptera for several years past, reports "no observed injury from it," nor is he able to identify the species, as described in Dr. Loew's paper, among the seventeen species of Psyllids contained in his collection. Professor A. J. Cook does not know of its presence in Michigan. Professor F. M. Webster has found it abundant in Ohio; and Dr. LeBaron has written of its presence and injuries in Illinois.

Its Injuries.

The injuries resulting from formidable attacks of this insect are the consequence of the large amount of sap which the myriads of individuals draw from the twigs, buds, leaves, leaf-stalks, and fruit-stalks of an infested tree, and eject in the form of "honey-dew," thickly coating the surface and thereby preventing the normal vital action of the leaves and bark.

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* It has since been observed in New Jersey by Dr. Smith.

Some of these injuries have already been referred to, as in the orchards of Mr. Powell, in Ghent, N. Y. The extensive pear orchards of Coe Brothers, at Meriden, Conn., have for several years suffered severely from it. In a letter from Mr. A. J. Coe, dated September 7th, 1891, he wrote that on his return from Europe, a few weeks previous to his writing, he found that his pear orchard had been devastated by the Psylla, and bore very little fruit.

A severe attack prevailed in a pear orchard of Mr. H. S. Wright, of Ithaca, N. Y., during the season of 1891. Mr. Slingerland, who saw the orchard in November of that year, has reported of it as follows: "The whole orchard appeared as though a fire had swept quickly through it, scorching the trees and blackening the trunks, large branches and the smallest twigs. Both young and old trees of dwarf and standard varieties had been attacked. Most of the trees had made little or no new growth during the season, and many buds were then dead."

Dr. LeBaron has described severe injuries from it in the State of Illinois, in the year 1871, when young pear trees had been so badly attacked by it that "the leakage of sap from the axils of the leaves [? the honey-dew given out by the insects] had in some instances run down the branches and trunk to the ground."

The frequent death of pear trees in former years, from unknown causes, after a season of languishing, is now believed to have been owing to the unsuspected presence of this insect, which from its minute size may have easily been overlooked. Mr. Powell unhesitatingly charges the recent death of many of his trees to Psylla attack. Certain it is, that a continuance for several years in succession of such injuries as have been cited, must necessarily prove fatal to the trees. If not carried to this extent,— in years of abundance of the Psylla, the crop would be a failure. The leaves, covered with a thick coating of the honey-dew and the sap withdrawn from their foot-stalks, would cease in midsummer to perform their functions and would fall to the ground: without them, the fruit could not mature.

Life-history.

There was not the opportunity during the season of 1891 to make a study of the life-history of this insect, or to learn much more of it than what has been given in the preceding pages. The following year, its abundance at Ithaca gave to Mr. Slingerland the opportunity of watching its development and habits; and in a Bulletin (No. 44) issued by the Cornell University Agricultural Experiment Station, under date of October, 1892, he has given to the public its entire life-history carefully worked out, together with its early history, description and illustrations of the several stages, methods of preventing its ravages, together with its bibliography and synonymy.

Whether or not, eggs of the pear-tree Psylla, are, in some cases at least, deposited in the autumn for hibernation, seems still an unsettled question.

Mr. Slingerland found a hibernating brood of the winged insect, in both sexes, in the month of December, hidden in crevices under loosened bark of the trunks and larger branches of trees. The females contained no mature eggs. During some warm days occurring about the 7th of April, hibernated adults were seen in copulation and a few eggs were laid. By April 18th, most of the eggs had been deposited — in crevices of the bark, in old leaf scars, and about the bases of terminal buds of the preceding year — usually singly, but sometimes in rows of eight to ten. Under a continuance of cold weather, the eggs did not hatch until more than a month thereafter, or May 10th to 18th, but eggs that had been removed and subjected to the warm temperature of the Insectary, gave out their larvæ in eleven days. The larvæ at once resorted to feeding grounds which were usually found in the axils of the leaf petioles or stems of the young fruit, into which they thrust their short beaks and extract the sap. "The whole life-cycle of the generation studied, from the laying of the egg to the appearance of the adult insect, was about one month" [in the Insectary].

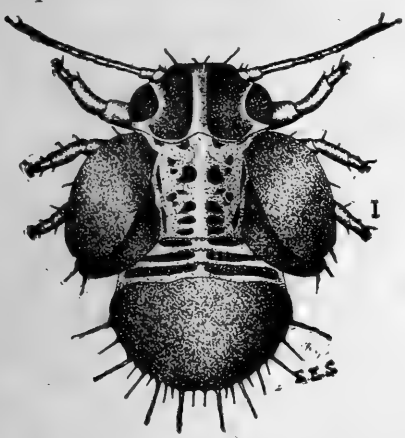

FIG. 12.—Pupa of the pear-tree Psylla, dorsal view.

During this time, five stages — "nymph stages"— of the immature insect were observed, followed by the fifth molt giving the winged adult. [If it be preferred to retain a "pupal stage" for the insect, the last two of the above noted may be so regarded, in which there are eight antennal joints, while the preceding show but three, four, and six or seven respectively, according to Mr. Slingerland's observations.] Figures 12 and 13 represent the full-grown "nymph" or pupa — the natural size indicated by the accompanying hair-lines.

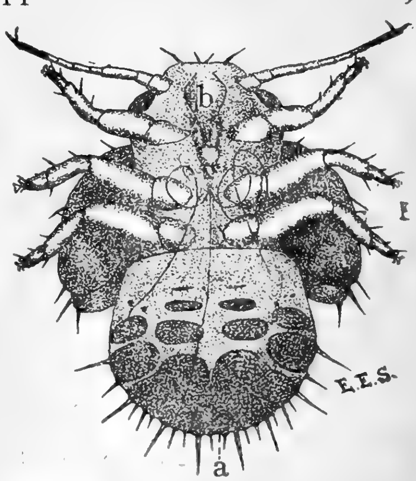

FIG. 13.—Pupa of the pear tree Psylla, ventral view.

The mature insects made their appearance about June 15th, and commenced to feed soon after emerging. "They appear to secrete no honey-dew." Within a week copulation ensued, and oviposition soon began. There were at least four broods during the year, at intervals of about a month. The adults of the summer broods were the most numerous July 20th, August 20th, and September 25th — the last constituting the hibernating form.

This last-named form varied so much from the preceding summer broods, being one-third larger and of much darker colors, that they were believed, at first, to be a different species. On careful comparison with descriptions of *Psylla simulans* Foerster, of Europe, it was found to present so close a resemblance as to leave scarcely a doubt that *P. simulans* had been described from the winter form of *P. pyricola,* and that the species is dimorphic, appearing in two distinct forms during the year, as some others of the Psyllidæ are known to do.

The *P. simulans* form continues to feed until the leaves fall, when it retires to its hiding places for the winter. None were observed in copulation during the autumn.

For descriptions of the insect in the several stages, the paper of Mr. Slingerland may be consulted.

Eggs of the Psylla.— Among the few notes made by me during the prevalence of the insect in 1891, the following occurs:

Prof. C. H. Peck, brought from his garden at Menands, N. Y., on June 15th, leaves of a pear tree having numerous eggs of the Psylla on both the upper and lower sides, but rather more abundant on the lower side. Many are placed along the midrib from the base to the tip, and some on other parts of the leaf, usually beside a vein and thrust in almost out of sight between the twisted hairs clothing the surface. The hair-like thread projecting from the narrow end of the egg, is, in most, a little longer than the egg, but in some, twice the length. The egg is not attached by it to the leaf but by a transparent teat-like process given off from near the broader end, as shown in the accompanying figure. Three eggs were seen standing close together on a leaf with the thread pointing upward, as if it were the remains of the secretion in which the eggs were enveloped at their oviposition.

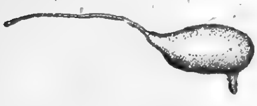

Fig. 14.— Egg of the pear tree Psylla.

Nearly all of the eggs are near their hatching as the inclosed larvæ are seen within, separated from the shell. On one leaf there were about thirty eggs. Young larvæ, apparently disclosed within a day or two, were also present. Cast pupa-cases were attached to various portions of the leaves. Professor Peck noticed the adults mating when the leaves were gathered.

Remedies.

Recent writers upon this insect have been recommending as perhaps the best method for its destruction, that of killing the eggs in which the insect was believed to hibernate during the winter, by spraying them with kerosene emulsion. This was based, not on actual experiment, but on the known insecticidal property of kerosene and its penetrative powers. Late experiments, however, carefully made, have given the unlooked-for result that there are insect eggs which can not be killed by kerosene emulsion of the extreme strength with which it may safely be used on vegetation, or even by undiluted kerosene. Such are the eggs of the Psylla, as has been shown by Mr. Slingerland in his Bulletin on the Pear-tree Psylla previously quoted. It was found by him that eggs dipped in a kerosene emulsion of full strength, and into kerosene undiluted, hatched a few days thereafter. The same result attended their immersion in spirits of turpentine, carbolic acid emulsion, whale-oil soap solution, strong potash solution, and undiluted benzine.

The vulnerable stage in this insect is when it has hatched from the egg and the larvæ are distributed over the young leaves and on the leaf-stalks. This, in ordinary seasons, in the State of New York, would be about the middle of May. If the infested trees are at this time sprayed with kerosene emulsion, even so weak as five per cent of kerosene, it will be fatal to all the insects with which it comes in contact. With careful spraying very few should fail of being reached, unless they are protected by a covering of honey-dew.

When the insect has passed to its winged stage, it has attained comparative immunity in the alertness with which it takes wing and leaves the tree upon the first motion communicated to the foliage by the impact of the spraying liquid. But even so late as the month of September, the war against the insect should not be abandoned, for multitudes may be destroyed, and the hibernating individuals for the following year greatly reduced. The kerosene emulsion will still be effective, but in its application, all of the ordinary spraying-nozzles should be discarded, even the finest gauge of the Nixon nozzle, and a Vermorel used, adjusted to the delivery of the finest possible mist-like spray. With proper care the emulsion may be distributed over the entire foliage without scarce stirring a leaf and with the least possible alarm to the winged tenants. Of those that take wing — after circling about the tree for a while — on their return to the leaves, their bodies will in most cases come in contact with the liquid, and take up sufficient of it to cause their death.

Chortophaga viridifasciata (De Geer).

The Green-striped Locust.

(Ord. ORTHOPTERA: Fam. ACRIDIDÆ.)

Additional to Bibliography given in Second Report, Insects of New York:

Tragocephala viridifasciata. RILEY: in 1st Rept. U. S. Ent. Commis., 1878, p. 256 (quotes from 8th Rept. Ins. Mo.); in Cassino's Stand. Nat. Hist., 1884, p. 203, fig. 285 (range).

Chimarocephala viridifasciata. SCUDDER: Entomolog. Notes, vi, 1878, p. 30 (collections in Florida).

Chimarocephala viridifasciata. LINTNER: 2d Rept. Ins. N. Y., 1885, pp. 187–198, fig. 54; in Count. Gent., lvii, 1892, p. 286 (at Canaan Four Corners).

Chortophaga viridifasciata. FERNALD: Orthop. New Engl., 1888, p. 40, fig. 15 (the two forms).

Chortophaga viridifasciata. COMSTOCK: Introduc. Entomol., 1888, p. 98 (stridulation), p. 104 (varieties).

Tragocephala viridifasciata. WEED: in 15th Rept. Ins. Ill., 1889, p. 42 (early appearance in Illinois).

Chortophaga viridifasciata. MCNEIL: in Psyche, vi, 1891, p. 62 (habits, etc.).

Chortophaga viridifasciata. BLATCHLEY: in Canad. Ent., xxiii, 1891, p. 76 (habits).

Young individuals of this locust (commonly called grasshoppers) were received from Canaan Four Corners, Columbia county, N. Y., where they had excited surprise and alarm by their having been seen in large numbers, on March 30th, hopping about on the snow and elsewhere in pastures and meadows having a warm southerly exposure.

Identification of the Species.

A notice of this occurrence was published in the *Country Gentleman* of April 14th, 1892, in which they were recognized as the young of "the green-striped locust," which had been described by Dr. Harris in his "Insects of New England" as *Locusta* (*Tragocephala*) *viridifasciata*. In my Second Report (*loc. cit.*) an account is given of this insect under the generic name of *Chimarocephala* — a name proposed by Mr. Scudder, in 1876 (meaning in the Greek, goat-headed) to replace the preoccupied one of *Tragocephala*. It has since been referred to the genus *Chortophaga* by Saussure, and this designation appears to have been accepted by our later scientific writers. It hardly seems worth the while, however, to attempt to follow the frequent generic alterations to which many of our insects are subjected.

Its Frequent Winter Appearance.

This particular species of locust seems, in its young stage, to respond more quickly to the influence of warmth in emerging from its winter retreat than any other of the species which, like it, hibernate in their larval stage, as *Arphia sulphurea* (Fabr.), *Hippiscus tuberculatus* Pal. de Beauv, species of *Tettix*, et cet. Its proneness to premature appearance has been remarked upon by several writers. Dr. Riley having received examples of it in Missouri, which were observed hopping about during mild weather in midwinter, has written of it: "It becomes active whenever the weather is mild. It is sometimes found in winter in the early larva stages, but more often in the pupa state."* Dr. Thomas has stated: "The larvæ and the pupæ and even the perfect insects are occasionally observed during the warm days in winter."† Mr. Weed (*loc. cit.*) saw them in Peoria county, Illinois, in the month of March, 1886, "hopping around on the grass, although the ground in many parts of the field was covered with snow." Mr. Blatchley records them as "frequenting dry open woods and roadsides, where the half-grown young can be seen jumping vigorously about in any warm sunny day in winter." In my Second Report (*loc. cit.*) record is made of their occurrence in several localities in the State of New York during the winter of 1882, in the month of February, in immense numbers — millions as stated by some observers — jumping about on the surface of the snow with all the life and activity of midsummer. That a temperature of about fifty degrees above zero, Fahr., will usually bring out the insect from its winter quarters, may be inferred from the following data: Of the thermometrical conditions attendant on the February (1882) occurrences in the State of New York, I have written: "From an average temperature for the several preceding weeks of +27° Fahr., it suddenly changed to a mean temperature (of one week) of 40°, reaching at the highest, 56°." Almost the same conditions seem to have attended the appearance at Canaan Four Corners above reported: Thus, the average temperature of the week preceding March 25th, as given in the "Report of the New York Meteorological Bureau" for the month of March, for Albany, the nearest reporting station to Canaan Four Corners, was +28½°; that for the week following (25th to 31st), 40°; the highest temperature observed, 57°, on the 26th.

The Two Forms of the Insect.

A description of *C. viridifasciata* has been given in the *Second Report on the Insects of New York*. Figure 15 represents the full-grown insect, and its larva in form and size as usually seen during the winter. The dimorphic forms under which it appears are quite marked. They have been thought by some

FIG. 15.—The green-striped locust, CHORTOPHAGA VIRIDIFASCIATA, young and adult.

* *Eighth Report on the Insects of Missouri*, 1876, page 149.

† *Eighth Report on the Insects of Illinois*, 1880, page 106.

to be sexual features and by others as seasonal varieties. "In one, the typical form, the head, thorax, and femora are green, and there is a broad green stripe on each wing-cover, extending from the horn to beyond the middle: this often includes two dusky spots on the edge. The second variety differs so much that it was described by Harris as a distinct species under the specific name, *infuscāta*. In this form the ground color is dusky brown. Intergrades occur in which the head and thorax are of a reddish velvety brown. Length of male to end of abdomen, 20 mm. (.8 inch); to tip of wings, 25 mm. (1 inch). Length of female to tip of wings, about 30 mm. (1.4 inch)." (Comstock.)

Transformation, etc.

This species has been shown from reliable data to be double-brooded, unlike our common red-legged locust (*Melanoplus femur-rubrum*), the Rocky Mountain locust (*Melanoplus spretus**), the lesser locust, *Melanoplus atlanis*, and most of the other *Acrididæ*, of which there is but one brood annually. It is to this fact in its life-history that its not infrequent appearance in winter or early spring may be ascribed.

The insects received from Columbia county are immature, being in their early stages of larvæ and pupæ — the latter distinguishable by their somewhat larger size (over half an inch) and possession of wing-pads or wing sheaths containing the future wings. They are from the egg-pods that were deposited in holes made in the ground by the ovipositor of the females last autumn. The larvæ hatching from the eggs two or three weeks thereafter, fed for awhile, until they had attained the size that they now present, when the coming of cold weather drove them to shelter for the winter in rubbish, beneath leaves, and in stone walls. Here they remained in an inactive, lethargic state, until unusually warm weather toward the last of March awakened them from their sleep and enticed them abroad.

The insect becomes fully matured, and takes its place among the earliest harbingers of spring, ordinarily toward the latter part of May. It has been seen by Mr. McNeil for the first, on the 22d of April, and he has pleasantly written of it: "This species is the first of its order to reach maturity in the early spring, and the noise of the male [it has remarkable stridulating powers] is the beginning of the grasshopper chorus which continues for six months to come."

Its Early Appearance Should not Excite Alarm.

Occurrences of this kind — the premature appearance of an insect associated in most minds with the warmth and heat and abundant vege-

* *Caloptenus spretus* of the earlier New York Reports.

tation of summer — never fail of exciting apprehension of its unusual abundance later in the year with serious injury to the grass crop. Such fear, however, need not be entertained. Large numbers of these locusts, in their tender and helpless condition, become the prey of black birds that come in flocks in the month of April, and feed eagerly upon them, aided in their work by others of our early appearing feathered friends. Furthermore, it is more than probable that this premature coming forth really serves to lessen prospective injuries from the brood, for the cold rains and frosts of early spring can not fail of killing a large proportion of those that are thus prematurely abroad, before they could find fitting shelter, even if they are endowed with the instinct in this phase of their life to seek it.

The So-called Grasshoppers are Locusts.

I have referred to these insects as *locusts*, for by this name the so-called "grasshoppers" should be known. The true grasshoppers are pale green, unicolored creatures, with long legs, and long thread-like antennæ projected from their heads, of the katy-did type. There is a lamentable confusion in the common names of these Orthoptera, as when we speak of the "17-year locust" which is not a locust, but a cicada, and belongs to quite a different order of the Insects from the Orthoptera, viz., the Hemiptera. It is always hard to correct long standing popular errors, and it would be foolish to attempt it in cases like the above, were it not that there are always those — albeit a small minority — who would prefer to call things by their right names.

Distribution of the Insect.

This species has an unusually extended range over the United States. According to Scudder, it occurs "from the White Mountains to Key West, Florida, Texas, and westward into northern New Mexico, and southern Colorado; also in Guatemala. It is found in Iowa, Minnesota, and Nebraska (Thomas). It probably occurs in all the States east of the Rocky Mountains, although Mr. Lawrence Bruner, of the Nebraska Agricultural Experiment Station, has not included it among the forty-eight species of locusts observed by him in his Locust Examinations in the valley of the Yellowstone river in eastern Montana and northwest Dakota in 1885.* In reply to an inquiry made of Mr. Bruner of its western distribution, he has kindly written:

"I have taken the *Chortophaga viridifasciata* as far west as the Rocky Mountains of Colorado and New Mexico; and I believe that it occurs also in Utah. I know that it is found in the Black Hills, S. Dakota,

**Annual Report of the Department of Agriculture* for the Year 1885, p. 307.

and also in the Platte river bottoms in Wyoming. These Rocky Mountain specimens are all of the darker form — *infuscata.* Here in Nebraska we have both the green and the brown, and find them in about equal numbers. It is a very common insect along all our streams and at the edges of natural and artificial groves. It is especially common on south hill slopes early in spring."

It probably does not extend to the Pacific coast, for Mr. Coquillet has enumerated eighteen species observed by him in the San Joaquin valley, California, in 1885, but this species is not mentioned among them.*

**Annual Report of the Department of Agriculture* for the Year 1885, page 297.

NOTES ON VARIOUS INSECTS.

Eriocampa cerasi (Peck).

The Cherry-tree or Pear-tree Slug.

As this common insect has not been noticed in this series of reports, a few words in relation to it may be convenient for reference. They were written in response to the following inquiry from Orange, N. J.:

For a few seasons past some of our pear trees have been badly damaged by numerous slugs which adhere to the upper sides of the leaves and devour all the spongy portion. These pests, a sort of flesh-colored snail, appear in great numbers soon after the leaves have attained their full size. Last season some of our trees were defoliated three times by these little pests. Consequently the trees made only a partial growth, and those that produced fruit were damaged to such an extent that the fruit did not attain half the usual size. Is there a remedy?

The pear-tree slug, the ravages of which are told in the above communication, is a well-known fruit-tree pest, occurring on the pear, cherry, plum, and quince, and also at times on the mountain ash. It was described under the name of *Sclandria cerasi* over a hundred years ago by Professor Peck, of Massachusetts, in a little pamphlet, for which a gold medal and fifty dollars were awarded by the Massachusetts State Agricultural Society.

FIG. 16.—The cherry-tree slug, ERIOCAMPA CERASI, enlarged.

The parent fly is a four-winged hymenopterous insect, of a glossy black color, with transparent wings, with the exception of a dusky cloud crossing the front pair. It is one of the "saw-flies," and bears the scientific name of *Eriocampa cerasi* (Peck), and is represented in Figure 16.

The female appears in the early part of June, and deposits her eggs singly in incisions made in the leaf, either on the upper or the lower side. The eggs develop into slugs in about two weeks time. Their slimy and disgusting appearance is too familiar to fruit-growers to need description. In the month of August, a second brood of the slugs make their

FIG. 17.—The pear-tree slug, in natural size and enlarged.

appearance, which feed for about a month, and are frequently more destructive than the first brood. The slug is shown in natural size upon the leaf, and in enlargement beside it, in Figure 17.

The insect is regarded as only two-brooded in Canada and in the Northern United States. Possibly there may be occasionally three broods in New Jersey, but it is not improbable that the supposed third brood may have been belated individuals of the second, as some of these do not develop the winged insect until September and even in October, while others pass the winter in the pupal state.

Remedies.— This insect is not a difficult one to destroy. Powdered hellebore has long been a favorite and satisfactory remedy for this and all other of the slimy slugs. It may be distributed over the foliage in powder, or, if more convenient, it may be mixed in water in the proportion of one ounce to two gallons of water, and applied with a force-pump. Spraying with Paris green and water would doubtless be equally effective, as the slugs feed upon the parenchyma from the upper side of the leaves. Powdered lime is also excellent for killing the slugs, when thrown by hand or otherwise over the leaves. A few years since, a young pear orchard in Western New York was severely attacked by a species of slug, allied to the *E. cerasi*, but apparently an uncommon insect, as appeared from examples sent me which I was unable to name. Request was made for additional specimens from which to breed the perfect insect, but answer was returned that the orchard had in the meantime been gone over with air-slaked lime, and no more of the slugs could be obtained.

Road dust has also been employed as a remedy, as almost any fine powder will kill the slugs by adhering to their viscid surface and closing the breathing-pores, unless they should be near one of their molting stages at the time, when the skin would be cast off and the dust inoperative.—(*Country Gentleman*, for May 19th, 1892.)

Papilio Cresphontes (Cramer).

The Yellow-banded Swallow-tail.

A number of the larvæ of this beautiful butterfly were received from Mr. Wm. Falconer, of Glen Cove, Long Island, on October 18th of this year, with the following notice of their occurrence: "I send you a few larvæ that I found on a bush of *Choisya ternata* — a Mexican shrub that I set out, in summer, and take in, in winter. I first noticed them two or three weeks ago. There were a great many of them on the bush then, but since a week or ten days many of them have disappeared: a few, but not nearly all of the missing ones, are on the ground, dead. They did not occur on any other shrub, although there were a hundred species of shrubby plants near by."

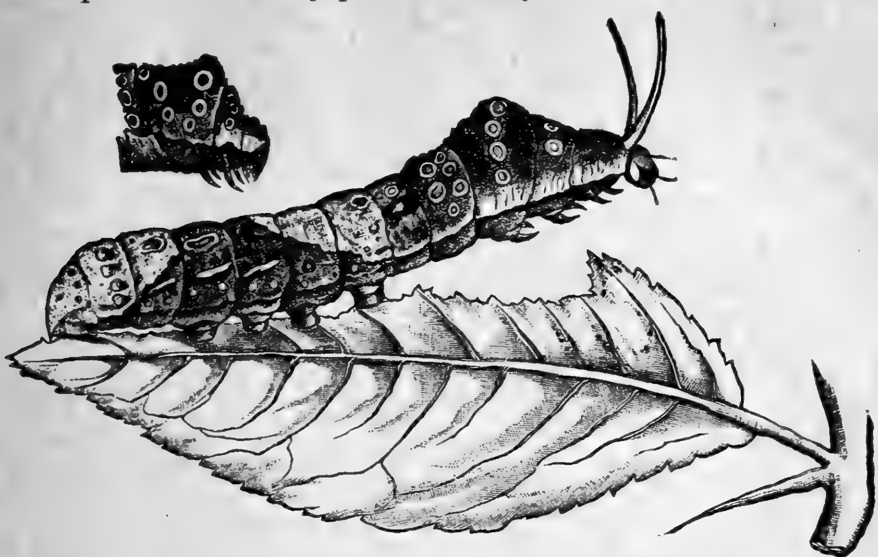

Fig. 18.—The caterpillar of Papilio Cresphontes, in natural size.

Mr. Falconer further stated, that a gentleman whose attention had been called to the larvæ, identified them with some that had occurred in his garden at Creedmore, L. I., a few years ago on a Fraxinella (*Dictamnus fraxinella*) bush, but on nothing else. Both the Choisya and the Dictamnus belong to the family of *Rutaceæ.*

Other known food-plants of the larva are prickly-ash (*Xanthoxylum*), hop-tree (*Ptelea*), orange, lemon, and others of *Citrus* — all pertaining to *Rutaceæ.* The larva is represented in its mature size, and in contraction of its anterior segments, in Figure 18.

Papilio Cresphontes is a southern species, ranging from the northern part of South America, northward. It has gradually extended its range until now it occurs as far north as the vicinity of Montreal in Canada. The first record of its appearance in the State of New York was in 1864. Within late years, from being an occasional visitor, it seems to have established itself in Westchester county, and at Poughkeepsie. In other localities in the State it is occasionally abundant, as in Rochester, where, according to Mr. Bunker, it "swarmed," one season, several years ago. Professor L. M. Underwood has written me that on September 12th, 1882, he saw several examples flying over the low swales near the Rhinebeck and Connecticut railroad in Columbia county. It has not been observed in the neighborhood of Albany. A single example was taken at New Baltimore, seventeen miles south of Albany, in the month of September.

Podosesia syringæ (Harris).

The Syringa Borer.

This beautiful moth is generally so rare that it remains a desideratum in the collections of some of our earnest collectors. That it may, at times, multiply to an inconvenient extent is shown from a letter received from Mr. John L. Lockwood, of New York city, who, sending examples of the larvæ in their burrows for identification, asks for some method by which he may arrest the attack, as all of his lilacs are being destroyed.

Possibly the insect is becoming more numerous, since, no longer confining itself to Syringas, it is multiplying in ash trees. Dr. Kellicott has "watched twenty or more [of the moths] emerging from an [ash] tree in a single day; and often a hundred or more were in a single tree." This was in Buffalo (*Entomologica Americana*, i, p. 177). Rev. Mr. Hulst records it (*Bull. Brooklyn Entomolog. Society*, v, 1882, p. 17) as so abundant in the English ash, in Brooklyn and the vicinity, that the tree is being rapidly exterminated. He had seen trees which were "completely riddled with the holes made by the larvæ and had died from the effects." Professor H. Osborn has also observed the larvæ boring in young shoots of ash trees, in Ames, Iowa. It appears to be a local insect, as are also several of the *Sesiadæ*.

Carpocapsa pomonella (*Linn.*).

The Codling Moth.

A correspondent from Malcom, Seneca county, N. Y., Mr. Malcom Little, writing November 4th, has sent a section of an apple containing a larva within its burrows, with the statement that it has done great damage to apples this autumn, in that, while not penetrating deeply, it greatly disfigures the fruit.

The calyx end of the apple received, had been eaten out into irregular open channels filled with rounded black excremental pellets, extending in one direction to more than a half-inch from the center of the calyx, but not penetrating deeper than its base. The calyx has the moderate depression of three-tenths of an inch below the apex.

The larva is at this time, November 6th, apparently full grown and quite sluggish in its movements, as if about to prepare for pupation. In its pink color and structural characters, I find no difference in it from the ordinary apple-worm of the codling-moth.

Dr. Harris has stated, that upon the hatching of the eggs "the little apple-worms or caterpillars produced from them immediately burrow into the apples, making their way gradually from the eye towards the core." In this he has [until recently as will be hereafter noticed] been followed, without qualification, by all our other writers, so far as I recall them, and all our illustrations show such a mode of procedure.

The feeding, to maturity, of the caterpillar in the apex of the apple, had never come under my observation before, and it seems to be quite new to Mr. Little, although he has long been engaged in growing fruit. Possibly it may not be uncommon, and may even frequently occur, when in the second brood of moths the eggs are deposited after the fruit has attained such a size and position on the tree that the "downward" direction that at first leads to the core would no longer guide the larva thither, but rather confine it to the apex. And at this time, the seeds, for which it shows a particular fondness, may be so far removed from it as to have lost their power of attraction. Later, it was learned from Miss Little, upon inquiry, that the section of apple sent was from a Rhode Island Greening, but that "the same trouble was common in all kinds of apples this fall." It was further stated that in several instances, the burrows were at the stem end, and occasionally one would be found where the skin on the side was affected in the same manner for a space not larger than a five-cent piece, and to a very slight depth. A few apples had been seen in which both the calyx and stem ends had been burrowed, with the core and parts surrounding, intact.

It would, therefore, appear that the second brood of larvæ not infrequently operate upon the fruit near its surface without penetrating to its interior. It would be of interest to learn to what extent this occurs.

Mr. P. C. Lewis, of Catskill, N. Y., has kindly permitted me to copy a portion of a letter addressed to him, from a correspondent in Tasmania, who, having the agency for the sale of his force pumps for spraying purposes, has given studious attention to the life-history and habits of the codling-moth. The habits of the insect, in the antipodes, as given, are so different in several respects from those observed elsewhere, that the letter will be read with interest:

I do not see why the codling-moth should operate here so differently from what it does in your country, but it does, most decidedly. Perhaps it would be best to simply state my experience or the mode of operation here, and then you can note the differences.

The moths emerge from the chrysalids from middle of November [corresponding with our May] to March, and *deposit their eggs promiscuously* — in the eye — on the side — on the stalk — where two apples touch (a favorite place),—in short, there is no rule, but perhaps, if the weather is wet, a larger percentage are in the eye. They strike [lay the egg] from the time that the apple is of the size of marbles until they are full-grown: this must be self-evident, from the long period during which they strike — from November to March.

In about a month the larvæ mature, leave the apple, seek shelter, spin a cocoon, and *lie in the larva state* until about October or November [April and May in New York], when they change into the chrysalis, and emerge as moths, as before stated.

There are some who hold that there is more than one generation, but that is contrary to my experience. If it is so, it is the exception and not the rule. I am constantly removing bandages from January to June, and have never found, in a single instance, a chrysalis or the empty case, but larvæ by the hundreds. I have also experimented with larvæ under cover, taken from the apple as early as possible, and they have not emerged until December.

I am strongly of the opinion that spraying should be commenced early — when the calyx of the apple is up, because I find that after the fruit has been struck in the eye, spraying is not effectual. The pear is chiefly struck in the eye. The apples most liable to attack are the Ribstone, Alexander, Dutch Mignon, Imperial Green, Russets, and Victorias. In some places, the apricot, peach, plum, cherry-plum, and even some cherries, are affected.—W. N. Cressy, Feb. 13, 1891.

Referring to the habit as above given, of the promiscuous egg-laying of the moth in Tasmania, upon any part of the fruit, and even on the stem, it is safe to say, that it is opposed to all observations made in this country.

Mr. L. O. Howard, in his extended account of the Codling-Moth, contained in pages 88–115 of the *Report of the Commissioner of Agriculture* for 1887, has aimed to give a complete account by bringing into one readily-accessible article a review of the life-history of the insect, and to this end, all of its literature, so far as known, was consulted and gleaned. According to this: "In the little crumpled-up spot caused by the falling off of the calyx the eggs are hidden, sometimes two or three to a single apple or pear. The eggs are laid sometimes upon the smooth cheek of the apple and sometimes in the hollow at the stem, but these are both unusual." From this statement we may conclude that an egg of the codling-moth deposited elsewhere than in the eye of the apple is, in this country, exceptional and of rare occurrence or, at the least, has not been frequently observed.* Probably the same rule would apply to the oviposition in Europe.

In a paper read before the Conference of the Fruit and Vine-growers of New South Wales, Australia, in June, 1890, by J. H. Dickenson, of South Bridgewater, Tasmania, based apparently on his personal observations, we read as follows: "The moth lays her eggs in the eye

* This will require qualification in view of observations since made, in Maine, by Mr. Munson, on the second brood of the insect, and given on the following page.

of the apple in the first part of the season, but later-hatched ones lay their eggs on the side of the apple as well as in the eye."

Accepting, therefore, as a fact, that in Tasmania eggs are *frequently* placed on the body of the apple, may not the explanation be found in the insular limitation of Tasmania, comparatively a small area of orchards, and such an abundance of the insect under conditions highly favorable to its multiplication, as to render it almost impossible for the moth to find an apple the blossom end of which has not already received an egg or two, and therefore compelled by instinct to resort to the side? Professor Riley has found that, in an instance where several moths were confined under a jar with a single apple, that in a few days it was fairly riddled with young larvæ.* The eggs had no doubt been placed at random, anywhere on the apple. In Tasmania, the codling-moth had been a notorious pest for many years — at least thirty — before its introduction into the Australian colonies.

The latitude of Central Tasmania is about equal, in degrees from the equator, to that of Central New York.

A recent publication by W. H. Munson, Horticulturist of the Maine State College Agricultural Experiment Station,† shows that the apple worm enters the fruit much more frequently from other points than at the calyx than had been hitherto supposed. He states: "The objection has been raised by some of our fruit-growers that a large proportion of the affected fruit is entered from side or base, and consequently that spraying before the fruit turns down has no special merit."

The following result is extracted, in condensed form, from a table given by Mr. Munson, from the examination of six trees of Rhode Island greenings, four of which had been sprayed twice with one pound of Paris green in 250 (in two trees) and 310 gallons of water.

The four sprayed trees gave 346 wormy apples, of which 133 (=38.5 per cent) had been entered from the calyx, and 213 (=61.5 per cent) from the side or base.

The two unsprayed trees gave 449 wormy apples, of which 252 (= 56.1 per cent) had been entered from the calyx, and 197 (= 43.9 per cent) from the side or base.

Of the entire number of wormy apples on the six trees, more than one-half (51.5 per cent) had been entered from the side or base.

This large proportion may probably be accounted for by the statement made by Mr. Munson, that "a large proportion of the fruit

* *Report of the Commissioner of Agriculture for the Year* 1887, page 91.

† *Annual Report of the Maine State College Agricultural Experiment Station* for 1891–1892, page 105.

infested had been attacked by the second brood, and the larvæ were still present" when the examination was made.

Possibly the second brood may have been unusually abundant. The trees had only received the June sprayings.

Dynastes Tityus (*Linn.*)

As a Fruit-Eater.

In the notices of this insect — the Rhinoceras beetle, or the Spotted Horn-bug, as it is popularly called — in the 5th and 7th Reports of this series, the ash was given as the food of the beetle — either the tender leaves of young shoots, the alburnum or sap-wood of the limbs from which the bark has been planed, or the sap which it has caused to flow. It has never been recorded as injuring fruits.

An example of the beetle — a male — was received October 4th of the present year (an unusually late period for it) from Mr. F. H. Emmord, of Magnolia, Md., with the memorandum, "came off a ripe pear." As its occurrence on the pear might have been simply accidental, it was inclosed in a box with a ripe seckel to see if it would feed upon it. The day following it was found with its head and thorax buried in the pear. In the meantime, Mr. Emmond had been written to, asking him if the insect had eaten into the pear from which it had been taken, and if any instances of its feeding on fruit had been observed by him. The answer returned, was the following:

"I found the spotted horn-bug in a soft, ripe, seckel pear which he had eaten into quite to the core. I had laid the pear in a crotch of the tree the day before. I put him in a paper box with a piece of the same pear which he ate. Where the juice of the pear had softened the paper box he ate through it."

