U. S. DEPARTMENT OF AGRICULTURE.

DIVISION OF ENTOMOLOGY—BULLETIN No. 46.

L. O. HOWARD, Entomologist.

PROCEEDINGS

OF THE

SIXTEENTH ANNUAL MEETING

OF THE

ASSOCIATION OF ECONOMIC ENTOMOLOGISTS.

WASHINGTON:
GOVERNMENT PRINTING OFFICE.
1904.

DIVISION OF ENTOMOLOGY.

L. O. HOWARD, *Entomologist.*

C. L. MARLATT, *in charge of experimental field work.*
F. H. CHITTENDEN, *in charge of breeding experiments.*
A. D. HOPKINS, *in charge of forest insect investigations.*
FRANK BENTON, *in charge of apiculture.*
W. D. HUNTER, *in charge of cotton boll weevil investigations.*
A. L. QUAINTANCE, *in charge of bollworm investigations.*
D. W. COQUILLETT, TH. PERGANDE, NATHAN BANKS, *assistant entomologists.*
E. A. SCHWARZ, E. S. G. TITUS, *investigators.*
Miss H. A. KELLY, *special agent in silk investigations.*
R. S. CLIFTON, F. C. PRATT, AUGUST BUSCK, OTTO HEIDEMANN, A. N. CAUDELL, J. KOTINSKY, H. S. BARBER, *assistants.*
W. E. HINDS, W. F. FISKE, G. H. HARRIS, H. E. BURKE, A. W. MORRILL, J. C. CRAWFORD, Jr., A. A. GIRAULT, C. T. BRUES, F. C. BISHOPP, SPRINGER GOES, C. M. WALKER, *temporary field agents.*
Miss L. L. HOWENSTEIN, *artist.*

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LETTER OF TRANSMITTAL

United States Department of Agriculture,
Division of Entomology,
Washington, D. C., March 3, 1904.

Sir: I have the honor to transmit herewith the manuscripts of the Proceedings of the Sixteenth Annual Meeting of the Association of Economic Entomologists, which was held at St. Louis, Mo., December 29–31, 1903. The papers presented at the meetings of this association are always of great economic importance, and the Department has hitherto published the secretary's reports of these meetings as bulletins of this Division. I therefore recommend the publication of the present report as Bulletin No. 46 of this Division. The two half-tone plates and one text figure are necessary to illustrate the text.

Respectfully,

L. O. Howard, *Entomologist.*

Hon. James Wilson,
Secretary of Agriculture.

CONTENTS.

* Withdrawn for publication elsewhere.

ILLUSTRATIONS.

PLATES.

TEXT FIGURE.

THE SIXTEENTH ANNUAL MEETING OF THE ASSOCIATION OF ECONOMIC ENTOMOLOGISTS.

MORNING SESSION, TUESDAY, DECEMBER 29, 1903.

The Association met in room No. 209, Central High School building, St. Louis, Mo., at 10 a. m. The following were in attendance:

C. C. Adams, Ann Arbor, Mich.; C. F. Adams, Lawrence, Kans.; A. F. Burgess, Columbus, Ohio; R. S. Clifton, Washington, D. C.; R. A. Cooley, Bozeman, Mont.; E. P. Felt, Albany, N. Y.; James Fletcher, Ottawa, Canada; G. H. French, Carbondale, Ill.; H. L. Frost, Arlington, Mass.; C. P. Gillette, Fort Collins, Colo.; E. C. Green, College Station, Tex.; C. A. Hart, Urbana, Ill.; J. S. Hine, Columbus, Ohio; L. O. Howard, Washington, D. C.; S. J. Hunter, Lawrence, Kans.; A. H. Kirkland, Boston, Mass.; Frederick Knab, Urbana, Ill.; C. L. Marlatt, Washington, D. C.; John Marten, Tolono, Ill.; G. W. Martin, Nashville, Tenn.; William Lochhead, Guelph, Ontario, Canada; Herbert Osborn, Columbus, Ohio; C. V. Piper, Washington, D. C.; E. D. Sanderson, College Station, Tex.; F. H. Snow, Lawrence, Kans.; J. M. Stedman, Columbia, Mo.; H. E. Summers, Ames, Iowa; O. H. Swezey, Columbus, Ohio; T. B. Symons, Collegepark, Md.; F. L. Washburn, St. Anthony Park, Minn.; F. M. Webster, Urbana, Ill.; E. V. Wilcox, Washington, D. C.

Owing to the unavoidable absence of President Slingerland, the meeting was called to order by the secretary, and Dr. James Fletcher was elected to preside throughout the sessions.

The presidential address, read by the secretary, was as follows:

INSECT PHOTOGRAPHY.

By M. V. Slingerland, *Ithaca, N. Y.*

A good photographic outfit is now one of the essential parts of every economic entomologist's equipment. The world's entomological literature now teems with illustrations from photographs. Some of our economic entomologists depend almost entirely upon photographs to illustrate their bulletins and reports. As I am one of the chief "sinners" in this respect, and as I am often asked how I do it, I have chosen the somewhat unusual topic of "Insect Photography" for my address to this Association.

HISTORICAL NOTES.

Probably it will never be known who first photographed insects. Photomicrographs were made more than one hundred years ago, and

it is quite probable that some minute insects or parts of larger insects were thus photographed. It is doubtful, however, if living insects were photographed more than fifteen or twenty years ago, for there was little incentive for such work before that. But the commercial development in the early eighties of cheap mechanical engraving processes for reproducing from photographs or negatives opened a new and unlimited field for the camera. The establishment and equipment of the Hatch agricultural experiment stations throughout the country in 1888 offered greater facilities than ever before for work with insects, and this gave another great impetus and incentive to insect photography.

A few half-tone reproductions from photographs relating to insect work appeared in the publications of the experiment stations for 1888 and 1889; they represented the Cornell insectary, fumigation tents, photomicrographs of the hole made by the ovipositor of *Trypeta* [*Rhagoletis*] *pomonella* in apple skin, and ears of corn eaten by *Heliothis armiger* [*H. obscura* Fab.]. These early half tones were poor, and it was not until 1892 that many fairly good insect photographs were thus reproduced in the experiment station literature.

The Cornell experiment station began to use the Hatch fund in 1888, and under the direction of Prof. J. H. Comstock the first building of its kind, an insectary, was built and well equipped with photographic and other apparatus. The camera was soon in use, and Professor Comstock was probably one of the first to photograph living insects in this country. His first object was to print from negatives onto blocks for Mrs. Comstock to engrave, or to get prints from which to make drawings. Some of this work appeared in 1890 in a Cornell bulletin, but no half-tone engravings of insects or their work were used at Cornell until 1893. A good half-tone of nematode root galls appeared in an Alabama bulletin in 1889, and since that date the mycologists have well illustrated with half-tones the gross features of such diseases as potato scab, the smuts, rusts, etc.

The first half-tone engraving of a living insect that I have found in our entomological literature was printed in Entomological News for January, 1891. It is a very good picture of the "hickory horned-devil" caterpillar, taken in August, 1890, by Mr. J. F. Sachse. Much progress has been made since then by the makers of half-tone blocks and by the printers in using them. In 1892 Prof. L. H. Bailey had a photograph of the interior of a greenhouse full of plants returned to him by a plate maker, who stated that he could not make a good half tone, as there was too much detail. Ten years later the same photograph was again sent to be reproduced, and came out beautifully.

A GENERAL PROTEST.

To-day the camera has become the constant companion of many economic entomologists, and no phase of an insect's life, habits, or

structure, alive or dead, is too minute or too active to be posed for a picture. Tested by both artistic and scientific standards, some of the results now appearing in our entomological literature have never been surpassed in insect illustration. But there is a lot of good printer's ink being wasted on very poor insect photographs. Sometimes a good photograph is not well brought out in making the half-tone plate, and often it is so poorly printed as to resemble a blotch of printer's ink rather than an insect. While we can not always remedy defects in making and printing half-tones from photographs, we can make better negatives oftentimes. Only a year or two ago a bulletin appeared with over 40 photographic illustrations, covering 20 full-page plates, and fully three-fourths of the "cuts" had little excuse for existence, so poor were they. The climax was reached in the final picture, just recognizable as a squash, which the author labeled "Eaten by millipedes, centipedes, and slugs, all of which were alive upon this at the time it was photographed, but as most of them were moving they are not plainly shown."

The best of photographers quite often get poor and worthless negatives, and anyone who attempts "hunting insects with a camera" will find this especially true. But my point is that such failures should go into the rubbish heap of experience rather than encumber our literature and degrade the standard of insect illustration. American economic entomologists lead the world in all that pertains to their subject; in our equipments and methods for investigation and experimentation; in our practical results; and let us maintain this standard in the illustrating of our literature.

A little more than ten years ago I was forced into insect photography by my inability to otherwise properly illustrate my graduating thesis. I have learned to appreciate a good insect photograph, but have yet to learn many of the "tricks" by which they are made. I find it is much easier to learn what not to do in photography than to discover just what to do. I have come to believe that "the man behind the camera" is largely responsible for many of the poor photographic illustrations of insects that get into print.

Some of the qualities of a good insect photograph are much detail; good backgrounds; evenly lighted and not too "contrasty;" taken from life is usually preferable, but not always possible; symmetrical or lifelike arrangement, if from dead specimens; and, lastly, artistic surroundings if practicable. Let me discuss the attainment of some of these qualities from my experience.

NECESSARY EQUIPMENT.

It is especially true in insect photography that first-class tools are necessary. My workshop, the Cornell insectary, is equipped with several cameras. For outdoor or field work the latest model of a 5 by 7 camera has recently been purchased. The photo-micro camera,

shown in Pl. I, fig. 1, and an ordinary copying camera, shown in Pl. I, fig. 2, and several lenses complete the outfit. Instead of a simple copying camera, I would get an enlarging and reducing camera, with attachments for making lantern slides direct from large negatives. It costs at least $150 to properly equip an entomologist's studio for photographing insects. Our present outfit at the Cornell insectary has cost over $300, and nearly every division of the experiment station is also well supplied with cameras.

Nine-tenths of my insect photographs are taken with a large copying camera and an old 6½ by 8½ rapid rectilinear lens, bought in 1888. For making considerable enlargements with this camera a 3¼ by 4¼ lens that has a large diaphragm opening (which is indispensable in focusing) is the best I have yet used. I increase the bellows length, and thus the enlarging power of the copying camera, with a wooden hood, shown at *a* in Pl. II. One of the new photomicrographic objectives has just been purchased for enlarging minute objects. They are better for this work than ordinary microscopic objectives. We have different lens boards, so that all of our lenses can be used on the upright photo-micro camera, and it is often easier to photograph insects in a horizontal plane than to arrange them in a vertical plane for the copying camera.

On my trips throughout the State investigating insect outbreaks I usually take the field camera and rarely return without some interesting and valuable picture of an insect, its work, or methods of fighting it. I have even secured good flash-light pictures in an orchard at night of canker-worm moths crawling up the trunks of the trees.

THE WORKSHOP.

In photographing insects I want all the light possible to bring out the details, and so I work on the middle bench in the insectary greenhouse, where the light streams in from all sides. Usually I shut off the direct sun's rays from the object by putting a piece of paper near the roof, and thus I avoid practically all shadows. Sometimes shadows add an artistic touch to the picture, but more often they obscure or darken something more important. I have never tried lighting up an object with mirrors.

WHEN TO PHOTOGRAPH.

I often drop everything else to get a picture of an insect which is then in a certain stage or position that it may not assume again in a year. Choose bright days if possible. I have made some good pictures of insects by long exposures on dark or cloudy days, but I am satisfied that better results are obtained with shorter exposures on bright days.

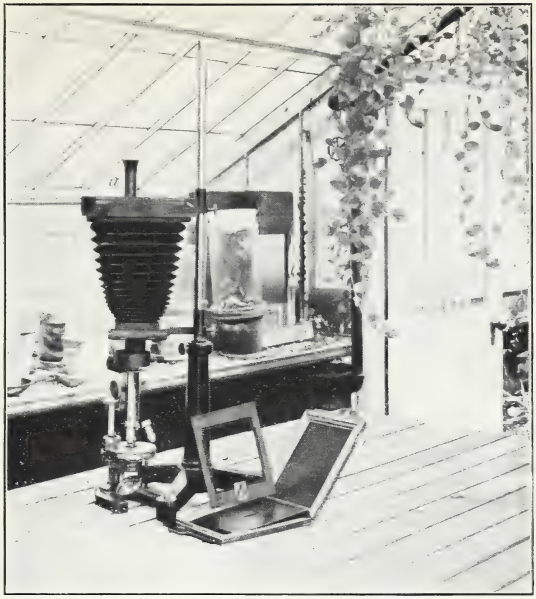

FIG. 1.—PHOTO-MICRO CAMERA IN OPERATION.
From photograph by author.

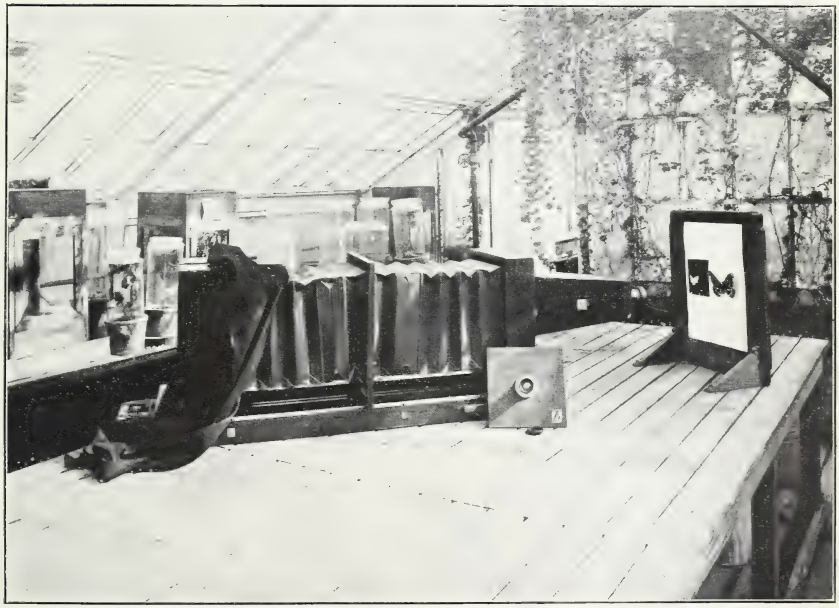

FIG. 2.—INTERIOR OF CORNELL INSECTARY, WITH COPYING CAMERA ARRANGED FOR TAKING AN ENLARGED PICTURE.
From photograph by author.

PREPARING THE SPECIMENS.

Poorly prepared specimens spoil many an insect photograph. The value and beauty of the plates in Howard's Insect Book and Holland's Butterfly and Moth Books were greatly enhanced by the care used in selecting the best material and getting the wings, legs, and antennæ in as nearly symmetrical or natural positions as possible. I often spend more time in preparing a specimen than in photographing it, and the resulting half-tone always pays for doing it.

In photographing from life, of course, one can not always pose the insect, but I find that insects can be coaxed often into desired attitudes or positions by a little patient manipulation. To get sphinx, Datana, and many other larvæ in their characteristic positions it is often necessary to only jar the supporting branch just before exposing. I once coaxed three Myron sphinx larvæ into a row on a branch and then got them to all raise the front part of their bodies, thus reminding one of a "cake walk." A little pinch often keeps larvæ quiet a few seconds, and it is necessary with Papilio caterpillars to get them to project their osmateria. To get the best results, it is absolutely necessary to have the insect perfectly quiet for a few seconds.

Some insects are so restless or active that one can not pose them alive. In such cases I often kill them in the cyanide bottle, and after they become limp, arrange them as naturally as possible. The army-worms on the eaten corn plant in my much-used picture were brought 50 miles, killed, and stuck on the plant the next day with thick Canada balsam. I have also obtained in this way quite lifelike pictures from alcoholic specimens of larvæ preserved for a year or more. Patient and painstaking efforts of this kind are often repaid by very good photographs of otherwise impossible subjects. Sometimes I pin the insect in the desired position and paint out the pin on the negative or print.

BACKGROUNDS.

Smooth white paper furnishes most of my backgrounds. Tinted papers have helped me very little. Light-colored insects need a black background, and the best thing I have found for this is a piece of fine black velvet.

FOCUSING AND EXPOSING.

One can save much time by marking on the side bars of the camera the distance it is necessary to draw out the bellows to get an image natural size or twice or more enlarged. Our ground glass is marked off with a pencil into areas of the size of the different-sized plates used, so it is easy to center the image and determine what size of plate will be required. In the center of the ground glass we also cement with Canada balsam a large, square cover glass used on micro-

scopic slides. This makes a small portion of the ground glass transparent, but with the focusing glass or eyepiece shown in Pl. I at *a* one can focus on this clear field more accurately than on the ground glass. This device is very useful when enlarging small insects. I always like to have a life-size picture of the smaller insects to use beside an enlargement instead of the usual hair line. One rarely gains much by enlarging insects which are an inch or more in size.

The proper length of exposure will have to be learned by experience, as it depends upon so many conditions, the rapidity of the plate, time of day, amount of light, magnification, etc. I usually expose an isochromatic medium plate about five seconds for a picture natural size under the most favorable conditions of light in my workshop. Several minutes are often required when considerable enlargements are made. I use regular photographic lenses as much as possible in enlarging, for they seem to give more detail and greater depth. Insects are usually photographed natural size or larger, and to do this well requires time exposures of from two seconds to several minutes. I can not get good detail and other necessary qualities with "snap shots;" I must have a second or two, even with instantaneous plates and good light.

I always use as small a diaphragm as possible (usually a No. 128 stop with opening about 7 mm. in diameter) under existing conditions of light, liability of objects to move, etc. In photographing large insects like the beetles, especially when enlarging them, it is absolutely necessary to use a small stop or some parts of the insect will appear out of focus in the picture; in other words, a small stop gives greater depth to the picture.

PLATES.

I now use isochromatic medium plates for most of my work. There is much in getting used to one brand of plates. I use some instantaneous plates for restless insects or outdoor work. And I find that for copying line-engravings or drawings plates made especially for such work give the best results.

COLOR SCREENS OR "RAY FILTERS."

These are sometimes indispensable in photographing many-colored insects like the butterflies and moths. I find, however, that in most cases the isochromatic plates give good color values, but certain colors, like those on the butterfly *Feniseca tarquinius*, require a color screen to bring them out well. I am too amateurish as yet to be able to determine from looking at an insect whether I had best use the screen. If I do not get a satisfactory negative without, then I put on the color screen. It is practically out of the question to use these screens in photographing living insects, for they lengthen the exposure from 15 to 18 times. I like the glass screens, adapted for special brands of plates, better than the liquid ray filters.

DEVELOPMENT, OR WORK IN THE DARK ROOM.

A properly exposed plate may be easily spoiled in the dark room. In insect photography, where detail is the essential element desired, the slower, contrast developers are better than the quicker ones used in landscape and portrait work. The following developer has given me good results for several years. It is also well adapted for lantern-slide making:

		Ounces.
I.	Water	40
	Sulphite of soda, crystals	8
	Hydroquinone	1
	Bromide of potassium	¼
II.	Water	40
	Carbonate of soda, crystals	8

For use, mix equal parts of I and II.

Usually beginners do not develop long enough. Let the image come up slowly and gradually go back into the background. The appearance of the image on the back of the plate is often a good criterion when to stop.

For fixing I use a plain hypo bath of 1 pound hypo in 2 quarts of water, and I pour about a teaspoonful of acid sulphite of soda solution into a quart of hypo in my fixing tray. This acid soda prevents the hypo from discoloring for a long time and helps it to give clear, stainless negatives. I have had considerable trouble with other much more complicated acid fixing baths.

I have made but little use of intensifying solutions. I throw away thin negatives and try again. But I find a reducing solution an essential, especially in making lantern slides. I use an ordinary reducer, composed of 1 ounce of ferricyanide of potassium (red prussiate of potash) dissolved in 10 ounces of water. Pour a few drops of this into a little hypo fixing solution, dip the freshly washed negative or lantern slide in a hypo bath for a moment, then with a small brush use the reducer locally over the plate, washing out all muddy backgrounds or too dense spots.

MAKING PRINTS.

Make your own prints, for it is the most fascinating part of insect photography, and your negatives will get better care in your own hands. I have tried the "velox" and similar papers for making prints, but find that the "aristotype" papers, burnished on ferrotype plates, give me the most detail. With water colors or ink I often paint out pins or put in hairs on the finished print. I have never tried making very large bromide or other prints from smaller pictures or negatives, but some very satisfactory work has been done by the late Mr. V. H. Lowe and others.

NOTES ON PHOTO-ENGRAVING.

I often have slightly enlarged or much reduced half-tones made from my photos by the engraver. I used to send the negatives to the engraver, but some were lost or injured, and they now do satisfactory work from the prints. With these one can make various arrangements of several pictures in one half-tone. At one time I thought the half-tones were better when the backgrounds were not removed or cut away by the engraver, but now I have them cut out whenever practicable, as the picture usually stands out better when printed.

LANTERN SLIDES.

Most economic entomologists now have more or less teaching or lecturing to do, and illustrations are necessary, especially as it is often impracticable in large classes or audiences to use specimens. Large charts are very useful, but I find the lantern slides are a much more satisfactory and cheaper method of illustrating lectures. I was forced into the making of lantern slides of insects by classes too large to permit of using and breaking specimens, oftentimes a lack of specimens to illustrate the work of injurious insects, enough charts were too expensive, and there were practically no slides of insects on the market. Lantern-slide making is not a very difficult process. It can not all be absorbed from books, however, but must be learned in the school of experience.

Whenever it will serve the purpose I use a $3\frac{1}{4}$ by $4\frac{1}{4}$ plate in photographing, then a lantern slide can be easily made from it by simple contact exposure, as in making a print. One feels freer to destroy poor negatives and try again when these smaller and cheaper plates are used. A lantern-slide size negative can be made from a large print, but I prefer to make slides direct from the large negatives in the copying camera with lantern-slide attachments. Many negatives do not have density or blackness of background sufficient to prevent light getting through and making a darkish or muddy background on the lantern slide. I constantly use a reducing solution with a brush locally, as directed above, to clear up such backgrounds; it brightens up wonderfully an otherwise dingy slide. This local reduction is one of the most useful tricks I have learned about slide making. I save all discarded negatives that are thin enough and cut them into cover glasses for lantern slides.

Coloring, well executed, adds much to the beauty and value of insect lantern slides. To do this work properly requires high artistic ability in the management of colors, deftness in applying them on so small a scale, and an appreciation and intimate knowledge of the insect being colored. I believe the day is not far distant when we can photograph in colors by a much simpler process than that by which the admirable three-color work used in the Butterfly and Moth Books is accomplished.

CONCLUSION.

Finally, if I have given anyone a few hints that will help in the interesting and useful work of photographing insects, my aim is accomplished in preparing these rambling notes from my experience. Anyone who attempts this work must expect many failures, for there is no more elusive game than the insect world affords, but one good negative out of a dozen used in photographing a living insect is worth all the trouble. Except when the cap is off in exposing, one should have unlimited time in such work. I fully realize that it is now difficult for the economic entomologist to find time to investigate, experiment, teach, attend institutes, take care of insect collections, and answer a multitude of letters, to say nothing about eating and sleeping. Insect photography can not be done with a rush or in push-the-button style, but the camera must be ready at opportune times, and if one can not find the necessary time to make a good negative, it is better to illustrate in some other way. One can not do two or three other things and make good insect photographs at the same time.

The field before us is unlimited; manufacturers have placed at our disposal excellent instruments and plates; good prints are easily made; the engravers are becoming more expert in making the half-tone blocks; the printers can print good pictures if given suitable paper and no other alternative; therefore let the entomologists of America introduce the personal element necessary to eliminate the poor work and not only maintain the present high standard of our insect illustrations, but strive for still better things in the way of insect photography.

A general discussion of the address followed. Mr. Fletcher stated that far too many photographs were made of poorly set and imperfect specimens, and felt that greater care should be exercised by all entomologists in selecting material before it was photographed for the purpose of illustration. He called attention to the fact that many insects could be induced to remain quiet for a few seconds by simply blowing on them. In his opinion it was a mistake to omit the hair line, as many people unacquainted with insects would more readily know their exact size. A hair-line outline of the insect was very satisfactory.

Mr. Felt expressed his appreciation of the many valuable suggestions contained in the address, and stated that it was his custom as soon as he obtained a paper for printing photographs that gave good results to stick to it, as he did not have the necessary time to experiment with different kinds. Good equipment was also necessary in order to save time.

Mr. Sanderson stated that he had used isochromatic plates. For negatives of printed matter and objects without much color from

which to make lantern slides certain kinds of dry plates were found satisfactory. It is often necessary to use a ray filter, especially to bring out such colors as orange. He also explained several devices which could be used to advantage in adjusting the plates.

Mr. Cooley used a plate holder which will hold any size of plate and is very convenient.

Mr. Washburn found it necessary to use a glass plate in order to avoid shadows.

The report of the secretary and treasurer was read and referred to the auditing committee appointed by the chair, as follows: Mr. J. S. Hine and Mr. C. A. Hart.

Mr. Webster moved that the chair appoint committees on programme, resolutions, nominations, and membership, and the following members were selected:

Programme: Messrs. Felt, Sanderson, and Gillette.
Resolutions: Messrs. Symons, Lochhead, and Sanderson.
Nominations: Messrs. Washburn, Felt, and Gillette.
Membership: Messrs. Osborn, Webster, and Felt.

On motion, an assessment of 50 cents each was levied on all members present at the meeting.

The following names were presented for membership:

Mr. George H. French, Carbondale, Ill., proposed by Mr. Webster; Mr. A. W. Morrill, Victoria, Tex., proposed by Doctor Howard; Mr. S. Arthur Johnson, Fort Collins, Colo., Mr. F. C. Bishopp, Collegepark, Md., and Mr. Estes Park Taylor, Champaign, Ill., each proposed by Mr. Gillette; Mr. Douglas B. Young, Albany, N. Y., proposed by Mr. Felt; Mr. P. J. Parrott, Geneva, N. Y., and Mr. O. H. Swezey, Columbus, Ohio, proposed by Mr. Burgess; and Mr. E. C. Green, College Station, Tex., proposed by Mr. Fletcher.

On receiving the report of the programme committee, a paper was presented, entitled:

THE USE OF ARSENATE OF LEAD FOR CONTROLLING THE CODLING MOTH.

