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TWENTY-SECOND ANNUAL REPORT

OF THE

ENTOMOLOGICAL SOCIETY

OF ONTARIO

1891.

PRINTED BY ORDER OF THE LEGISLATIVE ASSEMBLY.



TORONTO:

PRINTED BY WARWICK & SONS, 68 AND 70 FRONT STREET WEST.

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 Acridium America
 " frontalis
 Acronycta funeral
 Actias luna
 Agrilus ruficollis .
 " torpidus . .
 Agrotis annexa . .
 " campestris .
 " ochrogaste
 " turris
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To the Honorable

SIR,—I have the honor to acknowledge the receipt of your letter of the 10th inst. in relation to the proposed incorporation of the

The annual meeting of the Entomological Society of Canada, held at Montreal, November, 1891.

I am pleased to hear that you were elected President, and that your first reports were

whose work the Society has been able to do, and sections, to

address of the Society, and that you were also presented a

Entomologists' Society of Canada, and that you were elected President, Mr. J.

now includes a list of the members of the Society, and that you were engaged in the

interest and value of the Society, and that you were elected President, Mr. J.

The Canadian Entomological Society of Canada, and that you were elected President, Mr. J.

Entomologists' Society of Canada, and that you were elected President, Mr. J.

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TWENTY-SECOND ANNUAL REPORT

OF THE

ENTOMOLOGICAL SOCIETY OF ONTARIO.

To the Honorable the Minister of Agriculture :

SIR,—I have the honor to present herewith the twenty-second annual report of the Entomological Society of Ontario, in accordance with the provisions of our Act of Incorporation.

The annual meeting of the Society was held in London, on the 25th and 26th of November, 1891; the lateness of the meeting being caused by the severe illness of our President, who was on that account unable to attend earlier. At this meeting many papers of interest were read, the reports of officers received, officers for the ensuing year elected, and general business connected with the conduct of the Society transacted. The first reports were also received from the sections engaged on other branches of science, by whose work the Society hopes to be much benefited. The various reports of the officers and sections, together with the audited annual statement of the Treasurer, the annual address of the President, the papers read at the annual meeting and the report of our delegate to the Royal Society of Canada, will be found in the following pages. There is also presented a full report of the very important meeting of the Association of Economic Entomologists held in Washington in August last, under the presidency of our Vice-President, Mr. James Fletcher. This Society was first organised in Toronto in 1889, and now includes amongst its members all the leading scientists in North America who are engaged in the study of practical entomology; its proceedings are therefore of the highest interest and value to all concerned in any department of agriculture or horticulture.

The *Canadian Entomologist* continues to be issued regularly and is now the oldest Entomological publication in America. It numbers amongst its contributors the ablest students of the science in the United States as well as in Canada, and also some celebrated Entomologists in Europe.

I have the honor to be, Sir,

Your obedient servant,

W. E. SAUNDERS,

Secretary.

ANN

The annual meeting was held at Victoria Hall, London, on the 15th of the month, the President, Rev. Mr. F. J. occupying the chair.

On Wednesday the annual report was read and was carefully gone over.

At 2 p.m. a general meeting was held. Those present were:--The President, Rev. Mr. F. J. and W. H. Harrington, A. Moffat, H. Stevens,

The following

President
Vice-President
Secretary
Treasurer
Directors

Librarian
Editor of the
Editing Committee
South
Delegate
Auditors

The following resolution was read and adopted:

The Council in its report for the year has been one of the most successful. Ten monthly meetings were held, and a collecting party was sent to collect moths.

The presence of the Rev. Mr. Fyles and the Branch is indicative of the interest in the work.

During the year the following have been added to our list:

1. Notes on A.
2. Notes on C.
3. A Day in the

ANNUAL MEETING OF THE SOCIETY.

The annual meeting of the Entomological Society of Ontario was held in its rooms in Victoria Hall, London, on Wednesday and Thursday, November 25th and 26th, 1891; the President, Rev. C. J. S. Bethune, Warden of Trinity College School, Port Hope, occupying the chair.

On Wednesday morning, at 10 o'clock, a Council meeting was held, at which their annual report was prepared and adopted, the mailing list of the *Canadian Entomologist* was carefully gone over, and other business was transacted.

At 2 p.m. a general meeting of the Society was held, at which the following members were present:—The President; Rev. T. W. Fyles, South Quebec; Messrs. James Fletcher and W. H. Harrington, Ottawa; G. Geddes, Toronto; J. M. Denton, W. E. Saunders, J. A. Moffat, H. Stevenson, N. Stevenson, Foote and Roger, London.

ELECTION OF OFFICERS.

The following gentlemen were elected officers for the ensuing year:—

President—Rev. C. J. S. BETHUNE, M.A., D.C.L., Port Hope.
Vice-President—W. HAGUE HARRINGTON, Ottawa.
Secretary—W. E. SAUNDERS, London.
Treasurer—J. M. DENTON, London.
Directors—Division 1—JAMES FLETCHER, F.R.S.C., Ottawa.
Division 2—J. D. EVANS, Sudbury.
Division 3—GAMBLE GEDDES, Toronto.
Division 4—A. H. KILMAN, Ridgeway.
Division 5—J. ALSTON MOFFAT, London.
Librarian and Curator—J. A. MOFFAT, London.
Editor of the *Canadian Entomologist*—Rev. Dr. BETHUNE, Port Hope.
Editing Committee—H. H. LYMAN, Montreal; J. FLETCHER, Ottawa; Rev. T. W. FYLES, South Quebec.
Delegate to the Royal Society of Canada—THE PRESIDENT.
Auditors—J. H. BOWMAN and W. E. SAUNDERS, London.

REPORT OF THE MONTREAL BRANCH.

The following, the eighteenth annual report of the Montreal Branch of the Society, was read and adopted:—

The Council in submitting their report for the year 1890-91 are pleased to be able to state that the year has been one of decided progress.

Ten monthly meetings, most of which were well attended, have been held during the year; the June meeting, held at the residence of Mr Trenholme, Cote St Antoine being principally devoted to collecting moths.

The presence of Mr James Fletcher, Vice President of the parent society at the February meeting, and of the Rev. Mr Fyles of Quebec, on several other occasions gave an increased interest to those meetings, and the Branch is indebted to these gentlemen for the interest they have taken in its success.

During the year, one old member Mr E. D. Wintle has rejoined, and one new one Mr H B. Cushing has been added to our roll.

The following papers have been read during the year:

1. Notes on *Argynnis freya*, *A. Chariclea* and *A. Myrina*. H. H. Lyman.
2. Notes on Coleoptera (several papers.) J. F. Hausen.
3. A Day in the Woods. Rev. T. W. Fyles.

4. Notes on the Lepidoptera of 1890. A. F. Winn.
5. Description of a New Species of Pterostichus (P. Hornii.) J. F. Hausen.
6. Quebec representatives of the genus Plusia. Rev. T. W. Fyles.
7. Diseases of the Chrysanthemum caused by Insects, J. G. Jack, (selected.) F. B. Caulfield.
8. Tortoise Beetles. F. B. Caulfield.
9. On the occurrence of Gracilia minuta at Montreal. J. F. Hausen.
10. A preliminary paper on the genus Chionobas. H. H. Lyman.
11. Notes on Gryllidae, Field Crickets. F. B. Caulfield.
12. Notice of three new Species of Pterostichus. J. F. Hausen.
13. Notes on some methods of collecting insects. H. F. Winn.
14. Report on a collection of Lepidoptera from the north of Lake Huron. H. H. Lyman.
15. Can Insects survive freezing? H. H. Lyman.

Of the above, Nos. 1 and 9 have been published in the *Canadian Entomologist*; 3, 6 and 8 in the Annual Report for 1890; and 5 and 12 in the *Canadian Record of Science*.

The report of the Treasurer shows that the Branch is flourishing financially.

The Council would again urge upon the members increased activity in the collection and study of the insects of all orders in this locality, and especially of the more neglected ones, in order that we may obtain a better knowledge of those occurring here.

Only about 1,400 species are as yet recorded, and this number could be very materially increased by even one summer's careful work.

Your Council would suggest that occasional collecting excursions be held during the coming summer, as a means of stimulating the interest of the members in this science.

Respectfully submitted on behalf of the Council.

H. H. LYMAN, President.

The following officers were elected for the coming year:—President, H. H. Lyman; Vice President, F. B. Caulfield; Secretary-Treasurer, A. F. Winn; Members of Council, J. F. Hausen and W. C. Adams.

(Signed) A. F. WINN, Secretary.

REPORT OF THE TREASURER.

The Treasurer Mr. J. M. Denton, presented his annual statement of the finances of the Society and explained the various items to the meeting. On motion it was adopted as follows:—

RECEIPTS, 1890-91.

Balance from last year.....	\$153 90
Membership fees.....	292 88
Sales of <i>Canadian Entomologist</i>	192 16
Pins, cork, etc.....	73 32
Government grant.....	1,000 00
Interest.....	6 07

\$1,718 33

EXPENDITURE, 1890-91.

Printing <i>Canadian Entomologist</i> , etc.....	\$595 96
Report and meeting expenses.....	210 25
Library.....	33 55
Purchase of Collection.....	50 00
Expense account (postage, stationery, etc) ..	92 50
Rent.....	120 00
Insurance.....	35 00
Pins, Cork, etc.....	48 00
Grants to Editor and Curator.....	293 14
Balance.....	239 93

\$1,718 33

We certify that the above is a correct statement of accounts for the year ending August 31st 1891, of the Treasurer of the Entomological Society of Ontario, as shown by the books and vouchers.

(Signed) W. E. SAUNDERS,
J. H. BOWMAN.

R

Mr J. A. M
adopted :

The library was in the library register, viz: Nos. 100, 296, 614 102 books, inclu the year; the full nun According to a s if approved and publi subjects.

The number of Exchanges, such various kinds received

As recommende back volumes of the C Society to offer some of

The Society's col made of recent capture

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That the chairme to draw up regulatio and Mr. Fletcher, after

It was also move to Professor Penhallow Rhyncophorous beetle k

The reports of the following :

To the Council of the

GENTLEMEN,—In logical Society, it is fitti and for the opportunity being in touch with the refer to in matters of di section has made good pr is enthusiastic, and meet oftener, ever since inaug in Middlesex County, as whose breeding we have which point of view Mid different areas appear to

In connection with the distribution of birds of the various birds know

REPORT OF THE LIBRARIAN AND CURATOR.

Mr J. A. Moffat presented and read the following report, which was, on motion adopted :

The library was completely gone over in the beginning of the year, and each book checked by its No. in the library register, when it was discovered that there were five volumes that could not be accounted for, viz : Nos. 100, 296, 619, 729, 994.

102 books, including a gift of 38 volumes from the President, have been added to the library during the year ; the full number on the register being 1,168.

According to a suggestion at a previous meeting, a sectional catalogue has been commenced, which, if approved and published, will inform the members what books in the library deal with entomological subjects.

The number of volumes issued to local members during the year was 74.

Exchanges, such as reports and proceedings of societies, bulletins, magazines and periodicals of various kinds received during the year, average thirty per month.

As recommended by the Secretary, and approved of at the last annual meeting, an inventory of the back volumes of the *Canadian Entomologist* was taken. The information obtained thereby enabled the Society to offer some of the volumes to members at reduced rates, which were taken advantage of by many.

The Society's collection of native lepidoptera has been almost entirely renewed, and many additions made of recent captures, making it a good representative collection of Ontario lepidoptera up to date.

It is to be regretted that the coleoptera collection still remains in a very defective state, many blanks requiring filling in.

The other orders of native insects remain about the same, with no chance of extension, from a want of cabinet accommodation.

The exotics, so greatly increased by the purchase of the Pettit collection, have been made conveniently accessible, and have been a source of much interest and gratification to visitors.

A beginning has been made in arranging the European collection of coleoptera, which, when completed, will be valuable for reference, and the duplicates made available for sale or exchange.

An effort has been made to catalogue the wood-cuts and electrotypes, giving the No. of the drawer in which they are to be found, the name of what the cut represents, and the number of the annual report in which it has been described, which, when perfected, will enable anyone to trace the cut required with comparative ease.

Respectfully submitted,

(Signed)

J. A. MOFFAT,
Librarian and Curator.

RESOLUTION *re* LIBRARY.

The following resolution regarding the library was adopted :—

That the chairmen of the various sections of the society, and the librarian be appointed a committee to draw up regulations for the use of the librarian, the same to be submitted for approval to the President and Mr. Fletcher, after which they shall be published with the catalogue.

It was also moved and resolved "that the thanks of the Entomological Society of Ontario be given to Professor Penhallow, of McGill University, Montreal, for interesting specimens of an East Indian Rhynchophorous beetle kindly presented by him to the Society's cabinet.

The reports of the sections of the Society being called for, Mr. Saunders presented and read the following :

REPORT OF THE ORNITHOLOGICAL SECTION.

To the Council of the Entomological Society of Ontario.

GENTLEMEN,—In presenting the first report of the London Ornithological Section of the Entomological Society, it is fitting that the Section should acknowledge its indebtedness for the privileges enjoyed and for the opportunity of organizing under the aegis of the Entomological Society. The advantages of being in touch with the more important of the other branches of natural history, and of having experts to refer to in matters of dispute or inquiry, are not easily overestimated. Under such circumstances the section has made good progress during the time since its commencement. The membership, while not large is enthusiastic, and meetings, at which the attendance has been very good, have been held monthly or oftener, ever since inauguration. The section has compiled a list, presented herewith, of the birds breeding in Middlesex County, as well as supplementary lists of probable present and probable former breeders, of whose breeding we have not specific evidence. To this is added a short note on "Faunal Areas," from which point of view Middlesex occupies a peculiarly interesting position as a borderland, on which the different areas appear to meet.

(Signed)

W. E. SAUNDERS, Chairman.
W. A. BALKWILL, Secretary.

In connection with this section a paper was read by Mr. R. Elliott on "Life Areas," referring to the distribution of birds in the neighbourhood of London ; and a list was presented by Mr. W. E. Saunders of the various birds known to breed in the County of Middlesex.

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President.

vice President.
W. C. Adams.

Secretary.

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and to the general public. The titles to these are: "Kitchen Garden Pests and How to Deal with Them"; "An Outbreak of the Army Worm in Maryland"; "Tortoise Beetles"; "Quebec Representatives of the Genus *Plusia*"; "Origin and Perpetuation of Arctic Forms"; "Fuller's Rose Beetle"; "Hymenoptera Parasitica"; "Insects Injurious to the Elm"; "The Entomology of Shakespeare"; and "Experiments for the Destruction of Chinch Bugs." The rest of the report is made up with selections, and notices and critiques of the most important entomological publications that had appeared in the course of the year.

The *Canadian Entomologist* has reached its twenty-third volume. It is still under the able management of the Rev. Dr. Bethune, D.C.L. It has now been permanently enlarged to twenty-four pages, and "continues to receive contributions from all the most eminent entomologists in North America, and to circulate in all parts of the world." (21st report, introductory letter from the Secretary to the Honorable the Minister of Agriculture). In the volume for 1890, articles appear from thirty-five contributors who are pursuing their investigations in various parts of British North America, the United States of America, Great Britain, British India and Germany. No less than seventeen new species of insects are described in its pages.

The constitution of the Society provides for the formation of branch associations; and in Montreal an important branch has flourished for a length of time. It was chiefly through the instrumentality of Mr. F. B. Caulfield, that this branch was called into existence; and it still enjoys the benefit of his services as vice-president. Under the presidency of Mr. H. H. Lyman, the branch is raising up a number of young and enthusiastic entomologists who give promise of attaining eminence in their favourite pursuit. At its monthly meetings original papers have been read, and descriptions of several species of beetles discovered by Mr. J. F. Hausen, one of its members, have been given. The secretary of the branch is Mr. A. F. Winn.

The scheme for the formation of sections, which was put into operation last May, continues to work admirably. The sections formed in London, the head-quarters of the Society, are four:—the Botanical, the Ornithological, the Geological and the Microscopical, all of which are doing good work. The value of all these sections to the parent society will be readily perceived: of the Botanical, in determining the food plants of insects, and in tracing insect ravages and their effects; of the Ornithological, in discovering what insectivorous birds act as checks upon the undue increase of particular kinds of insects, and in answering such inquiries as that which called forth a volume from the United States Agricultural department—whether the English sparrow (which was said to destroy large numbers of injurious larvæ) was of benefit to the community or not; of the Geological, in showing what kinds of soils are favourable to the growth of certain food plants, and thus indicating the localities for particular insects, and also in tracing the impressions left by extinct species in various Geological formations; and the Microscopical, in noting the structural peculiarities of insects, and in aiding to classify minute forms.

The Botanical section numbers 16 members. Its chairman is Mr. J. Dearness; vice-chairman, Professor Bowman, and secretary, Dr. S. Carson. Meetings for study and mutual assistance are held by it every Saturday evening, from 1st of May, until 1st of October. A number of excursions have been carried out, and some new species added to the already well examined flora of the environs of London. Two new mosses have been discovered by Mr. Dearness, and a surprisingly large number of new fungi—more than 60 now named, and some yet unnamed. These fungi are for the most part new not to Canada only, but also to the whole of America.

The Ornithological section also is flourishing. It is engaged in gathering up facts of general import to ornithology, and is commencing a systematic list of the breeding-birds of Middlesex county to be presented at the annual meeting of the Society. Its chairman is Mr. William Saunders, and its secretary, Mr. N. O. Balkwell.

The Geological section has nine members. Dr. S. Wolverton being chairman, Mr. T. Green vice-chairman, and Mr. J. L. Goodburne, secretary. The members have made regular weekly excursions, and the district around London has been well worked by them,

and numerous interesting fossils have been added to the Society's collections; taken altogether the year's work done by this section has been very satisfactory. The interest of the members has not flagged at any time, but each has seemed anxious to do what he could towards adding to the general stock of information.

The Microscopical section has also been active. It numbers twelve members, and it has in use eleven first-class microscopes. Ten meetings have been held by the members for private study, and two public entertainments for the benefit of the young people of the city have been given. Special attention has been paid by this section to fungi, mildews upon fruit trees, rust in wheat, etc. Mr. John Denton is chairman of the section, and Messrs. Bowman and Dearnsey, microscopical directors.

It is generally conceded that the formation of these sections was a happy procedure that strengthened the Society and increased its usefulness.

At the last annual meeting the Society secured the services of Mr. J. Alston Moffatt one of its members who engaged to take entire charge of the Society's rooms, library and collections, and to be a permanent resident official in London. It is felt that the greatest care will be taken by Mr. Moffatt for the preservation and arrangement of the Society's valuable collections of insects. These have lately been enlarged by the purchase from Mr. Johnson Pettit of Grimsby, of several well filled and well-arranged cabinets of coleoptera, etc., the results of many years' intelligent labor on the part of Mr. Pettit.

Among the tokens of public recognition of the value of its collections, the Society preserves the medals and diplomas awarded it at the Centennial Exhibition, Philadelphia, in 1876, the International Fisheries Exhibition in 1883, and the Colonial and Indian Exhibition in 1886.

The library of the Society now numbers 1,100 volumes. Among them are such costly works as the Challenger Reports, 20 vols.; Smith's Collection of Abbott's Illustrations, 2 vols. 1797; Drury's Exotic Entomology, 3 vols.; Stephen's Entomology, 8 vols.; Kirby's Entomology, 4 vols.; Say's Entomology, 2 vols.; Edwards' Butterflies of North America, 2 vols.; Scudder's Butterflies of New England, 3 vols.; McCook's American Spiders, 2 vols.; Packard's Monograph of Geometrid Moths; Lord Walsingham's Illustrations of Typical North American Tortricidæ, 2 vols.; The American Naturalist, 20 vols.; Scudder's Fossil Insects, 2 vols., etc. It is being continually enriched by the printed reports and periodicals from the principal Entomological societies of Great Britain, Australia, Austria, France, Germany, India, Italy, Russia, Switzerland, South America and the United States of America.

The Society's collections, library, electrotypes, etc., are insured for \$3,500.

The Society reports, through its president, the unwelcome re-appearance of the Hessian fly (*Cecidomyia destructor*, Say), and recapitulates the best methods of dealing with this pest.

Another intruder that has been brought under the notice of the Society is the grain Aphid (*Siphonophora avenæ*, Fab.), which has appeared in many localities in Ontario.

The Larch saw-fly (*Nematus Erichsonii*, Hartig.), after doing incalculable harm to the tamarack forests of Canada, is now diminishing in numbers. A new importation allied to this (*Nematus pallidiventris*, Fallen) has made its appearance on willows brought from Russia by the late Mr. Charles Gibb.

The Mediterranean Flour Moth (*Ephestia Kuhnii*, Zeller) whose appearance two years ago in a large milling establishment in Ontario, caused so much consternation, and called forth such vigorous action on the part of the Ontario Agricultural Department seems happily to have been stamped out.

In these days of rapid transit and intercourse with foreign countries, the advent of new insect pests may be looked for. According to a wise provision the directors of the Society must be representatives from the different Agricultural sections of Ontario. By this arrangement it is hoped the appearance and operations of injurious insects in any part of Ontario will be speedily made known to the Society, and receive careful attention.

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The Society has noted with the greatest satisfaction the valuable work done by Mr. Fletcher, the Dominion Entomologist at Ottawa, who, by his entomological publications and his public addresses in various parts of the country, is diffusing knowledge that will be of the utmost importance to the community. The president of the Society has truly said that "the result of his work must in course of time be the saving of hundreds of thousands of dollars to the farmers and fruit-growers of the Dominion." (President's address, 21st annual report, p. 10).

A paper by Mr. H. H. Lyman, of Montreal, on "Pamphila Manitoba, Scudder, and its varieties," was read by the President, in the absence of the writer.

Various matters of interest were then brought up and discussed by the members present. Among them may be mentioned a consideration of the prevalence of the destructive Locust (or Grass-hopper) in some of the North-western States, and the probabilities of a further attack next year. The successful use of "Hopper-doers" was mentioned, and much credit was given to Mr. Lawrence Bruner for his valuable investigations. The occurrence of an imported species of Saw-fly on the European alder was noted; and mention was made of the destruction of Hawthorns (*Crataegus*) by the beetle *Anthonomus quadrigibbus*.

Mr. Fletcher exhibited a specimen of *Vanessa Californica*, taken by Mr. W. H. Danby on Vancouver Island, September 20th, 1890, being the first recorded capture of this butterfly in Canada. He also exhibited (1) a very rare and extraordinary beetle, taken by Prof. John Macoun, in 1887, at Victoria, B.C.; it is a large longicorn, but with its short wing-covers looks more like a rove beetle (*Staphylinid*); its name is *Ulochates leoninus*; (2) a specimen of the mole-cricket (*Gryllotalpa borealis*), which was taken at Leamington, in the County of Essex, by Mr. W. W. Hilborn, and gave an account of its curious and interesting habits: (3) a specimen of the pupa of *Chrysophanus thoe*, which he had raised from the egg; he procured from a pair of the butterflies in captivity twenty-four eggs, of which one hatched and went through all its larval stages to the pupa, feeding on dock (*Rumex*); the remaining eggs will evidently remain dormant till next spring: (4) a specimen of the cut-worm *Agrotis ochrogaster*, Guen., which is so injurious in the North-West, and compared it with *A. turris*, Grote; he stated that all grades of variation between the two forms had been obtained from one brood of the caterpillars, and that it was now accepted that they were all of one species, which should be known by the former name.

Mr. Fyles exhibited specimens of (1) *Colias interior* and *C. philodice*, var. *Laurentina*; (2) *Lycena Couperi*, taken at Brantford, Ontario, regarding the identity of which with the southern form, *L. Lygdamus*, a discussion took place, leading to the conclusion that they were local forms of the same butterfly: (3) a "hair-snake," (*Gordius*), ten inches long, taken from the body of the larva of an *Acronycta*, which was remarkable, as these creatures are usually found infesting grass-hoppers and crickets of the order Orthoptera.

The meeting adjourned at 5.30 p. m.

EVENING SESSION.

In the evening the Society held a public meeting in its rooms at Victoria Hall which was largely attended by members and other friends from London and the neighbourhood, amongst whom the following were noticed:

Mr. James Fletcher (Vice President), and Mr. W. H. Harrington, of Ottawa; Rev. T. W. Fyles, of South Quebec; Captain G. Geddes, of Toronto; Messrs. J. M. Denton, W. E.

Saunders, J. Alston Moffatt, Rev. W. M. Rogers, Dr. Woolverton, Dr. Wilson, Prof. J. H. Bowman, J. Dearness, H. Stevenson, W. Stevenson, D. Arnott, W. Foote, W. Scarrow, and — Ware, of London.

The Rev. Dr. Bethune, Warden of Trinity College School, Port Hope, President of the Society, took the chair at 8 o'clock.

The annual report of the Council was read, and upon motion by Rev. T. W. Fyles, seconded by Prof. Bowman, it was adopted and referred to the Editing Committee for publication.

REPORT OF THE COUNCIL.

The Council of the Entomological Society of Ontario beg to present the following report of their proceedings during the past year:—

They are happy to be able to congratulate the members of the Society upon the large increase in numbers during the past year, and the continued interest that is taken in its various departments of work.

The Twenty-First Annual Report on Economic and General Entomology was sent to the Minister of Agriculture in December last, and was printed and distributed in the following April. It consisted of 105 pages, illustrated with 47 wood cuts, and contained many useful and valuable papers.

The *Canadian Entomologist* has been regularly issued at the beginning of each month; the December number, which will complete the twenty-third volume, is now passing through the press. It is now the oldest publication of the kind in North America, and continues to maintain a high reputation among scientific entomologists, both from the value and interest of its papers and the eminence of many of its contributors. The number of pages has been much increased in the current volume. Nearly every issue has contained from 20 to 24 pages, and that for November extended to no less than 34. The whole volume will consist of over 280 pages, being more than forty in excess of the usual number.

Over one hundred volumes have been added to the library during the past year, including a handsome gift of 38 volumes from the President. Among the purchases may be mentioned the valuable work, by Mr. S. H. Scudder, on the Fossil Insects of North America, in two volumes, quarto.

A large and valuable addition to the cabinet of the Society has been made by the purchase of Mr. J. A. Moffatt's collection of *Lepidoptera*.

The following sections of the Society have been in active operation during the past year, viz.: The Botanical, Geological, Microscopical, and Ornithological. The reports of their proceedings are submitted herewith. It is gratifying to find that the formation of these sections has proved so successful and that it has led to an increase of our numbers and the performance of much valuable work. It is earnestly hoped that all persons interested in natural science, in London and the neighbourhood, will become members of the Society, and take part in the proceedings of one or more of the sections.

During the month of August important meetings were held at Washington, D.C. The Association of Economic Entomologists was presided over by our Vice-President, Mr. Fletcher, and was the most important, and the best attended, of any hitherto held in North America. A full account of its proceedings will be published in our annual report. At the meeting of the Entomological Club of the American Association for the Advancement of Science, Mr. Fletcher acted as our representative, and has given a report of the papers and discussions in the October and November numbers of the *Canadian Entomologist*.

The reports of the Royal Society

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The President's address upon the year.

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The reports of the Montreal Branch, and of the Rev. T. W. Fyles, delegate to the Royal Society of Canada, are presented herewith. The accounts of the Treasurer, and the reports of the Librarian and Curator are also submitted.

The Council desire to express their satisfaction at the manner in which the Curator has discharged his duties during the past year, in the care and arrangement of the library and cabinets, and of the rooms of the Society.

All which is respectfully submitted.

CHARLES J. S. BETHUNE,

President.

ANNUAL ADDRESS OF THE PRESIDENT.

The President cordially welcomed all present and proceeded to deliver the annual address upon the chief topics of entomological interest which had taken place during the year.

GENTLEMEN.—I have much pleasure in welcoming you all to the annual meeting of our Entomological Society. I am sorry that we have been unable to hold it at an earlier and more favourable period of the year, and that we should thus be debarred from having an outing together, like that of our memorable field-day last year. I was unfortunately laid up with a severe illness during the latter part of the summer, and my colleagues thought that it would not be advisable to hold this meeting without your President; it was consequently postponed to this late date. Owing to my being confined to my room for so long a time, I can only give you a meagre account of the principal events of the year in the entomological world. In doing so let me first refer to the most noteworthy injuries caused by insects during the past season.

The most serious insect pest of the year to the fruit grower in Canada was "the Eye-spotted bud moth," (*Tmetocera ocellana*, Schiff). This tiny insect (Fig. 1) has become very abundant of late and very widespread throughout the country. In Ontario, Quebec, New Brunswick and Nova Scotia it has been very injurious to the apple. The crop of fruit this year has been so unusually large that the loss occasioned by this insect has not, perhaps, been much noticed, but it is much to be feared that if it should be let alone to increase and multiply undisturbed, its ravages will become very serious and very conspicuous in the future. The object of attack, as the name of the insect indicates, is the opening bud of the apple; this is pierced by the young caterpillar, which forms a habitation for itself by drawing together portions of a dried and blackened leaf and lining them with silk to form a protecting case. As it grows larger, the worm often destroys a whole cluster of blossoms or of young fruit by drawing them together with silken threads and devouring the stems and foliage to such an extent that they wither and die. It occasionally also eats into the extremity of the twig from which the blossom proceeds, and by boring into it causes the destruction of the bloom and all hope of subsequent fruit. The caterpillar is of a dull brownish colour, with a few short hairs on its body proceeding from tiny warts. It usually becomes fully grown in June and forms its chrysalis in its larval case, from which the moth emerges in July. This is a pretty little creature, ashen gray in colour with a broad whitish band across the middle of the anterior wings. Its specific name is derived from the two little eye-like spots on each of these wings. A good deal may be done to check the spread of this insect by pulling off and crushing the clusters of withered leaves containing the caterpillars, but the best remedy is no doubt the spraying of the trees in early spring with a weak mixture of Paris green and water, not more than one quarter of a pound of the poison to fifty gallons of water, but it would be well to begin with a lower strength than this for fear of injuring the foliage of the trees.



Fig. 1.

Closely associated with the insect I have just referred to is "the Lesser Apple-leaf Folder" (*Teras minuta*, Røbs), which has also been very abundant this year, (Fig. 2). The caterpillars of this insect appear in early spring and commence their depredations upon the tender foliage which has just come forth from the opening buds. They draw the opposite sides of the leaves together to form a habitation, and devour the foliage nearest to them. When they occur in large numbers they cause the trees to look as if they had been scorched by fire at the extremity of the branches. The moth is about a third of an inch long, with bright orange fore wings and silky white hind wings. There are two broods in the year, the first moth appearing early in spring and the later ones towards the end of July.

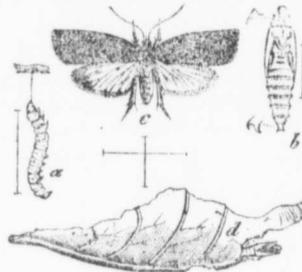


Fig. 2.

The larvæ of another and larger moth, "the Oblique-banded Leaf-roller," (*Cacasia rosaceana*, Harris), have also been very numerous and destructive. This insect feeds upon a large variety of plants, both fruits and shrubs, but has been especially injurious to the apple during the past season. Like the two species already mentioned, it begins its attack in early spring by rolling up the young leaves of the plant and fastening them with silken threads. In the hollow cylinder thus formed the caterpillar (Fig. 3) takes up its abode, and when disturbed at one end quickly slips out at the other and lets itself down and away from the threatening danger by means of a silken thread. There are a great many species of leaf-rollers known to entomologists—they belong to the family of Tortrices and are well represented everywhere. Their habits are much the same

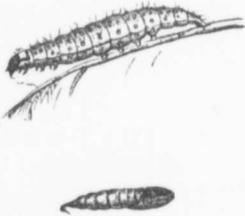


Fig. 3.

in all cases, and when numerous they become a positive injury to the plants they attack. The moths may be at once recognized by their peculiar flat shape, resembling the outline of a bell when the wings are closed, (Fig. 4) and having the outer margin of the fore wings wavy (Fig. 5.) In the species now referred to the fore wings are of a cinnamon or brown colour, and the hind ones a lighter yellow. The best remedy for this insect and the leaf-folder is the use of Paris green in the manner I have already described.



Fig. 4.



Fig. 5.

Canker-worms, the larvæ of the moths *Anisopteryx vernata*, Peck and *A. pometaria*, Harris, which are injurious almost every year in the Maritime Provinces, have this year been injuriously abundant in the eastern counties of Ontario, and have also been particularly destructive at Winnipeg, where they have in many cases stripped of their foliage the large trees of the ash-leaved maple which are there grown in the streets for shade. There are two classes of remedies for these insects. The object of one is to prevent the wingless female from climbing up the trees from the ground in order to lay their eggs after their emergence from the chrysalis state, which they pass in the earth. A common mode of doing this is to encircle the trunk of the tree a short distance above the ground with a band of cloth or thick paper, folded to a width of four or five inches and thickly smeared with tar or a mixture of tar and molasses. This should be applied to the tree in the autumn and kept on till the leaves are expanded in the following spring. The tar requires to be renewed from time to time, and should be looked to whenever any mild days occur at the beginning or close of winter. Tin and wooden troughs filled with oil have been used for the same purpose; also collars of tin, sloping downwards like an inverted funnel have been found effective in preventing the female moths from ascending the trees. The other style of remedy is that directed against the caterpillars when they

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have gained possession of the trees, and consists of spraying the trees with Paris green or London-purple—a method that may be very properly described as a universal remedy for all foliage eating insects.

The irrepressible Cut-worm has made his unwelcome presence known in many parts of the country. In Alberta territory they were very numerous and destructive in the early part of the season. In reply to an appeal for instruction in the modes of dealing with this pest made by the editor of the *Macleod Gazette*, I sent him copies of our last report and Mr. Fletcher's bulletin containing directions upon the subject, and advised him strongly to have the poisoned traps used by the farmers in the neighbourhood. The remedies were duly published in the *Gazette* and I have no doubt were found very effective by those who tried them. The species of cut-worm in question is evidently *Agrotis ochrogaster*, Guen, which has also been found in abundance at Lethbridge. Its habit is to attack vegetation of every description, and thus it may be rated as one of our most destructive species. It is evidently very widely diffused throughout the Dominion, as it has been found in abundance at Cape Breton. In Manitoba another species, *Agrotis campestris*, Grote, has been most prevalent and injurious.

The insect producing the well-known injury called "silver-top" in grass (*Meromyza Americana*) was very abundant this year in many districts of Ontario. In most instances it was attended by its parasite (*Calinius meromyza*, Forbes), which may be relied upon to keep it in check eventually. In the meantime it will be wise for farmers to break up their old meadows, wherever "silver-top" has appeared, and put in a crop with plenty of manure.

The turnip flea-beetle, (*Phyllotreta vittata*, Fab.) is almost ubiquitous and always injurious. Sometimes it is so numerous on the plants that on the approach of a disturber it hops off from leaf to leaf with the pattering sound of fine rain or hail. This year it has been abundant in some localities and requires measures for its destruction. In this country, where it is not the practice to feed sheep upon the turnips in the field, it is quite safe to employ a mixture of Paris green and land-plaster in a proportion of one hundred times the quantity of the latter to that of the former. The best time to apply the poison is when the leaves of the plant are wet with dew.

Another "pestilent fellow" that requires constant watching is the pea-weevil (*Bruchus pisi*, Linn) (Fig. 6.) It appears, unhappily, to be on the increase in this Province. As large quantities of choice varieties of peas are grown in order to export the seed, it is a very important matter that they should be perfectly free from this pest. The first precaution to be taken is to make sure that the seed intended to be sown is free from the weevils; in fact, this is about the only thing that can be done owing to the habits of the insect and its working inside the pod. Should the seed be found to be infested with the weevils, the utmost care should be taken to kill them. There are several modes of doing this, but the most effectual is to place the seed in a perfectly tight vessel and to put on the top of the peas a saucer containing a little bisulphide of carbon—one quarter of a pound is enough for three hundred weight of peas. This substance, when exposed to the air, becomes converted into a gas, which being heavier than the atmosphere, sinks down through the mass of peas and kills all living things exposed to it. It is necessary to exercise the utmost care in its use as it is highly inflammable and any light brought near it will cause an explosion. It is advisable, therefore, to put the peas to be treated into a barrel or other receptacle that can be moved out of doors before the cover is taken off.

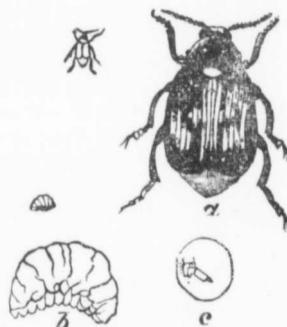


Fig. 6.

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The next insect on my list of the troublesome is the striped cucumber beetle (*Diabrotica vittata*, Fab.), a little yellow-striped creature (Fig. 7) that is no doubt familiar to everyone. Dr. Weed, of the Ohio State Experiment Station, has satisfactorily shown by a series of careful experiments that the best mode of preventing injury from this insect is to so protect the plants that the beetle cannot get at them, and that this can be most cheaply and successfully done by "protecting each hill by a piece of plant-cloth, or cheese-cloth, about two feet square. This may be done simply by placing it over the plants and fastening the edges down by small stones or loose earth. It is better, however, to hold it up by means of a half barrel hoop, or a wire bent in the form of a croquet arch."



Fig. 7.

The Pear-tree slug (*Selandria cerasi*, Peck), Fig. 8, has been very abundant and injurious in many quarters, completely destroying the foliage of cherry as well as pear trees. It is too familiar a pest to require description at my hands. An effective remedy has been found in the application of a weak mixture of Paris green and water. Last year I referred to the exceeding abundance in all parts of this Province of the fall web-worm (*Hyphantria textor*, Harris). I regret to say that this year it has been more abundant than ever, so much so that it may be regarded as the most noticeable attack of the season. It has become widespread throughout Canada and the United States as far south, at least, as Virginia.



Fig. 8.

The larch saw-fly (*Nematus Erichsonii*) continues to be very abundant and destructive. Unfortunately it is a kind of attack for which there seems no practicable remedy.

The tent-caterpillars (*Clisiocampa*) have again, I am happy to say, been conspicuous by their absence. It is to be hoped that this immunity may long continue.

The oyster-shell bark-louse (*Mytilaspis pomorum*, Bouché), Fig. 9, has become very injurious in orchards and gardens, but few fruit-growers seem to realise how much injury it occasions, because it is so inconspicuous. Scraping the bark of the trunk and larger limbs, or scrubbing them with strong soapsuds will be found useful, but when the insect covers the smaller branches and twigs, as it soon does when undisturbed, it becomes necessary to resort to some other method of treatment. Syringing with a kerosene emulsion just before the buds burst in the spring, or late in the autumn immediately after the fall of the leaves, will be found most effective.



Fig. 9.

As far as I have been able to ascertain, these are the most noteworthy insect attacks of the year. There have been, no doubt, many others in particular localities, but these that I have referred to were for the most part widespread and general.

You will probably have noticed that I have given Paris green as the remedy for most insect pests. Its use has now been pretty thoroughly tested both here and in the United States, and there is no doubt that it is by far the simplest and most effective remedy for the codling-moth of the apple, the plum curculio, and all leaf-eating insects. It is, of course, absolutely necessary that great care should be exercised when handling so virulent a poison, to prevent injury to human beings or animals, and that the directions given by skilled entomologists, who have made careful experiments, should be strictly carried out. It must also be borne in mind that satisfactory results cannot be expected without the use of proper pumps and nozzles. The great point to be aimed at is to envelop the tree in a fine mist of the poisoned mixture, not to simply cause the foliage to drip from the squirting of a stream of the liquid. For full information regarding desirable appliances for this purpose and the quantities to be employed, I would refer those interested to the Bulletin No. 11, issued by the Central Experimental Farm at Ottawa, and prepared by Mr. Fletcher. It is entitled "Recommendations for the Prevention of Damage by some Common Insects of the Farm, the Orchard and the Garden." It is a most admirable little manual, and

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contains within its thirty pages a wonderful amount of concise information regarding our commonest insect pests and the best way to deal with them. If any intelligent farmer or gardener will faithfully carry out the directions given, he will reap an abundant reward in the saving of a very large percentage of his crops or fruits, and he will at the same time gain a practical knowledge of insects that will stand him in good stead all the days of his life. If Mr. Fletcher had done no other work, and we all know how much valuable work he is always doing, the preparation of this little treatise would amply justify his appointment as Dominion Entomologist.