As the beetle also in like manner ate through the saturated bottom of the box in which he was confined in my office, it is probable that the sweet juice of the fruit is the chief attraction, and that fruit ordinarily would not be attacked by it unless its surface had been broken, permitting of the escape of its juices.

Crioceris asparagi (Linn.).

The Asparagus Beetle.

In the notice of this insect in the *First Report on the Insects of New York*, 1882 (pp. 239–246), it was stated, that in the State of New York "we only hear of its serious injuries from Long Island and the vicinity of New York city." It might have been added, that it was not known to occur elsewhere in the State.

Two years thereafter the insect appeared in Central New York. In June of that year (1884), Mr. E. S. Goff, at that time the Horticulturist of the Agricultural Station at Geneva, sent to me examples of larvæ, and the eggs on the leaves and slender branches of the plants, with the statement that it was the first time that he had met with the insect, but that he had learned that it was quite prevalent in and about Geneva. In a communication to the *Geneva Courier* of June 4, 1844, Mr. A. P. Rose wrote, after calling attention to the new insect pest: "I think that this must be the first year of its appearance in this part of the State. My attention was called to the subject by the late report of Professor Lintner, the State Entomologist, and on examining my own asparagus bed, I found a number of the beetles and great quantities of the eggs. As yet, no damage seems to have been done by them, but when the present crop of eggs hatches we may expect to hear many accounts of their ravages."

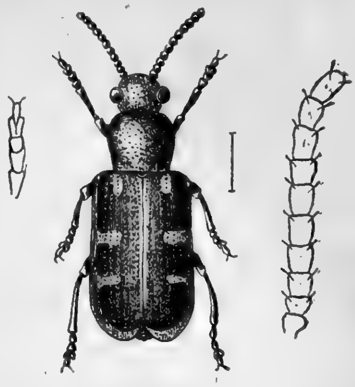

FIG. 20.—Asparagus beetle (a common six-spotted form), enlarged about six diameters, with further enlargement of antenna and front tarsus.

During the year (1892), the insect has made its appearance much farther westward in the State — at and about Rochester. At the meeting of the Association of Economic Entomologists in August, in that city, examples of the beetle taken within the city were brought in for identification. Later in the month, I learned through Mr. George S. Conover, an eminent horticulturist of Geneva, that Mr. John Charlton, florist and nurseryman of Rochester, had informed him that the insect was very destructive to his asparagus beds. Mr. Charlton had used every means that he knew of, and had sprayed with different insecticides, including Paris green, but had not succeeded in relieving himself from the pest, which was still abundant with him.

Systena frontalis (Fabr.)

Injuring Gooseberry Foliage.

This little Chrysomelid beetle was quite injurious to the foliage of gooseberry bushes at the Geneva Agricultural Experiment Station, during the later part of July and early August. It had not been noticed there before. Upon the identification of the insect, received August 6th, request was made for additional examples for the State collection, but answer was returned, August 12th, that no more could be found, the bushes having meantime been sprayed with Paris green.

S. frontalis, although common, has not as yet attained as bad a reputation as has some of its congeners, as for example *S. blanda* Mels.,* which has gone on record as injurious to cotton, to potatoes, and particulary so to corn (see *First Report on the Insects of New York,* pp. 155, 156), and to beets (*Insect Life,* iii, p. 149). *S. tæniata* (Say) has been injurious to beans in New Mexico (*Insect Life,* iii, p. 122) and feeds on many of the *Cucurbitaceæ,* and has been taken in association with a number of grass insects (*id.,* iv, 198). *S. elongata* (Fabr.) is at times destructive to cantaloupes in Maryland.

Chauliognathus Pennsylvanicus (De Geer).

The Pennsylvania Soldier-Beetle.

Mr. C. R. Moore, of Bird's Nest, Va., has sent this beetle — one of the *Lampyridæ* — as appearing with the rose-bug in the latter part of May, and eating roses and blossoms of grapes. He was informed that the insect was not recognized as an injurious one, although it was known to feed on the pollen of various blossoms. Writing again, he stated that he had observed the operations of the beetle on his grapes for the past three years, and wherever he had seen them operating, the blossoms were all destroyed.

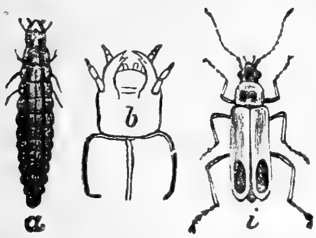

Fig. 21.—The Pennsylvania soldier-beetle, Chauliognathus Pennsylvanicus: *a*, the larva; *b*, its head enlarged; *i*, the beetle.

Should this form of injury by the beetle be established, it might be of more economic importance than the service rendered by it in its earlier stage of larva, when it is occasionally, at least, beneficial, in ferreting out and destroying the apple-worm of the codling-moth and the larva of the plum curculio and, as later discovered (*Insect Life,* i, p. 216), feeding upon the pupæ of the destructive cotton-worm.

Pissodes strobi Peck.

The White-pine Weevil.

An attack on the Norway spruce, of what was in all probability this insect, was reported, in August, 1892, by W. C. Pierce, of Richford, N.Y. According to his statement, one hundred and fifty Norway spruces, which had been planted in the cemetery at that place, commenced, last year, to die at the top. On examination, small borers were found working between the bark and the wood from above downward, and into the wood, beginning in the top shoot, and destroying the life of the tree as far as they progressed.

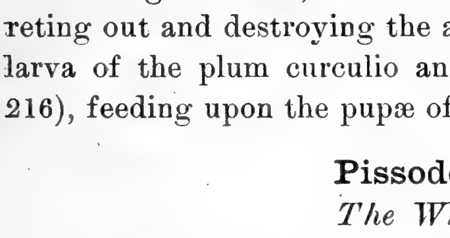

Fig. 22.—The white pine weevil, Pissodes strobi: larva, pupa, and imago—enlarged.

* Recently referred, together with *ligata* Lec., *mitis* Lec., *ochracea* Lec., and others, to *S. tæniata* (Say). See Dr. Horn's Synopsis of the Halticini of Boreal America, in *Transactions of the American Entomological Society,* xvi, 1889, page 273.

It is the well-known habit of this curculionid beetle to deposit its eggs in the bark of the topmost shoot of young pines, and also in spruces, the larvæ from which burrow into the wood and thence to the pith, causing the tip to die, and thereby arresting the normal growth of the tree, and producing deformity, in the crookedness produced by the sending out of lateral branches.

Dr. Fitch has treated of this insect in his usual able manner in his Fourth Report, giving the natural history of the insect, and the serious injuries that it causes to the white pine — one of our most valuable timber trees. Dr. Packard has devoted a half-dozen pages to this insect in the recently issued (1890) Fifth Report of the U. S. Entomological Commission — on *Insects Injurious to Forest and Shade Trees*, in which he includes Dr. Fitch's account, with figures of the insect in its several stages, and its work in the deformities caused by it in white pines. In addition to the pine, *Pissodes strobi* also attacks spruces and hemlocks, nor does it confine its operations to the terminal shoot, but according to Dr. Packard, may "lay its eggs in the bark and mine the sap-wood of large pines and other coniferous trees."

Perhaps the best remedy for this attack is to cut off and burn the infested shoots before the beetles have emerged — during the months of July and August.

Myzus cerasi (Fabr.).

The Cherry-tree Aphis.

Notice of a severe attack of this insect was received from Mrs. E. C. Brinkerhoff, of Nunda, Livingston Co., N. Y., under date of June 4th, 1892:

We have a large cherry tree of over one foot in diameter. Some six years ago a very few of the cherries ripened that were very fine oxhearts, but soon the remainder of the fruit was destroyed by a small, black insect similar to the small, black ant, but with wings. The insects almost entirely covered the cherries and the leaves and all were destroyed, but the tree leafed out again and has done so every year since. This year the pest came earlier and not a cherry was half-grown before they were destroyed. I have sprayed the tree twice each year for the past three years with Paris green, but it has done no good. I have two young sour cherry trees about forty feet from it that are not affected by the insect, nor plums, nor currants, nor do I know of any other neighbors who are troubled with it. Can you tell me what I can do to destroy them?

The lady was advised that Paris green was entirely ineffective against this or other aphides, but that remedies were found in kerosene emulsion, tobacco water, or strong soap suds, as given in the *Fifth Report* *on the Insects of New York*, 1889, pp. 256, 257. It was important that these applications should be made as early in the season as the first aphides were seen upon the leaves, and before they are partly sheltered from the spraying liquid within the curls or folds of the leaves resulting from their attack.

The preference shown by this aphis for the ox-heart cherry is interesting. Dr. Fitch has stated that it never invades any of our native or wild cherry trees. It was for a long time believed that it was limited to the cultivated garden cherry, but within late years it has also been observed feeding on the plum by Dr. Thomas, in Illinois, in 1878; and in the *Country Gentleman* for May 26th, 1892, I have identified the species in specimens taken from the wild-goose plum in Central Kentucky. It has also been found in Europe on the black currant.

The life-history of this common and destructive species was fully worked out by Professor C. M. Weed, while connected with the Ohio Agricultural Experiment Station, and was published in the Bulletin of the Station, Technical Series, i, No. 2, May, 1890. By the kindness of the Director of the Station, the plate illustrating the several stages of the insect which accompanied Professor Weed's article, is herewith given.

Pemphigus tessellata (Fitch).

The Alder-blight Aphis.

This alder aphis has been unusually abundant the present year (1892) in various localities in the State of New York. Mr. John D. Lyons, of Monticello, N. Y., has written me that during the month of August it occurred in such numbers on the swamp alders that "it was hanging in strings from the branches."

A larger number of their white patches and of larger size than usual, were observed at Keene Valley, N. Y., during July and August. On removing a colony of the aphids from a branch of alder, on July 23d, thirteen of the eggs of *Feniseca Tarquinius* were found scattered singly, or in twos and threes on the bark beneath. For the manner in which these eggs are placed among the aphides,—for the interesting habits of the caterpillar while living among and subsisting on the aphides, and for a detailed account of the insect, the second volume of "Scudder's Butterflies of the Eastern United States," pp. 1016–1026, may be consulted.

Professor Comstock, in writing of *P. tessellata*, has stated:* "There is a curious fungus which grows in large spongy masses immediately

* *Introduction to Entomology*, part 1, 1888, p. 166.

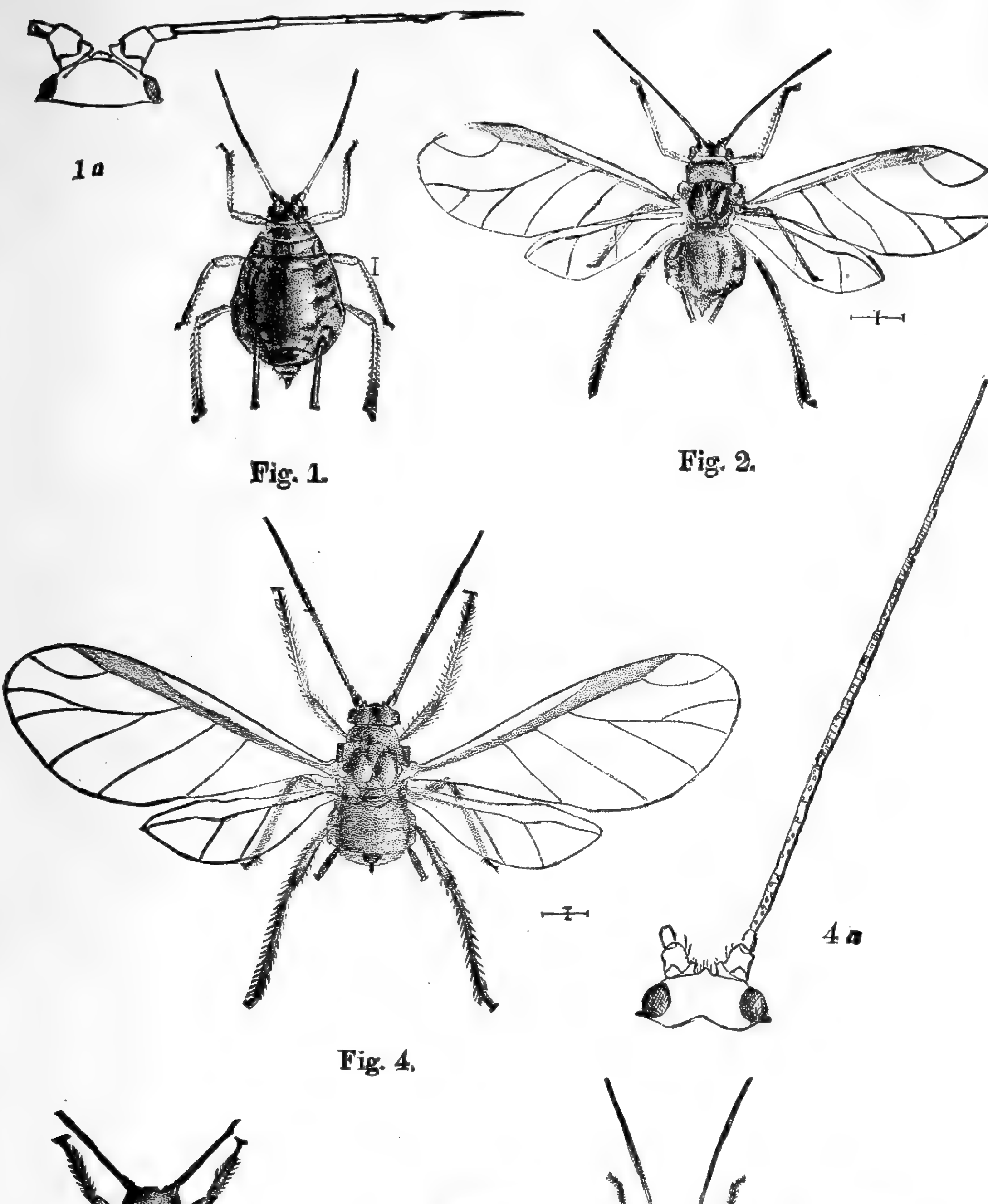

PLATE 1. The Cherry-tree aphis, MYZUS CERASI: Fig. 1, apterus viviparous, female; 1 a, head and antenna of same; 2, winged migrant; 3, return migrant; 4, winged male; 4 a, head and antenna of same; 5, oviparous female.

beneath the cluster of plant-lice; this is knows to botanists as *Scorias spongiosum.* It is evidently fed by the honey-dew that falls upon it."

An example of this fungus has been shown me by Miss Florence Himes, of Albany, who had taken it from an alder in Washington park. The fungus was at the tip of a small twig that was given off from about four inches below the aphis-bearing stem, and curved upward so near it that it might easily have received quite an amount of the honey-dew dropping from the plant-lice. The specimen was identified by Prof. Cha les A. Peck, State Botanist, as the above-named species of fungus. Two or three other examples of the same had been seen by Miss Himes.

Phylloxera vitifoliæ (Fitch).

The Grapevine Phylloxera.

Leaves of grapevine having their under surface almost entirely covered with the galls of this insect, similar to the representation in Figure 28, were received August 6th, from Director Collier, of the New York State Agricultural Experiment Station. They were from the vineyards of Mr. Edwin Slocombe, of Camillus, N. Y., who reported the foliage of his Delaware grapes as being literally covered with the galls, as shown in the examples sent. The insects emerged a few days after the reception of the leaves.

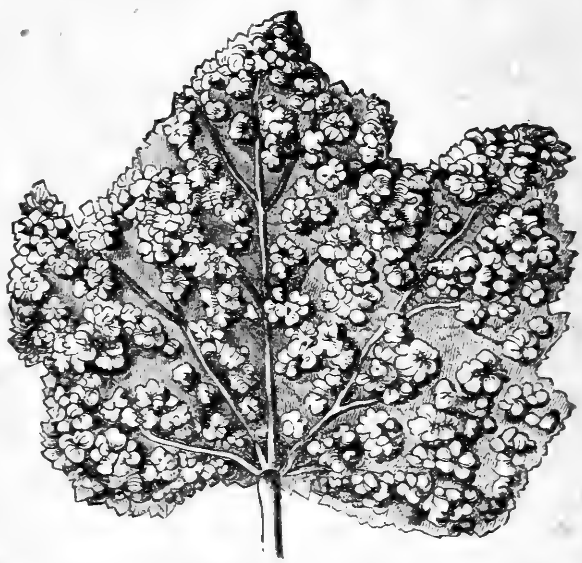

Fig. 28.—Grapevine leaf with galls of Phylloxera vitifoliæ.

Dr. Collier states that the insect has been quite plentiful on the Clinton grape, in the vineyards at the Station, and had also appeared on a few other varieties.

Crangonyx mucronatus *Forbes.*

A Blind Shrimp in Wells.

Several examples of this crustacean were received from Oswego, N. Y., where they were taken from the water of a driven well of moderate depth, located in a gravelly soil, on a rising knoll. The creatures are slender forms, white, about a half-inch in length, with rather long legs, and other thread-like terminal organs. "They are not occurring abundantly at the present time, but usually in the autumn small ones of the same general appearance are quite numerous."

The gentleman sending them desired to know what they were, and their source, as he feared that they might render the water unfit for domestic use.

It proves to be an interesting species of fresh-water shrimp which occurs only in such unusual localities as wells and subterranean streams. Like the blind craw-fish of the Mammoth Cave of Kentucky, to which it is closely allied, it is entirely destitute of eyes. It was first discovered by Professor S. A. Forbes, State Entomologist of Illinois, in a well at Normal, Ill., and was named and described by him, in *Bulletin No.* 1 *of the Illinois Museum of Natural History*, December, 1876, page 21. It belongs to the Order of *Amphipoda* and to the Family of *Gammaridæ*. It is described as follows,—combining the generic characters with the specific:

C. mucronatus Forbes. No eyes [a congeneric species, *gracilis*, has eyes]. Peduncles of the two pairs of antennæ subequal. Hind angles of first three abdominal segments rounded; no clusters of spines on posterior abdominal segments. Last pair of abdominal legs with inner branch minute, outer branch shorter than peduncle; the first two pairs of feet subequal. Telson single, of male a slender spine about as long as first three abdominal segments.

Illustration is given of structure in seven enlarged figures.

Professor Forbes informs me that the above is the first instance in which this crustacean has been reported from east of Indiana. It is not confined to wells, but it has been frequently found in certain springs in seasons of high water when the soil is saturated; it also often comes to the surface at the mouth of drains, but as it is entirely subterranean, it does not live for any length of time in surface waters.

In explanation of its occurrence in drains, Professor Forbes has kindly written me: "The drains referred to in my letter are ordinary farm drains, but as the *Crangonyx* and its companion crustacean, *Asellus stygius*, do not occur in such drains indiscriminately, but only in here and there one, I presume that their appearance in such situations is due to the presence of springy ground and a penetration of the tiles by the subterranean crustaceans from some underground source."

The publication of the occurrence of the *Crangonyx* at Oswego, in the *Albany Evening Journal* of March 27th, 1891, and in the *New York Times*, brought to light other localities in the State of New York and elsewhere where it was also to be found. Referring to the *Times'* notice, Mr. Walter L. Allerton, of New York city, wrote me as follows:

> They are frequently found in wells in Westchester county and in Fairfield county, Connecticut, and are generally believed to indicate the purity of the water. I have a well at my residence at Mt. Vernon [Westchester Co., N. Y.] in which they are quite abundant. This well is about fifteen feet deep, and is supplied by a large stream flowing through a bed of coarse gravel resting upon rock. I have also known them to be pumped from a well in my father-in-law's place at Berwick, Maine. I have no doubt that if there was any object to induce a careful search they would be found wherever the same conditions exist, viz., an underground stream of good size flowing through a layer or bed of gravel.

The Asellus crustacean above named as often associated with the Crangonyx, is probably the one noticed in *Insect Life*, ii, p. 375, as brought up abundantly by a pump from a well in Keokuk, Iowa, and which is figured in the *American Entomologist*, iii, 1880, p. 36, and of which Mr. H. G. Hubbard, writing of the inhabitants of the little pools of water in the Mammoth Cave of Kentucky, states: "Though none of the pools were larger than an ordinary washbowl, I found them all veritable little aquaria, well-stocked with the crustacean described by Packard (*Cæcidotea stygia*). Some of the pools contained twenty or thirty specimens in all stages of growth."

The presence of these crustaceans in wells need not excite the slightest fear. All of their kind are eagerly sought for food, and are regarded by epicures as great delicacies. In their subterraneous habitat the waters are necessarily, from filtration, very pure, and when, through underground currents, they are carried into wells they attest to the purity of the incoming water. As inhabitants of wells, they would serve as purifiers in the capacity of scavengers, feeding upon any injurious matter that might be present.

[From the Albany Evening Journal of February 14th, 1891.]

Insectivorous Birds for Protection.

State Entomologist J. A. Lintner made a vigorous protest before the committee of the Assembly having under consideration the codification of the Fish and Game Laws, against the provisions in the proposed act which gave no proper protection to insectivorous birds. The law under consideration repeals all former laws upon the subject. In his address to the committee he urged the importance of protecting all such birds as are of benefit to the agricultural interests of the State.

Doctor Lintner said, that to the wanton destruction of our wild birds was largely owing the present excessive ravages of insect pests, greater in this country than anywhere else in the world, and rapidly increasing annually. It had become a necessity that every bird which was of benefit to the agriculturist should be given protection. It was possible to pronounce definitely upon what particular birds were beneficial,— which were of negative importance, and which were injurious. This was arrived at through the investigations of the stomachs of birds shot during every season of the year, showing the food upon which each species feeds. These investigations were mainly conducted by the Division of Ornithology and Mammalogy at Washington, and when, as the result of such examinations, perhaps of a thousand stomachs of a single species, it was definitely asserted that such a bird was beneficial, the decision should be unhesitatingly accepted without question. The bird itself had borne testimony to the nature of the food upon which it fed.

Dr. Lintner asked of the committee to strike out from the printed bill under consideration, the following provision: "Nor does it [this act] protect the English sparrow, crane, crow, raven, hawk, shrike, owl, crow-blackbird or king-fisher;" also, the section, providing that the robin, blackbirds, and meadow lark may be killed during the months of November and December.

Referring to the birds named in the act, the professor said: The provision exempting the English sparrow lacked the stringent legislation against it contained in the old law. This bird was accepted as an unmitigated and intolerable nuisance, the rapid multiplication of which must be checked, even if poison must be used against it, as is being largely done in Australia.

The crane never occurs in the State of New York; the larger herons are mistaken for it. The precise economic status of the crow and the raven, were not yet determined; their investigation was still going on. It was certain that the crow rendered very valuable service in its feeding upon the white grub — a notorious pest,— often pulling up young corn to reach the grub concealed in the hill.

The hawks and owls, as a class, deserve protection more than any other birds, for the reason that considerably more than 90 per cent of their food consists of the enemies of the farmer, viz., field mice and grasshoppers. Even the bulk of the food of one or two hen-hawks — the red-tailed and the red-shouldered — consists of injurious rodents, and their occasional attack on poultry may properly be ignored.

The northern-shrike, notwithstanding its unpleasant popular name of "butcher-bird," had of late years, during its winter sojourn among us, treated itself almost entirely to the English sparrow, killing and impaling on thorns or thrusting in forks of limbs many more of the birds than it consumed in food. It should by all means be protected as a valuable ally of the farmer.

The blackbirds, of which there are several species, should also be protected. When the crow-blackbird was seen tearing off the husks from the ears of corn to feed, as generally supposed, upon the corn, examination of its stomach showed numbers of a caterpillar which feeds upon the tips of the ears, and only incidentally a few kernels of the corn. The kingfisher is only injurious in fish-ponds.

The robin is one of our most valuable insectivorous birds, and should therefore never be shot. It may be pardoned for the berries and the cherries that it takes, in consideration of the hundredfold return that it makes. The meadow lark feeds only on insects and wild seeds. It is difficult to imagine how one could kill for sale as food so useful a bird, the musical notes of which, while lacking the compass and volume of the famed English meadow lark, quite supasses it in sweetness.

In place of the provisions of the act, which Dr. Lintner wished to be stricken from the bill, he asked to have inserted the following: "The English sparrrow (*Passer domesticus*) is not protected under this act, and it shall be considered a misdemeanor intentionally to give it shelter or food, except with a view to its ultimate destruction; nor does it protect the crow, raven, or Cooper's hawk (*Accipiter Cooperi*), or the great horned owl (*Bubo Virginianus*)."

INSECT ATTACKS.

Resistance of Fleas to Insecticides.

That fleas are capable of resisting the effects of insecticides such as will usually destroy insect life, is shown in the following communication received from a gentleman in Central New York, under date of August 14th:

DEAR SIR.—I am in a quandary, and feel constrained to appeal to you to help me out of my difficulty. About six or eight weeks ago I discovered that my cellar was infested with fleas, and I at once went at them with a mixture of turpentine and gasoline, and supposed I had exterminated the pests. About two weeks later I found they were still jumping about, and I treated the floors with a solution of two ounces cyanide potassium in one gallon water. Later, I used Persian insect powder freely and an infusion of Cocculus indicus berries, one gallon containing four ounces cyanide potassium. Then I again used the insect powder, and gave my cellar two sulphur fumigations, using three drams sulphur each time. I supposed I had really knocked them out, until this morning, when I found that there were still a few left to tell what they know about "hades." I have reached the limit of my knowledge of insecticides applicable to fleas, and, if you can suggest to me anything that I can use to rid my cellar of these rascals, I shall be exceedingly indebted to you. My house is a new one, with a well-lighted, airy cellar, and the fleas must have come from a Scotch Collie dog that has slept in the cellar. I have almost concluded that fleas will resist the action of any insecticide, for I noticed to-day a number of lively fellows in a barrel standing outside of my cellar, that had come up through sawdust that had been saturated with the fish-berry and cyanide potassium mixture that I had swept up from the cellar floors a couple of weeks ago. I am very anxious to rid my cellar of these pests before my family returns from the country, and an early response from you will be greatly appreciated. I remain, sir, &c.

Reply was made of inability to recommend better insecticides than those that had already been employed, unless, without endangering the lives or health of his family, the infested cellar be charged with hydrocyanic acid gas [made by treating cyanide of potassium with sulphuric acid]. It was probable that the larvæ had been killed by the insecticides used, and that the imagoes that were now appearing, in smaller numbers than before, were those which had been sheltered and protected by pupation.

A resort to the favorite means for the reduction of this pest, used many years ago in Poland —"the paradise of fleas,"— was recommended for use in the present stage of the infestation, viz., setting a shallow vessel of water (a film of kerosene might be floated on its surface) on the floor, with a lighted candle standing in it. The fleas, attracted to the light, would leap toward it, and be caught in the water and killed. In Poland they would often almost blacken the water with their bodies.

White Grubs Injuring Nursery Stock.

A firm of nurserymen and florists at Newark, N. Y., have suffered severely from injuries from white grubs, as appears in the following letter, sent under date of June 18th, 1892:

"We have been corresponding with Dr. Peter Collier, of the Experiment Station at Geneva, N. Y., in regard to corn grubs. He has suggested that you might be interested to know about them, and might be able to recommend something that would help us to get rid of them. Two years ago these grubs destroyed thousands of dollars worth of nursery stock for us; last year they did not trouble us much; this year there appears to be millions of them, apparently about one year old. We do not suppose they will do as much damage this season as they will if let alone till another year, but, we wish, if possible to find some way of destroying them. Any suggestions that will help us in this matter will be thoroughly appreciated by us."

Request was made for some of the grubs to see if they could be identified. Upon their receipt, the following answer was returned:

"The larvæ kindly sent me on the 23d inst., are young white grubs, apparently in the second year of their growth. Whether they are those of the May-beetle, *Lachnosterna fusca*, or even of the genus of *Lachnosterna*, I am unable to say, as we can not identify with certainty, especially when young, any of the many different species of that genus, of which nearly one hundred have been described in their beetle stage [see remarks in 8th Rept. Insects of N. Y., page 175].

"White grubs of *Allorhina nitida*, in experiments made in the Capitol grounds at Washington, were killed by applying freely to the ground, kerosene emulsion of the dilution of one part to eighteen of water (see *Insect Life*, i, 1889, pages 48, 49), and afterward carrying it into the soil by soaking it with water for several days in succession. The grubs were among the grass roots at the depth of from two to four inches when the emulsion was first applied, but were subsequently found dead at various depths down to sixteen inches. The experiment was very satisfactory.

"If this method could be made equally effective with you, it would certainly pay to resort to it. The expense of following the emulsion with repeated water application could, I suppose, be saved, if the kerosening should be done before a rainy spell.

"At what depth do you find the grubs at the present time, and what nursery stock do they mostly infest?

"I wish that you would try the emulsion upon an area of some extent, and, after the rains, dig for the grubs, and see what the effect has been. The low cost of kerosene would permit of its free use if found to be effective. You probably have the formula for the preparation of the emulsion — if not I will send it to you."

In reply to the question of the nursery stock attacked, answer was made: "We raise mostly roses, ornamental shrubs, and grapevines. These grubs attack all of our stock; we even find them at the roots of two-year-old apple, peach, and plum trees, but they do the most damage to the roses. We would like to try the kerosene emulsion, and, if you will kindly send us the formula, we will do so, but fear that it may kill the young rose-bushes as well as the grubs."

The formula for the emulsion was sent as requested, but no report of results from its use has been received.

As the Entomological collection of the U. S. National Museum at Washington, D. C., contains more larval Coleoptera than any other collection in the United States, examples of the grubs noticed above were sent by me to Dr. Riley, at Washington, in the hope that they could, by comparison, be at least generically determined, but unfortunately, by some mishap, they failed to reach their destination.

The enormous aggregate of losses in garden and field crops inflicted by white grubs is offered as a reason for appending to the above some additional words in relation to this destructive class, which will be found of economic importance in directions that will be pointed out.

Professor Forbes, State Entomologist of Illinois, has recently written:* "The white grubs are among the immemorial enemies of agriculture in both worlds, but in neither Europe or America has the problem presented by their injuries on the farm and in the fruit and vegetable garden received a satisfactory solution."

While still unable to recommend entirely effective, simple, and inexpensive methods for destroying these larvæ when infesting grass land or other large pieces of ground, we now know through the labors of Professor Forbes† so much of the life-history of the more common species allied to the May-bug, *Lachnosterna fusca*, that we may say,

* *Seventeenth Report on the Insects of Illinois*, 1891, p. 30.

† On the Common White Grubs, *loc. cit.*, pp. 30-53, plate iv, figs. 1-7.

with certainty, when fields infested with these larvæ may or may not be with safety planted to another crop.

For many years past we have been told that the grub of the May or June beetle required three years for its maturity. The most particular statement of its transformations was that given by Professor Riley in his *1st Report on the Insects of Missouri*, in 1869. According to this, the eggs were laid in the ground after the pairing of the beetles, and hatched in the course of a month. The grubs attained their full size in the early spring of the third year, when they changed to pupæ, and soon thereafter to beetles, emerging from the ground in May. "Under favorable conditions it is probable that some of the grubs became pupæ and even beetles in the autumn, subsequent to their second spring," but remained in the earth until the following spring.

In correction of the above, Professor Forbes has given as the result of his studies upon the white grubs in Illinois (where thirty-one species are known to occur), and more particularly upon six of the most abundant and most destructive species, viz., *Lachnosterna gibbosa*, *L. inversa*, *L. fusca*, *L. rugosa*, *L. implicita*, and *L. hirticula*— the following as their life-history, quoting his carefully considered words:

"It is not too much to say concerning the six species above, and quite possibly of all the others, that they lay their eggs in June and early July; that these eggs hatch in from ten days to two weeks; and that the grubs live in the earth for a number of years unknown, but seemingly at least for two; that they may begin to pupate as early as the middle of June [late spring, but pupæ may be found until September 5th] of the year when they become full grown, and may form the first imago in the earth by the middle of August and the last as late as the middle of September [all in summer], but that they very rarely, if ever, pass the winter in the pupa state. They form the adult in this latitude in late summer and early fall, and escape from the earth the following spring and early summer * * * in April, May or June, or rarely in July."

Presuming, as it seems we may do, that there is a year in which the Lachnosternas deposit their eggs,— identical with the years in which the beetles appear, and that these are separated by a term of years (probably three), instead of there being deposits of eggs in successive years, giving grubs of various sizes and ages in the same field,— we may educe from the above statement of life-history the following:

1. The age of grubs turned up in spring plowing, seemingly about *half-grown*, can not positively be told; it is, therefore, uncertain whether they are to cease from feeding the following spring so as to

exempt from injury by them grain sown in the autumn and crops put in the following spring.

2. If *full-grown* grubs (their size is well known to almost every agriculturist) are found in the spring, no injury to roots will be caused by them after midsummer—during autumn or the following spring,—leaving winter wheat, and corn, potatoes, etc., of the succeeding year free from their attack.

It is interesting to compare the above life-history of *Lachnosterna* worked out in Illinois by Professor Forbes with that published in the *Patent Office Report* for the year 1852, part ii, page 219, by Mr. D. L. Bernard, of Ulster county, New York, which I have quoted in my pamphlet entitled "The White Grub of the May Beetle," being *Bulletin No. 5 of the New York State Museum of Natural History.* These almost precise points of agreement may be noticed: Eggs deposited generally in the month of June (Bernard); in June and early July (Forbes). Life duration of grubs, two years (B.); seemingly two (F.). larvæ mature, middle of June (B.); the same (F.). Pupation, middle of August (B.);* begins middle of June and continues into September (F.). The perfect stage or beetle, about the last of September (B.); middle of August to middle of September (F.). The beetle appears abroad about the last of April or first of May (B.); April — June (F.).

It will be observed that the above life-histories shorten the grub stage by one year from that given by most of our authors and drawn mainly from that of the European cockchafer.

See, also, "Notes on Lachnosterna," by G. H. Perkins, in *Insect Life*, iv, pp. 389–392.

The White Grub Eaten by the Robin.

Mr. W. C. Little, of the Commercial Nurseries, at Rochester, N. Y., has sent me the following note of observations made by him, of the fondness of the robin for the white grub of our lawns and fields, *Lachnosterna fusca:*

I do not remember to have seen it stated in print that the robin is a great feeder on the white grub of the May Beetle. Two or three years ago I noticed the robins industriously engaged in grubbing on our lawns. I thought at first that they were after the earth worms, but their mode of procedure was so peculiar that I was led to investigate and interrupt their operations; and in every instance I found the large white grub at the bottom of the hole which the bird had drilled with its beak — about an inch and a half below the surface. I estimated

* It will be observed that this date is later than that given by Prof. Forbes. They agree as to time that feeding ceases, but Mr. Bernard says that they then "descend deeper in the earth and become torpid until about the middle of August."

that these robins must have destroyed hundreds of grubs on my premises that summer.

In "Bulletin No. 5 of the N. Y. State Museum of Natural History," the robin was merely named among a few other birds that were said to feed on white grubs, in the absence of any definite information of the extent to which they entered into its food. That in addition to its other well-known insectivorous habits, it is also an active white grub destroyer, should certainly increase our regard for it, and secure as far as possible its protection.

A Maple-Tree Pruner, Elaphidion parallelum.

The following communication and reply is from the *Country Gentleman* of September 9th, 1886 :

"I enclose a sample of fallen limbs taken from beneath the ornamental maples that help to beautify the grounds surrounding the country residence of Hon. J. B. Dutcher, Pawling, Dutchess Co., N. Y. These pieces represent portions of boughs that have been cut off by a worm, and have fallen to the ground.

"So extensive is the injury inflicted by these insects that the handsome tree tops are becoming sadly disfigured by the unequal dismemberment of twigs and limbs that daily drop out, even if nothing worse results from it. The section of wood illustrates the manner in which the damage by these pests is effected. A knife has been passed longitudinally through one of the pieces to expose the interior of the wood. It will be seen that the heart or pith throughout the entire length of the piece has been destroyed. You will also please observe that the end of one of the sticks is a cross-cut, made by the worm, the woody part being neatly severed, while the outer covering or bark was left intact. It is a peculiar feature characterizing the work of this worm that it first enters the wood at the junction of a twig or limb with its larger parent stem. Having reached the heart, it turns and follows this until satisfied with the length of the tube bored out, and is then ready to cut the limb off. The reason for selecting a knotty point wherewith to commence business is known only to the instinct which prompts it to injure the tree at all. The work of cutting off the limb is done from its resting place in the heart of the wood, the cut thus radiating outwardly in continually enlarging circles until all is detached excepting the bark. There is, apparently, no aversion to attacking at any point other than a knot at this stage of the work,—the clear wood of the inclosed specimens being squarely cut off at an intermediate point between a growth of knots.