By A. F. Burgess, *Columbus, Ohio.*

Early in the spring of 1903 a series of experiments was planned to test the effect of spraying for controlling the codling moth. This insect had proved very destructive in an orchard at Delaware, Ohio, and although some spraying has been attempted in previous years the applications were not made in a systematic manner and the insect had not been held in check. It had continued to increase in abundance, and the loss resulting thereby had become so serious that systematic treatment was rendered absolutely necessary if a profitable crop of fruit was to be raised.

The orchard consists of about 1,700 trees, 560 of which are just coming into bearing. The principal varieties are: Ben Davis, Minkler, Stark, Rome Beauty, Jonathan, Rambo, Grimes Golden, and Baldwin. Mr. Hudson kindly consented to making the tests and assisted in every possible way in carrying them out. A block of 100 trees was reserved for the purpose on the north side of the orchard; two rows on the west end of the block were Rome Beauty, the next seven rows were Stark, and the last row on the east end was Ben Davis.

CONDITION OF THE TREES.

The Rome Beauty trees were about 14 years old and had been top grafted. The Stark and Ben Davis were set at the same time, but the Stark trees would average considerably larger but not quite as tall as the Ben Davis.

The orchard had been kept in sod, but was not pastured, the grass being cut and placed under the trees as a mulch. Although the trees were trimmed late in the winter, the foliage on many of them was very thick, and, as they had been headed low, it was rather difficult to spray them thoroughly. All were infested to a greater or less extent with the San Jose scale and had been treated for that insect earlier in the season.

A severe freeze in early April killed a great number of the fruit buds, but many of the trees were heavy with bloom early in May. At that time (May 4) another severe freeze occurred, the temperature dropping to 28°, so that ice was formed on much of the bloom, and the prospects for a crop were nearly ruined. About one-fourth of a crop was harvested from the entire orchard.

After most of the windfalls had dropped an estimate was made of the entire crop remaining, and is shown in Table I. Each row contained 10 trees.

TABLE I.—*Estimate of crop remaining on trees after windfalls had dropped.*

Row No.	Entire crop would equal a full crop for—	Row No.	Entire crop would equal a full crop for—
	Trees.		*Trees.*
1	4	6	2
2	3⅝	7	4¼
3	2¼	8	3¼
4	1½	9	4
5	2¼	10	⅜

The estimate at this time placed the yield of fruit at a little more than one-fourth of a full crop.

Rows 1 and 2 were Rome Beauty, rows 3 to 9, inclusive, were Stark, and row 10 was Ben Davis.

TREATMENT APPLIED.

Row No. 3 was left as a check and received no treatment.

Rows 4, 5, 6, and 7, all being of the Stark variety, were sprayed with Bowker's disparene or disparene and Bordeaux mixture, as is shown in Table II. In all cases the Disparene used was applied at the rate of 3 pounds, and the Bordeaux mixture was made by using 4 pounds of copper sulphate and 4 pounds of lime to each 50 gallons of water.

The treatment of these rows was placed in charge of two of my assistants, Mr. H. J. Speaker and Mr. Addison Hyde, both of whom have had long experience in applying insecticides, and are particularly careful and painstaking in their work. The first spraying was made by Mr. Speaker, May 8 and 9, and the last two by Mr. Hyde, May 22 and July 13.

Row 4 was sprayed with disparene as soon as the blossoms had fallen, and a second spraying with the same material was applied July 13, about nine weeks later.

Row 5 was sprayed in the same manner, except that Bordeaux mixture was added at the first spraying.

Row 6 received three sprayings with disparene, the first being made as soon as the blossoms had fallen, the second two weeks later, and the third on July 13.

Row 7 was treated in the same manner as row 6, except that Bordeaux mixture was added to the first two applications.

Rows 1, 2, 8, 9, and 10 were sprayed by Mr. Hudson immediately after the spraying was completed on the other rows. He treated the trees in his own way, and also sprayed the balance of the orchard. For the first two sprayings arsenate of lead was used, which he made from the raw materials, but for the third spraying the use of this material was discontinued and disparene was applied at the rate of 3 pounds to 50 gallons. Bordeaux mixture was used with the first and second spraying.

The formula used by him for making this arsenate of lead was: Thirteen ounces of arsenate of soda and 33 ounces of acetate of lead to each 50 gallons of spray. The salts were weighed out in these proportions and placed in paper sacks, so that they could be dissolved in separate quantities of water and placed in the spray tank when needed.

TABLE II.—*Showing treatment and date of application, also the number and percentage of sound and wormy apples.*

Row No.	First spraying.	Second spraying.	Third spraying.	Windfalls.		Picked apples.		Per cent wormy.		Per cent perfect.
				Wormy Aug. 4.	Wormy Sept. 23.	Wormy	Sound.	First brood	Second brood.	
1	Arsenate of lead and Bordeaux.	Arsenate of lead and Bordeaux.	Disparene	919	1,044	2,034	2,517	14	47	39
2	do	do	do	874	845	1,534	1,926	17	46	37
3	No	No	No	2,428	1,359	1,172	376	46	47	7
4	Disparene	No	Disparene	156	187	229	1,934	6	17	77
5	Disparene and Bordeaux.	No	do	273	335	497	2,449	8	23	69
6	Disparene	Disparene	do	246	250	435	3,933	5	14	81
7	Disparene and Bordeaux.	Disparene and Bordeaux.	do	468	554	864	4,417	7	23	70
8	Arsenate of lead and Bordeaux.	Arsenate of lead and Bordeaux.	do	965	1,268	1,918	3,011	13	45	42
9	do	do	do	876	1,407	2,824	3,094	11	51	38
10	do	do	do	639	1,614	1,558	633	14	72	14

WEATHER RECORD.

During the time when the spraying was made the weather conditions were favorable, with one exception, as the days were warm and the wind was light.

The rainfall at Delaware, reported to Mr. J. Warren Smith, director of the Ohio section of the Weather Bureau, by the local observer, shows that no precipitation was recorded for over a week after the first spraying was applied.

On the afternoon of May 22, the day that the second spraying was made, 0.53 inch of rain fell, and this was followed by continued rain or showers on every day for the balance of the month, 1.73 inches being recorded during this time. The first half of the month of June was also very rainy, especially during the first week, the rainfall on the 6th amounting to 2.91 inches. The total for the month was 4.97 inches.

Very little rain fell in July after the 13th, which was the date of the third spraying. On the 18th 0.23 inch was recorded, and this was the largest amount on any day during the month.

From the fact that the foliage of the trees on rows 4, 5, 6, and 7 was well covered with poison late in September, it is probable that the July rains had little influence on the results of the last spraying.

AMOUNT OF MATERIAL USED.

The average amount of spray material used by us on each row was 35 gallons. During the second spraying on row 6 four nozzles were

attached to a single spray pole, and 50 gallons were required to cover the trees. Row 7 was sprayed the same day, using three nozzles, and 35 gallons of spray were required. During the other sprayings a double Vermorel nozzle was used and an average amount of 35 gallons per row was applied.

Mr. Hudson used a little over 22 gallons per row.

COST OF TREATMENT.

Estimating the average amount of material used as 35 gallons per row, or 3½ gallons per tree, and counting the cost of disparene at 15 cents, copper sulphate at 6¾ cents, and lime at one-half cent per pound, the cost of material for treating this block is shown below in Table III.

The arsenate of lead made by Mr. Hudson is based on arsenate of soda at 8½ cents and acetate of lead at 10½ cents per pound.

TABLE III.—*Cost of material used in spraying.*

Row No.	First spraying.	Second spraying.	Third spraying.	Total cost.	Cost per tree.
1	Arsenate of lead and Bordeaux.	Arsenate of lead and Bordeaux.	Disparene	$0.71	$0.07 1/10
2	do	do	do	.71	.07 1/10
3	No	No	No		
4	Disparene	No	Disparene	.63	.06 3/10
5	Disparene and Bordeaux	No	do	.83⅔	.08⅓
6	Disparene	Disparene	do	.94½	.09½
7	Disparene and Bordeaux	Disparene and Bordeaux	do	1.35½	.13½
8	Arsenate of lead and Bordeaux.	Arsenate of lead and Bordeaux.	do	.71	.07 1/10
9	do	do	do	.71	.07 1/10
10	do	do	do	.71	.07 1/10

It is quite usual in reporting the results of spraying for the codling moth to ignore the amount of fruit that is ruined by the first brood of moths or make a general estimate of it. The picked fruit is then considered, and the percentage of wormy apples is based on the count of a few bushels from trees treated in different ways, or a general estimate is given of the amount of sound and wormy fruit.

As a matter of fact, the fruit continues to drop from the time the worms begin to feed until it is harvested.

In this experiment all windfalls were counted August 4 and removed from beneath the trees, and as examination showed that worms were present in the apples it was considered proper to class this fruit as having been destroyed by the first brood of moths.

All the fruit remaining on the ground under the trees was removed and counted before harvesting began and, together with the wormy picked fruit, was considered as having been attacked by the second brood. Upon these counts and the counts of the sound apples picked and blown to the ground, the table of percentages is based.

SUMMARY.

In considering the final results of this experiment, several important facts should be borne in mind:

First. The orchard had never before been systematically treated, and only a partial effort had been made to control this insect.

Second. The crop was very small, thus giving the fruit very little opportunity to escape attack. The same conditions as to the crop prevailed in an adjoining orchard and although systematic spraying was applied, as has been the case for several years, the number of wormy apples was unusually large.

Third. The weather late in May and early in June was very wet, and this may have caused the second spraying to have done a minimum amount of good.

Fourth. In the light of the results which show a very large amount of damage by the second brood of moths, it may be that more effective work would have been accomplished if the third spraying had been made a week earlier in July.

July 13, the date on which the spraying was made, is about as early as it is usual in this latitude to apply the third spraying. According to Riley, the second brood of the moth emerges in the latitude of St. Louis about July 8. As Delaware is about 125 miles north of that latitude, an application of poison on the 13th should be in sufficient season to protect the fruit from this brood. Unfortunately I was unable to determine the exact date of emergence of the second brood, but I am informed by Mr. Lowell Roudebush, one of the progressive horticulturists of Clermont County, which is in the southern part of the State, that he observed specimens of the second brood in his orchard at Nicholsville on July 7, 1902, and on July 12, 1903.

The materials used by us were of known strength, but the arsenate of lead[a] applied by Mr. Hudson depended on the purity of the raw materials that were obtained. This will always be the case with homemade preparations unless a definite guaranty of the chemical purity of the ingredients is required.

COMPARISON OF RESULTS.

It will be observed that on the check row 46 per cent of the fruit was ruined by the first brood and 47 per cent by the second brood of the codling moth. The remaining 7 per cent amounted to about 2 bushels and was small and imperfect. Had no spraying been done in this orchard scarcely any marketable fruit would have been harvested.

A comparison of the percentages of perfect fruit on the rows which were treated three times and those that were treated twice shows a slight increase in favor of three treatments. In this experiment the difference is not marked enough to warrant the expense of an additional treatment. The prevailing wet weather immediately following May 22 may have been responsible for this state of affairs.

It will be noted that the per cent of wormy fruit was considerably greater in each case where Bordeaux mixture was added. The results

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[a] An analysis of the acetate of lead and arsenate of soda used by Mr. Hudson, and also by the owner of the adjoining orchard, Mr. Vergon, in preparing this material, was made by the official chemist of the Ohio State board of agriculture. His report, which was received since the presentation of this paper, states that the arsenate of soda contained 25.9 per cent of salt; hence it was very impure.

of an early and late spraying on rows 4 and 5 show an increase of 8 per cent of wormy fruit where Bordeaux mixture was added to the first application, while on rows 6 and 7, where three sprayings were made, an increase of 11 per cent of wormy fruit occurs where this mixture was added to the first and second spraying. Apparently this phase of the treatment is worthy of further trial and consideration, as the results of a single season's work should not be accepted as conclusive evidence that the addition of Bordeaux mixture to poisonous sprays diminishes their effectiveness.

On row 6, where no Bordeaux mixture was applied, several trees near the north end were quite badly affected by apple scab. The other trees on the same row were only very slightly affected with this disease and to no greater extent than the trees where Bordeaux mixture was applied.

The results of the spraying by Mr. Hudson show a favorable increase when compared with the check row. This spraying was considerably less successful in holding the insect in check than the treatment that we used with disparene, as will be observed in Table II. This may in part be due to the quality of the poison applied.

Mr. Gillette stated that he was much interested in the spraying experiments for the control of the codling moth, as he had studied this insect for several years. He had used arsenate of lead recently in Colorado with good results. It was coming into very general use in his State. He called attention to the large percentage of wormy fruit on the check row, but stated that he believed that if the check trees had been at a considerable distance from the treated trees the amount of wormy fruit would have been larger. He was inclined to think that many of the fruit growers in Colorado were using too large an amount of lime.

Doctor Fletcher considered that entomologists should be very careful in making recommendations to dispense with Bordeaux mixture when spraying for the codling moth, as, in his experience, it had been exceedingly beneficial in holding several diseases of the apple in check. The "black spot" of the apple causes great loss to the growers in Canada and has been effectually controlled by adding Bordeaux mixture to the spray when treatment was made for the codling moth. He found that its addition usually decreased the effectiveness of the poison a little, but he would not favor leaving it out even if a considerably larger per cent of fruit than is the case were found wormy, as mentioned in the paper under discussion.

Mr. Gillette remarked that he had been able to recognize only two broods of this insect in Colorado, and that where he had made three sprayings he had, in one case, reduced the number of wormy apples to 1.6 per cent, while the check block had 31.6 per cent wormy.

Mr. French stated that a fruit grower near Carbondale, Ill., had been in the habit of spraying his apple trees eight times during the season with white arsenic and soda (carbonate of soda), and for the past four years had found only an occasional wormy apple. Some trees of the Winesap variety were sprayed last summer eight times with arsenate of lead, using 3 pounds to 50 gallons of water, and the fruit on these trees was one-fourth to one-half smaller than that on the trees treated with the other material.

Mr. Sanderson thought that this might be due to the fact that arsenate of lead would adhere better to the fruit, and that the trees had been oversprayed. He also spoke of the necessity of making accurate counts of all the wormy fruit and taking into consideration the apples that dropped to the ground early in the season, as well as those found on the trees at the time of picking, and gave the following summary of his experiments in Delaware:

(1) Arsenate of lead (disparene), 1 pound to 50 gallons, gives from one-third to one-half more in perfect picked fruit than arsenites of lime or soda, Paris green, or green arsenoid.

(2) Paris green or green arsenoid, 1 pound to 160 gallons, and arsenites of lime or soda, 1 gallon to 160 gallons, are practically of equal value.

(3) The addition of more arsenite than the above strength is unwarranted.

(4) Spraying three times does not give enough benefit to warrant the third spraying if the first two are properly made.

(5) It is doubtful whether the addition of adhesives is profitable.

(6) The addition of 15 per cent or 20 per cent 150-test kerosene is not deleterious to the insecticidal value of the arsenite or the fungicidal value of the Bordeaux mixture, but the same strength of crude petroleum can not be recommended for use when spraying for the codling moth.

(7) A benefit of from 25 to 75 per cent is derived from spraying as regards the amount of fruit dropped, varying with the season and spray.

(8) The benefit derived from spraying increases in direct ratio as the per cent of dropped fruit and the per cent of wormy fruit on unsprayed trees. (Thus with 56 and 60 per cent wormy fruit and 69 and 56 per cent dropped in 1902 and 1901, respectively, on Winesaps, there was 112 to 186 per cent benefit to the perfect picked fruit sprayed with disparene; 70 and 87 per cent with arsenites of soda and lime in 1902, and 120 per cent with Paris green in 1901; while with an average of 25 per cent wormy dropped on Stark and Nero in 1902 there was but 30 to 37 per cent benefit to perfect picked fruit.)

(9) In the same orchard and variety the per cent of perfect fruit dropping is practically the same whether sprayed or unsprayed, the amount of dropped fruit depending upon the percentage of droppings wormy.

(10) The benefit derived from the spraying lies in increasing the amount of picked fruit and decreasing the amount of wormy droppings, and only partly in decreasing the percentage of wormy picked fruit.

Mr. Piper suggested that all the fruit that dropped must not be considered as loss, because in many seasons the fruit on the trees should be thinned in order to produce a large and perfect crop.

Mr. Cooley agreed with Mr. Piper on this point and stated further that in Montana the problem for controlling the codling moth was to

prevent its spread into the large commercial orchards, and this was being attempted by spraying in the affected districts.

Mr. Lochhead stated that in Ontario one brood only of the moth exists east of Toronto, while two broods are present annually west of that point; he considered spraying essential in the eastern section, and spraying and banding the trees with burlap to be most satisfactory in the western part of the district. The chief difficulty was that many of the orchardists failed to examine the burlap bands regularly and carefully, and in this way many of the moths developed and escaped. In answer to a question of Mr. Sanderson as to the cause of the different number of broods, he replied that the climate of Ontario was peculiar, inasmuch as the two districts alluded to were located in different life zones, and that this fact would undoubtedly explain the difference in the number of broods.

Doctor Fletcher did not think it advisable to leave check trees in experimental orchards—there were only too many orchards which were not sprayed which could be used for comparison—and recommended spraying five times, but stated that where he had sprayed only twice in eastern Canada fairly good results had been obtained. He expressed the opinion that many apply the first spraying too early and that it is not necessary to make this treatment until a full week after the blossoms have fallen. During this season a severe drought had apparently checked the damage done by this insect in eastern Canada. The second brood was the most difficult to treat, and he had advised spraying in the East and the use of burlap in addition to spraying in the West, as had been stated by Professor Lochhead.

Mr. Gillette remarked that this insect passed the winter in the larval stage and that he had never discovered it in any other condition at that season of the year.

Mr. Piper spoke of the conditions in the State of Washington and expressed the opinion that the destructiveness of this insect depended largely on the life zones in which it was found. There were still many problems concerning it to be solved. In the valleys where the San Jose scale existed in many of the orchards the codling moth was also present. He had advised four or five sprayings and stated that Mr. Aldrich believed that there are three broods of the moth in some parts of the State.

Mr. Sanderson said that the insect was somewhat variable in regard to the number of broods in Delaware and that he had been able to demonstrate that in some cases only one brood existed. He found that larvæ collected August 10 had passed the winter without pupating. In Texas this insect was very destructive to pears in the vicinity of El Paso.

Mr. Gillette reported having found the second brood of moths as early as July 12 in Colorado, at Grand Junction, and Mr. Cooley had concluded from his experiences in Montana that there were two broods

annually and probably no more. Mr. Gillette had found that the first brood extends over about sixty-nine days—that is, the moths from this brood have continued to emerge for that number of days at Fort Collins.

Doctor Fletcher called attention to the fact that the difference in the time of hatching of eggs is very common in nature. Ten days' difference in the time of egg laying might have considerable bearing on the date of maturity of the progeny. Larvæ hatching early might mature the same season, while later individuals would go over the winter. He referred to the fact that Mr. C. B. Simpson had proved that the larvæ of the codling moth were able to develop on the leaves of apple trees and that this would give the insect a chance to be carried over in case the fruit crop was a failure.

Mr. Gillette cited an instance that had come under his observation, where a hailstorm, late in May, removed all the fruit from the trees. During the next two years the apples in orchards that were in the area covered by the storm had been almost entirely free from worms, while orchards lying just outside this area had their apples badly infested.

Mr. Cooley expressed the opinion that this moth was very susceptible to changes in temperature in the spring, and that this accounted for the overlapping of the broods. He had placed an unimpregnated female moth in a bottle in his refrigerator, and after two months it had been removed and placed in a window during a warm day. The moth revived and at first was very active, but died after a short time.

Mr. Sanderson suggested that the second spraying be made a little later in the season and believed that it would give better results.

The next paper presented is as follows:

A NEW ENEMY TO THE PLUM, DIMORPHOPTERYX PINGUIS.

By James Fletcher.

[Withdrawn for publication elsewhere.]

AFTERNOON SESSION, TUESDAY, DECEMBER 29, 1903.

The meeting was called to order by Doctor Fletcher, and the following paper was presented:

SOME ECONOMIC CONSIDERATIONS WITH REFERENCE TO THE TABANIDÆ.

By James S. Hine, *Columbus, Ohio.*

An interesting entomological study is that which has for its object the separation of beneficial and injurious species, but it is safe to say that one is almost sure to meet with perplexing questions when he

undertakes a study of the kind. Some statements bearing on the matter regarding the Tabanidæ have appeared from time to time in the literature of economic entomology. If I understand the situation, some hold that it is not advisable to attack these insects in the immature stages on account of the predaceous habits of the larvæ. So far as the study of this latter stage has advanced, all that bears on feeding habits indicates that they are as apt to feed on beneficial as injurious forms; and since the remedies for horseflies in any stage are, to a degree, unsatisfactory, it seems best to pursue any mode of attack that offers results without reference to the stage in which the attack is made.

By studying the egg-laying habits of different species, it is revealed that there is a certain uniformity in regard to the matter. *Tabanus stygius* Say, in the locality where I have studied it, places its masses of eggs on the leaves of Sagittaria almost altogether, and since these plants have a tendency to grow in patches, one often finds a small area where these eggs are very abundant, while but a short distance away where the plants may not be growing scarcely any are to be found. A few counts of the number of eggs composing a mass are of interest. Twenty masses of *Tabanus trimaculatus* averaged over 500 eggs each, and several masses of *T. stygius* averaged almost as many. From a desire to know how many eggs could be collected in a given time, I have found that it is easily possible to find places where as many as 60,000 may be taken in a single hour. Therefore it looks reasonable that some method of gathering the eggs might produce good results, especially when we consider the large size of the masses and the fact that these masses usually contrast very strongly in color with the objects to which they are attached. And again, a small area of marshy ground or stagnant water in some regions may be the only location in a large scope of country that offers favorable conditions for the oviposition of the Tabanidæ.

It is not to be supposed that an account of the habits and life history of one species will furnish facts which may be applied in all particulars to the other members of the family. A careful study of each species is almost sure to bring out striking differences, and it is this fact that makes their study interesting and instructive. Eggs may be placed in different situations, for example, over water or over mud, usually according to the species; but at other times it seems according to circumstances. Some species are known to habitually attach their eggs to projecting stones in ripples, others to foliage or any projecting object over stagnant water. It appears that the commonest species and at the same time the worst stock-pests oviposit over stagnant water or over wet ground. Larvæ hatched from eggs placed over water must drop into the water, and therefore a measure of success may be had by using contact insecticides on its surface at hatching time.

The method so long used of applying some oily or ill-smelling substance to stock for the purpose of repelling the flies has certain virtues that should not be lost sight of, but a single application is of such short duration and the objection to making such applications to animals so common that if any other equally effective measures could be brought out the former would become unpopular.

Since the injury caused by horseflies is produced only by the adults, a remedy for this stage is most desirable, and it is to be hoped that a careful study of the habits of this stage may reveal points where successful attacks may be made. Porchinski, of Russia, and Howard, of this country, have already made a notable contribution along this line; and besides, the habit which the adults of some species, at least, have of collecting in certain situations seems to offer promise of good results. In the few experiments I have made in this connection it has been demonstrated to my satisfaction that it is possible to get good results by systematically trapping the adults.

Mr. Washburn stated that he had been requested to advise some satisfactory remedy to prevent the attack of these flies upon horses in the rural districts. In at least one place rural mail delivery had been suspended at certain seasons of the year on this account, and he asked if fish oil and lard or lard and kerosene had been found satisfactory as a remedy.

Mr. Hine replied that undoubtedly these materials were of some value, but that they must be applied very often to the animals.

Mr. Fletcher remarked that he had seen plowmen in plowing matches in Manitoba spray their animals with kerosene emulsion, and that this is more effective if a little carbolic acid is added to the mixture. He knew of but one instance where animals treated with kerosene had been injured by the application. This was on rough, long-haired animals.

Mr. Washburn said that he had recommended for the horn fly a mixture made of 1 pint of kerosene and 3 pints rancid lard, and that this this worked well, the effect lasting twenty-four to forty-eight hours.

Mr. Fletcher used 1 pound of pine tar in 5 pounds of lard, but few people could be induced to use lard and pine tar on their animals, although they were good remedies, for the reason that they left the hair in a very dirty condition.

Mr. Marten stated that kerosene could be used on the human scalp if the hair is loosened up and left so that the material will evaporate quickly. In case evaporation is retarded, injury is likely to follow.

The next paper presented was as follows:

THE CARD-INDEX SYSTEM FOR ENTOMOLOGICAL RECORDS.

By E. Dwight Sanderson, *College Station, Tex.*

At several previous meetings of this association descriptions of entomological records have been given by Messrs. Forbes, Hopkins, Webster, and Ball,[a] and their merits discussed.

No one system will probably ever be devised which will meet the needs of all, but often by comparing methods we can secure suggestions of value. In taking charge of the work in Texas I found that a system of notes must be established, and proceeded to devise the scheme outlined, based almost entirely on a similar system which I had given three years' trial at the Delaware station. In looking over the papers above mentioned I am struck with the fact that in very many respects my methods are the same as those of others, which is somewhat of a recommendation. Though the following system is original, therefore, still it has been the result of the study of the strong and weak points of other records, and thus resembles them in many essential respects.

All of our records are kept in card drawers for 3 by 5 and 5 by 8 cards. The duplex punch and split guide rods are used. Several different files are kept of these two sizes. A great part of our records are of material received through the mails. Let us take an instance and follow it through the records.

CORRESPONDENCE RECORD (3 BY 5 CARDS).

When a card is received it is at once stamped. The date of receipt and answer is indicated. On the next line is indicated under what letter or name it is to be placed in the letter file. I find this necessary with the office help we have. The next four lines give spaces for indicating the county, crops, literature sent, and subject of letter. These lines refer to a card of the correspondence file. Every correspondent is given one of these cards and they are arranged alphabetically, under towns, according to the names of the correspondents, the towns under counties and the counties alphabetically. Guide cards can be purchased ready printed of the counties and leading towns. On this card is given the name of the correspondent, town, and county. On the next line is given the crops in which he is interested, as far as we can learn. This is for using the file as a mailing list. In sending out a cir-

[a] S. A. Forbes, Insect Life, Vol. II, p. 185, 1st meeting Assn. Econ. Ent.