I hope that I have not wearied you with so much practical entomology to-night, but there is no doubt that our department of science is just now more concerned with economic rather than with technical investigations. An evidence of this may be found in the record of the proceedings of the meeting of economic entomologists held at Washington in August last, under the presidency of our colleague, Mr. Fletcher. It was a remarkable meeting, both as regards the number of distinguished scientists who were present, and the ability and usefulness which characterised the large number of papers read and the discussions that resulted from them. I trust that a full account will be published in our forthcoming annual report.

Since our last annual meeting many publications on economic entomology have been issued from the press, for the most part in the form of bulletins prepared by the entomologists attached to the Experiment Stations in various States of the Union. They are too numerous to mention in detail, but are always useful and interesting, and in many cases most valuable contributions to the knowledge of the subject. The Division of Entomology at Washington must not be overlooked when referring to work of this kind. Besides the publication of *Insect Life*, which is by far the best periodical of its kind that we have ever seen, many valuable papers on both scientific and practical entomology have been issued.

About ten years ago (in 1881) what was then called the United States Entomological Commission, consisting of Messrs. Riley, Packard and Thomas—three very eminent men—issued a work by Dr. Packard on "Insects Injurious to Forest and Shade Trees," (Bulletin No. 7), a goodly volume of 275 pages, well illustrated and replete with valuable information. Recently a revised and much enlarged edition of this work has been issued by the Department of Agriculture at Washington, bringing the original work more nearly down to date, and furnishing, as far as is possible, a complete manual on the subject. The new volume is more than three times the size of the former edition, consisting of no less than 950 pages, illustrated by over 300 wood-cuts and 40 plates, 12 of which are coloured. Some idea of the extent of the work, as well as of the importance of the subject, may be formed when I mention that descriptions are given of over 300 species of insects that affect the oak, and the names of nearly 150 more are mentioned; 61 are described as attacking the elm, and 30 more mentioned; 151 described that affect the pine, and a list of 20 more given; and so on for a large number of other trees. Economic entomologists for the most part devote their attention to the insects that attack fruit trees, crops and vegetables, as these most directly affect the public; but surely no more important matter can be studied than the preservation of our forests, which are annually being depleted for the purposes of commerce, as well as by fire and insects. It is high time that more attention was paid to this matter, and that people generally should be aroused to the dangers that will surely result if we allow our country to be stripped of its woods and forests. In some countries of Europe, notably in Germany, a very rigid oversight of the forests is maintained by the Government, and no wanton or careless destruction is permitted. In connection with this, they encourage scientific men to devote their studies to the insect enemies of the trees, and as a result some magnificent books have been published. Chief among these are the grand work of Ratzeburg, and the perhaps less widely-known publications of Kaltenbach. Along side of these Dr. Packard's book will assuredly take its place.

Miss E. A. Ormerod, we are happy to say, continues her valuable work in England with unceasing devotion and industry. It is gratifying to know that the difficulties which led to her resignation of the office of Consulting Entomologist to the Royal

Agricultural Society have been satisfactorily composed, and that the Society, having apologised for the action which led to her resignation, will now be able to count once more upon her invaluable assistance in all matters that relate to practical entomology. A very remarkable testimony to her ability and worth was afforded by the British press when the fact of her resignation was first made known. The leading agricultural journals and the newspapers, including the *Times*, spoke in warm terms of her merits and deprecated the action of the Society; social papers, such as the *Queen*, discussed the case and took up the cudgels in her defence; and all alike bore lively testimony to the inestimable value of her services.

Her sister, Miss Georgiana E. Ormerod, has recently published a series of colored diagrams of insects injurious to vegetation; they are 30 in number, and include all the most prevalent attacks upon crops, fruits and trees. They are beautifully executed and will be found most useful for the illustration of lectures to classes or addresses to farmers' institutes. Though intended for England, nearly all of them are equally applicable to this country.

In technical entomology the year has been marked by the publication of Mr. S. H. Scudder's grand work on Fossil Insects of the Tertiary Period. He has devoted to its preparation about a dozen years of patient toil, and it stands forth in conjunction with his marvellous volumes on "The Butterflies of the New England States and Canada," as a monument to his great ability, industry and learning. In this work he gives descriptions of no less than 612 species, for the most part collected in Colorado, Wyoming and British Columbia, with some from Pennsylvania, and Scarborough in this Province. Nearly all the species are beautifully figured on large lithographic plates.

Mr. W. H. Edwards continues to issue his work on "The Butterflies of North America," with its unsurpassed colored illustrations. The twelfth part of the third series is now announced as ready for distribution.

To turn for a few moments to our own affairs, I think I shall voice the feelings of you all when I say that we have much reason to congratulate ourselves on the progress and continued success of our Society, which is testified to in the reports of the council, and the treasurer and curator, which will presently be laid before you. It is well, however, for us all to remember that membership of a society carries with it the duty not only of paying the annual subscription to its funds, but also of giving some of our time and some of our work to furthering the special objects which it has in view. Much could no doubt be done by even the youngest and least skilled of our members by collecting specimens for our cabinets, making field observations on the habits of insects, or rearing them through their preparatory stages. Much remains to be learnt regarding the life history of many of our common butterflies, and there is still a boundless field to be surveyed among the moths and the other orders of insects. Short notes of original observations will always be of value and will be welcomed for publication by the editor of your journal, the *Canadian Entomologist*; he will also be pleased, especially at the present time, to receive contributions of an economic character for the pages of the annual report.

I beg to thank you, gentlemen, for your kind patience with me while I have attempted to lay before you those matters of entomological interest which have presented themselves to me during the past year. I am happy to feel that my somewhat meagre remarks will be well supplemented by those gentlemen who are to follow me with addresses to-night.

Mr. Fletcher moved a vote of thanks to the President for his admirable and entertaining address, and in doing so spoke of the increasing interest amongst farmers in the practical application of economic entomology for the prevention of insect injury. The Eye-spotted bud-moth had been prevalent over a very large area in North America this year, extending through Canada from the Maritime provinces to western Ontario. There were still varying opinions as to the manner in which the insect passed the winter. The peculiar flattened eggs are laid in July, and Dr. Lintner had reared one almost to its full size before the end of August. Prof. Fernald stated that he had bred them and that they passed the winter amongst the fallen leaves. He himself had found larvæ in New

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Brunswick which he considered belonged to this species, which were in a sort of cocoon in the crevices of the gnarled fruit spurs of apple trees. He hoped members would try and settle the question for their own locality, as the decision as to this point is of great importance in deciding what is the best remedy to apply. He had secured good results in treating this insect as well as the leaf-rollers and canker-worms on apples by spraying early with Paris green. With regard to Cut-worms (*Agrotis ochrogaster*) the red-bellied cutworm had been complained of also by many of his correspondents. Several specimens had been sent to him from Lethbridge, a large proportion of which had proved to be parasitized. At Ottawa the species had also been abundant, and from rearing a large number he felt sure that the red form known as *Ag. turris* and the pale *ochrogaster* were the same species. Mr. Fyles had at the meeting a pair representing both forms taken in copulation. A new turnip pest had appeared in the Northwest Territories in the shape of a handsome chrysomelid named *Entomoscelis adonidis*. Several consignments were sent in during August.

Mr. J. Dearness had much pleasure in seconding the vote of thanks. He quite agreed with the mover in the practical value of such an address as the President had given them. Speaking of the pea weevil, Mr. Dearness had heard from farmers in the school districts he had visited that this pest was not so prevalent as last year. With regard to the Eye-spot bud-moth, he suggested spraying both the ground and the twigs during the winter. He mentioned having recently noticed a number of webs or tents on trees.

The President in acknowledging the vote of thanks explained that the tent caterpillars in the spring and the fall web-worms are two distinct insects, and that while the latter is very abundant, the former is scarce.

Mr. Denton had noticed that the *Olisiocampa* referred to by the President as being conspicuous by its absence in most parts of the Province during the past season, was unusually abundant in some orchards about London; he had collected no less than 103 nests in an orchard of three acres.

Capt. Geddes had also noticed the insect to be abundant in the state of New Jersey.

Mr. Denton referred to the injuries of the pea-weevil, and pointed out the importance of making its habits and life history known so that farmers should take the proper precautions against sowing infested seeds.

Mr. Fletcher said that frequently many of the beetles left the peas in the autumn and hibernated about barns and similar places, and therefore seed should be treated with bisulphide of carbon as soon after harvesting as possible. This substance is so inflammable and dangerous that it could not be recommended for general use by farmers, but most of the large seed dealers who handled peas had a special house built for treating their seed peas. This was especially the case in Prince Edward County.

REPORT OF THE BOTANICAL SECTION.

The report of the Botanical Section was then read by the Secretary and adopted, as follows:—

During the past year this section has held regular weekly meetings through the spring, summer and early autumn months, as well as occasional meetings during the winter. The proceedings of these meetings have been a source of great profit and pleasure to all the members.

Under the leadership of Mr. Dearness the primary instruction of a year ago gave place to earnest work of a more advanced order.

A collection of native plants was begun, and there are now in the herbarium over three hundred species, all neatly arranged in a cabinet provided by the parent society. The success that has attended our work in this particular has been largely due to the

kindness of Mr. White, of Edmonton, and Mr. Morton, of Wingham, each of whom has furnished us with a large number of specimens; also to Mr. Balkwill, whose untiring energy has enabled us to have the plants arranged in their present orderly condition. The object of the section is to establish a reference collection in London, by which botanists in Western Ontario may be enabled to identify specimens.

Among the botanical *finds* of the year are twenty species of Phanerogams—not heretofore reported from this locality—four of them (*viz.*, *Buchnera Americana*, *Physalis Grandiflora*, *Acerates Viridiflora*, and *Isopyrum Bi-ternatum*) being new to the Canadian flora as reported before. Besides these a very large number of rare plants have been brought in and examined.

Of mosses, our leader has discovered two new to Canada, while in the fungi Mr. Dearness has been able to add upwards of seventy species to the American list.

A floral calendar was kept from the united observations of the members, which we expect to be a source of interest for comparison with those of succeeding years.

During the year there were several very interesting outings participated in by the members of the section, the principal points visited being within a radius of a few miles. Profs. Bowman and Dearness and several of the other members explored the botanic treasures of the drowned lands of Huron and Middlesex, and the vicinity of Port Franks. These fields afforded several of the most notable of the recent additions to our herbarium.

We hope that the work so begun will be more actively and systematically carried on in the year to come, and we believe that the spirit and energy of the younger and newer members afford us a guarantee that such will be the case.

M. W. ALTHOUSE,
Secretary Botanical Section.

After the reading of the botanical report, upon invitation by the President, Prof. Bowman also spoke of the work of the section and expressed the view that the establishment of the different sections had been of great service to the parent society, having interested many students who were not specially devoted to the study of insects *per se*. He spoke also of the good service done by Mr. Dearness in naming and exhibiting specimens of fungi at the various meetings.

Dr. Woolverton reported upon the work of the Geological section.

CAN INSECTS SURVIVE FREEZING?

The President read the following paper by Mr. H. H. Lyman, of Montreal:—

In a foot note to his paper on "The Butterflies of Laggan" (*Can. Ent.* xxii. 129), Mr. Bean says, "I hope none of my younger readers entertain the absurd mediæval superstition that hibernating caterpillars pass the winter in a *frozen condition*. In successful hibernation they do not get near to such a condition; but if they do absolutely freeze, then are they undone caterpillars. Valkyria gives them sleep, unmixed with dreams, and they wake in Valhalla."

Without entering into any discussion as to my relative age in comparison with Mr. Bean's I may confess that I have long believed that some caterpillars as well as insects in other stages can and do survive freezing, and finding my belief so distinctly challenged, I have endeavoured to find some further light upon this subject from such literature as is accessible to me and from personal testimony. The first work to which I turned was Seudder's "Butterflies of New England."

In this work another, No. xx thrown upon the

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In this work there is an Excursus, No. xvii, on "Lethargy in Caterpillars" and another, No. xxii., on "The Hibernation of Caterpillars," but in neither is any light thrown upon this question.

In the same author's "Butterflies" but little more is said upon this subject. On page 135, writing of *Colias Philodice*, he says "winter overtakes at once caterpillars of various ages, chrysalids and butterflies, and probably eggs. The experience of breeders, and the diversity in the time of appearance of the butterflies in the spring, render it probable that the cold season kills not only the butterflies and eggs, but perhaps the chrysalids as well, leaving the caterpillars to renew the life of the species in the spring." But though I have failed to gather from his works any information upon this subject I have learned from him personally and by letter some facts which may be thought to throw some light upon this question. About 35 years ago Mr. Scudder was prodding for beetles in some hole of a rotten stump in winter, at Williamstown, Mass., and came across several caterpillars of *Isabella*, and breaking at least one in two, found it brittle like an icicle and he believes he noticed crystals within, and therefore took two or three home to his room to see if they would come to life, which one or more did. Mr. Scudder, however, does not lay much weight on these facts and adds "I may or may not have broken more than one and do not at all remember whether only one or all came to life, but, of course, I may have broken only one and that one already dead."

I have recently seen somewhere, where I cannot now say, though I have spent hours in searching for the reference, an account of a caterpillar being found frozen into a cake of ice. The finder cut out a cube of the ice containing the caterpillar by means of a red hot poker, and then left the block on the sill outside his window for several days while the temperature ranged below zero. Upon bringing it into the house and thawing out the larva it revived and became quite active, but further experiment was prevented by its spinning its cocoon.

In Mr. Fletcher's report for 1889 (Experimental Farm Reports, 1889, p. 79) it is recorded that four larvæ of the Mediterranean Flour Moth (*Ephestia Kuhnii*, Zeller), were placed in a glass phial out of doors for half an hour when the temperature was only 5 degrees above zero F. and as a result were frozen hard so that they "rattled like glass beads against the sides of the bottle." Of the four, two never recovered at all, but the other two revived partially and retained their natural appearance for about a fortnight and moved their bodies a little though they finally succumbed. The Rev. T. W. Fyles has kindly given me the following particulars of his experience with larvæ of Coleoptera. "In the winter of 1864-5 I was splitting up decaying hemlock logs in my pasture at Iron Hill, P.Q., intending to burn them in the spring. On several occasions I found in these logs numbers of the larvæ of *Orthosoma unicolor* in a torpid state. In some cases the water had percolated into the burrows of the insects and frozen around their occupants. One day I picked out a number of the largest grubs from their icy envelopments and found them rigid and seemingly lifeless. I took them to my house and watched them as they slowly thawed into activity."

Dr. John Hamilton, of Allegheny, Pa., on the other hand, found, as related in his interesting paper in Can. Ent. xvii. 35, that he could not revive specimens of Coleoptera which were unquestionably frozen though some larvæ inclosed in cylinders of ice were still found to be flexible and regained activity on a rise of temperature. Though Dr. Hamilton's experience was decidedly against the theory that actual freezing does not necessarily cause death in insects he still admits that a good deal of evidence has been adduced on the other side and that records of the survival of frozen insects cannot be summarily dismissed.

To turn to some of the older writers on entomology I may quote the following from Kirby and Spence's "Introduction to Entomology," Vol. II., second edition. On page 231, after referring to some very extraordinary instances of the survival of insects under such trying circumstances as immersion in gin for 24 hours and immersion in boiling water, the authors say "Other insects are as remarkable for bearing any degree of cold. Some gnats that DeGeer observed, survived after the water in which they were was frozen into a solid

mass of ice, and Reaumur relates many similar instances." Later on, pages 452-3 of the same volume, in treating of hibernation of insects, I find the following very interesting remarks: "But though many larvæ and pupæ are able to resist a great degree of cold, when it increases to a certain extent they yield to its intensity and become solid masses of ice. In this state we should think it impossible that they should ever revive. That an animal whose juices, muscles and whole body have been subjected to a process which splits bombshells and converted into an icy mass that may be snapped asunder like a piece of glass, should ever recover its vital powers, seems at first view little less than a miracle, and if the reviviscency of the wheel animal (*Vorticella rotatoria*) and of snails, etc., after years of desiccation had not made us familiar with similar prodigies, might have been pronounced impossible, and it is probable that many insects when thus frozen never do revive. Of the fact, however, as to several species, there is no doubt. It was first noticed by Lister, who relates that he had found caterpillars so frozen that when dropped into a glass they clinked like stones, which nevertheless revived. Reaumur, indeed, repeated this experiment without success, and found that when the larvæ of *Bombyx Pityocampa*, F. were frozen into ice by a cold of 15° R. below zero (2° F. below zero) they could not be made to revive. But other trials have fully confirmed Lister's observations. My friend, Mr. Stickney, the author of a valuable "Essay on the Grub" (larva of *Tipula oleracea*) to ascertain the effect of cold in destroying this insect, exposed some of them to a severe frost, which congealed them into perfect masses of ice. When broken, their whole interior was found to be frozen. Yet several of these resumed their active powers. Bonnet had precisely the same result with the pupæ of *Papilio brassicæ*, which, by exposing to a frost of 14° R. below zero (0° F.), became lumps of ice and yet produced butterflies. Indeed, the circumstance that animals of a much more complex organization than insects, namely, serpents and fishes, have been known to revive after being frozen is sufficient to dispel any doubts on this head." In Burmeister's "Manual of Entomology" the above instances are also referred to though at much less length, but as no additional facts are adduced it is unnecessary to quote from his work.

The above would seem sufficient to establish the proposition that some insects can survive freezing, and indeed when one remembers that insects successfully maintain their existence in the most arctic lands which have ever been visited by man, it seems strange that any one should ever have questioned it. Is it conceivable that these tiny creatures, when in a state of lethargy and partaking of no nourishment, could successfully resist yielding to frost in regions subject to a temperature of over 70° F. below zero, and when in summer the soil only thaws to the depth of 12 or 15 inches, the ground below this depth being perpetually frozen?

The meteorological tables of the English Arctic Expedition of 1875-6 show that the mean temperature of the winter months at the stations of the two vessels, *Alert* and *Discovery*, varied from 5° F. below zero in October and 17° F. below zero in April to 40° F. below zero in the middle of the winter, and that the minimum temperatures recorded were:—73 $\frac{3}{4}$ ° F. at the winter quarters of the first named vessel, and—70·8° F. at the station of the latter in Discovery Bay.

In spite of these terrible temperatures the naturalists attached to the expedition were very successful, and Mr. Robert McLachlan, F.R.S., to whom the collections of insects were submitted, wrote as follows in his report:

"The materials brought home from between the parallels 78° and 83° N. latitude, showed quite unexpected, and, in some respects, astonishing results. I have no hesitation in saying that the most valuable of all the zoological collections are those belonging to the entomological section, because these latter prove the existence of a comparatively rich insect fauna, and even of several species of showy butterflies, in very high latitudes."

But the most interesting account of experiments on this subject which I have seen, is that given by Commander James Ross, R.N., F.R.S., and inserted by Curtis in the Entomological Appendix to the "Narrative" of Sir John Ross's second arctic voyage. The

experiments were Boothia Felix, an account (page lxxi

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experiments were tried upon the caterpillars of *Larva Rossii*, a very abundant species in Boothia Felix, and, doubtless, all through the arctic regions of this continent. The account (page lxxi.) is as follows :

"About thirty of the caterpillars were put into a box in the middle of September, and after being exposed to the severe winter temperature of the next three months, they were brought into a warm cabin, where, in less than two hours, every one of them returned to life, and continued for a whole day walking about. They were again exposed to the air at a temperature of about 40° below zero, and became immediately hard frozen ; in this state they remained a week, and on being brought again into the cabin, only twenty-three came to life. These were at the end of four hours put out once more into the air, and again hard frozen ; after another week they were brought in, when only eleven were restored to life. A fourth time they were exposed to the winter temperature, and only two returned to life on being again brought into the cabin. These two survived the winter, and in May an imperfect *Larva* was produced from one, and six flies from the other."

That a caterpillar infested with parasites should have been able to survive such severe treatment and spin its cocoon is most remarkable, and it is not to be wondered at that alternate freezing and thawing should have been disastrous to the majority of those experimented upon.

Many other similar accounts doubtless exist, but I think that the records which I have thus brought together are sufficient to prove that actual freezing is not necessarily fatal to insects, and that Mr. Bean had no sufficient warrant for the statement quoted at the beginning of this article.

Mr. DEARNESS was of the opinion that it was clearly the thawing not the freezing of plants which caused the injury.

Mr. FLETCHER asked him whether he did not think that the rupturing of cells and tissues by the crystallization and expansion of the contained liquids was the chief injury.

Mr. DEARNESS thought not, because if care were taken in thawing out frozen plants slowly many of them would sustain little injury. He recounted the experience of a friend who had endeavoured to get very early potatoes by planting them before the usual time. After they were well above the ground a severe frost occurred. He went out very early in the morning and watered a part of them with cold water ; these were all killed, whilst others under a fence were uninjured. He accounted for this from the fact that at the time he watered the plants the temperature of the air was below the freezing point, and as soon as the water fell upon the plants they were temporarily thawed out and then froze up again, and were scorched by the sun as soon as it fell upon them. Geranium slips, he said, could be buried beneath the surface of the ground and would receive no injury if the thawing were gradual.

Prof. BOWMAN thought that insects were better able to withstand freezing in some stages of their growth than in others. Dallinger had found in his investigations of bacteria, that a kind of bacterium which could, at a certain stage of its development, withstand the effect of boiling water, would at others be easily destroyed. He thought that the woolly covering of plants and insects, as well as the cocoons of the latter, were intended to protect them from the effects of too rapid changes of temperature.

Mr. HARRINGTON gave a most interesting account of a trip to Japan, which he illustrated with a number of beautiful and remarkable specimens.

Mr. Fletcher gave a very interesting account of a visit he made in August last to Mr. W. H. Edwards, the celebrated author of the great work on "The Butterflies of North America," who lives at Coalburgh, in West Virginia. He was especially interested in the methods of breeding butterflies through all their stages from the egg to the imago. Among many valuable points that he referred to, there may be mentioned that when eggs are placed in a glass bottle preparatory to hatching, it is best to use a tight plug of cotton batting rather than a cork ; when the insects hatch out they usually do not require any food for twenty-four hours ; it is best to have a plant of the required kind growing in a

pot if possible, and transfer the young caterpillars to it, keeping the whole covered with gauze; a small plant may be kept under a glass lamp chimney with gauze pasted over the top; the larvæ will wander about if the plant is not the usual food-plant of the species, but they can usually be got to eat an allied plant of the same botanical genus. When the working table is covered with twenty or thirty breeding jars it is well to have a conspicuous coloured label for those that require frequent or regular attention. Bags for enclosing larvæ feeding on plants out-of-doors should be very neatly made, in order that there may be no corners for the insects to hide in. It is very important that the breeding-jars or cages should be kept scrupulously clean. Among the butterflies he saw at Coalburgh there may be especially mentioned *Argynnis Diana*, which was first found in the mountains near by; *Argynnis Cybele*, remarkable for the large size of the specimens; *Papilio Philenor*, *Debis Portlandia*, of which there are two broods in the year, etc. Single Zinnias were found to be most attractive to butterflies of all kinds, and should be freely planted in the collector's garden.

The next paper on the list was read by the Rev. T. W. Fyles on *Nematus Erichsonii*, the larch saw-fly, which has become so excessively destructive in the lower Province during the last few years.

The meeting adjourned at 10.45 p.m.

THURSDAY MORNING.

The Society met again in their rooms at 10.15 a.m. An interesting letter was read by Mr. Fletcher from Mr. Edmund Baynes Reid, who is now in charge of the Government Meteorological Station at Esquimalt, British Columbia.

Capt. Geddes read a paper on his recent visit to Germany and the entomologists whom he had met there.

Mr. Harrington described a method of packing beetles and other insects for transportation in rolls of paper, which he had found very simple and effective. Mr. Fletcher mentioned the capture at Ottawa of the rare Southern moth, *Erebus odora*. Mr. Fyles read a paper on the larvæ of *Gelechia gallæ-diplopappi* and a parasite which he had procured from it, and exhibited coloured drawings in illustration. The paper will be published in the *Canadian Entomologist*. Mr. Harrington said that the parasite was evidently, as Mr. Fyles said, a *Bracon*, but that the genus was a difficult one, and it was hard to say whether it was a new species or not.

Capt. Geddes exhibited a specimen of *Melitæa Carlota* taken at Scarborough, near Toronto. Mr. Fletcher exhibited a specimen of *Pyrgus centaureæ*, taken at Wabigon tank on the Canadian Pacific Railway, by Mr. W. McInnes, of the Geological survey, and one of *P. cæspitalis*, which resembles it very closely, from British Columbia, where it is not uncommon.

Mr. Moffatt read a letter from Miss Emily Morton, of Newburgh, N. Y., in which she described her experiences in rearing hybrids of the large Emperor moths, some of which remained for twenty-three months in their cocoons, and related her chief captures during the season, especially referring to her success in collecting at willow catkins last April.

Mr. Moffatt also read his paper on the results of his examination under the microscope of an unexpanded wing of *Callosamia promethea*.

Mr. Fletcher drew the attention of the meeting to specimens which he exhibited of (1) *Argytes longulus*, Lec., a rare Sylphid taken on Vancouver Island by Prof. John Macoun in 1887; (2) *Entomoscelis adonides*, a showy red and black chrysolimid which has occurred as a pest to turnips and cabbages in the Northwest territories during the past season; (3) *Acronycta funeralis*, bred from white birch at Ottawa; (4) *Gortyna cataphracta*, which is a troublesome pest in gardens, boring into the stems of tomatoes, lilies, and raspberries; and a single specimen which had entered the stem of a grass, *Elymus Canadensis*; (5) *Myrmeleon abdominalis*, bred from larvæ collected near Indianapolis, Indiana, and exhibited at the last annual meeting.

The meeting, which was throughout very enjoyable and successful, then adjourned.

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NOTE ON LIFE AREAS.

With regard to the distribution of birds, ornithologists have hitherto accepted as approximately correct the faunal areas as defined by Prof. J. A. Allen, of New York. By him the breeding areas of certain birds were considered to fall within the limits of one or more of these faunæ. For instance the Slate-colored Junco (*Junco hyemalis*) was held, during the period of reproduction, to be limited in its southward dispersion by the Canadian fauna; the Wood Thrush (*Turdus mustelinus*) by the Alleghanian, and the Cerulean Warbler (*Dendroica cerulea*) by the Carolinian.

The mean summer temperature being considered the most important factor in determining these divisions, latitude had less to do with the question than altitude. For instance, mountain tops in low latitudes were correctly held to be isolated portions of the Arctic fauna. But Middlesex is uniform in its physical features, and yet representatives of the three faunæ given above have been found breeding in the county under almost identical climatic conditions. Deep, cool swamps occur, which may account in part for the presence of the more northern species, but on the whole there is such an abnormal admixture of birds usually found in summer so far apart as to throw doubts on the feasibility of maintaining such divisions. It is probable that the researches of Prof. Merriam, Ornithologist for the Department of Agriculture at Washington, who has lately given much attention to the problem of distribution, will prove that there are but two life provinces in North America, viz.:—The Boreal (Northern), and the Sonoran (Southern) according as the forms of life inhabiting each have reached this continent from the north or south. When the limits of these two great divisions are mapped out it will likely be found that Middlesex occupies a neutral position, being on the whole Sonoran rather than Boreal, but with a strong tinge of the latter.

LIST OF BIRDS KNOWN TO BREED IN MIDDLESEX COUNTY, ONTARIO.

BY THE LONDON ORNITHOLOGICAL SECTION OF THE ENTOMOLOGICAL SOCIETY.

Those birds which are decidedly and directly beneficial on account of their feeding habits are marked (a). Those which are neutral or nearly so are marked (b). Those which are open to doubt as being possibly injurious are marked (c).

(b) *AIX SPONSA*—*Wood Duck*.—Residents around the pond at Dorchester say it bred there up to about five years ago.

(b) *BOTANRUS LENTIGINOSUS*—*Bittern*.—A nest of unfledged young found on the flats at Arva in 1889, by W. A. Balkwill.

(b) *ARDEA HERODIAS*—*Great Blue Heron*.—A few heronries containing sometimes as many as several hundred nests are known in the county, though they are becoming gradually deserted. Occasionally single nests are found in high deciduous woods.

(b) *ARDEA VIRESCENS*—*Green Heron*.—One nest found within two miles of the city in 1888 by W. A. Balkwill. Pairs are believed to breed in other parts of the county, having been seen regularly in summer.

(b) *PHILOHELA MINOR*—*American Woodcock*.—Not very common.

(b) *ACTITIS MACULARIUS*—*Spotted Sandpiper*.—Breeds commonly in fields and waste places near water.

(a) *ÆGIALITIS VOCIFERA*—*Kildeer Plover*.—Not very common, perhaps one pair to a square mile.

(b) *COLINUS VIRGINIANUS*—*Bob-white*.—Abundant in the west and south, but quite rare in the north-east of the county.

(b) *BONASA UMBELLUS*—*Ruffed Grouse*—Common in most large or thick woods at a reasonable distance from the towns.

(b) *MELEAGRIS GALLOPAVO*—*Wild Turkey*—Formerly quite common. A nest was found in Delaware Township in 1878 with thirteen eggs.

(b) *ZENAIDURA MACROURA*—*Mourning Dove*—Not as common in Middlesex as it is farther west in the peninsula.

(a) *CATHARTES AURA*—*Turkey Vulture*—A nest was found in 1890 by J. N. Sullivan near Kerwood. Several other pairs probably breed in the county.

(a) *CIRCUS HUDSONIUS*—*Marsh Hawk*—Breeds in almost all large sphagnum swamps, also in fields occasionally; one nest found in London South in June, 1890.

(c) *ACCIPITER VELOX*—*Sharp-shinned Hawk*—Three nests only are recorded; not many pairs spend the summer here.

(c) *ACCIPITER COOPERI*—*Cooper's Hawk*—Breeds sparingly.

(a) *BUTEO BOREALIS*—*Red-tailed Hawk*—Tolerably common.

(a) *BUTEO LINEATUS*—*Red-tailed Hawk*—Our most common hawk in the breeding season.

(a) *FALCO SPARVERIUS*—*American Sparrow Hawk*—Rather rare. Probably not more than one pair in three or four square miles.

(a) *ASIO WILSONIANUS*—*American Long-eared Owl*—Only one nest found, by R. Elliott near Plover Mills.

(a) *MEGASCOPS ASIO*—*Screech Owl*—Not uncommon, though nests are not often found. One by W. A. Balkwill near London in 1890, and 1891 in the same hole.

(a) *BUBO VIRGINIANUS*—*Great Horned Owl*—Tolerably common.

(a) *COCCYZUS AMERICANUS*—*Yellow-billed Cuckoo*—More common than the next, laying smaller sets of larger eggs. Believed to have increased in abundance during the last ten years.

(a) *COCCYZUS ERYTHROPHthalmus*—*Black-billed Cuckoo*—Contrary to its custom elsewhere, nests have been found with six eggs. Sets of this size in other parts of the country have generally been reported as being partly hatched, the eggs being laid at considerable intervals so that the first eggs are hatched before the last are laid.

(b) *CERYLE ALCYON*—*Kingfisher*—Common.

(a) *DRYOBATES VILLOSUS*—*Hairy Woodpecker*—Rather rare; nests usually escape detection until the young are hatched.

(a) *DRYOBATES PUBESCENS*—*Downy Woodpecker*—More common than the last.

(a) *SPHYRAPICUS VARIUS*—*Yellow-bellied Woodpecker*—Rare.

(a) *CEOPHLEUS PILEATUS*—*Pileated Woodpecker*—Very rare.

(a) *MELANERPES ERYTHROCEPHALUS*—*Red-headed Woodpecker*—Common.

(a) *MELANERPES CAROLINUS*—*Red-bellied Woodpecker*—Very rare.

(a) *COLAPTES AURATUS*—*Flicker*—Common. Holes made by this species and by the Red-head are occasionally found so close to the ground that the eggs are almost on the ground level.

(a) *ANTROSTOMUS VOCIFERUS*—*Whip-poor-will*—Tolerably common in suitable localities. Appears to be less common this year than formerly.

(a) *CHORDEILES VIRGINIANUS*—*Night Hawk*—Common.

(a) *CHAETURA PELAGICA*—*Swift*—Common. Still breeds in trees occasionally.

(a) *TROCHILUS COLUBRIS*—*Ruby-throated Hummingbird*—Rather rare.

(a) *TYRANNUS TYRANNUS*—*Kingbird*—Common.

(a) *MYIARCHUS CRINITUS*—*Crested Flycatcher*—Tolerably common.

(a) *SAYORNIS*—*Whip-poor-will*—Nests are also built in trees.

(a) *CONTOPUS*—*Starling*—Common.

(a) *EMPIDON*—*Chipping Sparrow*—Common.

(a) *OTOCORIS*—*Field Sparrow*—Common.

(c) *CYANOCYCLUS*—*Blue Jay*—Common.

(c) *CORVUS*—*Crow*—Common.

(a) *DOLICHOPUS*—*Robin*—Common.

(c) *MOLOTHRUS*—*Starling*—Common.

(a) *AGELAIUS*—*Starling*—Common.

(a) *STURNELLO*—*Starling*—Common.

(a) *ICTERUS*—*Yellow Warbler*—Common.

(c) *QUISCALUS*—*Starling*—Common.

(c) *CARPODA*—*Starling*—Common.

(b) *ACANTHUS*—*Starling*—Nests found in 1879. Birds from the same species.

(a) *SPINUS*—*Starling*—Rare on occasions.

(a) *POCETEUS*—*Starling*—Common.

(a) *AMMODRAMUS*—*Starling*—Common.

(a) *CHONDESIUS*—*Starling*—Nests found miles west of the city.

(a) *SPIZELLA*—*Starling*—Common.

(a) *SPIZELLA*—*Starling*—Common.

(a) *JUNCO*—*Starling*—Nests found so in the north-east.

(a) *MELOSPIZELLA*—*Starling*—Common.

(a) *MELOSPIZELLA*—*Starling*—Common.

one nest found, but the young were not seen.

(a) *PIPILO*—*Starling*—Common.

formerly.

(a) *PASSERINUS*—*Starling*—Common.

(a) *PIRANGA*—*Starling*—Common.

has suffered by the same cause.

(a) *PETROCHIA*—*Starling*—Common.

to the same cause.

(a) *CHELIDONIA*—*Starling*—Common.

(a) *TACHYCYCLUS*—*Starling*—Common.

so common as formerly.

(a) *STELGIDONIA*—*Starling*—Common.

(a) *AMPELIS*—*Starling*—Common.

(a) *LANIUS*—*Starling*—Common.

(a) SAYORNIS PHEBE—*Phoebe*—Common. Most suitable bridges contain one pair, and nests are also built in the upturned roots of trees in the woods.

(a) CONTOPUS VIRENS—*Wood Pewee*—Common.

(a) EMPIDONAX MINIMUS—*Least Flycatcher*—Common.

(a) OTOCORIS ALPESTRIS PRATICOLA—*Prairie Horned Lark*—Common.

(c) CYANOCITTA CRISTATA—*Blue Jay*—Tolerably common.

(c) CORVIS AMERICANUS—*Crow*—Common.

(a) DOLICHONYX ORYZIVORUS—*Bobolink*—Common.

(c) MOLOTHRUS ATER—*Cowbird*—Very Common.

(a) AGELAIUS PHENICEUS—*Red-winged Blackbird*—Common.

(a) STURNELLA MAGNA—*Meadow Lark*—Common.

(a) ICTERUS GALBULA—*Baltimore Oriole*—Common.

(c) QUISCALUS QUISCALA AENEUS—*Bronzed Grackle*—Common.

(c) CARPODACUS PURPUREUS—*Purple Finch*—Uncommon.

(b) ACANTHIS LINARIA—*Redpoll*—A single nest found near Hyde Park by J.A. Morden in 1879. Birds not seen, but eggs identified by comparison with European specimens from the same species.

(a) SPINUS TRISTIS—*American Goldfinch*—Common—Spotted eggs have been found on rare occasions.

(a) POOCETES GRAMINEUS—*Vesper Sparrow*—Very Common.

(a) AMMODRAMUS SANDWICHENSIS SAVANNA—*Savanna Sparrow*—Common.

(a) CHONDESTES GRAMMACUS—*Lark Finch*—Rare. A single nest found in 1890 a few miles west of the city.

(a) SPIZELLA SOCIALIS—*Chipping Sparrow*—Common.

(a) SPIZELLA PUSILLA—*Field Sparrow*—Common in certain localities.

(a) JUNCO HYEMALIS—*Slate-colored Junco*—Common in certain localities, particularly so in the north-eastern part of the country.

(a) MELOSPIZA FASCIATA—*Song Sparrow*—Very common.

(a) MELOSPIZA GEORGIANA—*Swamp Sparrow*—Common in marshy places, but only one nest found, by R. Elliott.

(a) PIPLO ERYTHROPHthalmus—*Towhee*—Common.

(a) HABIA LUDOVICIANA—*Rose-breasted Grosbeak*—Appears to be less common than formerly.

(a) PASSERINA CYANEA—*Indigo Bunting*—Tolerably common.

(a) PIRANGA ERYTHROMELAS—*Scarlet Tanager*—Tolerably common.

(a) PROGNE SUBIS—*Purple Martin*—Much less common than formerly. This species has suffered by the pre-occupation of its breeding places by the English sparrow.

(a) PETROCHELIDON LUNIFRONS—*Cliff Swallow*—Less common than formerly, owing to the same cause, somewhat, as the former species.

(a) CHELIDON ERYTHROGASTER—*Barn Swallow*—Common.

(a) TACHYCINETA BICOLOR—*Tree Swallow*—Tolerably common.

(a) CLIVICOLA RIPARIA—*Bank Swallow*—Common in suitable localities, although not so common as formerly.

(a) STELGIDOPTERYX SERRIPENNIS—*Rough-winged Swallow*—Uncommon.

(a) AMPELIS CEDRORUM—*Cedar Waxwing*—Tolerably common.

(a) LANIUS LUDOVICIANUS EXCUBITORIDES—*White-rumped Shrike*—Rare.

- (a) VIREO OLIVACEUS—*Red-eyed Vireo*—Common.
 (a) “ GILVUS—*Warbling Vireo*—Rather common.
 (a) “ FLAVIFRONS—*Yellow-throated Vireo*—Rare.
 (a) MINIOTILTA VARIA—*Black and White Warbler*—Common in deep woods, but only one nest found, by W. E. Saunders in May, 1881.
 (a) HELMINTHOPHILA CHRYSOPTERA—*Golden-winged Warbler*—Rather rare.
 (a) “ RUFICAPILLA—*Nashville Warbler*—Limited to a few localities; a single nest found by Wm. Saunders near London in 1882.
 (a) DENDROICA ÆSTIVA—*Yellow Warbler*—Common.
 (a) “ PENNSYLVANICUS—*Chestnut-sided Warbler*—Tolerably common.
 (a) SEIURUS AUROCAPILLUS—*Ovenbird*—Tolerably common.
 (a) “ NOVEBORACENSIS—*Water Thrush*—Rather rare.
 (a) GEOTHLYPS TRICHAS—*Maryland Yellow Throat*—Common in suitable localities.
 (a) SYLVANIA CANADENSIS—*Canadian Warbler*—Rather common. Partially fledged young found in several localities near London.
 (a) SETOPHAGA RUTICILLA—*Redstart*—Common.
 (a) GALEOSCOPTES CAROLINENSIS—*Catbird*—Common.
 (a) HARPORHYNCHUS RUFUS—*Brown Thrasher*—Locally common.
 (a) TROGLODYTES AEDON—*House Wren*—Common.
 (a) TROGLODYTES HIEMALIS—*Winter Wren*—A single nest found with one egg; not uncommon in deep cedar-swamps.
 (a) CERTHIA FAMILIARIS AMERICANA—*Brown Creeper*—Rare. A nest of young found nine miles from London in June, 1880.
 (a) SITTA CAROLINENSIS—*White-breasted Nuthatch*—Not very common.
 (a) PARUS ATRICAPILLUS—*Black-capped Chickadee*—Not common.
 (a) POLIOPTILA CERULEA—*Blue-gray Gnatcatcher*—Tolerably common.
 (a) TURDUS MUSTELINUS—*Wood Thrush*—Tolerably common.
 (a) “ FUSCESCENS—*Wilson's Thrush*—Common.
 (a) MERULA MIGRATORIA—*Robin*—Abundant.
 (a) SIALIA SIALIS—*Blue Bird*—Common. A few sets of white eggs have been found.