"Nature seldom commits the error of an absolute waste of energy, so it may be assumed that this operator has a mission of some sort, and means business. A little study into the possible object this fellow may have in tree chopping, I fancy reveals an effort on his part simply to reach the ground without exposure, and the boring and cutting is merely a means to an end. The two specimens of worms which accompany the pieces of wood, I hope may reach you lively enough to afford an examination. It is evident that while abundantly able to act on the aggressive, they have no means of defense, and are doubtless toothsome morsels to any prying woodpecker. Their length is one-fourth to three-eighths of an inch, and their body and the absence of any rapid means of locomotion would render them an easy prey, but for instinct of secrecy during the process of severing a limb. The wood is cut squarely in two, but the outside bark is left untouched as previously stated, so that while a wandering woodpecker may go about seeking a sign, no sign can be found.

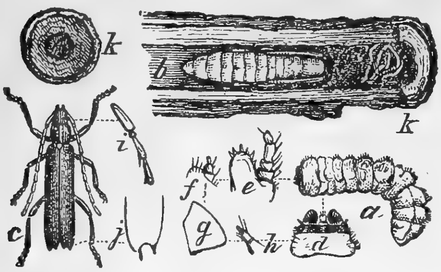

Fig. 29 — Elaphidion parallelum: *a*, larva; *b*, pupa, in burrow; *c*, the beetle; *d*, *e*, *f*, *g*, *h*, head and mouth-parts of larva; *i*, basal joints of antenna of beetle; *j*, tip of wing-cover; *k*, section of cut-off twig. (From Riley.)

"The mission previously referred to, probably includes a scheme of life, covering transformations from one form and habitation to another, until finally emerging into that of a fly or winged moth, which I imagine is the immediate ancestor of this fellow.

"After the wood is cut, securely hidden in the portion of the limb beyond the cross-cut, he has only to wait a passing breeze to have the branch blown off and borne to the ground. Once arrived there safely, he can quit the bough at the first favorable chance and pass into the ground.

"How much damage they may eventually cause to maples can only be conjectured. Nothing similar to this pest has hitherto been noticed in the vicinity of Pawling, and any suggestion through your columns looking to a remedy or preventive will be very thankfully received."

To the above the following reply was made to my correspondent, Mr. A. T. Thomas, of New York city :

The samples of wood sent, the larva (crushed and useless for specific identification), and the account of its operations given, show the cutting off of the limbs to be the work of a longicorn beetle of the genus *Elaphidion*, and of the species *villosum* (Fabr.) or *parallelum* (Newm.). The former, originally described in this country as *Steno-*

corus putator, the oak-pruner, by Prof. Peck, in the *Massachusetts Agricultural Repository and Journal*, vol. v, 1819, is the species that so frequently comes under observation as the pruner of the red and black oaks — occasionally of the scarlet oak. It also, according to Dr. Fitch, occurs in the beech, birch, chestnut, apple, and peach; in the spruce, on the authority of Dr. Haldeman, and in the hickory, according to many writers and my own observations. *E. parallelum* has been bred from some of the above food-plants, and also from plum; in the latter, not as a pruner, it is stated (*American Entomologist*, i, p. 187); also from apple (*id.*, ii, p. 60). It also bores the branches of the orange, according to Mr. Hubbard.

An Elaphidion attack upon maples is not of common occurrence. Dr. LeBaron, former State Entomologist of Illinois, mentions Elaphidion larvæ as well-known pruners of oaks, maples, and other trees (4th Report, p. 154), but I find no record of the particular species bred from the maple. They are not included among maple insects in Dr. Packard's "Insects Injurious to Forest and Shade Trees." The severe attack brought to our noti e in the above communication, is, therefore, of considerable interest, and it is to be hoped that the additional twigs containing the larvæ which I have requested of the writer may be sent to me and will give me the beetles for identification some time during the winter or the coming spring. [They subsequently gave *E. parallelum.*]

The observation of Mr. Thomas of the entering of the larva at the junction of a twig or limb with its larger parent stem, may need some correction. The burrows will, it is true, be found passing from the twig into the branch, but Dr. Fitch is probably correct when he states that the beetle deposits her egg near the tip of a twig of the same year's growth in the angle where a leaf-stalk branches from it. The egg hatching, the young larva burrows into the center of the twig, and consumes all the soft pulpy tissue until only the bark remains, which in its thin and tender condition, withers and dries. By this time the larva has eaten downward in the center of the twig, through the pith, to its base, and onward into the main branch from which the twig grows, passing to the center, an inch or less below the twig. Here, when about half-grown, it proceeds to cut off the branch, in the manner stated in the above communication, and as more fully narrated by Dr. Fitch, of *Elaphidion villosum.*

The account given by Dr. Fitch is quite interesting, and will amply repay for its perusal. It is to be found in his *Fifth Report on the Insects of New York*, pp. 17–24, and also in the *Transactions of the New York State Agricultural Society* for 1858, vol. xvii, pp. 797–812, under the name of the Oak-pruner, *Elaphidion putator.* In his Report 3, pl. 2, fig. 2, is a figure of the beetle. It is also noticed and figured in Dr. Harris' *Insects Injurious to Vegetation*, 1862, p. 98, figs. 47–8–9. Dr. Packard, in his *Guide to the Study of Insects*, 1869, on p. 496, represents the larva and pupa, but the accompanying figure should not be accepted for the imago. Excellent figures of *E. parallelum* in the larva and beetle, with enlargements of portions of the same, and of the pupa in a section of the excised branch, after Riley, may be found in Dr. LeBaron's *Fourth Report on the Insects of Illinois.* [These are given in Figure 29.]

In speculating upon the reason for the cutting off of the twigs by the larva, Dr. Fitch writes as follows: "As the worm is to remain in the limb through the winter, it appears to foresee that, from being wounded, as it is, it will perish and become too dry if it remains elevated in the air; it therefore drops it to the earth, where, lying among the fallen leaves and buried beneath the winter's snow, it remains moist and adapted for the development of the insect within it."

Although secreted within the central portion of the branch, the larva does not enjoy immunity from its foes. Woodpeckers may discover its retreat while still upon the tree, and artfully extract the favorite tid-bit. After the larvæ drop to the ground their burrows are probed, and they are extracted by many of the smaller birds, or eaten by burrowing insects. Certain it is that many of the excised twigs, when examined, will be found without the larva within them.

The branches sent by Mr. Thomas were received about the 20th of July, when the larvæ were already at least half-grown: the eggs had probably been deposited in early June. One of the twigs, four-tenths of an inch in diameter, had been cut off at three inches above where the burrow entered from the twig that nurtured the young larva. A section of a larger branch, over half an inch in diameter, shows the entrance of two larvæ from lateral twigs, one inch and three-fourths apart. In this the burrowing is still going on, as is shown by a large quantity of small, round, hard, whitish grains of excrement which are being thrown out. [Of several branches of red oak received from McGregor, Iowa,— in one, measuring one inch in diameter, the cutting was unusually thorough, passing entirely through the wood and into the bark, leaving only a thin outer film of the bark, so that the branch would break off by its own weight. Another section of a larger branch, measuring one inch and one-half, shows one-fourth of its plane uneaten, so that the action of the wind was necessary to its breaking and separation.]

Dr. Fitch, in writing of the transformations of the oak-pruner, states that some of the worms enter their pupa state the last of autumn, and others not till the following spring, to come forth as perfect beetles in June. Mr. F. Clarkson, of New York city, in a recent number of the *Canadian Entomologist* (1885, xvii, p. 188), states that this insect was very abundant in Columbia county, this State, in 1878, and that the September winds brought showers of twigs and branches to the ground, containing nearly full-grown larvæ, in tunnels of from ten to fifteen inches in length. Some of these, which had been placed in a room having very nearly the condition, thermometrically, of the temperature without, were opened in the early part of November, and were found in every instance to contain the beetle,—the transformation from the larva to the imago having been completed in less than eight weeks. It is not stated whether the season had been an unusually warm one, through which the ordinary development of the insect may have been hastened.

Remedy.— It is seldom that the operations of this insect amount to more than a moderate pruning of the infested trees, but, as in the instance above brought to our notice, they are seriously marring the beauty of the trees that they occupy, it is important that the attack should not be permitted to continue and extend itself. As the insect remains within the fallen branches until the following spring, and it is probable that very nearly all the tunneled branches fall to the ground, we have a simple and easy method of arresting the injuries We have only to collect and burn the severed branches as soon as they fall, or at any time during the autumn, and the deposit of eggs for another brood the following season will be prevented. If danger is apprehended that the species may be continued through a few of the insects remaining upon the tree, watch should be kept for withering ends of branches during the summer and early autumn, which may be removed and destroyed, or the outer limbs may be beaten, after the burrowing operations have ceased, with a moderate force, which would serve to break off any partially excised branches which the winds had failed to remove.

Diabrotica vittata (Fabr.).

The Striped Cucumber Beetle.

A squash plant, of a growth of nine inches above the ground and three inches of stalk beneath, was submitted, June 30th, for examination and for some method of destroying the insects attacking it.

Three of the larvæ of the cucumber beetle were boring into the stalk at about an inch downward upon it, and several round holes were seen that had been made by others — some of them clean cut and others surrounded with irregular erosions; still others were superficial and had not extended into the root. On cutting open the stalk seven nearly full-grown larvæ were taken from its interior, within a length of two inches, in longitudinal tunnels which they had excavated. Figure 30 shows the operations of the larvæ within a root, and Figure 31 the larva in natural size and enlarged.

Fig. 30.— Cucumber root infested with the larvæ of the striped cucumber beetle. (After Fitch.)

The best method of protection from this form of attack would undoubtedly be in preventing the deposit of the eggs on the stalk of the plants by the parent beetle, by covering them during the early stage of growth with a thin loose muslin or netting. By the time that they have out-grown such a protection, they will have attained a sufficient size and vigor of growth to enable them to resist attack unless it be unusually severe. Possibly an early application of the burdock infusion which is noticed in the *Fifth Report on the Insects of New York*, page 158, if repeated at intervals of about a week, would prevent attack by rendering the plants distasteful to the newly hatched larvæ. Kerosene emulsion — one-fifteenth kerosene, poured about the roots would destroy the eggs already deposited and such of the larvæ as had not already burrowed into the root beyond its reach.

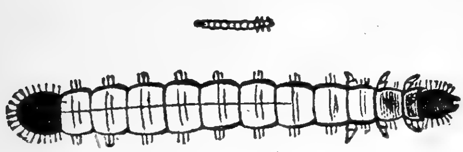

Fig. 31 — Larva of the striped cucumber beetle, Diabrotica vittata, natural size and enlarged. (After Fitch.)

In a communication recently made, by me to the *Country Gentleman* experiments by Professor Weed and others, with remedies and preventives for the beetle were noticed as follows:

A correspondent asks, what is the best remedy and how should it be applied for the destruction of the striped cucumber beetle?

This question is often asked, but can not be replied to satisfactorily. Various preventives are announced from time to time, as invariably giving efficient protection, but when tried by other persons, in different localities, only partial success is reported.

Last year a series of careful experiments were made by Prof. Weed, of the Ohio Agricultural Experiment Station in order to test the value of the various preventive and remedial methods that have been proposed against the beetle, *Diabrotica vittata*. The methods experimented with were divided into these four classes: 1. The use of offensive odors; 2. Mechanical coating of the leaves; 3. Poisonous coating of the leaves; 4. Inclosing plants under tents or gauze-covered frames.

The results of the above, made when the beetles were exceedingly abundant, were as follows:

Of class one, five substances were tested, viz.: hen manure, cow manure, carbolic acid, and bisulphide of carbon. None of these proved practically successful.

Of class two, three substances were tried, viz.: coal soot, gypsum, and saltpetre. Of these, gypsum only showed some beneficial effect, while the other two were worthless.

Of class three, were pyrethrum, slug-shot and peroxide of silicates. Pyrethrum killed the beetles with which it came in contact, but soon lost its efficacy. Slug-shot injured the plants. Peroxide of silicates was beneficial, and saved such plants as had been well started.

Class four, or fencing out the insects, was by far the most satisfactory. It was best accomplished by covering the plants with a piece of cheese-cloth about two feet square, held up by a bent hoop or wire, or two crossing at right angles, and fastened at the edges by loose earth or stones.

It would seem from the above that safety from the cucumber beetle is to be found only by excluding the insect from the plant. This method would, of course, be effectual if all attack from above and below ground could thus be prevented; but unfortunately it is not proof against the operations of the larva in the stalk, or the beetles that may develop from the ground beneath the plants.

It will be observed, however, that only a few substances were tested, and while these proved inefficient, it is not improbable that others, had they been tried, might have given better results. Paris green and London purple were not experimented with. Possibly they would not have been as injurious as slug-shot.

A writer in one of our journals (*Garden and Forest*, for March 12th, 1890), has stated that he annually saves his cucumber plants by sprinkling a handful of bone dust over each hill as soon as the seed-leaves appear, and rarely has to repeat the operation, unless washed off by rain.

A correspondent of the *Rural New-Yorker* claims as a cheap, simple, and effective preventive, spirits of turpentine mixed with common land plaster — about a tablespoonful of the turpentine to two or three gallons of plaster. "In the morning after the plants have shown up nicely, a man goes through the patch, taking two rows at a time, and scatters a small pinch on each hill. The turpentine drives away the beetles, and we seldom make the second application."

Another writer finds safety from the beetle by planting cucumbers and beans in alternate hills. In order to get two crops from the same ground, it is marked in rows three feet apart each way, and planted with melons or cucumbers in hills alternately in one row, and in the next, all beans. The string beans are out of the way in time for the melons to occupy the ground.

Another person has tested the efficacy of beans for ten years, with perfect success, by planting a circle six inches apart around the outer edge of each hill. The beans would come up in advance, and no beetle would molest the cucumbers. (*Country Gentleman*, for November 20th, 1890.)

The Grape Curculio, Craponius inæqualis (*Say*).

A correspondent from Sanford, Tenn., sends grapes that have been stung by an insect, desiring to know what the insect is. The bunch from which the grapes were taken had every one punctured in the same manner. The damage to his crop from this cause was very great, and he could only secure a good crop by bagging the clusters. The grapes showed a small, dark brown spot or puncture on one side, surrounded with a rounded discolored blotch. On opening them, a yellowish-white footless larva with a pale-brown head was found working within the pulp, and having partly eaten one or more of the seeds, somewhat after the manner of the caterpillar of the grape-berry moth. It was recognized as the larva of the grape curculio, *Craponius inæqualis* (Say).

This insect is rather a local one, and is only occasionally reported as injurious to the grape crop, and rarely so, outside of the valley of the Mississippi river, although it ranges, according to LeConte and Horn, over the Middle, Southern, and Western States. It was found by Professor Webster particularly abundant on one of the Ozark mountains in Arkansas, working in both cultivated and wild grapes. I have never met with it in the State of New York, but it is probably occasionally found therein, as it is reported from opposite New York city, at West Hoboken. Its attack can, of course, be prevented by bagging the clusters, and as bagging not only improves the appearance of the grapes, but also preserves them from injury to which they are exposed from several species of insects besides the curculio, and from some of the fungus attacks to which they are liable, it would be well always to resort to this method of protection wherever the curculio abounds. Where this is not done, perhaps the next best means of relief would be that of jarring the beetles from the vines upon a cloth when they visit the berries during the month of June for feeding on them and for depositing their eggs.

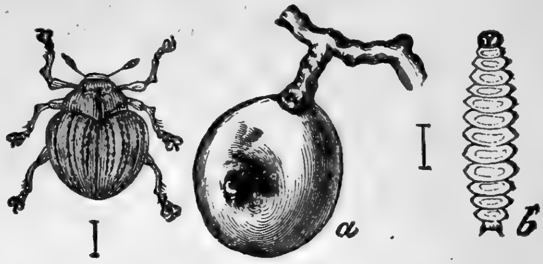

Fig. 32.—The grape curculio, Craponius inæqualis: *a*, grape injured by the larva; *b*, the larva.

The beetle may be recognized by its black color sprinkled with grayish spots; its prothorax with four large tubercles of which the outer ones are acute; the alternate interspaces of the wing-covers the more elevated and somewhat uneven; and its rounded form, unlike the oval of most of the curculio tribe. Its length is rather more than one-tenth of an inch. It is represented in Figure 32.

In August, the larva having attained its growth, drops to the ground and enters it for pupation, where it remains for about a month before changing to the beetle. If during this time the ground beneath the vines could be worked, many of the delicate larvæ or pupæ would be crushed or injured to a degree sufficient to prevent their maturity. The arsenical spraying so effective against the plum curculio, would not be available, it is thought, for protection against this insect. See Walsh, First Annual Report on the Insects of Illinois, 1878, pp. 13–21, fig. 1. Riley, First Report Insects of Missouri, 1868, pp. 128, 129, figs. 70–72. Saunders, Insects Injurious to Fruit, 1889, pp. 300, 301, figs. 311, 312. Webster, in Insect Life, iii, 1891, pp. 452, 453.

The Peach-bark Scolytus, Phlœotribus liminaris (*Harris*).

Mr. George C. Snow, of Penn Yan, N. Y., sent on the 7th of May, peach bark infested with the above-named insect, accompanied by the following note:

I send you by this mail under separate cover a section of peach bark which you will find filled with an insect that is new to me. It may be of interest to you to know that the trees that they are in are literally full of them from collar to branches.

I find an unusually large number of borers in the trees this spring. I am intending to make a mixture of sludge-oil soap, carbolic acid and lime for a tree-wash, to prevent any eggs from being deposited. Do you know of anything better?

Answer.— The insects sent in the bark are a destructive bark-borer, one of the *Scolytidæ*, known as *Phlœotribus liminaris*. Ordinarily it does not attack perfectly healthy trees, and from the fact that it is often found in trees affected with the "yellows,"— years ago it was commonly but erroneously believed to be the cause of the "yellows."

As we are not acquainted with the entire life-history of this species, I hope that you will be able to tell me from your observations whether the beetles are at this time boring into the trees for oviposition or are emerging from them. From the red dust that I find sprinkled on the bark, I judge that they are entering, as the pear-tree Scolytus, *Xyleborus dispar*, is known to do about the middle of May. If the beetles are still resorting to the trees to commence their burrowing in, a thick wash of sludge-oil soap and carbolic acid should repel them. If very thoroughly applied, it might even reach and kill those that had already entered, if they have not penetrated too deeply.

I wish that you would try the experiment of applying with an atomizer to a single infested tree of not great value, undiluted kerosene, over the entire trunk, so as to have it enter the little holes that the beetles have made. I do not think that kerosene thus applied would kill or even injure the tree. I have atomized it freely over rose-bushes and small branches of plum trees, without harm resulting.

If this little beetle once takes possession of a tree—unless it should be found that it can be effectually killed by kerosene as above suggested — the fate of the tree is sealed and it can not long survive. It had better be cut down at once and burned, rather than it should remain as a breeding place for the multiplication of the pest.

The wash that you name will be excellent for excluding the peach-tree borer, and I do not know of a better one.

I have noticed the *P. liminaris* in my Western New York Horticultural Paper of last year—"Late Experiences with Insects," — and in my Fourth Report—in each quite briefly.

Albany, *May* 8*th*, 1891.

From the small piece of bark received from Mr. Snow, there were found on June 15th in the box in which it had been placed, four dead and one living *P. liminaris* beetles, with living ones still in the bark.

To those who still entertain the belief that this beetle, in its attack of peach trees is the cause of the "yellows," the reply made by me, through the *Country Gentleman* of November 3d, 1887, page 837, to an inquiry from Ringwood, Ontario, Canada, may be of interest:

Inclosed I beg to hand you specimens of an insect taken from one of my peach trees. The inspectors for the yellows have recently been through this district, and on examination, have condemned several trees in my orchard and others. They say that the presence of this insect is a sure indication of the yellows; also an examination of the now little remaining fruit they say also shows signs of the disease by the pinkish appearance of the flesh around the stone. The insect appears to bore into the bark at the butt of the tree, similar to the borer, but above ground, showing a small amount of sawdust around the hole. Would you kindly give me through the columns of your valuable paper your opinion? While being perfectly willing to destroy the trees if so advised, we are not quite so sure of the experience of our inspectors to justify us in destroying our orchards. E. F. O.

The insect sent, taken from peach trees, the presence of which, according to the statement above, fruit-tree inspectors of Ontario pronounce to be a sure indication of "yellows," is one of the *Scolytidæ*, or bark-boring beetles, known as *Phlœotribus liminaris* (Harris). Its presence in a tree by no means shows the existence of "peach yellows" therein. Many years ago, Miss Morris found the beetle under the bark of peach trees affected with the yellows, and hence supposed that it was directly connected with that malady (*Downing's Horticulturist*, iv, p. 502, and Harris' *Insects Injurious to Vegetation*, 1862, p. 88). Dr. Harris and Dr. Fitch each found it under the bark of elms, where it occurs so often that it has been written of by Saunders in his *Insects Injurious to Fruits*, and by other writers, as "the elm-bark beetle."*

This beetle, like most of the other members of the *Scolytidæ* family, does not attack a peach or other tree for breeding therein (it may for feeding purposes) unless it be in an unhealthy or diseased condition. Injury from frost might invite its attack, or the presence of the peach-tree borer, *Sannina exitiosa*, in burrows about its base. According to Professor Penhallow, the operations of this last-named insect produce symptoms in the infested tree so like those of the yellows that they might easily be mistaken for it. The same writer, who has given earnest study to peach-tree yellows, states that the *Scolytidæ* can not in any way be connected with that disease, or even be considered as a predisposing cause.

I have, at different times, received the beetle under consideration, *Phlœotribus liminaris*, from peach-trees in localities where the yellows has not been known. Positive indications of this mysterious disease (its cause as yet not ascertained) must be found in other than insect presence.

The following have been named by authorities as reliable indications:

1. The production on the main stem and along the branches, of a multitudinous growth of slender, wiry, shoots, having small, narrow, yellowish-colored leaves.

*It has since been ascertained that it does not occur in the elm, but that another species, *Hylesinus opaculus*, had been mistaken for it.

2. The premature ripening of the fruit, which, when first attacked may be nearly normal in size, but becomes smaller each year, with its surface spotted more or less, and the flesh more deeply colored around the stone (*U. S. Dept. of Agriculture — Report of the Statistician*, No. 43).

An Unrecognized Attack on Pease.

Mr. B. W. Gregory, of Liberty, Sullivan Co., N. Y., reports in a letter of August 9th, 1892, the following injury to his pease:

Inclosed please find samples of peas: can you tell me what the matter is with them? They are not attacked by birds or by fowls, for I have watched them closely, nor have I been able to find any insect working on them. The vines are perfectly healthy and vigorous, and are of the Sexton's Alpha variety. The first picking from them was about June 25th, at which time four-fifths of them were affected like the sample. The later pickings were less injured. I picked from the same vines to-day and those sent [five pods] were all that I found. Other beds in the neighborhood are affected in the same way. You will observe that the lower end is cracked open, which is invariably the case when I find them, and the pulp is all taken out. Whatever insect does the work, I think does it at night.

In the pods sent, they had split open at the lower end, but the sides were closely adherent. From all of the pease within, the pulpy portion had been entirely removed, leaving only the outer wall, in more or less irregular shape.

In the absence of any knowledge of such an injury, which seemed, in all probability to be that of an insect, and as there was no possible clue to the depredator, the specimens, while still fresh, were taken to the meeting of the Association of Economic Entomologists at Rochester, and shown to those present. While all concurred in the belief that it was an insect attack, no one could assign it to any known insect.

Mr. Gregory was requested to keep careful watch another year and to report any discovery that he might make.

The Plum-tree Aphis and the Brown Rot.

Mr. J. W. Smith of Schoharie, N. Y., sends, June 5th, 1891, an aphis which is badly infesting his plum trees. Nearly all of them are winged, with a black head and thorax, a green abdomen, spotted with black, and yellowish legs. Plums are also sent, marked with a large ovoid brown spot, extending over nearly one-half the length of the fruit.

Usually one spot only appears, but in one example three are seen. They were accompanied with the following note:

I send you by this mail, plum leaves covered with plant-lice, also some plums that are affected from some cause. The trees from which these plums were taken have been sprayed with strong soapsuds. What can be used to spray the trees that will kill the lice and not injure the tree and its fruit? They are becoming very thick, not only on plums, but also on cherry and peach trees.

Mr. Smith was answered that the plant-louse infesting his plum trees, was the plum-tree aphis, *Aphis pruni* Fabr. Their multiplication could have been kept down by throwing a strong soapsuds or tobacco water upon them, if it had been done earlier and before they had commenced to acquire wings. A kerosene emulsion of a moderate strength would have been still better. But unfortunately it is quite difficult to reach the insects, gathered as they are on the underside of the leaves, where they feed. They could best be reached by a Vermorel nozzle attached to the end of a rod, and throwing an upward fine spray. This species so seldom appears in destructive numbers that the above report of its presence is rather a surprise. It is probable that its numbers will show a diminution soon, although it continues on the plum throughout the season, not migrating to another food-plant, as do some other species, as notably the hop-vine aphis, *Phorodon humuli* — its associate during the early spring.

The affected fruit has been attacked by the fungus known as the "brown rot," *Monilia fructigena* Pers. For this, spraying with a copper solution would perhaps be the best that can be done, but it is not probable that it would be of much benefit at this time when the fungus has made so great progress. It should have been done, as a preventive, before the leaves expanded in the spring, and at intervals thereafter.

The cherry aphis (*Myzus cerasi*) reported, is still more difficult to reach. The kerosene emulsion should have been used upon it on its first appearance, before it had multiplied to the extent of sheltering its myriads within the curled leaves which accompany its attack, where they are virtually inaccessible.

The peach-tree aphis, *Myzus persicæ* (Sulzer), although curling the foliage to a certain extent, may be more easily reached by the kerosene emulsion than the preceding species. Destructive pests as are most of the plant-lice, and of prodigious powers of multiplication, they are by no means beyond control if operations are commenced against them soon after their first appearance, or if proper sprays are applied to the plants or trees that they infest while the foliage is absent, to kill their eggs.

The Currant Aphis, Myzus ribis (*Linn.*).

I send you with this, leaves taken from the currant bushes in my garden which show the ravages of some insect which seems to be doing considerable injury to the bushes, or rather leaves of the same, although as yet not sufficient to prevent their bearing fruit and making considerable growth. I first noticed their work some weeks ago in the crumpled appearance of the leaves — not to any great extent then, but it has steadily increased until the present time. I notice, too, of late, that a small black ant is apparently attacking or feeding on the larvæ very freely on some of the bushes.

Will you kindly inform me what the insect is, and what is the remedy for the same without injury to the bushes.— C. J. H.

Unadilla, N. Y., July 3, 1891.

The insect that curls the leaves and lives within the folds is the currant aphis, *Myzus ribis*, (Linn.), which is frequently found on currant bushes from May to July. In some seasons it multiplies prodigiously and proves quite injurious, while in others it is early attacked by one of its natural enemies, the larva of the two-spotted lady-bug, *Adalia bipunctata*, and brought under control — at times completely exterminated, as was observed in my garden the present season. A minute hymenopterous parasite also frequently attacks it by depositing an egg within its body, which in a short time consumes its interior and escapes through a round hole made in its back. Nearly all of those which were found upon the leaves received from you had been destroyed in this manner, and the little parasite has apparently been rendering you valuable service.

These plant-lice, as with most other species of the family, may be killed by the application of a whale-oil soap solution, or tobacco water. As these kill by contact they must be so applied as to reach all of them — rather a difficult matter within their shelter of curled and crumpled leaves. A Vermorel nozzle attached to the hose of a force pump, will be found an efficient implement for this purpose, as, by the aid of a rod, it can be held beneath the bushes, and a mist-like spray thrown upward which should readily diffuse itself over and within the curled foliage.

Where this apparatus is not at hand, the bushes of a small garden may be treated by bending over the branches by hand and dipping and shaking them within the pail or other vessel containing the insecticide.

The little black ants that you observe in association with the aphides are not destroying them, but are giving them all the protection in their power, even by driving away some of their predaceous enemies that they may continue to feast upon the honey-dew which the aphides give out, through the two honey-tubes that may be seen projecting backward from the upper side of their abdomen.

Aphides and Myriapods, as Aster and Lily Pests.

A correspondent from Central New York has made inquiry of remedies for protection from some pests attacking lilies and asters.

It is important and desirable that in all cases where information of the kind is desired, that the insect complained of should accompany the inquiry. It may be possible that from the few descriptive words contained in an inquiry, recommendation of some general method may be made which is available against many insects of the family; but there are special remedies often to be employed for certain insects, and for this, specific determination of the pest of which complaint is made, is all important. Such positive determination might often, as in the present instance, in its contributing to our knowledge of our insect pests, more than compensate for the time expended in replies returned possessing no special scientific value.

Last year my aster plants, after growing finely, became yellow and ceased to make progress. On pulling up several, I found the roots covered with very minute white objects, and working actively among them were myriads of red ants. The white creatures possessed life and motion. This spring I find the same ruinous condition about the roots of self-sown seedling asters. What can I do?

My lilies suffer from the attack of small worms which eat into the stalk below the surface. The worms are as slender as pins, half an inch long, varying in color from white to shiny brown, with two conspicuous antennæ, and an infinite number of legs. The lilies are sometimes cut down by them when the stalks are as big as my thumb and full of flower-buds. Is there a method of extermination?

The aster insect is probably a root-feeding plant-louse or aphis. Professor Thomas has described a form living on roots of asters and the iron-weed, and varying in color from leaden-gray to white. As this species bears conspicuous honey-tubes, the ants associated with "the minute white objects" may have been drawn thither to feed on the honey-dew secreted by the aphides. Professor Thomas named the species *Aphis Middletonii* n. sp.* Mr. G. W. Oestlund, in writing of this aphis as observed by him in Minnesota, refers to "the ants which were always found to attend this species." †

The root-inhabiting plant-lice may be killed by removing the ground from over the roots until they are exposed, and drenching them with soap-suds, tobacco water, or pyrethrum water. Hot water poured over

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* *Eighth Report of the Insects of Illinois*, 1879, page 99.

† Bulletin No. 4, of the Geological and Natural History Survey of Minnesota. *Synopsis of the Aphididæ of Minnesota*, 1887, page 55.

the roots upon the ground would also kill the aphides, but care should be exercised not to apply it at too high a temperature, by first experimenting with a single plant.

The lily pest of which complaint is made, is, without doubt, a species of "thousand-legged worm," belonging, not to the insects, but to the Myriapoda. Many of these species are known to feed upon the roots and underground portion of the stalk of various plants. Lime water has generally been recommended for killing them, as also nitrate of soda spread about the stalks and water poured upon it to carry it into the ground.—(*Country Gentleman*, of June 23d, 1892.)

FIG. 33.—Thousand-legged worms.

The following notice of these insects and suggestions of remedies for them, is from the *New England Homestead* of August 24th:

Blight in Asters.—When asters blight or look yellow the trouble is often caused by root-lice. They are of two kinds, the white and the green. When planting, wood ashes should be raked in freely where the plants are to stand. To kill these pests, take a watering pot holding eight quarts of water and stir in three tablespoonfuls of hellebore. Water the plants thoroughly so that the water will soak in around the roots. Tobacco water or kerosene oil in dilution is also good.

Kent county, R. I. W. H. T.

Some Apple-tree Insects.

The fruit-growers of our county have learned to look to you for counsel and advice in time of trouble. My apple orchard is infested with more lice than all Egypt produced in the lifetime of Moses. I send you specimens in No. 1 of the most numerous of these foul insects. They cover and enwrap themselves in the foliage, and eat and destroy, as you will see on examination of what I send you. They also nest under the loose bark of the limbs and body of the tree.

There is also a green louse, not nearly so numerous, that gathers on a part of the apple which is covered by foliage, seemingly trying to hide themselves from view. They do not appear to eat the apples, but simply cluster in droves on the covered or hidden part of the fruit—perhaps doing no serious harm.

I inclose pieces of bark covered with lice which seem to be dead. There are a good many of these. Are they of any special harm to the trees; if they are, what is to be done to destroy them?

I have suffered greatly from the bud-worm—a little brown, black-headed worm or insect. I sprayed for these about the 12th of May with Paris green and London purple, but I suppose that I was ten or twelve days too late. The spraying may have affected them some, but I think not much.

I inclose some imperfect fruit, the checked development of which is probably caused by the lice destroying the foliage surrounding it. Is there any indication in the examples sent of the workings of the codling-moth worm? Would you advise any more arsenical spraying? I sprayed for the codling-moth on the 3d and 4th of the present month, and again on the 15th.

I suppose that all these fruit enemies have their period of active work, after which they retire for the season. Is there anything at this late day to be done that will be of benefit for this year? Kindly suggest anything that will promise to give relief. I have about a third of a crop of apples at the present showing, some of which are very fine and healthy looking.— N. M. R., Oswego, N. Y., June 29th.

The apple twigs sent show an unusually severe attack of the apple-tree aphis, *Aphis mali* Fabr.. which is present in the different stages of its growth. The curled and blighted condition of the leaves and much of the dwarfed and distorted forms of the fruit, shown in No. 1 package, is the result of the operations of this pest.

The green lice represented as clustering on the fruit where it is covered by the foliage are probably the young of the same insect — none being on the fruit when received, and no other similar species being found on the twigs. I do not know that the apple aphis ever punctures the young apple to feed upon it; nor do I know that it ever clusters under the loose bark of the limbs and trunk of the tree.

The multiplication of this plant-louse to any approach to that now shown might have been prevented by a few sprayings with the kerosene emulsion when it first appeared; and it is not too late now to derive some benefit from this treatment.

The "pieces of bark covered with lice" show the peculiar oyster-shell scale of the apple-tree bark-louse, *Mytilaspis pomorum* (Bouché) — an extremely common pest of the apple-tree. The scale is an excretion from the insect proper which covers the eggs when deposited. These insects, minute as they are individually, but making up in their incredible numbers, are always injurious to the tree, robbing it of its vitality through the draught made upon its sap, and thus predisposing it to other insect attacks. They can best be destroyed by spraying them, at the time when the young are hatching from beneath the scale, with a strong kerosene emulsion. (See *Fourth Report on the Insects of New York*, pp. 114–120.)

Fig. 34.—Scales on apple bark of the apple-tree bark-louse, Mytilaspis pomorum.

The bud-worm, *Tmetocera ocellana* (Schiff.), has wrought severe injury in the orchards of Western New York this season — greater by far than known before. It should be controllable by arsenical spraying, but, to make this effective, it must be resorted to early, when the caterpillar commences to feed upon the leaf buds. Later, it is of little service. The life-history of this insect has been published, but we believe has not been altogether correctly given.* Further study will undoubtedly show some simple and effective method for preventing its destruction of the buds and blossoms and twigs.

In addition to the injury to the fruit, as stated above, by the large amount of sap drawn from the leaves and twigs by the myriads of plant-lice, a portion of it has been scarred by the burrowing into it of a "case-worm"— a species of *Coleophora*, which is being studied at present.† The small caterpillar projects its front segments from its case, and eats round holes into the apples to a moderate depth and of about the diameter of a large-sized pin. Several of the apples have been excavated or deeply pitted by a larger caterpillar — one of the "leaf-rollers," and probably *Cocœcia argyrospila* (Walker), which is known to inflict similar injury to pears. The remedy for these two insects would be arsenical spraying. None of the fruit shows the presence of the apple-worm of the codling-moth. The timely spraying with Paris green seems to have prevented it.

During the coming month of July, most of the more destructive apple pests will have passed away, and the insects occurring then and later would be more effectively reached by a kerosene emulsion than with Paris green. The number of the sprayings during the spring and early summer should be governed by observation of the species of insects operating, and the amount of harm that they are inflicting.

Beet Insects.

The following inquiry in regard to serious injury to beets in the vicinity of Rochester, N. Y., was answered, as below, through the *Country Gentleman* of July 16th, 1891:

I send beet plants, and would be greatly obliged if information can be given as to what the insect is that has been affecting not only the market-gardener's sale of greens for the past three years, but also the subsequent growth of the beets.— J. H. C.

There is no one insect that is answerable for the recent injury to the beet crop mentioned above. The increased cultivation of the beet in our country, as encouraged by the beet-sugar industry, has added

* It has subsequently been fully worked out by Mr. M. V. Slingerland, and published in Bulletin 50, March, 1893, of Cornell University Experiment Station.