A. D. Hopkins, Insect Life, Vol. VI, p. 103, 5th meeting Assn. Econ. Ent.

F. M. Webster, Bul. 20, n. s., Div. Ent., p. 46, Proc. 11th meeting Assn. Econ. Ent. Also Bul. 114, Ohio Ag. Exp. Sta.

E. D. Ball, Bul. 31, n. s., Div. Ent., p. 37, 13th meeting Assn. Econ. Ent.

Also see Comstock's Insect Life.

cular we mail only to those parties interested in that crop. Or often we wish to know some fruit or truck growers in a certain county and can secure their names by running over this file. Below is a record of literature sent the correspondent and the dates and subject-matter of letters sent to and received from him.

FOOD PLANT RECORD (3 BY 5 CARDS).

The stamp on the letter also contains blank for the food of the insect and the scientific name of the pest, together with number of accession to collection and experiment number, if any. These items are first entered on the Food Plant Record. This is on 3 by 5 cards. These are arranged alphabetically according to food plants and genera. All accessions to the collection and records of injury to various plants are recorded on these cards, each insect being given a different card. Thus at a glance we can secure a reference to all notes and specimens of all insects recorded as affecting a given plant. On each card is indicated the position of insects affecting that plant in the economic collection.

ACCESSION CATALOGUE (3 BY 5 CARDS).

If specimens which are to be preserved accompany the letter they are given a number in the accession catalogue. This is recorded on 3 by 5 cards. Each accession is given a separate card, the cards being numbered consecutively with a numbering stamp. This card gives the name, number of specimens of each stage of the insect and its work, date and place of capture, food, collector, and notes. At the bottom are spaces for indicating the family and order of the insect. This is to enable a clerk unfamiliar with the classification to record the species on the distribution map to be explained below.

All accessions are entered on the food catalogue, after which the space on the accession catalogue marked "Food catalogue" is checked. In the same way the accessions are entered on the distribution map and the space on the accession card checked when so entered. A blank on the accession card is left to indicate the name of the party determining the species. In case this is some specialist at a distance, the card is sent to him so that he can secure the full record of the specimen, and he then signs his name in this space upon determining it. In a space marked "Preserved" is indicated by abbrevations the manner in which the specimen is preserved and after "Col. No." is given the number of the block on which the specimen is to be found in the economic collection. This number is similar to the number of a library book catalogued by the decimal system, and will be further explained later.

By having a card for each accession, and the cards numbered by machine, a number of men may be assigned a series of numbers without having to refer to each other. Thus one is given cards numbered

100 to 199, another 200 to 299, etc. When these are filed another series is taken. Furthermore, it is not necessary to encumber the work table with a bulky volume or to refer to it for the next number, as the first blank card is already numbered. For the accession catalogue we are now also using a book, the only one in use. This is a large volume with the pages 12 by 18 inches, having columns headed as follows from left to right across two pages: "Accession number," "Experiment number," "Species," "Locality," "Date," "Collector," "Remarks." This book was in use upon my coming to the office and will form a duplicate and complete record of all accessions. It will be noticed that it does not provide for all the data on the cards. By having this book cards can be sent with specimens to specialists for determination, and if not returned the record is intact, and cards written up by an assistant may be kept by him at his desk and yet have the whole record complete. The book record may be easily copied from the cards by the office clerk every week or so in a few minutes. It is quite possible, however, that we will discontinue this book record entirely after further trials, as it is not necessary. In the lower right corner of the correspondence card is a space—"Exp. No."—for number of experiment of this species. This refers to the number under which notes upon this species may be found in "Experiment file." The word "experiment" is possibly a misnomer in this connection, having reference more to studies of the life and habits than to experiments with remedies in most instances. But in want of a better term, and as this is used with this significance by many, it serves the purpose as well as any.

EXPERIMENT RECORD (5 BY 8 CARDS).

Were it desirable to enter upon a study of the sweet-potato weevil, or had we already done so, it would have an experiment number, in this case 17. In the experiment file notes on various species are arranged on cards or slips under guide cards bearing the number of each. The guide card bearing the number contains blanks for recording a brief account of the notes upon the species when the study has been completed or when it is desirable to make a résumé. On it are to be found all the accession numbers of that species. At such a time the notes for a given period are transferred to the systematic file and the guide card left with the last date of notes transferred upon it, and a new guide card started for subsequent notes. Additional subguides are often used to separate notes being taken at different points or on different phases of the study, such as insectary, field notes, insecticides, etc. All notes upon any species having an experiment number are filed under that number. A card index on 3 by 5 cards arranged alphabetically enables us to secure the experiment number of a given species at a glance, as does

a similar list in an indexed pocket memorandum book. Practically, one remembers most of the numbers until they become quite numerous. Also in the experiment file are kept prints of all negatives taken of the species concerned, with numbers referring to their position in the negative file.

SYSTEMATIC FILE (5 BY 8 CARDS).

Had the letter referred to some insect of which no special study was being made, but of which we wished a record of the information given, a note would have been made of it in the systematic file, on a card or slip the same as used in the experiment file. These 5 by 8 cards or slips are all punched for duplex rods and are used for all notes in the field or laboratory. The systematic file, as its name indicates, is arranged alphabetically, according to the systematic classification of insects. Large buff guides show the orders; small blue guides, the families; white guides, genera where notes or many species occur, and sometimes a tab card is used to indicate the location of notes on a species upon which many observations are made. Each group is arranged alphabetically under the next larger systematic group. A strictly systematic arrangement, as in a collection or check list, is not feasible, as the notes must be entered by a clerk not familiar with classification. Where a note is made upon an unknown species, which is not given an experiment number, it is given an accession number, which is placed on the note slip attached to the breeding cage. In case the species is still undetermined when the slip is to be filed it is placed under the smallest group to which its classification can be traced just after the guide card of that group. In this file are also kept occasional notes or suggestions regarding insecticides, machinery, etc., each under its own guide card.

At the beginning of notes on each species of economic importance—i. e., found in the economic collection—is placed a double card 8 by 10 inches folded to be 5 by 8, bearing an outline map of Texas on the inside, known as the distribution map. These maps can also be used for any species of which we wish a graphic record of its distribution, such selection of species being entirely arbitrary. For most States a card 5 by 8 would hold a map of the State on the same scale. Practically all specimens of a species not of economic importance are to be found in the systematic collection, so that its distribution can soon be ascertained by examining the locality labels on specimens. As it is impossible to write out or have printed on the map the name of each locality, the locality from which the insect is secured is indicated as nearly as possible by placing a number at the proper point in red ink. On the back of the card this number is recorded, and after it are given the post-office, county, collector, date, and accession number of the specimens. All specimens or new localities of any

species of economic importance are recorded on this card. In case no specimens are secured the "Acc. No." column says: "See notes" or "See letter." Thus this card forms a record of all material secured upon any species of economic importance, and by referring to it all accessions of that species can be found at a glance.

In connection with these distribution maps are used similar maps printed on thin tracing paper. On one of these is shown in different colors the approximate faunal areas of the State, on another the average rainfall for different sections or the rainfall for a given year, on another the average mean temperatures, etc. By superimposing one of these maps upon the distribution maps one can ascertain very quickly whether the insect is confined to any faunal area or is controlled by weather conditions, etc., so that it is only prevalent under certain conditions of rainfall, temperature, or altitude, etc.

The 5 by 8 card has been adopted, as it is a standard size and is the largest size that can be carried in a cover in the pocket. For field notes 5 by 8 heavy ledger paper, either with suitable heading or blank, and punched for duplex rod, is used. This is punched and carried in a "price book," 7¼ by 5, for sale by stationery dealers. A punch for this purpose is bought with the cover. This cover is made of flexible morocco and is the best note cover I have used, permitting the insertion or removal of any sheet without disarranging the rest of the contents. A stiff cover would not permit the use of 5 by 8 slips, as it could not be carried in an ordinary pocket. When these note slips are removed they are at once filed in their proper place without copying. Where it is desirable, diagrams of arrangement of plots, or schedules for recording data can be made and a number of copies made on these slips with a duplicator, either for field or laboratory use. I find this card large enough for almost all purposes of record, and a 5 by 7 photo print (the largest commonly used) can be placed on it. In many cases when a letter is received which is of such a nature that it contains the information to be recorded in as concise a way as if transcribed, it is folded once and one edge pasted on a card and filed that way. If large blanks or schedules are necessary for any purpose, they are folded so as to be slightly smaller than 5 by 8 and one corner attached to a card.

If now we were to undertake the study of sweet-potato insects, by turning to our food catalogue we have a list of all the species which we have observed injuring that plant, with the accession number or reference to notes or letter concerning each entry. If the sweet-potato weevil is then to be studied, we would turn to experiment No. 17, where would be found all the notes upon that species, with a record of all accessions of it and parasites and predacious enemies on the guide card. But where we wish to learn of some pest which has no experiment number, we would refer to the systematic file. Here under the proper family we would first find the double card bearing the dis-

tribution map and giving all the accession numbers and where the specimens are to be found in the collection, and after it all the notes on that species.

In keeping these records the office clerk enters any data stamped on the letter in the correspondence file and the food catalogue. He also makes all entries of the food catalogue and accession catalogue on the distribution map card, which gives the position of the specimen in the collection.

Two collections are being formed, one an ordinary systematic collection and the other an economic or biologic collection, arranged according to the food plants of the insects and the parts of the plant attacked. Both collections are kept on the Cornell block system, in glass cases, with the exception that cork carpet is used instead of the larger sizes of blocks, which are prone to warp. Where the insects are placed in the collection according to the food plant, it is manifestly impossible to find a specimen which may have a number of food plants, or if one does not happen to remember the food. To obviate this a system has been devised whereby the accession number indicates the place of the specimen in the collection. If the specimen is in the systematic collection, an "S" is placed after the number, as 324 S, and is at once easily found in its proper place. For indicating the place in the economic collection a fractional number is used in which the numerator is the accession serial number, and the denominator indicates its position in the collection the same as a shelf number in a library. Indeed, the same system is used. Each block is numbered the same as a book, according to the decimal system. For this I have used a modification of the outline furnished by the library of the United States Department of Agriculture for the classification of the books on agriculture. This brings all plants of a natural group under a given number and gives each individual plant a number indicating its position in the larger group. Also the part of the plant attacked is indicated by a number following a dash after the plant number. Thus $\frac{176\ L}{36.26}$ would mean that the specimen is a larva (L), accession No. 176, and is to be found at 36.26 in the collection.

This later number is to be found on the front of the case in which the specimen is, or is included in the numbers of the first and last specimens in that case which are given on the front. The first digit of this number (3) indicates that the plant is a vegetable-garden vegetable; the second (6) that it is a solanaceous plant; the first digit after the decimal point that it is the tomato, whose number is 36.2. After this the 6 indicates that it is the fruit of the tomato which is injured. In like manner had this accession number a denominator 11.66 it would indicate that the insect affects the fruit (ear) of corn and is to be found at that point in the collection, or 15.16, cotton, etc. This number can be readily found by referring to the general decimal

classification occupying but four sheets. This food number is given on the accession card at the lower corner on the back of the distribution map and on the food catalogue card. If the specimen is placed in the duplicate collection, for exchange or other disposal, it is marked "D" after the accession number, but rarely does this occur. Thus we can at once find any specimen, no matter in which collection or under what food. For the agricultural college I believe the building up of a good economic or biologic collection is of great importance. We wish the students to know the insects of a given food plant, which are much more readily studied when placed together. Also, if it is desirable to give a lecture before a farmers' meeting on the insects of some particular crop the cases are all ready to be carried to the lecture hall with the insects affecting that plant. Our cases are so constructed that strips can be quickly placed over the edges of the blocks without interfering with the specimens, and as the bent-necked bottles are wired to the blocks, the case, when ready, can be turned upside down and handled with impunity.

I might also briefly indicate one or two other card files in use. Clippings from newspapers are kept on manila slips 5 by 8 or 8 by 10 folded to 5 by 8, the clippings running the long way of the paper and leaving a space at the upper left-hand corner for writing the name of the species. They are then arranged systematically the same as the systematic file of notes, each species by itself, and chronologically under each species. Reports of county observers—a system for which we have modeled after that inaugurated by Doctor Felt in New York—are made on paper 8 by 10, which is folded 5 by 8, and are kept under printed guide cards by counties, alphabetically. Clippings concerning pests in that county or crop reports of that county are also kept here, together with a record of the correspondent literature and stationery furnished him, etc. Negatives are kept in card drawers with the rods removed, $3\frac{1}{4}$ by $4\frac{1}{4}$ in 3 by 5 drawers, 4 by 5 in drawers 4 by 6, and 5 by 7 in 5 by 8 drawers, as these drawers are made for cards and can be bought more cheaply than they can be built to order. Furthermore, they have a guide block which holds the negatives upright and solid no matter how many in the drawer. Each negative has a number in one corner and is kept in a folder on which all the data desired concerning it are recorded, and the negatives are given a serial number for each size. A print of each negative is kept with the notes in the experiment or systematic file, and the number of the negative and its size are given.

There are several considerations which commend such a general use of the card system to the entomologist. First, expansibility. Every one has experienced the inconvenience of having to keep notes on one species in half a dozen different places in the same book. The card system is capable of indefinite expansion. A second consideration is ease in filing and reference, for which I know of no method equal to

the card system with the cards on edge so that they can be readily thumbed, and with guides to indicate the approximate position of material arranged alphabetically or numerically.

In my first experience in Maryland we had our note slips arranged in boxes like spool boxes, with the class or subject on the front. We found, however, that it took considerable time to open the box, hunt through it for a slip, as there was no way to indicate its position in the box, to replace the cover, etc. With the notes arranged on the card system with numerous guide cards, a given note can be quickly found and replaced without disarranging the file. Third is the consideration of divisibility. If one wishes information concerning the accesssions of a given species, for instance, he can remove these cards from the file and have them before him without the necessity of hunting through a book and copying off each item. Or in working up a report from notes, it is much more easily done by having all the notes on a uniform size of paper, which can be sorted according to different subjects or phases of the work and written up accordingly, without having to bother with a large volume or several notebooks, the bulk of which is on other subjects than the one in hand. Again, where more than one man is in an office it is a decided advantage to be able to remove certain notes from the file without interfering with the work of another, which would be necessary were they all in one book or in several books in which several species are dealt with. Fourth, compactness is a decided advantage along the same line. In the systematic file are to be found all the notes of a given species, genus, or family, all together, ready for use, with no necessity of looking to an index and hunting them up separately. A fifth point of the greatest importance is that no copying of field notes is necessary. Where one has ample time or clerical help this may not be an advantage, but few men have time to recopy notes made in the field, and where it is necessary they alone can do it. With the note slips they are filed just as written in the field, and if written intelligibly will always be so.

How many a note written on the back of an envelope has been lost. How often has a man gone to a new place and found that though his predecessor has done years of faithful and valuable work, there are no records from which he can gain any knowledge of any of that work, except such as may have been published, or upon which he can build future work. One of the greatest difficulties under which our agricultural colleges and experiment stations are laboring in many States is the frequent change of men. For the present there seems to be no way of avoiding this. But it does seem to the writer that the work of its employee belongs to the station, college, or State, and should not be confined to the entomologist's head and carried off with him when he retires, but should be placed in writing in such intelligible shape that a successor can pick up the work and carry it for-

ward with some degree of continuity. A proper note system, whether like the above or some other, should greatly obviate this. The trouble lies in a lack of system.

Many large business houses are now discarding their ledgers and keeping their accounts and other data on cards, saving money by time saved with the greater convenience of such a system. Furthermore, it enables facts and information to be obtained readily, which, by the use of books, required so much work that they were rarely ascertained. By following some such methods the usefulness and permanent value of our entomological work can undoubtedly be greatly increased.

In discussing this paper, Mr. Felt stated that he had adopted a card system for accessions to the New York State collections, and that he believed any system would prove impracticable unless it was as simple as possible, in order to save time and clerical work. He has adopted a topical arrangement for all easily classified replies to letters, minuting upon the original the topic under which the copy is filed. All communications are filed alphabetically under name of writer or institution, and if the reply is in the topical file its subject can easily be ascertained by reference to the original communication. This system avoids the necessity of employing index cards and the labor incident thereto, and in many instances a reference, either to the alphabetic or topical file, would be sufficient, and only occasionally would it be necessary to consult both. He did not think that a collection could be catalogued satisfactorily.

Mr. Webster remarked that note keeping should be simply a means to attain a desired end, and that each person ought to select a system that best met his wants. The simpler methods should always be selected for the reason that an elaborate system will, in the course of time, become cumbersome and require so much clerical work that for most entomologists it would be wholly impracticable.

Mr. Fletcher observed that card catalogues were being used more than ever in all lines of work and that the entomologist should adopt such improvements as would be of assistance in his work and save time.

The following paper was then presented:

NOTES ON THE TREATMENT OF NURSERY BUDS.

By A. F. Burgess, *Columbus, Ohio.*

A common method of treating buds or grafts that are to be used by nurserymen has been to immerse them in whale oil soap mixture or to fumigate them with hydrocyanic-acid gas before planting in order to prevent the possible introduction of the San Jose scale. Some

growers fearing that the action of the soap on the buds would prevent growth and result in their failure to properly develop have followed the practice of allowing the bud sticks to remain in the mixture for a short time, and on taking them out of washing them with water in order to remove as much as possible of the caustic material remaining, with a view to preventing injury Others have tried fumigation in a limited way, but realizing that should this process cause injury, especially to the more tender varieties of trees, such as the peach, it would mean great financial loss, have been slow to adopt this measure.

In order to test the value of these treatments a set of experiments was begun at Painesville, Ohio, in August, 1902, in cooperation with Mr. W. B. Cole, of that place. The objects in view were to ascertain the effect of the treatments on the development of the buds and also to determine their action on living San Jose scale.

An excellent set of experiments on the fumigation of apple, pear, cherry, peach, and plum buds was conducted by Messrs. Lowe and Parrott in New York and was published in December, 1901 (Bulletin No. 202, N. Y. Agr. Expt. Station), but check trees were used to test the effect of the gas upon the scale, and the latter were fumigated in December and early in June.

In the experiment at Painesville peach trees were selected, as they were the most tender fruit trees available, and badly infested fruit from apple trees was fumigated or treated with the soap mixture at the same time and in the same manner as the buds.

FUMIGATION OF PEACH BUDS.

On August 28 three lots of Kalamazoo peach bud sticks were tied in bundles and placed in a gas-tight box, which was double boarded, with a double thickness of building paper between, and exposed to the action of hydrocyanic-acid gas for forty minutes. The cyanide used was of 98 per cent purity and the sulphuric acid was of the commercial grade. The following charges were used for each 100 cubic feet of space:

Lot 1: 1 ounce cyanide, 1 fluid ounce acid, 3 fluid ounces water.

Lot 2: Three-fourths ounce cyanide, three-fourths fluid ounce acid, 2¼ fluid ounces water.

Lot 3: One-half ounce cyanide, one-half fluid ounce acid, 1½ fluid ounces water.

Several apples badly infested with San Jose scale were fumigated with each lot.

TREATMENT OF PEACH BUDS.

On the same date two lots of Wheeler's Late bud sticks were immersed in whale oil soap mixture. Good's No. 3 whale-oil soap was used at the rate of 2 pounds and 1 pound to each gallon of water. The sticks were removed after remaining fifteen minutes and, with the exception of a few that were selected from each lot, were placed

under a faucet and thoroughly washed with running water. Those that were selected were not washed, but the soap mixture was allowed to dry in order to determine whether any injury would result to the vitality of the buds. Scale-infested apples were treated in a similar manner.

The seedlings were budded with the fumigated and treated buds by experienced workmen on the afternoon of the treatment and the morning following. The experimental trees were located in the center of a large peach block, the rows extending from east to west.

Check trees were budded with untreated buds at the west end of the rows, while those buds that were treated with the soap mixture without washing were at the opposite end.

Mr. Cole writes, under the date of September 2, 1902: "The seedlings run a little under size and the weather rather dry, for our soil, so that the stocks did not work quite as freely as usual. Morning of September 1 we had a soaking rain."

The trees were examined July 23, 1903, and the following tables give the results of the treatment:

Record of Kalamazoo peach buds fumigated with hydrocyanic-acid gas.

Lot No.	Formula.	Number of trees budded.	Number of buds set.	Percentage of buds set.
1	1 ounce cyanide	938	731	78
	Check	105	79	75
2	¾ ounce cyanide	1,085	749	69
3	½ ounce cyanide	1,050	705	67

Record of Wheeler's Late peach buds treated with whale oil soap mixtures.

Formula.	Further treatment.	Number of trees budded.	Number of buds set.	Percentage of buds set.
2 pounds per gallon	No	69	55	80
Do	Washed	964	652	68
Check		86	58	67
1 pound per gallon	No	68	52	76
Do	Washed	961	559	67
Check		86	48	56

It will be noted that the peach buds were not injured by fumigation or treatment with the soap. The fact that a greater percentage of the buds failed at the west end of the rows is due to other causes, such as the character of the ground and climatic conditions.

THE EFFECT OF THESE TREATMENTS ON THE SAN JOSE SCALE.

The fruit used in the tests was badly infested with the scale and in most cases many young lice were present. After the fumigation or treatment it was placed in paper sacks, which were labeled and removed to the office at Columbus, where the following records were made:

FUMIGATION.

Test No. 1:

August 28, 1902. Fumigated four apples, using 1 ounce cyanide; treatment similar to that of the buds in lot 1.

August 31, 1902. No living young or old scales present.

October 15, 1902. No young have developed. Old scales dead.

Test No. 2:

August 28, 1902. Fumigated three apples, using three-fourths ounce cyanide; treatment similar to that of the buds in lot 2.

August 31, 1902. No living young or old scales present.

October 15, 1902. No young scales have developed. Old scales dead.

Test No. 3:

August 28, 1903. Fumigated three apples, using one-half ounce cyanide; treatment similar to that of the buds in lot 3.

August 31, 1903. No living young present. On two apples some of the old females are apparently alive.

September 6, 1903. No young found. Old scales apparently dead.

October 15, 1903. No young have developed. Old scales dead.

The effect of the gas on the scales was fatal in each case. No living insects were noted in three days after treatment except in test No. 3, where the smallest amount of cyanide was used, and they perished without giving birth to young.

DIPPING IN WHALE OIL SOAP MIXTURE.

In the following tests the apples were placed in a coarse sack and immersed in the soap mixture for fifteen minutes.

Test No. 4:

August 28, 1902. Dipped three apples in whale oil soap mixture; 2 pounds of soap to each gallon of water.

August 31, 1902. No living young or old scales observed; scales are dark in color.

September 6, 1902. A few young scales and lice present.

September 15, 1902. Two apples very slightly infested; one not infested.

October 15, 1902. Two apples very slightly infested; one not infested.

Test No. 5:

August 28, 1902. Dipped three apples in whale oil soap mixture; 2 pounds of soap to each gallon of water. After removal they were washed with water.

August 31, 1902. Scales are bright in color; young lice present on two apples.

September 6, 1902. Most of the old scales are dead; many young crawling. Well-developed females appear to be more easily killed than immature ones.

September 15, 1902. Many young scales present.

October 15, 1902. Plenty of live scales in all stages.

Test No. 6:

August 28, 1902. Dipped three apples in whale oil soap mixture; 1 pound of soap to each gallon of water.

August 31, 1902. Lice crawling on two of the apples.

September 6, 1902. Many mature females dead; lice and young scales present on all apples.

October 15, 1902. Plenty of live scales in all stages.

Test No. 7:

August 28, 1902. Dipped three apples in whale oil soap mixture; 1 pound of soap to each gallon of water. After removal they were washed with water.

August 31, 1902. Plenty of young on all apples.

September 6, 1902. Plenty of young on all apples; few old females dead.

September 15, 1902. All apples thoroughly infested.

Test No. 8:

August 28, 1902. Check lot of infested apples. Scales breeding profusely

September 6, 1902. All apples thoroughly infested.

September 15, 1902. All apples thoroughly infested; badly rotted.

In the above tests with whale oil soap mixture it will be noted that many of the mature females were killed, but in all cases where the fruit was washed after treatment a large number of young developed. When used at the rate of 1 pound to each gallon of water and treated as in test No. 7 few of the scales were killed. The most successful treatment was in test No. 4, where 2 pounds of soap was used to each gallon of water, no washing being given the fruit, but even in this case one or more scales survived, as two of the three apples were very slightly infested at the close of the experiment. It is a difficult matter to reach every scale even by this method, as some time is required for the liquid to penetrate those that are hidden beneath the calyx lobes of the apple, which seems to be a favorite place for the young lice to settle.

A comparison of the method of dipping the buds and that of fumigation shows that the latter is more effective and leaves them in better condition for use. The cost of either measure is so small that it is scarcely worth considering when the benefits to be derived are taken into account. A little more time is required for fumigation, but the results are certain.

Buds may be injured by exposing them to the action of the gas for too long a time. Mr. Cole writes me that he has injured well-matured plum buds this season by allowing them to remain exposed to the gas for three or four hours. In all cases of injury the bark on the immature parts of the bud sticks was discolored. He further states, "I used cyanide, 1 ounce to 100 cubic feet, fumigated in the box we made last year. We used the buds that showed no discoloration, and where buds have been exposed but forty minutes my men have made no complaint of injury."

SUMMARY.

The results of these experiments show that the fumigation of bud sticks, using from three-fourths to 1 ounce of cyanide to each 100 cubic feet of space and exposing for forty minutes, is effective in destroying the San Jose scale and is not injurious to the buds. The soap treatment, when used as in the experiments detailed above, is not wholly effective, and if the sticks are washed after treatment it is of little value as far as killing the scale is concerned.

Owing to the practice of nurserymen of obtaining their buds, cuttings, and grafts from many different sources and to the fact that several recent cases of nursery infestation can be traced directly to the use of infested buds, all growers should be urged to fumigate all stock of this character before it is used in the nursery.

Mr. Lochhead said that the question had been raised in Ontario as to the relative merits of fumigating bud sticks or dipping them in whale oil soap mixture, but as the law in that province required fumigation he had not allowed the dipping method to be practiced as a substitute. The standard formula was used in Ontario for fumigating nursery stock and had proved very satisfactory, viz, 1 ounce of potassium cyanide (98 per cent pure), 1 fluid ounce commercial sulphuric acid, and 3 fluid ounces of water to each 100 cubic feet of space, with an exposure of about forty-five minutes.

Mr. Gillette mentioned the fact that the fumigation of all nursery stock entering Colorado might be required in the future, and queried as to the best formula to use.