SUPPLEMENTARY LIST—No. 1.

Birds which have probably bred in greater or less numbers in the past, but have now become so rare that it is unlikely that their nests will be found:

- (b) LOPHODYTES CUCULLATUS—*Hooded Merganser*.
 (b) ECTOPISTES MIGRATORIUS—*Passenger Pigeon*.

SUPPLEMENTARY LIST—No. 2.

Birds which are observed in summer and are likely to be found breeding as the fauna is better worked up:

- (a) RALLUS VIRGINIANUS—*Virginia Rail*.
 (a) PORZANA CAROLINA—*Carolina Rail*.
 (a) GALLINULA GALEATA—*Florida Gallinule*.
 (a) SYRNIUM NEBULOSUM—*Barred Owl*—Scarce resident.
- } Will probably be found in some of our larger marshes.

(a) NYCTAL
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(a) EMPIDIC
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(a) NYCTALA ACADICA—*Saw-whet Owl*—Young have been taken near St. Thomas, in Elgin County, in July.

(a) EMPIDONAX PUSILLUS TRAILLII—*Travill's Flycatcher*—Frequently observed in May and June.

(a) CONTOPUS BOREALIS—*Olive-sided Flycatcher*—One observed June 2nd, 1891. Common summer resident in Bruce County.

(a) ICTERUS SPURIUS—*Orchard Oriole*—Common in parts of adjoining counties, and observed every spring.

(a) ZONOTRICHIA ALBICOLLIS—*White-throated Sparrow*—Observed at different points in summer.

(a) DENDROICA CAERULESCENS—*Black-throated Blue Warbler*.

(a) " CAERULEA—*Blue Warbler*.

(a) " BLACKBURNIE—*Blackburnian Warbler*.

(a) " VIRENS—*Black-throated Green Warbler*.

(a) " VIGORSII—*Pine Warbler*.

(a) GEOTHLYPIS PHILADELPHIA—*Mourning Warbler*.

(a) CISTOTHORUS PALUSTRIS—*Long-billed Marsh Wren*—Nests will likely be found in some of our larger marshes.

(a) REGULUS SATRAPA—*Golden Crowned Kinglet*—Has been observed twice in June in the spruce swamp near London.

(a) TURDUS AONALASHKAE PALLASII—*Hermit Thrush*—Heard singing in June in cedar swamps.

Frequently observed
in May, June, and
July.

PAMPHILA MANITOBA (SCUD.) AND ITS VARIETIES.

BY H. H. LYMAN, MONTREAL.

In 1874, Mr. Scudder published his paper on "The Species of the Lepidopterous Genus Pamphila," in the Memoirs of the Boston Society of Natural History, in which the following species were described as new: Nevada, Colorado and Manitoba; and Sassacus, Ottoo, Juba, Comma of Europe, and Sylvanoides were also treated of.

None of the descriptions are detailed, but are altogether comparative pointing out the differences between the closely allied forms, and in the case of Manitoba, the comparisons instituted are exclusively with the European Comma. The four specimens (two males and two females illustrated) are all from the west of the continent, or rather, I should say, from the west and centre. One specimen was from Lake Winnipeg, one from Colorado, and two from British Columbia. The figures show specimens of which the underside of secondaries is dark greenish or greenish brown, and with considerable variation in the prominence or restriction of the markings.

Though no figure of any eastern specimen is given, it is stated in the text that the species had been taken at Riviere du Loup by Mr. Couper.

Since then it has been repeatedly taken on the Lower St. Lawrence by other collectors at Cacouna and Riviere du Loup, Metis, and even as far as Gaspe by myself, in 1888.

The form found on the Lower St. Lawrence is very uniform in colour and has the outer third of the underside of the fore wings and the whole of the underside of the hind wings, with the exception of the inner margin and hind angle, of dark brown colour, though occasionally with a slightly greenish tinge.

In 1890, on returning east from a trip over the Canadian Pacific Railway, I stopped for a day at Regina, the date of my visit being Aug. 5th, and as usual devoted a good

part of the day to collecting lepidoptera. Among other things I collected a good series of males of a Pamphila of the Manitoba group which was new to me, but only succeeded in securing one female, it apparently being a little early for that sex. During October of that year I paid a flying visit to New York and Boston taking a few specimens with me for comparison, among them a specimen of this skipper which I showed to Mr. Henry Edwards, who said that he did not know it and thought it must be new. Mr. Scudder said it might be new, but one needed a very full series in that group. I afterwards showed it to Mr. Fletcher and asked him if he had ever seen that form and he immediately said "Yes, at Regina." He added that he had sent a specimen to Dr. Henry Skinner who had pronounced it to be only Manitoba, but Mr. Fletcher expressed to me the opinion that it was at least a very distinct variety. The point in which this form chiefly differs from Manitoba of the Lower St. Lawrence is that those parts on the underside which are brown in the latter are of a very pale greenish yellow or yellowish green in the Regina form, but it also differs somewhat above in that the males are usually of a yellower tone while the brown of the female is decidedly darker and the spots of the fore wing decidedly lighter, some of them being almost white, than in the eastern specimens.

Wishing to get further light upon the probable relationship of these forms, I this year took a number of specimens of each with me on a trip to Boston and New York before returning home from a short holiday on the Atlantic coast, and through the kindness of Mr. Scudder was enabled to examine his original types of Manitoba. One of these agreed exactly with my specimens from the Lower St. Lawrence, while the ones from British Columbia and Colorado were greener, but none agreed with, or even approached the average of the Regina specimens. Mr. Scudder, however, on account of the close similarity of the markings seemed to be of opinion that the Regina form must be a variety of Manitoba. At New York Mr. Neumoegen kindly allowed me to compare my specimens carefully with the Pamphilas in his magnificent collection, but no specimen was found which at all agreed with the Regina form, and Mr. Neumoegen expressed the opinion that I would be safe in describing it. But in order to guard against all danger of being accused of rashness I took the specimens out to New Brunswick, N. J., to Prof. J. B. Smith, who very kindly at my request dissected the male abdominal appendages of one of the Regina specimens, which upon examination were seen to be practically identical with the illustrations of those of Manitoba drawn by the late Mr. Edward Burgess and published by Mr. Scudder. The form would therefore seem to be only a variety of Manitoba, but Prof. Smith expressed the opinion that it might very properly receive a varietal name as a distinct geographical race. Mr. Scudder, however, in his "Butterflies of New England" would seem to have adopted this form as a basis of his description of Manitoba, as he describes the underside of the hind wings as being, except for the markings, "almost uniformly greenish yellow," although he has no specimen of the Regina form in his collection.

I am, however, strongly of opinion that the difference between the eastern specimens and these from Regina is sufficiently great to be worthy of being indicated by varietal names, and if the name Manitoba is to be restricted to the dark brown or greenish brown specimens, as I believe it was originally applied, I would suggest the name, var. *Assiniboia*, for the light greenish-yellow Regina form. If, however it is preferred to call the latter Manitoba I should suggest the name, var. *Laurentina*, for the dark brown form of the Lower St. Lawrence.

NEMATUS ERICHSONII; A RETROSPECT.

BY REV. THOMAS W. FYLES, SOUTH QUEBEC.

The fecundity and voracity of this species must have arrested the attention of foresters and entomologists at a very early date after its introduction to America. It is believed to have been brought over on *Larix Europea*, and its operations were first noticed in 1880, by Professor C. S. Sargent, Director of the Arnold Arboretum at Brook-

line, Massachusetts State of Maine Bury and Lingv logical Society witnessed a flig flies from the d year the tamarax was impossible where around ; undergrowth wa had been traced

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*Dr. Lintner, 5th

†18th Ann. Rep.

‡Ibid.

§18th Ann. Rep.

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line, Massachusetts.* In 1881 and 1882 it came under the notice of Dr. Packard in the State of Maine; and in 1883 I observed it in vast numbers in the border townships of Bury and Lingwick in the Province of Quebec, and drew the attention of the Entomological Society of Ontario to the fact. Early in the summer of the following year I witnessed a flight of the perfect insects at Quebec, and gathered a number of the exhausted flies from the decks of the ferry-boats plying between Levis and that city. In that same year the tamaracks around my residence were completely defoliated by the larvæ. It was impossible to approach the trees with comfort. The creatures were crawling everywhere around; and the sound produced by the droppings of their excrements upon the undergrowth was like an incessant pattering of rain-drops. By this time their ravages had been traced through the length of eastern Canada and into the maritime Provinces.

It was at first thought that the tamarack would survive the assaults of the *Nematus*—the more because a second growth of verdure appeared on the trees after the larvæ had left them. So eminent an observer as Dr. Packard was inclined to this opinion;† but Professor Riley seems to have had a clearer view of the consequences of the insect's attacks ‡

Many entomologists watched the *Nematus* through its metamorphoses hoping to discover parasitic foes of the insect. I have not learned that any were successful. The European parasites of the species (if such there were) did not appear; and our native Hymenoptera parasitica had not, it would seem, acquired a taste for the immigrant. Predacious insects, ants,§ and ground beetles, || were found to prey upon it, but their attacks made but little impression upon the hordes of the invaders. This was owing probably to the fact that swamps, in which the tamarack abounds, are but ill suited for the abodes of ants and ground beetles.

The pest was clearly beyond human control. Ornamental trees around dwellings or in parks might, it was thought, be saved by "spraying," but beyond this nothing could be attempted.

The appearances, the life history, the operations of *Nematus Erichsonii* have all been minutely described; and allusions have often been made to the destruction wrought by the insect in Canada, but on this last point but little definite information has been given. With a view to arriving at something more precise in regard to it, I, a few weeks ago, made a visit to the townships in which I had first seen the insect, and in Bury I met by appointment the Rev. R. H. S. Fuller, rector of Bury, Mr. John B. Maddocks, superintendent of lumbermen, and Mr. Robert Clark, one of the leading farmers in that section. From conversations with these gentlemen, and from personal observation, I was able to gather the following particulars.

The tamarack swamps of the Township of Bury occupy about one-tenth of its surface, or 640 acres, and show on an average forty marketable trees to the acre. The largest of these trees are about 2 feet 6 inches in diameter at the butt—one was found having a diameter of 2 feet 9 inches. The usual size is 2 feet. This represents a growth of 200 years. Two hundred and twenty rings of annual growth was the actual record on the butt of one tree. Besides these marketable trees there are numerous others, in every stage of growth, which, under favourable circumstances, would, in successive years, have attained to marketable value. Of all these trees 98 per cent. are dead and the remainder dying.

Of the Township of Lingwick one-fifth, it is computed, is tamarack swamp. There is of such swamp one tract, lying partly in Lingwick and partly in Weedon, that is said to be five miles square. The destruction wrought in all this section is proportionate to that in Bury.

The tamarack as a shade tree is less valued than the pine, spruce, balsam and cedar, for the reason that its foliage is deciduous; but in the summer season when grown in the

*Dr. Lintner, 5th Report on the injurious and other insects of the State of New York, p. 22.

†18th Ann. Rep. Ent. Soc. of Ont. p. 32

‡Ibid.

§18th Ann. Rep. Ent. Soc. of Ont. p. 32.

|| Rep. of Proceedings of the Convention of fruit growers held at Ottawa, 1890, p. 69.

open, or the arboretum, it is a peculiarly graceful and beautiful object. For a short period also, in the autumn, when it has assumed its golden dress, it presents a pleasing contrast to the evergreens above named. Its wood, however, is valuable for many purposes. It is close-grained and firm, and resists the action of moisture, and, on these accounts, is prized for sleepers in buildings, railway-ties, and for fence-posts. As fire-wood, it is worth in the towns about \$3 per cord. But the chief value of tamarack is for the purposes of the ship-builder.

From the swamps of Bury the knees and other timbers have been cut for vessels ranging from barges of thirty tons to brigs of 400 tons burden. The firm that is operating in this section of country is that of Benjamin, Lewis & Company, of Bangor, Maine. One million feet, board measure, will, by the close of the season, have been cut by them in the present year, in the Township of Bury alone. I shall base my estimate of the loss sustained by the township through the saw-fly, upon the operations of this firm.

In former days when the timber was sound, \$3 per 1000 feet on the stump, board measure, was paid for it. Now, through waste and general deterioration, the trees are worth only one-half their former price. Sap-rot commences very soon after the death of the tree, and by the second year has proceeded to a very sensible extent. Various kinds of "borers" then make their assaults, and penetrate the heart wood, hastening the decay of the tree. It is believed that in three years, through use and decay, the supply of tamarack throughout the country will be exhausted.

The borers that I found at work in the tamarack were larvæ belonging to the families Buprestidæ, Cerambycidæ and Elateridæ. I also found one or two cocoons of a Hymenopterous insect.

As we have seen, there are in Bury 640 acres of tamarack giving on the average forty marketable trees to the acre, or 25,600 such trees in all. Every tree contains at least 400 feet, board measure, of lumber. This gives for the whole forest 10,240,000 feet, which, in a sound condition, would have been worth \$30,720, and which left standing would, under favourable circumstances, have been increasing in value. On the 1,000,000 feet that will have been secured by the end of the season, there will be a direct and immediate loss of \$1,500. Supposing, which is hardly probable, that 1,000,000 feet at the same price will be cut next year, there will yet be 8,240,000 feet of lumber, representing \$24,720 in money value entirely lost to the township, besides the value of the younger trees which would have been a source of income in future years, as they successively attained perfection.

The tamarack forest of the townships is a thing of the past. There seems to be a law of nature, that, when one growth of trees is swept away, another of a different kind shall succeed it. The hemlocks and pines of our mountain sides give place to the poplar and the white birch. The tamaracks will probably be succeeded by the American arbutus or white cedar (*Thuja occidentalis*). And, if there were no such natural law, the world is too old, its population too vast, and land in the temperate regions too valuable, for us to suppose that large tracts of lowlands will be left in a state of nature for 200 years to come.

The value of the Canadian tamarack was only beginning to be understood in the foreign market. The demands for it were increasing, and with increased demands better prices would have come. All things considered, I do not think it an exaggeration to say that the loss to the Township of Bury alone, through the attacks of *Nematus Erichsonii* may be estimated at \$50,000, and that of Lingwick at double that sum. And when we consider that the ravages of the insect have extended through the townships, and the seigniories,* and into the country beyond to its utmost known limits, we are brought to the conclusion that *Nematus Erichsonii* has been the worst insect pest that has ever visited the Province of Quebec. It has acquired the "bad eminence" of a position in the rank of infamy above the midge, the weevil, the potato-beetle, and the army-worm.

With its food-plant the insect must of necessity disappear, and in years to come the specimens preserved in our cabinets will be regarded as rarities.

*In the Seigniory of Lotbiniere alone there are 100,000 acres producing more or less tamarack to the acre.

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ON SOME OF THE COLLECTIONS IN ENGLAND AND THE GERMAN EMPIRE.

BY GAMBLE GEDDES, TORONTO.

It gives me great pleasure, Mr. President and gentlemen, to read to you some notes upon the collections I had the privilege of examining during a stay of some months on the continent and three weeks in London, England, when returning to Canada.

Crossing from Hoboken, N.J., by the German Lloyd S. S. Aller, the first entomologist I visited upon landing at Bremen in Germany was our old friend and collaborator Aug. R. Grote, and busy as he was about other matters in general, but music in particular, he found time to take me to see Mr. Lahmann's breeding room, where I saw a large number of the larvæ of Europe feeding, and also hundreds of pupæ ready for shipping to different parts of the world. In this collection I saw principally the Arctiadae and Bombycidae, but likewise many Papilios—and it was a matter of wonder to me, to see how Mr. Lahmann kept alive the food-plants for these larvæ in such a dark room as he kept them in. For the benefit of the members of the Society who might like to correspond with Mr. Lahmann, I may state that he is always ready to exchange for N. and S. American species, those of Europe, and he has succeeded in breeding many rarities in large numbers. His address is, Albert Lahmann (Ambrill Strasse 8) Bremen, Germany.

My next visit was to Dr. Meyer, director of the Natural History Museum at Dresden. Professor Ramsay Wright having furnished me with a letter of introduction, Dr. Meyer immediately put me in the hands of Dr. Heller the entomologist of the Institution, who was most attentive to my wants, and during my several visits to the collection, always managed to spend a portion of his time with me and placed the cabinets and library at my disposal whenever I desired to refer to them. Here I first observed the drawers made with glass at top and bottom, with only thin strips of cork fastened in to pin the specimens to. Any collector who has not already seen these drawers can readily appreciate the use of them. Instead of mounting Lepidoptera showing the upper and under surfaces, it is only necessary to set them right side up, and in order to examine the under-sides, all one has to do, is to turn the drawers up-side-down when the reverse sides can be examined through the glass, thus saving space and time.

This collection is well worth a visit from any traveller for it embraces fine representations in all classes of insects from every part of the globe. A number of collections have been donated to this museum by private individuals, and many purchases have been made. The whole lot have been carefully selected from and the best specimens consolidated into a fine collection of reference not only for the entomological students of Germany but for foreigners wishing to consult the cabinets. The books of the library are as carefully selected as the insects in the collection. I might mention that the moths and butterflies of Europe are particularly fine.

Herr Ribbe's collection was sold by auction during my stay in Dresden, and the chances of purchasing were remarkable. To give an idea, a fine cabinet, cork-lined drawers with glass tops (16 drawers) filled with inflated larvæ with the food-plants, was sold for 38 marks, equal to \$9.50 in our money.

I next went to see Dr. Staudinger, at Blasewitz, on the Elbe, and here I saw the most wonderful collection that I have ever come across.

Dr. Staudinger has named his place the "Villa Sphinx," and has built the house on purpose to accommodate the vast collection which for years and years has been accumulating.

Here one can see most of the insects known and a large number of the collector's own types, as well as a very numerous collection of unnamed species, to which Dr. Staudinger was devoting his time (in describing) during my visit of nearly six months at Dresden.

The room that attracted my attention most, after seeing the collection, was the room used for the students or pupils as they are called, and where all the mounting, spreading, packing takes place as well as addressing boxes, and shipping insects ordered from every quarter of the world.

It is like a bee-hive and no one has time for idling here. One student is taking out specimens from papers and envelopes, another sorting and laying aside any that are difficult to determine (these are afterwards handed over to an experienced hand for determination). The third pupil is placing specimens in relaxing jars and glasses of wet sand. The fourth and fifth are mounting and spreading and often patching and mending broken specimens. The packing and shipping is done in the most orderly and business-like manner, and by dusk everything is finished for the day.

I noticed an improvement upon our relaxing tins and jars which may be worth mentioning. Glass covers are used and the advantage is obvious, as one can see the specimens through the glass. They are very much the shape of the glass dishes kept at the railway stations in the restaurants for sandwiches, etc.

The spreading is done rather differently from what I have seen in England and the United States in that very short pins are used for fastening down strips of paper over the wings, and forceps are used entirely (and never the thumb and forefinger) for tightening down the pins. Twenty specimens is considered a good hour's work of the smaller species and more of the larger ones can be satisfactorily mounted and spread by a good pupil.

Dr. Staudinger is engaged upon a gigantic work upon the Paleo-Arctic Fauna, which he is most anxious to finish.

At Berlin I saw Alex. Bau's collection and went twice to call upon Mr. Howarth but was not successful in my endeavours to meet him or to examine his fine collection. In Berlin I met Prof. Ramsay Wright, of the Toronto University, who was hard at work at Prof. Koch's laboratories. He very kindly took me to several places of great interest to a naturalist.

Arrived at London, I first went to see Mr. Henley Grose-Smith's collection of diurnals only. He had nearly doubled his collection since I last saw it in 1882. A splendid addition of new things had just been added, collected by Mr. Woodford, in the Solomon Islands. This collector underwent great hardships and evidenced his pluck by living for 18 months amongst the worst cannibals that are known in the islands of the Southern Pacific Ocean. Mr. Woodford's collection has been of great assistance to scientists interested in the insects of these southern climes.

Mr. Grose-Smith furnished me with a letter to Mr. Kirby, at the South Kensington branch of the British Museum, and no one could have been kinder than was Mr. Kirby. Always busy, he seems to be able to find a little time to devote to collectors who come to see the collections. He went through the *Coliadæ* with me and helped to clear up a number of doubtful species which I had upon my mind.

Last of all, I visited the Insect House, at the Zoological Gardens, in Regent's Park, and saw the breeding cages. A large number of North American diurnals, and all our large moths are to be seen here in their different stages of metamorphoses.

Europe, Asia and Africa are also well represented in this respect, and one is always sure to find something new and interesting to repay a visit to Mr. Bartlett's Insect House, at the "Zoo."

A MICROSCOPICAL EXAMINATION OF AN UNEXPANDED WING OF CALLOSAMIA PROMETHEA.

BY J. ALSTON MOFFAT, CURATOR, ENTOMOLOGICAL SOCIETY OF ONTARIO.

In the July No. of that ably conducted and instructive English magazine, *The Entomologist's Record*, the subject of wing expansion is discussed in its various aspects. Amongst those taking part in it, Dr. Buckell remarks that, "as to expansion: the unexpanded wing is a miniature of the expanded. Newman, at p. 14 of *British Butterflies* quotes from Kirby and Spence to the effect that the two membranes of which the wing is

composed are, in as well as longitudinal roscopists? If so considering the method for making an attempt at possession of a number of moths, therefore: And secondly, although willing services of I had four *Samia* New York. In the pupa. I thought that it would I called the attention subject and read that I should state here to take notes of wings and correct them to verify. But Kirby and Spence. In view of expansion and development composed of two membranes between them. The nervures, contribute to the expansion. In the pupa, and the question do not touch and corrugated into longitudinal, and so much thicker than tubes, and being in for the nervures the membranes attached takes place, the expansion the action of the air observations made. We commenced operation hard; when broken body, smooth and the indication of where object, but worthless. At what stage of the

We next took investigation. The wing coloured and appeared three-eighths of an inch long; which possible

The first surface longitudinal, the membrane erect, yet the ornamental corrugations were distinct, applied to the wing to be more correct. The front edge had time.

Longitudinally they are of a fan; they

composed are, in the unexpanded state, corrugated into a vast number of folds, transverse as well as longitudinal, and that the nervures are folded. Are any of our readers microscopists? If so, will they try and verify this statement." After reading that, and considering the matter, it occurred to me that I might be somewhat fortunately situated for making an attempt at discovering the facts of the case. First, because I was in possession of a number of the cocoons of large Bombycids which had failed to produce moths, therefore some of them might be found to be good subjects for investigation. And secondly, although not a microscopist myself, I was sure I could obtain the able and willing services of some members of our Microscopical Section: so I examined my cocoons. I had four *Samia Cynthia*, out of nine which I had received from Mr. James Angus, of New York. In three of them the caterpillars had failed to transform, the fourth contained a pupa. I had also two *promethea*. In one was the pupa of a large female, but so soft that it would not endure handling; in the other I found a small male, dry and firm. I called the attention of Mr. Foot, one of the younger members of the section to the subject and read to him Dr. Buckell's request; he at once responded with, "Let us try." I should state here that the investigation extended over several weeks. My method was to take notes of what I saw, or thought I saw, at any time during its progress, compare and correct them afterwards, and if there was conflict or uncertainty, I had further views to verify. But before entering into details I will quote more extensively from Kirby and Spence. In vol. 3 p. 293, we read, "To understand more fully the cause of this rapid expansion and development of the wings, though often exceedingly thin, they are always composed of two membranes, having most commonly a number of hollow vessels running between them. These tubes, which after the French entomologists, I would name nervures, contribute as well to the development of the wings as to their subsequent tension. In the pupa, and commonly afterwards, the two membranes composing the organs in question do not touch each other's inner surface, as they afterwards do; and being moist and corrugated into a vast number of folds like those of a fan, but transverse as well as longitudinal, and so minute as to be imperceptible to the naked eye, the wings appear much thicker than in the end. Now, as soon as the insect is disclosed, a fluid enters the tubes, and being impelled into their minutest ramifications, necessarily expands their folds; for the nervures themselves are folded, and as they gradually extend in length the moist membranes attached to them are also unfolded and extended. In proportion as this takes place, the expanding membranes approach each other, and at last, being dried by the action of the atmosphere, become one." This description seems to be taken from observations made of butterflies, which will doubtless differ in some respects from moths. We commenced operations by trying the *Cynthia* first. The wing-case was thick and hard; when broken and removed the winglet was disclosed lying close to the shrunken body, smooth and transparent as that of a fly; not the vestige of a scale visible, nor an indication of where they were to come from. Under the glass it was a most interesting object, but worthless for our purpose. The question forces itself on our attention here, At what stage of the pupal period does the scale begin to grow?

We next took up the *Promethea*, which proved to be in fine condition for the investigation. The wing cover came off freely and clean, disclosing the winglet scaled and coloured and apparently ready for emerging; when it was removed, it measured just over three-eighths of an inch from joint to apex, and one-fourth of an inch across the widest part; which possibly might have expanded to one and a half or two inches.

The first survey of it through the glass at once suggested compression, lateral and longitudinal, the minute scales were so crowded on one another that they almost stood erect, yet the ornamentation was distinct. When the scales were removed the transverse corrugations were disclosed, crossing the winglet at quite irregular angles, but the term "foldings," applied to them would convey an erroneous impression; drawings or gatherings would be more correct. They had an exact resemblance to some gatherings in ladies' dressmaking. The front edge had a singularly knotted appearance which I could make nothing of at the time.

Longitudinally, the foldings were unmistakable, but with nothing like the regularity of a fan; they were of quite unequal length and depth; some were but a slight de-

pression, others so deep that I could not remove the scales from them ; none of them extending from base to outer angle of wing. One would commence near the base, run deep and terminate in a loop. Another would begin opposite to the middle of that one, run beyond it and stop. Others formed plaits on the outer angle, all inclining to be wavy, as if they had been subjected to longitudinal pressure. These foldings would account for the broken lines of the transverse corrugations.

My next effort was to lay bare the nervures ; for this end I soaked the winglet in water. It came out an elastic gelatinous mass. I tried hard to separate the upper and under membranes but without success. I turned it over to examine the underside, and found that the membranes had parted over some of the heavy nervures at the base of the wing, disclosing their structure completely ; the end next the joint of one of them turned upward, and I could see into the hollow tube as far as the bend would allow, the walls appearing to be very thin ; inside they were smooth with a waxy look. A general survey of the exterior reminded me of an earth-worm severely contracted. A close inspection showed them to be segmented ; one end of the segment was prominently rounded, sloping suddenly to the other end, entering the rounded end of the one next to it, and so on along the portion of the nervure laid bare, without any perceptible diminution in its size. If this structure is what is referred to in the statement, "the nervures themselves are folded," then the term is badly chosen and very misleading.

The condition of the costal edge of the winglet was now clearly displayed, but difficult to describe. If a piece of stiff twine is placed on the table, doubled back and forth in as short bends as is possible to give it, kept in place and looked at from above, it will give a good idea of the costa when it is viewed edgewise ; then cut the bends on the side representing the centre of the wing, and it will have a strong resemblance to the upper surface of the costal edge. The term, crimped, or crimped, would well express its condition.

These views were obtained, and could only be obtained when the winglet was saturated with moisture. We may find in this direction an almost unlimited field for observation. From what we know of insects, we should be warranted in expecting as much diversity to characterize this as any other department of their history. A general principle may cover the whole, but with very considerable latitude in working out of the details.

The difference between the expanded and unexpanded wing is great in more ways than size ; the wrinkled thickness of the nervures in the one, is in striking contrast to the smoothness and fineness of the other. The amount of space between the rows of scales is very suggestive ; in the unexpanded wing the roots of the scales are close together, each row being situated on the crest of a wrinkle ; in the expanded wing the tips of one row of scales just cover the roots of the row in front of it ; when the scales are removed, the space between the rows of roots is a smooth dull coloured membrane. When contemplating this, I thought I saw an explanation of what I had observed when rearing *Cecropias*. Occasionally I would get one of unusual size, but they were always thin in vestiture and defective in colouring. Now if each specimen of a species has the same number of rows of scales on their wings, which may be the case, and the membrane of one becomes unusually extended, without a corresponding increase in the size of its scales, we can easily see what the consequences would be.

But the expansion of the scales themselves has to be accounted for. This takes place at the same time as that of the wing. From whence comes the motive power ? It is known that the roots of the scales are bulbous, set in sockets, the bulb being under the surface of the membrane ; and that the scales are double, open inside, but closed at the outer end, forming a sac ; may not this opening extend through the stalk and root of the scale, connecting with the space between the two membranes of the wing, and receive from thence the impetus for its expansion ? I tried to settle the question by various observations but obtained nothing definite, yet this seems to be the direction in which we have to look for the result produced.

I bethought me of the *Luna* I had seen when it had just emerged from its cocoon, which was pure white, resembling a bit of swan's down, so I examined the expanded wing

of one, but I found most surprising in *Promethea*. Its surface in quiet the *Luna*, is not so and the more numerous of the scales separating some general scale formation, the scales. All of which reliable information

Mr. Fenn of butterflies as compared of a *Danais archippus* my eyes, when the time it had reached. With what force such rapid extension ; it is not

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of one, but I found I had got into an entirely different field of observation, and one of a most surprising character; everything seemed to be the very reverse of what I had seen in *Promethea*. The scales were long, fine, and of a hair-like form, strewed thinly over its surface in quite an irregular manner; the beautiful green colour so much admired in the *Luna*, is not given off by the scales but from the membrane. The scales are yellowish, and the more numerous the scales the more yellow is the tint given to the wing. Many of the scales separate into branches, these branches separating again into finer ones, resembling some grasses we have seen. The scales around the "eye spots" are of the ordinary scale formation, the membrane under the coloured scales partaking of the colour of the scales. All of which goes to show that it is not safe to trust to one insect in order to get reliable information about the constitution of another.

Mr. Fenn calls attention to the usually more rapid expansion of the wings of butterflies as compared with the moths. On one occasion I was looking at the chrysalis of a *Danais archippus*, which I had fastened to a door frame, a little above the level of my eyes, when the pupa case burst, and the butterfly fell fluttering to the floor; by the time it had reached it the wings had attained their full length, but limp as a wet rag. With what force must the fluid be injected to the very extremity of the wings to produce such rapid extension! It gives no opportunity for observing the manner of its accomplishment; it is more like the relaxing of a compressed spring than anything else.

For such an investigation, probably the best results could be obtained from the examination of a fresh pupa, secured just before emerging.

Since completing this, I have had the opportunity of making another investigation.

In the latter part of October I received from Dr. Woolverton a fresh chrysalis of *Danais archippus*. I suspended it in a convenient place for observation, doubting whether it would mature or not at that season of the year. On the 5th of November it still retained its delicate, pellucid green colour, no perceptible change having taken place in it, except perhaps that the golden spots were more conspicuous. On the morning of the 6th it had become a deep, dull, bluish black; by noon the red colour of *archippus* was quite perceptible through the wing-cases, and by evening its black lines and white spots were distinctly seen. It had been maturing so rapidly that I was afraid to leave it over night, lest it might burst its bonds before morning, so I gave it an alcoholic bath, which arrested its progress. Next morning it had an angular look, having shrunk a good deal. The outer integument peeled off freely, the pupa being well matured and firm to the touch. It required quite an effort to remove the winglet from the body, so completely had it matured. When taken off it measured nearly three-fourths of an inch in length, and was a perfect miniature of the expanded wing. A great quantity of fluid flowed from the wound made by the removal of the winglet, which soon reduced the body to less than one-half of its original diameter. The scales had the same crowded appearance as in *Promethea*; their tips had a flattened look, as if they had been pressed upon when growing, which turned them downwards; those of the fringes on the outer angle appeared as if they might be of their full length.

When the scales were removed the transverse corrugations were disclosed, showing them to be very much finer than those of *Promethea*, but there was not a trace to be seen of longitudinal foldings, not even on the outer angle; the lines of the corrugations crossing the wing were quite wavy, which would no doubt admit of a good deal of lateral expansion, but there were no plaits to let out, so I suspect there must be a considerable lateral compression to make up for it, although I could not detect anything in the membrane looking like longitudinal corrugations.

The winglet dried so rapidly that I made no attempt to lay bare the nervures, but there was no crumpling of the costal edge as in *Promethea*; the unexpanded wing being identical in form with the expanded one, which was not the case in *Promethea*. All going to demonstrate the certainty that we have in this direction abundant scope for investigation, each species probably having something peculiar to itself.

THIRD ANNUAL MEETING OF THE ASSOCIATION OF ECONOMIC
ENTOMOLOGISTS.*

AUGUST 17, MORNING SESSION.

The third annual meeting was held in the Columbian University building, Washington, D.C. The meeting was called to order at 9.45 a.m., President Fletcher, of Ottawa, Ontario, in the chair. Thirty-eight persons were present, among whom were the following members:—

W. B. Alwood, Virginia; W. H. Ashmead, District of Columbia; G. F. Atkinson, Alabama; M. H. Beckwith, Delaware; Lawrence Bruner, Nebraska; A. J. Cook, Michigan; E. W. Doran, Maryland; James Fletcher, Canada; L. O. Howard, District of Columbia; D. S. Kellicott, Ohio; J. A. Lintner, New York; C. L. Marlatt, District of Columbia; Herbert Osborne, Iowa; Theodore Pergrande, District of Columbia; G. H. Perkins, Vermont; E. A. Poponoe, Kansas; C. V. Riley, District of Columbia; J. B. Smith, New Jersey; E. B. Southwick, New York; J. M. Stedman, North Carolina; F. M. Webster, Ohio; H. E. Weed, Mississippi; F. H. Chittenden, District of Columbia; A. B. Cordley, District of Columbia; G. H. Hudson, New York; B. P. Mann, District of Columbia; M. E. Murtfeldt, Missouri.

PRESIDENT'S INAUGURAL ADDRESS.

The President, James Fletcher, Dominion Entomologist of Canada, then delivered his annual address.

GENTLEMEN,—It is not my intention to delay you upon this occasion either with a lengthened or an elaborate address, but I shall endeavour for a short time to direct your attention to some subjects for discussion which I trust may be found of interest and benefit to all present. These subjects are all of a nature which it seems to me may more appropriately be brought before this Association than before any of the other entomological organizations.

I am of the opinion that our meetings, to be of the greatest use to economic entomologists, should be largely of an informal nature; in fact, they should be meetings where workers can meet students in the same line of research and exchange experiences. We must all, to a large measure, go over the same ground and learn for ourselves the general principles of the structure and habits of insects which affect so closely the choice and application of the proper remedies to avert or mitigate their attacks upon crops. This training, however, is essentially necessary in the same way that learning the alphabet is necessary for one who wishes to read or speak accurately; but it is beyond this point that the advantages of our Association may be recognized. There is not, perhaps, any single line of practical science, certainly not one approaching it in the importance of the results attained, in which students have to work so much alone and cut off from companions of congenial tastes. Marvel at it as we may, we, who know the exquisite beauty and sustaining charms of the insect world, cannot but acknowledge that entomology is not a popular study, and although in this respect there is a gradual change taking place for the better, still all the same it is with feelings akin to amusement and patronage that the ordinary farmer allows himself to listen to arguments that there is after all *some* use in studying the habits of insects.

Probably most of us present have occasionally had the opportunity of addressing farmers' institute meetings, and know well that although, after the meeting is over, there

*The following report is taken from "Insect Life"—the official publication of the Entomological Division of the Department of Agriculture, Washington, D.C.

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are invariably more inquiries about common insect crop pests than any other subject which may have been discussed, and when the meeting breaks up it is always the entomologist who is detained to answer the questions of those who did not like to stand up and speak before the others ; yet for all this, probably most of you will recognize the extreme similarity which exists between the expectant smile which meets you from every part of the audience when you are introduced to speak on insects in a new locality and that which greets the announcement of the high-class comic songs which are usually dispensed on those occasions. You also know the necessity, and have probably been often asked by the chairman at these meetings in so many words, to begin with some joke to "catch the attention of the audience." An appeal must then be made to their pockets, and you must remind them of the crops destroyed and dollars lost by depredations of pests which levy tribute every year, as the turnip flea-beetle, cut-worms, potato-beetles, etc.

You explain the simplicity of many remedies and the great saving that will follow their application. They had not thought of these things ; gradually the smiles die out and the other extreme of seriousness is reached. They awaken now ; with bodies leaning forward and heads raised they drink in every word ; their eyes brighten and their mouths gradually open with wonder at the losses they have suffered and might have prevented had they but known of these simple things before. It touches them to the quick to be told that ten cents' worth of Paris green would have saved their crop of gooseberries or currants ; have done away with the necessity of sowing their turnips two or three times at a hundred times the cost ; that ten cents expended in spraying an apple or plum tree would have given them a return of three or four dollars' worth of good fruit ; that by simply wrapping a piece of newspaper around their young cabbages or tomatoes at the time of setting them out they might have saved a loss of perhaps 75 per cent of their crop from the ravages of cut-worms. In short, that by following the advice of entomologists, those who study the habits of what they had always called indiscriminately "bugs," they might have saved much that had disappeared from under their very eyes.

But I need not now pursue this thought further. Encouraged by the apparent interest taken in the subject by the audience, one is sometimes tempted to speak too long, but we must be discreet : farmers, as a rule, prefer a few new thoughts at a time and to have these plainly put. Having finished, we perhaps sit down amidst applause and requests to go on, and perhaps hear such complimentary remarks exchanged as "I tell you what it is, there *is* something in what he says," or, in a tone of surprise "That bug man was pretty good." No. Farmers and ordinary individuals throughout the country who are dependent upon them for food do not know, nor as a class appreciate, what they do now, might, and will in the future owe to the labours of the entomologist. The consequence is that those who do take up the study are few and isolated from each other. Moreover, I maintain that there is no branch of natural science or practical agriculture to which it is second in importance. The amounts lost and the value of produce which might be saved every year in our staple crops alone, by following the advice of a competent entomologist, are so enormous and of late years have been so often proved, that before long the value of these studies must certainly be recognized. The chief hindrance is the widespread and incomprehensible ignorance on the part of both growers and consumers of agricultural produce of the present generation. This ignorance is rapidly being dissipated by means of the various agricultural colleges and experiment stations all over the world, where the rising generation is being trained.

It will soon be seen that the scientific or accurate study of the habits of insects, by which we are enabled to prevent the injury or loss of existing crops, of which we have already learned the use or necessity, confers far greater benefits on the community at large than the discovery or introduction of new products of which we have not yet felt the need. But there is no natural study which presents so many different aspects, nor which provides so many subjects concerning which its students, although they must know something, find it quite impossible to inform themselves thoroughly, which, in short, demands that its different branches must be taken up by several specialists bound together by some bond, so that the knowledge gradually accumulated by one may, at need, be

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available for all. Such a bond I believe we have in the Association of Economic Entomologists, whose members have an opportunity of meeting once a year a large number of colleagues working in the same field, but upon different lines, with whom they can compare experiences and particularly can discuss any difficulties which may have arisen in the prosecution of their work during the year.

It is for this special reason that I set so much value upon an informal style of meeting, where the Association can, as it were, go into committee and a member can not only bring specimens for exhibition or identification, but can ask as many short questions as he likes and receive answers at once, together with opinions and comments, if necessary, from all present. Methods of applying and the most advantageous materials and proportions to be used in the manufacture of insecticides, the discussion of new discoveries either of materials or apparatus which may have come prominently before the public during the year, the most convenient modes of collecting, mounting and preserving material for study—all these seem to me to be subjects particularly appropriate for discussion before our association, concerning which, too, information is so badly needed now that the very progress of the science is seriously impeded by the want of it and which I think can not so well be brought up before any other existing body. Now these matters, although small in themselves, when neglected become of great importance, from the negative results which come out of them. I therefore took the liberty of addressing a circular to each member of the Association as well as to all economic entomologists of whom I could find the postal addresses, requesting them to come to this meeting prepared to derive the greatest possible advantage from intercourse with the eminent entomologists resident at Washington and those others who would surely be gathered together here; also at the same time to try to make the meeting enjoyable to others by favoring us with short notes of their operations during the year.

I am pleased to announce that one of our foreign members, Miss Ormerod, has sent us an interesting account of her work during the past year which will be read during the meeting.