† The insect has since been described by Prof. Fernald as *Coleophora Fletcherella*. See *Canadian Entomologist*, xxiv, 1892, p. 122.

largely to the number of its attacking insects, and at present the list of its known depredators embraces sixty-four different species.

The beet plants submitted for examination, show the operations of several distinct species. The principal of these seems to be a plant-bug which punctures with its beak the leaf or stem for sucking its juices,* and leaves an unsightly deadened spot and scar. On one of the leaves a hundred of these spots may be counted. Many of these are probably caused by that great pest of our gardens and orchards, the tarnished plant-bug, *Lygus pratensis* (Linn.). A number of these operating together upon the plant would not only mar the leaves in this manner, and render them undesirable for "greens," but would also tend to arrest the growth and development of the beet itself.

In some of the plants, irregular holes have been eaten in the leaves, which may have been by one of the several species of flea-beetles which are known to operate upon the beet in this manner. One of the most injurious of these is the "pale-colored flea-beetle," *Systena blanda* (Melsh.), while another is the very common "striped flea-beetle," *Phyllotreta vittata* (Fabr.), sometimes known as the turnip flea-beetle from its special fondness for this plant, although almost equally injurious to the radish and other of the *Cruciferæ.*

On a few of the leaves transparent spots were observed, which are probably the commencement of the attack of one of the beet-leaf mining-flies. This ordinarily commences about the middle of June, and it soon increases to such an extent that the leaves can no longer be used on the table for "greens." On holding them up to the light—within large semi-transparent blotches, a goodly-sized larva or "maggot," as commonly termed, may be seen industriously cutting out and feeding upon the inner material (parenchyma) of the leaf. The growth of these larvæ is completed during the latter part of July, when they creep out from the leaves and enter the ground for pupation. Early in August the pupæ give out the perfect insect, which is a fly, somewhat resembling the common house-fly, but of a smaller size, and quite nearly allied to the onion-fly. For an account of these beet-leaf miners, of which three distinct species are known to me, my *First Report on the Insects of New York*, 1883, pp. 205–211, may be referred to.

The best protection from the injuries of the insects above noticed is probably to be found in the application to the plants at the proper time of kerosene emulsion. The proper time would be when the insects first make their appearance, as the emulsion does not drive away, but kills by contact. If made of the usual strength recommended — one part of kerosene to fifteen of water — it would not interfere with the use of the

*See G. C. Davis, in Bulletin 102, of the Michigan Agricultural Experiment Station, 1893, p. 6.

leaves for the table after rains had washed the foliage. The emulsion would also kill the eggs of the leaf-miners which are deposited on the upper surface of the leaves.

No attack upon the beet itself (root-bulb) could be discovered, either of insect or of the nematode worms which are infesting the roots of so many of our vegetables and garden plants. Most of the beets seemed unusually small, but their dwarfing, if really such, may have resulted from impaired leafage or soil condition.

An interesting and valuable paper on the "Insect Enemies of the Sugar Beet" has lately been published by Mr. Lawrence Bruner, Entomologist of the Nebraska Agricultural Experiment Station, and contained in Bulletin 16, vol. iv, of the Station. For copies, the Station might be addressed, at Lincoln, Neb.

Diseased Austrian Pines.

The following communications relate to a diseased condition of Austrian pines and some other evergreens, which is not confined to the two localities indicated, but occurs elsewhere in the State,—perhaps more particularly in its southeastern portion :

Dear Sir.—I send you twigs of Austrian and California pines from trees in this place, showing disease, and beg the favor of information and advice either written or printed. This place is the estate of the late Colonel Howland, who was treasurer of the State in 1866. The ornamental or planted part is about 60 acres, and the trees were all carefully chosen and planted during the war, and have made excellent vigorous growth for thirty years. White pines and others have been struggling with disease for several years, and now are dying by ones and twos. But perhaps something may be done to save the others. The California (Bentham) pine has looked brownish for two years. The Austrians seem a case of sudden decay. The foliage of a whole group looks curled and dry, and boughs here and there turn brown, then yellow, and are dead. On supposition that it is caused by insect attack, I venture to address your office. A. M. W.

MATTEAWAN, DUTCHESS CO., N. Y.

Dear Sir.—I send you by mail a specimen branch of an Austrian pine (*Pinus Austriaca*) showing the manner in which several of my finest trees are affected. I can not find the trace of any insect, and I would thank you if you are able to give me any explanation of the cause and a cure for the attack. I have among the same group of trees white pine, balsam fir, red cedar, Scotch pine and Norway spruce, none of which are affected. A. F.

Mastic, Moriches P. O., N. Y.

The twigs, of which an ample number were sent with the first communication (received about the middle of September) did not at the first glance show serious injury. Upon closer examination, however, the tips of many of the leaves were found to be dead, shriveled, and brown. A large number were marked with small brown spots, which in some instances showed a depression or seeming puncture, while a few of the leaves were brown and dead for most of their extent. At the end of the twigs among the bases of the leaves, pitch had exuded to an extent, presenting the appearance of an inflorescence, and clearly indicating some abnormal state.

As the cause of the condition was not apparent on a cursory inspection, a careful microscopic examination was made in order to detect, if present, the suspected attack of some gall-mite, of the family of *Phytoptidæ* — such as are being found to infest many of our trees, both deciduous and evergreen, in their buds and leaves — one of which was noticed in the *Country Gentleman* of October 2d, under the heading of the "Pear Leaf Blister." None could be found, nor any indication, through exuviæ or eggs, of their previous occurrence. A few quite small insects of a different group were seen running rapidly over the leaves, but no part of the injury could be charged upon them. Several examples of a minute, black, shining thrips were detected upon the leaves and within the basal sheaths, but these, also, were at least harmless, and may possibly have been beneficial, as many of the species are believed to be of carnivorous habits. A few examples of a white scale-insect, *Chionaspis pinifoliæ* (Fitch), occurred upon the leaves, but their number was by far too small to have occasioned any serious injury.*

In the inability to detect insect injury, the twigs were submitted to the State Botanist, Prof. Peck, for examination for fungus attack. The brown spots and browned tips were carefully examined under a high power, but no fungoid injury could be discovered, except in the dead tips received from Mastic. In these, however, the fungus observed had evidently followed their death, and could not have been its cause.

*This pernicious scale has for some time been present in immense numbers on the Austrian pines in Washington Park, Albany, overspreading and whitening the surface of the leaves, and causing the death of a number of the trees, and a greatly impaired condition of others. On the worse infested trees from 100 to 200 scales could be counted on a single leaf.

It would seem, therefore, that the unhealthful and diseased condition of the evergreens is owing to some unfavorable soil condition or atmospheric influence, akin to, or possibly identical with, those that are affecting fruit trees (to an unusual extent this year), where the blossoms or leaves blight or die and are cast from the tree, and the fruit, if any, also falls. While many of the diseases infesting our trees are clearly traceable to fungus attack or bacterial presence, for others no satisfactory reason can be assigned. Among these is one which has lately been brought to my notice, as causing the death of the white pines on Beede mountain, near Keene valley, in the Adirondacks. A local name for the disease is "ring-rot," but why it should have been so called is not obvious. From account received from Forest Warden Parker, through Secretary Train of the Forest Commission, the attack is first to be seen in discoloration of the inner bark, arrest of circulation beneath it, and consequent death of the wood adjacent. It may occur on any portion of the trunk or limbs. The wood thus killed becomes brittle, valueless for working, and all that can be done is to fell the tree and convert it into lumber upon the first indication of the disease, and before it has spread.

It is not at all improbable that the affection of the evergreens in Southern New York, above noticed, is due to soil conditions. The Austrian and Californian pines might naturally be expected to respond more quickly to any unfavorable surroundings than would our native species. While the cause of this difficulty is for the present unknown, it would be well to make the experiment of applying fertilizers to the trees, in the hope that some exhausted or lacking material might be restored or given to the soil, or growth and vitality so stimulated that the disease or the attack, whatever it may be, may the better be resisted and overcome.

The State Botanist suggests that a liberal application of hard-wood ashes, would, under the apparent conditions, give promise of the best results.— *Country Gentleman*, for October 16, 1890.

Note.— Mr. William F. Fox, Superintendent of State Forests, has informed me of another form of "ring-rot" in the white pine long known to him, in which a decay within the trunk occurs, usually midway between the sapwood and center, and encircling the heart as a cylinder of decayed material extending from the base upward for fifteen feet or more.

APPENDIX.

(A)

CATALOGUE OF THE KNOWN HOMOPTERA OF THE STATE OF NEW YORK IN 1851.

The following paper by Dr. Asa Fitch, was published in the *Fourth Annual Report of the Regents of the University of the State of New York on the State Cabinet of Natural History*, 1851. Its scope is stated in the note by the author that precedes it. From the large number of original descriptions that it contains, viz., of eighty species and six genera, it has been a desideratum to many students working in this suborder, which, from the report having long been out of print, could only be supplied through the labor of transcription.

In this reprint, it is designed to reproduce the paper in its original form, *litteratum et punctuatum*, with the exception of the introduction in the text of the small reference figures, indicating corrections in the names, or notes thereon given in supplementary pages. The paging of the Fourth Report is retained in the catalogue, in brackets.

In compliance with request, Mr. E. P. Van Duzee, of the Grosvenor Library, Buffalo, N. Y., has kindly made revision of the nomenclature of the Catalogue as far as the Psyllidæ, and indicated such changes therein as are accepted at the present time. The remainder of the catalogue, comprising the Psyllidæ, Aphididæ, and Coccidæ, has been revised and annotated by Dr. C. V. Riley. The names in the catalogue unaccompanied with the reference figures are unchanged.

The case of Homoptera, arranged by Dr. Fitch, to accompany and illustrate the catalogue — each specimen indicated by name and number cut from the catalogue — was placed in the collections of the New York State Cabinet of Natural History in 1850. During ensuing years it became infested with Anthrenus and other museum pests, and a number of the specimens were destroyed. In 1879, those that had escaped destruction were removed and arranged with the original labels in a new case, which has since been in charge of the State Entomologist in his office in the capitol. A slip attached to the case states that it contains the TYPES of fifty-four species and five subspecies described in the catalogue. The Psyllidæ were all destroyed ; of some of the Aphididæ portions are remaining. In the other families, the structural features remain for comparison, but the colors have become so seriously impaired that they would be almost valueless for study.

(C.)

CATALOGUE

WITH REFERENCES AND DESCRIPTIONS

OF THE

INSECTS

COLLECTED AND ARRANGED FOR THE

State Cabinet of Natural History,

BY ASA FITCH, M. D.

The following paper comprises all the New York *Insects of the sub-order Homoptera* known to me, except some of the minute species, to determine which required further researches. The species and genera that are here presented as new, are indicated by an asterisk preceding the scientific name, and a brief description of these, embracing their essential characters, is added. To the described species is appended a reference to the name of the author and the place where the original description will be found.

In the generic arrangement of these insects, Amyot and Serville's *Hist. Nat. des. Ins. Hemipteres*, Paris, 1843, and Westwood's Synopsis of British Genera, have been my chief guides. An acknowledgment is due to the Rev. D. Zeigler, of York, Pa., for a copy of Germar's paper on the genera Clastoptera, &c., in the *Zeitschrift f. d. Entom.;* and to Dr. T. W. Harris, of Harvard University, who has been so kind as to place temporarily in my hands his entire collection of Homoptera, including the several species named in his Catalogue, and also those magazines and other publications which contain all the more important papers of Germar, Spinola and Fallen upon this order of insects. I regret that these latter favors were not received in season for me to avail myself of them in preparing the following paper, though it is not probable they would vary it in any important point from the shape in which it is here presented.

Albany, February 22d, 1851.

INSECTS.

FAMILY CICADIDÆ.

CICADA. Linn.

[1] Frosted Cicada, *C. pruinosa*, (Say.) Jour. Acad. Nat. Sci., vol. iv., p. 330. The specimen was taken near the east end of Long Island. No. 609, male.

Dog-Day Cicada, *C. canicularis*, (Harris.) Inj. Ins., p. 175. No. 610 male; 611, female.

Creviced Cicada, *C. rimosa*, (Say.) Jour. Acad. Nat. Sci., vi. 235. Two specimens were taken in Washington county the middle of June, 1845. As these are the only ones I have ever met with, I am led to suspect that, like the following, this species may be periodical in the time of its appearance. No. 612, female.

[2] Seventeen-year Locust, *C. septendecim*, (Linn.) Syst. Nat. ii. 708. No. 613, male.

FAMILY FULGORIDÆ.

CIXIUS. Lat.

Stigma-spotted Cixius, *C. stigmatus*, (Say.) Jour. Acad. Nat. Sci., iv. 336. On various trees and shrubs. No. 614, male; 615 female.

Pine Cixius, **C. pini*. Elytra with a few fulvous, cloud-like spots; destitute of a larger black stigma and black band at the base. Length to the tip of the elytra, 0.23, (twenty-three hundredths of an inch.) Found on spruce, fir, and pine. Smaller than the preceding, and evidently distinct. No. 616, male; 617, female.

4 Impunctate Cixius, **C. impunctatus*. White, dorsum yellow; two bands on the front, two dots on the vertex, and two on the prothorax, black; elytra brownish-pellucid, immaculate, nerves impunctate. Length, 0·23. Found on oaks. No. 618, male.

Var. *a*. The whole upper half of the face black. No. 619, male.

5 Five-lined Cixius, *C. quinquelineatus*, (Say.) Jour. Acad. Nat. Sci., vi. 241. No. 620, female.

DELPHAX. Fab.

6 Field Delphax, **D. arvensis*. Pallid-yellow, immaculate; elytra and wings pellucid. Length 0·17. Common in fields of wheat early in June. No. 622, male; 623, female.

7 Dorsal-striped Delphax, **D. dorsalis*. Dull yellow, dorsal vitta white; elytra dusky, middle apical nerve and a small dot on the tips of the outer apical nerves black; facial carinæ white, interstices black; tergum black, with a dorsal and lateral vitta orange red; legs pale yellow, striate with black. Length, 0·20. No. 621, male.

OTIOCERUS. Kirby.

Degeer's Otiocerus, *O. degeerii*, (Kirby.) Trans. Linn. Soc., xiii. 16. On various trees. No. 624, male; 625, female.

Coquebert's Otiocerus, *O. coquebertii*, (Kirby.) Tr. Linn. Soc. xiii. 18. Sometimes abundant on grape vines; also on beech and oak trees. No. 626, male; 627, female.

Var. *a*. The elytral vitta dividing into three branches. No. 628.

b. The vitta not prolonged upon the sides of the thorax. No. 629.

Wolf's Otiocerus, *O. wolfii*, (Kirby.) Tr. Linn. Soc., xiii. 19. Taken on walnut bushes. No. 630, male.

Abbot's Otiocerus, *O. abbotii*, (Kirby.) Tr. Linn. Soc., xiii. 17. Taken on oaks. No. 631, male; 632, female.

Kirby's Otiocerus, **O. kirbyii*. White; elytra without dots, with a faint brownish band from the middle of the inner to the apex of the outer margin, and spot on the apex of the inner margin. Length, 0·42, to the tip of the elytra. Found on oaks. No. 633, male; 634, female.

ANOTIA. Kirby.

Bonnet's Anotia, *A. bonnetii*, (Kirby.) Tr. Linn. Soc., xiii. 21. On willows, about the middle of September. No. 635, male; 636, female.

PŒCILOPTERA. Lat.

[8] Frosted Pœciloptera, *P. pruinosa*, (Say.) Jour. Acad. Nat. Sci., vi. 237. No. 637, male; 638, female.

[9] Common Pœciloptera, **P.* (?) *vulgaris*. Blackish-pruinose; elytra with a transverse row of pellucid-white points beyond the middle; legs pallid, femurs blackish; ventral segments edged with orange; medial carina sometimes obsolete. Seems more allied to this than any other genus, though the simple neuration of its elytra, and some other marks, present discrepancies to this association. Length, 0.20. Common on various shrubs and trees. No. 639, males; 640, female.

FAMILY MEMBRACIDÆ.

ENCHOPHYLLUM. Amy. and Serv.

[10] Two-spotted Enchophyllum, *E. binotatum*, (Say.) Appendix to Long's Exped., p. 301. Common on numerous plants and trees. No. 641, male; 642, female.

Var. *a*. Color brown. No. 643.

[11] Broad-footed Enchophyllum, *E. latipes*, (Say.) App. to Long's Exp., p. 302. No. 644, female.

ENTILIA. Germar.

Notch-backed Entilia, *E. sinuata*, (Fab.) Entom. Syst. Suppl., p. 513. No. 645, male; 646, female.

Sub-species **torva*. Front somewhat concave, causing the anterior foliole to incline slightly forward. No. 647.

[12] Hollow-backed Entilia, *E. concava*, (Say.) App. to Long's Exp., p. 301. That part of the generic definition which represents the thorax as "foliaceous and deeply notched" does not apply to this species. In all other respects this is so closely related to the preceding as scarcely to call for a generic separation. Both species occur on various herbs and trees, particularly on the Canada thistle, where the larvæ are, like plant-lice, attended by ants, which protect them and subsist upon their saccharine secretions. No. 648, male; 649, female.

[13]*CARYNOTA.

(Gr. χαρα, roundish, νωτος, the back.) Head broad, triangular; thorax in form of a half cone, not compressed above into a sharp or foliaceous edge; elytra with five terminal cells, the apical triangular with its end rounded; border broad, slightly wrinkled; nerves strong, elevated. Allied to *Gargara*, from which genus, however, our species are excluded by the form of the head and of the apical cellule.

Butternut Carynota, *C. mera*, (Say.) Jour. Acad. Nat. Sci., vi. 301. On the butternut. No. 650, female.

[14] Oak, or arch-striped Carynota, *C. arquata*, (Say.) Jour. Acad. Nat. Sci., vi. 302. On different species of oaks. No. 651, female; 652, male (?)

SMILIA. Germar.

[15] Unadorned Smilia, *S. inornata*, (Say.) Jour. Acad. Nat. Sci. vi. 299. Common on oaks, chestnut, hickory, &c. No. 653, male (?); 654, female.

Var. *a.* Edge of the keel not fuscous-black. No. 655.

[16] Unarmed Smilia, *S. inermis*, (Fab.) Ent. Syst., iv. 15. On oaks. No. 656, male; 657, female.

[17] V-marked Smilia, *S. vau*, (Say.) Jour. Acad. Nat. Sci., vi. 299. Abundant, particularly upon the white oak. No. 658, female.

Var. *a.* Elytra fuliginous throughout. No. 659.
b. Elytra hyaline throughout. No. 660.
c. The thoracic bands margined with black. No. 661.
d. Front tinged with sanguineous. No. 662.
e. Head white. No. 663.
f. Head white, with sparse large black punctures. No. 664.
g. Posterior thoracic band obsolete. No. 665.
h. Bands obsolete; a fulvous spot above each eye. No. 666.
i. White; apex of the thorax and a spot above each eye fulvous. No. 667.
j. Apex of the thorax white. No. 668.

[18] Chestnut Smilia, **S. castaneæ.* Fuscous, more or less green when recent; head, anterior edges of thorax and all beneath, bright yellow; elytra hyaline with an apical and large longitudinal basal spot, fuscous. Length, male 0·25, female 0·30. Common on the chestnut. No. 669, male; 670, female.

Var. *a.* Face with scattered fuscous dots. No. 671.

[19] Oak Smilia, **S. querci.* Black, with an abbreviated bright yellow dorsal vitta, which is commonly interrupted near its tip; legs pale yellow. Length, 0·22. On oaks. No. 672, male.

Var. *a.* Dorsal vitta not interrupted. No. 673.

Striped Smilia, *S. vittata,* (Amyot and Serv.) Hemipt. p 539. Common on the red and black oak. No. 674, female.

Subsp. **guttata.* The oblique stripe replaced by a few greenish spots or dots. No. 675.

[20] Eared Smilia, **S. auriculata.* Bright green, when faded mottled with yellow, immaculate; humeral angles somewhat salient, rounded; keel evenly rounded, much elevated, anteriorly advanced and overhanging the head; elytra scarcely exceeding the tip of the thorax. Length, from the front 0·35, from the anterior end of the keel 0.40; height 0·23. On oaks. Rare. No. 676, male.

[21] *CYRTOISA.[†]

(Gr. κυρτος, curved, hump-backed.) Humeral angles rounded, not salient; dorsum compressed-foliaceous, forming a regularly arched keel highest near its middle, and at most with a slight concavity posteriorly; apical cellule triangular, its end rounded. Differs from Smilia in having the keel most elevated in its middle instead of anteriorly.

[22] Marbled Cyrtosia, *C. marmorata,* (Say.) Jour. Acad. Nat. Sci., vi. 301. On oaks. No. 677, female.

[23] Windowed Cyrtosia, **C. fenestrata.* Yellow marbled with rufous; a pellucid spot behind the summit of the keel and a smaller one half way to the apex; an oblique yellow vitta below the anterior spot, margined with fuscous or sanguineous; tip of the thorax reaching beyond the terminal cells of the elytra. Male black, the pellucid spots almost obsolete and

[† Error for Cyrtosia.]

the yellow vitta replaced by a few yellow dots. Length 0·25. On oaks. No. 678, male; 678 (bis) female.

CERESA. Amy. and Serv.

Two-horned Ceresa, *C. diceros*, (Say.) App. to Long's Exp., p. 299. Occurs like the following, on various trees and shrubs. No. 679, female.

Buffalo Ceresa, *C. bubalus*, (Fab.) Ent. Syst., iv. 14. No. 680, male; 681, female.

Var. *a.* Sides of the thorax mottled with fuscous. No. 682.

b. Under side black-brown. No. 683.

[24] * TELAMONA.

(From *Telamones*, a synonym of Atlantes, in allusion to the enormous backs of these insects.) Humeral angles projecting, pointed and ear-like: dorsum compressed-foliaceous, the keel abruptly elevated at one or both its ends, forming a somewhat square crest or foliole: thorax nearly or quite reaching the tips of the elytra, with elevated longitudinal lines on each side: apical cellule triangular, its end rounded. The squarish dorsal crest forms a marked distinction between the genus here proposed, and that of Thelia, to which it is most nearly related.

[25] One-colored Telamona, * *T. unicolor.* Yellow, immaculate, apex of the thorax tinged with fuscous; summit and angles of the crest rounded. Length 0·45, height 0·25. No. 684, female.

Banded Telamona, * *T. fasciata.* Yellow; thorax anteriorly and at its apex, and an oblique band crossing the posterior part of the crest fuscous; head and anterior margin of the thorax yellow, with numerous black punctures and a black dot above each eye; crest longer at its base than above, anterior end more concave than the posterior, angles rounded. Length 0·38, height 0·20. Found on walnut trees. No. 685, female.

Hollow-crested Telamona, * *T. concava.* Brown; a large spot on each side and a transverse band behind the crest, yellow, with sinuous black margins, the spot traversed by an interrupted flexuous black line; summit of the crest slightly concave posteriorly, with a small yellow spot; crest contracted at its base before and more strongly behind, its posterior angle rectangular, its anterior rounded and more elevated. Length 0·42, height, 0·22. No. 686, female.

Beech Telamona, **T. fagi.* Black, varied with obscure cinereous; anterior half of the crest double the height of the posterior half, and elevated from it perpendicularly. Length 0·40. Taken on beech trees. No. 687, male.

Woodbine Telamona, *T. ampelopsidis,* (Harris.) Inj. Ins. p. 180. On the woodbine. No. 688, female.

27 Sad Telamona, **T. tristis.* Fuscous mottled with pallid; crest with a white line on its posterior base and one or two small pellucid spots in its upper edge; three black dots over each eye; posterior angle of the crest nearly rectangular and almost as high as the anterior, the upper edge nearly straight. Length 0·35. Found on bushes of hazlenut, &c. No. 689, female.

Hazelnut Telamona, **T. coryli.* Pale dull yellow; an abbreviated band occupying the anterior end of the crest, a curved and fuscous-margined band crossing its posterior end, and the apex of the thorax, ferruginous; form of the crest similar to that of *tristis.* Length 0·32. Taken on hazelnut bushes. No. 690, female.

28 Oak Telamona, **T. querci.* Green, freckled with yellow, fading to dull yellow punctured with black; crest with a pale yellow vitta on its posterior edge; angles of the crest rounded, the anterior much higher than the posterior. Length 0·40. On different species of oak. No. 691, male; 692, female.

Reclivate Telamona, **T. reclivata.* Greenish white; a sub-interrupted band crossing the back part of the crest, a stripe at its posterior base and the apex of the thorax brownish black; anterior end of the crest strongly inclined backwards, rectilinear. Length 0·35. On oaks and chestnut. No. 693, female.

THELIA. Amy. and Serv.

Two-spotted Thelia, *T. bimaculata,* (Fab.) Entom. Syst. iv. 10. Occurs on the locust. No. 694, male.

Single-striped Thelia, *T. univittata,* (Harris.) Inj. Ins., p. 180. On oaks. No. 695, male; 696, female.

Thorn-bush Thelia, **T. cratægi.* Fuscous varied with black and white; thorax with two broad white bands margined with black, the anterior narrowed on the front and notched on each side at the base of the foliole. Length, 0·34; height, 0·13; to the apex of the foliole, 0·26. On the thorn. No. 697, female.

TRAGOPA. Germ.

[29] Dorsal Tragopa, **T. dorsalis.* Greenish-white, polished; elytra hyaline; occiput, pectus, and large dorsal spot sending a branch towards each eye, black. Males black, with the face, apex of the thorax, the abdomen and feet greenish-white. Length, 0·20. On grape vines. No. 698, male; 699, female.

UROXIPHUS. Amy. and Serv.

[30] Walnut Uroxiphus, *U. caryæ.* Dull brown; elytra towards the apex obscure-cinereous; abdomen and annulus on the tibiæ pale yellowish; sternum pruinose-white. Length, male, 0·30; female, 0·37. On the walnut and pig-nut. No. 700, male; 701, female.

Var. *a.* Femurs rufous, tibæ and base of the hind tarsi pale yellow. No. 702.

FAMILY CERCOPIDÆ.

APHROPHORA. Germ.

Four-spotted Aphrophora, *A. quadrinotata,* (Say.) Jour. Acad. Nat. Sci., vi. 304. Taken on grape vines. No. 703, male; 704, female.

Var *a.* Elytra nearly hyaline. No. 705.

LEPYRONIA. Amy. and Serv.

Four-cornered Lepyronia, *L. quadrangularis,* (Say.) Jour. Acad. Nat. Sci., iv. 335. Common in autumn and spring in groves of the sugar-maple, where numbers may often be met with, drowned in the vessels of sap. No. 706, male; 707, female.

[31] Parallel-marked Lepyronia, *L. parallella,* (Say.) App. to Long's Exp., p. 303. Common on the white pine. No. 708, male; 709, female.

[32] Saratoga Lepyronia, **L. saratogensis.* Pale fulvous varied with white; anterior and posterior margins of the vertex parallel. Closely related to *parallella,* but that has the vertex crescentiform, is much darker colored, and is confluently nigro-punctate. Here the punctures are uncolored. Length, 0.40. Common on the pitch pines of Saratoga plains and is sometimes met with on the white pine also. No. 710, male; 711. female.

Var. *a.* Dorsal vitta obsolete; elytra pellucid-white. No. 712.

CLASTOPTERA. Germ.

Obtuse Clastoptera, *C. obtusa,* (Say.) Jour. Acad. Nat. Sci., iv. 339. If this is not the *C. achatina,* Germ., that species is unknown to me. No. 713, male; 714, female.

Testaceous Clastoptera, **C. testacea.* Testaceous; scutel rufous; elytra with a polished callous-like black dot near the apex. Length, 0.20. Found on oaks and pines. No. 715, female.

Var. *a.* A black callous-like dot on each side of the pectus. No. 716.

b. Pectoral dots present, elytral dots wanting. No. 717.

c. The black dots wanting, both on the elytra and pectus. No. 718.

[33] Pine Clastoptera, **C. pini.* Black; head yellow, with a black band on the anterior margin of the vertex; thorax with a yellow band anteriorly; elytra with a broad hyaline outer

margin interrupted in the middle, and a black callous dot near the apex. Length, 0·14. Found chiefly on pines. No. 719, male.

Var. *a.* A ferruginous dot on the apex of the scutel. No. 720.

b. The yellow thoracic band widely interrupted. No. 721.

Proteus Clastoptera, **C. proteus.* Head bright yellow, a black band on the anterior margin of the vertex and a broader one on the front; front polished, without transverse striæ; a callous black dot near the apex of the elytra; legs yellowish-white, tarsi black. Length, 0·16; males slightly smaller. Abundant on the panicled dog-wood, (*Cornus paniculata*). Closely allied to the *C. atra* (Germar,) but on examining a host of specimens, not one occurs in which the legs are annulated with black or fuscous. No. 722, female.

This pretty insect, though so small in size, presents an astonishing number of sub-species and varieties, so clearly and distinctly marked that at first glance they would be confidently regarded as well characterized species. The following are the more prominent, though by no means all, of the varieties that occur:

Sub-sp. 1. *flavicollis.* Thorax entirely yellow.

Var. *a.* Elytra yellow. No. 723.

b. Elytra with an oblique blackish vitta. No. 724.

Sub-sp. *cincticollis.* Thorax with a black band.

Var. *a.* An interrupted black band on the anterior margin of the thorax. No. 725.

b. An entire black band on the anterior margin of the thorax. No. 726.

c. Thoracic band crossing the disk instead of the anterior margin. No. 727.

d. Band on the disk of the thorax, and scutel black. No. 728.

Sub-sp. *maculicollis.* Thorax with one or two discoidal spots.

Var. *a.* A black spot on the disk and interrupted band anteriorly. No. 729.

b. A black spot on the disk and anterior band entire. No. 730.

c. Two black spots on the disk of the thorax. No. 731.

Sub-sp. *nigricollis.* Thorax black, with a yellow band forward of the disk.

Var. *a.* The black band on the anterior margin of the thorax interrupted. No. 733.

b. The band continuous. No. 734.

c. Scutel black, with a yellow dot at its base. No. 735.

d. Scutel entirely black. No. 736.

FAMILY TETTIGONIIDÆ.

TETTIGONIA. Geoff.

Fork-striped Tettigonia, *T. bifida,* (Say.) Jour. Acad. Nat. Sci., vi. 313. On grass in meadows. No. 737, male; 738, female.

Var. *a.* The usual three white dots in the black frontal spot confluent, forming a lunule. No. 739.

b. Two white dots only on the front. No. 740.

c. The orange color on the sides of the front replaced by black. No. 741.

Three-dotted Tettigonia, **T. tripunctata.* White; vertex with two black dots on the disk and a third on the apex; thorax with two pale brown bands; elytra pellucid-white, the longitudinal nervures brown, except at their tips; head longer and more pointed than in the preceding species. Length, 0·20. Taken on dog-wood. No. 742, male.

PROCONIA. Lepel. and Serv.

34 Four-striped Proconia, *P. quadrivittata,* (Say.) Jour. Acad. Nat. Sci., vi. 312. In having the vertex flattened, this and the succeeding species are widely separated from the two foregoing. Common, on various shrubs. No. 743, male; 744, female.

Var. *a.* Spots on the thorax sanguineous. No. 745.

b. Thorax with two black spots at its base. No. 746.

c. Thorax margined with black at its base. No. 747.

d. Disk and base of thorax green, immaculate. No. 748.

e. Thorax with a green mark shaped like a trident, based on its posterior margin. No. 749.

AULACIZES. Amy. and Serv.

35 Tender-footed Aulacizes, *A. mollipes,* (Say.) Jour. Acad. Nat. Sci., vi. 312. Common on the grass of meadows and pastures. No. 750, male; 751, female.

36 New York Aulacizes, **A. noveboracensis.* Yellow; elytra and large spot at the base of the thorax, olive-green; no black vitta on the sides of the pectus; head shorter, broader, and its apex more obtuse, than in *mollipes.* Length, 0·33. Rare. On grass in meadows. No. 752, female.

*HELOCHARA.

(*Gr.* ἕλος, a marsh, χαιρω, to rejoice.) Head, obtuse-triangular, broader than long, slightly broader than the thorax, the transversely striated front reflected over on to the anterior sides of the vertex; vertex with a slight longitudinal stria; ocelli on the vertex, farther from each other than from the eyes; tips of the male attennæ knobbed; elytra with five terminal and three discoidal cells. By its knobbed antennæ, this genus occupies a similar rank to the sub-family *Tettigonides,* that Idiocerus does in that of *Jassides.*

37 Common Helochara, **H. communis.* Dark green; females grass-green, when faded variously mottled with tawny yellow; beneath, more or less black, legs testaceous. Length, 0·20. On grass in marshy situations, often excessively numerous. No. 753, male; 754, female.

Var. *a.* The usual transverse row of large punctures on the foreside of the thorax obsolete. No. 755.

EVACANTHUS. Lepel. and Serv.

Orbital Evacanthus, **E. orbitalis.* Black, shining; orbital margins, antennæ and legs, tawny white; elytra deep fuscous, nerves and large spot at the apex of the outer margin white; face with a tawny white, transverse spot or band above. Length, 0.18, to tip of female abdomen 0·20. On dogwood, the last of July. Rare. No. 756, male.

GYPONA. Germ.

38 Yellow-striped Gypona, **G. flavilineata.* Pale green, immaculate; thorax with eight pale yellow vittæ, the middle ones common to the vertex and scutel. *Tettigonia* 8-*lineata*, var. *a*, of Say. Having never met with specimens possessing rosaceous stripes and nervures, and this insect being larger in size than the 8-*lineata*, I am induced to regard it as a distinct species. Length, 0·35 to 0·45. Common on oaks, maple, walnut, &c. No. 757, male; 758, female.

Red-mottled Gypona, **G. scarlatina.* Dull yellowish brown; elytra with rosaceous nerves and dots; thorax without vittæ; common disk of the elytra sparsely dotted with black; length, 0·40. No. 759, female.

PENTHIMIA. Germ.

American Penthimia, **P. americana.* Black; elytra white towards the apex; two dots on the anterior edge of the vertex, and a spot on each outer angle of the thorax sanguineous or rufous. Female, with the vertex, thorax, scutel and venter, sanguineous. Closely alied to the European varieties *hemorrhoea* and *sanguinicollis*, (Fab.) but is a size larger. Length, 0·23. Rare. Taken on the sugar maple. No. 760, male; 761, female.

ACOCEPHALUS. Germ.

39 Yellow Acocephalus, **A. vitellinus.* Yellow; elytra longer than the abdomen, with pellucid spots, and on the margins towards the apex a few black dots. Length, 0·26. Found on the sugar maple. No. 762, male.

Var. *a.* Four faint tawny yellow vittæ on the thorax, and an oblique tawny band across the middle of the elytra. No. 763, female.

CŒLIDIA. Germ.

40 Banded Cœlidia, *C. subbifasciata*, (Say.) Jour. Acad. Nat. Sci., vi. 310. Found on beech trees. I have also taken this species in Kentucky and Illinois. No. 764, female.

41 Garden Cœlidia, *C. olitoria*, (Say.) Jour. Acad. Nat. Sci., vi. 310. Taken on raspberry bushes. No. 765, female.

BYTHOSCOPUS. Germ.

42 Black-Backed Bythoscopus, **B. tergatus.* Sordid green immaculate; elytra smoky; tergum black; beneath greenish yellow; tarsi pale brown. Length, 0·30. On willows. No. 766, male.

43 One-colored Bythoscopus, **B. unicolor.* Greenish-yellow, immaculate; elytra hyaline; length, 0·28. Taken on flowers of goldenrod. No. 767, female.

44 Half-clothed Bythoscopus, *B. seminudus*, (Say.) Jour. Acad. Nat. Sci., vi. 307. Found on birch trees. No. 768, female.

45 Saddled Bythoscopus, *B. clitellarius*, (Say.) Jour. Acad. Nat. Sci., vi. 309. On various herbs and shrubs. No. 769, male; 770, female.

46 Pine Bythoscopus, *B. *strobi.* Yellowish-brown; elytra with three white bands, and closely inscribed with fuscous points and lines, outer margin with small fuscous spots; beneath brown; legs pallid, with spine-bearing black dots. Length, 0·20. Common on pines in May. No. 771, male; 772, female.

IDIOCERUS. Lewis.

Weeping Idiocerus, **I. lachrymalis.* Brown varied with white; elytra hyaline, immaculate, nerves fuscous; a black spot at the anterior edge of each eye; two remote black dots on the fore side of the vertex commonly connected by a transverse black line; scutel with a transverse black spot on the disk and two triangular ferruginous spots at the base. Length, 0·28.