Mr. Burgess stated that the formula recommended by the Division of Entomology, at Washington, and used in Canada, mentioned by Mr. Lochhead, had been used in Ohio with good results. He further stated that he had presented a paper concerning this matter at the last annual meeting of the horticultural inspectors at Washington, D. C., in November, 1903, and that the matter of a uniform formula had been discussed. The one decided upon for general use differed slightly from the one already mentioned, the amount of sulphuric acid and of water being increased 1 ounce each for every 100 cubic feet of space. Unfortunately, the length of time for exposing the stock was not mentioned, and later it was ascertained that the practice of those who already used this formula varied from an exposure of thirty to sixty minutes. It would seem desirable to have a definite length of time for exposure before adopting a uniform formula.

Mr. Fletcher said that all nursery stock imported into Canada was fumigated by government officials, and that the results had been very satisfactory. No living scales had ever been found after the stock had been fumigated, and no trees had been known to be injured by this process. In case the trees were carelessly handled, or allowed to remain with the roots exposed, they were sometimes damaged, but this could not be charged to the fumigation. No bad results had been reported where three times the normal strength of gas had been used. The local nurseries in Canada are required to fumigate their stock at the expense of the owner; the government pays the expense of fumigating at the ports of entry.

Mr. Martin queried as to the value of lye as an insecticide for treating bud sticks.

Mr. Gillette expressed the opinion that this material was of little value for the destruction of insects.

Mr. Martin stated that an orchardist in Tennessee had used it and reported good results. Mr. Martin had not been able to make an examination of the orchard, but the owner had inspected the trees in May or June and failed to find many live insects.

Mr. Burgess said that several peach trees had been treated experimentally with red seal lye in the spring of 1903 in Ohio; 7 and 15 pounds of this material were used to each 50 gallons of water. The trees became so badly infested by the middle of the following September that they were destroyed by the owner. Several parties had used the same material on an extensive scale last spring, and it had proved worthless for destroying the San Jose scale.

The following paper was then read:

THE RELATION OF THE SYSTEMATIST TO THE ECONOMIC ENTOMOLOGIST.

By F. M. Webster, *Urbana, Ill.*

[Withdrawn for publication elsewhere.]

A general discussion of this paper followed.

Mr. Osborn considered that it is the duty of the systematist not only to describe species but to determine their relation to other known species and genera. He believed that described species should be considered as something that exists in nature, and that such as are not known from types, or can not be found in nature, should be classed as lost species. Several instances were cited of insects that are now described and listed, but which are not represented in collections, and have never since the time that they were described been found in nature.

Mr. French stated that species were often described from a single specimen, and that he had in his collection possibly the only specimen known of *Apantesis shastaensis*. Whether this is an aberrant form of some known species or a species that may still be found in the Shasta Mountains is a question for future investigation.

Mr. Hine suggested that by continual study the systematist was able to detect minute characters easily, whereas a person unfamiliar with a particular group would fail to observe them.

Mr. Summers remarked that although the systematist lays the foundation for economic work, so far as accurately determining the species is concerned he is not dependent upon the economic worker, and therefore very often fails entirely to consider his needs. During the progress of systematic work, there must necessarily be many changes in the nomenclature of the older species, and the economic entomologist must accept these changes after time has proven them to have been well considered.

Mr. Webster considered that it was the upheavals, the sudden and frequent changes, that cause the trouble for the economic worker. The systematist can not properly carry on his investigations without a knowledge of the relation of one species to another, and such work comes within the province of the morphologist. Many species can not be properly and accurately determined without a knowledge of the larval stages, so that the life history work is very important and should not be overlooked.

Mr. Fletcher believed that the best accepted check lists should be used in toto by everyone until better ones took their places, and that the good work done by the systematist would be accepted by the economic worker in time as check lists became more and more perfect. He cited the work of the ornithologists, who, with the small number of species they had to consider, were able to accept a single name without citing an author. This was impossible with the vastly larger number of species of insects. Differences in names did not matter so much if writers would always cite the authors when using a scientific name.

Mr. Cooley next presented a paper, which is as follows:

NOTES ON A GRASSHOPPER OUTBREAK IN MONTANA.

By R. A. Cooley, *Bozeman, Mont.*

During the past three years grasshoppers and dry weather have been responsible for extensive losses in Montana. These losses have fallen, for the most part, on those citizens interested in the grazing of cattle, sheep, and horses on the fenced and open ranges. Less extensive, though serious, damage has been done in the agricultural valleys, where grain and alfalfa were in some cases completely destroyed. The trouble began three years ago in two localities fully 150 miles apart—one in Carbon County, the other in Rosebud County. In these localities the insects have been steadily multiplying during the three years, and each locality has increased year by year until, during the past season (1903), the advancing border lines met in the vicinity of Billings, thus making one infested tract fully 150 miles in length and of varying width.

The affected region may be roughly outlined by stating that it embraces all that part of Montana drained by the Yellowstone River between Miles City and Bigtimber, including not only the valley of the Yellowstone, but the valleys of the side streams that come in from the south and most of the cross countries between the tributaries.

So completely has the grass of the range been taken in some parts of this region that the ranchers have been obliged to sell their stock at a sacrifice or remove it to distant ranges. Many thousands of animals have gone north and south, and are now being fed on ranges

that previously were occupied by local stockmen. Farther west, on and across the divide between the Yellowstone River and the Gallatin Valley, the same species that are causing the destruction in the eastern part of the State have so increased in numbers that it is feared more or less damage will be done during the summer of 1904.

The grasshoppers should not be held responsible for all the loss that has been experienced in the grasshopper-ridden region. Coincidental with the appearance of these insects in unusual numbers has been a series of years in which the late snows and early rains have been much less than in previous years, and apart from any direct or indirect influence which the lack of these storms may have had on the grasshoppers or their natural enemies, the small amount of moisture has seriously interfered with the growth of the grass.

No one species of grasshopper is alone the cause of the devastation nor are the principal destroyers the same on the range as in the irrigated valleys. *Aulocara elliotti* Thom. was the most abundant species on the hillsides, with *Melanoplus atlanis* Riley second and *Camnula pellucida* Scudd. third, but more local in its distribution. Besides these were many other species, which varied greatly in abundance in different localities, dependent on a variety of causes. The first two mentioned species (*Aulocara elliotti* and *Melanoplus atlanis*) together made up on an average of about 60 per cent of all the grasshoppers on the hillsides.

The principal species that fed in the alfalfa fields is *Melanoplus bivittatus* Say. With it was found also *M. atlanis* and various others, while in the grain, which usually is grown on higher ground, were found *M. atlanis* and *A. elliotti* in about equal numbers.

Though the entire affected region is within what has been known as the permanent breeding ground of the Rocky Mountain migratory locust, *Melanoplus spretus* Uhl., not one specimen of this species was taken during the season, nor has the writer been able to capture a specimen during the five years that he has collected in all parts of Montana. What has become of *Melanoplus spretus?*

The writer has been unable to be of any practical assistance to the citizens of his State who have suffered loss on account of grasshoppers. The use of arsenical poison or kerosene pans is absolutely out of the question, except in the cultivated fields of the valleys, and plowing or harrowing would be inadequate to a degree that provokes a laugh.

The use of contagious diseases seemed to be the only artificial means that offered any hope of returns. Accordingly, through the kindness of Prof. C. P. Gillette, a culture tube of the South African fungus disease was secured and from it culture tubes were made and sent out to persons requesting them. Nearly 300 tubes were distributed, but, so far as we are now informed, absolutely no good was accomplished. Besides these practical field tests, various other trials

were made in the laboratory in cages constructed for the purpose, but no favorable results were secured.

While realizing that an experimenter should not have convictions before he has performed his experiments, the writer must confess that very little was expected from the use of the fungus. The test was undertaken since it offered the only hope of relief, for we felt that, since we have authentic statements to the effect that a greater or less measure of success has been secured in other parts of the world, we can be successful in the United States if we can secure the same organism and duplicate the conditions that obtained in those successful tests.

Remarks concerning the damage caused by grasshoppers were made by Mr. Fletcher and Mr. Gillette. Mr. Cooley stated th t the area devastated in Montana was so large that the problem of control would approach that of covering an acreage equal to the entire State of Massachusetts. The fungus disease received from South Africa had proved of little value, and Mr. Gillette stated that his experience with it had been the same in Colorado.

MORNING SESSION, WEDNESDAY, DECEMBER 30, 1903—9 A. M.

The meeting was called to order by Doctor Fletcher, and the following paper was presented:

OBSERVATIONS ON THE LIFE HISTORY OF LIBURNIA CAMPESTRIS, WITH NOTES ON A HYMENOPTEROUS PARASITE INFESTING IT.

By Otto H. Swezey, *Columbus, Ohio.*

In the family Fulgoridæ there are very few species whose life history has been completely worked out. For the most of the species very little is known of their egg-laying and the younger stages. During the past season I have been able to make some interesting observations, including a fairly complete tracing of the life history of a few species.

Liburnia campestris is our most common species in grass lands throughout the eastern and central part of the United States. It is one of the species showing dimorphism, some individuals having elytra somewhat shorter than the abdomen (brachypterous), while others have the elytra extending for about one-third of their length beyond the abdomen (macropterous).

In the autumn of 1902, at Columbus, Ohio, nymphs of some species were taken in quite large numbers, whose identity at the time was impossible to determine further than that they belonged to the subfamily Delphacinæ, as evidenced by the movable spur at the apex of

the tibia. It was thought that they might be the same species which Mr. Van Duzee has reported having taken in New York State in the immature form in the autumn and which he thought might prove to be *Achorotile albosignata*, a European species. A character tending to give one this opinion is that the nymphs have two median carinæ on the face.

In the spring of 1903 this nymph was quite abundant on the campus of Ohio State University. By caging some of them they transformed to the adult stage, and it was proved that they were *Liburnia campestris*. In the final molt the two facial carinæ of the nymph have fused into one median one, forked at the vertex. I am inclined to the opinion that this character of two median facial carinæ will be found to hold for the nymphs of the other species of Liburnia, when they have been discovered.

Nymphs of *L. campestris* were very abundant during the middle of March, and by the last week of the month adults began to appear in places where nymphs had been taken in abundance. April 11 I witnessed the transformation of three specimens from nymph to adult; at this time the adults were becoming quite abundant, increasing from that time on while the nymphs were decreasing, till by the last week in April none were taken.

May 1 a breeding jar was prepared with growing blue grass, and a dozen each of males and females placed therein. Egg deposition was never observed, but it must have occurred soon, for larvæ were noticed in abundance May 17, or in about two weeks. Examinations of the grass in the jar showed the manner in which eggs were deposited. The sheath of a grass leaf is punctured at one angle of the stem, and eggs are placed inside the substance of the leaf sheath, about four to eight in a row, up and down. Often several of these groups occur above one another in the same leaf sheath. The eggs slant downward from the place of insertion. The head end of the larva is uppermost, so that it may readily crawl out when hatched. After learning the place of deposition of eggs, search was made in the field and many grass stems found containing eggs, which were in all cases in the leaf sheath, as above described, and at a distance of 2 to 4 inches from the ground. Not a large number of eggs are deposited by each individual. By dissecting and counting eggs of several females, the number contained varied from 17 to 30. The period of egg-deposition undoubtedly extends throughout May, as the time of maturing of the hibernating nymphs extended over a period of about four weeks, beginning the latter part of March.

The young nymphs in the breeding jar reached their full growth in about six weeks, or the last week in June. At this time the observations were interrupted, so that the exact length of time to reach maturity was not ascertained, but freshly transformed adults were taken quite plentifully the first week in July. All through July and August

adults as well as nymphs of all sizes were very abundant. My observations were not conclusive as to whether there was an additional brood in the summer; but two broods are proven. To recapitulate: We have nymphs hibernating, reaching adult stage latter part of March to middle of April; eggs deposited about April 15 to June 1, nymphs reaching maturity throughout July. These adults probably produce the eggs for the brood of nymphs which hibernate, but I am not certain but what a third brood intervenes. I did not ascertain the time of egg-deposition for the hibernating brood of nymphs.

Details in the life history of *Liburnia lutulenta* are virtually the same as for *L. campestris*. The two species are often taken in the same locality, but *lutulenta* is more apt to be found in lower ground. The nymphs of the two species are very similar in color in the hibernating broods, those of *campestris* being dull light gray in general color, while those of *lutulenta* are darker; markings are similar, but *lutulenta* has a conspicuously defined lighter area on the tergum of first and second abdominal segments. The summer nymphs of *campestris* are lighter in color, often almost white, and usually of varying shades of yellow.

These two are the most abundant species of Fulgorids living in grass lands, so far as I have observed, and they may come to be of some economic importance should they suddenly increase in large numbers; but so far as I have noticed, their injury to grass by sucking the sap from the stems and leaves is very small compared to the injury resulting from the feeding of various species of Jassids, some of which occur in great numbers.

If these two Fulgorids should become so abundant as to be doing appreciable damage, they might be kept in check by close and frequent mowing of the grass during the period of egg-deposition. This would cut off the grass containing most of the eggs, and it was found that the eggs dried up and failed to hatch if the grass containing them was allowed to dry.

A check to their increase to injurious numbers is a hymenopterous parasite, *Gonatopus bicolor*, which is quite common upon both species. Some notes in regard to the habits of this parasite were published in the June number of the Ohio Naturalist, 1903. The larva of the parasite lives in a sack protruding from between the segments on the dorsal side of the abdomen of host. Nymphs of *Liburnia lutulenta* of the brood which hibernated were found infested with these parasites, only one parasite to a host. Some of these were reared to maturity and the parasite identified in the adult stage. When the parasitic larva gets its growth it escapes from the sack and spins a tiny white cocoon in the groove of a grass blade or some other suitable place. The growth of the larva so exhausts the host that it results in its death about the time the full growth of the parasite has been attained. The adults come forth from the cocoons in about three or

four weeks. In all cases under observation the females thus obtained were *Gonatopus bicolor*, while all the males were what has been described as *Labeo longitarsis*. Parasitized nymphs of *Liburnia lutulenta* and *Liburnia campestris* were taken at various times during the summer months, and rearing the parasites they always came out as above. This confirms the opinion expressed in the published notes above referred to that *Gonatopus bicolor* and *Labeo longitarsis* are the same species. It is probably on account of this sexual dimorphism and the lack of knowledge of their life history that the males and females of this species have been described as different species.

When the above-mentioned notes on *Gonatopus bicolor* were published in the Ohio Naturalist I had reared it only from *Liburnia lutulenta*. At the time little thought was given to the possibility of the parasite coming to have any economic importance. By some means the attention of the entomologists of Hawaii was called to these published notes, and Mr. Albert Koebele was sent to Columbus, Ohio, to investigate the matter and, if possible and if thought feasible, to undertake the introduction of these parasites into Hawaii to prey upon a Fulgorid, which is a pest upon the sugar cane. Probably many of you are aware already of the work done at Columbus during the summer by Mr. Koebele. He collected parasitized nymphs of *Liburnia lutulenta* and other species of Fulgorids and Jassids as well, reared them till the parasites attained their growth and spun cocoons, in which condition they were sent to Hawaii. Mr. Koebele was very successful in this collecting and rearing of parasites. Several thousand specimens were sent to Hawaii during the latter part of summer and early fall. These were probably of more than one species, since they were reared from a variety of species of hosts. At present it is with considerable interest that we await reports from Hawaii in regard to whether the parasites accepted the new host and new situation, and the probability of their being a check to the ravages of the sugar-cane Fulgorid.

Mr. Hine stated that he had watched the progress of this work closely and thought the results very important; also, that Mr. Koebele was hopeful that the insects sent to the Hawaiian Islands would survive and prove beneficial. Adults have already been reared from the cocoons sent to Hawaii by Mr. Koebele.

A paper was next presented entitled—

SOME DISTRIBUTION NOTES.

By F. M. Webster, *Urbana, Ill.*

In Volume IX of the Journal of the New York Entomological Society I gave the distribution of *Myochrous denticollis* in the United States, so far as I was able at that time. Quite recently Prof. W. S.

Blatchley, State geologist of Indiana, who has collected Coleoptera rather extensively in that State, sent me the following list of counties in which he had collected the beetle, and which are as follows: Posey, Floyd, Orange, Vigo, and Laporte. Thus this beetle is known to occur throughout the entire length of Indiana. As it may become a serious enemy to growing corn, this information has a certain practical value. In my paper just referred to I also gave the distribution of *Myochrous squamosus*, as far as it was then possible. At that time I had a rather vague report of its having been found in Kentucky, but as this was far out of its known range of distribution I withheld the information until such time as I could either verify it or be more prepared to show that it was an error. I find, however, that one of Dr. Forbes's assistants has taken it in Central Illinois on weeds and corn, and the Kentucky locality does not now appear at all doubtful.

Some ten years ago the late Mr. Bolter, of Chicago, wrote me that about twenty-five years before he had found the asparagus beetle (*Crioceris asparagi*) as far as 40 miles to the west of that city, but had never observed it since that time; also that Mr. B. D. Walsh had given him specimens taken about Rock Island, Ill. The species has remained unknown, so far as I am able to learn, in Illinois since that time. Last year, 1902, and again this year, 1903, two of Dr. Forbes's assistants have found it quite plentifully in some of the northwestern suburbs of Chicago.[a] During the past summer I searched carefully for it about Rock Island, but failed to find it there. It is certainly interesting that it should have continued to exist about Chicago during these thirty-five years without spreading, while in Ohio and Ontario its diffusion to the westward is sufficiently marked to attract considerable attention. When this westward tide of migration reaches Illinois, as now seems every way probable, it will be of much importance to observe if it stops here or continues its westward march across the State, leaving the old colony about Chicago behind.

I may add that the harlequin cabbage bug (*Murgantia histrionica*) is represented in the Bolter collection by a specimen taken about Chicago, while it bred in Urbana in 1896, the same year that it pushed its way north in Ohio, breeding on rape at Wooster and being found at Hinkley, about 25 miles from the south shore of Lake Erie.

Mr. Gillette reported the presence of the harlequin cabbage bug in Colorado and said that *Diabrotica vittata* is spreading in the State, a few specimens having been taken at Fort Collins.

Mr. Fletcher stated that in Ontario the asparagus beetles were

[a] In one of these localities an asparagus grower stated that the species had been present in that vicinity about twenty-five years before the time of writing.—E. S. G. T.

spreading east and west; also that both species were present, but that the injury had not been so severe as was anticipated.

Mr. Sanderson reported that *Crioceris asparagi* had, in his experience, injured new beds of asparagus.

Mr. Green reported that he had found this species 40 miles west of Chicago.

Mr. Gillette next read a paper entitled—

WHAT CREDIT SHALL WE GIVE?

By C. P. Gillette, *Fort Collins, Colo.*

What credits shall we give to those who assist in carrying on our investigations? Probably no one has been long engaged in scientific research who has not heard of other workers who do not give fair credit to those who assist them. Undoubtedly there have been occasions where such complaints were well founded, but it is also probable that heads of departments have often been seriously misrepresented by ambitious assistants who overestimate the importance of their work and are too eager to see their names in print.

I am of the opinion that there is much lack of uniformity also on the part of scientific workers in the matter of giving credit. Probably it is impossible to lay down definitely rules to be closely followed in all cases, but it seems to the writer that there are certain general principles that could be agreed upon and that would lead to af airly uniform practice if followed out. Perhaps it is not discreet to present a topic that is likely to meet with so wide a difference of opinion as this one, but I have no complaints to be adjusted, and I have frequently heard of the unfairness of other scientific workers in giving too little credit, and I believe there is no body of men more likely to agree upon a broad and just plan for the giving of credits than this body of economic entomologists. I am bold, therefore, to present this brief paper in the hope that it may help to bring about a better understanding and more universal good feeling between scientific workers and their assistants, and I wish it thoroughly understood that the paper is not written in criticism of anyone, and I have no one in mind as an offender in these matters.

What credit should be given in a particular case depends upon many conditions. In the first place I should make two very distinct classes of the assistance that might be rendered, viz, unskilled and skilled. Whether the man who plows the ground and plants the seed and cultivates the crop deserves any special credit or not when the final results of the experiment are published to the world, depends upon whether or not he has, on account of special training and ability, added materially to the value of the results obtained.

First, let us consider what credits should, in justice, be given to unskilled help. Here again we shall have to make a twofold division

and consider whether the work is being done under the direction and supervision of another or whether it is independent and original on the part of him who performs it. When the work has been planned and directed by the head of a department and carried out by an unskilled assistant there is no reason why any credit should be given unless such work is unpaid and voluntary. If such a helper, however, has shown unusual fidelity and ability, favorable mention might not be out of place. If the help has been voluntary and unpaid, the person should be given credit for his service if of much importance. His statements and observations, if quite valuable, may be quoted directly as coming from him. An orchardist, for example, puts bands upon all his apple trees and examines them once a week throughout the summer and fall at the request of the entomologist of an experiment station, and keeps a complete record of the worms found at the different dates and gives the results to the entomologist. Full credit should be given for the data furnished if they are used. On the other hand, if a man had been hired to do the same piece of work and furnish the data obtained he would have no claim for credit in a publication of the results, though to give credit would not be out of place and might be necessary as a matter of defense on the part of the entomologist. However, it is not from this class of help that we are most likely to hear complaints of too little credit, but from the other class that I have designated as "skilled."

Before going further let me mention the different ways in which credit may be given. There may be favorable mention (a brief statement giving credit), a direct quotation, joint authorship in publication, or independent publication on the part of the assistant.

In determining the credit due to a skilled assistant we shall also have to know, first of all, whether the work was planned by the head of the department, or whether it was independent and original work on the part of the assistant. If the work was planned quite fully by the head of the department and carried out by an assistant whose name is published with the paper, the writer would take the position that such assistant has no claim upon the head of the department for any further mention. At the same time, if the work were such as to reflect special credit upon the assistant, the author would doubtless be glad to make mention of the fact, and there would be nothing improper in his doing so.

On the other hand, if the work were done by a volunteer and unpaid helper, he ought always to be given credit for his part in the work, either by favorable mention or by direct quotations from his statements. For example, we will suppose experiments are being carried on to determine the life history of the codling moth and an assistant is given full directions and is set to work keeping full records upon wormy apples and numbers of worms appearing daily under bands

upon a certain number of trees throughout the season; the work is faithfully done and reported upon. The one directing the experiment examines the results, rejects certain records that show strong evidence of being abnormal or unusual, decides that certain observations will have to be repeated another year, and finally tabulates the figures and draws conclusions which he is willing to publish. The experiment is his, and he alone is responsible for the results. If he wishes to tell the world what part an assistant had to do in the work, he can do so, but the assistant has no just complaint if his name does not appear in the published results, unless the value of the results is due in considerable part to the originality or unusual qualifications of the assistant.

On the other hand, if the assistant in the progress of the work shows unusual skill and makes original observations of an important kind that were not anticipated in the planning of the experiment, and are not the natural and logical result of carrying out the work as planned, it is but just that he should have credit for it. What that credit should be will be determined by the importance or degree of originality of the observations or experiments that have been made. For example, an assistant is sent to keep records of worms taking refuge under bands of certain apple trees during the summer. One tree, apparently comparable with the others, gives a very much smaller record of worms. The assistant, upon going to the orchard just at the break of day one morning, finds ants capturing the worms upon this tree and carrying them away, and then notices that the nest from which these ants came is located near this tree. The observation is an independent one, not anticipated in the planning of the experiment, and if used the assistant should be given credit, and a mere mention of the fact, giving the assistant's name, is all that is needed. Or an assistant is sent into the field to search for the native food plants of an insect that is native to the locality, and which has turned its attention to cultivated crops. The assistant is told what family of plants the insect is most likely to be found upon. He goes and returns in a few hours with the desired information. It is likely that his success is due largely to his knowledge of botany and a knowledge as to what situations such plants would be found in. While such a case may not be one that would demand special credit being given, it is the opinion of the writer that it would be advisable to give the assistant credit for his observation in way of a mere statement of the fact. If in either of the above cases the assistant were asked to make extensive observations his work might be of sufficient importance to quote him directly or to offer him joint authorship in a paper upon one of the insects treated.

If a skilled assistant is asked to pursue a line of work for which he has shown special ability, the work being directed only partially or not at all by the head of a department, such work may be the basis

for a joint publication or for independent publication, as seems advisable and just by the head of the department. In any case, the fact must not be lost sight of that the head of a department is responsible for the publications of his department. If an assistant publishes a paper that is a discredit to himself, it is also a discredit to the head of the department in which he works. On the other hand, if an assistant publishes a paper that is a credit to himself, that credit is reflected also upon the head of the department. It therefore seems to the writer to be but fair to an assistant, if he has carried on a piece of work of his own planning and direction and writes a valuable paper upon the same, he ought to be allowed to publish under his own signature. If the work has been largely planned and directed by his superior, the assistant has no reason to expect anything more than joint authorship, although the actual work in carrying on the experiment and making the observations may be entirely his.

When the work of an assistant is purely perfunctory and done under direction, the writer sees no special reason why credit should be given in ordinary cases.

As stated in the outset, the whole matter of giving credit for assistance can not be determined by hard and fast rules. I have attempted to give what seem to me to be the broad, general principles which should regulate such matters. A definite understanding between the head of a department and an assistant when the latter begins work would usually do away with dissatisfaction in these matters.

Originality and independent work upon the part of an assistant are the qualities especially worthy of recognition, and in their absence there is very little that an assistant could reasonably ask in the way of special credits in the publications of the one who directed the work. At the same time I should prefer to give credit where there is little reason for doing so than to appear to be giving an assistant less credit than his work deserves.

There are several phases of this subject that should be treated more at length. I have only attempted to write enough to get the subject well before the Association, and there may be those present who have views widely at variance with those I have expressed. I shall be glad to have the subject thoroughly discussed, in the hope that we may agree upon general plans for giving credits to those who assist us in our various lines of work.

Mr. Fletcher heartily agreed with the sentiments expressed in the paper. He thought that if all the work was done by the assistant that he should have the credit, and that in all cases the chief of the department should be, if anything, overgenerous in giving credit to his assistants. Fortunately, this was usually the case now in America.

Mr. Webster called attention to the fact that when a chief has the reputation of giving credit to his assistants for the work actually performed by them, his publications have a better standing than they otherwise would, because it is known exactly who carried out each part of the work. In this way the responsibility for any of the results that are published can be definitely placed. Joint publication is all right, provided the chief has actually put the final touches on the work of his subordinates and not simply attached his name to the latter's work.

The meeting adjourned in order to hold a joint session with the Society for the Promotion of Agricultural Science, which was called to order in the same room. Mr. Fletcher introduced Professor Osborn, who occupied the chair for the joint session.