Thanks to the kindness of Professor Riley and the trouble taken by our secretary, Mr. Howard, arrangements have been made that the visiting entomologists may take the greatest advantage of the opportunities afforded by the meeting being held at Washington, and I would suggest that all should improve this opportunity by examining and above all by taking copious notes of the various entomological machines, so many of which have originated in the Division of Entomology, under Professor Riley. To-morrow a certain time will be devoted to the discussion of insecticides and the machinery for their application. I am convinced, after many failures, that success in treating insects just as much depends upon having the proper apparatus as upon the insecticide used, and I draw your attention now to this subject because of the exceptional advantages offered here, not only from having the machines to examine, but also the able members of the staff to explain their uses. For my own part I have found it quite impossible to judge of and compare the merits of these, in many cases, expensive machines, by simply reading the available descriptions, and I think we should make the most of this opportunity. My only regret is that every economic entomologist in the country is not present. You will see by the printed programme which has been submitted to you that there are papers upon many important subjects and arrangements have been made by which our meetings shall not clash with those of either of the other bodies before which entomological papers are to be read, so that there is nothing to prevent members wishing to do so from being present at the reading of all these papers during this week. By a mutual arrangement with the president of the Entomological Club of the A. A. S. authors have been requested to submit papers of economic interest to this Association, whilst those of a scientific or systematic nature will come before the club or the section of biology.

I trust, gentlemen, I may not be considered presumptuous if I make use of the opportunity which you forced upon me when you elected me to this honourable position at the last annual meeting, to lay before you some ideas which have occurred to me by which we can make our work more useful and also secure better facilities for making it popular throughout the country. Why is it that the botanist, the chemist and the geologist do not elicit

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the amusement only, from the ignorant, which is called forth by the entomologist in prosecuting his investigations? While not for one moment wishing to belittle their work I maintain stoutly that not one of these or all combined can compare with entomology in its possibilities when tested by the rule of *Cui bono?* The silent respect accorded these sciences is no doubt largely due to supposed, not to call them fictitious, virtues.

The botanist has from ancient times been inseparably associated with medicine and the discovery of a panacea for all the ills to which mortal man is heir. Even in the wilderness, with a handful of herbs he is exempt from molestation by either Indian or white man run wild. The chemist again deals with things unintelligible to the masses, illustrated with loud noises and nasty smells, and there has come down with him from the middle ages a sort of twin-brotherhood with the alchemist and the practisers of other dark arts—the possibility of his discovering in his laboratory an easy means of creating, without hard work, gold, that which is by most men most coveted, and for which many will commit crime or be induced to acts mean and contemptible. Too true even to-day are Virgil's words: "*Quid non mortalia pectora coges, Auri sacra fames?*" What will you not compel mortal breasts to do, cursed lust for gold? The geologist, with his pick, or his humble but sordid, vulture-like follower, the "prospector," means to the uneducated eye a public benefactor, who may find that purest but most degrading metal, the search for which is the mainspring and motor of so many lives. Who that has travelled in the far West has not seen the magic effect in removing difficulties of the words "I am working for the Geological Survey!" And yet—I say not as a wail—there is no such respect for the "bug sharp" or "grasshopper tenderfoot," who has saved them there, in that very country, the very means of subsistence, and he is only treated to shakes of the head and sinister looks, as though he were some dangerous character, when in answer to their questions "What are they for?" "What do you do with them?" he can not assure his interrogators that he either eats or, that which last of all he would do, sells his specimens.

But I have said that the change for the better in this respect has even now set in. Already the most highly civilized nations of the world, nobly headed by the Government of the United States of America, have seen the advantage of appointing specialists who can devise means for the prevention of the enormous losses of revenue due to the attacks of injurious insects. Germany, England and her colonies, notably Canada and particularly the province of Ontario, France, Italy, and other nations, all have followed the lead, and our favorite science has now changed from a study and amusement of the few to one of the most important branches of practical agriculture, the elements of which must be known by all engaged in tilling the soil or they will surely suffer. Already it finds a place upon the curricula of many of our schools and colleges and before long will force itself upon the notice of others. There has been a rapid development in this line, not only in this country but everywhere, during the last two or three years, and many new men have come to the front. My presumption does not carry me so far as to criticise these or other workers; but perhaps I may be permitted to refer to some of the dangers which beset a newly appointed entomologist, and particularly a young one. In such a task one must necessarily (for safety's sake) refer to what has occurred to himself in his own experience. The first consideration must of course always be to succeed in the work which you have undertaken, and I can not help thinking that some err considerably when they think that they will be expected to know everything and must answer every question off hand. On this point I am speaking particularly of our relations with farmers, who are as a rule very practical men, made so by the exigencies of their lives, but who are frequently those who have not had the advantages of a liberal education, and consequently have not the consideration and moderation which that alone gives. Moreover, as there is no policy so poor, because it is invariably seen through, as that which prompts an entomologist, when seeking information from one whom he knows is better posted than himself, to try and hide his lack of knowledge by making excuses why he does not recognise that exact specimen, or by asking indefinite questions in the hope of getting what he requires, without in so many words acknowledging his ignorance, so in the same way does he expose himself to the contempt and want of confidence

from those in whom he most desires to inspire respect, by trying to put them off with an indefinite answer. It has been my experience that a modest and honest acknowledgment of ignorance is no disgrace and brings no degradation with it, whilst an assumption of knowledge which we do not possess is a constant menace, which if once detected is never forgotten. It is the old tale, "honesty is the best policy;" but this must not end the matter; we must be honest with ourselves, and having once detected our lack of knowledge upon any subject which comes under our notice, we must use every means in our power of supplying the deficiency, and if we make a systematic study of every investigation which we undertake, taking all the time careful records of what we see, even with regard to the commonest insects, we shall frequently have the satisfaction of finding out that not only have we observed all that others have, but many other things besides, which will raise our simple investigation from a mere study into a scientific record. No man can possibly know everything even about his favorite study, and the sooner he knows this the better for his work.

A subject frequently referred to, but which can not too often be repeated is the necessity, or even, if we put it in another way, policy, of making the fullest acknowledgment of all assistance received from others, whether it be from their writings or otherwise. I know of nothing which so belittles a man's work as to find that it is derived without acknowledgment from some one else. It is not at all infrequent, I am sorry to say, to find whole sentences and clauses inserted in published writings without even quotation marks. An evidence of this is found in the innumerable mistakes which are perpetuated and handed down from author to author before they are detected as errors. Again, too great stress can not, I think, be laid upon the propriety of invariably acknowledging the source of all illustrations used. These are of the greatest assistance, and yet they are frequently used without a word of acknowledgment.

Now, all of this is essentially unwise from the base standpoint of policy alone; for although nothing may be said about the matter, be sure that every instance is noticed and stands forth as a black blot on the face of good work.

A defect which is occasionally discernible in some writings upon economic entomology is the want of a thorough grounding in the first elements of the science. This is easily detected; there is an uncertainty and indefiniteness about the work. It is like that of an artist who begins to paint pictures before he has learned to draw well. A far greater blemish, however, which has, I think, seriously impeded progress and effective work, is the fact that entomologists as a rule do not know enough about the collateral subjects which affect their studies. Their efforts are for the most part directed towards the protection of farm crops, and yet how few make a study or have much knowledge even of the elements of farming and horticulture, the growth and management of the various kinds of crops, the effects of different fertilisers, early and late planting, and the rotation of crops, the pruning and cultivation of trees and shrubs.

All of these are of paramount importance. The knowledge is necessary, and therefore must be acquired. A certain knowledge of botany is most important and will be constantly giving advantages to the one who possesses it over those who do not.

With regard to the presentation of the results of our labors for the use of others, one thing which should be avoided as much as possible is the recommendation of remedies which we have not actually tested ourselves. There are so many useless and untrustworthy remedies now published, particularly through newspapers, that great caution is necessary. Different conditions sometimes require differing remedies, according to circumstances: but I think that the best and fewest possible remedies should be given for any insect treated of, so as to simplify the application as much as we can. There is no doubt that the most valuable remedies are those which are simplest. As the late Mr. Frazer Crawford, of South Australia, has well said, a remedy must be (1) *effective*, so as to attain the object aimed at; (2) *inexpensive*, so as to be practical—worth the trouble and expense of application; (3) *simple*, so as to avoid as far as possible all chance of mistakes in applying it.

At the last meeting of the Association, in Champaign, Ill., I had the honor of a conversation with Assistant Secretary, the Hon. Edwin Willits, and he mentioned that he

was frequently entomological losses from insect by which they could them knew to be great injuries do which we had a investigation that to arrive at, and lest we should p of entomologists the necessity has direction of gath be printed for c and the part the loss, so that we i data with which obtain data I ha be reliable. I t statistics, which of items which By way of exampl mates which hav probably quite re considerations, as and similar subje

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them off with honest acknowledgment, whilst an "official policy;" but this we detected our duty to use every systematic study of records of what we could get, and the satisfaction of other things into a scientific study, and the repeated is the best acknowledgment or otherwise. derived without worry to say, to even quotation are perpetuated. Again, too, acknowledging the fact yet they are policy alone; for it is noticed and scientific entomology. This is easily like that of an A far greater work, is the subjects which protection of the elements kinds of crops, of crops, the y, and there- id will be con- use of others, on of remedies s and untrust- eat caution is according to ould be given as we can. dest. As the t be (1) *effect-* al—worth the ible all chance onor of a con- tioned that he

was frequently asked for information as to the advisability of large expenditures for entomological purposes, and that although entomologists frequently spoke of the large losses from insects, we did not provide politicians—and particularly himself—with data by which they could explain and justify these expenditures, which those who understood them knew to be of such enormous importance, and when we wished to point out the great injuries done by insects we had to go back continuously to old published records which we had all been quoting for upwards of ten or twenty years. Now we find upon investigation that accurate estimates of damage done by insects are exceedingly difficult to arrive at, and the figures are so large that we are rather afraid to quote them ourselves lest we should prevent rather than encourage investigation, and it has been the custom of entomologists to minimise the estimates for fear they should not be believed. Now the necessity has arisen, I think, and I lay it before the Association for action, in the direction of gathering together some reliable recent statistics in a short form, which may be printed for distribution, and which will cover the more important injuries to date, and the part the work of the entomologist has played in reducing injury or preventing loss, so that we may overcome this difficulty and provide legislators and ourselves with data with which to meet this argument. After a careful examination and great effort to obtain data I have found that there are certain of these large estimates which appear to be reliable. I think better results will follow the publication of a few quite reliable statistics, which may be taken as typical instances, than by accumulating a large number of items which would increase the chance of error and might not be read so carefully. By way of example I will refer to the Chinch bug. I have examined carefully the estimates which have been published concerning that particular insect, and the following are probably quite reliable and appear to have been made with due regard to all collateral considerations, as the increased value of the saved crop, the cost of remedial measures, and similar subjects.

In 1864 Dr. Shimer's estimate, which I find was drawn up with very great care, put the loss in the one state of Illinois to the corn and grain crops at \$73,000,000. In Dr. Riley's Reports on the injurious insects of Missouri, we find in 1874 there was a reliable estimate of the loss to that State by the same insect of \$19,000,000. In 1887 Professor Osborn's estimate, founded upon the reports of the correspondents of the State Agricultural Society of Iowa, put the loss in that State on corn and grain at \$25,000,000; and lastly, Mr. Howard's estimate, as given in the entomologist's report for 1887, for the nine States infested by the chinch bug in that year, was \$60,000,000.

Now, gentlemen, I think these statistics of the injuries to crops by one insect alone are probably as reliable as any that we can get, and they give a good argument which we may use as showing the depredations of insects; but it is not sufficient that we can convince people that great injury is going on; we must show that we are doing something to mitigate this injury. In Professor Comstock's Report for 1879 the estimate of the possible annual loss in years of general prevalence of the cotton Aletia is placed at \$30,000,000 through the cotton States. The injuries by grasshoppers in the different States of the Union and also occasionally through the British North American provinces have been so enormous that figures hardly give an idea of the injury they do, but they are known by all to be enormous.

As an instance, however, of what may be done to mitigate their attacks I would merely mention those for this year, which seem to have been very considerable. In the States of North Dakota and Minnesota it is probable that at least \$400,000 have been saved on account of work done by direct advice of entomologists—work they have in some instances forced upon the farmers. Two hundred thousand dollars is a probable estimate of the amount saved by plowing the land last autumn. Another equal amount has been saved by the use of "hopperdozers." Professor Bruner tells me that a sufficient number of grasshoppers have been actually taken this year, which if left alone and allowed to lay their eggs might next year have devastated the whole crops of those two States and the adjoining parts of Manitoba. These successful operations have been carried on by the state entomologist of Minnesota, Professor Luggler, and by Professor Waldron, of North Dakota, ably aided by the advice and assistance of the agent of the Department of

Agriculture, Professor Bruner under Professor Riley's instructions; and I think it is no exaggeration to say that at least \$400,000 have been actually saved in hard cash on this year's crop, not to speak of the enormous loss which would most probably have followed next year had they been left alone, and had climatic conditions been favorable for their increase.

The amount of damage done to crops every year is so vast that the figures excite incredulity from those who do not study crop statistics. The agricultural products of the United States are estimated at about \$3,800,000,000. Of this it is thought that about one-tenth is lost by the ravages of insects. This is in many cases unnecessary. In short a sum of \$380,000,000 is given up without a murmur and almost without a struggle by the people of the United States.

Crops of all kinds are injured, and simple remedies are known for many of the attacks and are more or less adopted. Some have already come into general use. Paris green is now applied to potato fields almost as much as a matter of course, as manure is to fertilize the soil. As an instance of how a saving may be made even in well-established methods, I give the following: Through the work of Mr. W. B. Alwood, of the Virginia experiment station, improved machinery and the water mixtures of poisons have come into general use amongst the farmers and potato-growers in the Norfolk region, and some of the largest growers now claim that they at present do for from \$40 to \$60 what used to cost them from \$500 to \$600. To-day in California and Florida, orange trees are universally treated with kerosene and resin emulsions or poisonous gas for scale insects.

In the treatment of cabbage caterpillars, pyrethrum diluted with four times its weight of common flour, and then kept tightly closed for 24 hours, leaves nothing to be desired, and thousands of dollars are yearly saved to small growers who most need the assistance.

Many excellent remedies have been devised by a mere modification of existing agricultural methods. Instances of these are found in the early and late sowing or harvesting of some crops, as sowing turnips between the broods of the turnip flea-beetle, the late planting of cabbage for the root maggot, the late sowing of wheat for the Hessian fly, etc. In the 1879 report of the U. S. Department of Agriculture was first detailed the only successful method of treating the clover-seed midge by cutting or feeding off the first crop before the young larvæ are sufficiently matured to leave the heads and go into the ground to pupate. This was simply the change of one week, by which not only is the insect destroyed, but the clover is saved in better condition than under the old method.

During the present summer Professor Osborn has discovered that a serious pest of the clover plant, *Grapholitha interstinctana*, a small moth, may be destroyed in all its stages by simply stacking the hay soon after it is cut.

In the Southern States Mr. Howard Everts Weed writes to me with regard to the cotton worm: "The loss would indeed be great were it not for the fact that the planters keep it in check by the prompt application of Paris green in a dry form. The only method now used is to apply it by means of two sacks attached to a pole and borne through the plantation by a negro mounted on a mule who rides down the rows of plants. This gives perfect satisfaction, and the farmers of the state tell me that they want no better remedy for this insect."

Mr. F. W. Mally writes on the same subject: "The benefit which the public generally derives from the researches of economic entomologists is well illustrated by the result of the cotton-worm investigation published in the Fourth Report of the U. S. Entomological Commission. In that report estimates of damage, etc., are given, and I will only allude to the benefit which the planters have derived from the report. Formerly, planters waited until the August brood of the Aletia issued and depredated on their cotton. This brood may be called the migratory one, since it spreads over vast areas of cotton fields. At that time, too, the planters used Paris green just as they purchased it from the dealers. They have now been educated to know that the Aletia propagates in certain quite well-

defined centres rather than they had been. Now, too, they are reducing the cost of poison is now applied in the River Valley, for plantations (to be applied to this line is hardly to be considered of economic extent C. V. Riley."

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During the Lafayette, Indiana Department of Agriculture has advised by an 5 to 75 per cent. examination the *Diabrotica longicauda* insect at \$10,000 advice of Mr. W to oats, and the first 5,000 acres of this rotation the farmer's estimate, say

Professor Osborn that the small leaved would feed one half by the use of hay upon two plots, of hay produced 100 per cent. greater than

I have said to workers. It is equally going on all the so many different

In conclusion, careful notes of economic investigations, but there is perhaps which it involves them away systematically on a future occasion. the greatest possibility of use to others through the collection of rare and interesting material, and how they were bred often, do we remember all allude to the conclusion notes, are far more

defined centres earlier in the season, and that if taken in July (or about five weeks earlier than they had been accustomed to), they can prevent their spreading to larger areas. Now, too, they dilute the Paris green with flour and finely-sifted wood ashes, greatly reducing the cost of the poison per acre. At the same time the acreage or area to which poison is now applied has been reduced tenfold, at least. For example, here in the Red River Valley, for 30 miles up and 50 miles down the river in July there were only two plantations (together about 2,000 acres) upon which Aletia was found. In August this brood would have spread over almost the entire section mentioned. Paris green was applied to this limited infested area, and the larger areas saved from injury. The saving is hardly to be estimated. The above appears to me to be one of the greatest triumphs of economic entomology, and, I may truthfully say, also of my most estimable chief, Dr. C. V. Riley."

With regard to another injurious insect, the following facts well illustrate what may be done by following the advice of an experienced entomologist.

During the year 1885 the Hon. Moses Fowler, a wealthy banker and landowner of Lafayette, Indiana, applied to Prof. F. M. Webster, an agent of the United States Department of Agriculture, then located at that place, for relief from very serious deprivations by an unknown enemy to his corn, which was damaging some of his fields from 5 to 75 per cent., he having this year 10,000 acres of land devoted to this crop. Upon examination the predator proved to be the well-known corn-root worm, the larva of *Diabrotica longicornis*. Mr. Fowler estimated the loss in his fields by reason of this insect at \$10,000, with a probability of still greater injury the following year. On the advice of Mr. Webster, the next season he sowed 5,000 acres of the worst infested lands to oats, and the following year the other 5,000 acres was treated in the same manner, the first 5,000 acres being this year again devoted to corn. As a result of a continuation of this rotation the pest has been practically exterminated, thereby, according to Mr. Fowler's estimate, saving him \$10,000 per annum.

Professor Osborn has shown that grass insects destroy much produce. He estimates that the small leaf-hoppers (*Jassidae*) destroy as much food from two acres of pasture as would feed one head of stock. From recent experiments he has found that it is possible by the use of hopperdozers to reduce the numbers of these insects so materially that, upon two plots, chosen for their similarity of the conditions of the growth, the amount of hay produced upon a plot which was once treated with the hopperdozer was 34 per cent. greater than upon the corresponding untreated plot.

I have said that the study of economic entomology is many sided and requires many workers. It is equally true that all who would keep up with the rapid development which is going on all the time must work day and night, early and late. The various habits of so many different objects of study, many of them nocturnal, require constant attention.

In conclusion, I would urge on everyone the great importance of keeping the most careful notes of everything which affects their work, not only of what is seen in one's own investigations, but of whatever is found in the literature of the different subjects studied: there is perhaps no detail of our work which so well repays the slight extra trouble which it involves as making all notes carefully, completely and neatly, and then putting them away systematically, so that they can be found when required suddenly on some future occasion. Our "private notes," as we call them, should, I think, be made with the greatest possible care, not only for our own sakes, but to insure that they may be of use to others after we are gone. Who has not felt the disappointment on looking through the collection of some great worker suddenly called away from this life, of finding rare and interesting specimens, without a single note of locality, date, or other information, and how comparatively useless such specimens, and even the labor by which they were bred or procured, are thus rendered. We all know this, and yet how, too often, do we put aside material without labels, thinking that we know and shall remember all about them. After many years of much wasted labor I have come to the conclusion that a few specimens well preserved, properly mounted, and with full notes, are far more valuable than a large number of specimens without these characters.

When a collector once gets the habit of accumulating a large number of specimens of everything he sees, he very soon gets careless about putting them away while they are in good condition, and has not time to make the proper notes.

Not only should notes be taken of what we ourselves have seen, but much time will be saved if an index book be kept of all literature which passes through our hands. Even in this we must protect ourselves. The time of an enthusiastic entomologist is necessarily short, and he has not time to "look through" books on his work to see if they are good, with the idea that he will remember where to get the contained information at some future time. All reading must be done earnestly and keenly as though we should never again have an opportunity of seeing the book in question. Let all our labour be work, not play. I think it is John Ruskin who defines work as systematic effort with a definite end in view, while unsystematic effort, no matter how severe the labour may be, if it have no definite end, is merely play. In the index book should be entered a reference to the page where any facts which strike us as useful are to be found. Some restraint will be necessary, when this work is once taken in hand systematically, not to index what is not useful, as well as that which is. It is very easy to get a mania for indexing, and then the gems we are picking out may soon be lost amongst less valuable matter. Whatever we have to read or whatever we have to see, let us give it our fullest possible attention with the idea that at some future time the information may be useful. A tale that is told about Henry Ward Beecher illustrates this very well, and is probably known to many of you. Upon one occasion he was driving in the country and his horse cast a shoe. He had always made it a rule of his life that whenever he had to see anything done he gave it his fullest attention, with the idea that at some time he might require the knowledge so obtained. He had frequently stood by whilst his horse was being shod, and consequently, when after a time, he reached a country village and found that the smith was away from home, the tale goes, he felt so confident of the knowledge he had acquired from watching carefully other horseshoes made that he lighted the fire, fashioned and finished a shoe, and shod his horse. He drove on about ten miles and reached another village. Upon passing the forge of the village blacksmith he thought it wise to have his work examined, so went in and explained the circumstances and asked the man to see if all were well. The smith looked critically at the shoe, examined it from every point of view, looked at the nails and the way in which they were clinched, and then raising himself up, said: "Look here, mister, if you made that shoe yourself and put it on, as you say, you had better give up preaching and take to smithing."

Gentlemen, I thank you for the kind hearing you have given me, and I trust we may have a pleasant and useful meeting.

Mr. OSBORN, in discussing the address, thought that the subject suggested by the President, of the great importance of careful statistics, could hardly be overestimated. He moved the appointment of a committee of three to operate with Mr. Fletcher to prepare, if possible, some careful statistics as to the amount of insect damage, and as to the benefit resulting from the work of economic entomologists.

Mr. RILEY indorsed the suggestion. He had been greatly gratified with the address and with the many valuable ideas which the president had put forward. Most entomologists who had treated of the losses occasioned by insects to agriculture have followed in the wake of Walsh, who had stated a quarter of a century ago, upon general estimates that the annual loss from injurious insects in America was \$300,000,000. Since his time the values in crops had greatly increased and the proportionate injury should have also increased; but we must take into consideration the advance in economic entomological knowledge, which has greatly reduced the proportionate loss. The loss is at most a relative thing, and we must always remember that with a decrease in the amount of

the crop its money and we have about other parts of the adopted, and h

Mr. SMITH of insect damage, louse is very abundant insect, but upon c

Mr. WEED'S attributed to the species uniting in

Mr. POPENOI and damage to the so abundant there

Mr. FLETCHER entomologists the upon the statement

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The motion of and Smith as the

On motion of publish their results next annual meeting

The SECRETARY No. 5, Vol. III., of him with a deficit age, and posters.

On motion of

By vote of the member. The or Fletcher; those of J. W. Toumey, of department of Agriculture. F. J. Niswander, of Association. Mr. member.

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On motion of together on the pr

the crop its money value is correspondingly increased. The present year is an exception, and we have abundant crops in this country with high prices as a result of failure in other parts of the world. He hoped that Mr. Osborn's motion, which he seconded, would be adopted, and he felt sure that such a committee would accomplish good results.

Mr. SMITH spoke of the unreliability of the testimony of farmers on the question of insect damage, and adduced as an instance the fact that this year the Melon Plant louse is very abundant in New Jersey, and that all melon injury is attributed to this insect, but upon careful examination the main trouble is found to be a bacterial disease.

Mr. WEED spoke in the same line, and stated that in Mississippi great damage was attributed to the Boll Worm of Cotton, which was not done by this insect, a number of species uniting in producing it.

Mr. POPENOE had found a similar misapprehension with regard to affairs in Colorado, and damage to the potato crop by the Colorado Beetle was laid at the door of the locust so abundant there, *Dissosteira longipennis*.

Mr. FLETCHER was of the opinion that the statistics should be gotten up by the entomologists themselves by the most careful personal examination and without reliance upon the statements of farmers.

Mr. SMITH called particular attention, not to the confusion of the damage done by different insects, but to the confusion of insect damage with that brought about by fungus or bacterial disease.

The motion was put and carried, and the President appointed Messrs. Riley, Osborn, and Smith as the committee.

On motion of Mr. HOWARD it was resolved that the committee be authorized to publish their results in case sufficient data for publication should be collected before the next annual meeting.

The SECRETARY reported that the minutes of the last meeting had been published in No. 5, Vol. III., "Insect Life"; that the past Secretary had transferred the treasury to him with a deficit of 38 cents, and that he had been at some expense for circulars, postage, and posters.

On motion of Mr. COOK, a tax of \$1 was levied on each member present.

By vote of the Association, Dr. James Stimson, of Watsonville, Cal., was elected a member. The credentials of Mr. H. E. Weed, of Mississippi, were presented by Mr. Fletcher; those of Mr. F. L. Washburn, of Oregon, by Mr. J. B. Smith; those of Mr. J. W. Toumey, of Arizona, by Mr. Weed; those of Mr. F. H. Chittenden, of the Department of Agriculture, Mr. A. B. Cordley, of the Department of Agriculture, and Mr. F. J. Niswander, of Wyoming, by Mr. Howard. All were inscribed as members of the Association. Mr. A. S. Ollif, of Sydney, New South Wales, was inscribed as a foreign member.

A communication was read from Mr. Forbes concerning the desirability of holding the meeting of 1893 with the Columbian Exposition at Chicago. Action upon this communication was deferred.

On motion of Mr. SMITH, it was resolved that all insecticide papers should be brought together on the programme for Tuesday afternoon.

DESTRUCTIVE LOCUSTS OF NORTH AMERICA, TOGETHER WITH NOTES
ON THE OCCURRENCES IN 1891.

BY LAWRENCE BRUNER, LINCOLN, NEBR.

In introducing this subject it is my intention to speak shortly upon the various species of locusts which have appeared in injurious numbers within the limits to be designated with each species. Some of these species have covered a vast area of territory, and have caused extensive injury from time to time, while others have appeared over limited areas and have caused but slight injuries; yet these injuries have been sufficient to necessitate their mention among the destructive species of the country. Taking them all together we have exactly twelve destructive locusts within the territory designated.

Selecting the species as they occur to me, I will mention first the Long-winged Locust, *Dissosteira longipennis*. During the early part of July reports came from the eastern and south-eastern portions of Colorado of locust depredations. The first of these was that trains had been stopped by grasshoppers getting on the rails of the Santa Fé Railroad 100 miles or thereabouts east of Denver. Shortly after this reports appeared in the newspapers of serious damage being done around the point where they were first mentioned as stopping trains. About this time other reports of depredations came in from North Dakota and Minnesota and other portions of the West and North-west. On the strength of these reports Professor Riley instructed me to visit the localities for the purpose of ascertaining the extent of country over-run, the actual and possible future injury which might result, and the exact identity of the species concerned. Being a Nebraska man and looking out for first interests, I naturally went to Colorado, the nearest locality to my home from which reports had been received. I first visited Akron, Colorado, the nearest point on the Burlington and Missouri line to the region infested. There securing a team and driving to the south only about six miles, the advance guard of the enemy was encountered. Imagine my surprise at finding here an entirely new insect as far as destructive locusts are concerned. Here in Colorado, and in immense numbers, was the *Dissosteira longipennis*, an insect usually considered rare in collections, and one heretofore only known to occur over the higher portions of the plains lying to the eastward of the Rocky Mountains, in the States of Wyoming, Colorado, and New Mexico. This insect, as ascertained from inquiry, covered an area of about 400 square miles of territory in sufficient numbers to materially injure the grasses growing on the ranges of the entire region, and amongst these grasses the species of *Bouteloua* or Gramma grasses, and the Buffalo grass, *Buchloe dactyloides*. Grains and other cultivated plants did not appear to be especially attractive to it. In fact very little or no injury was done by it to the cultivated crops growing within the region infested. About the same time that I was investigating this insect upon its northern line of injury, Professors Snow and Popenoe were studying it upon the southern border of its range, and they found practically the same food habits there that I had noted in the north, and by inquiry found that the insects had come into that country from the south last fall and had laid their eggs over a large area. This year when the eggs hatched, the young began to move from their breeding centres in all directions, seeking open places and the edges of plowed fields and following roadways. This trait of seeking open spots this season is probably due to the habit of the insect of naturally living on open ground, where grasses are short and scattering. The present year was very wet in this particular region and caused an undergrowth of grasses; hence the desire to find the natural conditions under which the insect lives. The young began moving, and, finding these open places, congregated there. Having thus congregated, they must naturally feed, and they swept the grasses clean around these spots. So noticeable was this that, in certain spots where they had gathered about the hills of a species of ant which raises mounds of small gravel and cuts away the vegeta-

tion for some distance half an acre. The such ease, by re

Dissosteira appearance to it in injurious numbers common in the Boise City, Idaho *spurcata* in his

Camnula p in parts of California very destructive territory. It al Valley of Minnesota the Prickly Pear in North Dakota Nebraska. It a species which re of any of our in our earnest atte though not mig locust, from the

Acridium c occasionally dev United States in in dangerous nu north as the nor

Dendrotettia while visiting W locust, I heard o some places enti working to the c some of the inse ination proved t only in the vicin year later this sp insect occurs in t ease and often le the least distur also exceedingly The eggs are laid square miles of f previous year.

Melanoplus the insect which has caused more combined. It is marked is this tra of Mexico in one is unnecessary. crease along our received from Mi and upon investig

tion for some distance around them, they had enlarged these areas in some places for fully half an acre. This year Messrs. Snow and Popenoe observed them flying southward with such ease, by reason of their long wings, that they resembled birds.

Dissosteira obliterata, Thomas.—Closely related to the above, and very similar in appearance to it, is a second species of these large, long-winged locusts, which was found in injurious numbers along with *Camnula pellucida* in Idaho last year. It was quite common in the Wood River country lying north of Shoshone and in the vicinity of Boise City, Idaho. One form of this species was described by Saussure as *Dissosteira spurcata* in his *Prodromus Aedipodorum*. This is not the *Aedipoda obliterata* of Stoll.

Camnula pellucida.—This is the insect which has occasionally been very destructive in parts of California and Nevada. It has since spread eastward into Idaho, where it is very destructive the present season, covering an area of at least 1,300 square miles of territory. It also appears in great numbers, with several other species, in the Red River Valley of Minnesota, North Dakota, and Manitoba. I also observed it abundantly in the Prickly Pear and Gallatin Valleys of Montana, near the mouth of the Yellowstone, in North Dakota, in portions of Wyoming, Colorado, and the extreme western part of Nebraska. It also occurs in the New England States and British America. This is a species which readily adapts itself to any new locality, being the most easily acclimated of any of our injurious locusts. When once domiciled, it is there to stay, and will require our earnest attention from time to time in the future. In fact I consider this locust, though not migratory, fully as destructive as the Rocky Mountain or true migratory locust, from the fact that it so soon becomes acclimated.

Acridium americanum, Drury.—This large, handsome locust is the species which occasionally devastates Yucatan, Central America, and Mexico, and even reaches the United States in injurious numbers along our southern coasts. It has also been known in dangerous numbers as far northward as the Ohio River, and occurs sparingly as far north as the northern States, but I imagine never reaches British America.

Dendrotettix longipennis, the Post Oak Locust of Texas.—During the spring of 1887, while visiting Washington County, Tex., to investigate a local outbreak of an injurious locust, I heard of a species that was attacking the oaks of that particular region, and in some places entirely defoliating them. On my way from the region where I had been working to the city of Brenham, we passed through the infested locality, and I obtained some of the insects in question, which were then in the larval stage. A careful examination proved the insect to be new and congeneric with a species heretofore collected only in the vicinity of St. Louis, Mo., and which also occurred only on oak. About a year later this species was described by Professor Riley under the above name. The insect occurs in two forms, long-winged and short-winged. The former flies with great ease and often leaves the trees in midday and alights in fields and other clearings; with the least disturbance it flies to the tops of the adjoining trees. The larvæ and pupæ are also exceedingly active and run over the branches and trunks of trees with great rapidity. The eggs are laid in the ground around the bases of the trees. An area of at least 50 square miles of forests was completely defoliated by these insects during that and the previous year.

Melanoplus spretus, Thomas, the Rocky Mountain or Migratory Locust. This is the insect which is generally referred to as the destructive locust of North America, and has caused more injury during the past 20 years than any dozen of the other species combined. It is this species which we most fear on account of its migratory habits; so marked is this trait that swarms hatching on the Saskatchewan have been traced to the Gulf of Mexico in one season. Its habits have been so frequently described that further mention is unnecessary. Suffice it to say that at the present time it is again decidedly on the increase along our northern boundary. During the present year reports of its injury were received from Minnesota, North Dakota, and Manitoba by the Department of Agriculture, and upon investigation I found these reports to be only too true. In Minnesota and Dakota

the authorities, ably assisted by the efforts of settlers, have been carrying on a vigorous warfare with marked results, which will doubtless save their crops from devastation next season.

Melanoplus atlans, Riley, the Lesser Migratory Locust.—This locust, which very frequently becomes very injurious on account of its excessive increase, is somewhat smaller than the Rocky Mountain species. It is also migratory in its habits, but to a much less degree than is *spretus*. In its distribution this insect is much more widely spread than the preceding, being common in almost all parts of our country from the Mexican boundary to the fifty-third degree of north latitude, and even beyond in some parts of the country. It is the species which most frequently does the locust injury in the New England States, much of that in our Northern States, and some in the extreme Northwest. It has also been known to become injurious even in the Middle or Southern States. In its distribution *atlans* appears to be more partial to hilly or mountainous country, and especially is this noticeable in reference to its appearance in destructive numbers. It also seems to prefer wooded or mixed country to the open prairie or plains.

As would naturally be expected from its wide distribution, this particular locust presents some variation in its size, color, and, to some extent also, its structure. At any rate there appear to be three well-marked forms of the species to be met with within the confines of North America.

Melanoplus devastator, Scudd.—A third species of the genus *Melanoplus* is the one that occasionally appears in destructive numbers in portions of California and the adjoining States. It is about the same size as the *atlans* just mentioned, and often does considerable injury to the crops of the regions where it occurs. Although this locust is known to inhabit almost the entire region lying to the west of the main divide of the Rocky Mountains and to reach even beyond in Montana and Colorado, it has never, to my knowledge, been injurious except in Nevada, California, Arizona, and Oregon. This species also occurs in two forms, viz., small and large, being the spring and fall broods as nearly as I have been able to decide from specimens in collections.

Melanoplus bivittatus, Say, the Two-striped Locust.—This is our common species of native grasshopper all over the country, and the one that so frequently becomes injurious in our gardens and about the edges of fields. It occurs from the Atlantic to the Pacific, and from the Gulf of Mexico to the Saskatchewan. Its increase in destructive numbers appears, however, to be confined chiefly to the regions lying between the Rocky Mountains and the Atlantic. This locust also appears to vary considerably in its size and colour. There are, however, two well defined forms, the one receiving the name *bivittatus* and the other going by that of *femoratus*, the latter occurring only northward.

Melanoplus differentialis, Thomas, the Differential Locust.—Next to the species just mentioned we frequently find a second species of our large native locusts appearing in destructive numbers. This latter species occurs in the Western and Middle States only, and here is very often known to become unduly numerous and destructive to both the field and the garden crops. It has been reported at different times to have been present in such numbers in portions of Illinois, Indiana, Missouri, Kansas, Iowa, and Nebraska. A melanic or black form is quite frequent in portions of Nebraska and Kansas, but otherwise it is quite permanent in its character.

Melanoplus ponderosus, Scudd., the Ponderous Locust.—An insect very closely related to the preceding is that known to the entomologist by the above name. It is a native of several of our southern states, and has on several occasions been a depredator of crops in portions of central Texas. As the name would imply, it is of robust form, and has a somewhat similar appearance to the *differentialis*.

Melanoplus femur-rubrum, De G., the Red-thighed Locust.—Last on the list of destructive locusts for North America north of Mexico, is herewith presented the one that

perhaps enjoys locust in all part circle to Central preceding, have any other one. species, *femur-ro*

After giving in the past to h country, it will r year, and to give then, let me say t states:—Alaban Kansas, Nebrask York. In fact, t ever heretofore f

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Finally, let r saves nine." In o hence—whether t thing and stamp recent work in th sistently. By the pans or hopperdo counties in the tw on wheat alone, t locust year, and d crops and the inj destroyed. With one species that h been sufficient to c the two Dakotas t favouring circum This we should ki

perhaps enjoys the greatest geographical range of all our species. It is the common locust in all parts of the country from the Atlantic to the Pacific and from the Arctic circle to Central America. Its devastations, while perhaps not as vast as some of the preceding, have been more frequent and have occurred at more localities than those of any other one. Like the *bivittatus*, *differentialis*, and several of our non-destructive species, *femur-rubrum* is a frequenter of rather low places and rank vegetation.

After giving these brief notes on the various species of locusts that have been known in the past to have been connected with the injuries from this class of insects within the country, it will not come amiss for me to say a few words about the subject for the present year, and to give my opinion as to the probable outlook for the coming year. Briefly, then, let me say that there have been received reports of locust injury from the following states:—Alabama, Mississippi, Texas, New Mexico, Arizona, California, Idaho, Colorado, Kansas, Nebraska, North Dakota, Minnesota, Iowa, Indiana, Ohio, Michigan, and New York. In fact, there have been more separate reports received the present year than ever heretofore from this cause.

Now a word or two as to the different species of these destructive locusts that are responsible for the injuries of the present year. In California the *devastator* is present; the *Camnula pellucida* is known to be unduly common in Idaho, Minnesota, North Dakota, and parts of the Rocky Mountain region; the Rocky Mountain or migratory locust is the one that is responsible for much of the injury that has been reported from the Red River Valley of Minnesota and North Dakota as well as in Manitoba to the north of the international boundary; *Melanoplus diferencialis* is the one that must receive much of the blame for Kansas and Nebraska injury, while in the states of Indiana and Ohio *femur rubrum* and *bivittatus* are the guilty parties. *Melanoplus atlantis* is present in injurious numbers in the Red River Valley along with *bivittatus*, *spretus*, and the *Camnula pellucida*. In Colorado and New Mexico for the first time *Dissosteira longipennis* has appeared as one of the injurious species of the country.

While all of these locusts, along with almost every other species of the group which is native to North America, are to be counted as injurious, the particular one that has been the dread of the whole country, and especially of the region lying between the Mississippi River and the Rocky Mountains, is the migratory species—*Melanoplus spretus*. This insect is now on the increase in a limited area on our northern boundary and across the line in the province of Manitoba. By continuing the prompt and energetic efforts that are being carried out by the populace and state authorities of the states of Minnesota and North Dakota we can be assured of success only provided the Canadian government will also see the advantage of co-operation at this time. This, let me state, is all the more necessary at this particular time, as all reports seem to indicate that at present this locust is not present in abnormal numbers in any other part of the entire country. A stamping out of the pest in this region might, therefore, forever give immunity from their further injury.

Finally, let me urge on the inhabitants of all infested regions that "a stitch in time saves nine." In other words, we do not know what the climatic conditions may be a year hence—whether they will be such as to favor the hoppers or not—so we should do the wise thing and stamp out the pest. This has been done time and again in the past, and the recent work in the north shows how very profitable is the warfare when carried on persistently. By the plowing under of the eggs laid last fall, and the use of the kerozene pans or hopperdozers in the destruction of the young locusts that did hatch, the twelve counties in the two states of Minnesota and North Dakota saved, by actual computation, on wheat alone, the sum of \$400,000. This, mind you, was in a year not considered a locust year, and does not take into consideration what was saved in the region in other crops and the injury that might have resulted next year had the hoppers not been destroyed. With every favouring circumstance, the comparatively few locusts of this one species that have thus far been destroyed the present year in this region would have been sufficient to overrun, at least calculation, the entire area of the state of Minnesota, the two Dakotas and Nebraska, along with portions of Iowa and Kansas. True, these favouring circumstances might never occur, but it is always best to be on the safe side. This we should know from our past experiences with this same insect.