Taken on poplar and walnut trees. No. 773, male; 774, female.

Var. *a.* The black frontal line prolonged to the spots forward of the eyes. No. 775.

b. The usual small black spot beneath each ocellus wanting. No. 776.

c. The black frontal line wanting. No. 777.

d. One or two small four-sided discoidal cells in the elytra in addition to the usual number. No. 778.

47 Alternate-marked Idiocerus, **I. alternatus.* Brown varied with white; elytra hyaline, immaculate, nerves fuscous with white alternations; two remote black dots on the anterior edge of the vertex; scutel with two dots on its disk and two triangular spots at its base black. Length, 0·22. Common, on willows. No. 779, male; 780, female.

Spotted-winged Idiocerus, **I. maculipennis.* Chestnut-brown varied with white; elytra hyaline, with a large fuscous spot on the middle and another at the apex of the outer margin, with an intervening white spot; a faint white spot towards the base of the sutural margin. Length, 0·25. Taken on thorn bushes No. 781, female.

Suture-striped Idiocerus, **I. suturalis.* Yellowish white; elytra hyaline with a dusky vitta on the suture, and two dusky spots on the base of the scutel. I have never met with the males of this and the following species, but their facial ocelli and elytral neuration indicate this to be their generic place. Length, 0·25. Taken on chestnut trees. No. 782, female.

Pale Idiocerus, **I. pallidus.* Greenish white, immaculate; elytra hyaline. Length, 0·22. On poplars and willows. No. 783, female.

PEDIOPSIS. Burm.

Green Pediopsis, **P. viridis.* Light green, immaculate; elytra pellucid, almost hyaline. Length, 0·18. No. 784, female.

THREE-SPOTTED PEDIOPSIS, **P. trimaculatus.* Dull brown; scutel with a black spot at each angle, the posterior one sometimes obsolete; elytra with pellucid white spots situated one on the apex, one on the disk and a third anteriorly, scutellar region obscure cinerous; face whitish. Length, 0·18. No. 785, female.

ATHYSANUS. BURM.

To this genus we refer those species which differ from *Macropsis* and *Pediopsis* in having the ocelli between the vertex and the face, and from *Jassus* in having the elytral suture straight.

48 VARIABLE ATHYSANUS, **A. variabilis.* Sulphur-yellow; elytra commonly with an oblique black vitta, their tips pellucid; vertex, thorax and scutel often fulvous or black. Length, 0·20. Abundant on birch trees, in June. No. 786, female.

Var. *a.* Dull yellowish-white throughout. No. 787.
b. Bright sulphur-yellow throughout. No. 788.
c. An oblique black stripe on each elytron. No. 789.
d. Vertex, thorax and scutel tawny yellow. No. 790.
e. Vertex and thorax tawny yellow, scutel black. No. 791.
f. Vertex, thorax and scutel black. No. 792.

49 SPRUCE-TREE ATHYSANUS, **A. abietis.* Black, shining; head light yellow, mouth and two bands on the vertex confluent at their ends, black; middle of the sutural edge of the elytra with a white streak. Length, 0·20. Taken on the black spruce. No. 793, female.

50 WINDOWED ATHYSANUS, **A. fenestratus.* Brownish-black; face and scutel rufous; elytra each with a pellucid spot near the apex, another on the disk, and a third opposite this last on the sutural margin. Length, 0·20. On birch trees. No. 794, female.

51 SMALLER ATHYSANUS, **A. minor.* Cinnamon yellow; elytra with a discoidal and large apical spot hyaline. Length, 0·18. Common on birch trees. No. 795, female.

52 **Beech-tree Athysanus**, **A. fagi.* Elytra fuscous, immaculate; scutel, face and pectus black; venter and legs light yellow. Length, 0·18. Taken on beech trees. No. 796, female.

53 **Black-nosed Athysanus**, **A. nigrinasi.* Pale yellow, lower part of the face black or fuscous. Length, 0·18. Common, particularly upon the hornbeam (*Carpinus americana.*) Presents many varieties. No. 797, female.

AMBLYCEPHALUS. Curtis.

54 **Curtis's Amblycephalus**, **A. curtisii.* Greenish yellow; two dots on the vertex, band on fore part of the thorax, and six vittæ on each elytron, black; beneath black. Length, 0·15. Common particularly on the grass of meadows. No. 798, male; 799, female.

55 **Say's Amblycephalus**, **A. sayii.* Pale yellowish, without dots; elytral cells partially margined with fuscous or black, nerves white. Length, 0·13. Abundant on grass in pastures and meadows. No. 800, male; 801, female.

Var. *a.* A black spot on the base of the thorax. No. 802.
b. Three black spots on the base of the thorax. No. 803.
c. Only the apical cells margined with fuscous at their tips. No. 804.

56 **Melsheimer's Amblycephalus**, **A. melsheimerii.* Pallid, base of the tergum black; elytra pellucid, nerves white. Length, 0·10. Common on grass. No. 805, male; 806, female.

57 **Inimical Amblycephalus**, *A.? inimicus*, (Say.) Jour. Acad. Nat. Sci., vi. 305. Though this much resembles the species named *Sayii*, above, it differs from this genus by the length of its elytra, and from *Jassus* by its striated front and the number of its discoidal and apical cells. It probably forms the type of a separate genus. Common on grass, and its larva has been said to depredate upon the roots of young wheat. No. 807, male; 808, female.

Var. *a.* Nerves white, cells margined with fuscous. No. 809.

b. Two smaller dots between the ordinary ones on the head. No. 810.

c. Two dots only on the neck. No. 811.

d. Dots on the neck all wanting. No. 812.

JASSUS. FAB.

58 FRECKLED JASSUS, **J. irroratus*, (Say.) Jour. Acad. Nat. Sci., vi. 308. Common on herbage. No, 813, male; 814, female.

Var. *a.* A transverse row of five white dots on the anterior edge of the head. No. 815.

59 YELLOW-BACKED JASSUS, **J. fulvidorsum*. Head, thorax and scutel sordid yellow, uninscribed; elytra white, closely inscribed with fuscous lines and points, and on the outer margin irregular spots. Length, 0·25. On pines. No. 816, male, 817, female.

60 POINTED JASSUS, *J.? acutus*, (Say.) Jour. Acad. Nat. Sci., vi., 306. Found on hornbeam. No. 818, male.

61 * ERYTHRONEURA.

(Gr., ερυθρος red, νευρον, nerve; in allusion to the color of portions of the elytral nerves in several of the species.) Head crescentiform, about as broad as the thorax; vertex rounded down to the front without an angular edge; ocelli between the vertex and the front, almost as near each other as to the eyes: elytra without closed cells in the disk; apical cells four, longish; middle apical nerve simple. Forward of the transverse nerve the exterior and middle nerves are sometimes obsolete. For a group of our small *Jassides*, who-e elongated linear bodies give them the aspect of *Tettigoniides*, no place appears among the genera defined by Amyot and Serville. This and the following genus is therefore proposed for their reception.

62 WOUNDED ERYTHRONEURA, **E. vulnerata*. Fulvous-brown spotted and lined with whitish; elytra with an abbreviated yellowish-white vitta on the outer margin, interrupted near the middle by an oblique black line, and towards the apex by an oblique sanguineous one; tips dusky, with whitish nervures and spots; a whitish medial line common to the vertex, thorax and scutel; beneath black, legs pallid. Length, 0·12. On

raspberry bushes, grape-vines and other situations where the foliage is dense, often in great numbers. No. 819, male; 820, female.

63 Grape-vine Erythroneura, *E. vitis*, (Harris.) Inj. Ins., p. 184. Inhabits with the preceding. No. 821, female.

64 Allied Erythroneura, **E. affinis*. Pale yellow; elytra hyaline, spotted with light yellow, with a black dot on the inner margin towards the apex, and a broad yellowish brown band on the base. Allied to *basillaris* Say, but readily distinguished, being destitute of sanguineous markings. Length, 0·12. No. 822, female.

65 Three-banded Erythroneura, **E. tricincta*. Pale yellow, with three broad bands, the anterior velvet-black, occupying the thorax and basal half of the scutel; the middle bright ferruginous ending outwardly in black, forward of the middle of the elytra, the posterior dusky brown, on the apex. Length, 0·12. No. 823, female.

Var. *a*. Anterior band sanguineous. No. 824.

66 Oblique-striped Erythroneura, *E. obliqua*, (Say.) Jour. Acad. Nat. Sci., iv. 342. No. 825, male.

67 Bean-vine Erythroneura, *E. fabæ*, (Harris.) Inj. Ins., p. 186. No. 826, male; 827, female.

68 *EMPOA.

(Gr. εν, upon, ποα, herbage.) Differs from Erythroneura in having the apical nerve widely forked, forming a triangular apical cell, which is shorter than the three other terminal cells.

69 Oak Empoa, *E. querci*. White; elytra pellucid, with three blackish dots in a transverse row behind the middle. Length, 0·12. On oaks, sometimes excessively numerous. No. 828, female.

70 Scarlet Empoa, *E. coccinea*. Scarlet-red, immaculate, pectus and venter orange, elytra brownish-pellucid. Length, 0·10. Taken on pines. No. 829, male.

FAMILY PSYLLIDÆ.

PSYLLA. Geof.

[71] Three-dotted Psylla, **P. tripunctata.* Wax-yellow, dorsum black; legs and antennæ pale yellow, the latter black at the tips; elytra hyaline, nerves brown, beyond the furcation widely margined with smoky-fulvous, a blackish dot on the middle of the terminal margin of each of the inner apical cells. Length 0·16. No. 830, female.

Four-lined Pyslla, **P. quadrilineata.* Bright fulvous; elytra hyaline, nerves blackish; four whitish longitudinal lines on the middle of the metathorax; abdomen black with a yellow band at its base. Length, 0·12. No. 831, female.

Hornbeam Psylla, **P. carpini.* Light-green or greenish yellow; elytra hyaline, nerves light-green. Length, 0·16. Common on the hornbeam, in July. No. 832, male; 833, female.

[72] Annulated Psylla, **P. annulata.* Straw yellow; legs white; elytra hyaline, nerves straw yellow; antennæ black, basal half straw-yellow annulated with black. Length, 0·15. Occurs on the sugar-maple. No. 834, male; 835, female.

LIVIA. Lat.

Vernal Livia, **L. vernalis.* Bright ferruginous; pectus and tips of antennæ black; legs ferruginous-pallid. Length, 0·15. Found in spring in vessels of sap of the sugar-maple. No. 836, male; 837, female.

Black-legged Livia, **L. femoralis.* Bright ferruginous; pectus, four forward femurs and tips of the antennæ black. Perhaps not distinct from the preceding. Length, 0·15. Taken on a pine tree, in July. No. 838, female.

FAMILY APHIDÆ.

APHIS. Linn.

Apple-tree Aphis, *A. mali*, (Fab.) Ent. Syst. iv. 216. Common on the under side of the leaves and tips of the young branches of the apple-tree. No. 839, male.

73 Cherry-tree Aphis, *A. cerasi*, (Fab.) Ent. Syst. iv. 211. Common on the under side of the leaves of the garden cherry, (*Cerasus vulgaris*, Mill.) No. 840, male.

74 Cherry-inhabiting Aphis, **A. cerasicolens*. Pale greenish yellow; antennæ and legs black, base of the femurs pallid; nerves of the fore wings dusky, stigma pellucid white; abdominal horns quite short. When irritated, the legs and antennæ instantly emit from their pores a bluish white cotton-like substance, which remains adhering to them, resembling fine mould. Length, 0·20, to the tips of the wings. On the common black-cherry-tree, (*Cerasus serotina*, DC.) No. 841, male.

75 Berberry Aphis, **A. berberidis*. Black; pectus and abdomen pale yellow, tip black; legs dusky; larva and pupa pale, with a green or black vitta on each side of the back, parallel with the outer magin. Length, 0·10. On the under side of berberry leaves. No. 842, male; 843, female.

Cabbage Aphis, *A. brassicæ*, (Linn.) Syst. Nat. ii. 734. Common on the under side of cabbage leaves. No. 844, male.

76 Silk-weed Aphis, **A. asclepiadis*. Black; abdomen pale green; sides with two rows of impressed fuscous dots, three in the lower, larger, five in the upper; abdominal horns nearly equalling the tip; stigma smoky whitish; nerves brown; the costal whitish. Length, 0·15. On the lower surface of young leaves of the common silk-weed. No. 845, male.

Dogwood-leaf Aphis, **A. cornifoliæ*. Apterous females black, subpruinose, obovate; legs pale yellow, feet black; antennæ pale yellow, tips black; horns nearly equalling the truncated tip of the abdomen. Length, 0·05, to tip of abdomen. On the under surface of the leaves of *Cornus paniculata*. No. 846, female.

Thorn-leaf Aphis, **A. cratægifoliæ.* Black; abdomen green, with a row of blackish dots along each side; nerves of the fore wings whitish, black at their tips; tibiæ, except at their tips, and base of the femurs, green; horns nearly half equalling the tip of the abdomen. Length, 0·15. On the leaves of *Cratægus punctata,* corrugating them. No. 847, male.

[77] Birch-inhabiting Aphis, **A. betulæcolens.* Sulphur yellow; antennæ deep black, two basal joints sulphur-yellow, the following joints white at their bases; stigma pellucid yellowish; nerves black, the costal and marginal sulphur-yellow, base of the forked nerve hyaline; horns very short. Length, 0·18. No. 848, male.

[78] Maple-tree Aphis, *A. aceris,* (Linn.) Syst. Nat. ii. 736. Our insect appears to correspond with the brief description given of this species. Occurs on the *Acer pennsylvanicum.* No. 849, male.

Elder-leaf Aphis, **A. sambucifoliæ.* Black; tibiæ and base of the femurs pallid; stigma dusky; nerves black, the furcate one hyaline at its base. Length, 0·15. On the under side of the leaves of the elder. No. 850, male.

Pine-inhabiting Aphis, **A. pinicolens.* Straw-yellow, densely pruinose; antennæ black, bases pallid, with a fuscous annulus; fore wings with a fuscous spot on the apex of each nerve; nerves brown, hyaline at their bases, the costal straw-yellow; horns very short. Length, 0·25. Solitary on the pine. No. 851, male.

[79] Poplar-leaf Aphis, **A. populifoliæ.* Chestnut-brown, pruinose; legs hairy, black, above the knees pale brown; stigma smoky fulvous, margined with black; nerves brown; tergum with two dorsal rows of impressed, quadrate, fuscous spots, and on each side two rows of impressed dots; horns equalling a third of the distance to the tip. Length, 0·22. On the leaves of the *Populus grandidentata.* No. 852, male.

[80] Cone-flower Aphis, **A. rudbeckiæ.* Red; antennæ and legs black; basal half of the femurs pale yellow; horns equalling the tip; stigma yellowish; nerves brown, the costal sulphur-yellow. Length, 0·20. Infests the upper part of the stalks of *Rudbeckia laciniata, Solidago serotina* and *S. gigantea.* No. 853, male.

LACHNUS. Illig.

Spruce-tree Lachnus, **L. abietis.* Apterous females pubescent, broad oval, blackish clouded with lurid brown, with a faint cinereous dorsal vitta; venter lurid, pruinose, with a black spot near the tip; antennæ sordid-white, with a black annulus at the apex of each joint. Length, 0·15 to tip of the abdomen. Occurs on the *Abies nigra.* No. 854, female.

Oak-leaf Lachnus, **L. quercifoliæ.* Light yellow; antennæ pellucid white, with a slender black annulus at the tip of each joint; fore wings with a blackish spot on the apex of each nerve and a deep black dot on the base of the curved apical nerve; stigma whitish. Length to tip of wings, 0·15. On the leaves of the white oak. No. 855, male.

Willow Lachnus, **L. salicellis.* Black; tibiæ and base of the antennæ obscure pallid; base and costal margin of the fore wings yellowish-white. Length, 0·08. On the young succulent twigs of willow trees. No. 856, male.

Alder-leaf Lachnus, **L. alnifoliæ.* Apple-green; antennæ greenish-white, with four black annuli; legs greenish-white, tarsi, knees, and line on the posterior side of the tibiæ black; wings hyaline, the three oblique nerves black. Length, 0·10. On alder leaves. No. 857, male.

81 Elm Lachnus, *L. ulmi,* (Linn.) Syst. Nat. ii. 733. Solitary, on the under side of elm leaves. No. 858, male.

82 Poplar Lachnus, *L. populi,* (Linn.) Syst. Nat. ii. 736. On the under side of the young leaves of *Populus grandidentata.* No. 859, male; 860, larva.

ERIOSOMA. Leach.

83 Apple-tree Blight, *E. lanigera,* (Hausman.) Illiger's Magaz. vol. i. p. 440. *Myzoxylus mali,* (Blot.) Mem. Soc. Agricult. de Caen, 1830, p. 38. On the bark of young branches of the apple, to which tree, in Europe, it has been a great pest. Commonly only solitary individuals are here found, and in but one instance, have I met with it clustered and covering a limb as described by foreign writers. No. 861, male.

84 Apple-root Blight, **E. pyri*. Black, more or less pruinose, with a tuft of cotton-like down on the tergum and commonly a smaller one on the head; fore wings hyaline, with a black stigma and nerves, the externo-medial nerve hyaline towards its base; inner edge black from the base to the apex of the first nerve, hyaline beyond. Length, 0·20. Common on the wing in groves, in autumn. On the roots of a young apple tree brought me from a nursery, excrescences were observed, the crevices in which were found to be covered with small lice-like larvæ, among which some winged individuals occurred which proved on examination to be this species, from which circumstance its habits are inferred and ts name bestowed. No. 862, male.

85 Alder Blight, **E. tessellata*. Dull bluish-black; tergum with the segments marked by strongly impressed lines and covered by white down in square checker-like spots. Length, 0·16. On the under side of branches of the alder, (*Alnus rubra*, Marsh.) crowded together and concealed beneath a dense covering of snow-like down. I have searched in vain for winged individuals of this species. No. 863.

86 Beech-tree Blight, *E. imbricator*. Black; three last segments of the abdomen blue-pruinose; stigma brown; longitudinal nerve and a line on the middle of the inner margin black. Female (?) winged; abdomen fulvous, with a black spot on the disk; legs pallid. Larva pallid, with 2 fuscous dorsal stripes; posterior half of the abdomen covered with a tuft of cotton-like down, from which proceeds two longer and coarser filaments. Length, 0·22. On the under sides of the branches of the beech tree, covered with snow-white down. On the slightest jar of the branch, a shower of tiny drops of a water-like fluid falls from these insects. Having met with no description of the *E. fagi*, (Linn.,) or its habits, I am unable to ascertain whether that insect is dissimilar to ours. No. 864, male; 865, female (?); 866, larva.

87 Pine-tree Blight, **E. strobi.* Black, pubescent, subpruinose; a dorsal row of white meal-like spots on the tergum; fore wings with the costal margin, the apical and two inner basal nerves, black. Length, 0·20. Common on branches of the white pine, giving to the bark of infested trees a peculiar black appearance. Belongs to a nondescript genus, intermediate between this and Lachnus. No. 867, male; 868, female.

BRYSOCRYPTA. Halliday,

88 Witch-hazel Brysocrypta, **B. hamamelidis.* Males black, pruinose; wings hyaline; nerves brown; legs whitish; knees and tarsi black. Larva smaller, brown. Length, 0·09. Inhabits conical follicles on the upper surface of witch-hazel leaves; each follicle contains about a dozen individuals, and has a small orifice in the under surface of the leaf. No. 869, male; 870, larva; 871, its follicle.

FAMILY COCCIDÆ.

Our species of this family have not as yet been investigated in their living state. The dried shield-like bodies of the dead females have been met with on several of our indigenous trees. In addition to the species so abundant upon the apple-tree, and currently regarded as the
89 *Coccus arborum-linearis* of Geoffroy, (specimen No. 872,) the following may serve as New York examples of this family: The Wil-
90 low Coccus, **C. salicis*, is ferruginous with obsolete black spots, has an oval nearly hemispheric form, and measures 0·20 in length, (No. 873.) The Linden Coccus, **C. tiliæ*, the largest of our
91 species that have been observed, is ferruginous, hemispheric, and measures 0·24, (No. 874.) Both these species have the usual slit at the posterior end, and are wrinkled transversely.

CORRECTIONS AND NOTES TO THE PRECEDING CATALOGUE, BY E. P. VAN DUZEE.

1. Cicada tibicen *Linn. Uhler.**
2. Tibicen rimosa (*Say*) *Uhler.*
3. Tibicen septendecim (*Linn.*) *Uhler.*
4. Myndus impunctatus (*Fitch*).
5. Oliarus quinquelineatus (*Say*).
6. Liburnia arvensis (*Fitch*).
7. Stenocranus dorsalis (*Fitch*).
8. Ormenis pruinosa (*Say*).
9. Lamenia vulgaris (*Fitch*).
10. Enchenopa binotata (*Say*).
11. Campylenchia curvata (*Fabr.*).
12. Publilia concava (*Say*).
13. Carynota n. genus. Dr. Goding gives Optilete *Stal* as a synonym of this genus. Membracis mera *Say* must be considered its type.
14. Vanduzea arquata (*Say*).
15. Cyrtolobus inornatus (*Say*).
16. Stictocephala inermis (*Fabr.*).
17. Cyrtolobus vau (*Say*).
18. Atymna castanæ (*Fitch*).
19. Atymna querci (*Fitch*).
20. Archasia galeata (*Fabr.*).
21. Cyrtosia n. genus. This name being preoccupied, Dr. Goding has adopted in its place Mr. Uhler's MS. name Cyrtolobus (see Trans. Amer. Ent. Soc., xix, 1892, p. 257).
22. Carynota marmorata (*Say*).
23. Cyrtolobus fenestratus (*Fitch*). Type of *Cyrtosia* Fitch = Cyrtolobus *Goding*.
24. Telamona n. genus. Type, T. fasciata *Fitch*.
25. Telamona fasciata *Fitch*, female.
26. Heliria scalaris (*Fairm.*).
27. Telamona coryli *Fitch*, female, if I have rightly identified the species.
28. Telamona monticola (*Fabr.*).
29. Acutalis dorsalis (*Fitch*).
30. Microcentrus caryæ (*Fitch*).
31. Aphrophora parallela *Say*.
32. Aphrophora saratogensis (*Fitch*).
33. Clastoptera pini *Fitch* — probably correct.
34. Diedrocephala coccinea (*Forst.*).
35. Diedrocephala mollipes (*Say*).
36. Diedrocephala novæboracensis (*Say*).
37. Helochara communis *Fitch*. Type of genus.
38. May possibly be Burmeister's Gypona striata, published a few years earlier.
39. Paramesus vitellinus (*Fitch*).
40. Only the female of the next (41).
41. Jassus olitorius *Say*.
42. Chlorotettix tergatus (*Fitch*).
43. Chlorotettix unicolor (*Fitch*), type of genus Chlorotettix *VanD.*
44. Eutettix (?) seminudus (*Say*).
45. Thamnotettix clitellarius (*Say*).
46. Phlepsius strobi (*Fitch*).
47. May prove identical with Jassus verticis *Say*.
48. Bythoscopus variabilis (*Fitch*).
49. Male of B. variabilis.
50. Bythoscopus fenestratus (*Fitch*).
51. Bythoscopus minor (*Fitch*).
52. Doubtless a species of Bythoscopus.
53. Bythoscopus nigrinasi (*Fitch*).
54. Athysanus Curtisii (*Fitch*).
55. Deltocephalus Sayii (*Fitch*).
56. Deltocephalus Melsheimerii (*Fitch*).
57. Deltocephalus inimicus (*Say*).
58 Phlepsius irroratus (*Say*).
59. Phlepsius fulvidorsum (*Fitch*).
60. Platymetopius acutus (*Say*).
61. Erythroneura. Now united with Typhlocyba *Germ.*
62. Typhlocyba vulnerata (*Fitch*) *Woodw.**
63. Typhlocyba vitis (*Harris*) *Woodw.*
64. Typhlocyba affinis (*Fitch*) *Woodw.*
65. Typhlocyba tricincta (*Fitch*) *Woodw.*
66. Typhlocyba obliqua (*Say*) *Woodw.*
67. Empoasca fabæ (*Harris*).
68. Empoa n. genus: also united with Typhlocyba *Germ.*
69. Typhlocyba querci (*Fitch*) *Woodw.*
70. Typhlocyba coccinea (*Fitch*) *Woodw.*

* In the Cicadidæ, Mr. Uhler's list published in the *Transactions of the Maryland Academy of Sciences*, vol. i, has been followed: in the Typhlocylidæ, that of Mr. Woodworth, in *Psyche*, vol. v.

CORRECTIONS AND NOTES BY C. V. RILEY.

71. Trioza tripunctata (*Fitch*).
72. Psylla annulata *Fitch*. Is probably a variety of P. carpini *Fitch*.
73. Myzus cerasi *Fabr*.
74. "Aphis cerasicolens" *Fitch*. The Fitch types (4) in the U. S. N. M. are, from their condition, absolutely indistinguishable, and do not admit of comparison with *A. cerasifoliæ* to determine the validity of the species.
75. Rhopalosiphum berberidis (*Fitch*).
76. Siphonophora asclepiadis (*Fitch*).
77. Callipterus betulæcolens (*Fitch*).
78. Chaitophorus aceris (*Linn.*).
79. Chaitophorus populifoliæ (*Fitch*).
80. Siphonophora rudbeckiæ (*Fitch*).
81. Schizoneura ulmi (*Linn.*).
82. Chaitophorus populi (*Fitch*).
83. Schizoneura lanigera (*Hausm.*).
84. Pemphigus pyri (*Fitch*).
85. Pemphigus tessellata (*Fitch*).
86. Schizoneura imbricator (*Fitch*).
87. Lachnus strobi (*Fitch*).
88. Hormaphis hamamelidis (*Fitch*).
89. Mytilaspis pomorum (*Bouché*).
90. Lecanium salicis (*Fitch*). While the "Coccus salicis" of Fitch is a Lecanium, there is a Coccus alicis of Linnæus which is a Chionaspis, and Bouché's salicis is a Pulvinaria.
91. Lecanium tiliæ (*Fitch*).*

The following is a list submitted by Dr. Riley, of the Psyllidæ, Aphididæ, and Coccidæ of the Fitch catalogue given in the preceding pages, arranged in their systematic order with their present accepted family, subfamily, generic and specific names, their Fitch synonyms, and indication of types contained in the United States National Museum.

Family PSYLLIDÆ.

Subfamily Liviinæ.

Livia Latreille.

Livia vernalis *Fitch*. Types (4) in U. S. N. M.
Livia femoralis *Fitch*. In U. S. N. M., type lost from pin.

Subfamily Psyllinæ.

Psylla Geoff.

Psylla quadrilineata *Fitch*. Types in U. S. N. M.
Psylla carpini *Fitch*. Types in U. S. N. M.
Psylla annulata *Fitch*. Probably var. carpini.

Subfamily Triozinæ.

Trioza Förster.

Trioza tripunctata (*Fitch*). *Psylla tripunctata* Fitch. Types in U. S. N. M.

Family APHIDIDÆ.

Subfamily Aphidinæ.

Siphonophora Koch.

Siphonophora asclepiadis (*Fitch*). *Aphis asclepiadis* Fitch. Types in U. S. N. M.

* There is no *tiliæ* Fitch in the Fitch collection, but specimens of *tiliæ* Linn., which Comstock believes to be *liriodendri* Cook.

Siphonophora rudbeckiæ (*Fitch*). *Aphis rudbeckiæ* Fitch.

Rhopalosiphum Koch.

Rhopalosiphum (*Fitch*). *Aphis berberidis* Fitch.

Myzus Pass.

Myzus cerasi (Fabr.). *Aphis cerasi* Fabr. Fitch.

Aphis Linn.

Aphis brassicæ *Linn.*
Aphis cornifoliæ *Fitch.* Types (nearly destroyed) in U. S. N. M.
Aphis cratægifoliæ *Fitch.* Types (nearly destroyed) in U. S. N. M.
Aphis cerasicolens *Fitch.*
Aphis mali *Fabr.*
Aphis malifoliæ *Fitch.*
Aphis pinicolens *Fitch.* Type (without abdomen) in U. S. N. M.
Aphis sambucifoliæ *Fitch.* Type in U. S. N. M.

Subfamily Callipterinæ.

Chaitophorus Koch.

Chaitophorus aceris (*Linn.*). *Aphis aceris* Linn. Fitch.
Chaitophorus populifoliæ (*Fitch*). *Aphis populifoliæ* Fitch.
Chaitophorus populi (*Linn.*). *Lachnus populi* Linn. Fitch.

Callipterus Koch.

Callipterus betulæcolens (*Fitch*). *Aphis betulæcolens* Fitch.

Subfamily Lachninæ.

Lachnus Illiger.

Lachnus abietis *Fitch.* Types (nearly destroyed) in U. S. N. M.
Lachnus alnifoliæ *Fitch.* Types (nearly destroyed) in U. S. N. M.
Lachnus quercifoliæ *Fitch.* Types (nearly destroyed) in U. S. N. M.
Lachnus salicellis *Fitch.*
Lachnus strobi (*Fitch*). *Eriosoma strobi* Fitch. Types in U. S. N. M.

Subfamily Schizoneurinæ.

Schizoneura Hartig.

Schizoneura imbricator (*Fitch*). *Eriosoma imbricator* Fitch.
Schizoneura ulmi (*Linn.*). *Lachnus ulmi* Linn. Fitch. Specimens in U. S. N. M.
Schizoneura lanigera (*Hausm.*). *Aphis lanigera* Hausm.

Hormaphis O. S.

Hormaphis hamamelidis (*Fitch*). *Brysocripta hamamelidis* Fitch. Type in U. S. N. M.

Subfamily Pemphiginæ.

Pemphigus pyri (*Fitch*). *Eriosoma pyri* Fitch. Type in U. S. N. M.

Pemphigus tessellata (*Fitch*). *Eriosoma tessellata* Fitch. Type in U. S. N. M.

Family COCCIDÆ.

Mytilaspis pomorum (*Bouche*). *Coccus arborum-linearis* Geoffroy. Fitch.

Lecanium salicis (*Fitch*). *Coccus salicis* Fitch. Type in U. S. N. M.

Lecanium tiliæ (*Fitch*). *Coccus tiliæ* Fitch.

(B)

ENTOMOLOGICAL ADDRESSES.

REPORT OF THE COMMITTEE ON ENTOMOLOGY.

[Read before the Western New York Horticultural Society at its Annual Meeting, January 29th, 1891.]

The Committee on Entomology beg leave respectfully to report:

It is gratifying to be able to report not only continued, but a marked accelerated progress in this department during the past year. It is safe to say that greater attention has been given to insects than in any preceding year. Large collections have been made; many new species have been described; life-histories have been worked out; experimentation in methods of controlling injurious species has been earnest, extended, and successful; and publication of these labors and results has been placed in the hands of the student and the agriculturist. As illustrating the growing interest manifested in this branch of study, we may state that, while in former years, far more attention had been given to plants than to insects, a recent report of Director Atwater, of the Office of Experiment Stations, at Washington, gives as the number pursuing entomological investigations at the different stations, at that time (1890) as twenty-nine, as against thirty engaged in botanical studies. From so large a corps of earnest entomologists, generally distributed over the United States, and vying with one another to produce the best results, what may we not expect for the future of economic entomology.

Of the progress which we have mentioned, most of it has been in a practical direction,—in methods of control of insect pests. Prominent among these, and, therefore, the first to which we will refer, we will name

Spraying with Insecticides.

Effect of London purple on the plum.— At the last annual meeting of this Society it was stated by one of the members, in discussion, that he had nearly ruined a plum orchard by spraying it with a pound of London purple in three hundred gallons of water, for, as the result of spraying, every leaf fell from the trees. In the report of the recent meeting of the Ontario Fruit Growers' Association, this statement from the same gentlemen, is repeated in still stronger terms—"he had utterly ruined a valuable plum orchard by the use of London purple." The statement was questioned at the time when made to this society, and from what has subsequently been learned, we deem it proper to say that there is hardly a remote probability that the injury to the trees, causing the falling of the foliage, which followed the spraying, can be in the least ascribable to the spraying, but was solely owing to a fungus attack of the leaves.

In recent experiments by Professor Bailey, of Cornell University, conducted in the most careful manner, plum trees sprayed with one pound of London purple to *two hundred gallons* of water, were not injured in the slightest degree. Although not so stated, it may be inferred that the ordinary coarse spray was used—not the fine one, which appears to be much more safe on delicate foliage.

Experiments reported by Prof Gillette of the Iowa Agricultural Experiment Station, show slightly differing results from the above, as the same mixture gave a seven per cent injury to plum foliage. The application, in this instance, was with the Woodason bellows-sprayer or atomizer. (*Bull. No.* 10, *Iowa Agr. Exp. Station,* August, 1890.

London purple on the peach.—The spraying experiments of Professor Bailey have confirmed observations previously made by others, that the foliage of the peach is more susceptible to injury from London purple than other of the fruits. While it sustained no harm from one pound of Paris green in two hundred and fifty-six gallons of water, one of London purple four to hundred, caused slight injury. It is probable that one to four hundred and fifty, applied in a fine mist-like spray, could be used with entire safety; but as it is quite doubtful if this degree of reduction would kill the curculio, it is advisable that Paris green only, of the arsenites, should be employed on the peach unless other substances are combined with them.

Solubility of London purple.—The greater liability to injury from London purple is owing to its greater solubility in water. According to Professor Bailey—"the arsenic in London purple is in the form of a normal arsenite of calcium, which substance comprises about seventy-two per cent of the whole compound; and over fifty per cent (52.38) of it, or *nearly forty per cent of the London purple is quickly soluble in water.* (*Bulletin No.* 18 *of the Cornell University Agricultural Experiment Station,* July, 1890.)

An efficient nozzle for low spraying.—Mention is made and illustration given, in the Bulletin from which we have quoted, of a bush nozzle devised by Prof. Bailey, for use on low bushes, when the insects, like the currant worm, feed largely on the underside of the leaves. The discharge from it may be graduated to any desirable degree by mechanism which admits of a speedy and definite compression of the end of a rubber discharging tube. A single spraying early in the season with this nozzle and Paris green water kept the currant bushes free from the larvæ for nearly the entire season, which was one of unusual abundance of the worms.

Addition of lime to the arsenites.— Quite an interesting and seemingly valuable result has been obtained by Professor Gillette, in that he has found that lime added to London purple or Paris green in water, greatly lessens the injury that these poisons would otherwise do to foliage. With this addition, it seems that they may safely be used on the most tender foliage, even on the peach. On this, only one per cent of injury was observed with one pound of the purple to two hundred gallons of water, and only five per cent with one hundred gallons. The average of several experiments with the limed arsenical mixture on cherry, apple, plum, and peach, with one pound of the purple to *one hundred* gallons of water, was the trifling amount of *one per cent.* It would seem, therefore, to be a desirable spraying liquid against the curculio, in that the insect would be more surely affected by feeding on heavily poisoned leaves.

The lime was prepared by slaking it in a barrel, and stirring it afterward until the water became quite milky — up to the degree that it would not clog the nozzle of the sprayer.

Fungicides combined with the arsenites.— The convenience of combining fungicides with insecticides, has been for sometime recognized and regarded as a desideratum. Professor Gillette, after having experimented with several of the fungicides with a view of ascertaining their efficiency in destroying leaf-feeding insects, reports: that of all the substances which he has used, none can be compared with Bordeaux mixture for the prevention of injury to foliage. Although the statement seems hardly credible, he had been unable to produce the least harm upon plum and peach foliage (the more sensitive of the fruits) with London purple in standard Bordeaux mixture, even when used in the proportion of one pound to fifty gallons. In the proportion of one pound to twenty-five gallons, not the least injury was produced to plum foliage. As a severe test, one pound to ten gallons caused no damage to the apple. This almost perfect immunity from harm, might be owing, it was thought, to the precipitation of the soluble arsenic in the purple by the lime and copper hydrate of the Bordeaux mixture. Several other interesting conclusions in relation to various substances and compounds used in spraying, were reached, for which reference is made to the Bulletin cited.

While the Bordeaux mixture may be freely and advantageously used in combination with London purple, it should be borne in mind that the ammoniacal solutions of copper — so valuable against the apple-scab and some other of the plant diseases — should not be used with it; and especially, that these solutions are very harmful when combined with Paris green, as the ammonia acts as a solvent of the arsenite, and thereby greatly adds to the injury that it may cause. In evidence of this, see Bulletin No. 11 (page 14), of the Massachusetts Agricultural Experiment Station, January, 1891, where a report of experiments shows that carbonate of copper solution, combined with Paris green in the proportion of one pound to five hundred gallons of water very seriously injured the foliage.