The following programme was presented:

The Economic Status of the Fulgoridæ, by Herbert Osborn, Columbus, Ohio.

Remedies for the San Jose Scale, by E. P. Felt, Albany, N. Y.

Some Results of the Use of the Lime and Sulphur Washes in Ohio, by A. F. Burgess, Columbus, Ohio.

The Cotton Boll Weevil—A Great Problem in Economic Zoology, by L. O. Howard, Washington, D. C.

Notes on the Mexican Cotton Boll Weevil in Texas, by E. Dwight Sanderson, College Station, Tex.

The second of these papers is published herewith; the remainder will be found in the Proceedings of the Society for the Promotion of Agricultural Sciences.

REMEDIES FOR THE SAN JOSE SCALE.

By E. P. Felt, *Albany, N. Y.*

Experimental work against this scale insect was begun by us several years ago, and the following is a brief summary of results:

Early spring applications of a 20 per cent mechanical crude petroleum emulsion indicated that it was one of the most effective methods of controlling this pest, and that if the spraying was properly done very little or no injury resulted to the trees. This was true not only of the more resistant pear and apple, but also of the more delicate plum and peach. Certain trees have been sprayed by us four years in succession with crude oil, and we are confident that the enlarged lenticels and very rough bark is a result. This does not seem to be a very material injury to the trees, though in one instance the foliage of a pear was deficient in size and abnormally light in color. We propose to test further the effect of continued applications, and it may be that trees can not stand it in our climate. The oil has the advantage of being very easily applied, and its tendency to run around limbs is a distinct advantage. Unreliability of mechanical pumps is a serious objection, though we believe that even this

can be overcome. Somewhat to our surprise it has been demonstrated that this material (20 per cent mechanical emulsion) can be applied to peach trees in midsummer without material injury beyond dropping foliage in places where it is exceptionally thick. This heroic measure was adopted in the case of a very badly infested orchard; and an application of this character is certainly preferable to allowing the scale to breed with very little or no check.

Experiments with many lime-sulphur combinations were inaugurated last spring for the purpose of testing, in a practical way, the value of different proportions of ingredients and also of a more or less prolonged boil. Two formulæ in particular were tested; the 30–30–30 combination to 100 gallons, and the 40–15–20 to 60 gallons. The former gives a smoother wash with very little sediment, and its insecticidal value is most excellent. The latter wash has considerable more sediment and forms more of a coating upon treated trees. It was just as destructive to the scale as the preceding, so far as our observations went. A modification consisting of 25 pounds of lime and 20 pounds of sulphur to 60 gallons of water was tried, and in our own experience was fully as desirable as either of the others. It contained a little more sediment than when equal proportions of lime and sulphur are used and not so much as where twice as much lime as sulphur is employed. Tests to determine the value of salt led us to the conclusion, taken in connection with the results obtained by others, that it had comparatively little value, and we therefore omitted it from our formula. The prolonged boiling insisted upon in so many formulæ was reduced in some cases to but thirty minutes, and we found that where lime was slaked in a kettle of hot water and the sulphur added at the beginning of the operation, thirty minutes' active boiling gave a wash just as efficient as though it had been boiled two hours. Consequently we are at present recommending a lime-sulphur wash composed of 25 pounds of lime and 20 of sulphur to 60 gallons of water; slake the lime in a few gallons of hot water in a kettle, add the sulphur at once, boil actively for thirty minutes, and dilute to the required amount, preferably with warm water, though no ill effects seem to follow the use of cold water. We also tested the utility of employing a resin adhesive made by dissolving 3 pounds of sal soda in 3 quarts of water and adding thereto 4 pounds of resin and boiling until it was dissolved. This was diluted to 5 gallons and then added to the lime-sulphur wash. We found that the wash must be moderately warm or the resin solution is apt to cause coagulation and thus produce a mixture which might clog the pump seriously. This wash undoubtedly adhered a little better than where the resin was not employed, though in practical field work we could see no decided advantage from the addition of the resin.

Observations in a large apple orchard at Poughkeepsie, which has been infested with San Jose scale for thirteen years, have proved to

us conclusively that it was possible to keep this insect in check. Mr. Hart used crude petroleum for two or three years, and was satisfied that it injured his fruit buds to some extent. He tried the lime-sulphur wash last spring and obtained most gratifying results. In fact, some trees which were but half sprayed gave most striking testimony to the efficacy of the application. The treated portions were practically free from the scale, while the untreated limbs were nearly covered with the pest.

A series of experiments with summer washes were undertaken, the principal material used being a modification of the lime-sulphur wash. A large series of small experiments were tried, with no very satisfactory results, except possibly in the case of one wash composed of 25 pounds of lime, 20 pounds of sulphur, and 4 pounds of resin to 240 gallons. This compound was prepared as is described for the winter wash, except that it was boiled but fifteen minutes before diluting to the required amount. It slightly burned the foliage of old apple trees and killed 85 per cent of the scale. It should be stated that this application was made September 4, and it is very probable that the leaves would stand more then than earlier in the season. We hope to continue experiments along these lines another season, and it may be that something of value will result therefrom. There is need of some more effective summer wash for the San Jose scale than the ordinary kerosene emulsion or whale oil soap solution, and while the mechanical petroleum emulsion mentioned above checks the scale in a fairly satisfactory manner, we do not like to indorse its employment to any great extent.

In discussing the papers concerning the treatment for San Jose scale, Mr. Kirkland quoted a Mr. Brown as authority for the statement that very successful work had been done by using a wash made of lime, sulphur, and caustic soda, and that no boiling was necessary, and asked the opinion of the members concerning this wash.

Mr. Felt stated that he did not have very much confidence in the efficacy of a wash prepared as directed by Mr. Brown, and that he could not advise its use. He further stated that he did not think the so-called lime-kerosene wash was what it purported to be, and that even under the best conditions only a relatively small proportion of the kerosene combined with the lime. He did not consider this material suitable for application to fruit trees.

Mr. Marlatt stated that he had just come from an examination of insect conditions in California, and that the San Jose scale had reached the stage there and the means of its control were so universally appreciated that it had ceased to be a matter of much discussion. The lime, sulphur, and salt wash is the remedy almost universally used. Its effectiveness varies somewhat with the condition of the bark of the

tree. For example, it is more efficient on the comparatively smooth-barked Newtown Pippin and Yellow Bellflower, the varieties grown in northern California, and less so on the rougher-barked White Winter Pearmain, which is the common variety in southern California. Mr. Frederick Maskew, a horticultural inspector of Los Angeles County, has also noted, as he informed the speaker, that this wash, where it is not thoroughly effective, is very apt to cause an increase in the spotting of fruit, so much so that the fruit of sprayed trees is sometimes more spotted than of unsprayed trees similarly infested. This seems to come from the fact that the young from the few females escaping the treatment near or on the fruit spurs are driven by the limy coating on the bark to the young fruit and settle there, whereas under normal conditions they would remain on the bark.

Mr. Fletcher stated that one of the great objections to these washes was the fact that they required prolonged boiling, and asked if any successful experiments had been carried out in order to reduce the time recommended, especially regarding the use of caustic soda in preparing the wash without boiling, after the plan suggested by the late Professor Lowe, of Geneva, N. Y.

Mr. Burgess stated that washes made with caustic soda had been tried by Mr. Parrott, and that he reported that the results were of so variable a character that he would not recommend them for general use. He further remarked that it seemed inadvisable for the entomologist to recommend any treatment for general use unless it had proved entirely satisfactory when tried in an experimental way. He doubted the advisability of reducing the length of time of boiling the lime and sulphur wash until more tests had been made, as fruit growers are apt to fail to boil the material sufficiently, and if the proper chemical action is not complete imperfect results will be obtained from spraying.

Mr. Felt replied that he believed if the wash were boiled vigorously for thirty minutes the necessary chemical action would take place.

Mr. Piper stated that in the State of Washington the wash was thoroughly boiled for one-half hour, and when prepared in large quantities was diluted with cold water.

Mr. Summers remarked that it would seem that the conditions under which the mixture was kept must vary somewhat in the different experiments. Chemical action will evidently go on so long as the mixture is at the boiling point. As the addition of the water to the lime brings it up to this point, it would seem that all that is necessary is so to insulate the vessel in which the mixture is kept that it will not lose heat rapidly, and then to leave it for a sufficient length of time to complete the necessary chemical action between the lime and the sulphur.

Mr. Gillette remarked that he had not been called upon to use these washes for the San Jose scale, but would like to ascertain if anyone

present had tried them for controlling the Cottony Maple scale. No one present appeared to have had any experience in using these washes for controlling this insect.

AFTERNOON SESSION, DECEMBER 30, 1903.

The meeting was called to order by Mr. Fletcher, and Mr. Osborn presented a paper entitled—

A SUGGESTION IN NOMENCLATURE.

By Herbert Osborn, *Columbus, Ohio.*

I presume every member of this Association has had occasion once, if not many times, to lament the fact that he is obliged by force of custom and for certainty of precision to burden his publication with two sets of names (in some cases possibly more), and I think we would hail with delight some plan which would enable us to designate certainly any particular insect by a single name or term that would be at once recognized by the unscientific reader as well as the trained biologist.

Our chemical friends seem to have succeeded better than we have, in some respects at least, for they have been able to put into common use terms which are scientifically exact and distinctive. These have become a part of everyday language, and hence many substances can be discussed in economic literature or in general assemblies without the appearance of pedantry on the one hand or the sacrifice of precision on the other. Such examples as calcium carbid or the common names of sulphur, carbon, oxygen, nitrogen, etc., are sufficient to indicate the one term for both popular and scientific use.

We should begin to appreciate that it is not the purpose of modern education to conceal knowledge in a mummy shroud of technical terms for the benefit of the few, but to use every possible means to make this knowledge accessible to the many.

There is much in the structure and life history of insects that is necessarily complex, but I believe one of the most serious hindrances to a more general acquaintance with insect life lies in the complexity and confusion and uncertainty connected with the terms we use in trying to make sure as to the particular thing with which we are dealing.

We must admit that this uncertainty does not all rest with our popular constituency, for upheavals, revisions, shiftings, and turnings in generic and specific names in any group of insects in an effort to reach a "stable" nomenclature are such that only a specialist in any limited group of insects can possibly be sure as to the latest revised combination for many of the common insects. The economic entomologist whose duties compel him to deal with insects of many orders

must often be at a loss as to what generic or specific name to use in his writings to make sure that his species will be certainly recognized by other entomologists.

I venture to say that not one-half of the distinguished entomologists gathered here would be able to give off-hand the "correct" generic and specific combination for a couple of dozen common insects, to include such frequently discussed species as codling moth, oyster-shell scale, plum curculio, fall webworm, etc.

Even with access to a considerable body of literature he would have great difficulty in some cases to decide which was the latest or which was backed by the highest authority.

The name *Carpocapsa pomonella* may very likely persist for some time in economic literature, though our systematic friends now place it in Cydia. The oyster-shell scale I learned under the name of *Aspidiotus conchiformis*, a little later I knew it as *Mytilaspis pomicorticis*, then as *Mytilaspis pomorum*, then as *Mytilaspis ulmi*, and now I must again revise the name and call it *Lepidosaphes ulmi*—all this within my short experience in economic work. I am not yet the oldest relic in the field. This species, by the way, has been treated under 6 different generic names, 12 different specific names, and in 25 different combinations. *Aspidiotus hederæ*, which for assurance we may mention as the oleander scale, is about as bad, for with 3 generic names and 30 different specific names, it has had 38 different combinations.

To the beginner this confusion is especially perplexing, often disheartening, and I believe in many cases is responsible for promising students going into other lines of science where the complexities of nomenclature are less trying.

Now, I must not be interpreted as inveighing against the effort to reach a basis of nomenclature in technical entomology that will give stability and precision. As a systematist I fully realize the importance as well as the difficulty of securing stability, and I am only objecting to the insistence on carrying the conflict, with its necessary upheavals and shiftings, over into the realm of economic entomology. This branch, from its very nature, demands that its results, in order to be of service to the people, for which they are sought, shall be presented in such form that the many may understand.

I am perfectly aware that there are hosts of insects whose common or vernacular names are so indefinite, so variable, or for some reason so unacceptable that the only basis of precision lies in the acceptance of a technical name which, even if changeable, is at least traceable in successive publications.

On the other hand, we do have a number of common names which are strictly distinctive for certain widespread and familiar insects, names that have been much more persistent and unchangeable than the technical names applied to the same species, and the suggestion I

wish to make in this note amounts simply to the adoption of the exclusive use of such names in all purely economic writings. Such exclusive use I would apply to a list of species approved by this Association.

For example, such names as codling moth, chinch bug, Hessian fly, pea weevil, bean weevil, Cecropia moth, plum curculio, hog louse, and many others I could name have just as definite and precise a significance to every entomologist and to every farmer and gardener as the Latin terms usually appended to them, and no confusion would ensue from omitting the variable Latin compound.

This, of course, has not always been the case, and I readily admit the need of using the additional terms in the early writings of economic entomology, but I believe the time has now come when for a considerable list of names we could safely rely on the vernacular name alone.

I do not believe in a too radical departure, but it seems to me it would be safe to adopt the following plan: Let this Association appoint a committee of its members to correspond with entomologists representing as wide a territory as possible, each one of whom should be requested to prepare a list of, say, 300 insects of widespread occurrence and for which a definite common name is used. These lists to be sent to some designated person, the secretary, for instance, or a chairman elected by the committee, who should select from the various lists such names as appear in all or in a majority of them, and thus prepare a list of, say, 100 names, which might again be referred to the members representing different districts, to be submitted to the association at the next meeting for action, and, if approved, all members be advised or urged to use in their economic writings such names only, without any Latin combination or with the Latin name at one place in article only.

It may appear at first sight that this will afford but little relief, but if we look at any bibliography we will find that the great body of written matter on economic entomology is devoted to less than 100 species. Howard says there are 73 "prime" insect pests in the United States. I am sure that of these a large proportion have a common name that has now become so definite in the literature of economic entomology as to be clearly distinctive.

Moreover, our list once established may be increased as rapidly as it is found that certain names have come to have such definite significance as to render their use secure. We have already an excellent basis for the starting of such a list in the sets of names gathered by Professor Gillette and elaborated by Professor Doran.

This list with the Latin equivalents would, of course, be published with our proceedings, perhaps in other places for standard reference, and any author who chose might have appended to his paper Latin equivalents for the names used in his paper.

One other suggestion, and that is regarding the coinage of new names. It seems to the writer that there should be an effort to secure short but significant terms where an expressive vernacular term is not already current.

The use of the generic name, a practice which is so common and generally so satisfactory in botany and to some extent in ornithology, is less available here because of the frequent change of generic names due to splitting or revision of old genera, which are unable to accommodate the grist of new species poured into the hopper.

It would be a little awkward to have to perpetuate as a common name the wheat aphis when the species has been relegated to an entirely different genus.

Mr. Fletcher considered that the matter was an important one, and suggested that a committee of three take the matter up for the Association.

Mr. Gillette considered that the adoption of such a list of common names for well-known pests would prevent some of the confusion that exists at present. He thought that the scientific name should appear somewhere in the publication.

Mr. Webster agreed with the statements made by the last speaker, and stated that he thought that there should be uniformity in nomenclature as far as possible. Much care should be taken in making up this list, and he cited the fact that in the South the name chinch bug is applied to the bedbug, and the buffalo moth to the carpet beetle in the North.

Mr. Hine called attention to the difficulties experienced by teachers on account of the continual changing of scientific names, and said that a set of uniform common names for well-known insects seemed desirable.

Mr. Felt remarked that most common names were spontaneous, and that it was necessary for the entomologist to adopt such as would be understood by his constituents. He considered the matter of common names of somewhat minor importance, though he was willing to cooperate, so far as possible, in securing the adoption of desirable ones. He did not believe it advisable to omit the scientific name, even in very popular publications, though it could occupy an inconspicuous place.

Mr. Washburn agreed with Mr. Felt, and remarked that in some parts of Minnesota several different insects were called the "squash bug," among these being the striped cucumber beetle.

Mr. Kirkland called attention to the fact that in South Africa the insect that in this country is known as the woolly aphis is there called "the American blight," and farmers would not be able to recognize this insect under any other name. It appeared to him that the

economic entomologist must use the best-known common name, and that it would be no disadvantage for the scientific name of the insect to appear in publication.

Mr. Sanderson believed that the scientific name should be placed at the end of the publication, and that the work of the committee would be of great value. It is sometimes necessary to change the common names of insects, and this matter should be referred to such a committee.

Mr. Osborn stated his opinion that the time had come to make a beginning on this line of work, and offered the following resolution, which was adopted:

Resolved, That a standing committee of three be appointed, to be called a committee on nomenclature, members to hold office three years, one changing each year, to consider and recommend adoptions and changes of names in use in economic entomology; this committee being empowered to secure cooperation of entomologists in various parts of the world, as they may find advisable.

The following committee was appointed by the Chair: Mr. Osborn, three years; Mr. Gillette, two years; Mr. Webster, one year.

Mr. Piper read a brief paper, entitled:

NOTES ON PERANABRUS SCABRICOLLIS.

By C. V. Piper, *Washington, D. C.*

This large locustid has periodically for a decade caused more or less damage to the wheat fields in Douglas County, Wash., in a limited area encompassed in a radius of 30 miles. In past outbreaks the insects seem to have bred mainly in the bottoms of the large canyons known as Moses Coulee and Grand Coulee, which are 800 to 1,000 feet lower than the plateau where wheat is grown. In years when drought has caused a scarcity of food in the coulees the insects have invaded the wheat fields in great armies and, while the country was sparsely settled, ruined many isolated crops. After the country became well settled the farmers resorted to ditching to control the insect, with perfect success. Indeed, it appears that along Moses Coulee this process has reduced the numbers of the insects so greatly that for some years past they have caused no apprehension. It is stated by reliable farmers near the coulee that the insects started to return to the lower altitudes when ready to oviposit, and that by ditching against this return very few of the invading army escaped. Whether the insects actually do return in an army to the coulees to oviposit is questionable. This conclusion of the farmers is based largely on the fact that the insects occur every year in the coulee bottom, and only when their numbers make food scarce do they migrate out of the canyon to the plateau above.

In 1902, and in far greater numbers in 1903, the insects appeared on the south slope of Badger Mountain. This land has been settled only within the last five years. The outbreak during 1903 was so serious that the county authorities appropriated funds to combat the insect, which in its march reached within a few miles of Waterville, the oldest wheat-growing region in the county, and where the insect was never before known. It was found much cheaper to stop the insect by fences made of 1 by 12 smooth boards placed on edge than by ditches, and after these were built the progress of the insect was stopped, but not before several thousand acres of wheat were destroyed. Those of the insects not destroyed oviposited in the soil near the barrier fence. No evidence whatever was seen of any return migration to other breeding grounds.

It is evident that the control of this locustid offers no difficult problem, and it is possible practically to exterminate it by no other means than fencing or ditching.

Attempts were made in 1902 and again in 1903 to inoculate it with the South African Mucor, but all the attempts proved fruitless. If a disease could be found, the chances of its spreading are particularly favorable, owing both to the insects' habit of congregating in great numbers at night in the shelter of plants and low bushes and from the further fact that they are cannibalistic.

The distribution of this insect is remarkable. It was described by Thomas from specimens collected in 1872 in the mountains of southwestern Montana at an altitude of 9,000 feet. No other collections have been made since except these recent ones in Douglas County. In Washington it seems to be normally an Upper Sonoran insect, only occasionally invading the transition zone. The Montana types are from the boreal zone, and as they are well preserved there can be no question as to the identity of the Douglas County insect, which matches the types exactly.

Scudder's monotypic genus Peranabrus is founded on Thomas's *Thamnotrizon scabricollis* and differs from Anabrus only in its roughened pronotum.

In answer to a question asked by Mr. Felt as to whether this species devasted the country as they marched along, Mr. Piper replied that they fed upon the grass, and were also carnivorous to some extent.

Mr. Fletcher asked if it were not possible that these large crickets were largely carnivorous; he had eviscerated a large number of *Anabrus purpurascens* when preserving them, and had never found any vegetable matter in their stomachs. He also remarked that the latter species was abundant in Manitoba.

The next paper was presented by Mr. Burgess:

NOTES ON ECONOMIC INSECTS FOR THE YEAR 1903.

By A. F. Burgess, *Columbus, Ohio.*

In general in may be said that few serious outbreaks of destructive insects have appeared in Ohio during the past year. The chinch bug (*Blissus leucopterus*) and the Hessian fly (*Cecidomyia destructor*), two of the prime agricultural pests of the State, have caused little damage. One of the reasons for the disappearance of the latter is probably due to the fact that farmers are learning to sow their wheat late enough in the fall to escape the second brood of this insect.

During June and July great damage was caused to apple stock in the nurseries in the northeastern part of the State by the apple aphis (*Aphis mali*), and where no effort was made to control this insect many small trees were ruined. I have also been informed that the same conditions prevailed in New York, especially in the vicinity of Geneva. One of the leading nursery firms near Painesville, Ohio, tried many different remedies, but the best results were obtained by dipping the tops of the young trees in a wash made of whale-oil soap, tobacco extract, and water. This was prepared by dissolving 1 gallon of whale-oil soap in 50 gallons of water and adding 1 gallon of tobacco extract to each 75 gallons of this mixture. The tobacco extract was purchased from a firm in Louisville, Ky. Continuous applications were necessary in order to control the insect, but by following up this treatment serious injury to the trees was prevented. The leaves of birch trees growing in this region were also attacked by an undetermined species of aphis and many were seriously injured.

In other sections of the State, particularly in the nurseries where a careful examination of existing conditions was made during the summer, no unusual abundance of aphides was noted.

The reports of the Weather Bureau show that the rainfall for northeastern Ohio for the period from the middle of May until early in July was several inches above, and the temperature was considerably below, the normal for this region. These conditions were undoubtedly favorable for the reproduction of this insect and proportionally unfavorable for the increase of its parasitic and predaceous enemies, and as there was a good supply of overwintered eggs an outbreak was inevitable.

On August 24 Mr. E. C. Cotton, one of my assistants, while inspecting a nursery near Bucyrus, found that the roots in a block of 1-year-old apple seedlings were being eaten by a white grub (*Lachnosterna* sp.?) to such an extent that some of the trees were dying. The land had been in corn the previous year, and as the nursery stock was kept free from grass and weeds it was evident that the insects were forced to attack the small roots on account of lack of food. The outer tissue

was eaten in some cases for several inches, but the roots were not severed, as is the case when grass is attacked. The grubs appear to prefer the outer tissue to the more fibrous and woody material within. In a letter received from the owner December 22, 1903, it is estimated that 20 per cent of the trees have been destroyed.

The cankerworm (*Paleacrita vernata*) occurs locally throughout the State, and during the past few years has done a great amount of damage to apple orchards and in some sections the elm trees have been defoliated. The prospect for a destructive brood last spring was very promising, as many orchards contained large numbers of the young larvæ. Early in May the temperature in many parts of the State dropped below the freezing point and in some places ice was formed in the blossoms, so that a large percentage of the prospective fruit crop was ruined. After this time few of the worms could be found in many of the infested orchards, and as this is the testimony of a large number of careful observers it is fair to presume that many of the small worms were killed by the cold weather.

A general investigation of the cankerworm problem has brought out the fact that the spring species predominates throughout the State. The fall species (*Anisopteryx pometaria*) is only known to occur in two localities in Columbus, and in one of these colonies, which is near the State university, the females were found depositing their eggs November 23, 1903.

The San Jose scale (*Aspidiotus perniciosus*) continues to inflict serious injury to fruit and ornamental trees and shrubs, and is causing large expenditures of both time and money by orchardists and landowners. It has to a large extent remained unchecked in cities and towns, and many trees and shrubs are now in a dying condition as a result of its attacks.

During the past season the lime and sulphur washes have come into prominence both experimentally and commercially. Treatment of peach orchards with either the California or the Oregon wash has given satisfactory results. In a few cases slight injury to the twigs has been noticed, when the former wash was applied, about the time that the buds were starting in the spring. Only a few apple orchards have been sprayed with these washes, but as a rule the scale has been reduced by their use. The cheapness and efficiency render them desirable for spraying operations, and they will be the chief insecticides used against this insect during the coming year.

A colony of the Asiatic ladybird (*Chilocorus similis*) was received August 17, through the courtesy of Dr. L. O. Howard, and the two beetles that survived shipment were placed in a peach orchard in Clermont County, which was badly infested with the San Jose scale. A hurried inspection October 28 revealed the presence of twelve beetles, which shows that one generation has been produced. As Clermont is one of the most southern counties in the State, it is hoped

that this colony will survive the winter and thus add another beneficial insect to our present list.

Although the woolly aphis (*Schizoneura lanigera*) is a common insect throughout the State and at times attacks the roots of nursery stock so as to render it unsalable, it has not, so far as is known to the writer, caused serious injury to orchards. While inspecting an apple orchard near Thivener, in Gallia County, my assistants, Messrs. H. J. Speaker and G. A. Runner, found several trees in a 12-year-old orchard that were in a dying condition. About twenty of these trees were growing on a hillside and three of them were nearly dead. They proved to be badly infested with this insect, both above and below the ground. A photograph of the roots of one of these trees that was removed shows that this pest had practically killed the tree. Mr. Haffelt, the owner, informs me that the trees in this orchard were of the Rome Beauty and Ben Davis varieties, and had been planted about twelve years. Doubtless they were infested at the time of setting. Three small crops of fruit had been picked from this orchard, but it is probable that none of the trees will recover from the injuries caused by this insect.

The grape root-worm (*Fidia viticida*) has caused considerable damage to the vineyards in northern Ohio. The foliage showed abundant indications of the work of the beetles, but I am informed that where thorough cultivation and spraying was practiced the injury done by the insect was less than in previous years. The fact remains, however, that many acres of vines have been pulled out and the land planted to other crops on account of the expense of fighting this insect and the grape rot, which is prevalent in this district.

The grape berry moth (*Eudemis botrana*) has been particularly abundant and destructive this year. Mr. T. J. Clymonts, of Cleveland, who controls large vineyards near Euclid, Ohio, informs me of the destruction of the entire crop on 16 acres of Catawba vines. The berries were so badly infested that they were unfit for use in making wine.

The oyster-shell bark-louse (*Lepidosaphes ulmi*) is present in destructive and increasing numbers in northern Ohio, particularly in Cleveland and vicinity. Apple, poplar, and willow trees and lilac bushes are commonly found completely incrusted with the scales and in a dying condition. Failure to apply contact insecticides at the time when the lice are hatching in the spring is largely responsible for the increase. It is a noticeable fact that this is the only section in the State where this species is causing any considerable amount of damage.