"Native" locusts, while perhaps not to be dreaded equally as much as the species just spoken of, certainly can commit an equal amount of injury when size and numbers of the insects are taken into consideration. They cannot, it is true, get up and fly away to regions new, but they are equally rapid breeders, with favouring conditions. They can be destroyed equally as well, if not better, than can the Rocky Mountain species, on account of their local restrictions, even in the regions where found.

Mr. Southwick had noticed *Melanoplus femur-rubrum* flying to the tops of grasses towards sunset in the fields near New York City.

Mr. Osborn had noticed the same habit. He spoke of the great difficulty of estimating the damage done by grasshoppers. Some discussion followed upon this point by Messrs. Southwick and Atkinson.

Mr. Cook stated that *M. femur-rubrum* had been very abundant in Michigan for three or four years back, but that he had no difficulty in estimating the damage to oats. He thought that the outlook in Michigan was not at all serious, and considered that perhaps Mr. Bruner's prediction was too doleful.

Mr. Bruner stated that we cannot take any chances. The black picture is justifiable if we make people work to destroy the insects and the local species have it in their power to become serious pests.

Mr. Webster stated that *femur-rubrum* is the species which is doing the damage in Ohio. He had noticed a fungus parasite working to a considerable extent near Columbus.

Mr. Smith thought that Mr. Bruner's point that it is unsafe to predict comparative immunity on account of a tendency of farmers to shirk work was a very good one.

Mr. Cook stated that there was another side to be considered, for if the entomologists predicted danger and the farmers did no work and the plague did not come, the entomologists would be forever discredited.

Mr. Weed spoke of the cotton worm, and stated that where the planters were always ready with their stock of Paris green they were in condition to fight the worm whenever it appeared in numbers.

Mr. Webster thought it was always best to tell the truth and to frankly admit all inability to give valid predictions.

Mr. Fletcher was of the opinion that in all probability predictions can be made more confidently in the western country worked over by Mr. Bruner than in Canada and the region spoken of by Professor Cook.

CHILO SACCHARALIS IN NEW MEXICO.

BY C. H. TYLER TOWNSEND, LAS CRUCES, N. MEX.

On July 8, 1891, I found a considerable number of stalks of young corn on the college farm infested with a borer. The borer enters by a hole in the stalk a short distance above the ground, and bores down into the root. It makes its burrow exactly down through the centre of the stalk, and some go upward a considerable distance also. The infested stalks are easily known by the tassel and most of the top being entirely withered and white or yellow. Some stalks showed the work of more than one borer evidently, unless the same one had eaten out and then eaten in in other places. In several stalks the live chrysalids of the borer were found near the bottom of their burrows, in the root, about even with the surface of the ground. From these pupæ two of the moths were bred, issuing July 12th. Sorghum grown near the infested corn on the college grounds could not be found infested by the borer. The same borers were sent to the college from Eddy, New Mexico, with report of much damage to corn. In many cases on the college

farm the chrysalid larva was also found. Ones were found, and for the pupæ lodged

In discussing extent in Mississippi

Mr. Howard Southern states a pest to be feared w

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On the 30th of Mesilla, dug into the grubs had been found. The root of vegetation four. It was a burrow sixteen grubs were all about. It contained no roots of this manner: The an elongate white at the same time of this larva could be known of *Allorhiza* have been found on roots of grass or c

There is no doubt of grubs, yet the adult full of their grub

Ten of the adult two imagos of *A.*

Mr. Alwood's *nitida*.

Mr. Marlatt proved no general matter so as

Mr. Smith told on.

Mr. Popenoe of the species.

Mr. Marlatt

A specimen of 12th, 1891, on which I have seen here.

farm the chrysalids were found dead and decaying in the burrows in the stalks. A dead larva was also found some distance above ground in a stalk. More dead pupæ than live ones were found, and probably this is the result of irrigation, which makes it too damp for the pupæ lodged in the roots and engenders disease.

In discussing the paper Mr. Weed said that this insect damaged corn to some slight extent in Mississippi, and considerably more so in Louisiana.

Mr. Howard said that this species is spreading northward rapidly through the Southern states and has reached the southern border of Maryland, but that it is not a pest to be feared with the methods of careful cultivation in vogue at the north.

A NOTE ON THE WHITE GRUB OF ALLORHINA.

BY C. H. TYLER TOWNSEND, LAS CRUCES, N. MEX.

On the 30th of April, 1891, I had a spot of ground on Judge Wood's place, near Mesilla, dug into for white grubs. The particular spot dug into was selected because white grubs had been found in it before, although I was assured by Judge Wood that not a particle of vegetation, not even a weed, had grown on it for at least three years, and probably four. It was a bare spot in the back yard, and by digging over a square foot or two of ground sixteen grubs were secured, at from six to ten inches below the surface. These grubs were all about the same size, and apparently nearly full grown. The ground contained no roots of any kind, but their food habits in this barren soil were explained in this manner: They were left over night in a tin can in earth in which was also placed an elongate white larva about an inch and a half long that had been found in the earth at the same time with the grubs. The next morning nothing but the caudal extremity of this larva could be found; the white grubs had devoured it. If this carnivorous habit is known of *Allorhina* I am not aware of it. I know that some other Scarabæid larvæ have been found occasionally carnivorous. But *Allorhina* I had supposed lived only on roots of grass or other plants.

There is no complaint in this country of injury to roots of alfalfa or grasses by white grubs, yet the adults swarm in the summer and destroy much fruit, and the ground is full of their grubs.

Ten of the above grubs were placed in a jar of earth to breed. On July 24th, 1891, two imagoes of *A. nitida* were found in the jar on the surface of the earth.

Mr. Alwood stated that he had bred a dipterous parasite from the adult of *Allorhina nitida*.

Mr. Marlatt thought that this instance of Mr. Townsend's was interesting, but that it proved no general habit. He considered that the ground was probably rich in vegetable matter so as to afford food for the white grubs.

Mr. Smith thought that it would be interesting to know what the other larva fed on.

Mr. Popenoe expressed himself as surprised at the extreme south-western distribution of the species.

Mr. Marlatt then read a third paper by Mr. Townsend.

NOTES OF INTEREST.

BY C. H. TYLER TOWNSEND, LAS CRUCES, N. MEX.

A specimen of the Colorado Potato-beetle (*Doryphora 10-lineata*) was taken July 12th, 1891, on our common wild purple-flowered *Solanum* here. It is the only specimen I have seen here.

The Bean Epilachna is in full force on the college farm. All stages, from eggs to adults, found last of July. Some experiments in spraying with Paris green were tried. The results up to August 1st were negative, neither the insects nor the plants being killed. The solutions were purposely made very weak.

The latter part of July, 1891, the Bollworm (*Heliothis armigera*) was found in nearly every ear of corn in a patch on the college farm. They were of all sizes and colours, and were accompanied almost invariably by large numbers of Coleopterous (Elaterid?) larvæ, which seemed to work entirely independently of the worms, and bored all through the ripening kernels, doing much destruction.

A leaf-miner was found on the vine during June, 1891, but was not bred. It mines the substance from between the two skins of the leaf, and its gallery may be seen plainly, with its small grub at the terminus of it.

On the 15th of June, 1891, I found a rather large number of adults of a Rose Chafer (*Macrodactylus* sp.) on the leaves of the vine in the vineyard about a mile from this place. They had eaten the leaves very badly and were nearly all *in coitu*, but were found on only two or three vines. They soon afterward all disappeared.

A leaf-miner on the cottonwoods here (*Populus fremontii*) annually destroys the whole first crop of leaves on nearly every tree in the valley. April 30th, 1891, nearly every cottonwood presented a thoroughly blistered appearance, caused by the inside of almost every leaf on the tree having been entirely eaten out, leaving the blistered-like skins of the leaves alone on the trees. This appearance continued for a couple of weeks until the trees gradually put forth a whole new crop of leaves. The second crop of leaves was but little infested this year, though I am told that in some years they also are nearly destroyed. I was unable to breed this miner.

The vine-leaf hopper has been studied. Eggs deposited singly, last of April, beneath skin of leaf, marked by a minute globule of exuded sap. Hatched last of May or first of June. Kerosene emulsion on the young hoppers, diluted fifteen times, proved effective; I. X. L. compound only partially so.

Owing to a misunderstanding of one of the names in this paper a slight discussion on the habits of *Aleochara* followed.

Mr. Schwarz considered the larvæ of these beetles not to be true parasites, but simply predatory.

Mr. Fletcher had bred larvæ of this genus from puparia of the cabbage maggot, in which no holes of egress or ingress could be discovered, and considered them to be true parasites.

Mr. Schwarz said that Mr. Coquillett had noticed the larvæ of *Aleochara* enter the puparia of *Anthomyia*, and stated, moreover, that the beetle larva has no approach to the parasitic habitus.

Mr. Southwick mentioned the occurrence of mites upon *Scarites subterraneus*.

Mr. Webster mentioned the abundance of *Uropoda americana* at Columbus, on *Diabrotica* and a large number of other insects.

Mr. Alwood and Mr. Atkinson spoke of the abundance of beetle mites in their localities.

NOTES ON BLACKBERRY BORERS AND GALL MAKERS.

BY JOHN B. SMITH, NEW BRUNSWICK, N. J.

Blackberries are raised in New Jersey on a very large scale, and near Hammonton, in Atlantic County, several hundreds of acres are devoted to this fruit. After many trials the "Early Wilson" was selected by growers as the most satisfactory variety for size, flavour, date, and shipping qualities, and it forms the bulk of the crop. A few other

varieties are raised ately it adds to its and of all the va only is killed dov looked after.

I began my st berry in the early the canes had beg pests infested can

One of the cl *ruficollis*, or red-ne Its life history has nothing of any imp (Fig. 11) usually i how to get rid of i borer, because, tho a gall. If a gall involved in the gal early summer, Ma dance. The egg i thrust into the tiss the bud there sta larvæ were found. at the leaf axil, an every dead bud sh and very slender y

Usually they become well deve more than one egg often as many as t leaf axils may be i upwards in a cork Some are at that j nothing in diame reasonably stout. long circles around the cane and get gall forms. Oth canes will circle t the girdles not n trace of a gall appears over ever is perfectly traces sawdust and excr and also to dest instead of the g more prominent. In some cases, an exceptional. In have been found r berries may simp have seen beetles the cane is due, bark. Beyond th the gall formatio ting the galls ou is already practise

varieties are raised to extend the season; but the "Wilson" is the staple. Unfortunately it adds to its many excellent qualities that of extreme susceptibility to insect attack, and of all the varieties grown in New Jersey this only is killed down in a few years unless carefully looked after.

I began my studies on the insect pests of the black berry in the early part of the present year, before yet the canes had begun to leaf out, and found that all the pests infested cane or root.

One of the chief pests is the well known *Agrilus ruficollis*, or red-necked blackberry cane borer (Fig. 10). Its life history has been worked out by others, and I have nothing of any importance to add. The well-known galls (Fig. 11) usually indicate the position of the borer, and how to get rid of it is the question. I say the galls usually indicate the position of the borer, because, though there can be no gall without a borer, we can have a borer without a gall. If a gall be split the length of the cane it will be seen that the wood is not involved in the gall growth, but only the bark. The insects emerge from the canes in early summer, May 25 to July 10, the month of June being the time of greatest abundance. The egg is laid by the female at the base of a leaf stalk, and I believe it is not thrust into the tissue, but is simply laid at the base of the stalk or in the bud there starting. It was not until late in July that any larvæ were found. The first sign of their presence was a dead bud at the leaf axil, and where the stem was carefully examined almost every dead bud showed traces of having been eaten into, the minute and very slender young larvæ being found under the bark near by.

Usually they run up the main shoot; but where laterals have become well developed they often go into these, especially where more than one egg was laid in the same place. In neglected fields, often as many as three eggs may be found at a single point, and five leaf axils may be infested on a single stalk. The young larva bores upwards in a cork screw channel in the sap wood, until early August. Some are at that period only one fourth of an inch long and almost nothing in diameter, while others are half an inch in length and reasonably stout. Sometimes a larva will make only two or three long circles around the cane and then, while yet minute, will pierce the cane and get into the pith. Where this is done, no visible gall forms. Others, however, and usually those in large, stout canes will circle the stalk half a dozen times or more in succession, the girdles not more than one-eighth of an inch apart. The first trace of a gall I found in early August, when a slight ridge appears over every larval gallery, so that the course of the borer is perfectly traceable on a smooth stem. As the cane grows the sawdust and excrement in the galleries seem to swell and enlarge and also to destroy the vitality of the tissues around it, until instead of the girdlings becoming smaller, they really become more prominent, and the abnormal growth of tissue continues. In some cases, as stated, no galls appear; but this is somewhat exceptional. In raspberry I have not found the galls, while borers have been found not rarely. This indicates that some of the exempt varieties of black-berries may simply form no galls. I am the more inclined to believe this, because I have seen beetles in no small numbers in "exempt" fields. I believe, too, that killing the cane is due, not to the injury in the pith, but to the injury done under the bark. Beyond this, the history of the insect is well known; but I am not aware that the gall formation has been as fully observed. Of course the remedy is obvious. Cutting the galls out thoroughly in early spring and burning the cuttings is certain. This is already practised by our best fruit growers, and they are not much troubled. Unfortu

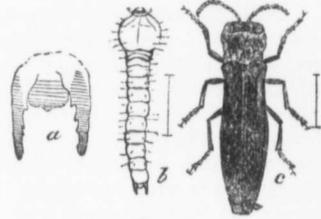


Fig. 10.



Fig. 11.

near Hammonton, N. J. After many experiments the best variety for the present is the "Wilson". A few other

nately there are many who seem unable to understand their own interests, and will delay cutting or refuse to burn. Some fields, too, belong to men of other occupations, and as they become unprofitable, they allow them to go to ruin and to become breeding places for all sorts of pests, fungus and insect.

Next in order, and indeed sometimes even worse, is the larva of a Sesiid, probably *Bembecia marginata*, Harr. The eggs of this insect, which I have not yet seen, are laid late in August or in September. The young larva hatches that same fall, and in the following spring is found in canes of the previous year's growth, boring only a short distance up from the roots. It is then less than half an inch long and of a faint reddish tint, which it loses as the summer advances. In July it leaves the cane on which usually no fruit has set, and attacks a new shoot, eating around the base and burrowing up between bark and wood. The shoot wilts, but the larva seems not to travel more until the following spring. It is then an inch long, white in colour, and with a brown head. It eats at the crown until the new shoots are large and vigorous, and early in July the wilting shoot in infested fields indicate the whereabouts of the larvæ. They pupate in August, one pupa newly formed being found on the 10th, and a number on the 23rd, but at these dates no imago was yet noticed. One pupa had wriggled out through the stem at the latter date, apparently ready to transform. The insect is important because it cuts two year's growth of infested hills. The remedy is also mechanical. It consists in cutting the shoots as they wilt close to the crown, and destroying the contained larvæ.

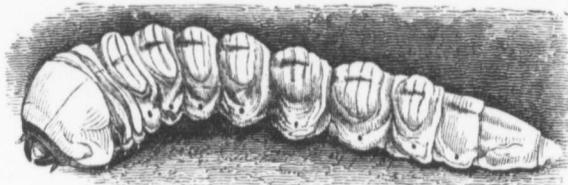


Fig. 12.

Sometimes in June a hill will suddenly wilt and die as if burnt. Search will in all cases reveal an enormous longicorn larva, (Fig. 12) which I make out to be that of *Prionus laticollis* (Fig. 13). In some old fields it is very mischievous, boring huge channels in the main root. I am not aware that this has been heretofore noted as infesting blackberries, and simply record the habit.

Another insect infesting growing canes escaped me during the present season because unexpected and unnoticed. In cutting some new shoots I found them marked, through the pith from base nearly to tip, a distance of three or four feet, by a larval channel. The new canes had been already topped a first time and I missed the culprit. In some fields not yet topped I found that the borer had emerged or had been parasitized, fragments only remaining, which seemed to prove it Lepidopterous. No apparent damage was done by the insect and none of the bored stems died.

A little gall on young shoots, found very locally only is formed by a *Cecidomyiid* very near to *Lasioptera farinosa*, if not identical with it. The young shoots are always trimmed out before the imago emerges in spring, and no damage is done. The larva is also parasitized quite frequently, and only a few imagos were obtained. The relations of the parasites to each other are still somewhat obscure, and one of the species may be secondary.



Fig. 13.

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AFTERNOON SESSION.

Meeting called to order at 4 p.m. by President Fletcher ; 29 persons were present.

THE SQUASH BORER, *MELITTIA CUCURBITÆ*, AND REMEDIES THEREFOR.

BY JOHN B. SMITH, NEW BRUNSWICK, N. J.

The most dangerous enemy to squash culture in New Jersey is undoubtedly this borer. Its life history is already fairly well known, and the question of remedies is the vital one. Those usually recommended have not proved eminently satisfactory in practice, and cutting out is still most generally relied upon. Summer squashes are badly infested, but have a large stout stem and usually mature a crop before the borers can kill the vine. Of the later varieties the Hubbard is the favorite, not only of the grower but of the borer. The missing links in the life history seemed to be in the egg stage, and these were carefully observed by me during the present season. I found in every case one or more eggs at the base of the plant, as near to the root as possible, and usually on the underside of the stem, *i. e.*, that portion of it resting on the ground. The moth evidently gets as near to the base of the plant as possible, and deposits her eggs as far towards the root as her ovipositor will extend. Rarely the egg will be found at the axil of the first or second leaf stalk ; but it is at such points that the insects rest at night. The egg itself is chestnut brown in colour, in form a flattened disk and of quite large size. The shell is quite hard and chitinous, but brittle. It is not readily pervious to the kerosene emulsion diluted 12 times, but is readily crushed. This stage is quite a protracted one, lasting at least 12 and probably often 15 days. The young larva when it leaves the egg moves off less than an inch and immediately enters the stem. This habit accounts for the ill success of the arsenical mixtures applied to the stem. The difficulty of getting all around it is great in the first place, and the larva eats so little that it has at least an even chance for escape. The kerosene emulsion might be more satisfactory but for the difficulty of getting the application on the under side of the stem. When the egg-laying habits were observed the experiment patch was examined, all the spare vines pulled up so as to verify the universal presence of eggs, and then with the fingers the bases of the vines were rubbed thoroughly. This was intended to crush the eggs, and it was effective. The process was twice repeated, and two or three larvæ only escaped. The other vines continued healthy and free to date. Where planting can be deferred to July the vines will be free from borers, and this is the plan adopted by some large growers. In small or garden patches, rubbing the stems of the vines near the base will prove effective and is a simple and cheap remedy. Planting summer squashes as traps and destroying the vines before the insects mature would also be a good way to avoid injury.

Mr. Riley asked whether Mr. Smith had tried the ordinary method of mounding the vines with ashes.

Mr. Smith said that he had not, and that he thought that this practice would simply oblige the moths to lay their eggs higher up the stalk.

Mr. Alwood said that he had found all cucurbitaceous plants quite resistant against the injurious effects of kerosene, and inasmuch as he had been successful against *Diabrotica* with kerosene emulsion, he thought that this substance would be available against the borer.

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a Sesiid, probably have not yet been discovered that same growth, boring about an inch long and finally it leaves the ring around the stem the larva seems to be long, white in colour, hoots are large and ate the where-being found on as yet noticed. Recently ready to be infested hills. They wilt close to

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Fig. 13.

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NOTE ON A COTTON CUT-WORM.

BY G. F. ATKINSON, AUBURN, ALA.

[Secretary's abstract.]

During the early part of July the author visited Greensboro, Ala., at the request of a cotton planter who complained that great damage was being done to the young cotton by worms. He found that an acre had been entirely stripped and had been plowed under and replanted. He found Noctuid larvæ at the roots of 20 or 30 of the plants, which he subsequently reared to the adult stage and proved to be *Agrotis annexa*. Experiments with Paris green seemed to show that this insect could be treated with this substance. He also found the same feeding on *Amarantus*.

NOTE ON A NEMATODE LEAF DISEASE.

BY G. F. ATKINSON, AUBURN, ALA.

[Secretary's abstract.]

This worm has been found by Dr. Byron D. Halstead affecting the leaves of *Chrysanthemum* and *Coleus* in New Jersey. It makes no swelling or deformity as do many other Anguillulids, but causes a brown patch upon leaves. Mr. Atkinson has determined this as a species of the genus *Aphelenchus*. He entered into some details as to the distinguishing characteristics between *Aphelenchus* and *Tylenchus*, and showed that this species is somewhat aberrant in the genus in which he has placed it.

Mr. Smith asked whether the characters of the genitalia are constant.

Mr. Atkinson replied that they are within generic limits, but that they do not differ with species except as regards the distance from the anal end of the body to the genitalia. Mr. Atkinson further stated that he thinks that these Nematodes reach the leaves by being borne up in the axils of the leaves as the plants grow.

Mr. Riley asked whether it was not possible that the young might work their way up the plants to the leaves during rain.

Mr. Atkinson agreed as to the possibility of this method, and further stated that he had received what he supposed to be the *Tylenchus tritici* or *scandens* of Europe, from grass in Colorado.

KEROSENE EMULSION AND PYRETHRUM.

BY C. V. RILEY, WASHINGTON, D. C.

In the *Rural New Yorker* of June 20th, 1891, Dr. Albert E. Menke, director of the Arkansas Experiment Station, criticises a review of Bulletin No. 15 of his station, published in *Insect Life*. The principal point raised by Dr. Menke is that kerosene extract of pyrethrum, made into an emulsion with soap and water, is entirely different from an aqueous extract of pyrethrum made into an emulsion with soap and kerosene, as recommended by Professor Gillette. He also disputes the statement that the idea of combining kerosene and pyrethrum was given him by Prof. Jerome McNeill. Prof. McNeill has experimented with both the Gillette and the Menke combinations, and in a recent communication he confirms the statement that he first suggested the combination of these two substances to Dr. Menke and gives the results of his experience as follows:

In preparing, in accordance with your directions, Dr. Menke's mixture, I used the proportions given in Bulletin No. 15 of the Arkansas Station. The extract of

pyrethrum was made. The resulting emulsion claimed it to be on proportion of soap. The emulsion was made. When Dr. Menke the two in appearance the application of Menke applied the mixture of the two I had used considerable number without further troubled my satisfaction a dilution of a given affected than the pyrethrum made in pyrethrum made in It may be of some and the kerosene extract two are absolutely extract emulsion is the idea that kerosene wanted to announce rum, could be combined. When I was assured mixture while work Menke claims to be its cheapness. It may be used in the Gillette's is inferior. The chief when compared with

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pyrethrum was made by simply digesting the powder in kerosene for three or four hours. The resulting emulsion is good, and it is about as effective on the Cabbage Worm as he claimed it to be on the Cotton Worm. Mr. Gillette's mixture I made with the same proportion of soap, kerosene and pyrethrum as the first mixture contained. * * * The emulsion was made in the usual manner, and then it was diluted with the kerosene tea. When Dr. Menke's mixture was diluted equally, there was no difference between the two in appearance or odor. In using dilutions of the strength, fewer worms survived the application of Mr. Gillette's solution, but the difference was immaterial, as when I applied the mixture without knowing which I was using, I could not always tell which of the two I had employed. Such in brief are the conclusions I have reached after a considerable number of experiments with the two. I shall not be satisfied, however, without further trial of these mixtures upon different worms. One thing that has disturbed my satisfaction with these experiments is, that in many cases where I had applied a dilution of a given strength to larvæ of different age, the younger larvæ seemed less affected than the older. Concerning the difference between an aqueous extract of pyrethrum made into an emulsion with kerosene and soap, and a kerosene extract of pyrethrum made into an emulsion with soap and water, there is no practical difference. It may be of some slight interest to scientific people to know that the aqueous extract and the kerosene extract are technically different. As far as their use is concerned these two are absolutely one. If there is any practical difference between them, the aqueous extract emulsion is preferable. I have never made any public claim to having originated the idea that kerosene would dissolve the insecticide principle of pyrethrum. What I wanted to announce the discovery of was, that the two insecticides, kerosene and pyrethrum, could be combined in an emulsion which would be more effective than either. When I was assured by Mr. Mally (an agent of the Division) that he had made such a mixture while working with Mr. Gillette, my personal interest in the matter ceased. Dr. Menke claims to have discovered an "entirely new" insecticide which is remarkable for its cheapness. I think I have shown that it is composed of the same materials which may be used in the same proportions, so that the difference between his emulsion and Mr. Gillette's is in method of preparation, and in this respect his method is decidedly the inferior. The chief difficulty in the use of pyrethrum in kerosene emulsion is the cost when compared with the cost of the arsenites in the form of powder or in solution.

* * * * *

Mr. Smith had tried the kerosene-pyrethrum combination according to Menke's formula, but had found it of no use against the Rose Chafer.

In response to a question by Mr. Smith, Mr. Alwood stated that he buys imported powder for from 38 to 40 cents per pound at wholesale in New York. For buhach he has to pay 75 cents per pound and considers that one is as good as the other. He finds that he can keep the powder in bulk for two or three years, with care.

Mr. Webster stated that he could buy it by the 10 or 20 pounds in Lafayette, Ind., at 30 cents per pound.

Mr. Alwood stated that in his opinion this powder must be adulterated on account of the cost of production in Dalmatia.

Mr. Smith buys in Philadelphia for 25 cents per pound.

Mr. Weed had found kerosene combined with pyrethrum perfectly useless against the Harlequin Cabbage Bug. Kerosene emulsion is also ineffective against the same insect.

Mr. Alwood, however, had found it effective for this insect.

Mr. Weed stated that he had killed the plants but not the bugs. He has found the eggs of this insect to hatch in three days in Mississippi (first brood), those of the second brood hatching in two days, and those of the later brood in four days. These periods, however, are not definite, and considerable variation occurs.

Mr. Smith finds this species in southern New Jersey, but never upon cabbages.

Mr. Doran stated that the bugs can be caught upon Mustard before the cabbages are set out.

Mr. Weed said that he had experimented in that direction and recommended the application of pure kerosene upon the first brood of bugs upon Mustard.

Mr. Bronk had traced an attack of this Cabbage Bug from Kale to Cabbage, the Kale having been destroyed and but three plants accidentally left.

Mr. Osborn said that Mr. Gillette conducted his kerosene-pyrethrum experiments nearly a year before his results were published, awaiting confirmative evidence.

Mr. Riley said that the great efficacy claimed for these combinations of Mr. Menke and Mr. Gillette will not be borne out by further experiment. Against the Boll Worm his agents have not found them thorough antidotes.

The association then adjourned.

AUGUST 18, MORNING SESSION.

The Association was called to order by President Fletcher at 9.30 a.m. Thirty-four persons were present. The minutes of Monday's meeting were read and approved. On motion, a nominating committee, consisting of Messrs. Howard, Weed, and Bruner, was appointed.

WORK OF THE SEASON IN MISSISSIPPI.

BY H. E. WEED, AGRICULTURAL COLLEGE, MISSISSIPPI.

[Secretary's abstract.]

There has been no one great outbreak the present season. Last year stock was injured by the Screw Worm quite extensively, but the planters are now treating with carbolic acid washes and are lessening the damage. The Cotton Leaf-worm and the Boll Worm are the principal insect enemies of the State. The former is only just appearing and will not be destructive. The Boll Worm was injurious last fall owing to wet weather. *Egeria pyri* occurs abundantly in apple trees, but not in pear. *Hippodamia convergens* (Fig. 14) he has proven to be an injurious insect, as he has seen it feeding upon the leaves of cabbage. Moreover, he has poisoned with Paris green and killed the beetles. The Chinch Bug occurs in the western part of the State on corn. The cabbage crop is almost invariably destroyed by the Harlequin Bug and other insects. The Plum Curculio is very abundant upon peaches. Cattle Ticks (*Ixodes bovis*) are very abundant in the southern part of the State. The remedy in use is to feed the cattle equal parts of sulphur and salt continuously.

The question of the action of the sulphur was brought up by Mr. Fletcher and Mr. Marlatt, and Dr. Marx stated that the sulphur was eliminated by the sudoriferous glands, thus bringing it into contact with the ticks.

Mr. Smith considered Mr. Weed's experiments with Paris green against *Hippodamia convergens* not conclusive as indicating their phytophagic habit, as the beetles might have been feeding upon plant lice and thus have been poisoned by the Paris green.

Mr. Popenoe stated that he had found *Hippodamia* feeding upon rust spores.

Mr. Weed described the treatment of Cotton for the Cotton Worm by means of a long pole carried across a mule's back with a bag of Paris green hanging to each end of the pole. In this way four rows of Cotton can be treated at once with undiluted Paris green.

Mr. Webster stated that in Louisiana four sacks were thus strung upon a single pole.



Fig. 14.

Since the full many others, doubt no reports of its central Ohio. Dr. farm of Mr. A. F. on the backs and fly, true to its ins a few were found, were to be found. a fair opportunity seen at Columbus that it is spreading passes but a short indeed probable, t

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NOTE ON THE HORN FLY IN OHIO.

BY D. S. KELLICOTT, COLUMBUS, OHIO.

Since the full accounts of the Horn Fly given in *Insect Life* and elsewhere, I, as many others, doubtless, have sought for it wherever I had an opportunity. I remember no reports of its occurring west of the Atlantic border, but it certainly has a foothold in central Ohio. During the first week of July last I found it in great numbers on the farm of Mr. A. Freed, Pleasant Township, Fairfield County. Large patches were seen on the backs and about the horns. The animals referred to had been dehorned, but the fly, true to its instincts, congregated about the stumps. At Sugar Grove, 8 miles south, a few were found, whilst at Rockbridge, 4 miles farther down the Hocking Valley, none were to be found. There appears to be none north of the first-named station, as I had a fair opportunity to examine cattle at Lakeside (Licking reservoir). They have not been seen at Columbus. It seems from the limited observations I have been able to make that it is spreading southward from near Lancaster. The Baltimore and Ohio Railway passes but a short distance north of this place, and it is easy to see that it is possible, or indeed probable, that it was introduced by transportation in cattle cars from the East.

Mr. Smith stated that the Horn Fly was not injurious in any part of New Jersey last year, stockmen adopting the plan of spraying with fish-oil compound. He also stated that the plastering of the dung was practised in his State in small stock yards.

Mr. Howard said that even in large grazing fields this latter plan is often practicable in spite of the objections which stock-growers urge. At the time when the flies are ovipositing the cattle are generally congregated in some one spot for shade.

Mr. Lintner said that he heard of the fly in the southeastern portion of New York State.

Mr. Osborn said that there had been an unverified report of its occurrence in Iowa. He believes that the plaster treatment of the dung will be practicable in his State.

Mr. Fletcher said that many remedies which are considered impracticable by farmers prove eventually to be very practicable, and he instanced the poisoned ball system for cut-worms, and said that standing grain can be sprayed with knapsack pumps.

NOTES OF THE SEASON.

BY ELEANOR A. ORMEROD, ST. ALBANS, ENGLAND.

The Secretary then read the following, which was addressed to the President, Mr. Fletcher:

You pay me the compliment of suggesting that I should send a short report of my entomological work of this year up to present date. But though it would indeed be a gratification to me if anything I could mention should be thought of interest, yet I feel such a hesitation in submitting anything I can say to such a supremely well skilled tribunal as that of the meeting of the Association of Economic Entomologists at Washington, that I will rather endeavour to give, in letter form to yourself, some notes of what we have been doing, from which, if you judge fit, you could lay some points, with my best respects, before the meeting.

Paris green.—I think that I may now report the use of Paris green in fluid state (as a remedy for attacks of orchard caterpillars) as having thoroughly taken root in this country. It is not yet as widely spread as could be wished, but the very large amount of inquiry sent me during the spring and summer months as to the nature and method of application of the remedy gives me good hope that its use is extending.



Fig. 14.

We have nearly, if not entirely, overcome the clamour as to the use of a "deadly poison," and now I have rather to attend to the other side of the question and warn as to the necessities of care.

My correspondents are not without a sort of dry jocoseness in the matter, for having cautioned one inquirer that if he sprayed his gooseberries he had better have a large gooseberry pie made and *consumed* by himself and household as a proof that all was right, I presently received a donation of as fine green gooseberries as could be desired. Did he wish to transfer the experiment, I wonder? About effect of Paris green on leafage, one of my correspondents reports to me that in his plum garden (32 acres) he syringed twice with Paris green at a strength of 1 ounce to 10 gallons, using the "Gelair" sprayer. He did not begin until the plum blossoms fell, and had to syringe twice because of the badness of the attack, also because rain came. The syringing was very carefully done so that there was no observable dropping from the leaves, and on the 10th instant he wrote me: "I have an extraordinary crop of plums in consequence."

With regard to foliage of the sprayed trees, he says:

I find that the Pershore Egg Plum, Victoria, and Damsons, have their foliage quite uninjured and looking very healthy: but Czar and Rivers Early Prolific are decidedly injured, and New Orleans in a lesser degree. These are all the varieties I grow. Evidently some varieties of plums are much more easily injured than others by Paris green. (I.R.)

I hope, before preparing my next annual report, to obtain detailed information on this subject from various quarters, but I think the further observation of my correspondent (M. J. Riley, of Putley Court, W. Ledbury) well worth attention *here* until *we* are more experienced.

I syringed 60 acres of apple trees which were badly attacked by caterpillars, 1 ounce to 20 gallons, which seemed to kill the caterpillars, so that one naturally asks, why make it any stronger for plums? (I.R.)

But I find difficulty in persuading people to be moderate, as they desire a strong spraying to do all the work at once.

M. J. Riley further notes, relatively to effect of method of spraying, that last year (before we could procure proper sprayers) he had only common garden syringes; that he syringed "Damascenes," badly infested, with the same strength of Paris green now used with success on several kinds of plums, namely, 1 ounce to 10 gallons, and too much being put on so that the trees dripped, the lower branches were killed.

After our real difficulties, and the boundless and fathomless amount of damage and trouble predicted last year, it is a very great satisfaction to me to have trustworthy reports of the excellent state of foliage of trees properly sprayed last year, and also to find the greatly lessened amount of caterpillar presence which occurs compared to previous appearances where Paris green applications or banding have been *properly* attended to.

But I should be ungrateful and fail in proper thankfulness if I did not acknowledge that, for this benefit to British fruit-growers from the use of Paris green, we are indebted, I believe, primarily, to the exertions of our respected friend, now holding the distinguished office of Entomologist of the Department of Agriculture of the United States of America, and likewise to the careful working forward of the subject both in the United States of America and Canada, and for myself I am bound to say (and I hope you will permit me to acknowledge) that but for the efficient and kind help you were good enough to give myself and our Gresham committee, I greatly doubt if we could have pushed the subject to its present well-based standing.

Our Gresham fruit committee is doing good work by the investigation of the members being extended to all our noticeable injurious fruit attacks which they discover to be present. These are entered on at their meetings. Where the insect pest is unknown to them they forward it to me and I identify (or procure its identification) for them, and with the addition of their practical observations of life history, and means of prevention and remedy, added to what we find recorded, we make serviceable advance.

It would be very advantageous if we had more such committees, for the work is so

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This year we have been working up for one thing, the Raspberry Beetle, *Byturus tomentosus*. Fab., which Mr. C. D. Wise finds at the Toddington fruit grounds may be best got rid of by shaking down into bags moistened or sprinkled with paraffin.

The Raspberry Bug Caterpillar of the *Lampronia rubiella*, Bjerk., has also been greatly troubling raspberry growers by its injury to the young buds and sometimes in the canes. We hope by gathering the infested buds or neighbouring bunches of leaves in which the larva has pupated, and destroying these, to have forestalled much recurrence of next year's attack.

Plum Saw-fly has also made a slight, and Apple Saw-fly a very decidedly injurious appearance. I conjecture that the similarity (to general inspection) of the attack of the latter to that of the Codling Moth Caterpillar has caused it not to be generally noticed before, and I hope to be able to add some notes on the changes in appearance of the larvæ. In all respects of habits and appearance preceding pupation this Saw-fly larva agrees with such descriptions as I have access to of that of the *Tenthredo testudinea*, Klug (= *Hoplomampa testudinea*, Klug), but previously I find that instead of the head being tawny or pale chestnut, and little trace of colour above the caudal extremity, that the head is pitchy black, and there is also a pitchy black plate above the tail preceded by a cross band and a few small markings also pitchy or black.

We have traced this change by the observer (Mr. Wm. Coleman, of Cranfield, Beds.) watching specimens for me in natural conditions through their transformations. I think that if this change has not been noted it will be of serviceable interest to record it, as on first glance the variously marked larvæ appear to be of different species.

For prevention of recurrence of this attack I am suggesting lightly shaking infested trees over cloths sprinkled with some mineral oil, so that the caterpillars which are very fairly active should not escape. Plum Saw-fly has been only reported from one locality.

The bud-galls on Black Currant caused by the *Phytoptus ribis* or Black Currant Gall Mite have been present to a seriously destructive extent. We know of no remedy for this attack excepting use of soft soap and sulphur wash, or, as a preventive of spread, breaking off the bud-galls. We, however, have found this year that parasites are at work in the persons of Chalcids, which we have not yet identified specifically, and from some small amount of further observation I venture to hope that we may find a dipterous larva is also aiding us in preventive service.

I fear these simple matters may not be worth your attention, but I just mention them as a part of the work to which our fruit growers are giving careful attention.

The field crop insects pests have been very prevalent this year, and at this time we have just begun a heavy visitation at three places in the east of England of the larvæ of the *Plutella cruciferarum*, Zell (Diamond-back Moth as we call it). But I ought not to venture to intrude on your time more than with just two further observations.

One, that I find the distorted growth of heads of Tares (*Vicia sativa*) which I drew attention to in my fourteenth report is originated by the presence of Cecidomyiid larvæ. I found them present in large numbers, and have carefully figured the head and caudal extremity and likewise the anchor process, which agrees so minutely with that of *Cecidomyia leguminicola*, Lintner, that I am looking forward with impatience to the development of the imago. My special colleague in observation of this attack (Mr. A. Hamlin of Chellowes Park, Lingfield), has planned an arrangement in the open field by which the imagos when they rise from the soil will (according to all ordinary habits of insect procedure) be safely trapped conveniently for examination. I am sparing no pains also myself to develop the imagos, though I have not the opportunity to attempt to rear the larvæ in absolutely natural and undisturbed circumstances.

My other observation is regarding the *Hypoderma bovis*, the Warble Fly. We are still fighting ignorance and idleness and downwright knavery, which are the supports of

continuance of this attack; but I had the great satisfaction this summer of hearing from Mr. Bailey, the head master of the Aldersey Grammar School, Bunbury, Tarporly, Cheshire, that it was not worth while to give me a detailed report again this year, as for all practical purposes the attack was now stamped out in the district.

This gratifies me exceedingly. Some six or eight years ago, Warbles were described "as plentiful as blackberries" in the district, and, under the teaching of their admirably intelligent master, the boys, who are mainly sons of farmers and agricultural laborers, set themselves yearly to clear all the cattle they had access to of the maggots. I had yearly detailed reports of quantity killed, and now I can point to the district and to the satisfaction of the cattle owners as a proof of what can be done by the simplest hands where head and heart go to the work.

But now I ought not to add another word, and if there is anything in the foregoing pages which you think worthy of bringing before the distinguished Entomological meeting at Washington, it will be a great gratification to me. I should like much to be present myself, with the double pleasure of seeing many whom I know by their letters are kind friends to myself, and also learning much that would be of enormous benefit to me. (Torrington House, St. Albans, England, July 20, 1891.)

Mr. Southwick moved a vote of thanks to Miss Ormerod for her excellent paper. Adopted.

Mr. Osborn spoke of the great value of Miss Ormerod's work against the Warble Fly as showing how combination among workers can bring about almost entire immunity from this pest. Miss Ormerod's plan should be adopted in this country.

Mr. Fletcher also spoke highly of Miss Ormerod's work in this investigation.

Mr. Marlatt, however, stated that the plan of gathering the bots from the backs of cattle can only be practised in the East, where the cattle are domestic, and will not pay for the trouble in the West, where the cattle are wild and would have to be roped and thrown.

Mr. Fletcher thought, however, that the saving of hide value alone would pay for this trouble.