Spraying for the plum curculio.— Experiments by Dr. C. M. Weed, of the Ohio Agricultural Experiment Station, show that plum trees sprayed four times with Paris green — one to two hundred gallons of water, gave twice the amount of protection that was obtained from jarring, while "vastly cheaper and easier of application." It at the same time, gave protection from the plum-leaf fungus and the brown rot, that later visited the unsprayed portion of the orchard. *Bulletin* (*Vol. III, No.* 8, *September*, 1890), *of the Ohio Agr. Exper. Station.*

Spraying for the codling-moth.— The following results were obtained by M. H. Beckwith, of the Delaware Agricultural Experiment Station (*Bulletin No.* 8, March, 1890): 1. Trees sprayed with Paris green (1 to 150, too strong, and 1 to 200) gave four times as large a yield as did the unsprayed. 2. The average yield of sound apples from the sprayed, was nine times as great as from the unsprayed. 3. Of the sound apples gathered from the sprayed trees, ninety per cent had been saved by the spraying. 4. The sound apples from the former were much superior in quality to those from the latter.

A new insecticide machine.— Dr. Riley, in his Presidential Address before the Association of Economic Entomologists, at Champaign, Ill., has noticed, with commendation, a new and distinct type of insecticide apparatus — the invention of Mr. Strawson, of Newbury, Berks, England. We quote, as follows: "The machine is called the 'Strawsonizer,' and is a pneumatic or air-blast distributor, and may be adapted to a variety of uses, such as broadcast sowing of grains, distribution of fertilizers or of disinfectants in cities, and of dry or liquid insecticides. The machine is light, simple in construction, and easily operated by one man, the larger sizes being drawn by a horse, and the smaller by hand power. The distributing power is obtained by a blast of air produced by a revolving fan worked by the traveling wheels of the machine.

"Very uniform and rapid work may be done with this machine in broadcast sowing of wheat, oats, and smaller seeds. These are distributed with great regularity over a track eighteen to twenty feet wide, giving a rate of thirty to forty acres per day. It is especially serviceable as a distributor of fertilizers (phosphates, nitrate of soda, lime, etc.,) and all insecticide powders, which latter may frequently be applied in connection with the former substances.

"Liquid insecticides are distributed broadcast at the rate of from one gallon upwards per acre, and by the action of the powerful blast of air are broken up into a fine mist, which spreads uniformly to a width of twenty feet."

"The one-horse power machine for broadcasting grains, fertilizers, and other solid or liquid insecticides, with suitable receptacles and nozzles, is retailed in England for £30 sterling, or $150. Hand-power machines are sold for £12 and £14."—*Insect Life*, iii, 1891, pp. 194, 195.

Insecticides lately recommended.— Prof. J. B. Smith, of the New Jersey Experiment Station has recently written of the value of potash salts for insecticidal purposes. High testimony to their value is given. Kainit was found to be more effective than the muriate of potash. Used of a strength of a half-pound to a gallon of water, it was effective against cabbage maggots, plant-lice infesting rose-bushes, and other species. Muriate of potash of the same strength quickly killed the mealy bugs on green-house camellias when sprayed upon them, without injury to the plants. It was also promptly effective upon the rose-leaf roller, *Cacœcia rosaceana.* It was found to injure some of the more delicate plants, and therefore needs further experiment with it.

Of the several preparations of tobacco, Prof. Smith gives preference to that known as "X. O. Dust," which seems to be tobacco, carbolic acid, and whiting. It was more active against plant-lice than even pyrethrum, and all kinds of naked larvæ yielded readily to it. The cabbage-worm was destroyed by it.

Prof. Smith also gives high attestation to the value of Sludge-oil soap, manufactured by the Columbia Chemical Works, Brooklyn, N. Y. It was tried upon the rose-bug, *Macrodactylus subspinosus*, against which, when appearing in full force as it often does in New Jersey, everything else had failed. This was the only material that would conquer these insects, in the experience of Prof. Smith. Col. Pearson of Vineland, who has so long been experimenting with methods for controlling the rose-bug, also had most gratifying success in the use of this insecticide. The experiments made with this soap were necessarily limited, and it is to be hoped that they will be continued.

NOTES ON SOME GARDEN AND ORCHARD INSECTS.

It may be of interest to refer to a few observations and experiments made during the year upon insects of importance to the horticulturist.

Protection from the striped cucumber beetle.— Dr. Weed's experiments indicate that the most promising insecticide for preventing the ravages of this insect, is tobacco powder, applied in liberal quantities to the plants. A shovel full may be used to a hill, as it acts both as a mulch and a fertilizer. In some factories the dust is given away as a refuse material. (*Bull. Ohio Agricul. Exper. St.*, iii, No. 8, September, 1890.)

The apple curculio.— The oviposition of the apple curculio, *Anthonomus quadrigibbus* Say, has been described and illustrated, by Prof. Gillette, in *Bulletin No.* 11 *of the Iowa Agricultural Experiment Station*, for November, 1890. This insect, so destructive in some of the Western States, is not very injurious within the State of New York.

The pear-blight beetle.— The little wood-boring beetle, noticed in the Proceedings of this Society at its Annual Meeting in 1890, under the name of the pear-blight beetle, or *Xyleborus pyri* (Peck), as having nearly destroyed a young pear orchard in Lockport, N. Y., has been found to be identical with the European species long known as *Xyleborus dispar* (Fabr.). The American name which has been recognized by us for so many years, will therefore have to give place to the older Fabrician one. This insect was probably introduced into this country from Europe toward the latter part of the last century. Since its destructive appearance at Lockport, as narrated, it has not been observed in that locality. The nature of the peculiar larval food, lining the chambers as a thick white coating, has not yet been satisfactorily determined.

The rose-bug.— The announcement made in the same paper above cited, that the Entomological Division at Washington had succeeded in working out the life-history of the rose-bug and would soon publish it, was premature. Dr. Riley, in *Insect Life*, for April, 1890 (ii, pp. 295-302), has given an excellent paper on this insect, illustrating the larva, pupa, and imago, and containing its past history, the little that is known of its natural history, its geographical distribution, interesting remarks on its food-plants and ravages, the enemies that prey upon it, which are few in number and include no true parasites, and remedies resorted to against it. Its full life-history is yet a desideratum. In *Insect Life*, for January, 1891 (iii, No. 5), Prof. J. B. Smith has presented a graphic account of an "Experience with the Rose-bug," the preceding season, in Vineland, N. J., during an invasion not at all uncommon there, but such as we are never called to contend with in the State of New York. He "had never seen insects in such numbers, in such constantly increasing swarms and of such enormous industry. * * It was simply awful! Every cherry was cleared off. Apple trees presented a great mass of sprawling rose-bugs burdening each apple. The fruit itself was not visible, but its situation was marked by the clumps of beetles. Nothing escaped them except peaches, and they, only, because there were none anyway. Pears were infested as badly as apples. Of the small fruits the blackberry seemed very attractive. * * * Raspberries were entirely destroyed. * * * They were in such force in Colonel Pearson's strawberry patches that the field looked like a yellow mass of moving insects. Millions of them swarmed on a couple of sour-gum trees on the road. In the vineyard, the havoc was woeful. Dozens of them were on each bunch of blossoms, and their fate was sealed. There were not blossoms enough to go round. On Clintons, they ate the entire leaf. * * * The contemplation of such enormous swarms induced a feeling of helplessness that was discouraging."

Colonel Pearson had used the usual copper compounds and found none of them effective. Vines completely coated with the Bordeaux mixture were as badly attacked as were those where none was applied. London purple had been used, and while it had killed some of the insects, "it was not protective at all, since all the buds and blossoms were eaten before the poison began to work."

Experiments made by Prof. Smith gave the following results: carbolated lime served no purpose as a repellant; fresh air-slaked lime dusted on the leaves, was ineffective, and applied in liquid to the extent of whitening the foliage, gave no better results; powdered napthaline mixed with carbonate of lime, although strongly odorous, had no effect; tobacco powder and the X. O. Dust, seemed to serve as a relish and an appetizer; a strong solution of tobacco applied until the leaves were coated, gave the same effects; pyrethrum powder, which has been recommended by the *Rural New Yorker* as an infallible remedy, failed entirely to keep away or to kill the insects, or arrest the ravages, although used of the strength of one-fourth of a pound to a gallon of water, and of a quality warranted pure and perfectly fresh, for which $2 per pound was paid; a strong decoction of quassia was not in the least distasteful to them; acetate of copper, digitalis, and acetic acid, were each barren of any good result; even kerosene emulsion, while it drove them away temporarily, did not prevent their return. At this time, toward the close of the campaign, sludge-oil soap was applied, with the result already stated.

The Marguerite fly.— This destructive miner of the leaves of the Chrysanthemums, Cinerarias, Eupatoriums, and other Compositæ, which has been so injurious in portions of New York and Massachusetts, was treated of at some length in the *Fourth Report on the Insects of New York*, under the scientific name of *Phytomyza lateralis* (Fallen), it having been identified by Baron Osten Sacken, of Germany, to whom it had been submitted, as identical with the European species of that name. It has subsequently been found that the identification was an erroneous one, and it has accordingly since been named and carefully described as *Phytomyza chrysanthemi* Kowarz, as will appear in the *Seventh Report on the Insects of New York*.

The bean weevil.— The report last-named will contain an extended article on this pernicious insect, based on studies made during the past year, in which it is shown that the insect may continue to breed indefinitely within the same lot of beans, although old and dried, for as long a time as the food-supply may last.

Conclusion.

It was purposed to extend materially the above insect notes, through examination of the literature of the year, and also, to cite some of the publications, especially, Bulletins of the Experiment Stations containing matters of especial interest to horticulturists; but this has been prevented by other engagements and duties that have intruded into the time allotted to this paper.

And further: the "Report of the Committee on Entomology" might properly be expected to contain mention of the several insect attacks — their character, extent, etc., which have occurred during the past year within the sphere of the Society's operations. That such is not found herein, is chargeable to the fact, that this paper can only be offered as the report of the chairman of the committee — it having been prepared without the opportunity of conference with his associates, or even its submittal for their approval and acceptance. Request for their aid was necessarily delayed, until, doubtless, too late for the preparation of the information asked for, and its communication.

Respectfully submitted,

J. A. LINTNER,

Chairman.

REPORT OF THE COMMITTEE ON ENTOMOLOGY.

[Read before the Western New York Horticultural Society at its Annual Meeting, January 26th, 1893.]

In grateful recognition of the TRIBUTE paid by this society to the science of economic entomology, in giving place in its annual convocations, amid so many papers of a high order of excellence, and discussions replete with interest and instruction, to a "Report on Entomology" your committee takes pleasure in presenting the following report:

[Remarks on the remarkable exemption during the past year from insect injuries and its probable causes, with reference to several species, are given on pages 293, 294 of this Report.]

Various Pests of the Year.

Among the insect demonstrations of the year, the following may deserve a few words of notice at the present time.

[Notice of several of these demonstrations, as of the fall tent-worm, *Hyphantria cunea;* the green-striped maple worm, *Dryocampa rubicunda;* the cabbage caterpillar, *Plusia brassicæ;* the canker-worm, *Anisopteryx vernata;* the apple-worm of the codling-moth, *Carpocapsa pomonella;* the white grub, *Lachnosterna fusca;* the elm-leaf beetle, *Galerucella xanthomelæna;* a gooseberry pest, *Systena frontalis;* the Colorado potato-beetle, *Doryphora decemlineata;* the plum curculio, *Conotrachelus nenuphar;* and a house-infesting beetle, *Otiorhynchus ovatus*, are contained in General Notes for the Year on pages 295, 296, and 297 of this report and are therefore omitted here.]

Passing from these general notes, may I ask your attention to a more detailed notice of three insect enemies of fruit and forest and shade trees, which are, at the present, subjects of special study, in the hope of discovery of means by which their serious ravages may be arrested.

The Gypsy Moth.

Notwithstanding the many insect pests of the first rank that are preying upon and devouring the products of the orchards, vineyards, nurseries, gardens, fields, and forests of the State of New York, it is a cause of thankfulness that another insect pest which the people of an adjoining State have been for the past two years, under liberal State aid, endeavoring to exterminate, has not yet entered within our borders. I refer to the Gypsy Moth, *Ocneria dispar* (Linn.), which was accidentally introduced into Massachusetts about the year 1869, by a gentleman interested in the rearing of silk-worms.

When first brought to notice in 1889 by Professor Fernald, of the Massachusetts State Agricultural College, as a dangerous public enemy, it was believed to be confined to a single locality in the town of Medford, less than a square mile in area. It had at that time, according to Professor Fernald, "multiplied to such an extent as to cause the entire destruction of the fruit crop and also to defoliate the shade trees in the infested region." The imperative necessity of its arrest, and the probability that it might be exterminated if proper means were promptly brought to bear upon it, urged by Professor Fernald, led to an appropriation by the Massachusetts State legislature, in March, 1890, of $25,000, for the accomplishment of the desired end, and the appointment by the Governor of three commissioners to conduct the work. An additional appropriation of an equal amount was made later in the year.

The commissioners, in entering upon their labors, found that the moth, instead of being confined to the narrow limits above named, had already invaded various parts of a territory four miles long by sixteen broad. Active measures were carried on by the commissioners during the season of 1890, yet, at its close, they reported the insect in seven different towns over an area of fifty square miles. Many acres of brush had been burned over, and 70,000 trees had been sprayed with Paris green and water, in which about two tons of the Paris green were used.*

The following year, in lieu of the commissioners, the work was placed in the hands of the State Board of Agriculture, and by them intrusted to a Gypsy Moth Committee of three carefully selected persons. The magnitude of the work becoming apparent, another appropriation was made by the legislature in June of 1891, of $50,000 — making the aggregate of appropriations thus far, $100,000.

It appears, from a special report on the subject recently made by the State Board of Agriculture, that their committee have conducted their work during the past year (*i. e.*, in 1891), with energy, with judgment, and with all the success that could have been expected. Some of the measures used by them for the control of the insect, were the following: spraying trees with Paris green in water; spraying the caterpillars with insecticides that kill by contact; spraying infested stone walls with kerosene and firing it; gathering the egg-clusters and burning

* Up to the present time, three and a half tons of Paris green has been used.

them; banding the trees with tarred paper to prevent the ascent of the caterpillars, and with burlaps for a hiding-place where they could easily be destroyed; burning brush and infested shrubbery after kerosening it; burning out nests in holes of trees and cementing; inspecting all vehicles going out of the infested territory for the caterpillar.

The extent of the work done will more fully appear from the following statement published by the committee, covering operations from April 1, 1891, to December 31, 1891:

Trees:	Number inspected	3,591,981
	Number infested	213,828
	Number cleaned of eggs	212,423
	Number sprayed	177,415
	Number cemented	19,296
	Number burlapped	68,720
	Number banded	12,000
Buildings:	Number inspected	87,536
	Number infested	3,647
	Number cleaned of eggs	3,574

What is regarded as a conservative estimate, based on the daily reports made to the committee, shows the aggregate number of egg-clusters destroyed during the first six weeks of the season, to be 757,760. Their bulk, according to Director Forbush, was nearly eight cart loads. The average number of eggs in a cluster being 468, there were over 353 millions of eggs destroyed during that time. The largest number of men employed at any one time was 242.

At the close of the year 1891, covered by the report referred to, the insect was known in twenty-six towns in Massachusetts, over an area of 200 square miles. No instance of its occurrence outside of the State of Massachusetts had been authenticated.

Through the kindness of Prof. Forbush, director of the field-work of the Gypsy-moth Committee, in sending me for use on this occasion a typewritten copy of his address before the State Board of Agriculture, in December last, I am able to make extracts therefrom relating to the operations of last year (1892).

The appropriation made by the Legislature to the State Board of Agriculture for the prosecution of the work in 1892 was $75,000. Operations were conducted much in the same manner as in the preceding year, but after thoroughly testing the principal means of control employed in this country and in Europe for this and similar insects, they proved to be inadequate, and new measures were experimented with, and employed when their value became established.

Thus it was found that arsenical spraying, on which much dependence had been placed, failed to kill the larger and more vigorous larvæ. Insecticides that kill by contact were therefore resorted to. The eggs were killed by an oil not previously used to any extent for insect destruction; and four tons of "insect lime," known as "raupenleim" in Germany, was imported from Europe and applied in bands on the bark around the tree: its viscidity — lasting for two months — served an admirable purpose in catching and holding all insects and effectually preventing their ascent of the tree.

The banding with burlaps was not only successful in entrapping large numbers of the Ocneria caterpillars, but also hosts of other injurious species, which could then be conveniently destroyed.

Gratifying success is reported from spraying infested brush and shrubbery on waste lands with kerosene from a cyclone nozzle and then igniting it. The same method, it was thought, might be effective against the marches and invasions of the army-worm.

It is claimed by the committee that they have succeeded the past year in staying the spread of the insect, and in greatly reducing its numbers. Fifty towns were thoroughly searched, and the moth found in thirty. In some of the towns it has been locally exterminated, and in three entirely destroyed. Not one egg-cluster can now be found as against a hundred in 1891. If sufficient means are provided for the work, extermination of the insect within a few years is regarded as next to certain. With an annual appropriation of $50,000, it is confidently believed by the committee that further spread can be prevented and the insect steadily reduced in numbers.

From my present knowledge of the work of the committee, I must commend it heartily, and would further express the desire that such appropriations shall continue to be made by the State as will enable the committee so to reduce the number of the insect that it may soon be handed over to its parasites, predaceous insects, and birds for complete extermination.

If I have seemed to you to have dwelt too long upon a single insect pest, please bear in mind the deep interest which we in New York must feel in the efforts being made for the extermination of this omnivorous insect before it shall have entered within our borders. In this interest, each one of the other States should also share. And then again, if success shall, as we hope, attend this effort, it can not fail of furnishing a precedent for calling for State aid and possibly upon the National

Government, from time to time, for prevention of the spread of some other newly introduced noxious pest, by stamping it out at its place of introduction — quite as much within their province as is protection from an invading army of soldiery, or from the fearful pestilence. How insignificant were the losses inflicted by the Hessian soldiers, compared to those which have resulted from the bringing hither of the Hessian fly.

A Destructive Shade Tree Pest.

A destructive borer of some of our most highly prized shade trees, as the elm and maple, has within the last five years been brought to notice in northern New Jersey, and in New York city and its immediate vicinity.

It is the larva of a rather large Bombycid moth, bearing the name of *Zeuzera pyrina* (Fabr.), closely allied in its habits and character to our long-known borer of the locust, oak, and willow — *Cossus robiniæ*. In Europe it has long been known as *Zeuzera æsculi* (Linn.) — the specific name referring to the horse-chestnut on which it was probably first observed, although, according to Kollar, "choosing that tree for its abode less frequently, in the neighborhood of Vienna, than any of the other trees that serve it for food, living chiefly in elms, walnut, pear, and apple trees."

The first example of it, so far as known, taken in this country (it is another of our introduced European pests), was found in a spider's web at Hoboken, N. J., in June, 1881 (*Papilio*, ii, 1882, p. 34).

Several examples of it were captured by collectors at electric lights in the summer of 1887, at Newark, N. J. The following year nearly fifty specimens were taken at Newark, also at electric lights. In 1889, it was found at Arlington and at Orange in New Jersey, and also, according to Mr. Pike (*Insect Life*, iv. p. 318), in Brooklyn, N. Y., where it had attacked "nearly all the trees, mostly maples, from Carlton avenue to the entrance of Prospect Park." In June of 1890, it was reported as girdling and boring young maple trees within a few inches of the ground, at Riverside Park, New York, causing them to break and blow over with the wind; it had also attacked the elms and maples in Prospect Park, Brooklyn, and along the whole length of the eastern boulevard. The following year (1891) it had so multiplied in New York city, that, according to Mr. Southwick, the entomologist of Central Park, more than twenty species of trees and shrubs had been attacked by it, and even vines, as Wistaria, had not escaped its polyphagous habit: thus far, evergreens and other strongly odorous trees, as sassafras and ailanthus, seemed to be exempt from its ravages. Two men were constantly employed during the month of May in collecting and destroying the larvæ that are taken out of the limbs that had broken off as the result of their burrowing. After every high wind, wagon loads of branches were gathered from the ground and burned. It was being combatted by every possible means, not only by burning the falling limbs, but by removing from the trees those that from their changing color or withering gave indications of infestation, and also, in case of the rarer trees, searching for an opening to burrows and injecting therein the powerful insecticide, bisulphide of carbon.

The same year it had extended its operations all over the city of Brooklyn — not an avenue or street therein but gave abundant evidence of its presence. It had also spread, according to Mr. Pike (*loc. cit.*), to Astoria, New Rochelle, Jamaica, New Lots, and Flatbush, on Long Island.

The injuries caused by this borer are quite serious. In young maples it attacks the trunk near the ground, as already stated, and so weakens it with its large burrows running around the tree as to cause it to break with the wind and fall to the ground. In the elms, different species of which it attacks, its operations, so far as observed, are confined to the limbs and branches, which are so weakened by the burrows of often a half-inch or more in breadth that they fall from their own weight or even with a moderate wind — the branches thus broken ranging from a half-inch in diameter to more than five inches.

Already many of the larger elms in Central Park have had their symmetry and natural beauty greatly impaired through this Zeuzera attack. We are not told that any have been killed, but such a result might follow should the insect become sufficiently numerous to invade the entire tree.

We do not know that any better methods can be used to arrest this increase than those that are employed at the present at Central Park, unless some means may be devised for destroying the eggs of the moth before the hatching of the larvæ and their entrance into the tree.

An Elm Tree Bark-borer.

The preceding attack, as yet, is quite local in our State yet destined, we fear, not long to continue so. Throughout the entire State, and beyond its limits, the beautiful white elm, *Ulmus Americana*, which has been so liberally planted and so highly prized as our most valuable shade tree, is suffering from the ravages of a hidden and insidious enemy, and dying one by one from a cause, not apparent, and known to but a few. This is chargeable to the operations of one of our longicorn beetles, named *Saperda tridentata* Olivier, the larvæ or grubs of which work in the inner bark and sap-wood of the trunk — the attack apparently commencing not far above the ground and gradually extending upward. When the grubs are numerous, their broad, flat burrows so reticulate and run into one another as effectually to girdle trunks of two to three feet in diameter, when, with the circulation arrested, the death of the tree inevitably follows. No effective remedy against this attack has as yet been found. It is probable, however, that where it has not proceeded too far, protection may be attained in coating the bark with some thick repellant substance (of which carbolic acid and Paris green should be components) that would repel egg-deposit or prevent the passage through of the newly-hatched larva. This coating would not need to be applied to the entire trunk, but might be limited to a broad zone of several feet, at and beyond that part where the burrows of the preceding year were mainly run — to be found by removing portions of the bark, which will readily scale off from the deserted older-infested portions.

A still better remedy, I think, would be the following: Remove the outer bark from the entire infested portion of the tree in the spring (occupied at the time by the larvæ or the pupæ) by shaving it down to the inner bark until the first indications of the fresh burrows are disclosed. A kerosene emulsion of good strength brushed over the shaven surface would kill the insects, after which a coating of some thick substance, as lime and cow-dung, should be applied to prevent the splitting of the sap-wood from exposure to the sun, drying winds or extreme weather.

That the barking of elms to even a greater extent than the above may safely be resorted to, appears from experiments made in France by M. Roberts, detailed in the *Gardeners' Chronicle and Agricultural Gazette* for April 29th, 1848, and quoted by Dr. Packard in his recent report on "Insects Injurious to Forest and Shade Trees" (1890), as follows:

"The whole of the outer bark was removed from the elm (this may be done conveniently by a scraping-knife shaped like a spoke-shave). This operation caused a great flow of sap in the inner lining of the bark (the liber) and the grubs of the Scolytus beetle were found in almost all cases to perish shortly after. The treatment was applied on a large scale, and the barked trees were found, after examination by the commissioners at two different periods, to be in more vigorous health than the neighboring ones of which the bark was untouched. More than two thousand elms were thus treated."

M. Robert has also obtained good results from cutting out strips of the bark of old elms of about two inches wide from the boughs down to the ground. "It was found that where the young bark pressed forward to heal the wound and a vigorous flow of sap took place, many of the larvæ near it were killed, the bark that had not entirely been undermined was consolidated, and the health of the tree improved."

For a long period of years the elm has been remarkably free from insect attack, but now it is struggling for existence against four insect destroyers, so pernicious in their operations that we are almost compelled to look upon it as a doomed tree. The Zeuzera is robbing it of its beautifully branching top; the elm-leaf beetle is defoliating it and rendering it in midsummer useless for shade; the caterpillars of the white-marked tussock-moth (*Orgyia leucostigma*) are skeletonizing its leaves and arresting terminal growth by amputating the ends of the twigs and strewing them over the ground; and lastly, the three-toothed Saperda — the most dangerous of all — is running its mines through sapwood and liber so closely and tortuously that the death of the tree is the inevitable result.

It is sincerely to be hoped that should the suggestions above made for staying the ravages of the last named insect not prove to be practicable, other means may be found, so efficient and so simple as to lead to their general use by individuals and by city authorities; and that the steady progress northward and westward over the State of the two other elm destroyers — the Zeuzera borer and the elm-leaf beetle — may be stayed, and the most beautiful and serviceable of our shade trees be spared to us and to coming generations.

Experiment Station Publications.

The work of the Experiment Stations during the past year has developed results which are of considerable value to the members of this society. I will briefly refer to a few of the studies, citing the bulletins where they are more fully detailed, in order that those who so desire may make application for them to the several stations, and procure copies before the editions shall be exhausted.

The Pear Tree Psylla.— Mention has been made of the remarkable cessation of the injuries during the past year of the pear-tree Psylla in the Hudson river valley. This insect is not confined to the eastern part of the State of New York and portions of the Eastern States adjoining, but it also occurs in Central and Western New York,— not as yet in great abundance, but the pear orchards are at any time liable to an outbreak of it.

A careful study of the insect has been made at Cornell University by Mr. M. V. Slingerland, and its results published in an illustrated bulletin of 28 pages, being Bulletin 44, October, 1892, of the University Agricultural Experiment Station. Its life-history has been worked out, and the remedies available for its destruction are given. Of the various remedies experimented with, the most efficient was found to be kerosene emulsion sprayed upon the insect while in its larval stage before acquiring wings. A single spraying with the standard emulsion reduced with twenty-five parts of water (less than three per cent of kerosene) killed, as estimated, from 75 to 90 per cent of the larvæ. The early spring, just after the leaves had expanded, proved to be the best time for spraying. In the experiments made, the unexpected result was obtained that the fully exposed eggs of the Psylla were not to be killed by spraying with undiluted kerosene, or even when they were immersed in the liquid.

Insects Injurious to the Blackberry.—In Bulletin N. of the New Jersey Agricultural Experiment Station, November 30, 1891, Dr. J B. Smith, entomologist, has given popular descriptions, accompanied with illustrations, of the more destructive blackberry insects, with suggestions regarding the remedies to be used against them.

Insects Injurious to Young Fruit Trees.— The entomologist of the Oregon Agricultural Experiment Station, in Bulletin No. 18, for March, 1892, has given popular accounts of, with suggestions as to remedies for, a large number of the insect enemies of young fruit trees.

The Grapevine Leaf Hopper.— Mr. Townsend, the entomologist of the New Mexico Agricultural Experiment Station in writing of this insect *Typhlocyba vitis* (Harris), often referred to as "the thrips," states: For some time after the hatching of the eggs, the minute young are to be found mostly on the lower, older leaves. Kerosene emulsion has been conclusively proven as the only practical remedy for them. It should be diluted with fifteen times its volume of cold water and applied *as soon as the young hoppers appear*, thoroughly reaching with the spray the underside of all the leaves, especially the lower ones. If deferred until they have acquired wings, it would be too late to attempt to destroy them in this manner. Vineyards sprayed only once the past season with the emulsion as above directed, showed thereafter not enough hoppers to do any injury for the remainder of the season, the same vines having been very plentifully infested before the application. (Bulletin No. 5, March, 1892, New Mexico Agr. Exp. Station.)

It is strange, when this insect can be so easily destroyed, that there should appear every year in the *Vineyardist* and other papers, so many complaints of severe injuries sustained from it.

The Strawberry Weevil.— Mr. M. H. Beckwith, of the Delaware Agricultural Experiment Station, in Bulletin No. 18, for September, 1892, has written of this weevil, *Anthonomus musculus*, which works in the buds and blossoms of the perfect flowering varieties, its larvæ penetrating the center of the blossom (the ovary or the rudimentary berry) and thereby blasting the berry. Kerosene emulsion and powdered hellebore in water are recommended for use against it.*

A New Strawberry Slug.— Prof. Herbert Osborn, of the Iowa Experiment Station, reports successful experiments in killing the green strawberry-slug, *Monostegia ignota* (Norton), which in the early part of June had extensively eaten the leaves of a strawberry patch on the Station grounds. They were thoroughly sprayed with one pound of London purple to 200 gallons of water. The fruit was partly grown at the time. Further injury ceased within two or three days, and the slugs were killed, as shown by the presence of their dead bodies. Two and one-half gallons of the spray, containing about forty grains of arsenic, had been applied to a patch of nearly one square rod. Estimating that the fruit—about six quarts—had received one-tenth of the spray distributed (four grains) and that one-half of the amount of the spray would have been equally effectual, and accepting two grains of arsenic as a dangerous dose, it appears from these data that upwards of twelve quarts of the ripe fruit would have to be eaten to give a fatal dose of the arsenic (Bulletin No. 18, Iowa Agricultural Experiment Station, August, 1892).

Protection from the Cabbage Maggot.— In the Eighth Annual Report of the Wisconsin Agricultural Experiment Station for the year 1891, Professor E. S. Goff has presented very successful results in protecting cabbage and cauliflower plants from the attack of the cabbage-fly, *Anthomyia brassicæ* Bouché, by surrounding the stalk of the plants at their setting, with small hexagonal discs of tarred paper, rapidly cut from sheets by means of a tool devised for the purpose. It seems to be the most successful method yet discovered for protection against this most annoying pest of truck-farmers and gardeners, which often destroys entire crops of early cabbages and cauliflowers. For details of the method, the report cited may be referred to, or an article contributed by me to the issue of *Gardening* for February 1, 1893.

Kerosene for the Aphis.— Professor Goff has also experimented with kerosene emulsions for destroying the eggs of the aphis infesting apple and plum (*Aphis mali* Fabr.) during the winter while there were no leaves to interfere with the distribution of the insecticide. The experiments were not successful, for although emulsions of the strength of twenty, twenty-five, and thirty per cent were used, it was

* This insect has recently been shown to be the *Anthonomus signatus* of Say. See *Insect Life* v, January, 1893, pp. 167–186, for an extended account of it, with illustrations, by Mr. F. H. Chittenden.

subsequently found that the sprayings had failed to destroy the eggs. Full success, however, was attained by a spraying of emulsion containing thirteen per cent of kerosene, on April 24th, just as the buds of the apple were beginning to burst. The aphides were hatching from the eggs at this time, and they were almost entirely destroyed. This, therefore, may be accepted as the most vulnerable period in the life of the insect. (See the report above cited.)

Soapsuds for the Cabbage Aphis.—Kerosene emulsion has been recommended for killing the plant-lice that often congregate in immense numbers on the leaves of cabbage, but if the emulsion is used of the proper strength to kill the insect, it also imparts a permanent flavor of kerosene to the plant. In trials made at the South Dakota Station of various insecticides, strong soapsuds gave better satisfaction than any other remedy and proved highly efficacious. While most fluid applications were found to roll off from the aphides without wetting them, the soap solution readily penetrated the gray powdery substance which covers their body and killed them. (South Dakota Agricultural Experiment Station, Bulletin No. 30, March, 1892.)

Plant-lice and Red Spiders on Rose bushes.—Professor C. H. Fernald, of the Hatch [Massachusetts] Agricultural Experiment Station, reports that potted rosebushes of different varieties, every twig of which was literally covered with the aphides, and more or less the surface of the leaves, and also having the red spider, *Tetranychus telarius* (Linn.) exceedingly numerous on the leaves, were inserted and held for about a quarter of a minute in a pailful of kerosene emulsion, with this result: two days thereafter, examination of the bushes failed to show either a single living plant-louse or red spider; and none appeared on them for the rest of the season.

Spraying and Insecticides.

A few notes on what is being done in spraying for insect pests, and on some new insecticides, may not be out of place at this time.

Experiments with Paris Green on Tent Caterpillars.— Professor Fernald reports that with one pound of Paris green to 1,000 gallons of water, all the caterpillars placed on the leaves died within twelve days. One pound to 150 gallons of water burned the foliage and injured the tree considerably. The best proportion for use on apple trees appeared to be, one pound of Paris green to 200, 250 or 300 gallons of water; even the last-named strength killed all the caterpillars within two days; with a dilution of 400 gallons, all were dead in three days.

Paris Green on the Gypsy Moth Caterpillar.— That Paris green has failed to give entire success in killing the Ocneria caterpillar, is the report of the Gypsy Moth Committee. The mixture used by them would seem to be an excellent one, viz., one pound to 150 gallons of water and two quarts of glucose. The glucose held the poison on the leaves during hard showers, and proved to be a useful addition, and preferable to any other substance tried for prolonging the effects of the arsenite. Yet this, they state, while destroying the young caterpillars, failed to kill those that were nearly mature. A grove of trees that had been twice sprayed with a strength of one pound to 100 gallons of water was afterwards entirely stripped of leaves. Although many of the caterpillars were killed, there were subsequently gathered from under the same trees over 1,100 living pupæ of Ocneria. The Paris green used was several times analyzed and found to be fully equal to any in the market.

It is difficult to believe that foliage sprayed with a strong mixture of Paris green will not kill all caterpillars that feed freely upon it, and the statement above-made needs confirmation. It is not impossible that the nearly matured caterpillars which were not killed, may have fully matured and ceased feeding preparatory to their pupation; or the observations may have been during the two or three days of cessation from food that may precede the last of the larval moltings.

Spraying for the Codling Moth.— The following is quoted from the *American Cultivator*, of January 2d, 1892: A careful examination was made of two trays of unassorted apples, each containing one hundred specimens, the fruit in one tray being taken from a sprayed tree and the other from an unsprayed one adjoining. The apples were divided into three grades, No. 1 being perfect apples, No. 2 having one or two blemishes, and No. 3 being almost worthless. In the tray from the unsprayed tree, there were four perfect apples, 58 second-class, and 38 culls, while the tray filled from the sprayed tree contained 84 first-class, 9 second-class, and 7 culls. (*Insect Life*, iv, 1892, p. 288.)

E. G. Lodeman reports, in Cornell Bulletin 48, signal results in spraying for codling-moth in the very wet season of 1892.

Spraying for the Plum Curculio.— Reports from a number of fruit-growers in Ohio indicate that spraying with Paris green is considered an effective remedy for the plum curculio. It is thought that two ounces of the green to 50 gallons of water is sufficient, if three or four applications are made during the season; and that the use of the dilute Bordeaux mixture in connection with the insecticide will prevent injury to the foliage. The mixture of fungicides and insecticides was also used with beneficial effects on pear trees attacked by the curculio. (Abstract in *Experiment Station Record*, from Ohio Station Bulletin, No. 9, vol. iv, December, 1891.)

From an address made by W. J. Green, before the Ohio State Horticultural Society at its last meeting, and reported in the *Country Gentleman* of January 12th, 1893, it appears that while the effectiveness of arsenical spraying for the curculio is conceded, it can not be done with sufficient frequency during the long period of the curculio's presence — from May to August — without injuring the foliage and causing the leaves to fall. A large degree of protection, however, to the foliage may be secured by using a dilute Bordeaux mixture with the Paris green. The following is the formula given: Lime, 4 pounds; sulphate of copper, 4 pounds; Paris green, 4 ounces; water, 50 gallons. This mixture was found satisfactory for European plums, but damaged the American varieties. With the Paris green reduced to two ounces, very little harm resulted, but it was questioned if this proportion of the arsenite would prove effective against the curculio.