The willow curculio (*Cryptorhynchus lapathi*) has continued to spread, and was found this year in Painesville, several miles west of any point previously noted.

An outbreak of the white-marked tussock moth (*Orgyia* [*Hemerocampa*] *leucostigma*) occurred in Cleveland during the summer, and many shade trees were defoliated. I am informed by Mr. M. H. Horvath, who is the superintendent of the city parks, that the trees in some localities were defoliated by the last of July and that the succeeding growth of leaves which the trees put forth were devoured by the second brood of larvæ. As the trees in this city, except in the parks, have a desperate struggle to maintain an existence, few will be able to survive any continued amount of defoliation.

Late in August the black locusts that are abundant on the hills in the valley of the Ohio River were badly stripped by the small beetle *Odontota dorsalis*. The trees were bare and brown in many localities, and the defoliation was general from Gallipolis, Ohio, to Guyandot, W. Va., a distance of over 50 miles. Mr. Runner, my assistant, who reported this outbreak, states that he was informed by parties who had traveled extensively through West Virginia that the same conditions existed in the Cumberland Mountains. It would not pay to carry on any extensive work for the suppression of this insect, but in case persons are planting locust trees to be used for posts or poles, as is the case in some sections of this State, it is possible that this insect may cause considerable loss.

Mr. Webster stated that while in Ohio he had planted, at Wooster several apple trees, the roots of which were badly infested with the woolly aphis. The young trees had made a good growth, but he was unable to state what their condition was at the present time. He called attention to the fact that he had reported the defoliation of the locust trees along the Ohio River by *Odontota dorsalis* about seven years ago.

A paper was next read entitled—

OBSERVATIONS IN 1903.

By E. P. Felt, *Albany, N. Y.*

The following brief accounts relate to some of the more important species brought to notice during the past season. The year will be remembered on account of the exceeding abundance of plant-lice, particularly of species of economic importance. The attack was not only characterized by excessive severity, but also by an undue prolongation, and this latter may have been due in part to unusual rains, which were not favorable to the comparatively unsheltered natural enemies, and therefore probably hindered them in their beneficial work. The apple-tree plant-louse (*Aphis mali* Linn.) was one of the most conspicuous of the destructive forms, and its ravages were so

marked that entire trees had their foliage smeared with honeydew, blackened with the sooty fungus, and eventually lost a considerable proportion of their leaves. Young trees showed the work of this pest more than older ones; but even in the case of those in bearing the development of the fruit was severely checked. Plant-lice of this species appeared about the last of May, were more abundant in June, continuing through July and, in some cases at least, even to the middle of August. The conditions in the nursery were no better than in the orchard, and a correspondent reports that this species obliged him to keep a gang of 15 or 20 men and boys at work continuously in the nursery with a whale oil soap solution, and some nurserymen found themselves almost unable to cope with the pest. The severe injuries led us to experiment with whale oil soap solution—1 pound to 4 gallons—with the result that it killed all the plant-lice touched without injuring the foliage to any extent. We, however, believe that thoroughness is of more importance than using a strong insecticide.

The cherry plant-louse (*Myzus cerasi* Fab.) was also generally destructive throughout the State, and in some cases inflicted very serious injury. We have in mind certain small trees in Chautauqua County which were so badly infested that nearly one-third of the leaf-bearing portion of the twigs had the foliage so badly affected that it curled, died, and dropped by midsummer. The injury was so great that one or two trees died, probably as an indirect result of the severe drain upon their vitality. The plant-louse on Norway maples (*Chaitophorus* (*?*) *aceris*) has likewise been exceedingly abundant and injurious, affecting trees so seriously that practically all the foliage was smeared with honeydew and discolored by fungus. In a few instances the leaves were so badly curled and stunted that they presented only about one-quarter the usual surface, and the trees, instead of being objects of beauty, were monuments of misery and an eyesore on the landscape. The elm aphis (*Callipterus ulmifolii* Mon.) was also generally abundant upon American elm and occasionally exceedingly injurious. The foliage of affected trees was smeared with honeydew, blackened, and the borders of the leaves turned yellowish by midsummer. Affected trees presented a very miserable appearance. The delicate and beautiful plant-louse (*Drepanosiphum acerifolii* Thos.) was likewise very abundant on hard and soft maple in various sections of the State and caused considerable dropping of the foliage. The birch aphis (*Callipterus betulæcolens* Mon.) was abundant and excessively injurious to birches, particularly the cut-leaved variety. The outbreaks of various species of plant-louse were largely checked by hosts of natural enemies, such as ladybugs, syrphus, and lacewinged flies.

Diplotaxis liberta Germ. is rarely brought to notice on account of its depredations, and the complaint by John R. Crandall, of Haup-

pauge, that the beetles had stripped all the foliage from many young peach trees in an orchard of about 30 acres was somewhat of a surprise. He states that they work at night, burying themselves in the dirt during the daytime, and that anywhere from 10 to 50 were found under each tree, they apparently preferring Albertas. He found the insects nowhere except in the peach orchard. A search of economic literature resulted in finding no references to this species, and only one or two to allied forms which had caused, in the case of *D. frondicola* Blanch., considerable injuries to leaves of rose, mountain ash, and wild plum in an Iowa nursery in 1871, and in that of *D. harperi* Blanch., damaging strawberry plants at Campbellsburg, Ind., in 1894.

The codling moth (*Carpocapsa pomonella* Linn.) is a well-known pest which has been studied for a number of years, and we were surprised to meet with many larvæ on a young apple tree, which had entered galleries made by borers, and in excavating pupal cavities had not refrained from eating into living tissues, where they caused considerable bleeding and at first sight led one to suspect that the injury was due to the round-headed borer. The tree in question has a trunk about 6 inches in diameter, and some 12 or 15 larvæ were taken from several of the cavities. Three or four of the caterpillars were found contiguous to living tissues, which had been recently gnawed and from which considerable sap was flowing. The borings were conspicuous, and many of the pellets were covered with exuding sap. It is well known that larvæ of this species gnaw pupal cavities in dead bark, though our attention has never before been called to its working in this manner in living tissues.

The pear psylla (*P. pyricola* Forst.), like various species of plant lice, distinguished itself by its remarkable abundance and excessive depredations in many fruit-growing sections of the State. The injury was much more general and severe than has been observed before, and the explanation is probably found in the unusually favorable climatic conditions. Evidences of great damage began to appear in June, and during July and August the trees presented a truly wretched sight. In some cases the injury was so severe that most of the fruit dropped. One correspondent, Mr. H. D. Lewis, of Anandale, reports the crop of his section a failure on account of the work of this pest.

The San Jose scale (*Aspidiotus perniciosus* Comst.) developed in unusually large numbers toward the latter end of the season, and as a consequence many infested trees were literally covered by this pest. The rapidity of its spread in a locality is of considerable importance and is undoubtedly influenced by a number of factors. The insect has been in the large orchard of Mr. W. H. Hart, of Poughkeepsie, for thirteen years, and yet it has failed to spread to any great extent, portions being practically free even after the lapse of years. A close examination of the center of infestation existing at Clinton Heights shows that while the insect has been present there for about the same

time there has been no extensive spread, it having made its way through a number of small gardens only about one-eighth of a mile in one direction, while it has failed to cross a road to orchards even nearer in another direction.

One infestation was discovered fully a quarter of a mile distant in another direction, but this was due to its having been carried upon trees and not to a normal spread. It should be stated that in both of these cases the scale has been kept in control as a rule, and as a consequence the spread has not been nearly so rapid as if the reverse had been true. On the other hand, investigations and inquiries in a peach-growing section where the scale had become established in a few places three or four years ago reveals the fact that the pest has already obtained a foothold in some orchards from half a mile to 2 miles or thereabouts from others, and in this instance we are inclined to believe that these colonies established at a distance are due to the fact that no very adequate control of the insect has been maintained.

The distribution of insects is one of considerable importance to economic entomologists, and it is interesting to report the presence of the common asparagus beetle (*Crioceris asparagi* Linn.) at Glens Falls, Warren County, where it has become established over an area several miles in extent. This is the northernmost New York locality we know for this species. The cabbage maggot (*Pegomya brassicæ* Bouché) has been unusually injurious in various sections of the State, and has been reported as destroying one-fourth of the crop in St. Lawrence County, besides causing damage in other sections. The onion maggot has also been very injurious, and in St. Lawrence County it ruined one-fourth of the crop, besides causing considerable damage in the vicinity of Albany and probably in other sections.

The saw-toothed grain beetle (*Silvanus surinamensis* Linn.) is a well-known species, and in this country has attracted little attention as a household pest, aside from its annoying presence in cereal preparations and similar materials. The past summer our attention was called to a curious condition in which this species figured as a household pest. The conditions were as follows: The insects bred in immense numbers in a bin of a brewery containing several thousand bushels of oats, and on warm days appeared in large numbers and invaded nearby dwellings. They were so numerous in infested houses that they made their way into everything, and the housekeeper could sweep up nearly a pint on any warm day. They were found in all parts of the dwellings, resting upon ceilings, crawling upon walls, under mats, tablecloths, etc., and even invaded wearing apparel. They were found in shoes and made their way into beds, and caused not a little discomfort by a slight biting or possibly pricking by the serrate edges of the prothorax.

Shade-tree pests have not attracted special notice on account of their depredations, though the elm leaf beetle (*Galerucella luteola*

Müll.) was present this year in enormous numbers in the village of Saratoga Springs, and would have caused serious injury had it not been for the thorough and systematic spraying conducted by village authorities. This species has also been reported as being present in very large numbers at Schuylerville, only a short distance from Saratoga Springs. The depredations of the white-marked tussock moth (*Notolophus* [*Hemerocampa*] *leucostigma* Abb. & Sm.) have not been so excessive as usual, though the pest was generally present in the city of Buffalo and partially defoliated thousands of trees.

Mr. Felt remarked, after reading his paper, that a bulletin concerning the grape root-worm was now in the hands of the printer, and would be distributed at an early date. He had found that where poison was applied to foliage which made a rapid growth, as is the case with grape vines in the spring, that it was not effective in holding this insect in check.

Mr. Gillette stated that during the past year apple and cherry trees in Colorado had been badly infested with aphides. He had found from observation, however, that many of the eggs which were deposited in the fall failed to hatch during the following spring. He estimated that not one in 1,000 of the eggs laid in the fall of 1902 hatched last spring. In spite of this fact there was an abundance of plant-lice present in June.

Mr. Cooley had observed the same fact in Montana, and remarked that many growers were inclined to give up apple culture because of the serious damage to young orchards caused by the apple aphis. He had observed that a ladybird (*Hippodamia 5-signata*) was very abundant and destroyed many of the lice.

At this point two papers sent by Mr. Slingerland were read by the secretary. They were entitled "Some Serious Insect Depredations in New York in 1903" and "Notes and New Facts about some New York Grape Pests."

SOME SERIOUS INSECT DEPREDATIONS IN NEW YORK IN 1903.

By M. V. Slingerland, *Ithaca, N. Y.*

The year 1903 may be recorded in the entomological annals of New York as one noted for an excessive and unprecedented development of plant-lice and the pear psylla, which were generally destructive throughout the State.

PLANT-LICE.

The foliage of shade trees, especially maple, elm, cut-leaved birch, and purple beech, swarmed with plant-lice in many localities. Young fruit trees—apples, quinces, plums, pears, and cherries—in nurseries

and in orchards were so badly infested that growth was seriously checked and the trees in many cases permanently injured. Two nurserymen report that their losses would aggregate $5,000 each. Apple and sweet cherry stocks suffered the most; sour cherries beside badly injured sweet varieties were not touched; some varieties of apples were damaged more than others, and the infestation was worst in certain spots in some nurseries. But the most surprising and destructive work was wrought by these little pests in many large bearing apple orchards in western New York. Reports reached us in June that large prospective crops of apples were being ruined by plant-lice. So unusual is it for these insects to appear in sufficient numbers to injure the fruit that we could hardly believe our eyes when we visited some infested orchards. The young fruits were swarming with the lice, which had stunted their growth and given the fruits a misshapen, knotty appearance, as shown in Pl. II. One large apple buyer stated in the autumn that it was very difficult to pack good stock in the infested orchards. One grower reports that he thinks his crop was reduced one-half by the lice.

We believe that certain weather conditions and a scarcity of their natural enemies were potent factors in causing this unusual outbreak of plant-lice. We found but comparatively few of their enemies, like the ladybird beetles and their grubs, the lacewing flies, and the Syrphus flies, in the infested orchards in June. Later in the season some of their enemies "rose to the occasion" and reaped a rich harvest, often cleaning trees completely of the lice. It is possible that the excessive wet season of 1902, or perhaps an extreme dry period in the spring, may have been unfavorable for the development of these natural enemies and favorable for the plant-lice. We have but little definite knowledge of just what weather conditions cause the "ups and downs" of insect life. Can not this Association devise some scheme for filling in this much-needed chapter in our insect-life book?

We found both the rosy apple aphis (*Aphis sorbi*) and the apple leaf aphis (*Aphis pomi*) in the infested orchards in June, but it is quite probable that Fitch's apple aphis (*Aphis fitchii*) was also abundant on the buds earlier in the season. Owners of large orchards made little or no effort to check the lice, but many young orchards and hundreds of acres of nursery stock were treated several times with the usual oil and soap mixtures with good success where the work was thoroughly done. We can offer no definite predictions for 1904, but it is very doubtful if plant-lice are again as numerous in several years in New York.

THE PEAR PSYLLA.

The summer broods of this serious pest swarmed over most New York pear orchards last season, and much damage was done; even

dooryard trees all over the State were overrun by the psyllas. It was the most general infestation that has occurred in New York. Except the San Jose scale, this psylla is the most destructive insect pest of the pear. Its ravages seem to be increasing in New York, and it has come to be nearly as standard a pest as the codling moth or plum curculio. Only the most thorough work with an oil or soap spray (whale-oil soap, 1 pound in 5 to 7 gallons water, kerosene emulsion diluted with 7 to 10 parts water, or an oil and water spray of 10 to 15 per cent of oil) will control the psylla. Some orchardists with very tall standard trees are now discouraged after fighting the pest nearly every year for ten years. Prompt and thorough work early in the season is necessary in fighting the psylla.

SNAILS OR "SLUGS."

Large numbers of small shell-less snails or "slugs" ravaged young corn, beans, and tobacco plants in central New York in June. In one case 10 acres of beans were badly injured, the "slugs" riddling the leaves and eating into the stalks. Doubtless the wet season of 1902 was very favorable for the development of these moisture-loving animals. A dry spell in July checked their ravages and prevented the carrying out of some experiments we had planned. Some hand-picked them at night, and a strip of salt kept outsiders from getting into a bed of seedling tobacco. Doubtless a poison spray or dust will check these "slugs."

THE ROSE-CHAFER.

There are several very sandy spots in New York where rose-chafers breed and swarm onto near-by strawberry beds, vineyards, and cherry and apple orchards. The beetles appear in these limited areas every year, but they were unusually numerous in 1903. We are convinced that much can be done to check this pest by thorough and timely cultivation of their breeding grounds when they are in the pupa state in May. Grape-root-worm pupæ and wireworm pupæ are easily killed in this way, and why not rose-chafer pupæ also? We shall try very strong doses of arsenate of lead in the menu of the beetles in 1904 if they again appear in destructive numbers.

THE APPLE BUCCULATRIX.

This little pest has again swung into its "up" or destructive period in New York, and last season the foliage in several apple orchards in central New York were badly skeletonized by the tiny caterpillars. A bulletin will soon be issued from the Cornell experiment station on this insect. We have observed several new and interesting phases of its life, and were able to get a series of photographs of the heretofore unobserved process of the making of the cocoon. The common name now in use for this insect has long been a stumbling-block to us, and

some systematist is liable to put the insect into another genus any day. We like the name of "ribbed cocoon-maker of the apple" better than any other we have been able to get, for it is suggestive of that phase of the insect which is usually the first to attract the orchardist's attention.

THE APPLE-LEAF BLISTER MITE.

The pear-leaf blister mite is now a well-known pest in many sections of the country, but never before until last summer had we seen or heard of a similar pest in apple leaves. Scattered through central New York there were many apple trees with many of their leaves showing the corky blisters characteristic of these mites. We have not yet made a careful study of the mites to determine if they are the same as the pear species. The blisters in the apple leaves differ slightly from those in pear, but this may be due to the different food-plants.

CABBAGE AND ONION MAGGOTS.

Much loss resulted in the large cabbage and onion sections of New York last season from these maggots. Apparently no one made any effort to check the pests.

GRAPE PESTS.

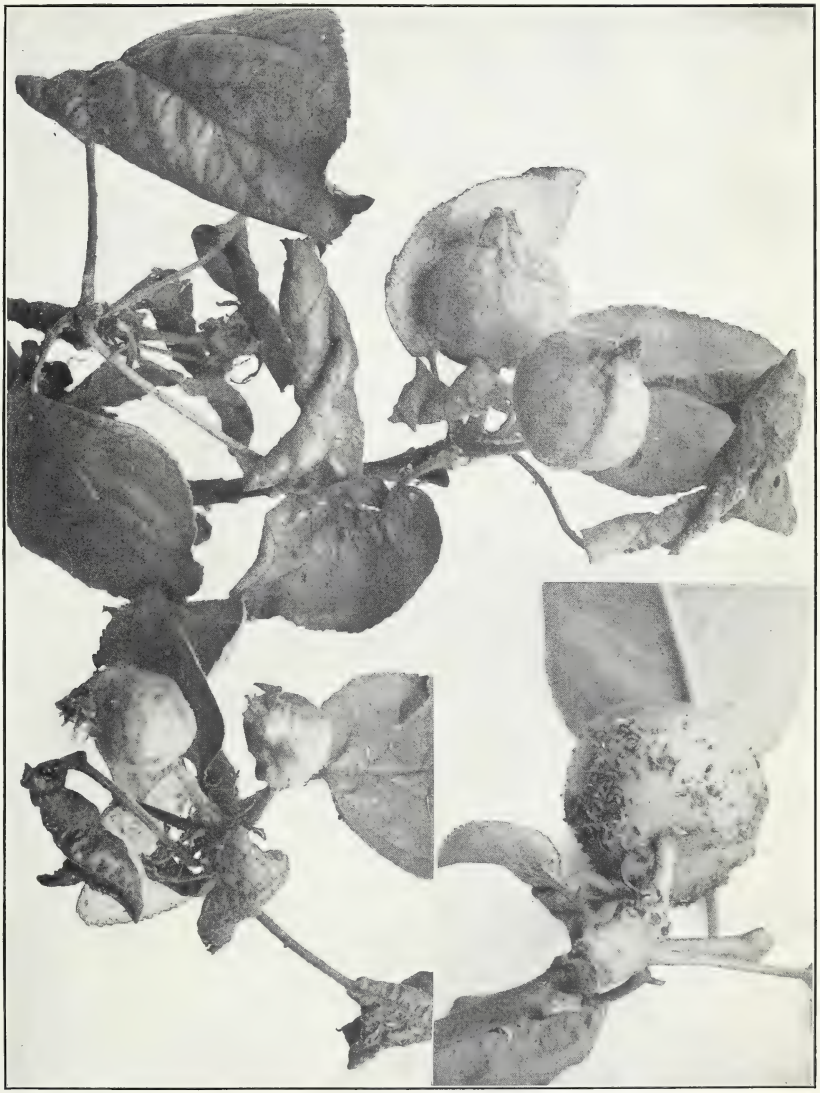
The ravages of three grape pests in Chautauqua County have been discussed in another paper in these proceedings.

THE PLUM CURCULIO.

Many New York plum and cherry growers have long desired a less laborious method than the "jarring" process for fighting this pest. Poison sprays have been recommended and tested for many years, and some think they succeed in controlling the insect in this way. Last season several growers made thorough tests of arsenate of lead, and the results were very gratifying on both plums and cherries. It was used at about 2 pounds in 50 gallons of water or Bordeaux mixture and applied thoroughly two or three times soon after the blossoming period. Recent experiments in other States show that this poison is more effective than Paris green and similar poisons in fighting the codling moth. Thus the indications are that arsenate of lead will come into more general use.

AN HISTORICAL NOTE ON THE CODLING MOTH.

We insert this note simply to place on record some observations on the eggs of this insect which were recorded in Italy in 1857. The account was overlooked in some unaccountable way when we made an exhaustive survey of its early literature in 1898. In 1857 A. Costa published an important work on the insects infesting fruit trees and



DESTRUCTIVE WORK OF APPLE PLANT LICE ON FRUIT AND LEAVES ON LARGE TREES IN NEW YORK IN 1903.

From photograph by author.

dry seeds. On pages 95–100 he discusses the codling moth, and on plate 6 of his work some fairly good figures of all stages of the insect, including the egg and its position on an apple, are given. He describes the egg as "spheroidal, with walls delicately membranous, somewhat netted, transparent, of a whitish-yellow color," and states that the eggs are most often laid in the neighborhood of the stem or calyx. Thus there is little doubt that Costa saw the eggs nearly fifty years ago.

NOTES AND NEW FACTS ABOUT SOME NEW YORK GRAPE PESTS.

By M. V. Slingerland, *Ithaca, N. Y.*

During the past three or four years many vineyards in the great Chautauqua County grape region have been very seriously infested by three insect pests—leaf-hoppers, rootworms, and the fruit moth. Never before had any of these pests menaced this grape section, and the vineyardists were wholly unprepared to cope with such new difficulties. The entomological and horticultural divisions of the Cornell Experiment Station and State Entomologist Felt devoted a large part of their energies to field work in the infested region in 1902 and 1903, and some work will probably be carried on next year. Apparently one of the factors which brought about this unusual outbreak of these grape pests was neglect in cultivating and feeding the vineyards a few years ago when grapes brought very low prices. It has been demonstrated that proper and timely cultivation is one of the most effective methods for controlling the rootworms (*Fidia viticida*), and nothing suits the "hoppers," as the growers call them (*Typhlocyba comes*), better for hibernation quarters than a grass-grown and weedy vineyard. The fruit in some of these neglected vineyards was not worth harvesting, and oftentimes grapes are sorted in the field, the wormy and diseased berries being thrown on the ground near the vines. These conditions favor the unhampered breeding of the fruit moth (*Eudemis botrana*).

It has been a strenuous warfare to devise, test, and evolve effective and practical methods for controlling these grape pests, but the results have demonstrated that such methods are available.

The rootworm is vulnerable in its egg, pupa, and beetle stages. Some vineyardists have found it practical to go over their vines and by rubbing the canes crush the masses of eggs laid under the loose bark. The pupa rests in a little earthen cell, and but few of them survive if this cell is broken by cultivation. More than half of the pupæ can often be killed in this way by thorough stirring of the soil in June.

The beetles feed quite extensively on the leaves, eating characteristic chain-like holes. Thus theoretically they should succumb readily to a poison spray. Although many acres of infested vineyards

were sprayed with arsenate of lead in 1902, such excessive rains fell that no conclusive results were obtained. But last season similar spraying experiments with arsenate of lead (4 pounds in 50 gallons of water) gave some very promising results. In one vineyard three plots of vines gave the following striking results: On the unsprayed vines the leaves were badly eaten by the beetles, and on 10 vines 97 egg clusters were found; on vines sprayed once the foliage was but little eaten, and only 7 egg clusters were found on 10 vines; one plot was sprayed twice and there were scarcely any signs of the foliage being eaten, and a careful examination revealed but 1 egg cluster on 10 vines. These are certainly astonishing results, but the spraying was thoroughly done, and there is scarcely a chance that any peculiar conditions could have influenced the results when the plots were practically side by side in the same vineyard. Furthermore, another reliable vineyardist in another town who sprayed a large portion of his vineyard but once feels very sure that he accomplished much toward controlling this destructive pest, and an examination of his vines in comparison with a neighbor's across the road gave very encouraging results. Further spraying will be done next season in a vineyard into which a swarm of the beetles migrated and fed extensively last summer from a badly injured vineyard across a meadow 30 or 40 rods away. This migration of the beetles in a body from one vineyard into another thrifty one affording better pasturage for themselves and their grubs later is a new and very alarming fact, for it means that the best-cared-for vineyards are constantly menaced by neighboring infested vineyards where no fight is being made against the pest. Doctor Felt has captured thousands of the beetles in a "catcher," designed to be drawn along on each side a row of vines. Other hand "catchers" have been devised, but most vineyardists are waiting for a more conclusive demonstration of the effectiveness of this laborious method before they will put it into practice.

Mr. P. J. Parrott informs me that this rootworm, which has devastated Ohio vineyards for several years, is now in its "down" or non-destructive period and is comparatively scarce in the infested region. There are some indications that it is also disappearing as a pest from the earliest-infested region in Chautauqua County, N. Y.

An outbreak of that common grape pest, the grape leaf-hopper, unprecedented in extent and destructiveness in the annals of New York, has occurred in nearly the same region infested by rootworms in Chautauqua County during the past three years. More than a thousand acres of vineyards have been infested to the extent that the vines did not make growth enough to furnish sufficient wood to tie up for the next season's crop, and the foliage was often killed in early fall, and thus the proper coloring and ripening of the fruit and wood was prevented. No vines were killed, but it will be two or three years before many vineyards regain their normal vigor. After

a long, hard, and sometimes discouraging warfare in 1902 against the "hoppers," we demonstrated that they can be effectively, practically, and cheaply controlled. The details of our work will appear in Bulletin No. 215 of the Cornell Experiment Station.

We finally devised a large, practicable, sticky shield (fig. 1) for catching thousands of the adult "hoppers" in the spring on considerable areas. The trouble with many of the previous recommendations for this pest is that they are impracticable or too expensive to operate in large vineyards. We could not get New York vineyardists with 10 to 100 acres of vines to use a sticky fan or shingle. We were unable

FIG. 1.—A practicable, large and efficient sticky shield for capturing adult grape leaf-hoppers in the spring (from photo by author).

to kill many of the adult "hoppers" with a spray or dust of any kind that did not injure the leaves, until we finally tried the cowardly scheme of "hitting them when they were down" with a 25 per cent mechanical mixture of kerosene. We found that a 5 per cent kerosene mixture would not injure the leaves and would bring the "hoppers" to the ground, where they would remain a few moments wiping it off. Continuing this to the end of a row of vines, the pump was set to throw 25 per cent of oil, and going back the same row, this spray was directed at the "hoppers" on the ground. We killed thousands of them in this way, but soon found that none of the

several oil and water pumps we used could be depended upon to throw the scheduled amount of oil. The supposed 5 per cent oil spray varied so much that too much injury resulted to the foliage and we had to abandon these pumps. We believe it is practicable to use two pumps, one for whale-oil soap (1 pound in 5 gallons of water) to knock the "hoppers" down, and the second an oil and water pump with a longer hose to follow close behind and hit them on the ground with a 25 per cent oil spray. Water will not bring down satisfactorily. It is of the utmost importance to kill all of the hibernated adult "hoppers" possible in the spring, for they often do as much injury as their children later in the season. We believe that if 50 to 75 per cent of them could be killed then that the vineyards would not suffer seriously during the rest of the season.