Mr. Southwick thought that it would be a very easy matter to rope and throw the cattle in the West, and considered that it would pay.

Mr. Osborn called attention to the fact that the majority of Western cattle are sent East and slaughtered so that the bots have no chance of maturing. He insisted upon the ease of stamping this pest out in restricted localities in this manner, since the flies do not migrate to any extent.

Mr. Kellicott stated that he had known the Warble Fly to be very bad in Oswego County, New York.

Mr. Lintner stated that it is not a general pest in New York State, but occasionally a local one. Mr. Lintner further stated that Miss Ormerod has proven the Plum to be less susceptible to the arsenites in England than the Apple—a remarkable fact and not at all in accordance with our experience in this country. This difference probably depends upon climate and upon difference in varieties.

Mr. Southwick suggested the reference of this question to the botanists.

Mr. Fletcher stated that the different varieties of plums show with him great difference in susceptibility to this treatment. He spoke of the great variation in the texture of the leaf and in other particulars in the varieties of plums. Much work must be done in this direction. He also mentioned the great susceptibility of the peach.

Mr. Alwood mentioned the fact that the addition of lime water to the arsenical mixture absolutely prevents the burning of the foliage.

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Mr. Cook had found the Bot-fly attack much less in cleared farms than in wooded ones. In regard to the arsenites, he said that an abundance of Aphids and consequent weakening of the vitality of the tree might make it more susceptible.

Mr. Smith suggested that the water referred to by Miss Ormerod might contain lime salts so as to make the application more innocuous. He stated that the chemical reasons for the prevention of injury to foliage by the addition of lime water are given in the appendix to his annual report of the present year.

NOTES ON THE RECENT OUTBREAK OF DISSOSTEIRA LONGIPENNIS.

BY E. A. POPENOE, MANHATTAN, KANS.

[Secretary's abstract.]

July 10 to 19 the author visited the northern part of Lincoln County, Colo., on account of newspaper reports of the stopping of trains by grasshoppers. He found a strip of country 16 by 25 or 30 miles in extent fairly covered with locusts, which proved to be *Dissosteira longipennis*, a western isotype of the eastern *D. carolina*. They were congregated especially in the boundaries of this area. The country is poor, and planted here and there to corn and sorghum, and there are occasional patches of garden vegetation. The season has been favourable and cool. The locusts are said to have come in swarms from the South last fall, and to have settled along the Big Sandy Creek in a patch two or three miles in circumference, in which they laid their eggs in great numbers. Upon hatching this spring the young spread outwards. At the time of his visit in the northern part of the strip the insects were in the last larval and pupal stages, with very few imagos. At the south line, however, the winged individuals were very abundant and flew like birds. The young hoppers had the habit of crawling up the side of buildings for a few feet, presumably for warmth. They were not strictly confined to roads, but travelled over bluffs and rounded hills, eating the buffalo and gramma grass. The winged individuals flew always to the south, but the others spread regularly outwards in all directions. The line of march was quite visible at some distance on the hillsides, and sheep-growers had to change the localities of their flocks. In marching, as a general thing, they preferred to follow the roads, moving quite rapidly, about one mile in six hours for six or eight hours in a day only. They are credited with all the destruction which has been done by all kinds of insects, and he thinks that they did but very little damage to potatoes and corn, although marching through the fields in great numbers. At the time of his visit they were marching through wheat fields in the same way, but since he left they have done some damage to this crop. Many dead ones were noticed in one locality, but no signs of parasitism were found. It is supposed that they were destroyed by hail. In his opinion the insect occurs generally upon low ground rather than upon high ground.

Mr. Bruner said that this species is very seldom found below 3,000 feet, or above 5,500 feet elevation. It occurs in Nebraska, Kansas, Colorado, Wyoming and north-eastern New Mexico. It preferably locates itself on the side of the hills or the upper portion of slopes where the vegetation is scattered. Its near ally, *D. carolina*, is found throughout North America following civilization in cattle yards, roads, and streets. He had also seen the dead locusts in one locality in eastern Colorado, and considered that they had been killed by hail.

Mr. Popenoe said that he had really found that they had stopped trains, but upon steep grades only and by greasing the rails.

Mr. Osborn has found this species in southwestern Kansas in the higher portions of river valleys and feeding upon the grass along the roads.

NOTES ON A CORN CRAMBID.

BY M. H. BECKWITH, NEWARK, DEL.

[Secretary's abstract.]

For three years the author had heard complaints in the southern counties of Delaware of an insect called by the people a "Cutworm." This year at the Experiment Farm at Dover many hills were destroyed by this insect which he had had an opportunity to study. The land was in timothy last year and planted to corn the present season. Large numbers of the larvæ were found, sometimes thirty in a hill, working around the outside of the stalk below the surface of the ground in silken galleries, but not boring into the heart of the stock. He had sent specimens of the moth which he reared to the Department of Agriculture and it had been determined for him as *Crambus caliginosellus*. He had tried Paris green, but does not know with what effect.

Mr. Smith had heard of a similar attack on corn in New Jersey. He advised the farmers to put on a heavy dose of kainit just after plowing and had heard no more complaints.

Mr. Osborn suggested that if the insect works like *Crambus exsiccatu*s plowing at the right time will prove affective.

Mr. Howard said that the insect was abundant in 1886 at Bennings, Md., and that the only remedy which he was able to suggest at that time was plowing immediately after harvest.

Mr. Alwood doubted whether kainit would act as well as the refuse salt from meat-packing establishments, which he had found to be a good cut-worm remedy if sowed before planting.

Mr. Smith recommended kainit because it is a fertilizer as well as an insecticide.

Mr. Alwood stated that kainit is a bad form of potash for tomatoes and potatoes.

Mr. Southwick said that his grandfather used to drop a salt herring into each corn hill as a preventive against Cutworms.

Mr. Beckwith said that he had applied a fertilizer and salt in Delaware for cabbage and thus prevented Cutworms, as he proved by a check experiment.

Mr. Alwood uses tobacco also in fertilizers as insecticides.

NOTES OF THE YEAR IN NEW JERSEY.

BY JOHN B. SMITH.

During the spring of 1890 the larvæ of the Clover-leaf Beetle, *Phytonomus punctatus*, appeared in great numbers and threatened to become seriously destructive. A fungoid disease opportunely attacking them, the vast majority were killed off before they were more than half-grown. Some few escaped, however, and the threat of injury was repeated during the spring of 1891. The numbers were not so great, however, and the fungus disease stepped in as before, destroying the larvæ before they had done serious injury.

Complaints of twig blight in apple were made early in the season, and on investigation two coleopterous insects were found to be concerned in it. One of these, the larva of *Eupogonius tomentosus*, bored through the centre of the new wood, or rather that

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made during the previous year, and killed the twig. The beetles appeared in June. The other was a small Scolytid, probably *Hypothenemus*, which made short galleries in the extreme tip of the twigs infested by the Longicorn larva. It is probable that this attack is secondary, and not made while the wood was sound.

Some discussion was had at our last meeting concerning the points of the tree attacked by the larva of *Saperda candida*. (Fig. 15.) This led me to observe carefully during the present season, and I find that while in quince the attack is almost exclusively at the base of the tree, in apple and pear, any part of the trunk and even the larger branches may be attacked. The larvæ are more numerous at the base, as a rule, but the other localities are not by any means exceptional. I know that no other larvæ were concerned, because I cut out pupæ and imagoes as well, and am certain of my facts.

Peach borers, the larvæ of *Sannina exitiosa* (Fig. 16), are now largely treated by mechanical coatings to the trunk. The favourite means is the one recommended by me in the bulletins of the station and at farmers' meetings. It is simply a thick whitewash with Paris green and glue added. I have never discouraged the use of other mechanical coatings, but have taken great pains to explain that no remedial results must be



Fig. 16.

expected; that the measure was protective merely. The use of paint, as suggested by Mr. Alwood, does not find favour, owing to a fear that injury may result to the tree.

Blackberry insects have been particularly observed; but as I have already described these, a mere mention here is all that is needed.

The Rose-chaffer, *Macrodactylus subspinosus*, has been less destructive than usual. My studies on this insect have appeared in bulletin form, and I need only emphasize here that all my tests of remedial measures were made in the field under ordinary field conditions, and that the results are such as would likely be obtained by a farmer employing them.

The Grape Flea-beetle made its appearance very early in the year, before even the leaves had made their appearance, and began eating the buds. I recommended collecting in kerosene pans early in the day, and this proved effective. About a pint of the beetles were sent me in grateful acknowledgment.

Root maggots have been very abundant, and onions have been most severely attacked. In some places the young sets have been completely destroyed. This pest is now pretty well distributed in the trucking districts around Philadelphia.

Aphides on orchard fruits, and particularly on apple, became very abundant during a three weeks drought near New Brunswick, and blackened tips everywhere caused serious alarm. A cold storm, lasting two days, broke the drought, and apparently checked the multiplication of the species. There was no further increase of injury, at any rate, and no other complaints reached me.

The melon vines have suffered greatly from attacks of Aphides, but still more from a bacterial disease. The damage done by the latter is quite usually attributed to the Aphides.

I have made some study of squash insects, more particularly of the "Borer" *Melittia ceto*, of which I have previously spoken. The Stripped Beetle, *Diabrotica vittata*, does not bother our large growers very much. When they seem abundant, they use lime or plaster on a day when there is a gentle wind, sowing it on broadcast. The beetles fly before it and are driven off the field. The next man takes up the work on his field, and so the beetles are driven off until they reach some unguarded field which is then usually injured quite seriously. *Epilachna borealis* has been very abundant, and



Fig. 15.

has eaten characteristic patches at the edges of the leaves. The insects made their appearance as soon as the squashes were well up, but did not begin mating or ovipositing until the middle of July. Larvæ were not found until August. This gives quite a long period for the mature insect. It is easily kept in check by the use of the arsenites.

The Corn Bill-bug, *Sphenophorus sculptilis*, appeared in large numbers in Burlington, Salem, and Gloucester Counties, and perhaps in other surrounding regions. The beetle drilled the characteristic holes in the young plants at or near the surface and thus destroyed many acres of corn. I advised replanting after a short delay, and the second crop of plants was undisturbed. The insect was a new one to growers, and its appearance in such numbers caused consternation. They were most numerous on old sod, but by no means confined to such land.

Diplosis pyrivora has been complained of as an injurious species for the first time. It has reached Newark, Montclair, Elizabeth, and Paterson, so far as my information extends, and has probably been in some orchards for at least three years. Where it first made its start in this State I have been unable to ascertain. The Lawrence pear is the one most generally attacked, in one orchard over 90 per cent. of the fruit being infested. From an examination of the infested fruit I believe the egg is laid in the ovary, or if not that, the young larva does not pierce the fruit, but follows the pistil into the ovary or seed chamber, the opening in this variety of pear being quite wide. In many cases also this same passage is used by the larva to leave the fruit where it remains sound and does not crack. This promises to be one of the most dangerous of the fruit pests.

Spraying fruit trees with London purple has been very generally practised in New Jersey, and always with most gratifying results. An unexpected result has been the destruction of the fungus on the pear which so generally disfigures varieties like the Bartlett. Fruit on sprayed trees is fine and clean, that on the others is spotted and clouded and of an inferior grade.

The Plum curculio has made a plum crop almost impossible in New Jersey. I made only one experiment myself during the season, spraying one tree with the kerosene emulsion, 1 to 12, once a week for six weeks. At the end of that period nearly every plum on the tree had from one to six larvæ, and I called the experiment a failure. Several growers who had a few trees only report a favourable result in spraying with the arsenites, and there seems little doubt but that a certain percentage of fruit can be saved in this way. For small trees of choice varieties I suggested cutting out the egg. This was done in a few cases with absolute success. It leaves only a trifling scar, no more than that of the original puncture, and is certain in effect. Of course this would not answer on a commercial scale, but for choice fruit in the garden it is not impractical, and might be used to supplement spraying with arsenites.

I have followed out my inquiries into the action of certain fertilizers as insecticides, and am more than ever convinced that in kainit we have a powerful agent for the destruction of forms infesting sod-land. Where this material is used before planting corn even on old sod, cutworms and wireworms will do no injury. In addition, I always advise fall plowing to give the winter a chance. Direct experiments in the laboratory show that Elater larvæ will die in soil that contains kainit, though it acts slowly and two weeks are required to produce a complete result. The experiments will be given in detail elsewhere.

Mr. Alwood, in discussing, said that he had recommended London purple against *Fusicladium* for some years.

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GOVERNMENT WORK AND THE PATENT OFFICE.

BY C. V. RILEY, WASHINGTON, D.C.

[Author's Abstract.]

The paper was based on a patent recently obtained by three parties in California for the treatment of trees by hydrocyanic acid gas for the destruction of scale-insects and other insects that injuriously affect trees. It reviewed at length the efforts of the Department in this line of investigation, and showed conclusively that this gas treatment had originated and been perfected by one of the agents of the Division of Entomology, who had, in fact, for the past five years, been carrying on a series of experiments in this particular line under the author's direction; that so soon as the treatment came to be recognised as of the greatest utility and perfected so that it was cheap and available to all needing to use it, application for a patent was made by the parties in question, and, in spite of an official protest from the Department of Agriculture pending the application, a patent was finally granted, as, under the law, the Commissioner of Patents has no right to consider *ex parte* testimony pending examination, even though offered by an officer of the Government in the interest of the public. The fact that the process had been fully described and recorded in official reports from the Department of Agriculture did not prevent the issuing of the patent. So valuable is this treatment considered that an effort has been made in southern California to subscribe the sum of \$10,000 to buy the right from the patentees. The author remarked that he personally had no hesitation in advising the orange-growers to pay no heed to the claims of the patentees, and that it would be wiser to combine to oppose them if suit were brought than to subscribe to give them an undeserved and valuable royalty.

His own conviction was that the patent was invalid and the certificate but a piece of paper carrying no absolute evidence of priority of invention; and it is greatly to be regretted that, through legal technicality or otherwise, it should ever have been granted.

The author mentioned other cases of this kind where, after years of labour and large expenditures on the part of the Department of Agriculture, valuable results had been obtained. In some cases they took the form of mechanisms, which were described and figured in the official reports; in other cases of mere discoveries. He said:

"There is nothing more discouraging to an officer of the Government engaged in original investigations, with a view to benefiting the public, than the efforts of various private individuals to appropriate the results, of which the foregoing case is an example. I have been engaged now for nearly a quarter of a century either as a State or Government officer in investigations, having for their object in the main the protection of plants and domestic animals from the attacks of injurious insects. Either directly or with the aid of assistants these investigations have resulted in some important discoveries of universal application, and I can say with pride that, though often urged to take personal advantage of such discoveries, I have in no single instance accepted a fee for information given, or received a dollar from any application of these discoveries, even where others have reaped fortunes. As a salaried officer my duty was plain, and I make the statement, without boastfulness and simply to emphasise the discouraging fact, that in every instance where the benefit to the public has been great, either the honour has been contested by private parties or else means have been taken by private individuals to control, through patent or otherwise, the discoveries for their personal ends."

It would seem that on this account the Patent Office should endeavour, in considering applications for patents for objects which the Government is already endeavouring to accomplish, to ascertain fully what the Government has done, as any other course will tend to pervert, discourage and neutralize all honest efforts made by other Departments of the Government for the public good. It would seem, also, that there is need of some modification of the law in so far as Government evidence is concerned.

Mr. B. P. Mann said that no patent can be held valid unless held by the inventor. The Government ought to get out a patent on the broad invention, and it could then prevent the present holders of the patent from using it.

Mr. Riley and Mr. Mann further discussed the subject.

The president announced that a reception, to which all were invited, would be held at Mr. Riley's residence, Sunbury, Wyoming avenue, at 7 o'clock this evening.

The meeting then adjourned.

AFTERNOON SESSION.

The meeting was called to order at 2.30 p.m. by President Fletcher. Twenty-eight persons were present. The minutes of the preceding session were read and approved. The committee on nominations reported the following nominations for the ensuing year:

For president, J. A. Lintner, of New York.

For first vice-president, S. A. Forbes, of Illinois.

For second vice-president, J. H. Comstock, of New York.

For secretary, F. M. Webster, of Ohio.

On motion, the report of the committee was adopted, the committee was discharged, and the officers named were declared elected. The name of George H. Hudson, of Plattsburg, New York, was presented by Mr. Lintner; that of H. A. Morgan, of Louisiana, by Mr. Weed; that of B. P. Mann, of the District of Columbia, by Mr. Bruner, and that of Miss M. E. Murtfeldt, of Missouri, by Mr. Riley. All of these names were ordered to be inscribed upon the roll of members.

On motion of Mr. Howard, seconded by Mr. Smith, it was resolved that the next meeting of the society be held at the place of, and two days preceding, the next meeting of the American Association for the Advancement of Science.

Mr. Riley read a paper entitled "*Dermestes vulpinus* and Tobacco," which is held for publication elsewhere.

Mr. Southwick stated that he had found *Dermestes* under the bark of a mahogany log in New York, and that it had entered this crevice for pupation after having originally fed upon some animal matter.

A NOTE ON PARASITES.

BY L. O. HOWARD, WASHINGTON, D. C.

The object of this brief note is to impress upon the members of this Association the fact that one cannot be too careful in statements for publication concerning the relation between a given parasite and its host.

The possibilities for error are very great, as a few instances will show.

In 1882, while studying the Army Worm at Huntsville, Ala., I noticed an Ichneumonid walking about a fence-rail over which the worms were swarming in countless numbers. The parasite was apparently excited, walked and flew from one part to another, occasionally lighted upon a caterpillar and brought her ovipositor into position. I captured her, and in my notes wrote "Found ovipositing upon the larva of *Leucania unipuncta*." Now it transpires that this Ichneumonid was *Bassus scutellatus*, and as the consensus of rearing experiments shows, the species of this genus are parasites of Diptera, and my inference was in all probability entirely mistaken. If the original observation had been published it would have been absolutely necessary for perfect safety to have detailed the circumstances in order that future students should not be misled.

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REPORT OF

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Recently a well-known entomologist sent to Professor Riley specimens of the common *Pteromalus puparum* with the record "Reared from the cells of a mud-wasp." From what we know of the habits of this parasite we may take it for granted that had the entomologist in question examined the cells of his mud-wasp he would have found specimens of some lepidopterous larva or pupa stored up as food for the young of the wasp and that from these stored-up insects the parasite had emerged.

Within the last few weeks specimens of a Chalcidid were received from a most careful observer and excellent collector, with the statement that they were reared from the eggs of a saw-fly deposited in a willow leaf. While I am not in the habit of discrediting any statement which this gentleman makes, and while I have learned by experience that his accuracy is something astonishing in this world of error, the fact remains that this parasite is plainly from the known habits of its near relatives an enemy of some lepidopterous or dipterous leaf miner, and that never under any circumstances would it have been an egg parasite. He had probably put his willow leaf in a pill box and had later found the parasites in the box. He did not examine the leaf carefully for traces of a leaf miner or he would never have sent in the record.

Where the parasite is reared from a gall or from a twig burrowed by some other insect it often happens that it is assumed to be parasitic upon the gall maker or upon the most abundant twig borer. Such an assumption should never be made without a complete statement of the facts and without the most careful examination of gall and twig, to see whether they were not inhabited by other insects either asinquilines or parasites, or in the case of twigs as perhaps unnoticed borers.

Instances like these might be multiplied, but this will suffice to indicate the absolute necessity, first, of extreme care in forming conclusions, second, of detailing all circumstances which may possibly have led to error. It is only by such careful work as this that we can ever arrive at proper conclusions concerning the group habits of parasites. Our present published records are full of errors and require a most careful sifting of evidence, which in many instances can no longer be obtained. The most heterogeneous and unlikely errors in many genera are published, and the discriminating work is of extremely slow accomplishment.

Mr. Fletcher stated that he had seen an Ichneumon ovipositing upon a glume of wheat upon which there was no insect.

Mr. Doran stated that he had reared a parasite from *Bruchus scutellaris*.

Mr. Howard stated that this parasite was probably an undescribed species of Mr. Ashmead's genus *Bruchophagus*.

REPORT OF A TRIP TO KANSAS TO INVESTIGATE REPORTED DAMAGES FROM GRASSHOPPERS.

BY HERBERT OSBORN, AMES, IOWA.

In accordance with instructions received July 24, to visit and report on grasshopper injury in western Kansas I started the following morning for Kansas and improved every opportunity on the way to learn of grasshopper injury. The following account is in advance of a report prepared for Dr. Riley. At Des Moines, where I waited a few hours for the Kansas City train, I went through a large number of Kansas papers, kindly placed at my service in the office of the State Register and Iowa Homestead, without, however, getting any information except assertions in some places that there were no hoppers in Kansas.

From a gentleman lately through Arizona, I learned of the appearance of considerable numbers in that Territory, and the expectation that these might be travelling east-

ward. At Kansas City I was equally unsuccessful, the only information received there being the statement of railroad men as to the occurrence of hoppers on the railroad in Colorado (the case investigated by Professors Snow and Popenoe), and of some in Arizona, along the line of the Atchison, Topeka and Santa Fe Railroad.

At Topeka I went first to the office of the State Board of Agriculture. The Secretary, Mr. Mohler, was absent, but the gentlemen present, Messrs. Longshore and Niswander, kindly gave me a full statement as to the information the office contained.

They receive reports from over 600 correspondents who are scattered over the entire State, the western portion being well represented. They assured me that not a single report had been received by them which mentioned injury from grasshoppers, and they were positive that no damage was being done.

At the newspaper offices I received similar replies, except that in the office of the *Kansas Democrat* I learned of a report that some damage had been done in Kearney County. As this report, however, was somewhat indefinite, I hesitated to make it the basis of a special trip to the extreme southwest part of the State, and Lawrence being so near at hand, I concluded to go there to see if Professor Snow had any recent information.

Professor Snow was absent, but his assistant, Mr. V. L. Kellogg, kindly gave me all the information he could. He said that they had heard nothing from the region that had been examined by Professors Snow and Popenoe in Colorado except that the winged insects were moving south, and he was sure that none of these had entered Kansas.

He also informed me that they had received information of injuries at Garden City, and showed me specimens of *Caloptenus differentialis* and *bivittatus* received from there.

This information tending to substantiate the report of damage in Kearney County, I decided to visit Garden City, and took the first train for that place. On the way I kept a careful outlook for any signs of damage, and improved the opportunity of occasional stops to collect specimens and inquire of residents as to the prevalence of grasshoppers. All answers agreed in denial of any unusual numbers of grasshoppers or of injury from them, and it was not till I reached Garden City that I learned of any damage. Here I was told that the alfalfa fields were being ruined, and it was only a short time after my arrival that I was in a field a mile from town where the conditions showed at once the state of affairs to be serious.

The alfalfa was badly stripped, the blossoms and seed entirely eaten up, and in many patches the stems were stripped bare of leaves, looking brown and dead.

The grasshoppers, mostly *differentialis*, with a considerable number of *bivittatus*, when rising in front of me as I walked through the field, formed a cloud eight or ten feet high and so dense as to hide objects beyond them. Here I noticed a number of grasshoppers dead from the attacks of parasitic *Tachina*.

From this field I went to another, owned by the same man, which was also well filled with grasshoppers, but the injury here was less, especially around the buildings, where a large number of turkeys were doing excellent service in killing the hoppers and at the same time adding rapidly to their own weight.

In a field of sorghum directly adjoining there was also considerable injury, but *differentialis* seemed scarce, while a bright green species, *Acridium frontalis*, Thos., was abundant and apparently the principal agent of destruction. This species was also noticed here and in other places occurring in great abundance on the wild sunflower so common on these plains, and the question arose whether this was not its natural food plant and its attacks on sorghum incidental.

The day following I spent the forenoon with Dr. Sabin, who kindly furnished a horse and cart and accompanied me in examining a number of farms within five miles of Garden City, where alfalfa fields and orchards were injured. I met and talked with a number of farmers who had suffered from grasshopper depredations, and the information received from them with what I gained by personal observation satisfied me that losses could be avoided by proper measures.

I learned that alfalfa was grown, and I p alfalfa fields showed free from serious in had been serious, es Some fields near the little damage, but st the fields.

Mr. Longstreet accompanied me on a tour of alfalfa fields, in all of which were entirely stripped of limbs. The alfalfa here a great many *Tachina*.

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I learned at La and that damage was slight as compared some damage to alfalfa *differentialis* I found made this fall and in localities, and prob

As this point c no report of damage on Road, in order to f points intervening, *Dissosteira longipes* this species occurred at Horace only in s future at least. Th finding any evidence in localities in the Sta reported, I returned examined, the spec this section.

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I learned that the same injuries extended farther west along the river where alfalfa was grown, and I proceeded from Garden City to Lakin, observing on the way that all alfalfa fields showed presence of grasshoppers, but that in some cases the bloom was still free from serious injury or destroyed only in patches. At Lakin I learned that injury had been serious, especially on the place of Mr. Longstreth, some two miles from town. Some fields near the river and occupying low land were noticed in full bloom and showing little damage, but still grasshoppers could be found in abundance by closer inspection of the fields.

Mr. Longstreth's son, being in town, drove me out to his father's farm, and accompanied me on a tour through his extensive orchard of ten acres, his oat fields and alfalfa fields, in all of which the damage had been serious. Many of the trees in the orchard were entirely stripped of leaves, and in some cases the bark had been eaten from the limbs. The alfalfa presented the same appearance as observed in other fields. I found here a great many dead grasshoppers, whose empty shells attested the activity of *Tachina*.

I was told by Mr. Longstreth that skunks were amongst the most active enemies of the grasshoppers, and he believed played an important part in reducing them. He had even seen one up in an apple tree catching hoppers on the limbs.

I learned at Lakin that alfalfa was also grown in the next county west, at Syracuse, and that damage was also reported there, but on reaching the place found the injury slight as compared with the other places visited. In fact, aside from one farm on which some damage to alfalfa and orchard had occurred I could learn of no loss. *Caloptenus differentialis* I found in some numbers, and there is little doubt that unless some effort is made this fall and next spring to destroy eggs and young they will multiply as in other localities, and probably by next season prove as destructive as in them.

As this point carried me into the westernmost row of counties in the State, and there was no report of damage farther on, I determined to cross northward to the Missouri Pacific Road, in order to follow up some rumours regarding damage from grasshoppers at some points intervening, and which, from the descriptions given, seemed possibly to be due to *Dissosteira longipennis*. No point where serious loss occurred was found, however, and this species occurred but sparingly at points between Syracuse and Tribune, and occurred at Horace only in small numbers, too few to cause any apprehension for the immediate future at least. Taking the Missouri Pacific, I passed through to Kansas City without finding any evidence of damage from grasshoppers, and as I could learn of no other localities in the State than in the three counties examined where such damage was reported, I returned to Ames, and will now proceed to a detailed account of the territory examined, the species observed, and the special measures needed to meet the outbreak in this section.

THE TERRITORY AFFECTED.

The damaged territory is quite easily defined and might very properly be said to coincide with the irrigated portion of the Arkansas Valley lying in Finney, Kearney, and Hamilton Counties in southwest Kansas. The entire irrigated district, however, is not equally injured and there are some fields much less damaged than others. The whole area covered extends with occasional breaks a distance of about fifty miles along the river and forms a strip from one to five miles wide but limited entirely to areas where irrigation has been practised, and within this limit is dependent upon the kind of crops raised.

The greater damage was observed at Garden City, though nearly as bad was seen at Lakin, and but little was found at Syracuse, corresponding as near as I could learn pretty closely with the length of time since alfalfa has been made a principal crop on the irrigated lands.

THE CROPS AFFECTED.

Alfalfa is the crop in which there is the most loss, but orchards are suffering badly and were they extensive throughout the district would very probably present the heavier loss.

The alfalfa crop is a very profitable one and easily grown with irrigation and has been very extensively planted, the fields devoted to it covering many thousands of acres.

The injury to this crop is of such a nature that I believe practical remedies may be adopted, and, as will be stated later, active measures should be adopted this fall and next spring.

THE AMOUNT OF INJURY.

The great loss this year has resulted from the destruction of the seed crop. In many fields this has been a total failure, and the loss may be considered as covering thousands of acres and involving many thousands of dollars. One man who had something over 100 acres in alfalfa considered that his loss amounted to about \$2,000. While he expected to cut and use the crop for hay, the damage had been such that the hay would be little better than after the seed crop had been secured, and he reckoned the full loss of the seed crop for the season. In some cases farmers were cutting for hay when they had intended to allow the crop to go to seed, and in this way were reducing the amount of their loss by the value of the crop of hay cut early over what the hay would be worth after maturing seed, the latter, of course, being much less valuable than the hay cut before seed matures. In many cases the farmers had been depending largely upon the crop of seed to help them out of debt, and the loss from the grasshopper injury falls heavily upon them.

THE SPECIES DOING THE DAMAGE.

The Differential Locust is, I think, chargeable with fully nine-tenths of the destruction, both in alfalfa and orchards, and the reasons for its increase in this section seem to be quite evident. The irrigated fields of alfalfa furnish it with favourite food in abundance throughout the year, and have given it an opportunity to multiply rapidly without exhausting its food supply.

The ditches which traverse the fields and possibly parts of the fields themselves furnish a most excellent location for the deposition of eggs, the ground being compact and for the most part undisturbed throughout the year. That the eggs are deposited in or alongside the ditches is indicated by several facts, though at the time of my visit the locusts, while pairing, were none of them ovipositing. In the first place, the greatest damage had occurred in strips on either side of the ditches, and only in the worst fields extends over the entire field; second, at the time of my visit the pairing individuals were quite evidently collecting more particularly in these locations; third, the testimony of those who seemed to have observed most closely agreed in placing the greatest number of young hoppers in spring along the borders of the ditches, a point which is clearly supported by the injured strips so plainly to be seen. No one whom I questioned had seen the locusts in the act of ovipositing.

The ditches contain no water during a large part of the year, and in fall the compact bottom, which doubtless affords more moisture than the fields in general, would seem an excellent place for the deposition of eggs, as well as the banks on either side. Judging by the habits of these and allied species in other locations it would be hard to conceive a more favorable place for the deposition of eggs, and it seems to me very probable that this, as well as the suitability and abundance of the food, may be considered an important factor in the rapid increase of the species in the last three or four years, an increase that has taken place directly with the cultivation of alfalfa by irrigation.

It would seem also that this habit renders the insect especially open to attack, and I see no reason why concentrated effort may not entirely prevent a repetition of the damage another year.

MEASURES RECOMMENDED.

The situation, it seems to me, is one deserving serious attention, but one which offers every hope for successful work, if the residents of the affected localities can but be induced to make a little effort at the proper time.

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The species in fields was *bivittatus* habits are so new mention, and I prove as effective

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Dissosteira Kearney, Hami in eastern Colorado inquire as to numbers, and future at least.

The injury for the present season is mainly past, as the grasshoppers are in large part mature, many already pairing, and the loss of the seed crop, the heaviest part of the loss, beyond repair. The effort, therefore, must be toward preventing the damage another year, and it seems to be very desirable that the Division should distribute to the people of this section a careful set of directions for their guidance this fall and next spring in working against the grasshoppers.

The means which appear to me from the inspection of the ground to promise most successful results would be as follows:

(1) To thoroughly break up the surface of the ground in and along the ditches before winter by harrowing thoroughly, cultivating or shallow plowing, thus exposing the eggs to winter weather and natural enemies.

(2) Wherever practicable, to flood the ground for a day or two at the time young locusts are hatching. I was told that the young hoppers were entirely unaffected by water, as they would crawl up the alfalfa stems and escape, and it is probable that sufficient flooding to accomplish much good in this region is out of the question. My only hope in this line would be in watching carefully for the time of hatching, and using the water before the hoppers had obtained any growth, and if abundant along the ditches, putting a little kerosene on the water.

(3) A use of the hopperdozer as early in the season as possible, when I believe the treatment of a strip eight or ten feet wide on each side of the ditches would destroy so large a part of their number as to prevent any serious damage. As I learned from a number of parties the hoppers are scarcely half grown when the first crop is cut, it would seem that immediately after cutting the first crop would be the best time to use the hopperdozer. The hoppers would be large enough to jump readily and the dozers could be run very easily. It would be difficult to use them at any other time than directly after a crop was cut, as the dense growth of alfalfa would obstruct their movement.

My strongest recommendation would be the urging of effort in breaking up egg masses before winter, and then in case locusts still appear in any number in spring to resort to the dozers at first opportunity. I believe active use of these measures will be effectual, with a cost but trifling compared with the value of the crop to be saved.

The information as to the species and the measures needed are covered very fully in your Bulletin on Destructive Locusts, and with some specific instruction regarding the treatment of ditches in this special locality would, I think, give the people of the district affected all the information necessary to protect themselves, and it would seem advisable to send a number of copies of that bulletin to the postmasters at Garden City, Lakin and Syracuse, to distribute to farmers who would make use of them, as well as to those whose names I will furnish for this purpose.

OTHER SPECIES OBSERVED.

The species next to *differentialis* that I should call most abundant in the injured fields was *bivittatus*, but taken alone its damage would have been insignificant. Its habits are so nearly like those of *differentialis* that I see no occasion to give it further mention, and I have little doubt that any measures adopted against *differentialis* will prove as effective against this species.

Still other species occurred, but seemed generally distributed, and so far as injury in the devastated fields is concerned need no mention.

THE LONG-WINGED LOCUST.

Dissosteira longipennis was taken in some numbers at all points visited in Finney, Kearney, Hamilton and Greeley Counties, and as this species has caused so much injury in eastern Colorado this season, I took rather special pains to note its abundance and inquire as to any destruction resulting from it. At no point did it occur in destructive numbers, and I should not look for any injury from it in these localities in the near future at least.

The moths increased in number from the time they were first observed until, by the 3rd of June, in the early evening, when the field lay between the observer and the sun, a perfect cloud of them could be seen hovering over the blossoms as far as the eye could reach. They would spring up from under the foot like grasshoppers in a meadow on a sunshiny day. It was also noticed that they were pairing freely at this time.

On the 24th of June an examination of 177 heads of clover taken from the field before mentioned showed 91 heads infested with the caterpillar of the moth as against 86 not infested. Many of the larvæ were full grown and some were spinning their cocoons. The hay was cut at this date. An examination the next day, June 25, of 48 clover heads taken from scattered bunches on the college campus, showed 8, or 16½ per cent., of the whole infested. Examining 42 heads from a different field, cut on the 23rd and 24th of June, only 3, or 7 per cent., were found infested.

The damage was done by eating into the young florets, and later into the seed vessels, causing the heads to dry up and the flowers to shell from the receptacles like chaff.

The larva is a small, greenish white caterpillar, with a dark brown head, about .25 to .30 of an inch long when full grown, many of them becoming tinged with red toward the hinder extremity as they approach the time of pupation. About the 24th of June the adults had nearly all disappeared, a few stragglers only being found by diligent search. Of a number of larvæ preserved in a breeding cage the first pupa was found July 14, but a visit the same day to the field before mentioned proved the second brood of the adults to have already appeared. An examination of dried bunches of hay left on the field disclosed some larvæ in the heads, which had spun their cocoons to pupate, from which it is concluded that the caterpillars can live in the cut hay for a considerable time if not hampered in their movements. An examination of the hay from the same field stored in the barn showed all the larvæ to be dead. A dead pupa was also found, but nothing living. There were no empty pupa cases found to indicate that any moths had escaped from the hay thus stored. It seems certain, therefore, that everything that was subjected to the pressure and heat incident to storage was killed. The remedy, then, for this pest, which has caused the destruction of probably 50 per cent. of the clover seed in the field observed, is to cut the hay soon after the first brood of larvæ appears, or in early June. The hay should be carefully cleaned from the field, so that no larvæ will find harbour in stray bunches which have not been gathered up. Scattered clover growing by the roadsides and in the fence corners should also be carefully mown at this time, and the heads at least disposed of in some manner to insure the destruction of the larvæ they may contain. This method can not but prove effective in reducing the second brood of the moths, and will also operate against the clover-seed midge *Cecidomyia leguminicola*.

The track of the larva is very uniformly from the base of the head upward, and the younger larvæ are almost invariably found near the base, and beginning their work on the florets there. It would seem, therefore, that the eggs are deposited at the base of the receptacle, and the larvæ upon hatching may begin at once upon the older florets. In working upward, roughly speaking, they usually form an irregular spiral track around the receptacle.

The delicate, white, silken cocoons of this insect are spun in the head among the dried florets, frass and bits of eroded but undevoured flowers so covering them with brown as to make them difficult of detection. The pupæ work their way entirely out of their cocoons and drop to the ground before bursting their pupa cases, which may be found in abundance on the ground from which a brood has just issued.

The second brood was observed pairing during the last week of July, and August 5 the larvæ were found in great numbers, one having at that time spun its cocoon preparatory to pupating. The rate of growth would seem to establish that there are three broods per year at Ames, and possibly, though not probably, four. [In advance from a forthcoming bulletin, No. 14, of the Iowa Experiment Station.]

STANDARD FITTINGS FOR SPRAY MACHINERY.

BY WILLIAM B. ALWOOD, BLACKSBURGH, VA.

(Abstract by Author.)

It is my desire to briefly present to this Association a matter with which doubtless many of your members are already familiar, and which I feel confident will meet the hearty approval of all the economic workers. At the Champaign meeting of the Association of Agricultural Colleges and Experiment Stations, held in November, 1890, I presented a paper before the botanical section, dealing with some of the newer forms of machinery used in fungicidal work, and pointed out the great inconveniences under which we labored from the diversity of styles and sizes of fittings and thread connections used in the various machines now offered by manufacturers. The subject was considered of such importance that a motion was carried to ask the sections of entomology and horticulture to unite with the botanists in appointing a conjoint committee, which should be charged with recommending to manufacturers such styles and sizes of connections and fittings as were thought to be most convenient in the practical work of treating injurious insects and the fungus diseases of plants. This committee, as finally organized, was composed of the writer, as chairman, Mr. G. D. Fairchild, assistant mycologist of the Department of Agriculture, and Prof. James Troop, horticulturist of the Indiana Experiment Station.

This committee issued a circular letter to manufacturers which met with a very general and cordial response from them. Nearly every one fully endorsed the ideas set forth by the committee, and most of the prominent parties agreed to carry out the committee's suggestions so far as practicable with the state of their business. By the time standard styles of fittings could be circulated among the makers of spray machinery the season of '91 was so far advanced that we could not hope to effect much change during the current year. However, now that interest and sympathy with this effort have been awakened, we believe that it is possible through united effort to secure all we ask in this line. While we are all aware that the members of this Association are in a large part station entomologists, it is also true that some very prominent members are not connected with station work; hence my reasons for bringing this subject before you for discussion. To any one who has had actual experience in field work the importance of better, and, I will say, uniformly standard sizes of fittings, can not be doubted, and to aid in securing this desideratum is the chief purpose of my paper.

I shall at an early date publish an illustrated circular dealing with the question of styles and sizes of fittings, which will give detailed information, both for the use of manufacturers and the special workers.

On motion of Mr. Smith, seconded by Mr. Lintner, it was--

Resolved, That the Association of Economic Entomologists heartily indorses the work of the committee from the Association of Agricultural Colleges and Experiment Stations, appointed for the purpose of consulting the manufacturers of spray machinery, with the end in view of securing the adoption of standard sizes of connections and attachments on such machinery.

Further, the Association of Economic Entomologists urges upon the manufacturers of this machinery the importance of acceding to the request of this committee. The Association requests the committee to publish its recommendations, with drawings and descriptions for the information of manufacturers and special workers, and to include in this publication a list of all manufacturers who have agreed to conform to the standard sizes.

Mr. Kellicott stated that in his opinion firms which will not comply with the request to manufacture standard fittings should be requested to furnish an adapter to their machines which will enable their use with the standard fittings.

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ENTOMOLOGICAL WORK IN CENTRAL PARK.

BY E. B. SOUTHWICK, NEW YORK, N.Y.

[Author's abstract.]

The work of the entomologists of the department of public parks is in the care of trees, shrubs and plants, under the directions issued by the president of the board of commissioners.

The work of removing the egg masses of *Orgyia leucostigma* was the first done in this department, when twelve men were employed to clean the trees, benches, walls, and stonework in the parks. The first autumn of our work we collected thirteen bushels of these cocoons and egg masses, leaving those cocoons that were apparently parasitized until the final cleaning. The large elms on the Mall were thoroughly cleaned with steel brushes made for the work, and each tree received a wash to destroy any insects that might be in the crevices of the bark. This work of collecting (and burning in the furnace) has been carried on each year as the force would allow, in this way keeping them in subjection. We now treat them in four different ways:

(1st) By hand-picking, of which bushels are each year taken from the trees with tools especially adapted for this work.