A New Contact Insecticide.—The Gypsy Moth Committee in Massachusetts have found by experiment that the soap-powders, such as "Gold Dust" and "Babbitt's Continental Washing-powder," are deadly to caterpillars when properly applied, and were efficient in killing both the caterpillars and the pupæ of *Ocneria.* Babbitt's 1776 soap-powder was used in the proportion of one pound to six gallons of water, the powder being first dissolved in a little warm water, and sprayed upon the congregated caterpillars until they were well soaked with the liquid. It was thought that the "Gold Dust" gave the most uniform and satisfactory results. Unfortunately, "these solutions can not be used for spraying tender plants, as they injure the foliage. They can be used only on insects that cluster about the trunks of trees or smaller objects." (Forbush.)

Creosote Oil as an Insecticide.— For killing the eggs of the gypsy moth, the committee found that creosote oil, applied to the clusters by means of a brush so as to saturate them, penetrated and killed the eggs at once. The oil is made by the Carolina Oil and Creosote Company, at Wilmington, North Carolina, and is sold at fifteen cents a gallon by the barrel.

Experiments should be made to test the efficacy of this oil on the apple-bark and other scale insects, and on the eggs of such insects as have failed to be killed by applications of kerosene, as those of the pear-tree Psylla, the apple-tree aphis, the squash-vine borer (*Melittia cucurbitæ*), and the squash-bug (*Anasa tristis*).

A Cheap Insecticide.— The assistant chemist, B. W. Kilgore, of the North Carolina Experiment Station, has proposed the following cheap preparation for spraying fruit-trees: A mixture of one pound of the commercial white arsenic and two pounds of lime, boiled together for half an hour in two to five gallons of water, and then diluting it to about one hundred gallons of water. The mixture prepared as above contains absolutely no soluble arsenic; and it was clearly shown that the "burning" or "scorching" of leaves is due entirely to the soluble arsenic present, and is in direct proportion to its amount.

Arsenites with Bordeaux Mixture.—Mr. Kilgore also reports: "Practical tests of the effect upon foliage of combinations of Paris green and London purple, each with Bordeaux mixture, were made. These combinations contained one pound of Paris green and one pound of London purple, separately, in 150 gallons of Bordeaux mixture, and applied to fig, grape, mulberry, blackberry, peach, pear, and apple leaves. Each mixture was tested for soluble arsenic, but none was found in any case. Nor did the slightest injury result to any of the leaves from these combinations. Some experiments were also made with combinations containing one pound of the arsenites to 100 gallons of Bordeaux mixture, with the same results as the above. Both theory and practice show these combinations to be perfectly harmless to foliage, and that they may be used with freedom."

These results are accompanied with elaborate tables, on which they are based. The use of lime for neutralizing the injurious effects of the arsenites is in accord with the publications of Professor Gillette, in Bulletin No. 10 of the Iowa Agricultural Experiment Station. Professor Kilgore's experiments were made in July, 1890, but their publication was delayed until a year thereafter. (See Technical Bulletin No. 2, of the North Carolina Agricultural Experiment Station, Raleigh, July 1, 1891.)

E. G. Lodeman, of the Cornell (N. Y.) Station (Bulletin 48), has found excellent results to follow the combination of Paris green and Bordeaux mixture for spraying apple trees to combat codling-moth and apple-scab. His conclusions upon this point are as follows:

"When Paris green was added to the Bordeaux mixture, the fungicidal action of the combination was more marked than when London purple was used in place of Paris green.

"Paris green has a certain fungicidal value, but in this respect it does not nearly equal the Bordeaux mixture.

"The value of Paris green as an insecticide does not appear to be materially affected, whether it is applied alone or in combination with the Bordeaux mixture.

"The insecticidal value of Paris green when used with the Bordeaux mixture was greater than that of London purple when similarly applied."

Farmers' Bulletin on Spraying.—A serviceable bulletin for the use of fruit-growers is one published in 1892, by the United States Department of Agriculture, entitled "Farmers' Bulletin No. 7. Spraying Fruits for Insect Pests and Fungous Diseases," 20 pages.

It discusses spraying with kerosene emulsion and the arsenites for insect pests, and spraying from the hygienic standpoint. Spraying for fungus diseases of the apple, pear, and other fruits. Does it pay to spray? The fungicides used in spraying. How and when to spray. Treatment of scab, powdery mildew, the leaf-blights, black-rot of the grape and anthracnose. Use of copper compounds from a hygienic standpoint.

This is perhaps the most convenient and reliable bulletin on spraying that has yet been prepared, and copies may probably be obtained by addressing the Department of Agriculture at Washington.

Bulletins on Spraying and Insecticides.—Several bulletins on these subjects have been published during the year 1892 and the preceding one, which would be found of service to fruit-growers, florists, nurserymen, and others. Among them are the following:

Information on Spraying Fruits. Pennsylvania State College Agr. Exp. Station, Bulletin No. 19, April, 1892.

Insecticides and Fungicides. Michigan Agr. Exp. Sta., Agricultural College, Bulletin No. 83, April, 1892.

The Spraying of Orchards. Ohio Agr. Exp. Sta., Wooster, vol iv, December, 1891.

Experiments with Fungicides and Insecticides. Hatch Exp. Sta., Amherst, Mass., Bulletin No. 17, April, 1892. 11 plates.

Injurious Insects and Insecticides; Spraying Machinery. Delaware College Agr. Exp. Sta., Newark, Bulletin No. 12, March, 1891.

Kerosene Emulsion. Michigan Agr. Exp. Sta., Agricultural College, Bulletin No. 76, October, 1891.

Spraying for Insect and Fungous Pests of the Orchard and Vineyard. New Jersey Agricultural College Exp. Sta., New Brunswick, Bulletin No. 86, April 4, 1892.

Spraying Apple Orchards in a Wet Season. Cornell University Exp. Sta., Ithaca, N. Y., Bulletin No. 48, December, 1892.

Bounties for Insect Pests.

Garden and Forest, for December 21, 1892, records an interesting "Campaign against the Tent-caterpillar." The apple-tree tent-caterpillar has for several years past been an almost unendurable nuisance in various parts of Massachusetts, particularly in the vicinity of Boston. Entire trees and shrubs are completely stripped of their leaves, convert-ing the fresh spring foliage into a painful and depressing scene, and robbing walks and drives of their natural rural beauty.

In order to arrest or mitigate, if possible, this evil, the Newton Horticultural Society and the Newton Center Improvement Association prepared and widely distributed a circular illustrating the insect in its several stages, giving a full description of its eggs, and offering prizes for the collection of the egg-belts, to be brought to the Horticultural Society before April 1st. As the result, $75 was distributed in prizes and gratuities among the competitors, the first prize of $15 being given to a young lad who presented over 15,000 belts.

The above effort having effected the destruction, as estimated, of 25,000,000 of eggs during the year, the society is encouraged to offer for the following year a reward of $1 for every thousand belts brought in, and has invited contributions, that the work may be successfully carried on.

I would heartily recommend this method for localities in New York where the tent-caterpillar has become unusually abundant. Could other of our wide-spread insect pests be controlled by similar means, it would be a wise economy to employ children in the work by the payment of suitable rewards. Unfortunately, few insects offer so vulnerable a point of attack as does the apple-tree tent-caterpillar, in its shining egg-belt on a leafless tree. In cities and villages where the white-marked tussock-moth, *Orgyia leucostigma*, frequently strips the elms and horse-chestnuts of their foliage, the devastation for another year could be stayed by offering a certain sum per thousand, or by weight or measure, for the egg-deposit of the moth on its cocoon — so conspicuous in their snowy whiteness on the trunks and lower branches of trees and beneath window-sills and copings, during the months of August and September, or before they have become dingy from weathering.

In conclusion, I feel that I owe an apology for the length of my report, and I accordingly offer this: Your president and a number of individual members of the Society have from time to time manifested to me so deep an interest in entomological studies as directly bearing upon their pursuits and labors, that I have presumed upon a patient listening to whatever I had to present. The report, certainly, would have been much more brief had it been prepared for any other body than for the intelligent and appreciative membership of this Society, before whom I am always glad to appear and offer my humble tribute.

Respectfully submitted on behalf of the Committee on Entomology.

J. A. LINTNER,
Chairman.

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LIST OF PUBLICATIONS OF THE ENTOMOLOGIST.

The following is a list of the principal publications of the Entomologist during the year 1892 — thirty-three are named,— giving title, place and time of publication and a summary of contents.

A similar list for the years 1870–1874 is appended.

Killing the Pea-Weevil. (Rural New Yorker, for April 2, 1892, li, p. 227, c. 2, 3 — 9 cm.)

Bruchus pisi may be killed in newly ripened pease by exposure for one hour to a temperature of 145° Fahr. The vapor of bisulphide of carbon is believed to be the best agent for killing the bean- and the pea-weevil.

Early "Grasshoppers." (Country Gentleman, for April 14, 1892, lvii, pp. 286–7, cols. 4, 1 — 28 cm.)

Insects taken in Washington Co., N. Y., hopping about on March 20th, are the young of the green-striped locust, *Chimarocephala viridifasciata* De Geer, noticed in the Second Report on the Insects of New York, as appearing in the winter of 1882 in different places in New York. Their life-history is sketched and reasons given why severe injuries may not be expected from these early appearances. Reference is made to the erroneous popular use of the name "grasshopper" for locust.

[See extended notice as *Chortophaga viridifasciata*, in pp. 330–334 of this report (ix).]

*Cluster Flies—Pollenia Rudis. (Country Gentleman, for May 5, 1892, lvii, p. 358, c. 1, 2 — 54 cm.)

The fly identified and the names which it has borne; notice by W. H. Dall, of its occurrence at Geneva, N. Y., and elsewhere by other writers: its hibernation in houses: its principal features: how it may be killed.

[Extended in pp. 309–314 of this (Ninth) Report.]

Report of the State Entomologist for the Year 1890. (Forty-fourth Annual Report of the New York State Museum for the Year 1890, pp. 197–405, figs. 1–40.) Separate: Seventh Report on the Injurious and Other Insects of the State of New York [April 29], 1891, pp. 210, figs. 40.

The contents are: INTRODUCTORY: INJURIOUS INSECTS: Aulacomerus lutescens, the Poplar saw-fly. Pyrrharctia isabella, the Black-and-red Woolly

*The capitalization, etc., of the *Country Gentleman* is followed herein in the citation from it of titles of publications.

Bear. Helophilus latifrons—one of the Syrphus flies. Chloropisca prolifica, the Prolific Chlorops. Dynastes Tityus, the Rhinoceros Beetle. Bruchus obsoletus, the Bean-Weevil. Bruchus rufimanus, the European Bean-Weevil. Bruchus lentis, the Lentil Weevil. Conotrachelus nenuphar, the Plum curculio. Cicada septendecim, the Periodical Cicada. Brief Notes on Various Insects: Ocneria dispar, the Gypsy Moth. Spilosoma Virginica, the Yellow Woolly Bear. Thyridopteryx ephemeræformis, the Bag-worm. Erebus odora. Tmetocera ocellana, the Eye-spotted Bud-moth. Cecidomyia balsamicola, the Balsam Cecidomyia. Cecidomyia sp.? within a jumping gall. Epilachna borealis, the Northern Lady-bird. Sitodrepa panicea, as a Leather Beetle. Aphodius fimetarius, a Dung Beetle. Saperda candida, the Round-headed Apple-tree Borer. Diabrotica 12-punctata, the 12-spotted Diabrotica. Phytonomus punctatus: the fungus infesting it. Monarthrum mali, the Apple-tree Bark Beetle. Aphis brassicæ, the Cabbage Aphis. Myrmeleon ?immaculatus: a Strange Habitat for the Larva. Dendroleon obsoletum; a Climbing Ant-Lion. Injurious Arthropods: Bryobia pratensis, the Clover Mite. Cermatia forceps — a Household Centipede. Appendix. (A) Entomological Contributions: The Insects of the Past Year and Progress in Insect Studies. Late Experiences with Insects Injurious to the Orchard and Garden. (B) List of Publications of the Entomologist. (C) Contributions to the Department. General Index.

Slugs on Pear Trees. (Country Gentleman, for May 19, 1892, lvii, p. 387, c. 2, 3—20 cm.)

An attack on pear-trees in Orange, N. J., is recognized as that of the pear-tree slug, *Eriocampa cerasi* (Peck), which also occur on cherry, quince, and plum trees. The two broods are noticed. It may be killed by powdered hellebore, dry or in water, spraying with Paris green, dusting with powdered lime or even with road dust unless just before molting. Are there three broods in New Jersey?

[See pages 335, 336 of this Report (ix).]

The Cherry-tree Aphis on the Wild-goose Plum. (Country Gentleman, for May 26, 1892, lvii, p. 407, c. 4—16 cm.)

Insects from Central Kentucky as quite injurious to wild-goose plum trees and "observed also on the burning bush," are *Myzus cerasi* (Fabr.). Although for a long time thought to occur only on the cultivated cherry, it is now met with occasionally on the plum. Spraying with strong whale-oil soap solution would be effective if all the insects were reached by it. Kerosene emulsion would be preferable, if used before the aphids are protected by the curling of the leaves. This aphis is not found on the burning bush: another black species, *Aphis rumicis* (Linn.), was probably mistaken for it.

The Scurfy Bark-Louse. (Country Gentleman, for June 9, 1892, lvii, p. 458, c. 1—26 cm.)

Scale-insects on apple twigs from High Bridge, N. J., are *Chionaspis furfurus* (Fitch), occuring on most of the fruit-trees, and distributed from the Atlantic to the Pacific, and recently found in Europe. The specimens received on small twigs, were of an unusually elongate shape. Spraying with kerosene emulsion soon after they are hatched, will kill them. Other remedies are application of "heavy-oil," soap-suds and carbolic acid, and other means mentioned in the Country Gentleman, for March 1, 1888, p. 169.

The Harlequin Cabbage-Bug. (Country Gentleman, for June 9, 1892, lvii, p. 458, c. 1, 2—27 cm.)

The conspicuous and peculiar markings of this insect, the *Murgantia histrionica* (Hahn.), received from Woodbury, N. J., have given to it its specific and popular name. It feeds on most of the *Cruciferæ*; its distribution is noticed: now for the first time received from New Jersey. Recommendations for destroying it are: sprinkling with hot water; trapping with leaves placed on the ground; burning the rubbish of the fields; destroying the hibernated insects while ovipositing in the early spring, and crushing the eggs. The insect develops rapidly — may mature from eggs within three weeks.

[See pages 315–317 of this Report (ix).]

The Pear-tree Psylla. (Science for June 17, 1892, xix, pp. 343, 344 — 30 cm.)

Recent injuries to pear-trees from two pests, *Diplosis pyrivora* and *Psylla pyri:* when they were introduced: injuries from the latter in the Hudson river valley: what the insect is: when it appears in its several stages: should not be hard to control: may be killed by spraying when first hatched, and even after it is winged, with kerosene emulsion: the Vermorel nozzle preferable against the winged insect, and how to use it.

[See extended notice in pp. 317–329 of this Report (ix).]

The Apple-tree Tent-Caterpillar. (Country Gentleman, for June 23, 1892, lvii, p. 492, c. 1—11 cm.)

In reply to inquiry from Boston, Mass., for preventive means against caterpillars which have defoliated fifty apple-trees: the insect, *Clisiocampa Americana* Harris, is easily controlled by two methods — either by collecting the egg-belts while the trees are leafless and burning them, or by destroying the nests with the contained larvæ as soon as they can be discovered in early spring, during the cool part of the day.

Aster and Lily Pests. (Country Gentleman, for June 23, 1892, lvii, p. 492, c. 1—12 cm.)

The "minute white objects" associated with myriads of small red ants (specimens not submitted), covering the roots of asters in Riga, N. Y., are probably a species of plant-louse, and perhaps the *Aphis Middletonii* of Thomas (8th Illinois Report). The "worms" boring into the stalk of lilies below the ground, judging from the brief description sent, are one of the Myriapods or "thousand-legged worms." These may be killed by lime-water or nitrate of soda in solution. For the Aphides, withdraw the ground and apply strong soap-suds, or tobacco water or pyrethrum water, or pour hot water on the ground about the plants.

[Published in pp. 371, 372 of this Report (ix).]

The Cow-Horn Fly. (Country Gentleman, for June 30, 1892, lvii, p. 501, c. 2—16 cm.)

A remedy is asked for the fly, *Hœmatobia serrata*, which is occurring "in millions" in Madison county, N. Y. It is rapidly increasing and spreading throughout this State, and has also appeared in Ohio, Kentucky and Mississippi. Any of the greases or oils with some carbolic acid, if rubbed on the cattle, will usually act as a repellant, as also tobacco-dust rubbed into the hair. Spraying the cattle with kerosene emulsion two or three times a week will drive away the flies and prevent their return. The larvæ may be killed by daily spreading thinly the fresh droppings where they breed or by sprinkling lime thereon.

The Meal-Worm, Tenebrio Obscurus. (Country Gentleman, for June 30, 1892, lvii, p. 501, c. 2, 3—18 cm.)

Insects infesting wheat in a granary in Buckland, Va., are the American meal-worm, *Tenebrio obscurus* Fabr. The larva and beetle are characterized; is more injurious than the European *T. molitor*, as it prefers dry and sound flour; both infest granaries, mills, and farm houses. The best remedy for it is bisulphide of carbon, used as directed, one ounce to a hundred pounds of grain. The dead insects should be removed from the grain, as serious results have followed their having been ground into the flour.

[Extended in pp. 307–309 of this Report (ix).]

The Pear-Leaf Blister. (Country Gentleman, for June 30, 1892, lvii, p. 504, c. 2—7 cm.)

Leaves from Carlton, N. Y., are nearly covered with the pear-leaf blister, caused by the operations of the microscopic mite, *Phytoptus pyri*. Sulphur has been used for killing, but when applied it can reach so few of the concealed mites that it is not effective. The best remedies are found in picking off and burning the infested leaves or the branches, heavy pruning in the winter or spring, or in the removal of the infested tree. Reference is made to the *Country Gentleman* of October 2d, 1890, for further information of the *Phytoptidœ* and of the species.

Injuries to a Maple Tree. (Country Gentleman, for July 21, 1892, lvii, p. 552, c. 2—8 cm.)

The tree has probably been attacked by the maple-tree borer, *Glycobius speciosus*. The remedies for this attack are given. The eggs observed under a thin gray film on the bark could not have been the source of the attack.

A Cauliflower Pest. (Country Gentleman, for August 11, 1892, lvii, p. 600, c. 3—6 cm.)

Pieris rapœ is identified as injurious to cauliflowers at Cheviot-on-Hudson. Recommendation is made to mix fresh pyrethrum powder with four times its bulk of flour, and, after it has stood for twenty-four hours, to dust it thinly over the caterpillars.

Pear-eating Beetle. (Country Gentleman, for September 8, 1892, lvii, p. 667, c. 2, 3—8 cm.)

A beetle, from Buffalo, N. Y., eating into pears, is the Indian Cetonian, *Euphoria Inda* (Linn.). Its habits are given, as also its injuries to fruit and vegetables, and means of protection from it.

Roseleaf Caterpillar. (Country Gentleman, for September 8, 1892, lvii, p. 667, c. 3—5 cm.)

A caterpillar feeding on roseleaves at Cos Cob, Conn., the prominent features of which are given, is one of the *Cochliopodæ*, but can not be identified at present.

[It was subsequently identified as *Parasa chloris* H.-S.]

Strawberry Root Grub. (Country Gentleman, for September 8, 1892, lvii, p. 667, c. 3—4 cm.)

For the white grub infesting strawberry roots, remedies named are digging out, and pouring kerosene emulsion over the roots.

The Black Blister Beetle. (Country Gentleman, for September 15, 1892, lvii, p. 689, c. 3—7 cm.)

In reply to complaint from Meriden, Conn., of this beetle, *Epicauta Pennsylvanica* (De Geer), several of the food-plants of the insect are given, and remedies for it, as beating into a vessel of water with kerosene, dusting with pyrethrum powder, and inclosing the blossoms in gauze during the prevalence of the beetles.

The Hag-Moth Caterpillar. (Country Gentleman, for September 22, 1892, lvii, p. 709, c. 3—8 cm.)

A caterpillar from East Greenwich, R. I., is the *Phobetron pithecium* (Sm.-Abb.). Its peculiar features are given. It is often received for name in August and September. Its food-plants and stinging powers.

Remedy for the Army Worm. (Country Gentleman, for October 6, 1892, lvii, p. 750, c. 3—7 cm.)

The best remedy for the army worm in its migrations is ditching with walls sloping inward and deep holes at intervals. Other remedies are barriers of boards coated with tar, rolling the ground when smooth to crush the worms, and poisoning with Paris green, strips of the threatened crop in advance of attack.

Weevil in a Granary. (Country Gentleman, for October 6, 1892, lvii, p. 750, c. 3—5 cm.)

Bisulphide of carbon — about one pound to a ton of grain, in an open vessel on top of the grain will kill the weevils in a tight granary, without injury to the grain, or affecting it for food purposes.

The spotted Horn-Bug. (Country Gentleman, for October 13, 1892, lvii, p. 767, c. 3 — 14 cm.)

A beetle of this species, *Dynastes Tityus* (Linn.), is received from Magnolia, Maryland, where it was taken in a ripe pear. Its more prominent features are given. It is a southern form which has once been taken in the State of New York. Not having been recorded as injurious to fruit, if it had eaten into the pear in the above instance, it would indicate a possibility of its becoming a fruit pest. October is apparently a little late for the occurrence of the beetle.

[See page 342 of this Report (ix).]

Cabbage Worms. (Country Gentleman, for October 13, 1892, lvii, p. 767, c. 4 — 6 cm.)

In reply to inquiry whether the published remedy of sprinkling corn meal over the leaves when wet with dew will destroy the caterpillars, answer is made: The efficiency of the proposed remedy is improbable. It has met with ridicule in some scientific journals. A test of it can easily be made.

[Some late experiments seem to show that the caterpillars can be killed by the meal.]

Tent Caterpillar. (Country Gentleman, for October 13, 1892, lvii, p. 767, c. 4 — 5 cm.)

A formula for killing this insect, consisting of kerosene, water, castile soap, and caustic potash, in proportions given, of which its value is asked, does not promise to kill the caterpillars by contact or through feeding. Reliable methods are collecting and burning the egg-belts, and wiping out and crushing the nests when first formed.

Kerosene Emulsion. (Country Gentleman, for October 13, 1892, lvii, p. 767, c. 4 — 8 cm.)

Replying to inquiry — the method of making the emulsion is given, and directions for applying it to strawberry plants for killing the grubs at the roots.

Will the Cow-Horn Fly Remain with us? (Country Gentleman, for October 13, 1892, lvii, p. 769, c. 4 — 18 cm.)

Although very injurious in New Jersey in 1888, it is now no more annoying in that State than is *Stomoxys calcitrans*. Two or three years hence it will probably have diminished in number to the same extent in the State of New York, although it will doubtless continue as a pest in localities favorable for its multiplication. Will the *Hæmatobia serrata* eventually drive away the *Stomoxys* (an early importation) after the manner of many newly infested pests, as *Pieris rapæ* has done with *Pieris oleracea*? The name of "Buffalo" fly is improperly applied to this insect: suggestion as to how it may have received it.

A Thrips Attack on Cabbage. (Country Gentleman, for October 27, 1892, lvii, p. 809, c. 2, 3 — 27 cm.)

Cabbage and cauliflower leaves received from Kingston, Pa., abound with a minute Thrips, the particular species of which can not be named: it is probably an undescribed species, no attack of the kind having been previously reported. The number of genera and species of Thrips: their low position among insects: referred to Thysanoptera: their general features: carnivorous and herbivorous: food plants: the nature of injury to cabbage and cauliflower by this species: pyrethrum will prevent injury by it.

The Tischeria Apple-Leaf Miner. (Country Gentleman, for October 27, 1892, lvii, p. 809, c. 3, 4 — 20 cm.)

Reddened leaves from an orchard in Schenectady, N. Y., show the attack of *Tischeria malifoliella* Clemens. The mines and the process of their construction are described. They contain at this time the larva, which hibernates in the leaves and transforms to the pupa and imago in the spring. The remedy would be, collecting and burning the infested fallen leaves during the autumn or winter. The insect extends over a large part of the United States into Texas. It is rather local, and seldom, for reasons given, proves particularly injurious. It occurs also on *Cratœgus*, blackberry, and raspberry.

Distribution of the Pear Psylla. (Country Gentleman, for November 3, 1892, lvii, p. 831, c. 2, 3 — 13 cm.)

The probable introduction of *Psylla pyricola* at Salisbury, Conn., in 1832, is stated, together with its present known distribution. Request is made for information of its occurrence in other localities; and as aid in its recognition, its features and mode of operating are stated.

The Cow-Horn Fly in New York. (Country Gentleman, for November 10, 1892, lvii, p. 847, c. 1 — 10 cm.)

The interest attaching to the spread of insect pests into new territory, renders it desirable to ascertain the extent to which this fly has been distributed over the State of New York during the two and a half years that it has been known therein. Of the sixty counties of the State, it has been reported from twenty-eight. Information of its presence in any of the other thirty-two counties (named) would be gratefully received by the State Entomologist.

Apple-Tree Bucculatrix. (Country Gentleman, for December 22, 1892, lvii, p. 967, c. 2 — 8 cm.)

Cocoons from Clyde, N. Y., contain the pupæ of *Buculatrix pomifoliella* Clemens. The transformations of the insect and the remedies for it, are named.

(D)

PUBLICATIONS OF THE ENTOMOLOGIST DURING THE YEARS 1870-1874.

[First Observation of Pieris rapæ in New York.] (Sunday Morning Press [Albany, N. Y.], for August 7, 1870, p. 4.)

Examples of this butterfly, introduced from Europe into Quebec about the year 1857, were taken within the city of Albany a few days since, and could be seen at the New York State Museum of Natural History.

"The Poisonous Cabbage-Worm." (Albany Argus, for October 20, 1870.)

Newspaper statements of the poisonous nature of the *Pieris rapæ* larva, and of its poisoning the cabbage on which it feeds, are entirely unwarranted and untrue. Its excrement may render the cabbage unsuitable for table use unless properly cleansed. What the cabbage-worm is, how it was introduced and has been distributed, and the injuries caused by it.

The Recently Imported Cabbage-Butterfly — Pieris rapæ. [Read before the Albany Institute, November 2, 1870.] (The Albany Argus, for November 2, 1870. Proceedings of the Albany Institute, i, 1873, pp. 199–201.)

First seen in Albany in the summer of 1870; brought to the United States in 1857; its distribution; its transformations and life-history; probability of its spread throughout the United States; no parasite yet attacking it.

On Graptæ interrogationis and Fabricii Edw. (Transactions of the American Entomological Society, for December, 1870, iii, pp. 197–204.) Separate with cover and half-title.

Exception is taken to the conclusions of Mr. W. H. Edwards that the black-winged Grapta (*umbrosa*) is the *interrogationis* of Fabricius, and the red-wing, the *C-aureum* of the same author. The uncertainty and confusion among different authors as to *C-aureum* is reviewed. The umbrosa form seems not to have been described by any of the old authors. [It subsequently proved to be a dimorphic form of *G. interrogationis*, as shown by Mr Edwards.]

Spectrum femoratum. (Country Gentleman, for August 31, 1871, xxxvi, p. 552, c. 2 — 2 cm.)

Identification of the species from Columbia, Missouri. It is commonly known as the "walking-stick" or "spectre-insect."

[Dryocampa imperialis Harris.] (Country Gentleman, for September 21, 1871, xxxvi, p. 600, c. 2—8 cm.)

Description of the moth and note on its transformations and habits.

Pieris rapæ Parasite. (American Naturalist, v. 1871, p. 742. Canadian Entomologist, for November, 1871, iii, p. 197.)

The cabbage butterfly has been attacked by a parasite. Large numbers of a species of *Pteromalus* were bred from chrysalids of *P. rapœ* during the last of September. It is thought to be identical with the *P. puparum* which preys upon it in Europe.

Cabbage Butterfly. (Country Gentleman, for November 16, 1871, xxxvi, p. 728, c. 1—17 cm.)

Notice of the larvæ of *Pieris rapœ* in Delaware; notes on the species and discovery of its parasite, *Pteromalus puparum*, in Albany, N. Y., in October of the present year.

Cut Worms in Corn. (Country Gentleman, for May 30, 1872, xxxvii, p. 339, c. 2—11 cm.)

Caterpillars which had cut off the corn below the surface of the ground from several acres in Queens county, N. Y., after the manner detailed, are identified as young cut-worms, which in their immature state can not be referred to any of the twelve or fifteen known species. Judging from their habits as given, they may be *Mamestra Arctica* Boisd.

Spindle Worms. (Country Gentleman, for June 13, 1872, xxxvii, p. 376, c. 1, 2—8 cm.)

Caterpillars eating into the stalks of corn in Dutchess county, N. Y., are probably a species of *Gortyna*, as several of the genus are known as notorious burrowers in stalks, etc.

Apple-Twig Borer on Pear Trees. (Country Gentleman, for June 13, 1872, xxxvii, p. 375, c. 2, 3—32 cm.)

Habits, distribution, and injuries of the species, *Amphicerus bicaudatus* (Say), and remarks on the importance of a knowledge of the natural history of injurious insects.

[See *Second Report on the Insects of New York*, 1885, pp. 125–132, figs. 28–31.]

Hessian Fly. (Country Gentleman, for June 13, 1872, xxxvii, p. 376, c. 2—6 cm.)

Identification of the "flax-seeds" from Franklin county, Ohio, where they occur in abundance at the joints of the wheat stalks.

Bark Louse. (Country Gentleman, for July 11, 1872, xxxvii, p. 440, c. 2, 3—8 cm.)

The insect infesting a thorn-hedge in Windsor, Canada, is a species of *Coccus*. Remarks on the *Coccidœ*, their habits, the means and the best time for destroying them.

Owl Beetle. (Country Gentleman, for July 18, 1872, xxxvii, p. 456, c. 1 — 9 cm.)

The *Alaus oculatus* identified, with description and habits, and mention of the frequent occurrence of its larva in old apple-trees.

Revision of Some of the American Butterflies. (American Naturalist, vi, 1872, pp. 354–359.)

Review of a publication under the above title, published by Samuel H. Scudder, in the Report of the Peabody Academy of Science for 1871, pp. 24–82.

Biography of Hemileuca Maia (Drury). (Entomological Contributions, 1872, pp. 5–21, pl. 2, figs. 1–3. Twenty-third Annual Report on the N. Y. State Cabinet of Natural History, for the year 1869. 1873, pp. 137–153.) Also in the Swiss Cross, for April, 1887, i, pp. 135–139, figs. 1–3.

Presents the life-history of this Bombycid moth under the following subheads: the egg; egg-belt; egg-cement; oviposition; hibernation; hatching; egg-shell; young larva; first molt; second molt; third molt; sting of larva; fourth molt; fifth molt; mature larva; food-plants; parasites; pupation; the pupa; imago; metamorphoses; discrepancies; rarity; habits of the imago; geographical range; synonymy; additional note on pupation, etc.: an interesting variety of the moth.

Observations on Melitæa Phaëton (Fabr.). (Entomological Contributions, 1872, pp. 22–25. Twenty-third Report on the N. Y. State Cabinet of Natural History, for the year 1869. 1873, pp. 154–157.)

Rarity of the species; eggs obtained from a female described; death of the larvæ after preparing for hibernation; fatality attendant on hibernation; *Chelone glabra*, the food-plant; the insect confined to a very small area at Center, N. Y.; other localities for it; the genus *Melitæa*, with the exception of *Phaëton*, confined to west of the Mississippi river; seventeen species known according to Edwards [now increased to thirty-seven].

Notes on Melitæa Nycteis (Doubl.). (Entomological Contributions, 1872, pp. 26, 27, fig. 14 of pl. 8. Twenty-third Report on the N. Y. State Cabinet of Natural History, 1873, pp. 158, 159.)

Larvæ found feeding on *Helianthus divaricatus* L. are described, and after a subsequent molt and at maturity: the chrysalis is described and figured. Another colony taken from the same food-plant were carried through two molts, after which they became lethargic and died before hibernation. Note on its abundance at Center, N. Y., and absence from other neighboring localities.

Notes on Pieris oleracea (Harris). (Entomological Contributions, 1872, pp. 28, 29. Twenty-third Report on the N. Y. State Cabinet of Natural History, 1873, pp. 160, 161.)

The eggs and the emergence of the larvæ, with notes on the four molts. From the egg to the imago is but three weeks. There are three broods each year, and there may be a fourth as shown by data given.

Descriptions of New Species of Nisoniades. (Entomological Contributions, 1872, pp. 30–36, figs. 1–12 of plate 7. Twenty-third Report on the N. Y. State Cabinet of Natural History, 1873, pp. 162–168, figs. as above.)

Description of *N. Icelus* and its egg, time of its appearance, and the mythological import of its name. Description of *N. Lucilius* and its comparison with *N. Persius* Scudd., which it resembles; abundant at Schoharie, N. Y. *N. Ausonius* is described from the only example that has occurred; it seems to be the rarest of the Nisoniades.

Description of a New Sphinx. (Entomological Contributions, 1872, pp. 37–39, figs. 8–13 of pl. 8. Twenty-third Report on the N. Y. State Cabinet of Natural History, 1873, pp. 169–171, figs. as above.)

The male and female moths of *Ellema pineum* are described, and also the larva from examples taken on pines at Schoharie, N. Y. Comparison is made with *E. Harrisii* and *E. pinastri*. Reference is made to the larva of *E. coniferarum* (Sm.-Abb.).

List of Sphingidæ occurring in the State of New York. (Entomological Contributions, 1872, pp. 40–43. Twenty-third Report on the N. Y. State Cabinet of Natural History, 1873, pp. 172–175.)

Forty species are recorded, arranged under their subfamilies, and giving their principal synonyms.

List of Butterflies Occurring in the State of New York. (Entomological Contributions, 1872, pp. 44–47. Twenty-third Report on the N. Y. State Cabinet of Natural History, 1873, pp. 176–179.)

The list embraces 113 species, with notes on those of rare occurrence, and mention of 13 others which may be presumed to occur in the State.

Calendar of Butterflies for the Year 1869. (Entomological Contributions, 1872, pp. 48–55. Twenty-third Report on the N. Y. State Cabinet of Natural History, 1873, pp. 180–187.)

Contains notes on sixty-three species as they appeared successively, from *Thecla Irus* Godt., on April 27th, to *Pamphila Leonardus* (Harris) on August

20th; giving also comparative abundance, number of broods, dates when observed, habits, observations on their larvæ, etc.

Dates of Collection of New York Heterocera. (Entomological Contributions, 1872, pp. 56–65. Twenty-third Report on the N. Y. State Cabinet of Natural History, 1873, pp. 188–197.)

Contains dates of collection of ninety-four species during the year 1869, under their respective families, and of two hundred species in years prior to 1869. Also notes on the following species: *Darapsa Myron*, *Trochilium* (*Bembecia*) *marginatum*, *Lycomorpha pholus*, *Orgyia leucostigma*, *Eudryas unio*, *Ichthyura inclusa*, *Hyperchiria Io*, *Anisota senatoria*, *Nadata gibbosa* *Platycerura furcilla*, *Xyleutes* [*Cossus*] *robiniæ*, *Gonopteryx libatrix*, *Cleora pulchraria*, and *Zerene catenaria*.

List of North American Lepidoptera Contained in "Species Général des Lépidoptères," by A. Guenée. (Entomological Contributions, 1872, pp. 66–80. Twenty-third Report on the N. Y. State Cabinet of Natural History, 1873, pp. 198–212.)

Embraces above six hundred species described in the six volumes of the above-named work, with reference to volume and page; particular habitat when given, and also designation of the species credited to, or known by the compiler to occur in, the State of New York, of which there are two hundred and fifty-three species.

Notes on Cucullia intermedia Speyer. (Entomological Contributions, 1872, pp. 81–84, figs. 5, 6, 7 of pl. 8. Twenty-third Report on the N. Y. State Cabinet of Natural History, 1873, pp. 213–216, figs. as above.)

The larva is described, its probable food-plants named; its earthen cocoon and how constructed, and its pupa; the two annual broods; how the imago feeds. Note on the larva of *Cucullia convexipennis* and its cocoon. Remarks on a translation of a paper by Dr. A. Speyer "On Cucullia intermedia and C. lucifuga" given in the following pages (85–90); and on the valuable studies made by him of our American Noctuidæ. Mr. Meeke's field collections, and the cyanide bottle.

On the Larva and Imago of Sesia diffinis Harris. (Twenty-fourth Annual Report on the N. Y. State Museum of Natural History, for the year 1870: 1872, pp. 109–111. Entomological Contributions — No. II, 1872, pp. 5–7.)