The young "hoppers" or nymphs are quickly killed when hit with a weak soap or oil spray. We sprayed many acres with whale-oil soap (1 pound in 10 gallons of water) early in July, with very successful results. The keynote to success is in hitting the little nymphs on the undersides of the leaves. To do this it is necessary to stop at each vine and with underspray nozzles direct a forceful and fine spray onto the undersides of the leaves. Vineyards can be thoroughly and effectively treated in this way in July for about $5 per acre, and one treatment is usually sufficient to reduce the pest far below the danger limit. Our sprayed vineyards remained green until frosts came, and the fruit and wood thus fully ripened. The fruit sold above the market price, as it was riper and sweeter.

As no one had worked out the life history of this common pest, we made careful studies in the field and insectary, which resulted in many new and interesting facts. Recent writers have guessed there were three or more broods of the "hoppers" in a year. Our observations, extending over two years, lead us to the following conclusions regarding the life and habits of the grape leaf-hopper in New York. The adults hibernate largely in nearby grass and woodlands, and emerge about May 1 to feed for two weeks or so on various plants, as strawberries, dewberries, and raspberries, their reddish, winter coloring changing to a lemon yellow; then they go to the grape foliage, and the insect spends the rest of the season thereon. About June 1 egg laying begins and continues for several weeks, the eggs being stuck just beneath the lower skin of the leaves, usually one in a place, but sometimes six or more in a row. They hatch in about two weeks. The young "hoppers" live on the undersides of the leaves through five different nymph stages, their cast skins often remaining on the leaves for weeks. The nymphs run rapidly, but, contrary to tradition, they do not hop or leap. After about five weeks of this nymphal life they appear as flying and leaping adults in August. Evidently some of the first of these adults to appear lay eggs which develop a partial second brood of nymphs in New York, but most of them soon

take on their protective, reddish, winter coloration, and in October go into hibernation. Some of these hibernating adults doubtless live from one August until the next, or for nearly a year. There is but one full brood and a fragment of a second brood of the insect in New York vineyards in a year. Apparently the life pendulum of the grape leaf hopper has begun its downward swing after an "up" period of great destructiveness for two years, for last season they were not so numerous, although millions of them went into hibernation in the fall of 1902.

The grape fruit moth has been unusually numerous in some vineyards in Chautauqua County for two or three years, sometimes more than half the fruit being ruined. We have not yet observed the spring and early summer life and habits of the pest. In August we readily found the eggs stuck onto the skin of the fruits in various localities. They remind one much of the codling moth's egg. The accepted notion has been in this country that this fruit moth is the same as the European species, and that it hibernates as a pupa in its cocoon made inside a peculiar flap cut from the leaf. In 1899 an exhaustive account of 75 pages about the European species appeared in Italy.[a] There the third or last brood of larvæ spin their hibernating cocoons under the loose bark of the older parts of the vines or on their supports, while the cocoons of the first and second spring and summer broods that work on the flower clusters and growing fruits are made among the flowers or on the leaves of grape and various other plants. In October, 1903, we made a very thorough examination of many vines in a badly infested vineyard and failed to find any cocoons except on the fallen leaves. Either we have a different species from the European grape fruit moth or else it has quite a different hibernating habit in New York. One of the systematists who is studying this group of moths tells me that there seem to be at least two different species now labeled *Eudemis botrana* in our collections. In the Murtfeldt collection now at Cornell University there is probably the largest series of bred specimens of moths under this label in this country, and it is quite evident at a glance that there is more than one species in the material. As soon as authentic European material can be obtained we hope to arrive at some definite conclusions regarding the identity of the American grape fruit moth. We also expect to carefully compare our insect in its various stages to see if it corresponds in all its details with the many figures given for the European species in Guercio's excellent work.

Some experiments were made during the past season in combating this grape fruit moth. Some vineyardists found they could pick off the conspicuous, infested, green fruits for about $2 per acre. This is, of course, a very effectual method. Some vineyards were sprayed

[a] Nuove Relazioni R. Stazione di Entomologia Agraria, Serie Prima No. 1, pp. 118–193, by G. del Guercio.

with arsenate of lead (10 pounds to 100 gallons) twice, just before blossoming and again when the fruit was about the size of grape seeds. The vineyardists state that these sprayings gave almost absolute protection to the crop. The point is to poison the early brood of larvæ that feed externally on the blossoms and very small fruits.

We found that many of the larvæ of this grape pest were killed by a Braconid parasite (*Bracon scutator*).

Continuing the discussion, Mr. Webster gave some of the results of the experiments which he had made for controlling the grape root worm in Ohio. He expressed the opinion that as this species was subterranean in its habits during the larval stage, great care was necessary in drawing conclusions concerning any experiments for its control, he himself having been frequently disappointed.

Mr. Felt stated that he had seen considerable spraying with arsenical poisons for destroying this pest, and in these instances, as well as in his own experience, the measure had proved unsatisfactory. He cited a case where two vineyards had been carefully investigated; one was sprayed and the other was not. At the close of the season there were relatively more grubs about the sprayed than the unsprayed vines, and he has yet to find a vineyard where satisfactory results followed this treatment. His experiments showed that if pupæ were killed by cultivation at the proper time, and the beetles collected and destroyed at intervals of five days, so long as they were abundant enough to warrant this measure, the numbers of the pest were very greatly decreased.

MORNING SESSION, THURSDAY, DECEMBER 31, 1903—9 A. M.

The meeting was called to order by Mr. Washburn. Letters were read by the secretary from Miss Murtfeldt, Mr. Skinner, and Mr. Smith, expressing regret that they were unable to be present at the meetings. A letter was also read from Prof. William Trelease, containing an invitation to the members of the Association to visit the Missouri Botanical Gardens, which was unanimously accepted.

The following paper was presented:

NOTES OF THE YEAR FROM COLORADO.

By C. P. Gillette, *Fort Collins, Colo.*

[Withdrawn for publication elsewhere.]

Mr. Gillette exhibited a collection containing some of the insects discussed in his paper, and stated that the wheat-stem maggot that he referred to attacks the stems of the wheat plant.

Mr. Fletcher suggested that this insect be called the Colorado

wheat-stem maggot, to distinguish it from *Meromyza americana*, which is widely known as the wheat-stem maggot.

Mr. Snow reported that he had taken *Nysius californicus* abundantly in the San Francisco Mountains, near Flagstaff, Ariz., at an elevation of 12,800 feet above the sea level, and that no vegetation was present at that point.

Mr. Osborn thought that *Pentatoma sayi* must occur on some native plant, but had evidently adapted itself to cultivated plants, and suggested that it might spread in the same manner as the potato beetle.

Mr. Washburn referred to having found this species on wheat last summer, but did not consider it a serious grain pest.

Mr. Wilcox spoke of a method of catching grasshoppers which he had seen practiced in the West, which was known as "ballooning." A large sack was tied with a rope in such a manner as to keep the mouth of the sack open. The other end of the rope was attached to the pommel of a saddle, and as the horse was driven rapidly across the field large quantities of the insects were caught. He stated that where a bounty of 1 cent a pound was paid for the insects a man could make from $5 to $10 a day by using the "balloon."

Mr. Gillette stated that the short-winged forms of *Melanoplus bivittatus* and *M. femur-rubrum* were not common, and that the specimens that he was showing were mostly taken by Mr. E. D. Ball in shady places, especially among some small trees at Fort Collins.

The following paper was then read:

SOME INJURIOUS INSECTS OF 1903 IN ONTARIO.

By William Lochhead, *Guelph, Ontario, Canada.*

Ontario occupies a unique position in many respects. The great agricultural part of the Province lies between the three Great Lakes, Huron, Erie, and Ontario, while to the north lies another large basin of water, the Georgian Bay. That these large bodies of water exercise an influence on plant and animal life is apparent to anyone who has looked into this question. For example, the plant life along the north shore of Lake Erie is fully two weeks in advance of the plant life near the center of the peninsula—say in the vicinity of Guelph. In that district peaches and grapes can be grown very successfully. Again, fully 200 miles north of Lake Erie is the Georgian Bay. On the south shore of this body of water is an attractive country which is excellently adapted for fruit growing. There peaches and grapes can also be grown without danger from frost. All through the central part of the peninsula grapes and peaches can not be grown successfully.

It is evident, therefore, that climate must exert a strong influence on both plant and animal life, and it is the duty of the economic

entomologist to find out the amount of this influence. During the seasons of 1899, 1900, and 1901 the Hessian fly and pea weevil were very prevalent in the southwestern part of Ontario, but through some unknown cause these pests have to some extent largely disappeared. Believing that it would be possible to determine some of these unknown causes, the Ontario Agricultural College has decided to establish small meteorological stations in the various sections of the Province in order to obtain reliable data regarding the temperature and precipitation throughout the year. It is thought that in time some information of value may be obtained based on these observations.

As I have already noted, the Hessian fly is no longer a serious pest in Ontario, for it has been observed in one or two localities only during the past season. When we remember that in the years 1900 and 1901 the annual loss from this insect alone in Ontario was at least two and a half millions of dollars, we can realize to some extent the relief which the farmers feel on the disappearance of this fly.

The pea weevil, which was so disastrous last season, has not been so active in 1903. There is no doubt that weevils are present in large numbers, but the farmers are now well acquainted with the best methods of dealing with this pest. Some districts have discontinued the growing of peas altogether and provided substitute crops. In other districts fumigation with carbon bisulphid is largely practiced, and farmers are careful to fumigate all their seed peas.

Ontario sells more than $2,000,000 worth of clover seed, and a reliable buyer told me that not less than one-fourth of the crop had been ruined this year. In some districts the entire crop was destroyed. That the clover-seed midge is the chief cause of the destruction an examination of the infested fields in June clearly showed, but there are other insects working with the midge. The clover thrips was very abundant in many parts, and I am inclined to believe that some of the loss must be attributed to this pest.

The Grimsby-Burlington district, at the head of Lake Ontario, has suffered severely for many years from the effects of the pear psylla. Last season the injury was very perceptible, and many of the orchardists consider the outlook decidedly gloomy for the coming season. The recent experiments against San Jose scale have taught many the value of early spraying with crude petroleum, whale-oil soap solution, or lime-sulphur salt mixture. The orchards which were the most effectively treated for the San Jose scale suffered least from the effects of the psylla.

For the first time in many years the Grimsby-Burlington district suffered severely from the apple aphis. Previous to this year it was a rare insect, but the injuries done this past season have convinced the fruit growers that something must be done to control this aphis.

Among garden insects, while the common squash bug was not so abundant this year as usual, the cucumber beetles kept up their attacks as in previous years. The asparagus beetles are now passing through Ontario, but, strange to say, the twelve-spotted species is taking the lead. In the districts which have been infested for two or more seasons the common asparagus beetle is by far the more abundant.

With regard to the San Jose scale I regret to report that the insect was never more abundant than it is at present. The fruit growers are now in earnest regarding the matter of controlling the scale, but they have delayed too long. Hard, persistent work is now necessary to present marketable fruit, and much money will have to be expended in providing spraying materials. Our San Jose scale-infested area occupies only a small portion of the Province, and many of our finest fruit sections are still free from the pest. Our fumigation act is rigidly enforced, and it has undoubtedly been the chief means for the prevention of the spread of the scale.

In the southwest part of the province the lime-sulphur-salt remedy has been tried on an extensive scale, and it has been found effective and cheap. By the establishing of township sprayers better work has been done and at little trouble by the owners. The owner acts as general supervisor of the spraying operations and sees that the operation is done properly.

A little east of this section crude petroleum is the standard remedy. Oil wells are close by, and the orchards are almost altogether composed of apples, pears, and plums.

In the Niagara district, for some reason or other, the two remedies found effective farther west are not popular.

Mr. Felt remarked that in New York *Crioceris asparagi* was more injurious than *C. 12-punctata*, this being especially true in the Hudson Valley.

Mr. Lochhead stated, in answer to a question, that grapes were grown to a large extent in Ontario, but the grape fidia had not yet appeared.

Mr. Gillette reported that alfalfa was attacked by thrips in Colorado, the seed being ruined, and asked if any new remedies had been found for destroying the squash bug.

Mr. Felt replied that the shingle method, which had been used in Massachusetts years ago, was the most satisfactory one that he had tried.

Mr. Fletcher next presented a paper entitled—

INSECTS OF THE YEAR IN CANADA.

By Dr. James Fletcher, *Dominion Entomologist.*

The season of 1903 in Canada has presented some unusual characteristics in almost all parts of the Dominion. Until the middle of June an exceptional drought prevailed from the Great Lakes to the Atlantic coast. On the prairies spring conditions were most favorable, but a cool summer with a moist autumn delayed ripening of all crops. These conditions had a marked influence on the prevalence of insects. There were few outbreaks of cutworms and there was no complaint of widespread injury. The pea weevil, which has done so much harm in the pea-growing districts of the Province of Ontario, was decidedly less destructive than usual. This, I believe, was to a large measure due to a vigorous campaign instituted last year to induce farmers and seed merchants to adopt the well-known remedies and preventive measures of controlling this insect. The pea moth was hardly mentioned in correspondence, but occurred to some extent in the Maritime Provinces. Over the same area the carrot rust-fly was the cause of some damage, particularly to red carrots. The asparagus beetles, which are a somewhat recent introduction into Canada, occurred over a rather wider area in Ontario than in previous years, and have now spread east as far as Toronto.

Some of the important pests of the field, orchard, and garden were conspicuously absent last season. There was a marked decrease in the amount of injury by the Hessian fly. This insect was observed in one or two localities only in western Ontario, where for some years it has been the cause of excessive loss. A slight injury was reported from Manitoba and the northwest territories, as well as from Prince Edward Island. In the case of the northwestern records there is no doubt that there was some confusion with injuries both by the wheat-stem maggot (*Meromyza americana*) and the wheat-stem sawfly (*Cephus pygmæus*). There was hardly a complaint of injury by the squash bug (*Anasa tristis* DeG.), and no mention whatever of the tent caterpillars. Even those two redoubtable enemies of the fruit grower the codling moth and the plum curculio failed to appear in sufficient numbers to draw attention. The codling moth in the eastern part of the Dominion, where there is only one brood, scarcely affected the crop at all, and west of Toronto, where there are two broods, it was only late in the season when any injury was noticeable. This exemption from injury is due undoubtedly, in a large measure, to the nature of the season, but has been contributed to by improved orchard methods, including systematic spraying by most of our best fruit growers. The double method of spraying in spring and banding with burlap in autumn have been recommended, and fruit grow-

ers have been reminded that the examination of these bands and the destruction of the contained larvæ is of even more importance than putting the bands on the trees. Stress was also laid upon the fact that more effective work could be done, looking to future exemption, by thorough and careful work in years of small occurrences than when the insects were enormously abundant. The plum curculio was locally the cause of severe injury in a few localities where spraying had been neglected, but the enormous crop of plums this year in all parts of Canada rendered the attacks of the plum curculio insignificant, if not an actual benefit. There is one subject I should like particularly to bring before the Association, which is spraying for the control of the plum curculio. In Canada spraying for this insect is a practical paying remedy, which I calculate will save 50 per cent of the crop, but I notice that United States writers seldom mention spraying, and pin their faith to the extremely expensive, troublesome, and, with me, comparatively ineffective method of jarring the trees. Last year I corresponded with some of those who recommended jarring, and was very much surprised to find how few had tried spraying and compared it as to efficiency and cost with jarring.

The eye-spotted bud-moth was abundant in Nova Scotia and caused some injury to the apple crop. Two insects which are noticeably on the increase in Canada are the fall webworm and the white-marked tussock moth. Fruit growers and municipal bodies have been reminded that these well-known insects are easily fought if the proper measures are adopted. The birch skeletonizer, *Bucculatrix canadensisella* Cham., appeared again in some numbers in central Ontario, but was not nearly such a pest as it has been for the past two years.

Among insects which have been the cause of considerable damage during the season of 1903, or have been unusually abundant, mention may be made of the following:

Plant-lice of all kinds have been very prevalent. The grain aphis extended from the Northwest Territories to the Atlantic coast, but compared with its great abundance affected very little the quality of the crop. The cabbage aphis was a serious enemy of early cabbages in British Columbia, and of turnips to some extent throughout the Dominion, but was the cause of more considerable loss in Prince Edward Island and Nova Scotia. The apple aphis appeared early in the season in enormous numbers in Ontario, Quebec, and Nova Scotia, but was less abundant than usual in British Columbia, where, as a rule, it is one of the most destructive enemies of the apple grower. The most important injuries by the apple aphis in 1903 were to young trees in nurseries and to the fruit while young and green. In some varieties more than others the fruit was much distorted and disfigured so as to give very much the appearance of apples which had been "stung" by the small British Columbian apple fruit-miner (*Argyresthia conjugella* Z.). The black-cherry aphis and the two plum aphides

appeared in considerable numbers in central Canada and were the cause of some injury.

The clover-seed midge was one of the most destructive insects of the year and was the cause of enormous loss in the clover-seed-growing districts of western Ontario.

The sugar-beet webworm (*Loxostege sticticalis* L.) appeared in countless swarms in Manitoba in June and September, and was the cause of considerable alarm among farmers, who feared from the large number of different plants which the larvæ attacked that they might develop into an enemy of the all-important wheat crop. Their depredations, however, were almost entirely confined to weeds or plants of no value. In the districts where this insect occurred there happened to be very few fields of either mangels or sugar beets. The most attractive plant was the common weed *Chenopodium album*, of which some fields were entirely cleared. In gardens spinach and beets suffered most.

In Manitoba some loss was caused by grasshoppers. The Criddle mixture was again experimented with, and very satisfactory results were obtained. After three years' practice Mr. Criddle now recommends that this mixture be made as follows: One part by measurement of Paris green to 120 parts horse droppings, preferably fresh, or about 1 pound of Paris green to half a coal-oil barrel of barn droppings. One pound of salt should be added when the droppings are not fresh. I again had the pleasure last summer when in Manitoba of seeing how effective this mixture is in destroying locusts. A field which had been protected by having the mixture scattered freely around the edges stood out as a green patch in a brown plain among fields where nothing had been done to kill the grasshoppers. The species of locusts concerned in this outbreak were the same as occurred in the locality last year, viz, *Melanoplus atlanis*, *M. spretus*, *M. bivittatus*, and *M. packardii*. They were abundantly accompanied by their parasites, the red locust mite and the blister beetles, *Epicauta sericans* and *E. pennsylvanica*. Through the kindness of Doctor Howard I was able to try some experiments upon this swarm with the locust fungus, of which he provided me with six test tubes of a fresh culture. These were very carefully manipulated by Mr. Norman Criddle throughout the season, but no appreciable results could be detected, an outcome which I learn has been similar to those of all other experimenters who have tried this at first sight attractive but really disappointing method of killing locusts.

The pear-tree flea-louse (*Psylla pyricola* Foerster) occurs to some extent in many Canadian orchards and has in a few instances caused considerable loss. During the past season specimens were received from as far east as Nova Scotia. A remedy which has been much cited is one which has been used by Mr. Henry Lutz, of Youngstown, N. Y. This consists of scraping the trunks of the trees in cold

weather, burning the scrapings, and then giving them a thorough coating of slushy whitewash. I shall be glad if any members present who have tested this remedy will give us the benefit of their experience, as I know that this enemy of the pear is attracting a good deal of attention in the Eastern States.

The San Jose scale in Canada, I am thankful to say, has not spread beyond the limits of the area which was known to be infested at the time of our last meeting, but nevertheless its numbers have decidedly increased within that area. The injury now being done, it must be acknowledged, is extreme. This area is comparatively small and lies south of a line drawn from the extreme western end of Lake Ontario to Lake St. Clair. The Federal Government is watching most jealously every shrub and tree imported from countries known to be infested, and all classes of plants upon which the scale is liable to be introduced are fumigated at the border by Government officials, whether this is stated to have been previously done or not. It is but just to state that up to the present time not a single instance has been found of new infestation from stock brought into the country, or of a living scale upon any tree which had been fumigated. Those progressive fruit growers who have sprayed their trees to clear them of the San Jose scale have had the greatest satisfaction with the lime, sulphur, and salt wash, either with or without the salt. Experiments are in progress with the New York Geneva station lime and sulphur wash, in which the sulphur is combined with the lime by mixing it, while the latter is being slaked, with a solution of caustic soda or caustic potash. If this combination should prove stable and effective, it will, I believe, be found to be one of the most important discoveries in economic entomology. The one great difficulty in the way of getting this useful remedy against scale insects adopted is the trouble and inconvenience of boiling it from two to three hours to dissolve the sulphur. I regret to say that my own experiments with this wash, like those of all other workers I have so far corresponded with, are incomplete. I have found that the combination of the sulphur with the lime can be brought about quickly and without difficulty, but as yet I do not know how effective the wash thus made is upon the scale insects. I hope at this meeting to get some further light upon this important subject.

Root maggots of the cabbage, turnip, radish, and onion were very destructive in many parts of Canada during the past season, complaints of their depredations having been received from both the Atlantic and Pacific coasts, as well as from many points in the interior. Satisfactory remedies for these insects seem still to be desiderata. For cabbages and cauliflowers, in my experience, the best remedy has been the use of the tarred-paper disks recommended by Professor Slingerland. Next to these is the pouring of a small quantity of a strong decoction of pyrethrum insect powder (4 ounces to the

gallon of water) around the root of each plant, after drawing away the earth; the earth then to be replaced. For onions and radishes, dusting white hellebore along the rows as soon as the young plants appear has given good results. For garden radishes and onions undoubtedly the best application is Prof. A. J. Cook's carbolic wash, made by adding 1 quart of soft soap or 1 pound of hard soap to a gallon of water, heat to the boiling point, and add crude carbolic acid half a pint. When required for use take one part of the stock mixture to fifty of water and sprinkle directly upon the growing plants once a week from the time they appear above the ground.

Some very satisfactory experiments from the entomologist's standpoint were made during the past summer by Mr. W. T. Macoun, the horticulturist of the Central Experimental Farm. Several varieties of tobacco and vegetables were grown beneath a cheese-cloth inclosure, so as to improve the quality of the plants, and it was observed that not only were satisfactory results obtained with the plants, but that this cheap protection prevented entirely the attacks of many kinds of injurious insects. Radishes, onions, cabbages, and cauliflowers were well developed and absolutely free from root maggots. Nothing was attacked by either the tarnished or four-lined leaf bugs, or by the turnip flea beetle. Cucurbits of all kinds were free from attack by the striped cucumber beetle; in fact, this experiment has shown that at small expense choice vegetables can be grown, the cultivation of some of which had been relinquished by gardeners, owing to the difficulty of producing them free of insect injury. The plan of applying this preventive method will, of course, vary with circumstances, but I believe that a light frame covered with cheese cloth will form an easy means for entomologists to protect plants against some insects which now defy our efforts. There is not, of course, anything new in the idea except the extent to which the protection was applied.

An insect which of recent years has given very little trouble in Canada is the hop aphis. During 1903 hop yards in southern central Ontario were badly attacked and much loss was sustained. Where the quassia and soap wash was applied much benefit was manifest, and hop growers claim that the results paid them well for all expenditure of time and labor.

The hornfly, which some years ago was the cause of so much loss on dairy and stock farms, was last year decidedly more troublesome than it had been for several years. This was probably due to the moist season, which kept cattle droppings in a condition suitable for the development of the larvæ for a much longer time than usual. I was interested at finding specimens of this fly upon horses at Regina, in the center of our Canadian northwest prairie region. I also observed that during the summer of 1903 it had reached the Pacific coast in British Columbia and was injuriously abundant on Vancouver Island.

Mr. Sanderson reported that creoline can be used to destroy fleas on domestic animals.

Mr. Summers stated that thrips had been found destroying carnations in greenhouses; also that he had found that burning sulphur in a house was satisfactory for clearing it of bedbugs.

Mr. Fletcher stated that in making the bran mash for destroying cutworms he mixed only enough Paris green with the bran to make it perceptibly green.

Referring to the best treatment for grasshoppers, Mr. Gillette remarked that the Criddle mixture of horse droppings, salt, and Paris green had not been very effective in Colorado during the past year.

Mr. Fletcher had found this mixture remarkably effective in Manitoba.

Mr. Wilcox cited the fact that at a recent meeting of the Public Health Association in Washington, D. C., a discussion arose as to the value of using hydrocyanic-acid gas for destroying bedbugs. It seemed to be the opinion of the meeting that this was a rather dangerous remedy, but very effective.

Mr. Felt remarked that he has used a full-strength charge for fleas in Albany, N. Y., and had accomplished good results. He thought it well to recommend iron bedsteads for use in houses where bedbugs are present. During recent years a thrips had injured onions and lettuce in New York, and *Corythuca irrorata* had caused much injury to chrysanthemums. It is probable that this insect usually lives on weeds. One grower sprayed with a mixture of whale-oil soap, using 1 pound of soap to 9 gallons of water, and reported good results.

Mr. Osborn believed that it was now recognized that the thripidæ were, on the whole, destructive and not carnivorous. A few years ago, when he made a statement to this effect, it was not generally accepted, but subsequent observations seemed to show that his previous statement was correct. The results of some studies made in 1881 showed that these insects had injured 80 per cent of the apple blossoms under observation, in all cases the pistils having been eaten. They also injure clover, and have been found working on strawberries in Illinois. This year plants in greenhouses in Columbus, Ohio, had been badly attacked by these pests.

Mr. Felt stated that he was able to kill fleas with one fumigation. In Mr. Summer's experience a fumigation, using a double strength, had been effective against these insects, but he had obtained satisfactory results by burning sulphur. He considered that great care should be taken to allow a room that has been fumigated with hydrocyanic-acid gas to air thoroughly before entering it, as some persons were able to stand only a small amount of the fumes.