(2nd) By jarring the larvæ down with a pole, so arranged that a blow from a mallet on a projection placed at the large end of the pole will jar any down that may be on the branches. With a sudden blow most of them will fall to the ground, where they can be crushed.

(3rd) By poisoning the foliage with London purple, which is quite effective and used especially on very large trees that can not be treated otherwise.

(4th) By poisoning or spraying the trunks of large trees with an emulsion of petroleum and carbolic acid. This penetrates most of the cocoons sufficiently to kill the inmates, the disadvantage being that it kills the parasites too. This method is only resorted to when the egg masses are very numerous and we are short of help, and as a means of reducing the next brood. Large numbers of trees were so treated this season to arrest the late summer hatchings.

The next insect in abundance and destructive working was the Bag Worm, *Thyridopteryx ephemeriformis*. Whole portions of the parks were literally stripped of their foliage; many of the trees on the drives were nearly as bare as in winter. So abundant were they that the branches were strung with their cases, and with one push of the instrument prepared for collecting them, a handful of these cases would be taken. Four kinds of tools were made for this work, and the cases were collected and destroyed. In this way nearly twenty-two bushels have been collected and destroyed.

The *Datana* have always been abundant in the parks, and as many as fifteen pounds of caterpillars have been taken from a single tree. These are collected while massed, as is their habit, and then destroyed.

Hyphantria cunea is very abundant in our parks and has been destroyed by cutting down the webs as far as was possible. If the tree was too valuable, they have been twisted out with poles made especially for this work. In some cases spraying has been resorted to, but as this does not remove the unsightly web, the most practical thing to do is to remove the whole colony.

Clisiocampa americana has this year appeared in our parks for the first time, and in great abundance. The webs that appear on the trees before they are in full leaf can be easily removed, and in this way the finer trees can be protected. The eggs are also removed in the late autumn and winter, as they are very conspicuous.

Vanessa and *Grapta* sp. are sometimes very abundant, and are collected and destroyed as soon as discovered. *Cecropia* and *Eacles* are always abundant and on many of the smaller trees do much damage. These are hand-picked and destroyed.

Alypia octomaculata (Fig. 17) is one of our most troublesome caterpillars, the great abundance of *Ampelopsis* vines in the parks, and especially around it, covering "squatter sovereignty" houses, affords congenial food for its rapid propagation. In the parks the vines are twice annually treated with a solution of London purple, applied with a spraying machine. This is found most effective and the vines do not seem to be injured as easily as most plants by the arsenites.



Fig. 17.

Beetle is double-brooded with us.

The Elm Borer, *Zeuzera pyrina*, is getting to be very destructive with us, already twelve species of trees and shrubs are affected by it, and during the past year two men were kept during May at collecting the larvæ from broken branches. All branches as soon as detected in a weak or broken state are removed and the larvæ extracted. In very choice trees the limbs are carefully examined and where holes can be found bisulphuret of carbon is put in with an oil can and putty put over the hole. This is only resorted to in the case of rare trees and shrubs.

For scale insects the trees are washed with preparations and then cleaned with steel brushes, leaving all in fine condition. Many thousand trees and shrubs have in this way been put in fair condition.

A large number of poisons have been experimented with for *Aphis* and other insects, due notice of which will be given in reports soon to be published.

The spraying machine used by the department of public parks is a two-barrel machine manufactured by the Nixon Nozzle Company, Nixon, Illinois. This machine, to better adapt it for city work, has been entirely remodelled. A set of strong cast-iron wheels, with a strong axle, was first made, then a pair of strong easy springs, so as to make the tank less liable to jars. The tank was lined with zinc entirely, and on top of the tank was placed a well about a foot high to keep the liquid from flushing over. On the rear of the tank was placed a box for poisons, hose, etc., and on the front a box for coats, lunches, and collecting cases and bottles. On one side of the machine and running nearly to the horse's breast was placed the bamboo pole used to elevate the hose and on the other side long handled pruning shears. Thus equipped the men drive all over the city and are at any time or place ready for work at short notice.

Our parks comprehend nearly 4,000 acres, and are from one extreme to the other sixteen miles apart. The work with the present force and appliances is chiefly centred in the island parks and places.

SOME HISTORIC NOTES.

BY A. J. COOK, AGRICULTURAL COLLEGE, MICHIGAN.

Upon special request, I am very pleased to state the following facts regarding the early use of the kerosene emulsion and of the arsenites.

I used kerosene and soap mixture, as I then called it, successfully in 1877. I used very nearly the same proportions that I prefer now, heated it to dissolve the soap, and I

think made a perfect mixture, which has no record. Whether fully as in later years or not, I do not know. It was reported the fact that it did this to the world, and

As to Paris was the first to autumn of 1878. canker worms. T. Moth larvæ, and same year. Mr. canker worms, which he used with the reported the fact that it did this to the world, and belief in the matter that Paris got results of these experiments for the Adv. were remarkable. I treated a small great care to-day the first to suggest positively that it determine the fact it is safe to practice is properly

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As to Paris green, I believe my friend Hon. J. S. Woodward, of Lockport, N.Y., was the first to announce it as a specific against the Codling Moth, which he did in the autumn of 1878. He relates to me that he advised a neighbour to use it to destroy the canker worms. The neighbour observed that the trees treated were very free from Codling Moth larvæ, and Mr. Woodward divined the cause. I had a very similar experience the same year. Mr. J. W. Taft, of Plymouth, Mich., came to me in 1878 with specimens of canker worms, which he said were destroying his orchard. I advised Paris green, which he used with the same results that greeted Mr. Woodward's neighbour. Mr. David Allen reported the facts to me. I said, "Can it be possible that the poison has worked this double benefit? I will test the matter." Mr. Woodward had already announced his belief in the matter. In 1879 I made the first careful test and proved by a most crucial test that Paris green was not only a specific against the insect but safe to use. The results of these experiments were given at the Boston meeting of the American Association for the Advancement of Science, August, 1879. The results which I then secured were remarkable beyond what may usually be expected or hoped for. This was because I treated a small tree and took special pains that every fruit should receive the poison. As great care to-day will meet with the same success. Thus while Mr. Woodward was the first to suggest and announce this remedy, I was the first to prove and announce positively that it is both safe and effective. So far as I know I was also the first to determine the best proportion—1 pound to 200 gallons of water—and to show that it is safe to pasture in an orchard at once after the poison is applied if the application is properly made.

AN EXPERIMENT WITH KEROSENE EMULSIONS.

BY HERBERT OSBORN, AMES, IOWA.

The most satisfactory method of preparing the valuable kerosene emulsion is desired by all, and a comparative test made this season may be of interest.

The first was a preparation in which the formula advocated by Professor Cook was carefully followed, using the hard soap and not the soft soap formula, the materials while still hot being thoroughly mixed with an egg beater.

The result was that we had what appeared to be an excellent emulsion, but in a glass jar we could soon see a separation taking place, the white emulsified part rising to the top and the water or soapsuds gradually increasing at the bottom. This continued until there was about two-thirds or a little more of soapsuds and one-third or less of emulsion above it.

While this at first could be readily mixed again a day later, the soapsuds in the bottom had hardened into a jelly that when mixed with additional water would but incompletely dissolve and the clots included caused great inconvenience by clogging the nozzle.

The other preparation, made according to the usual formula for soap emulsion (the Riley-Hubbard formula), emulsified and remained fixed with but a very few drops of soapsuds gathering at the bottom, even after days of standing, showing that the proportions were such that the soap water and kerosene balanced each other. This thickened to a buttery consistence, but dissolved perfectly in water, and only a trace of oil arose to the surface when thus mixed.

A microscopical examination of the substance prepared by Professor Cook's formula showed the buttery mass above to be apparently a good emulsion, and the jelly-like mass below to contain scarcely any traces of oil globules. A similar examination of the second preparation showed in different samples as usual a uniform emulsion.

I conclude that in the first case I formed an emulsion, that is, the oil was broken into minute globules and these coated with a film of soapsuds so that they did not coalesce, but that there were such an excess of soapsuds that the emulsion separated therefrom and rose to the top.

It is evident, I think, at sight that the preferable preparation is the one which combines the proportions so that no excess of either ingredient results, for, as indicated, the hardening of the thick soapsuds results in clots and these interfere with spraying, while to skim off the emulsion and leave the mass below is a useless labor and loss of material.

In the Riley-Hubbard formula we have evidently the exact proportions carefully determined, and I feel obliged to recommend this formula when giving advice to those wishing instructions as to preparation of kerosene emulsion.

A NOTE ON SILK CULTURE.

BY PAUL WALLACE, LOS ANGELES, CAL.

[Secretary's Abstract.]

The author reviewed the attempts which have been made to raise Silkworms in this country, and stated that they had proven the entire adaptability of the United States to this industry. He stated that all that was needed to make it a success was either a bounty paid by the Government or an import duty upon raw silk, but to his own personal knowledge attempts in this direction were thwarted by the work of large silk manufacturers who were bitterly opposed to the establishment of silk culture in America. He urged that the Association should use its best efforts to foster a popular sentiment antagonistic to such efforts on the part of the manufacturers of silk.

Mr. Lintner, in discussing this paper, contended that there is no question as to our ability to raise good silk, but that it will not pay. He spoke particularly of the work of the division of entomology in experimenting in this direction.

NOTES ON A FEW BORERS.

BY G. C. DAVIS, AGRICULTURAL COLLEGE, MICHIGAN.

If we go on the principle that "every little helps," even though it be slight and incomplete, then perhaps a few notes incidentally picked up on our forest borers may be of some utility at this time. Dr. Packard's work on forest insects, so recently issued, is of inestimable value to the working entomologist, but by the reporting of the few observations we happen to make while at our other work we can make the volume still more complete and helpful. Perhaps the habits of some of these species may already be known, but as they have not been specially reported in this work, reference is here made to them.

From the maple was reared the Cerambycid borer *Acanthoderes decipiens*. It was found as a pupa in the rude chip case just under the bark. The cylindrical burrow made in its exit extended well in toward the heart of the tree and through quite sound wood.

Another Cerambycid, *Leptura proxima*, was found quite numerous in blocks of hard maple sawed from the tree the winter previous. The grubs were quite large, and it was

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thought that they would pass through the transformations that season, but it was not until a year from the following May that the first beetle issued. From the data given it seems that the borer must require two or more years to reach maturity.

In "Forest Insects" Dr. Packard mentions *Lyctus striatus* under the list headed "Found in rotten oak wood; not known to be injurious." We have quite recently found them issuing from a red oak floor in one of our college halls. The floor was laid two years previous to the time of this appearance, and the lumber was seasoned at that time. The beetles issued from the sap wood only, and probably were feeding there when the tree was sawed into lumber.

In order to learn more of their habits quite a number were placed in a glass jar containing a branch of green oak, one of dead oak, and a seasoned stick from the shop. The beetles preferred the latter when first introduced, and made themselves at home by boring a hole entirely through it diagonally the first night. Mating took place in a few hours after issuing and eight days later ovipositing was first noticed. Mating again took place before each egg was deposited. This seems essential, as a female was placed by herself immediately after mating the first time, and, although watched for several weeks after the others had died, no sign of ovipositing was noticed. The branch of green oak was preferred in depositing the eggs, and none were placed on the stick from the shop. Ovipositing occurred about once in half an hour and lasted but one day. One week after oviposition young larvæ were found. We are in hopes to get the complete life history from them.

From the oak posts of one of our summer houses were taken quite a number of *Phymatodes dimidiatus* along with *P. varius*. Four different kinds of wood—elm, maple, hickory, and ironwood—besides the oak, enter into the construction of the chalet, but none of the others showed signs of borers, while the oak was well perforated. The species seem to work mostly just beneath the bark.

Two specimens of *Alaus oculatus* were taken in the trunk of a white oak near the partially decayed heart. A full-grown larva of this was also found in the trunk of a "sappy" aspen.

On the 10th of June a piece of bark was torn from an aspen (*Populus tremuloides*) that had but recently died, and under it signs of insect depredations were quite evident. Upon further investigation the bark and wood were found to be almost entirely separated. Underneath, the wood was yet sound and quite green. Here were found galleries penetrating almost to the heart, and in them were found *Enchodes sericea* in the imago stage, although some of them were yet in the pupa case and nearly as soft and white as a pupa.

These beetles belong to the family Melandryidæ, which contains a number of quite diversified genera that in general live on fungi or under bark. As far as their habits are known those living under bark do not seem to be injurious as borers, and whether we can consider this species as merely working in decayed wood or as a borer in green wood can hardly be decided by this one instance. It is certain that the larvæ are capable of penetrating sound wood.

The beautiful little Buprestid, *Pecilonota cyanipes* was reared from the aspen. When found, June 9th, it was in the pupa state in the axil between the body of the tree and quite a large branch. So much had been eaten around the base that the branch was already dead. Mr. Harrington reports capturing the species on a dead willow stump, and Mr. Fletcher a specimen on a dead aspen stump in Ontario.

Galls made on branches of the willow, *Salix discolor* by *Agrilus torpidus* have been found quite common in certain districts near here, and in other districts was found *Saperda concolor* in galls equally as numerous. In no case yet noticed have the two been found in close proximity. The galls made by the Buprestid are an oval swelling of the live branch very similar to the one made by the Saperda. Inside there is a difference in the architecture of the home. While the Saperda remains mostly within the swelling and makes its exit through it, the *Agrilus* bores an oval gallery downward from the gall, sometimes in the pith, but oftener indiscriminately through the wood, and makes its exit often an inch and a half below. The imago issued about a month later than the Saperda.

From the Saperda galls were reared two specimens of parasites. One of these is *Pimpla pedalis* and the other belongs to the genus Bracon, which we have yet been unable to get named.

Galls on the willow also yielded us a few specimens of the handsome Sesiid, *Sciapteron tricincta*, as named by Professor Fernald. The galls did not differ in appearance externally from the others. Inside the gall a tunnel was made downward along the centre for an inch. The whole cavity was lined with a soft, delicate, though very strong, buff cocoon, and undisturbed in this silken bed the larva passed through its transformations to the moth.

From *Hylesinus acuelatus*, the Ash Scolytid, was reared a species of Bracon, pronounced by Mr. Ashmead as probably a new species.

From a species of trefoil, *Ptelea trifoliata*, was reared a species of the Tineid genus *Hyponomeuta*. Wherever the shrub was found the thin white web was quite common early in the spring before the leaves were out. These webs were always at the terminal portions of the green shoots. The caterpillars, entering the stalk usually at the terminal bud, would bore down through the pith some three to six inches in the shoots connected by the web. The larvæ seem to remain in the stalk only part of the time, but spend the remainder of the time above in the web. The twigs, of course, are killed down as far as the larvæ go, which greatly mars the symmetry and beauty of the bush. This habit of boring is probably a generic characteristic, as several European species are mentioned as having similar habits.

THE POPLAR GONIOCTENA.

BY A. J. COOK, AGRICULTURAL COLLEGE, MICHIGAN.

The past spring the poplars about the Michigan Agricultural College were seriously and extensively defoliated by a Chrysomelid beetle, *Gonioctena pallida* Linn. The larvæ were first found in early June, so that we did not have the eggs. The larva is much like the Elm-leaf Beetle in form and colour. The beetles appeared June 21. They are yellowish brown, except the eyes, epicranium, two horn-like spots, and a central oval spot on the posterior portion of the prothorax, the scutellum, two large spots, one on each elytron near the scutellum, two nearly as large rounded spots near the suture, and just posterior to the centre, three small spots along the lateral margins, and the entire underside of the body except a narrow margin, which are black.

The beetles came forth late in June, but we found no larvæ or eggs.

NOTES OF THE SEASON FROM SOUTH DAKOTA.

BY J. M. ALDRICH, BROOKINGS, S. DAKOTA.

Cutworms have been more injurious than ever before. From limited data, I judge that the loss in the State reaches several millions of dollars. Corn, flax, gardens, and other crops suffered about in the order mentioned.

At our station the large Willow Sawfly (*Cimbex americana*) is much less injurious than for several years. I have reared six or seven species of parasites from it, four of them being numerous.

The Cottonwood Leaf Beetle is with us in large numbers, as usual. Our experiments in spraying with arsenites for this insect are more successful than heretofore, and I now feel confident that it can be controlled (though not exterminated) by this method. Our new Russian poplars, so desirable in other respects, are chosen by the beetle in preference to cottonwood.

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Gooseberries have suffered from a combined attack of the Spanworm (*Buflitchea ribearia*) and the Sawfly. I have not observed the latter in our State till this year.

The Ash Borer (*Trochilium fraxini*, Lagger) is still increasing rapidly, and will probably destroy most of the ash trees in the neighbourhood of the station in two or three seasons more. The Ash Sawfly and the Sphinxes (*Ceratomias*) are assisting to a noticeable extent. The ash is a bad investment in our locality.

In May the station procured five colonies of bees, aiming merely to see what they would do, with ordinary care, in a region devoid of natural timber with its accompanying honey plants (the nearest is five miles away). We have now increased to ten strong colonies. I have taken off 35 pounds of fine honey, and shall probably get 100 pounds or so of fall honey. Considering that the original swarms were weak, I think the record good so far. Of course the winter will try them.

A building 16 by 32 was erected this year for our department. It has a wing 12 feet square for bees. In the main part we have an office and a small breeding room. We moved into the new quarters July 1.

A NOTE ON REMEDIES FOR THE HORN FLY.

BY WM. B. ALWOOD, BLACKSBURG, VA.

This plague to cattle, which has now become so common throughout several of the Atlantic coast States demands attention from workers in economic entomology. Doubtless some very good recommendations have been made by Dr. Riley, Professor Smith, and others, but as conditions vary we are bound to treat such questions from the standpoint of local practicability. The recommendation to lime the droppings when practical may prove a very good way of dealing with this pest, but with me it is quite impractical from the fact that lime is neither cheap nor easy to procure, and this is the case in many parts of Virginia.

Some two years since, from a suggestion of mine in a lecture at Charlottesville, Va., the late Henry M. Magruder began the use of kerosene emulsion on his dairy cattle. The application was made with a Japy knapsack pump, and though it had to be repeated with frequency, proved a considerable success. During the year 1890 I frequently recommended this remedy, stating that the standard emulsion (Hubbard formula) should be diluted ten to fifteen times.

The Horn Fly did not become troublesome at our place, which is in the upper mountains of southwest portion of the State, until late in 1890, and I did not as a consequence, have opportunity to treat this insect myself. However, the present year they showed themselves in abundance in July, and I concluded to try my own recommendations.

The experiments were made upon ten dairy cows, beginning with plain emulsion diluted ten times. I found that this killed a majority of the flies actually wetted with it and produced considerable immunity from attack for the space of one or two days. Desiring to make the treatment more effective, I used as diluent a water extract of tobacco waste, made by thoroughly boiling one pound of tobacco in each gallon of water. This used with emulsion, 1 to 10 parts, gave almost perfect immunity for a period of three days.

My work shows that two treatments with this preparation per week almost entirely relieve the cattle from annoyance. I make the application with a knapsack pump fitted with a cyclone nozzle. The work is most conveniently done just after milking in the morning. Two men treat the cows rapidly, requiring about one minute per cow, and using from one to two pints of liquid. The preparation as given above causes no particularly unpleasant odor, and thus far the milkers have made no complaint whatever concerning its use on cows.

The President announced that he had received letters of regret from Mr. J. H. Comstock, Mr. C. W. Hargitt, Mr. H. Garman, Mr. C. P. Gillette, and Mr. C. H. Tyler Townsend.

On motion of Mr. Alwood, seconded by Mr. Smith, it was resolved that Mr. Riley be requested to publish the proceedings of this meeting in *Insect Life*, and on motion of Mr. Smith, seconded by Mr. Bruner, the Secretary was instructed to send an abstract of the proceedings to the *Canadian Entomologist*.

On motion of Mr. Southwick, the Association passed a vote of thanks to Mr. Riley and the members of his office force for the courtesies to members during the meeting of the Association.

On motion of Mr. Osborn, a vote of thanks was extended to the President for his able efforts to make the meeting a success.

The Association then adjourned.

L. O. HOWARD,

Secretary.

Just after the adjournment of the meeting the following communication was received from Mr. Snow, one of the vice-presidents of the Association, which, although it can not properly be incorporated in the minutes, may be properly appended here:

THE CHINCH BUG DISEASE AND OTHER NOTES.

BY F. H. SNOW, LAWRENCE, KANS.

In response to your circular letter asking for notes of work done in economic entomology during the past year I beg to submit the following brief and incomplete account of the work done in Kansas this year under my direction in the matter of the artificial dissemination of a contagious disease or diseases among chinch bugs:

The legislature of the State of Kansas at its last session in the winter of 1890-'91 made an appropriation of \$3,500, available during the years 1891-'92, for the purpose of carrying on these experiments. With this money I have been enabled to largely increase the facilities of my laboratory and to conduct on a rather extended scale practical experiments in the field. According to a provision in the act of appropriation, I am required to make a monthly report to be printed in the official State paper of Kansas, the *Topeka Daily Capital*. From my last report, made on July 15, I quote as follows:

Since making the last report, June 15, the wheat has ripened and mostly been harvested. The chinch bugs at harvest time left the wheat fields and invaded the fields of young corn. The experiments of 1889 and 1890 were carried on among bugs in the corn fields, and the experiments of this year in wheat fields are thus new features in the work. The results have been gratifying, but the reports from this year's corn fields and the investigations of my field assistant, Mr. Hickey, show that the massing of the bugs in the hills of corn offers more favorable conditions for the successful workings of the disease than the usual conditions incident to the presence of bugs in wheat.

The hatching and appearance of the young bugs is a feature in the work added since the last report. It is with satisfaction that I note the evident communicability of the disease from old to young bugs by contact. The young bugs are as susceptible to the infection as the old ones.

The part of the State reporting bugs in the corn fields lies between 96° 30' and 98° 30' west longitude; or between a line drawn through Marshall, Pottawatomie, along the eastern boundary of Geary, Morris, Chase, and along the eastern boundary of Greenwood, Elk and Chautauqua Counties, and a line drawn along the eastern boundary of Jewell, Mitchell, Lincoln, Ellsworth, Rice, Reno, Kingman, and Harper Counties. This bug-in-

festated belt extends presence of the 30' line.

Up to date (to 1,700 applicants sent, owing to failure to get good have got dead but from my laboratory experiment has been evident that the disease is being (to July 15) have ever, reports are senters make no out.

Because of C. Hickey, an ir field agent. Mr Butler, Greenwood seventy-two per cent. of the seven fields, and verified.

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fested belt extends clear across the State from north to south. Scattering reports of the presence of the bugs are in from various eastern counties, and from a few west of the 98° 30' line.

Up to date (11 a.m., July 15) infected bugs have been sent out from my laboratory to 1,700 applicants. To several of these applicants second lots of infected bugs have been sent, owing to failure to use the first lot for various reasons, and occasionally because of failure to get good results from the first experiment. But as many, if not more, persons have got dead bugs from fields wherein the bugs are dying because of infection sent out from my laboratory as have received bugs directly from me. Each successful field experiment has been the means of establishing a secondary distributing centre. It is evident that the experiment of killing chinch bugs by infection with fungoid and bacterial disease is being given a trial on a large scale. The reports for the past month (June 15 to July 15) have been gratifying, in that they show a good percentage of success. However, reports are not made out as carefully as they should be, and worse, many experimenters make no reports. I desire to have a report on every lot of infected bugs sent out.

Because of the difficulty of getting careful reports from the field, I sent out Mr. E. C. Hickey, an intelligent university student doing special work in natural history, as a field agent. Mr. Hickey's last trip was through Chautauqua, Harvey, Sumner, Cowley, Butler, Greenwood, and Elk Counties, lasting from June 12 to July 6. He visited seventy-two persons who had experimented with infected bugs, and found over 80 per cent. of the seventy-two experiments successful. Mr. Hickey personally visited the corn fields, and verified by careful observations the statements of the farmers.

The laboratory facilities for sending out infected bugs have been largely increased, and all demands can be promptly met. Application for infected bugs received in the morning's mail are answered with bugs and directions on the noon outgoing trains. The work of scientific investigation in the laboratory is going on steadily and carefully. Inoculation experiments from pure cultures of *Sporotrichum* will be reported on next month. A feature of the work unnoticed previously in this report is the prevalence of *Empusa*, the fungus with which the first successful experiments were conducted. *Empusa* and *Sporotrichum* develop side by side in the infecting cages, and dead bugs sent in from fields where the bugs are dying show both fungi. At the close of the season I hope to present a full report of the laboratory investigations, which the brief monthly reports offer no space for. Prof. S. A. Forbes, the eminent State entomologist of Illinois, who has experimented in his laboratory on the development of parasitic fungi in insects and who early noted the bacterial disease of the chinch bugs, visited my laboratory last week. He expressed the hope that a series of field experiments such as are now being carried on in Kansas could be conducted in Illinois.

In closing, I may say that the outcome of the work so far this year is highly encouraging.

Since making this report the requests for infected bugs have grown much less numerous. The laboratory experiments have been carried on with more attention paid to bacteria. So far I have been unable to successfully infect bugs in the laboratory from pure cultures of *Sporotrichum*. The *Sporotrichum* grows readily on a medium composed of beef broth and Irish moss, and pure cultures are easily obtained. Other experiments with these cultures are necessary, however, to make this statement positive. *Empusa* will not fruit on the plates. It behaves very peculiarly. Long erect filaments are sent out strikingly different from the customary hyphae, but no spores are produced. As regards the bacteria, I am assured that the forms in my cultures are identical with Burrill's *Micrococcus insectorum*, two slides of which have been furnished me by Professor Forbes. This *Micrococcus* is found almost without exception in bugs which have died in the field and been sent in for examination. Another *Micrococcus*, larger and almost perfectly circular in optical plane, is often present in dead and dying bugs. Spraying experiments with fluids containing this *Micrococcus* give no successful results in infection.

I am not in position at present to make a full report of the season's work in the field and laboratory. This report I shall make late in the fall.

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Other injurious insects besides the chinch bug in Kansas especially noticeable this year were the Hessian Fly, in about the same abundance as usual. Much damage is annually done by this pest. The Wheat Straw Worm (*Isosoma tritici*) was reported from a dozen or more counties of the state in June. It occasioned considerable alarm and really did some damage to the wheat in central and western Kansas. I received reports of the presence of the worm from twenty-seven correspondents. It appeared in wheat which had been planted on stubble ground, though the state of affairs shown in one or two reports contradicted this general condition. One correspondent reports the worm in wheat planted on sod; another in a field of 40 acres new ground, only grown to wheat once before, plowed last fall and after the wheat had come up fed off so close that the field looked quite bare. The Wheat Head Army Worm (*Leucania albilinea*) was reported in June from a few fields. However, little damage was done.

An attempted grasshopper scare was put down by a little investigation. Grasshoppers were reported to be in immense numbers in eastern Colorado and overflowing into Kansas. I made a trip to the infested region and found the grasshoppers to be a local species (*Dissosteira longipennis*) which was in great abundance over about 300 square miles of country near Arriba, Colo. Of course, no danger to Kansas was to be feared from these locusts. Arriba is 70 miles west of the Kansas line. The limits of the infested area extended approximately from Limon 16 miles east, 9 miles north, 7 miles west, and diagonally southeast to Hugo, 15 miles. Within this area the two favoured grasses of the range, buffalo and gramma grass, were eaten to the ground. The swarms when visited (July 17) were almost entirely composed of pupæ. Reports agree that the eggs from which these swarms were hatched were deposited last fall by the locusts which flew into this area in August and September from the south. And by observations during my trip and by regular reports received since then I discovered that the locusts as fast as their wings were acquired were flying south. Whenever there was a favouring wind from the north the winged individuals would rise high in the air and fly directly southward, having massed in great numbers along the southern boundary of the infested area. When the wind was from the south, however, no flying would be indulged in.

The rate of progress of the army of immature locusts was northward at the rate of 9 miles in about two weeks; eastward at the rate of $2\frac{1}{2}$ miles in 12 days. Over the face of the country traversed by the hosts the ground looked bare and brown, owing to the almost complete destruction of the grass leaves. When the devouring multitudes were at work upon the grass the noise of the grinding of their jaws was distinctly audible as a well-defined crackling sound. About the station of Limon the hogs of the town were fattening upon the locusts, which also furnished food for turkeys, chickens and hawks.

ENTOMOLOGICAL CLUB OF THE A. A. A. S.

The Entomological Club of the American Association for the Advancement of Science, held its annual meeting at Washington, D. C., August 19-22, 1891, the President, H. Osborn, of Ames, Iowa, in the chair. This meeting was one of the most successful ever held both in point of attendance and interest; seven sessions were held, at which forty-two persons were present, the average attendance being twenty-two. The Entomological Society of Ontario was represented by its Vice-President, Mr. James Fletcher, of Ottawa. A full official account of the proceedings has been published in the October and November numbers of the *Canadian Entomologist* (1891) to which the reader is referred.

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THE NORTHERN MOLE CRICKET. (*Gryllotalpa borealis*, Burm.).

BY JAMES FLETCHER, OTTAWA.

The above-named and most interesting insect is I believe rare in Canada, as I have for some years endeavoured unsuccessfully to obtain Canadian specimens. Good luck, however, has at last favoured me. During the month of September last I was much pleased to find amongst several packets of "live-stock" sent in for identification, one containing a fine living female Mole Cricket. This was sent by Mr. W. W. Hilborn, who had caught it in his garden at Leamington, in Essex county, Ont. My correspondent stated that the insect was the first he had seen, and that none of his neighbours knew it.

Upon opening the box carefully an exceedingly active seal-brown velvety creature was seen to burrow down out of sight beneath the light earth with which the box was half filled. The contents of the box were then emptied into a tall glass jar, which I keep for the purpose of examining strange or refractory prisoners when they are first sent in. I at once recognized my visitor as the long looked for mole cricket, and my pleasure was much enhanced by finding it a far more beautiful and interesting creature than I had anticipated. The only way to understand the habits of insects properly is to study them in a living state, and the pleasure thus derived is so great that all who once begin this method of investigation soon become fascinated with it. The Mole Cricket seems to be easily domesticated, and I have now had this specimen in confinement for nearly three months in a glass jar in my office, and it is apparently in perfect health. From being nocturnal in its habits and passing nearly all its life beneath the surface of the earth, it is rather difficult to observe.

Its movements as it runs over the surface of the ground or over the hands are less insect-like than those of any member of that class which so far has come under my observation and remind one very forcibly of the movements of an otter. Its bright black eyes and the way it turns its head and looks up at you giving it a very animal-like appearance.

A few weeks after the arrival of the female another specimen was sent to me from the same locality, by Mr. George H. Mills, of Leamington. It had been found in a ditch which was being cut through a swamp, and it was stated that it had appeared to be perfectly at home in water, swimming with great ease. This proved to be a male but it had been injured in some way during its journey of 500 miles in the mail bag and died a few days after arrival. The Mole Cricket (Fig. 18) belongs to the order *Orthoptera*, which contains the grasshoppers, locusts, cockroaches, etc., and to the family *Gryllidae* or crickets. It takes its name from its resemblance in burrowing habits to the small mammal after which it is called. For these habits it has its front pair of legs similarly modified so as to especially adapt them for digging. They are certainly the most remarkable feature about this insect and deserve special attention. They are short, but exceedingly strong. The tibiae or shanks, which can be closed tightly into grooves on the thighs, are flattened and broadly triangular in shape, bearing on the lower edge four curved and hollowed claw-like projections, the outer two of which are distinctly articulated at the base. These digging "hands" are turned somewhat obliquely outwards like those of the mole, and this throws the tarsi or feet to the outside where they are attached to the shanks at about its centre. The feet are no less remarkable than the shanks; they consist of three joints, the first two of which are broad, flattened and claw-like, the first much larger than the second. These two joints lie obliquely in front of, and reach as far as the tips of the two articulated claws of the shanks, which undoubtedly strengthen them very much when in use. The third joint is small, oval in shape, and bears two weak, almost straight claws; this joint lies at the back of the first two and is almost hidden between them and the two corresponding claws of the shank. The other legs are comparatively weak and the hind legs are not formed nor strengthened as in other crickets for leaping, they are twice as long as those of the second pair; but are only slightly swollen.



Fig. 18.

The female which is larger than the male, is a little more than $1\frac{1}{2}$ inches in length from the front of the head to the end of the abdomen, and the antennæ and tail-bristles are each about half an inch more. The head is small, dark brown and moveable, the eyes oval, black and shining, and when the insect is alive the facets do not show by reason of their small size. Between these two compound eyes, but higher up, are two simple eyes or ocelli. Pro-thorax large and prominent and like the powerful fore legs which it bears is covered with a short velvety pile of a rich seal-brown with a golden reflection. The wing-cases are short, $\frac{3}{8}$ of an inch in length, pale gray, broadly veined with black, somewhat oval* in outline, with a deflexed outer margin, and lie flat on the back. The wings themselves are also small and lie folded up like a fan beneath the wing-cases, the tips exceeding them in length by about $\frac{1}{8}$ of an inch and reaching rather more than half way down the abdomen as two slender white bristles. The whole body is covered with a fine velvety down which is most conspicuous on the forelegs and the inner side of the shanks of the second pair of legs, there are also scattered over the body a few slender hairs $1\frac{1}{2}$ to 2 mm. in length, which are most abundant on the tail-bristles. The female does not chirp and has no ovipositor. She is distinguished from the male by having no notched nerve on the wing-covers and having the nervures more regularly arranged. The females, too, have only 7 segments to the abdomen while the males have 8.

The habits of this little creature are strictly nocturnal, and it is possible after all that it may not be so rare in Canada as is supposed. Prof. Comstock says "It is not a common insect, but occasionally it is found in great numbers in a limited locality. It inhabits nearly the whole United States east of the great plains, from Louisiana to Massachusetts."

It lives in light moist ground, near streams, burrowing beneath the surface and seldom coming out except at night time. Prof. J. A. Lintner says (Rep. VI. 1890, p. 150) "it burrows into moist earth to a depth of 6 or 8 inches by means of its front pair of legs, which are admirably constructed for digging. Its eggs are laid in these galleries in a tough sac, to the number of from two to three hundred, within a chamber scooped out for the purpose. Here it feeds on such roots of plants as may come in its way. Occasionally these crickets occur in large numbers, when they may become very injurious, destroying grass and garden vegetables, and in one instance they are said to have nearly ruined a crop of potatoes. Their chirp differs from that of other crickets in being a dull, interrupted, jarring sound, which has been compared to that of the goat-sucker. The song of the male during the warm nights of early summer has been described as 'a low, continued, rather pleasant trill, quite similar to that of the common toad but more shrill.' Mr. S. H. Seudder has written at some length on the chirp of the Mole cricket, in *Psyche*, for October, 1885, 1. p. 105-6. He has written its notes and has described them as a guttural sound like *grü* or *grèu* repeated in a trill indefinitely, but seldom for more than two or three minutes and often for a less time. It is pitched at two octaves above middle C."

The food of the Mole Cricket like that of the Field Cricket (*Gryllus*) seems to be both vegetable and animal. I have never, however, been able to see my specimen feed, and when worms or insects have been placed in its way it has shown fear, and either run quickly backwards or burrowed down out of sight, but Brehm in "Les Insectes" I, p. 448, gives the following of *G. vulgaris* the European species. The autopsy of a large number of *Gryllotalpæ* revealed along the whole intestinal canal, legs and antennæ, heads of ants perfectly recognizable. I easily kept some in captivity for several weeks in jars filled with mellow earth, and fed them with meal worms and mud worms, upon which they rushed eagerly, when presented to them with forceps." The Rev. J. G. Wood in "Insects at Home," says they relish raw meat.

The habits of the European Mole Cricket appear to closely resemble those of our Canadian species, and the following kindly translated for me by Prof. J. A. Guignard from Dr. J. Ritzema Bos's valuable treatise "Animals Injurious and Beneficial to Agriculture" (Tierische Schädlinge und Nutzling für Ackerbau, etc.) will give a clue to some points not yet observed with regard to our Northern Mole Cricket. There is a difference in the nature of the egg receptacle as stated by Prof. Lintner and Dr. Ritzema Bos.

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"Shape ungainly; feelers and testers (*palpi*) very long, as well as the tail-bristles. The forelegs are real digging legs and at first sight seem very much like the fore-paws of the mole. The thighs are broad and flattened, the legs likewise short and flat; bear inward five (*sic*) saw teeth. The joints of the foot are small; the foot is implanted on the outer edge of the leg and can be folded backwards. The two leathery fore-wings cover each other almost completely and the posterior wings only in part. The latter are mostly folded in the shape of a fan and lie on the back in the shape of two little tails. The *Gryllotalpa* is of a dark brown color."

"This insect lives generally in swampy ground containing some sand or clay, and besides in all kinds of soil rendered cohesive by much manure. Its occurrence is also local. It hibernates in a torpid condition; it leaves its retreat very early in the year. Its burrows may be found as soon as March, extending at a small depth under the surface of the ground. At the spot where the female intends to build her nest, the burrow slopes a little downward; the walls of the nest are hardened by pressure with the hard back, so that the nest can be extracted in one mass from the ground. The diameter of the nest is about 4 cm; the entrance is narrow and somewhat crooked. The number of the eggs varies usually from 200 to 250. They are not laid all at once; after having laid a little heap of eggs, the female leaves the nest and comes repeatedly back to it. The eggs are about the size of a rape seed, but are egg-shaped and yellowish. All the eggs in one nest are also not of a uniform size. One month after being laid they hatch; the young are at first white, but soon become brown above and dirty yellow beneath. On their emergence they are already of a shape similar to their mother's. The latter watches faithfully over her brood, remaining with her young until the last egg is hatched; meanwhile the nest is enlarged in size to make room for the growing insects, while at the same time new food is laid bare in the roots successively uncovered."

The young grow rapidly, and after the first moulting remain still under the care of their mother; they may then go out of the nest, but never to any great distance. They can only after the second moult do without the mother's care and begin their independent life. The third moult follows in October or November, they then bury themselves, still without their wings, in their winter quarters.

The fourth moult takes place in April or May next, when the wing cases appear, and after the fifth moult, in May or June, the *Gryllotalpa* attains its full size and has become an adult winged insect. From what precedes it follows that it requires a whole year for its evolution.

The *Gryllotalpa* lives in orchards, gardens, meadows, even in nurseries and woods, and is everywhere equally destructive. Generally it prefers dry ground to wet ground, without altogether avoiding the latter. It gnaws the roots of various plants, and not a single plant can be named which it does not attack; it does not even spare the roots of fruit or forest trees, though preferring herbaceous plants to the harder roots of trees. Consequently when the *Gryllotalpæ* are very abundant they do considerable harm. Witewaall, a skillful Dutch farmer, writes as follows on the subject: "In a vegetable garden the damage by the *Gryllotalpæ* was constantly very great; the owner paid his men a penny for every captured specimen. One day, after very hot weather, it rained heavily, so that the garden was partly flooded. When the water had been absorbed by the ground the men went on to a plot where cabbages were severely damaged by Mole Crickets. The plot was dug up, and on a surface of two-fifths of an acre there were obtained 1,400 full grown Mole Crickets.

"This insect burrows close to the surface of the earth, and in so doing raises somewhat the surface after the same fashion as the Mole. Young plants are thus raised out of the ground, and older ones also die when the Mole Crickets burrow amongst their roots. In vegetable gardens whole rows of peas in a bed are often seen to die suddenly as a result of the operations of a single individual. Over the nest all plants wither. In short this insect must rank as one of the most injurious, and the opinions of those authors who consider Mole Crickets injurious only on account of their burrowing and not on account of the injury they do by gnawing the roots appear to be quite mistaken. In such localities as Mole Crickets occur abundantly the roots are gnawed off to such an extent that plants can be raised up by the leaves."

Besides the above a great deal of interesting matter concerning these insects is to be found in Westwood's "Modern Classification of Insects." It is there stated that "of all vegetable food they prefer potatoes; but if raw meat were offered them they attacked it in preference to anything else with great greediness. Gould also states that he fed a Mole Cricket for several months on ants."