The larva, taken from bush-honeysuckle, *Diervilla trifida*, is described: remarks on the "annulets" (usually eight) in which the segments of the *Sphingidæ* are divided: flight and other habits of the imago in the breeding cage: the slightly attached wing-scales in this and allied species: the species abroad.

[Now known as *Hemaris diffinis* (Boisd.).]

Transformations of Sesia Buffaloensis GR.-ROB. (Twenty-fourth Annual Report on the N. Y. State Museum of Natural History, for the year 1870: 1872, pp. 112, 113. Entomological Contributions — No. II, 1872, pp. 8, 9. Also in Transactions of the American Entomological Society, xv, 1888, p. 105.)

Descriptions of the egg and of the larva in its five stages (four molts), of its cocoon, and its pupation. The eggs and larva were found on the snowball, *Viburnum opulus*.

[Now generally known as *Hemaris Buffaloënsis* (Gr.-Rob.).]

On the Larva and Pupa of Thyreus Abbotii SWAINSON. (Twenty-fourth Annual Report on the N. Y. State Museum of Natural History, for the year 1870: 1872, pp. 114–116. Entomological Contributions — No. II, 1872, pp. 10–12.)

The "male" and "female" larvæ and the pupa are described, with reference to marked variations in the larvæ of *Deilephila lineata*; and remarks on the pupation of *T. Abbotii* occurring either above or below the surface of the ground.

[The two forms of this larva have since been shown to be simply dimorphic and not, as for a long time supposed, sexual.]

On the Larva of Philampelus Achemon (DRURY). (Twenty-fourth Annual Report on the N. Y. State Museum of Natural History, for the year 1870: 1872, pp. 117, 118. Entomological Contributions — No. II, 1872, pp. 13, 14.)

Description of the egg, the young larva, the larva after each of its four molts, and at maturity.

Smerinthus geminatus SAY and its Supposed Varieties. (Twenty-fourth Annual Report on the N. Y. State Museum of Natural History, for the year 1870: 1872, pp. 119–127. Entomological Contributions — No. II, 1872, pp. 15–23.)

Description of the egg and of the larva in its first stage and after its first, second and third molts (the usual fourth molt of the Sphingidæ did not occur), and at maturity: notes on the pupation: time passed in the several stages: is double-brooded: a variety bred having but one ocellated spot on the secondaries: the *S. Jamaicensis* of Drury: *S. Cerisyi* Kirby believed to be a variety of *S. geminatus* [since shown to be a good species]: *S. opthalmicus* compared with *S. geminatus* and *S. ocellatus* of Europe: bibliography of *S. geminatus*.

Transformations of Daremma undulosa Walker. (Twenty-fourth Annual Report on the N. Y. State Museum of Natural History, for the year 1870: 1872, pp. 128–131. Entomological Contributions—No. II, 1872, pp. 24–27.)

Remarks on rearing Lepidopterous larvæ on their living food-plant inclosed in a net. Description of the larva of *D. undulosa* in each of its five stages, and of the pupa: its food-plants.

Notes on Platarctia Parthenos (Harris). (Twenty-fourth Annual Report on the N. Y. State Museum of Natural History, for the year 1870: 1872, pp. 132, 133. Entomological Contributions—No. II, 1872, pp. 28, 29.)

Notes on the young larva and dates of seven molts, hibernation and pupation, and markings of the imago.

[In the Smith "List of Lepidoptera of Boreal North America," 1891, this species is referred as a synonym to *hyperborea* of Curtis.]

Notes on Euprepia Americana (Harris). (Twenty-fourth Annual Report on the N. Y. State Museum of Natural History, for the year 1870: 1872, pp. 134, 135. Entomological Contributions—No. II, 1872, pp. 30, 31.)

Description of the egg and notes on the larval molts: regarded by some writers as identical with *caja* of Europe: Packard's description of the larva.

[Catalogued as a variety of *E. caja* (Linn.) in the Smith List of Lepidoptera.]

Notes on Euchætes egle (Drury). (Twenty-fourth Annual Report on the N. Y. State Museum of Natural History, for the year 1870: 1872, pp. 136, 137. Entomological Contributions—No. II, 1872, pp. 32, 33.)

The caterpillar described in its last three stages with their habits: parasites from the larvæ: a difficult species to carry to its imago stage.

Transformations of Lagoa crispata Packard. Twenty-fourth Annual Report on the N. Y. State Museum of Natural History, for the year 1870: 1872, pp. 138–145. Entomological Contributions—No. II, 1872, pp. 34–44.)

Its eggs, from *Quercus ilicifolia*, described: the young larva, and habits and features after each of its five molts: its stinging power: the cocoon with its peculiar lid: pupation, and the pupa: emergence of the imago: abundance of the larvæ at Center, N. Y.: a parasitic attack.

Transformations of Hyperchiria Io (Fabr.). (Twenty-fourth Annual Report on the N. Y. State Museum of Natural History, for the year 1870: 1872, pp. 146–149. Entomological Contributions — No. II, 1872, pp. 42–45.)

The caterpillar described after its last four molts and at maturity; processionary habits in its second stage: its pupation: its food-plants: the true *Io* of Fabricius — not *varia* of Walker.

Transformations of Eacles imperialis (Drury). Twenty-fourth Annual Report on the N. Y. State Museum of Natural History, for the year 1870: 1872, pp. 150–154. Entomological Contributions — No. II, 1872, pp. 46–50.)

Description of the egg, the first larval stage, the four subsequent stages, and death from bacterial disease. A number of nearly full-grown larvæ collected from pines, *Pinus strobus*, in September, and their transformations to the imago.

Larval Notes on Anisota senatoria (Smith). (Twenty-fourth Annual Report on the N. Y. State Museum of Natural History, for the year 1870: 1872, pp. 155, 156. Entomological Contributions — No. II, 1872, pp. 51, 52.)

Oviposition on under surface of oak leaves, *Quercus prinoides*, in July: the four molts of the larvæ and pupation. Trains on the New York Central railroad stopped by the caterpillars on the rails: their great abundance annually at Center, N. Y.

Calendar of Butterflies for the year 1870. (Twenty-fourth Annual Report on the N. Y. State Museum of Natural History, for the year 1870: 1872, pp. 157–167. Entomological Contributions — No. II, 1872, pp. 53–63.)

Observations of seventy-three species of butterflies occuring in six localities in the vicinity of Albany during the spring and summer of 1870, indicating each day of occurrence, are given in tabular form. Twenty-nine species are noted at one locality on June 16th. Also, notes on the abundance, condition, time of appearance of sexes, successive broods, etc., at various dates from May 3d to October 21st.

Dates of Collection of some Heterocera for 1870. (Twenty-fourth Annual Report on the N. Y. State Museum of Natural History, for the year 1870: 1872, pp. 168–170. Entomological Contributions — No. II, 1872, pp. 64–66.)

Embraces twelve species of Sphingidæ, nineteen species of Bombycidæ, twenty-eight species of Noctuidæ, and fourteen species of Phalænidæ.

Hypena scabra (Fabr.) and H. erectalis Guen. (Canadian Entomologist, May, 1873, v, pp. 81, 82.)

The two forms hitherto regarded as distinct species are found to be the same, the former being the male and the latter the female. Dr. Speyer's studies on these forms. Reference by the same author of *Depréssaria Ontariella* Bethune to *D. heracliana* DeGeer.

Entomology. [Remarks on Myrmeleon, Termes, et cet., at a Field Meeting of the Albany Institute at Schoharie, N. Y., June 7, 1873.] (Albany Evening Times, for June 9, 1873, xvii, p. 3, c. 3, 4 — 35 cm. Proceedings of the Albany Institute, 1878, ii, pp. 48–50.)

Remarks upon the appearance, habits, etc., of the Ant-lion, Myrmeleon sp., the white ant (*Termes flavipes*), the cabbage butterfly (*Pieris rapæ*), several caterpillars, and other insects exhibited, of the day's collection.

Economic Entomology, etc. [Remarks made at a Field Meeting of the Albany Institute at Watkins Glen, N. Y., June 27, 1873.] (Albany Evening Times, for June 30, 1873, xvii, p. 3, cols. 3, 4 — 62 cm. Proceedings of the Albany Institute, ii, 1878, pp. 65–69.)

On the omnipresence of insects, infesting our food, injuring clothing, and sometimes attacking our persons. The province of the economic entomologist is to guard against these depredations. When powerless to resist them, parasites often come to our aid, as did *Pteromalus puparum* in controlling *Pieris rapæ*. The parasitic habits of *Rhyssa atrata*, and remarks on *Pyrameis Atalanta*, *Melitœa* species, and *Deloyala* [*Coptocycla*] *clavata*.

Caterpillar [on apple tree]. (Country Gentleman, for July 17, 1873, xxxviii, p. 456, c. 2—6 cm.)

Caterpillars from Ottumwa, Iowa, prove to be *Notodonta concinna*: their habits, food-plants, how recognized and how they may be destroyed.

Coccus Insect on the Pine. (Country Gentleman, for August 21, 1873, xxxviii, p. 535, c. 1, 2—23 cm.)

Features of *Coccus pinicorticis* Fitch, its operations, and remedies for it, in answer to inquiry from Tivoli, N. Y., where large trees are being killed by it.

[See extended notice in the *Second Report on the Insects of New York*, pp. 180–187, figs. 48–53, as the pine-bark Chermes, *Chermes pinicorticis* (Fitch).]

On the Larva of Eudryas unio (Hübn.) and Allied Forms. (Twenty-sixth Annual Report on the N. Y. State Museum of Natural History, for the year 1872 : 1874, pp. 117–124, figs. 1–5. Entomological Contributions — No. III, May, 1874, pp. 117–124.)

Larvæ of *E. unio*, found feeding abundantly on *Epilobium coloratum*, described at maturity. The allied species are *Alypia octomaculata* (Hübn.) *Psycomorpha epimenis* (Drury), and *Eudryas grata* (Fabr.). Comparisons are made between these species, and figures given of their larval and perfect stages.

Transformations of some Bombycidæ. (Twenty-sixth Report on the N. Y. State Museum of Natural History, 1874, pp. 125–128. Entomological Contributions — No. III, 1874, pp. 125–128.)

The transformations of the following-named species are given: *Platysamia Cecropia* (Linn.), *Callosamia Promethea* (Drury), and *Actias Luna* (Linn.).

Descriptions of the Larvæ of some Bombycidæ. (Twenty-sixth Report on the N. Y. State Museum of Natural History, 1874, pp. 129–134, figs. 6, 7. Entomological Contributions — No. III, pp. and figs. as above.)

Descriptions are given of the following: *Parorgyia parallela* Gr.-Rob., *Apatelodes Angelica* (Grote), *Cœlodasys* [*Schizura*] *unicornis* (Sm.-Abb.) with figures, *Platycerura furcilla* Packard, with figures, *Dryocampa rubicunda* (Fabr.), and *Tolype velleda* (Stoll).

Descriptions of the Larvæ of some Noctuidæ. (Twenty-sixth Report of the N. Y. State Museum of Natural History, 1874, pp. 135–141. Entomological Contributions — No. III, 1874, pp. 135–141.)

Acronycta Americana Harris MS. [is *Acronycta funeralis* Gr.-Rob.], *Acronycta morula* Gr.-Rob., *Ceramica picta* (Harris) [is *Mamestra picta*], *Cucullia convexipennis* Gr.-Rob., *Cucullia asteroides* Guenée, and *Catocala* sp.?, are described.

Notes on some New York Bombycidæ. (Twenty-sixth Report on the N. Y. State Museum of Natural History, 1874, pp. 142–156, figs. 8–11. Entomological Contributions — No. III, 1874, pp. and figs. as above.)

Contains descriptions or notes, mainly larval, of the following species: *Callimorpha Lecontii* Boisd., *Arctia Arge* (Drury), *Spilosoma Virginica* (Fabr.), *Spilosoma latipennis* Stretch, *Euchœtes Oregonensis* Stretch, *Euchœtes collaris* (Fitch), *Ichthyura vau* (Fitch), *Halisidota caryœ* (Harris), *Orgyia leucostigma* (Sm.-Abb.), *Empretia stimulea* Clemens, *Phobetron* *pithecium* (Sm.-Abb.), *Lithacodes* [*Limacodes*] *fasciola* (Her.-Sch.), *Nadata gibbosa* (Sm.-Abb.), *Notodonta* sp.?, *Edema albifrons* (Sm.-Abb.), *Cerura borealis* (Boisd.), *Telea Polyphemus* (Linn.), *Actias Luna* (Linn.), *Hemileuca Maia* (Drury), *Gastropacha Americana* Harris, *Clisiocampa Americana* (Harris), *Ctenucha virginica* (Charp.), and *Scepsis fulvicollis* (Hübn.).

Notes on some New York Noctuidæ. (Twenty-sixth Report on the N. Y. State Museum of Natural History, 1874, pp. 157–167, fig. 12. Entomological Contributions — No. III, 1874, pp. and figs. as above.)

The following species are noticed: *Dipthera deridens* Guenée (with figure of larva), *Acronycta Americana* Harris MS., *Acronycta oblinata* (Sm.-Abb.), *Agrotis tricosa* nov. sp., *Hadena lignicolor* (Guenée), *Hadena* [*Mamestra*] *adjuncta* (Boisd.), *Cucullia florea* Guen., ?*Chariclea exprimens* (Walker) [*Pyrrhia umbra* Hübn.], *Chamyris cerintha* (Treits.), *Plusia balluca* (Hübn.), *Plusia æroides* Grote, *Scoliopteryx libatrix* (Linn.), *Catocala parta* Guen., *Mesographe stramentalis* Hübn. [*Evergestis straminalis* Hübn.], *Nematocampa filamentaria* Guen., *Ennomos magnaria* Guen., *Amphidasys* [*Eubyia*] *cognataria* Guen., *Abraxas* [*Eufitchia*] *ribearia* Fitch. Also, Notes on the seasons of 1858 and 1859.

Description of New Species of Cucullia. (Twenty-sixth Report on the N. Y. State Museum of Natural History, 1874, pp. 168-176, figs. 13, 14. Entomological Contributions — No. III, 1874, pp. and figs. as above.)

Describes and figures *Cucullia Speyeri* from examples taken at Albany and Sharon Springs, N. Y., with remarks on the five other previously known N. American species [fifty-two species are now catalogued from boreal North America], and characterization of the orbicular spot in eleven native and European species: also, describes *Cucullia serraticornis* from examples received from California.

Observation of some New York Rhopalocera for the year 1871. (Twenty-sixth Report on the N. Y. State Museum of Natural History, 1874, pp. 177, 178. Entomological Contributions — No. III, 1874, pp. 177, 178.)

Give dates of observation of forty-six species of butterflies, up to July 7th, when the record was suspended.

Dates of collection of some New York Heterocera for the year 1872. (Twenty-sixth Report on the N. Y. State Museum of Natural History, 1874, pp. 179-184. Entomological Contributions — No. III, 1874, pp. 179-184.)

Of Sphingidæ, 16 species; Ægeridæ, Zygænidæ, and Bombycidæ, 18 species; Noctuidæ, 69 species; Phalænidæ, 37 species — in all 140 species. Also, of 59 species taken in preceding years. Also, Notes on *Erastria carneola* Guen., *Camptogramma* [*Plemyria*] *fluviata* Hübn., and *Cryptolechia Schlagœri* Zeller.

Description of a Convenient Insect Case. (Twenty-sixth Report on the N. Y. State Museum of Natural History, 1874, pp. 185–188. Entomological Contributions—No. III, 1874, pp. 185–188, 3 figures.) Also in Fifth Report on the Insects of Missouri, 1873, pp. 38–40, fig. 21.

Describes the construction of a case with glass sides, on one of which pieces of cork are cemented for holding the insects—the whole to be bound in the form of a folio volume; also, of less expensive unbound cases.

[The above is also contained in Dr. Riley's "Directions for Collecting and Preserving Insects" (pp. 101–104), published by the Smithsonian Institution, in 1892.]

The Three-lined Leaf-Beetle. (Country Gentleman, for July 23, 1874, xxxix, p. 471, c. 1—17 cm.)

The insect, *Lema trilineata* (Oliv.), received from Clyde, N. Y., from potato vines, is described, its larval habits and transformations given, and the remedies for it.

[See notice in the *Second Report of the Insects of New York*, 1885, pp. 132–136, figs. 32, 33.]

The Soldier Bug. (Country Gentleman, for July 23, 1874, xxxix, p. 471, c. 1, 2—12 cm.)

Arma spinosa Dallas, sent from Carbon Cliff, Ill., is a valuable agent in the destruction of the Colorado potato-beetle.

[Published in the *Sixth Report on the Insects of New York*, 1890, p. 137, fig. 18, as *Podisus spinosus* (Dallas).]

A Timothy Eater. (Country Gentleman, for July 23, 1874, xxxix, p. 471, c. 2—9 cm.)

Notice of an unknown caterpillar feeding upon the heads of timothy at Jarrettown, Pennsylvania. They spun up in slight cocoons of pieces of grass and bits of wood, from which it is hoped to obtain the moth for identification.

[The moth was *Leucania* sp.? See, also, the *Country Gentleman* for August 6, p. 505, c. 1, where the caterpillar is reported as eating at the heart of corn, and on wheat.]

The Raspberry Borer. (Country Gentleman, for July 30, 1874, xxxix, p. 487, c. 1—15 cm.)

Description of *Oberea tripunctata* (Fabr.), found in Potsdam, N. Y., girding the canes of the raspberry; of the manner in which the canes are ringed, the injury caused by it, and suggestions for the prevention of its increase.

[Extended in the *Fifth Report on the Insects of New York*, 1889, pp. 231–233, fig. 28—*as Oberea bimaculata* (Oliv.).]

Insect on the Potato. (Country Gentleman, for July 30, 1874, xxxix, p. 488, c. 1, 2—14 cm.)

Insects proving destructive to the potato vines in Sonyea, Livingston Co., N. Y., are identified as one of the true bugs, known as *Cosmopepla carnifex* (Fabr.). Beating from the vines, and exposing to poultry recommended. Habits of allied Hemipterous forms referred to, with difficulty attending their destruction.

[See the *Second Report on the Insects of New York*, 1885, pp. 144–148, fig. 36.]

The Joint-Worm. (Country Gentleman, for September 10, 1874, xxxix, p. 584, c. 1, 2—13 cm.)

Account is given of the galls and transformations of *Isosoma hordei* (Harris), with habits and history in brief, in reply to inquiries from Clarksboro, N. J.

[See *Fourth Report on the Insects of New York*, 1888, pp. 27–35, figs. 10–14.]

Cimex lectularius. (Country Gentleman, for September 24, 1874, xxxix, p. 615, c. 4—26 cm.)

The literature, natural history, habits, etc., of the bed-bug given, and fumigation of infested rooms by brimstone recommended for its destruction in this instance where they infest books and papers in a library at Prarieville, Mo.

[Published also in the *Second Report on the Insects of New York*, 1885, pp. 16–18. The insect is now known as *Acanthia lectularia* (Linn.).]

The Maple Leaf Cutter. (Country Gentleman, for October 1, 1874, xxxix, p. 631, c. 1, 2—29 cm.)

Identification of *Ornix acerifoliella* Fitch, destroying maple forests in Pittsford, Vt., and notice of its operations and occasional multiplication; probabilities of its continuance in the future.

[Extended in the *Fifth Report on the Insects of New York*, 1889, pp. 215–219, figs. 22–24, under generic name of *Incurvaria*.]

The Cattle Tick. (Country Gentleman, for October 1, 1874, xxxix, p. 631, c. 2—14 cm.)

Appearance and habits of *Ixodes bovis* Riley, prevalent in Pennsylvania; its abundance at times, and notice of other species of the genus.

The Oil-Beetle. (Country Gentleman, for October 15, 1874, xxxix, p. 663, c. 4—10 cm.)

Notice of appearance, interesting habits and vesicating properties of *Meloe angusticollis* Say, received from Perry, N. Y., and where the insect is found.

[Published in *Sixth Report on the Insects of New York*, 1890, pp. 130, 131, fig. 15.]

Mr. Otto Meske's Collection of Lepidoptera. (Albany Evening Times, for October 27, 1874. Transactions of the Albany Institute, 1876, viii, pp. 215–220.)

Commended for its arrangement and preparation and perfection of its specimens: how the field collections were made: the labor devoted to its arrangement: Mr. Meske's devotion to the study: the rare Sphingidæ of the collection and full New York representation: abundance of Catocalas in North America: to insure thoroughness in entomology specialists are required.

Description of a New Species of Calocampa. (Bulletin of the Buffalo Society of Natural Sciences, ii, October, 1874, pp. 188, 189.)

Calocampa nupera, from localities in New York, hitherto regarded as identical with *C. vetusta* of Europe, is described as a new species.

(E)

CONTRIBUTIONS TO THE DEPARTMENT.

The following are the Contributions that have been made to the Department during the year (1892):

HYMENOPTERA.

Examples (4) of *Augochlora* sp.? from a cavity in decayed wood, in November. From H. F. BASSETT, Waterbury, Conn.

Cocoon clusters of *Apanteles rufocoxalis* Riley, parasitic on larvæ of *Clisiocampa Americana*, Harris, May 29th. From JAMES ANGUS, West Farms, New York city.

Currant twigs containing larvæ of the girdler — believed to be *Janus flaviventris* Fitch. From J. F. ROSE, South Byron, N. Y.

Bombus Pennsylvanicus (De Geer), *Bombus* sp., *Xylocapa Virginica* (Drury), *Vespa maculata* Fabr., *Vespa* sp., *Odynerus capra* (Sauss.), and three other species undetermined. From Mrs. E. B. SMITH, Coeymans, N. Y.

Galls of species not determined on wild rose. From Prof. C. H. PECK, Albany, N. Y.

LEPIDOPTERA.

Larvæ of *Papilio Cresphontes* Cramer, from *Choisya ternata*. From WILLIAM FALCONER, Glen Cove, L. I., N. Y.

Ancyloxypha Numitor (Fabr.) and ten specimens of Heterocera From Mrs. E. B. SMITH, Coeymans, N. Y.

Larva of *Thyreus Abbotii* Swainson. From Mrs. H. SIMMONS, Albany, N. Y.

Larva of *Sphinx Celeus* (Hubn.) parasitized by *Apanteles congregatus* Say — the imagoes emerging August 24th. From Mrs. ANTHONY VICTORIN, Watervliet Arsenal, N. Y.

Larvæ of *Podosesia syringæ* (Harris) boring in lilac. From JOHN L. LOCKWOOD, New York city.

Phobetron pithecium (Sm.-Abb.), spun up in its cocoon, August 28th. From IRA PEASE, Oswego, N. Y. The same, on *Cornus*, from Dr. T. C. ALDRICH, Tarrytown, N. Y. The same, on oak, September 5th, from Mrs. J. CARTER BROWN, East Greenwich, N. Y.

Larva of *Eacles imperialis* (Drury), August 23d. From RICHARD LEWIS, Crugers Island, Barrytown, N. Y.

Larvæ and pupæ of *Zeuzera pyrina* Linn. in elm. From E. B. SOUTHWICK, Central Park, New York City.

Larvæ and imago of *Plusia brassicæ* Riley, from a greenhouse, April 12th. From Rev. Dr. SAMUEL COX. L. I., N. Y.

Larvæ of the eye-spotted bud-moth, *Tmetocera ocellana* (Schiff.), in its winter dwelling on apple twigs. From JAMES FLETCHER, Dominion Entomologist, Ottawa, Canada.

Tischeria malifoliella Clemens — the larvæ in mines in apple leaves, September 22d. From Mr. McDougal, Schenectady, N. Y.

A Tineid, in numerous examples, from trunks of elms. From L. N. GILLIS, Albany, N. Y.

DIPTERA.

Tabanus sulcifrons Macq., *Tabanus lineola* Fabr., *Chrysops niger* Macq., *Eristalis tenax* (Linn.) 5 and puparia 6, and a Trypetid and three Tipulidæ undetermined. From Mrs. E. B. SMITH, Coeymans, N. Y.

Chrysopila thoracica (Fabr.), *Eristalis Meigenii* (Wied.), *Eristalis tenax* (Linn.), and *Helophilus latifrons* Loew. From L. N. GILLIS, Albany, N. Y.

Hystricia vivida (Harris). From Hon. W. L. LEARNED, Albany, N. Y.

Hæmatobia serrata R. Desv. From GEORGE S. FRENCH, Mexico, Oswego county, N. Y.

Lauxania flaviceps Loew, April 4th, from birds' nests collected in the preceding autumn. From Dr. W. H. VANDENBERG, Fort Edward, N. Y.

COLEOPTERA.

Cicindela 6-guttata Fabr., *Cicindela generosa* Dejean., *Silpha Americana* Linn., *Macrodactylus subspinosus* (Fabr.), and *Desmocerus palliatus* (Forst.). From L. N. GILLIS, Albany, N. Y.

Larvæ of *Harpalus* sp? and ?*Anisodactylus* from roots of strawberry plants, October 22d. From H. VAN SLYKE, New Baltimore, N. Y.

Dytiscus marginalis Linn. (living, November 11th). From W. C. HITCHCOCK, Pittstown, N. Y.

Silvanus Surinamensis (Linn.) in crushed oats; larvæ and imagoes of *Dermestes murinus* Lec. From G. R. LUMSDEN, Greenville, Conn.

Silvanus cassiæ Reiche, and *Carpophilus pallipennis* (Say). From H. E. WEED, Agricultural College, Miss.

Cis fulvipes Mellié (of the Cioidæ), from the fungus *Polystictus versiscolor*. From C. L. SHEAR, Glen, N. Y.

Ellychnia corrusca (Linn.), taken in numbers from the pæony. From Mrs. H. D. GRAVES, Ausable Forks, N. Y.

Chauliognathus Pennsylvanicus (De Geer), feeding on pollen of roses and grapes, June 3d. From C. H. MOORE, Birds Nest, Va.

Trox unistriatus Beauv. From BERTHOLD FERNOW, New Paltz, N. Y.

Lachnosterna tristis (Fabr.), 63 examples. From J. S. SMART, Cambridge, N. Y.

Euphoria Inda (Linn.), feeding on ripe pears, August 30th. From T. G. AVERY, Buffalo, N. Y.

Dynastes Tityus (Linn.), taken from a ripe pear, October 4th. From F. W. EMMORD, Magnolia, Maryland.

Monohammus confusor (Kirby). From. C. M. Reed, Sinclairville, N. Y.

Paria aterrima (Oliv.), 3 examples taken from strawberry roots in November. From H. F. BASSETT, Waterbury, Conn.

Systena frontalis (Fabr.), from gooseberry leaves in August; *Bruchus obsoletus* Say, taken alive from a glass case of beans put up in 1882. From Dr. PETER COLLIER, Agricultural Experiment Station, Geneva, N. Y.

Bruchus obsoletus Say. From GREENVILLE M. INGALSBE, Sandy Hill, N. Y.

Tenebrio obscurus Fabr., infesting wheat in a granary. From ROBERT L. REILLY, Buckland, Va.

Tribolium ferrugineum (Fabr.) in wheat middlings. From Dr. E. W. DORAN, College Park, Maryland.

Epicauta Pennsylvanica (De Geer) feeding on asters. From A. C. RICE, Meriden, Conn.

Otiorhynchus ovatus (Linn.) infesting a dwelling-house. From AUGUSTUS FLOYD, Moriches, N. Y.

Lixus concavus Say, and 10 other species of Coleoptera. From Mrs. E. B. SMITH, Coeymans, N. Y.

HEMIPTERA.

Murgantia histrionica (Hahn.) from cabbage, May 9th. From ISAAC A. GARSCUM, Woodbury, N. J.

Phymata Wolfii Stal. From W. H. COLEMAN, Albany, N. Y.

Myzus cerasi (Fabr.) from ox-heart cherry. From Mrs. E. C. BRINKERHOFF, Nunda, N. Y.

Callipterus castaneæ Fitch — exuvia of the aphis on the under side of chestnut leaves. From VERPLANCK COLVIN, Albany, N. Y.

Pemphigus tessellata (Fitch), on alder, in association with the honey-dew fungus, *Scorias spongiosum.* From Miss FLORENCE B. HIMES, Albany, N. Y.

Galls of *Phylloxera vitifoliæ* (Fitch). From Edwin Slocombe, Camillus, N. Y.

Mytilaspis pomorum Bouché, occuring on seventeen species of food-plants. From John D. Lyons, Monticello, N. Y.

Chionaspis furfurus (Fitch) on apple. From T. O. Aller, High Bridge, N. J.

Orthoptera.

Œcanthus niveus (De Geer): *Amblycorypha oblongifolia* (De Geer) and *Melanoplus femur-rubrum* (De Geer). From Mrs. E. B. Smith, Coeymans, N. Y.

Egg-deposit of *Œcanthus niveus* (De Geer) in an apple twig. From Norman Pomroy, Lockport, N. Y.

Chortophaga viridifasciata (De Geer) — the larvæ taken on March 20th. From C. H. Coy, Cossayuna, N. Y. The same, on April 18th. From E. H. Kilmer, Canaan Four Corners, N. Y.

Neuroptera.

Ephemera sp.— larvæ of, taken from a water-filter. From G. C. Hodges, Utica Academy, Utica, N. Y.

Plathemis trimaculata (De Geer.) From L. N. Gillis, Albany, N. Y.

Thrips sp. ?, infesting cabbage and cauliflower. From Mr. Garrahen, Kingston, Pa.

Epeira insularis Hentz, from heliotrope. From Robert Lenox Banks, Jr., Albany, N. Y.

Ixodes sp. ? and *Rhipistoma Americana* Marx. From Mrs. George Notman, Brooklyn, N. Y.

Gamasus sp. ? feeding on mushrooms. From William Falconer, Glen Cove, N. Y.

An Acariden infesting potatoes and thought to be the cause of the scab. From D. J. Garth, Scarsdale, N. Y.

Julus cœruleocinctus Wood, in cavities in potatoes. From D. G. Garth, Scarsdale, N. Y.

(F)

CLASSIFIED LIST OF INSECTS NOTICED IN THIS REPORT.

Hymenoptera.

Monostegia ignota (*Norton*), the strawberry slug.
Eriocampa cerasi (*Peck*), the cherry-tree or pear-tree slug.

Lepidoptera.

Papilio Cresphontes *Cramer*, the yellow-banded swallow-tail.
Podosesia syringæ (*Harris*), the Syringa borer.
Ocneria dispar (*Linn.*), the Gypsy moth.
Orgyia leucostigma (*Sm.-Abb.*), the white-marked tussock-moth.
Dryocampa rubicunda (*Fabr.*), the rosy Dryocampa.
Clisiocampa Americana *Harris*, the apple-tree tent-caterpillar.
Zeuzera pyrina (*Fabr.*), the leopard moth.
Plusia brassicæ *Riley*, the cabbage Plusia.
Tmetocera ocellana (*Schiff.*), the eye-spotted bud-moth.
Carpocapsa pomonella (*Linn.*), the codling-moth.
Coleophora Fletcherella *Fern.*, the apple case-bearer.

Diptera.

Pulex irritans *Linn.*, the common flea.
Hæmatobia serrata *R. Desv.*, the cow-horn fly.
Pollenia rudis (*Fabr.*), the cluster fly.
Anthomyia brassicæ *Bouché*, the cabbage fly.
Phytomyza chrysanthemi *Kowarz*, the Marguerite fly.

Coleoptera.

Adalia bipunctata (*Linn.*), the two-spotted lady-bird.
Attagenus piceus (*Oliv.*), the black carpet beetle.
Anthrenus scrophulariæ (*Fabr.*), the carpet beetle.
Chauliognathus Pennsylvanicus (*De G.*), Pennsylvania soldier beetle.
Macrodactylus subspinosus (*Fabr.*), the rose-bug.
Lachnosterna fusca (*Fröhl.*) and congeners, the white grubs.
Lachnosterna tristis (*Fabr.*).
Dynastes Tityus (*Linn.*), the Rhinoceros beetle.

Allorhina nitida (*Linn.*), the fig eater.
Elaphidion parallelum *Newm*, a maple tree pruner.
Saperda tridentata *Oliv.*, the common elm-tree borer.
Crioceris asparagi (*Linn.*), the asparagus beetle.
Doryphora decemlineata (*Say*), the Colorado potato-beetle.
Diabrotica vittata (*Fabr.*), the striped cucumber beetle.
Galerucella xanthomelæna (*Schr.*) the elm-leaf beetle.
Systena frontalis (*Fabr.*).
Tenebrio obscurus *Fabr.*, the American meal-worm.
Otiorhynchus ovatus (*Linn.*).
Pissodes strobi (*Peck*), the white-pine weevil.
Anthonomus quadrigibbus *Say*, the apple curculio.
Anthonomus musculus *Say*, the strawberry weevil.
Conotrachelus nenuphar (*Herbst*), the plum curculio.
Craponius inæqualis (*Say*), the grape curculio.
Xyleborus pyri (*Peck*), the pear-blight beetle.
Phlœotribus liminaris (*Harr.*), the peach-bark Scolytus.

Hemiptera.

Murgantia histrionica (*Hahn.*), the Harlequin cabbage-bug.
Typhlocyba vitis (*Harris*), the grapevine leaf-hopper.
Psylla pyricola *Foerster*, the pear-tree Psylla.
Myzus ribis (*Linn.*), the currant aphis.
Myzus cerasi (*Fabr.*), the cherry-tree aphis.
Aphis mali *Fabr.*, the apple-tree aphis.
Aphis pruni *Fabr.*, the plum-tree aphis.
Aphis Middletonii *Thomas*, the aster-root aphis.
Pemphigus tessellata (*Fitch*), the alder-blight aphis.
Phylloxera vitifoliæ (*Fitch*), the grapevine Phylloxera.
Chionaspis pinifoliæ (*Fitch*), the pine-leaf scale-insect.
Mytilaspis pomorum (*Bouché*), the oyster-shell bark-louse.

Orthoptera.

Chortophaga viridifasciata (*De Geer*), the green-striped grasshopper.

Neuroptera.

Ephemera sp. ?, a May-fly.

Arachnida.

Tetranychus telarius (*Linn.*), the red spider.

Myriapoda.

Thousand-legged worms.

Crustacea.

Crangonyx mucronatus *Forbes*, a fresh-water shrimp.

GENERAL INDEX.

*In consideration of the labor that it would involve, the indication in this index of the synonymy of the species listed in the Fitch Catalogue of Homoptera (as given in Aphis species), will not be continued, as the accepted nomenclature may readily be found through the page references.

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ERRATA.

Page 291, line 9, for (Foerster) read Foerster.
Page 308, line 6 from bottom, for *remotepuncta* read *remotepunctata.*
Page 317, line 20, for (Foerster). read Foerster.
age 320, line 29, for *lunata* read *lanata.*
Page 333, line 17, for attennæ read antennæ.
Page 335, line 18, for *Sclandria* read *Selandria.*
Page 342, line 19, for Emmond read Emmord.
Page 344, line 17 from bottom, for Peck. read (Peck).
Page 363, line 9, after manure insert kerosene,.
Page 374, line 12, for *Cocœcia* read *Cacœcia.*
Page 385, line 9, for CREVICED read [2] CREVICED.
Page 391, line 6, for BEECH read [26] BEECH.
Page 396, line 11 from bottom, for attennæ read antennæ.
Page 410, line 23, for castanæ read castaneæ.
Page 410, line 2 from bottom, for Typhlocylidæ read Typhlocybidæ.
Page 411, line 6, read, 84. The root-form of 83.
Page 411, line 14, for alicis read salicis.
Page 412, line 3, after Rhopalosiphum insert berberidis.
Page 413, line 2, dele the line, [as P. pyri = Schizoneura lanigera].
Page 413, line 6, for (Bouche) read (Bouché).
Page 415, line 25, for four to read to four.
Page 442, line 10, for where read wherein.
Page 445, line 3 from bottom, for *Buculatrix* read *Bucculatrix.*
Page 450, line 9 from bottom, for Meeke's read Meske's.
Page 454, line 25, for *Melitœa* read *Melitœa.*
Page 456, line 11, for *oblinata* read *oblinita.*
Page 456, last line, for *Schlagœri* read *Schlœgeri.*
Page 457, lines 4–5 from bottom, for girding read girdling.
Page 462, last line, for *versiscolor* read *versicolor.*
Page 463, line 4, for C. H. Moore read C. R. Moore.
Page 464, line 10 from bottom, precede with ARACHNIDA, ETC.
Page 472, line 14, for plate 6 read plate 1.