Remedies.—There would seem to be no doubt that where these insects occur, as is sometimes the case, in large numbers that they cause serious injury to crops. The best remedy would probably be poisoning the adults either by dipping slices of potato or raw meat in some mixture containing arsenic, as White Arsenic, Paris green or London purple, and then placing these in or near their burrows. In Germany, where they are often abundant, says Dr. Bos, "The best remedy is the destruction of the nests, preferably in June. These are sought for in spots where the plants are dead and weakly. The nest must be carefully taken out whole when its presence has been ascertained by the finger.

Flower pots with their holes plugged may be used as traps by burying them in the ground so that their edge be on a level with the burrows.

The insects pair in the spring, and in early summer they may be entrapped in glazed pots partly filled with water and sunk up to their edges in the alleys between the beds.

Pouring water in the burrows has also been recommended, and the Mole Crickets are then killed when they have thus been driven out, but I doubt the efficiency of this method, as the insect has more than one entrance to its retreat.

Finally, horse manure may towards winter be thrown into ditches between the beds of vegetable or flower gardens. The Mole Crickets like warmth; they can thus be enticed into the manure and then killed."

The figure (18) used above has been kindly lent to me by Prof. J. A. Lintner, and is the same as was used to illustrate the article cited in his Sixth Report.

NOTES ON JAPANESE INSECTS.

BY W. HAGUE HARRINGTON, OTTAWA.

My absence from Canada during the past summer interrupted my studies of our own insects, and has prevented me from preparing any paper upon them. I venture, however, to offer a few observations of a general character upon the insect fauna noted in my somewhat extended travels in the Sunrise Kingdom; my object being briefly to indicate wherein the fauna of that country more closely resembles, or differs from, that of Canada. Leaving out the many small islands which stretch far to the north and south, we find that the four large ones (Yezo, Hondo, Shikoku, and Kiushiu) which constitute Japan extend from 31° north latitude to 45° north latitude, or in other words, from the latitude of New Orleans to that of Ottawa; the capital, Tokio, (and Yokohama) being in the latitude of Cape Hatteras. This extent of one thousand miles from north to south affords room for much variation of climate, which is further greatly influenced by the Kuroshio or Black Stream (the Gulf Stream of the Pacific), and by other currents flowing along the coasts and between the islands. The country is also intersected by many mountain ranges, and has many lofty peaks, some of which are active volcanoes. The naturalist may find in a few hours' climb upon one of these mountains almost as great a range of vegetation as if he travelled to the northern extremity of the empire. As an instance of such changes in the flora I may mention that in a trip from the railway station at Gomba to the summit of Fuji-san the first four miles of our road ran through fine cultivated fields with a light soil composed largely of fine ashes thrown out by the volcano in past ages. Then from the village of Nakabata there was the same distance over a plain covered with wild grasses and flowering herbs, intermixed with shrubs and a few stunted

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trees, the soil composed more largely of ashes and getting coarser as we advanced, and with thinner vegetation. Then the ascent became more abrupt and we entered a wide belt of forest containing many varieties of trees, but none of large size. Further up there were shrubs, grasses, etc., many of them in flower and attracting many insects. A few species of plants went far up the ash slopes, probably to a height of 10,000 feet.

Although I do not intend to give lists of the insects or to enter into particulars regarding the dates and localities of those captured (a few of which I have brought for your inspection), it may still be convenient to refer separately to the members of the various orders.

Neuroptera; Pseudoneuroptera.—Walking up the Bund on the morning of the 12th of August, having just landed by sampan from the good ship Empress of India, I was at once interested in the number of dragon-flies, of two or three species, which darted to and fro along this fine promenade. The profusion of Odonata then indicated was noticeable throughout the country, and was doubtless due to the abundant opportunity for breeding offered by the wide-spreading rice-fields. These are always kept submerged, or at least partially so, and in addition there are numerous ponds and myriads of irrigation channels cutting the plains in all directions. Many of the species of *Diplax*, *Calopteryx*, *Libellula*, etc., were very handsome, and I much regret that I was able to bring back only a few examples, and these of the common species. The insects are called by the natives *tombo*, possibly from their hawk-like flight, as the name for the large kite which is so abundant near the cities is very nearly the same, viz., *tombi*.

Many other neuropterous insects were observed, with species closely related to those which occur in Canada, such as Caddis-flies, Laced-winged flies (*Chrysopa*), Scorpion flies (*Panorpa*), which were very common, *Chauliodes*, etc. Near Yokohama I twice obtained with sweeping-net several young specimens, about one-eighth of an inch long, of the curious larvæ (in shape like miniature stag beetles), of *Ascalaphus*, which is a relative of the ant-lions, but could not determine on what plants they had been, although I made a careful examination of the foliage. A species of white ant is quite abundant.

Orthoptera.—Of both terrestrial and arboreal grasshoppers (*Jap. Butta* or *hata-hata*) large numbers were observed. The former are especially numerous in the cultivated plains, and upon the grass-covered mountains and wastelands such as occur in the Hakone district. The name *inago* is given to a species which is known as the rice-locust, and which is reported to do serious damage to the principal crop of the empire. One very common, yet striking, grasshopper was a slim, bright green species, nearly four inches long when fully grown; the head being elongated and the antennæ flattened. The outline of the insect is that of a blade of grass and the insects are very difficult to see when they are at rest among the grass, even on a closely cut lawn. Some specimens (apparently a variety of the same species) had a row of white dashes along the wing-covers and frequented grasses with such markings upon the blades. Along the paths between the fields and on the grassy hills I saw great numbers of a very large robust grasshopper, resembling very much the big American species called *Acridium americanum*, but belonging probably to a different genus. These large voracious insects must devour an immense amount of vegetation.

Very interesting both in appearance and habits, were the numerous members of the katydid and tree-cricket tribes, the dwellers in the trees and shrubberies, whose notes were very often piercing and prolonged. One large species was very frequently kept in little bamboo cages by the natives, but I cannot say that its song was very pleasing, although there was plenty of it. A pair kept near my brother's house used to shrill for long periods each evening, producing a noise which I at first took for the running of some machine, so loud and monotonous was the prolonged strain.

Another conspicuous insect was a large species of Mantis (*Jap. Kamakira* or *toro*) which was quite abundant. I frequently saw them devouring grasshoppers and other insects. The curious insects known as walking-sticks were abundant, as in this country, upon oaks, etc., and looked much like our species in the immature stages, in which alone I observed them.

Of crickets (Jap. *koriji*) there were big fat fellows in scores under any heap of weeds or rubbish; and cockroaches (Jap. *abura-mushi*) scuttled about the houses, which are sometimes much infested by them.

Dermaptera.—In Canada this order is represented only by the small and very rare *Labia minuta*, which is probably known only to entomologists. In Japan, however, earwigs were very numerous and swarmed among dead leaves, etc., and especially along the beaches among the windrows of cast-up sea-weeds. Some resemble greatly in appearance our own rare little species and probably belong to the same genus.

Hemiptera.—The Japanese name for bugs appears to be the same as that applied to insects in general, viz., *Mushi*. The bug *par excellence*, that species which, in not very remote regions of this country, makes the wooing of sweet sleep often more of a necessity than a luxury, is said to be unknown in Japan, and I certainly did not meet with it in any of my travels either on land or water.

The ponds and ditches contained water-bugs very closely resembling our species, including a *Belostoma* like the big water-bug which is seen so frequently upon our side-walks since the introduction of the electric lights. Of terrestrial Hemiptera there were numerous species of *Reduviina*, *Capsina*, *Lygaeidae*, *Alydina*, *Pentatomina*, *Scutelleridae*, etc., some of the phytophagous species of which were so abundant that they must have done serious injury.

The members of the sub-order Homoptera were, however, much more noticeable because the large species of the *Cicadidae* made such an outcry during the hot weather that the most indifferent person (unless afflicted with deafness) could not help being aware of them. The most vociferous species was a large smoky-winged *Platyleura* that was very abundant in Yokohama, and sent forth his loud, shrill *me-me-me* from every lawn and grove. There were also three or four clear-winged species of *Cicada*, with lusty voices which joined in the concerts, and added noise if not melody. The children caught numbers of these big bugs by means of slender bamboos with a little rice glue on the tip, and were very expert at getting them from their resting places in the trees. They also caught in the same way dragon-flies, for what purpose I know not, and an apparatus of this kind might often be of use to an entomologist for bringing down insects from otherwise inaccessible situations. The Japanese name for the *Cicada* is *Semi*, probably in allusion to its shrill notes.

Several species of small *Fulgoridae* were taken, but I did not see any of the large Lantern-flies such as occur in China. A bright green species about two-thirds of an inch long was common, both young and full-grown, on lawn shrubbery. There were also various tree-hoppers and frog-spittle insects, of which some were very prettily marked and coloured. These were closely allied to Canadian forms, but there occurred also abundantly a handsome little insect belonging to the sub-family *Ricaniida*, which is unrepresented in North America. This pretty insect looks more like a little butterfly than a bug, as the wing-cases are expanded and held horizontally. They are of a brown color, with two transparent bars, and when the insect is alive they are covered with a rich iridescent bloom, and have each a sort of eyespot near the margin. Unfortunately the fine powdery coating rubs off very easily, so that my specimens have lost the greater part of their beauty, and do not so much resemble lepidoptera. A beautiful green bug, looking like a small moth with drooped wings, occurred in great numbers, at times forming a regular fringe on the stems of plants. When disturbed they slipped very cunningly around to the opposite side of the twig. This species belongs to the genus *Ormenis*.

Coleoptera.—Beetles are well represented in Japan, some of the species being exceedingly, and destructively, abundant. Many of the species are very large and handsome in comparison with those of the more boreal fauna of Canada, which is especially noticeable in such families as the *Scarabæidae* and *Lucanidae*.

Of tiger-beetles there was a very brilliant species, which was abundant near Yokokawa (about one hundred miles inland from Yokohama), and also at Chofu, near the Western entrance to the Inland Sea. It was of a rich green and blue colour with bands of ruddy gold or bronze across the thorax and elytra. Upon the upper slopes of Fuji (at perhaps 8,000

feet of altitude of the ashes and closely did it a volcanic mount

Of Carabid brothers. I have one *Carabus*, beetles, with the much elongated one living species *Pterostichus* and

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Diptera.—The America, and only kinds of flies are, large robber-fly (

feet of altitude) I obtained several specimens of a *Cicindela* which was of the dark colour of the ashes among which it lives, and could be seen only when it was in motion, so closely did it agree in colour with the ground. The same species also occurred upon the volcanic mountain Asama, the slopes of which are likewise of dark ashes and scoriae.

Of Carabidæ I captured very few specimens, but received several fine species from my brothers. I have seen no Carabids corresponding to our large species of *Calosoma* and only one Carabus, but some striking specimens of *Danaster* occur. These are elongate black beetles, with the elytra resembling those of some tenebrionids (*Blaps*), but with the thorax much elongated, and the legs very long, so that they must be able to run rapidly. Only one living specimen was seen by me. The other carabids observed were mostly *Harpalus*, *Pterostichus* and *Amara*.

Water beetles closely resembled Canadian ones and among them was a large *Hydrophilus* like *H. triangularis*. *Staphylinidæ* seemed to be very rare, and of carrion beetles the most common species was a large black *Silpha*. *Coccinellidæ* produced some very pretty "lady birds," but very few of the species were abundant.

One of the most brilliant beetles obtained was a fine green buprestis (a species of *Chrysochroa*) which is found not uncommonly in the mountainous regions of Nikko and Hakone, and probably infests the giant conifers which grow there so plentifully. In the same district occur fine species of *Chalcophora*, of which one is much like the *C. fortis* which lives in Canadian pine trees. The only other buprestid observed was a small species which occurred plentifully on grasses and flowering shrubs, and which is much like a small *Brachys*.

Of all the Coleoptera observed, the most tropical in appearance as well as the most bulky, was a giant Scarabeid (*Xylotrupes dichotomus*) which occurs abundantly in the districts above mentioned, and probably inhabits decaying specimens of the big trees. The male of this fine insect has upon his head a long horn, flattened and forked at the tip, and a shorter, notched protuberance upon the thorax, in which the long horn can rest when the head is raised. The beetles vary considerably in size, and large ones will measure two inches in length, and more than an inch in width; the horn on the head being one and one quarter inches long. The family Scarabæidæ was also rich in the flower-loving Cetonians, some species of which were so abundant as to be very injurious to vegetation. A greenspecies about half an inch long swarmed in the fields near Yokohama, and destroyed especially the beans, which form an important crop.

A pretty mottled green *Euryomia* was in such swarms upon roses, altheas, etc., that all the flowers were eaten off before they could expand, and each bud would be the centre of a struggling group, which when disturbed buzzed about like a swarm of angry bees. *Copris*, *Geotrupes*, and other dung-beetles were numerous on the country trails where the packhorses had marked their passage.

The Lucanidæ, or Stag-beetles furnished two fine species of *Lucanus*, and also some good specimens in the genus *Dorcus*, probably of two species. These seem to be generally distributed, especially in the wooded regions already quoted.

With such a rich and varied vegetation the leaf-feeding Chrysomelidæ were naturally rich in species and numbers. Many of the species were very pretty, and among the most common were some species of flea-beetles, one just like the little striped-wing turnip flea-beetle.

Next to the Scarabæidæ, the most interesting beetles were the Snout-beetles, or weevils (*Rhynchophora*). The *Rhynchitidæ* and *Attelabidæ* were especially well represented by very pretty species. Of *Curculionidæ* there were also numerous species, but as my specimens have not yet been mounted I do not know what they are. I only obtained one specimen of *Balaninus*, but found the acorns of some oaks to be greatly infested by larvæ of these nut-weevils.

Among the Japanese names for beetles are *Kogane-mushi* (gold-insects) and *Yoroi-mushi* (mailed insects).

Diptera.—The common house-fly is not in Japan the pest that it is found to be in America, and only in a few places did I notice more than occasional specimens. Other kinds of flies are, however, abundant, and some of them are large and showy, such as a large robber-fly (*Asilidæ*) with brilliant green eyes and a conspicuous tuft of white

pubescence at the tip of the abdomen. Large horse-flies (*Tabanus*) were annoying along some of the pack-horse trails, and I received quite a severe bite on the arm from one as I was returning from the ascent of Fuji.

The great areas of wet fields offered ample opportunity for the propagation of aquatic insects, and mosquitoes were therefore abundant, except in the higher mountainous districts. The common species is smaller than those of this country, and is nearly black with white markings on the legs. Its bite I did not find very severe, and they are troublesome only from their numbers, and the long period during which they abound. The native name for this insect is *Ka*, and the mosquito net which is used at night in all houses in infested regions is called *Ka-ya*, or mosquito-house.

Fleas were exceedingly abundant in all parts of the country I visited, and in the native houses where we slept on the floors we often had to make a liberal use of insect powder to insure a night's repose. They find good hiding places under the matting which covers the floor, but would not be so troublesome if bedsteads were used. (*Jap. Nomi.*)

Lepidoptera.—In this favorite order I saw many beautiful insects, the most conspicuous being the large black swallow-tailed butterflies, which flitted about the mountain roads and over the grassy plains, and hovered about the flowering shrubs such as the abundant *Hydrangea*. Of yellow papilios, however, I saw few specimens, but these were very similar to our common *P. turnus*. In the woods, which are often almost impenetrable from bamboo scrub, creepers, etc., were many fine Satyrids, Graptas, etc., and a pretty *Limenitis* having a pale blue band across the wing. The small blue butterflies were sometimes in immense numbers, as along the road leading across the plain from the foot of Fuji to Nakabata, where they rose in swarms from every moist spot. With these occurred also great numbers of bright sulphur-yellow butterflies (*Colias*). Of white butterflies there were fine large species, and I also saw flying in Yokohama examples of what I took to be the common white cabbage butterfly, *P. rapæ*. Skippers did not seem to be in any variety, but on the other hand there were some common butterflies quite unlike those of Canada. High up on one of the mountains, where the flora began to have a home-like appearance, I saw *Vanessa antiopa*, and I also saw on the wing what was apparently *Pyrameis atalanta*. The Japanese name for butterflies is *Chō*, and for the silkworm *Kaiko*.

Of moths I often saw very pretty specimens, but did not attempt to collect any, and cannot even say what groups were most abundant. It will not be out of place here, however, to make a few remarks on what is to Japan a most important species, viz., the silkworm moth, *Bombyx mori*. The rearing of silkworms and the manufacture of their products employ a large part of the population and contribute greatly to the prosperity of the country. The silk is produced chiefly in the central and western parts of the main island of Hondo, and in these regions enormous tracts of land are devoted to raising the various varieties of mulberry whose leaves supply food for the innumerable and voracious worms. In the Shinshiu provinces the extensive plains were almost covered by mulberry bushes, so that we saw little else from the car windows as we passed through them. At the flourishing city of Nagano, the chief town of the province, the shops contained enormous numbers of cocoons, and in almost every house along the neighbouring roads were displayed the same white objects heaped in trays and baskets. In each house also the women were busy reeling the silk from the cocoons with small hand wheels. The main production is by the spring brood, but in some localities there is also a summer one. I did not see any worms feeding at the time of my visit (the middle of Sept.) but saw the moths emerging from the cocoons. At various places in the country I saw large factories for the manufacture of silk (including one at Gifu, since destroyed by the great earthquake of 28th October), but the greater part of the silk is still, I believe, woven upon hand looms.

Hymenoptera.—I collected a fair number of insects belonging to this order, but have not since examined them. The honey-bee does not appear to receive much attention, and the only specimens I saw were at Nikko. All the honey used in Yokohama is obtained from San Francisco. Possibly the flora may not furnish a succession of nectar-bearing flowers sufficient to make the keeping of bees profitable.

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Humble-bees appeared at first to be wanting, but later I saw a few species, but not many individuals of any. One very handsome species was velvety-black with the last two segments of abdomen red.

I took one specimen of a carpenter-bee (*Xylocopa*) very like our *X. virginica*, and two or three examples of a large, stout black *Megachile* (*Lithurgus*?), the only leaf-cutting species almost which I observed. Species of *Andrena*, *Halictus*, *Prosopis*, etc., were more or less common.

Wasps were more abundant than bees, and a very large dark *Vespa* (*mandarina*?) abounded both in Yokohama and in the country districts. Its nest was constructed of a coarse, heavy mottled paper made from bark, which I frequently saw the wasps obtaining from a maple tree on the lawn. The nest is of large size, and is built in trees, under the eaves of temples, etc. I saw two servants destroying a large one which was suspended in a small tree near the gateway of one of the "foreign" houses in Yokohama. One captured the wasps, which having been disturbed were crawling about on the nests, by means of a slender bamboo, with rice glue on the tip, and the other knocked them off and killed them as captured. When disturbed these wasps buzz around in a very alarming manner, and from their size have a very formidable appearance, but though often threatened I was never stung. A smaller black and white species was also common, but I did not see its nest.

Polistes were very numerous, and built their small exposed combs in the shrubs, especially in the closely-trimmed cedars, which give a good shelter. Fine species of *Sphex*, *Pompilus*, *Ammophila*, etc., were common, as were also *Crabronidæ*, *Scoliadæ*, etc. I only saw one *Mutilla*, which was captured in a very shady corner, near a small shrine embowered in camphor trees, and which gave me a sharp sting before I recognized what I was catching. The only other sting received while in Japan was from a stout black *Scolia* which I picked up in one of the temple grounds at Nikko, and almost dropped again. Did these insects think that their capture in such sacred precincts was an act of sacrilege deserving of instant punishment, and "Make the punishment fit the crime?"

Parasitic hymenoptera seemed to be less numerous than the stingers, and I obtained but few specimens of ichneumons and braconids, although a few fine species of *Pimpla*, etc., were seen. It was perhaps too late in the summer for these insects, as there seemed to be very few larvæ feeding to be attacked by them. In the Ueno National Museum in Tokio I saw an interesting braconid with an ovipositor about twice as long as that of our large *Thalessa atrator*, although the insect was smaller. The insect collection in this museum embraced all orders, but was a small one consisting only of a few cases.

Chalcids and Proctotrupids were very rare, although I kept a good look out for them, especially when using my sweeping net. One fine species of *Smicra* was common, especially about shrubs on the lawn and on some of the rows of broomcorn, which are planted on the margin of fields, and which sometimes attract many hymenoptera and diptera to feed on their exuding juice.

Saw-flies were at first abundant, especially when I was in the Hakone district, but it was late in the season for them, and they rapidly disappeared. I noted some interesting larvæ, especially a large one somewhat like the larva of *Cimbex*, but having a row of fleshy spines along the back. Gooseberry and rose bushes suffer as they do here, and I saw on willow leaves globular galls of *Nematus* almost like those seen upon our Canadian trees. Some of the galls also contained, as they do here, inquilinous weevils (a small black *Apion*).

In conclusion, I may say that Spiders were numerous, some of the species being very large and handsome and constructing gigantic webs. Some of the species were also very curious, especially those with thin attenuated bodies, in shape like young walking-sticks, and green or black in colour. Ugly looking Centipedes, three or four inches long, occur under rubbish, etc., even entering the houses, and are said to be venomous.

The observations and collections (not yet mounted or studied) which form the subject of this very hastily prepared, and, therefore, very fragmentary paper, were made between the 12th of August and the 22nd of October.

THE MOOSE FLY—A NEW HÆMATOBIA.

BY WM. A. SNOW, UNIVERSITY OF KANSAS, LAWRENCE.

Entomologists will be interested to learn of the occurrence of a near relative of the Horn Fly, *Hematobia serrata*, in the middle of the great cranberry swamps of Northern Minnesota. These vast low areas extend for hundreds of square miles in the vicinity of the Lake of the Woods. They are the favoured home of the American moose, and the hope of obtaining some specimens of this animal for the museum of the University of Kansas, led Professor L. L. Dyche of that institution to traverse these dangerous marshes. Professor Dyche has recently returned after remaining for over three months in the very centre of the swamps, camping upon the occasional sand ridges which cross the region; and to him I am indebted for specimens of a new *Hæmatobia*, which I have named *H. Alcis*.

The flies were noticed first upon skinning the first moose, when a number of them were discovered in the animal's rectum, into which they had crawled for two or three inches in order to deposit their eggs in the excreta. The dejecta upon the ground were also found to contain hundreds of the eggs. Altogether nineteen moose were killed, and in almost every case these flies were observed about them, remaining upon their carcasses as long as they lay unskinned, which was often twenty-four to thirty hours. For some time after the death of the animal, the *Hæmatobia* could be seen only with difficulty, concealed as they were by the mosquitos, which were incredibly numerous, lingering in clouds upon the dead moose as long as any of its juices could be extracted. The flies seemed to prefer the regions of the head, rump and legs, where the hair is shortest. It is highly improbable that they find a resting place upon the horns of the moose. The male moose go thrashing about in the underbrush with tremendous energy. They use their horns during a great part of the year to scrape away the bark from trees; and they have a way of winding them in among the bushes when a rival is near, as a challenge. The females, as is well known, have no horns. The present species is very probably indigenous, infesting as it does an animal not in domestication; and inhabiting such secluded inland portions of this continent. The moose obtained by this expedition were all killed far within the swamp, fifteen to twenty miles from firm land; and it is only in such places that this now rapidly disappearing animal can be found. This region is rarely visited by white men, and the few Indians that venture there wait until the surface of the fens is frozen over. It is not altogether unlikely that this fly infests the caribou also. It was hardly possible to observe its actions on the living moose; but we know that it lays its eggs in the excrement, and in all probability it resembles *H. serrata* in other habits as well.

Professor Dyche heard no complaints from owners of stock on the borders of the swamp of the ordinary Horn Fly, or of any similar fly. The cattle are, however, tormented with mosquitos, and smudges are kept constantly burning to which they may run for relief.

OBITUARY—HENRY EDWARDS.

This well-known and highly-esteemed entomologist died at his home in New York City, at 1.30 a.m., on the ninth day of June, 1891. His death was caused by dropsy and other complicated troubles, which affected the heart.

In him the world has lost an earnest devotee to science and art, and those who knew him, a kind-hearted, generous, true and sympathising friend. In his death, entomological science has lost one of its most active and energetic workers, and his loss is deeply felt and deplored by all who knew him, and he has passed out of this earthly domain with the affectionate regret of many grateful and loving friends.

Mr. Edwards was born in Ross, Herefordshire, England, August 27th, 1830, and was destined by his father to become a lawyer. After studying for some time without evincing any particular aptitude for the profession, he entered a London counting house, and frequently appeared in amateur theatricals, for which he had much talent. He finally

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decided, much against the wishes of his parents, to adopt the professional stage. In 1853 he embarked for Australia, where he made his first appearance as an actor, and where he passed many prosperous years. From Australia he drifted to Peru and Panama, and in 1867 he reached, San Francisco, California. In about 1877 he made his first appearance in the east, at Boston, and finally in 1879 he came to New York. In 1889-90 he again visited his old home in Australia, from where he returned last year. During all these years he was constantly connected with the stage, until only a short time previous to his decease, when he was compelled to retire on account of his illness. At the time of his death he had just returned from a trip to the Catskill Mountains, where he was staying for his health, and three and a half hours later he entered into rest and the everlasting silence.

As an entomologist Mr. Edwards was world-known, and was considered one of the greatest authorities of the science, to which he was attached ever since his boyhood days. He was chiefly known by his excellent papers on the Pacific Coast Lepidoptera, which contain the descriptions of many new and interesting species from that region. He was also known by his articles on North American *Aegeriadae*, of which family he described nearly all our American species. Besides these papers he has also written many other articles on descriptions of new species and transformations of Lepidoptera. He also edited three volumes of the journal "Papilio." The last large work he published was his "Bibliographical Catalogue of the Described Transformations of North American Lepidoptera," which is now in the hands of all our working entomologists. Mr. Edwards spent much money for the increase of his collection of insects, and devoted all his leisure time to his favourite study. His travels afforded him many rare opportunities for collecting material for his collection and writings. The collection consists of about 300,000 specimens of insects of all the orders from all parts of the globe. It contains the types of all the species he described, about four hundred and fifty, except a few which are in other collections. It also contains a number of Grote's types of Noctuidae and Pyralidae, and many of Fish's types of Pterophoridae, and types of other writers. It contains also the unique pair of *Oniticellus californicus*, and many other uniques, oddities and rarities of considerable value. The collection is one of the largest private collections in the world. His library consists of about five hundred volumes of entomological works, and about double the number of pamphlets, and about two thousand volumes on travels and other topics. (I am not sure about these figures.)

Mr. Edwards belonged to many scientific and other societies. He was for some time vice-president of the California Academy of Sciences, life-member Brooklyn Entomological Society, member of the Torrey Botanical Club, Players' Club (New York), Bohemian Club (San Francisco), corresponding member Boston Society Natural History, San Francisco Microscopical Society, San Diego Natural History Society, Belgium Natural History Society, etc.

He leaves a widow who deeply mourns his loss, and we would here add our condolence and sympathy and heart-felt regret to her irreparable bereavement.

WM. BEUTENMULLER.

NOTICES.

INSECTA: By Alpheus Hyatt and J. N. S. Boston: D. J. Heath & Co.

This handy volume forms the eighth of the series of the "Guides for Science Teaching," issued by these well known publishers of educational works. The series is intended for the use of teachers who wish to give practical instruction to their classes in Natural History. The volume before us forms a marked advance upon those previously issued, inasmuch as it consists of 300 pages, with over 200 illustrations, while none of the others was more than a fourth of these dimensions. This great enlargement is due, no doubt, to the growing popularity of Entomology as a subject for the teaching of observation in schools, as well as for intelligent recreation and serious study on the part of individuals.

The volume before us is an admirable manual for teachers who wish to instruct their pupils in the science of Entomology, and will be found most useful also by private stu-

dents. It is full of admirable diagrams and illustrations, for the most part original, and it takes up for discussion some of the commonest insects in the different orders that can be readily procured by any one. For instance, the external structure and the internal anatomy of insects are first taught by means of the common locust (*Caloptenus*), which can be taken in quantities anywhere; a May-fly (*Ephemera*), a Dragon-fly, a Cockroach, a May-beetle, the *Archippus* butterfly, etc., are used to illustrate the different orders. No teacher or student need be at a loss for material with which to follow out the instructions in the book. The whole book is excellent, and we have no doubt that it will be found most valuable in the various agricultural colleges especially, as well as in other educational institutions.

We may quote the following advice from the opening chapter:— "Encourage children to watch living locusts. . . . Better a child should learn to handle one animal, to see and know its structure and how it lives and moves, than to go through the whole animal kingdom with the best text-book, under the best teacher, aided by the best charts ever made. The former would have learned what real knowledge is and how to get it, while the latter would have simply learned how to pass at his school examinations."

C.J.S.B.

AMONG THE MOTHS AND BUTTERFLIES: By Julia P. Ballard. G. P. Putnam's Sons, New York; pp. 237, 1890.

This beautiful book is an enlarged and revised edition of "Insect Lives," published in 1880, and contains recent studies and many additional illustrations. It treats especially of rearing butterflies, sphinges and moths from the caterpillars, and is based wholly on the personal observations of the author. Without previous knowledge of entomology, Mrs. Ballard found herself attracted by some species of caterpillar, and followed it up to pupa and imago, making original discoveries at every step, and gaining experience day by day, she has become an expert in that line. Many of the species treated of, if their earlier history is mentioned at all in books, have never been so carefully studied as here; witness the story of the Great Leopard Moth, the Bulrush Caterpillar, the Monkey-faced Moth, the Beechnut Box, the Rosy Dryocampa. Of many others, better known than these, there are interesting notes, as *Orgyia leucostigma*, *Deilephila lineata*, *Cerotocampa regalis*. The enthusiasm of the authoress is contagious, and makes the reader wish that spring would hurry along. I do not know of any book—certainly there is none in America—which has attempted to enter the field now taken possession of by Mrs. Ballard. If any good pater, or aunt, or cousin, wishes to do a good turn to an active boy or girl, they could not do better than put this book in the young person's hand—at the same time a net and collecting apparatus (which our good friend John Akhurst will be happy to furnish), and bid them, when spring comes, search the fields and woods as Mrs. Ballard has done. The difference between eyes and no eyes is wonderful, and occupying the former will keep young people out of mischief, at least giving them something to do and to think of. Once let a boy put his foot over the threshold of this temple of ours and catch a glimpse of the inner mystery, and there will be no idle and wasted hours. And to this end the authoress of "Moths and Butterflies" has well served her generation.

W. H. EDWARDS.

MANUAL OF ANIMALS INJURIOUS AND BENEFICIAL TO AGRICULTURE: By Dr. J. Ritzema Bos, Lecturer at the Agricultural College of Wageningen, Holland. Berlin, 1891.

This magnificent volume in German makes one wish that English-speaking farmers and gardeners, as well as Entomologists, possessed in their own language, and for their respective countries, a similar compendium of knowledge on the "Animals injurious and beneficial to agriculture, Cattle-breeding, Forestry and Horticulture."

This work of 876 pages contains all the information necessary concerning the forms, occurrences, life history in relation with man of his various animal friends and foes, and the curative and preventive measures against their attacks. The newest discoveries of

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workers in this field, and original researches by the author are recorded, and 477 figures, engraved with scientific accuracy, show the appearance of the different mammals, birds, insects, snails, and worms, the details of their structure, and many devices for resisting the injurious kinds or assisting those that war against the latter and are thus precious allies of the farmer and gardener.

The first 30 pages are devoted to considerations on the causes of occurrence of obnoxious animals, and on the general means of protection against them. Then 80 pages treat of mammals from the bear to the mouse and the bat, 120 of birds, 460 of insects, 130 of snails and worms. The depredations of insects, which have been particularly studied by Dr. Bos, are especially dwelt upon.

At the end of the book are tables of the animal pests arranged according to the place where they live. This table is most useful, for, with its aid, anyone who has found any form of animal life preying on man, cattle, domestic animal, tree, or plant, or in granary, barn, or house, and wishes to know its name, habits, the nature of its ravages, the remedies against it, etc., can with very little trouble find the page in the volume where the desired information is given.

For instance, the first item of this table is as follows, with reference for each animal to the page in the book :—

BEE, BEE HIVE :—Foxes, marten, polecat, bear, honey-buzzard, tits, occasionally other bird species ;—spiders ;—wasps ;—the brown bee louse (*Braula caeca*, a winged louse) ;—the so-called black bee louse (larva of an oil beetle), which, however, leads usually its cuckoo life only in wild bees' nests ;—bee moths, wax moths ; bee-beetles ;—earwigs.

Similar lists follow for cat, cattle, dog, domestic birds and eggs, goat, horse, man, pig, rabbit, sheep.

The references to apple tree pests are arranged under the different heads : In roots, in wood, under bark, in bark crevices, on and in buds, on young shoots, on one year's twigs, on buds and leaves, in the fruit, ravagers of the fruit ; and similarly for all common trees and plants of field, garden, or forest.

J. A. GUIGNARD, Ottawa.

ANNUAL REPORT OF THE EXPERIMENTAL FARMS : Ottawa : p.p. 314 ; 1891.

The Director of the Experimental Farms of the Dominion of Canada has recently issued his report for last year, and a very interesting "blue book" it is. The record of experiments with two-rowed barley is particularly valuable and important at the present time, and concerns everyone who is interested in the welfare and prosperity of this province. The reports of the Agriculturist, who treats especially of dairying, of the Horticulturist, Chemist and Poultry Manager, are all useful and instructive ; but the one which especially interests us is, of course, that of the Entomologist and Botanist, Mr. James Fletcher. His share of the report occupies over fifty pages, and is illustrated by some wood cuts of noxious insects, and nine beautiful full-page plates of various useful grasses. The insects treated are the American Frit Fly (*Oscinis variabilis*), the Cabbage Maggot (*Anthomyia brassicae*), the Diamond-back Moth (*Plutella cruciferarum*), whose larvae attack the leaves of cabbages, the Mediterranean Flour Moth (*Ephestia Kuhnella*), the Pea Weevil (*Bruchus pisi*), the Strawberry Weevil (*Anthonomus musculus*), and the Vancouver Island Oak Looper (*Ellopija somniaria*). In each instance Mr. Fletcher fully and carefully describes the mode of attack, and then gives the most satisfactory remedies. It is hardly necessary to tell our readers, who are familiar with Mr. Fletcher's work, that these articles are as complete and accurate as is possible in a limited space. It is very cheering to find that the mill that was so badly infested with the *Ephestia* moth year before last (of which the writer was an eye-witness), has been completely cleared of the pest by scrupulously carrying out, though with no little labor and expense, the directions of the entomologist. In spite of this example, it is surprising to find that the proprietors of other mills and feed stores in the same city are too apathetic and careless to take any measures to exterminate this insect when it appears on their premises. They will soon find that such neglect means utter ruin to their business, unless they take warning in time. The remainder of Mr. Fletcher's report is almost entirely devoted to the subject of grasses, of which he has been cultivating for the sake of experiment over a hundred different kinds.

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THE BUTTERFLIES OF NORTH AMERICA: by W. H. Edwards. Third series; Part XI.

It is hardly necessary to do more than chronicle the issue of a new part of this magnificent work. The beauty and accuracy of the plates, and the excellence and value of the descriptive letter-press are too well known to need any further commendation. The part now before us illustrates and describes the complete life history, in all its stages, of *Apatura flora*, Edw. *Satyrus Meadii*, Edw., *Chionobas chryxus*, Doubleday, with its variety, *Calais*, Scudder. The last mentioned species is of peculiar interest to us, as it is found throughout the Rocky Mountains from Colorado to Canada. A most graphic account of its habits is given by Mr. Bruce, who has observed the insect for several years past. Why is it that every North American lepidopterist does not possess himself of a copy of this noble work? It can hardly be the cost, for the numbers appear at such long intervals that a very little self-denial even on the part of the impecunious would suffice for their purchase. While the subscriber would get a joy and treasure for life, let him think what a gratification and help it would be to Mr. Edwards to have his subscription list trebled, as it should be.

C. J. S. B.

BIBLIOGRAPHICAL CATALOGUE OF THE DESCRIBED TRANSFORMATIONS OF NORTH AMERICAN LEPIDOPTERA; being Bulletin No. 35 of the United States National Museum, by Henry Edwards, 1889.

This work, issued by the Smithsonian Institution, is one of very great value to the working lepidopterists of North America, and truly supplies a long felt want. Mr. Edwards, who has devoted so much time to the compilation of this work, is entitled to the warmest gratitude of his brother entomologists for his public-spirited labours in this connection. The work extends to 147 pages octavo, and comprises a table of the number of species in each family, of which descriptions of earlier stages are recorded in this catalogue, a list of the principal authors and publications quoted, the body of the catalogue extending from page 9 to page 137 inclusive; an appendix giving references to a few species which are not distinguishable by modern authors, and a list of some of the most valuable papers which have been published on this continent on the subject of preparatory stages, food plants, rearing and describing larvæ, etc., etc. Then follows an index to genera, and the work ends with a most useful food habit index. The general plan of the work is to give the names of all species of which any of the preparatory stages have been described, followed by the references to these descriptions in the order in which they are published, the dates of publication being given. Upon turning to any species one can thus see at a glance just what of its earlier stages have been described, and by looking up the references can tell whether or not they could be supplemented with advantage, while the absence of any species from the list is a very sure indication that its preparatory stages are wholly undescribed. One can thus see just what has already been done and what remains for investigation, and this is most important, for it is undoubtedly the case that many observations of interest and value are made every year without being published, chiefly, perhaps, because those who make them are unaware that they have not previously been given to the world. The amount of literature examined in the preparation of this work was very great, and the care necessary to avoid errors and omissions proportionate. The table on page seven shows that some part of the earlier stages of 1069 butterflies and moths have been described, but many of these descriptions are very incomplete, and we can thus see how much still remains to be done in working out these life histories. Of course in a work of this kind, where the field was so large, it was inevitable that some mistakes and omissions should occur, but it is most creditable to Mr. Edwards that they should be so few and so unimportant. It was unfortunate that the printing had to be done during the absence of Mr. Edwards in Australia, as otherwise most of the typographical errors would unquestionably have been detected and corrected. It is, however, a mistake to refer to author's separates, instead of to the work in which the description originally appeared, as for example in regard to the larva of *Chionobas Macounii*--the reference given is "J. Fletcher, a trip to Nepigon, p. 12," whereas it ought to be, "J

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Fletcher, Rep. Ent. Soc., Ont., 1888, p. 85." It is greatly to be hoped that Mr. Edwards will be able to fulfil his promise to issue yearly supplements, in order that the work may be kept up to date and its usefulness be thus maintained. The price of this work was fifty cents, but the first edition has already been exhausted. It is greatly to be hoped that a new edition will soon be issued, as no working lepidopterist can get on without it.

H. H. LYMAN.

INSECTS AND INSECTICIDES, by Clarence M. Weed. Hanover, N.H., 1891.

Under the above caption Dr. Weed has published a small volume of 281 pages, well printed and copiously illustrated, which will be found most useful by those for whom it is prepared, the farmer, the fruit-grower, the floriculturist and the housekeeper. The work consists of an introduction and six parts. The introduction gives a concise account of the transformations of insects, which are illustrated by the life history of *Papilio Asterias*, the Celery Caterpillar, for those which have a complete metamorphosis, and the Chinch Bug for those who pass through incomplete transformations. The differences between biting and sucking insects are explained, and the natural enemies of injurious insects are treated of. There is then a summary of the different insecticides and the best methods of applying them. The introduction closes with short instructions for collecting and preserving insects.

PART I. Trees of Insects affecting the Larger Fruits—apple, plum, pear, cherry, peach.

PART II.—Insects affecting Small Fruits.—Strawberry, currants and gooseberries, raspberry and blackberry, grape.

PART III.—Insects affecting shade trees, the rose, and house-flowers. Parts I. and III. of Dr. Weed's work have appeared previously in a small edition issued by the Columbus (Ohio) Horticultural Society.

PART IV.—Insects affecting Vegetables.—Tomato, potato, celery, squash, cucumber, bean, pea, cabbage, onion, asparagus and rhubarb.

PART V.—Insects affecting Cereals and Forage Crops—Indian corn, wheat, clover, grass.

PART VI.—Insect Pests of Domestic Animals and the Household.

On the whole this is a very useful and attractive volume, well arranged, easy of reference and well illustrated. The accuracy and quality of Dr. Weed's scientific work are now too well-known to need any comment further than to say that this, his last publication, is up to his usual excellent standard.

J. F.