Mr. Fletcher remarked that the sulphur fumes would probably be more effective to fleas and their larvæ if the floors were wet at the time the fumigation was done. Mr. Felt stated his belief that sul-

phur fumes might injure carpets, and added that he had fumigated successfully with hydrocyanic-acid gas without removing the carpets.

An abstract of the following paper was then presented:

OBSERVATIONS ON SOME OF THE INSECTS OF THE SEASON IN OHIO.

By Herbert Osborn, *Columbus, Ohio.*

The season of 1903 may be considered as somewhat uneventful entomologically for the State of Ohio, as there has been no unusual outbreak of the insects that are commonly destructive.

Of course there have been the usual abundance of grasshoppers and other forms which are almost universally present, but their abundance has not been sufficient to attract particular attention. On the other hand, insects have been noted which have more or less importance from the economic standpoint, and a few notes devoted to these may serve to indicate the nature of the season and also to continue the annual record which it seems desirable to maintain for each State.

The fall webworm (*Hyphantria cunea*), while not apparently very abundant over the State, at least not so numerous as a year or two ago, was quite abundant on the native forest trees and shrubbery of Cedar Point, near Sandusky. Here it occurs under practically native conditions, there having been no particular changes in the plants available for their attack and any marked modifications due to settlement or cultivation. The increase of the species, therefore, which seemed quite marked as contrasted with the previous year, may be considered simply as a natural increase due to some change in the abundance of the parasites or other favoring influences. While a number of bushes and small trees were badly eaten, in some cases completely defoliated, the damage will in all probability be repaired in another season's growth and probably none of the plants killed.

The apple maggot (*Trypeta* [*Rhagoletis*] *pomonella*) has been evidenced quite extensively by injured fruit which comes into the market in Columbus. Whether this is local or not I am unprepared to say, although most of the fruit so injured has been in market in such manner that it may have come from outside localities. Professor Hine has observed the work of this insect in apples which have come from the northwestern part of the State, and hence for that part of the State its presence may be recorded. The damage done by this species is often but slightly appreciated, at least until the fruit is used. The skin in many instances shows little evidence of their presence, and it is only in the rotting spaces or the pithy spots within the pulp and beneath the skin that its injury is apparent. Of course the keeping qualities of the fruit are greatly injured, as well as the qualities for table use.

Cankerworms were present in the early season in considerable numbers and a considerable proportion of the injury was due to the fall cankerworm.

The San Jose scale has of course attracted no little attention and its spread in the State has been marked by serious loss, but this species will doubtless be mentioned in detail by our secretary, whose duties have brought him into special connection with it.

During the latter part of August and in September I found on a species of Euphorbia, which occurs as a somewhat common weed on the university campus, considerable numbers of the little capsid, *Eccritotarsus elegans*, in both larval and adult forms, and was therefore able to secure the different stages in the life history of the species, with the exception of the egg.

It appears that the development is quite rapid, since the larvæ of different stages occur at the same time upon the same plants, and these, when kept in confinement, moulted frequently and attained their maturity in a short period of time. The species seems ordinarily quite rare, but this rarity in collections is doubtless due to its limitations in food plants, and perhaps also due to the limited period during which it occurs each season. It appears to coincide with the development of the blossoms in its host plant, and both young and adults match the color of the buds and portions of the leaves so closely that they are doubtless well protected by the mimicry. The young have the distinct purple-red color which agrees perfectly with the unopened buds, or, in some cases, with the parts of the leaves, the adults, with their white markings, with the seed pods after the dropping of the petals.

At the same time and on the same host plant there were found large numbers of one of the Coreid bugs, *Corizus hyalinus*, which in its development, and especially in the coloration and marking of the larvæ, shows a distinct adaptation to life upon this host.

One other species of considerable interest observed for the first time this year is a Fulgorid, which shows a rather anomalous habit of living underground and feeding upon the roots of various plants. This I have named *Myndus radiciis* and described in a recent number of the Ohio Naturalist (Vol. IV, p. 42). It was first noticed in the larval stage, occurring upon roots of Impatiens, nettles, and various species of grasses. Within a few days I secured by rearing several of the adults and about the same time these were found also in the ground, occurring in the cavities tenanted by the nymphs. The nymphs are of a pale greenish color, the sutural bands of the abdomen appearing white, and there is a prominent cottony tuft secreted on the posterior segment, which, when fully developed, extends one-third of the length of the abdomen beyond its apex. Two nymphal stages were observed, the younger having a length of 2.6^{mm} and a width of 1^{mm}. The mature nymph or pupa, as determined by rearing,

has a length of 4^{mm}, or, including the cottony secretion, 4.5^{mm}, and a width of 1.2^{mm}. This stage is somewhat paler than the preceding, being pale yellow or whitish, some individuals being dusky, or in some cases somewhat darker green. In all cases they show the effect of the subterranean habit, although not totally devoid of the green color which may be associated with existence on foliage. In this respect they are pretty nearly parallel with some of the species of plant-lice which have adopted the subterranean habit. There is a well-marked stripe along the middle of the dorsal and fainter lines laterally marking the borders of the wing pads. The cottony tuft is very easily broken off, and until replaced is represented simply by white borders for the terminal abdominal segment. In no case have the nymphs been found on the foliage of plants, but always attached to the roots or in the cavities of earth, where they have access to the roots of their food plants. In some cases, however, where the roots were exposed on the surface, protected by drooping leaves of grass or by an accumulation of dead leaves or other rubbish, the larvæ were above ground, though under conditions similar to the underground cavities in which they most frequently occurred. The adults also were found in cavities beneath the ground and under leaves and rubbish at the surface, and they seemed quite closely confined to such locations. The wings, however, are well developed and they must be able to migrate without difficulty.

The economic importance of this species does not appear to be very great, as the plants affected are not of particular value, but the observation of a Fulgorid adapted to subterranean existence is of considerable economic interest, since it suggests the probability of other species in the same family, and particularly other members of the genus Myndus or of related genera, having a similar habit. Possibly these species occur in much greater numbers, and have a more important economic relation than we have suspected, since they are not often captured, and their work naturally goes unobserved.

The committee on nominations reported as follows:

For president, Prof. A. L. Quaintance, Washington, D. C.
For first vice-president, Mr. A. F. Burgess, Columbus, Ohio.
For second vice-president, Miss Mary E. Murtfeldt, Kirkwood, Mo.
For secretary-treasurer, Prof. H. E. Summers, Ames, Iowa.
For members of the council, Dr. Henry Skinner, Philadelphia, Pa.; Dr. James Fletcher, Ottawa, Ontario, Canada.

Respectfully submitted.

F. L. Washburn, *Chairman.*
C. P. Gillette.
E. P. Felt.

The report was accepted unanimously, and the above-mentioned officers were duly elected for the ensuing year.

The report of the committee on resolutions was next read, and is as follows:

Resolved by the Association of Economic Entomologists, That we appreciate most fully the past favors of the Department of Agriculture in publishing the proceedings of the Association, and respectfully request that the proceedings of the present meeting be published as heretofore.

Resolved, That the thanks of the Association be tendered to the board of education for the courtesy extended in the use of their building and for the excellent luncheon provided.

Resolved, That our thanks be extended to the local committee of arrangements for their successful efforts in behalf of the meeting.

Resolved, That we appreciate and do hereby tender our thanks to the Commissioners of the Louisiana Purchase Exposition for the invitation extended to the members of this Association to visit the grounds of the exposition.

Resolved, That our thanks are due and are hereby extended to the University Club for their courtesy in entertaining members of the Association.

Resolved, That our thanks be expressed to Dr. William Trelease, director Missouri Botanical Gardens, for his most cordial invitation to the members of the Association to visit the gardens.

Resolved, That we hereby acknowledge our indebtedness to the various members of the Association who have contributed so largely, by their papers, to the success of the meeting.

Respectfully submitted.

THOMAS B. SYMONS, *Chairman.*
WILLIAM LOCHHEAD.
E. DWIGHT SANDERSON.

By vote of the Association this report was accepted and adopted, as was the report of the treasurer and auditing committee, which follows:

REPORT OF THE TREASURER FOR 1903.

Balance on hand March 12, 1903		$5.57

EXPENDITURES.

Printing announcements and programmes	$3.75	
Postage on announcements, programmes, and correspondence	3.50	
Envelopes for mailing announcements and programmes	.55	
		7.80
Deficit		2.23

Respectfully submitted.

A. F. BURGESS, *Treasurer.*

ST. LOUIS, MO., *December 30, 1903.*

We have examined the report of the treasurer, above given in full, and find it correct.

Respectfully submitted.

JAMES S. HINE,
CHARLES A. HART,
Auditing Committee.

The committee on membership submitted the following recommendations:

For active members: Mr. George H. French, Carbondale, Ill.; Mr. P. J. Parrott, Geneva, N. Y.; Mr. A. W. Morrill, Victoria, Tex.

To be changed from associate to active members: Miss Mary E. Murtfeldt, Kirkwood, Mo.; Mr. F. H. Snow, Lawrence, Kans.; Mr. T. B. Symons, Collegepark, Md.

For associate members: Mr. Otto H. Swezey, Columbus, Ohio; Mr. S. A. Johnson, Fort Collins, Colo.; Mr. F. C. Bishopp, Collegepark, Md.; Mr. Douglas B. Young, Albany, N. Y.; Mr. E. C. Green, College Station, Tex.; Mr. E. P. Taylor, Champaign, Ill.

The committee further recommend the adoption of the by-law relative to membership, which was presented at the meeting at Pittsburg in June, 1902.

Respectfully submitted.

HERBERT OSBORN, *Chairman.*
F. M. WEBSTER.
E. P. FELT.

By vote of the Association the list of names presented for membership was accepted as reported by the committee.

The by-law referred to in the report is as follows:

It shall be the duty of the officers of the Association, each year previous to the annual meeting, to carefully examine the list of members and recommend to the Association the dropping of such names as have in their opinion no further place upon our roll, such recommendations to be acted upon by the Association, and a vote of two-thirds of the members present to be sufficient to drop any name.

That in the interpretation of the paragraph of the constitution regarding the election of new members it be understood that an "economic entomologist" is a person who has been trained in entomological work and whose known work or published papers show him to be capable of conducting original work in economic entomology.

That the term "practical entomologist," referring to associate members, be held to indicate persons who have done general work in entomology and who have, by published papers or otherwise, given evidence of their attainments in such work.

That associate members be listed separately in the published roll, or the fact that they are associate members be indicated in the list.

After some discussion it was voted to adopt the first paragraph of the suggested by-law, and the remaining paragraphs were laid on the table until the next annual meeting.

Mr. Sanderson next read a paper entitled—

INSECTS OF 1903 IN TEXAS.

By E. DWIGHT SANDERSON, *College Station, Tex.*

Entomological problems in Texas are many and varied. Many pests are brought to our attention which have been comparatively unknown to entomological records heretofore.

GRAIN INSECTS.

The southern grain louse (*Toxoptera graminum* Rond.), made its appearance on wheat and oats in parts of north Texas early in March, but was soon destroyed by parasites. The winged aphis evidently migrates to the grain in the fall, as the injury commences in spots here and there over the field, and previous to the outbreak of 1901 these spots were observed as early as December, 1900. It seems probable that the pest is held in control by hymenopterous parasites whose reproduction is prevented by continued cold, wet weather, as Professor Webster has shown is the case with the nearly allied grain Nectarophora. The early spring of 1901 was unusually cold, wet, and backward in the injured territory. The aphides disappeared from the fields early in April, 1903, as in 1901. Evidently they migrate to some other host plant. They were reared in the laboratory until June 1 without any change of form or habit being indicated.

Specimens of *Nectarophora cerealis*[a] were secured early in January and reared until late April. Late in April apterous oviparous females and winged males appeared, and eggs were laid on the stalks of grain in the tubes. I was unable to secure the hatching of any of these eggs, or to find them in the field. This species becomes rare on small grains after early June, when they commence to head. It evidently must migrate to some other plant, upon which it probably lays an egg, as I have been unable to find any record of the egg.

Aphis avenæ Fab. (?)—Specimens determined by Mr. Th. Pergande as this species were found on small grains early in January commonly throughout the grain belt of the State and sometimes in considerable numbers. Several generations were reared up to June 1. This species remains near the surface of the soil, largely at the bases of the leaves. In May it was found on the roots of Johnson grass, and it was often found on the crown of a grain plant. The specimens I have do not agree with the description of Fabricius, but are given under this species upon Mr. Pergande's authority.

Aphis maidis Fitch was received upon barley which it had damaged in January and May. I have not noticed it on any other small grain. In August it becomes abundant on corn and later on sorghum, sometimes doing considerable damage.

The chinch bug (*Blissus leucopterus*) has been the most serious insect pest of corn in Oklahoma and north Texas for many years. In 1901 and 1902 drought and chinch bugs caused a practically total failure of the corn crop in the larger part of north Texas. This year the bugs appeared in large numbers upon the corn as soon as it

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[a] I am unable to determine whether this is *N. cerealis* Kalt. or *N. granaria* Kby. Mr. Pergande informs me that he will shortly publish a paper in which these characters will be defined. Up to this time the two names seem to have been used synonymously by American writers.

appeared above ground, but, owing to a good rainfall through the spring, did not do general injury. Here and there injury by the second brood was reported to us. College Station is the southernmost point where we observed injury which was due to the first brood in May. The habits of this pest are somewhat different from what they are farther north, and it is therefore more difficult to combat. Where small grains are grown in winter it migrates from them to the corn early in June as elsewhere, and most injury is then due to the second brood, in June or early July. But where no small grains are grown the bugs emerge from winter quarters by the middle of April and assemble on the young corn in large numbers as soon as it is out of the soil. At this time the air is often full of them. On May 8 from 20 to 50 adult bugs and 5 to 15 newly hatched nymphs were to be found on each hill of corn at the college. The first brood of adult bugs commenced to appear about the middle of June. The second brood was found the first week of August, and a third brood is found about the middle of September, mostly on sorghum. Wherever sorghum stubble is left on the land over winter injury is worse the next season, as the bugs breed on it late in the fall and hibernate in the stubble. It has been found that the bugs seem to prefer millet and sorghum to corn in early spring, and we are now planning experiments to use these as trap crops for the protection of the corn.

Thyanta perditor Fab. was sent me from several points in north Texas during the summer months, with reports that it occurred in extraordinary numbers and had seriously injured oats, corn, and sorghum, and was also in milo maize and cowpeas. The habits of the pest seem to be very similar to those of *Lioderma uhleri* Stal, described by Prof. D. A. Saunders in South Dakota in 1898,[a] for which insect we first mistook it. Its identity was kindly determined by Dr. H. T. Fernald. It occurs commonly in central and north Texas on various crops.

The larva of *Diabrotica 12-punctata* caused the replanting of corn in a number of instances in central Texas.

COTTON PESTS.

The cotton square borer (*Uranotes melinus* Hubn.).—The larva of this dainty butterfly has been a serious pest of cotton for many years, as well as that of *Calycopis cecrops* Fab. (*Thecla pœas* Hubn.) This season the former species has been the more common observed by us. The principal injury occurs in June by the larvæ of the first brood boring into and hollowing out the young squares. One larva will go from square to square, thus soon stripping a plant, and often boring into the stalk. Fortunately these larvæ were severely parasitized, it being difficult to secure an unparasitized pupa, and no injury was

[a] So. Dak. Agr. Exp. Sta. Bul., p. 57.

reported after June. We are informed that in some localities this insect has been injurious for some years, while elsewhere this seems to have been the first season in which it has been noticed. It is a common pest of cowpeas and other legumes.

The white-lined morning sphinx (*Deilephila lineata* Fab.) always does more or less damage to young cotton in weedy fields. This year these larvæ appeared in extraordinary numbers near San Antonio and destroyed not only cotton but all sorts of garden truck.

The garden webworm (*Loxostege similalis* Guen.) did serious injury to young cotton in southwest and north Texas and Oklahoma, causing replanting in many instances. The common name "careless worm" used by the planters is peculiarly applicable to this pest, as it increases and becomes injurious only where the careless weeds (*Amaranthus* spp.) are allowed to grow, and can easily be controlled by spraying or dusting.

In southwest Texas the large lubber grasshopper (*Brachypeplus magnus*) usually destroys a considerable amount of cotton. The hoppers occur in large numbers and go through a field, cutting off all the cotton in their path.

Likewise *Lachnosterna lanceolata* Say often occurs in large swarms and cuts off the young plants on considerable areas.

PECAN INSECTS.

The growing of pecans is becoming a very profitable industry in Texas, though its development has only commenced.

The worst pest yet brought to my attention is the pecan husk worm (*Acrobasis caryæ* Grote). The larvæ bore into the young pecans, hollowing them out and causing them to drop to the ground. Later they riddle the husk and channel the surface of the nut. This species occurs on pecans where they grow in Texas, and, according to Doctor Dyar, in Illinois, Massachusetts, and New York. It is reported to sometimes almost totally destroy the crop in localities and to do serious injury generally in west central Texas, the chief pecan section. Usually injury is most between May 20 and June 10. This year the pest did comparatively little damage and no moths emerged until July 9. This was largely due to hymenopterous parasites. No means of practical control have yet been ascertained.

Phylloxera sp. has been sent me as injurious to pecan foliage near Galveston, and I find it common on the campus at the college.

The fall webworm is frequently injurious to pecan trees and this season did much damage to fruit trees in south Texas. A similar webworm, but of uniform brown color, which we have not determined, but either another species of Hyphantria or a variety of the above, seems to be peculiarly a pecan insect.

May 15 I received specimens of the pea louse (*Nectarophora pisi* Kalt.) from Dallas, and May 27 I found that they had destroyed a garden patch of peas on the Brazos River, near Wellborn, Tex. It would seem probable, therefore, that this is a general pest of peas in Texas, as Professor Quaintance has also observed it near Victoria.

The southern leaf-footed plant-bug (*Leptoglossus phyllopus*) is one of the worst pests of ripe plums and peaches, and this year was frequently reported injuring tomatoes by sucking the fruit.

The striped blister beetle (*Epicauta vittata*) is also a common pest of tomatoes and alfalfa.

A new tomato pest, determined for me by Prof. E. D. Ball, is *Stictocephala rotundata* Stal. The adult insects puncture the stems of the young plants, causing them to wilt. No nymphs were reported found on tomatoes in the fields. In the breeding cage eggs were laid in the base of the stem in pairs, much like those of the buffalo treehopper. The nymphs did not seem to thrive on tomato, however, all dying shortly. This is probably a synonym of *S. festina*, and, if so, has been previously recorded on tomatoes in Georgia and in New Mexico on alfalfa.

A leaf-bug, *Dicyphus separatus* Uhl., nearly related to the suck-fly of tobacco, has been troublesome to tomatoes in the college greenhouse.

The chicken tick (*Argas americana*) is now to be found as far north as the Red River and is occasionally reported from localities where formerly unknown.

The sweet-potato weevil (*Cylas formicarius*) has been the cause of the practical abandonment of the growing of sweet potatoes, which were formerly a quite profitable crop, in counties in south Texas. It has now spread to Austin, where it has been known for four years, and near Marlin, where it was destructive for the first time this season. This is a southern or tropical insect, but it is quite cosmopolitan, occurring in India, China, Madagascar, and Jamaica, and may very possibly spread farther north. Boring from the stem into the root and working in stored sweet potatoes, it is a difficult pest to combat and easily spreads.

One of the principal pests of the plum is the aphis, hitherto undescribed though first recorded and figured by Mr. W. M. Scott at the thirteenth meeting of this Association.[a] As this is evidently a southern species, I propose to name it the southern plum aphis, and hope to publish a full description of the viviparous forms shortly. It undoubtedly oviposits on plum in the fall and in Texas migrates from it in early summer.

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[a] Bull. 31, Div. Ent., U. S. Dept. Agr., pp. 56–58, figs. 1 to 4.

This was followed by a paper by Mr. Symons on—

ENTOMOLOGICAL NOTES FOR THE YEAR IN MARYLAND.

By T. B. Symons, *Collegepark, Md.*

The past year has not been marked by any unusual outbreaks of injurious insects, except in the case of a few species, which will be cited briefly. The usual depredations by the San Jose scale have occurred, and which, it may be said, is being controlled in a marked degree in many sections of the State by the use of the lime, sulphur, and salt wash.

Many complaints were received in the spring from the damage done to apple foliage by the "apple aphis" (*Aphis* spp.), and it was necessary to recommend several washes for their control. "Rose Leaf," one part to forty parts of water; 15 per cent kerosene emulsion, and whale-oil soap, one pound to the gallon of water, were the washes suggested.

The strawberry weevil (*Anthonomus signatus* Say) likewise did considerable damage to strawberries in the State. This injury was especially severe this year from the fact that a large number of the early blooms were killed by frost, which left a smaller percentage for the needs of the weevil, reducing the crop in some instances one-fourth of the average one.

Early in May and, in fact, throughout the summer months the ravages of the fruit-tree bark-beetle (*Scolytus rugulosus* Ratz.) were apparent in many orchards in the State. May 13, at St. Margarets, we observed several hundred trees injured by the beetle. My attention was called to many instances where the beetles had attacked perfectly healthy trees of peach, plum, and cherry. While this insect commences its work on sickly or half-dead trees, there is no doubt but that the beetles have developed the habit of attacking perfectly healthy ones. There seem to be no better remedies than to destroy the infested trees and the preventive measures of keeping dead wood cut out of the orchard and carefully burning all the brush.

The apple-tree tent caterpillar (*Clisiocampa* [*Malacosoma*] *americana*) was present in unusually large numbers during the early spring, but was practically controlled by burning and by the use of arsenical poisons, together with the unfavorable weather conditions.

There was locally a serious outbreak of the corn stalk-borer (*Diatræa saccharalis*), which attacked a field of corn in Kent County, damaging about 25 per cent of the cornstalks. This insect has not appeared in injurious numbers in Maryland since 1898, and it is peculiar to note its presence in such great numbers in two or three cornfields this year. Its injury consists in boring into the stalks of corn, thereby weakening them, and where several occur on a stalk it

is so injured that it may fall down. There is practically nothing that can be done for this pest after it appears, and it is only left to ward against its reappearance the next season.

Injury was observed in a cornfield at Taylors Island from the stalk borer *Papaipema nitela*. This insect does its damage in a somewhat similar manner to that done by *Diatraea saccharalis*, except that after boring into the stem it tunnels its way upward, eating out the center of the plants.

Injury by the twelve-spotted diabrotica (*Diabrotica 12-punctata*) to young corn on the college farm was observed about the middle of May, but it did not later become serious.

The asparagus beetle (*Crioceris asparagi*) was a conspicuously injurious species the present year, and it is needless to say that an entirely satisfactory treatment for the pest has not yet been found.

The strawberry root-louse (*Aphis forbesi*) appears now to be generally distributed over the State, more so than in recent years, doing in some cases considerable damage. Likewise with this pest we are confronted with the fact that there is no satisfactory treatment, except rotation of crops and perhaps the burning over of the patches in early spring. It is the opinion of the writer, from observations up to this time, that in some localities in our State the aphides pass the winter on the roots of the plants, as I have found plants infested with the louse as late as December 12.

The melon aphis (*Aphis gossypii*) was conspicuous by its absence the past season, as in other years it has been a source of much apprehension on the part of the melon growers. From two or three complaints sent in the past season, one of the growers stated afterwards that he controlled the pest effectively by fumigating with carbon bisulphid.

Many complaints of the oyster-shell bark-louse (*Mytilaspis* (*Lepidosaphes ulmi*) *pomorum*) and the scurvy bark-louse (*Chionaspis furfurus*) were received during the year, and the latter is observed in nearly every orchard that is inspected.

The cigarette beetle (*Lasioderma serricorne*) has given us a great deal of trouble in Maryland. It is the opinion of the writer that there are very few tobacco warehouses and factories which are free from the pest. Also, that it is increasing under cover—that is to say, few owners of tobacco-leaf warehouses have detected its presence in their stock. The majority of them keep on hand a large quantity of tobacco boxed up in cases, and seldom examine their tobacco to detect the insect. The loss occasioned by this insect does, however, not fall on the tobacco-leaf merchant, but on the manufacturer who takes it into his factory and attempts to work it. When this insect is once established in a tobacco factory it is very difficult to entirely eradicate it. The writer knows of one instance where the owner has expended

about $1,000 and has only partially eradicated the pest, and has since been constantly on the outlook for another outbreak. In one instance a stock of 30,000 pounds of leaf tobacco had to be fumigated in order to destroy the insect. In this connection it may be said, from our experience in using the two gases, carbon bisulphid and hydrocyanic-acid gas, we find the latter in general to be more effective. But in using either in fumigating large quantities of tobacco done up in cases of 350 pounds, it is difficult for the gas to entirely penetrate the case. In my opinion, tobacco warehouses should be inspected by an entomologist, who should issue a certificate to show that the buildings are apparently free from this pest. In this way the manufacturer would be protected from serious loss in purchasing tobacco that is infested with the insect.

Mr. Sanderson stated that the best remedy that he had found for *Anthonomus signatus* was to burn over the strawberry beds.

Mr. Washburn next presented a paper entitled—

INSECTS OF THE YEAR IN MINNESOTA, WITH DATA ON THE NUMBER OF BROODS OF CECIDOMYIA DESTRUCTOR SAY.

By F. L. Washburn, *St. Anthony Park, Minn.*

Plant-lice of various kinds have been extremely numerous this year, notably a grain plant-louse which for a while caused serious alarm among the farmers. It may have been either *Nectarophora cerealis* or *N. granaria*. It was well taken care of by parasites.

Eggs of apple aphides hatched in April, but a cold snap with some snow and sleet killed the young lice.

Two strawberry insects did some damage, *Anthonomus signatus* Say, and *Corimelæna* sp.?

A wholesale grocer in St. Paul complained to this office of a troublesome mite on dried figs from California and dried apples from New York State in a storage warehouse. This proved to be, according to Banks, *Carpoglyphus passularum* Hering.

This year has seen numerous leaf-miners on oak trees, notably *Lithocolletis hamadryadella* Clem., which was extremely destructive on various kinds of oak, particularly white oak, in the vicinity of the twin cities, but was not observed in other parts of the State.

Specimens of *Tribolium confusum* were sent to the laboratory from an elevator, and while being used in some laboratory experiments a few escaped; we afterwards found one attacking a dried insect specimen in an imperfect insect box, not an unusual habit of this omnivorous pest.

A powder-post beetle (*Lyctus striatus* Melsh.)[a] is causing much concern to wholesale houses dealing with ax handles and wheel spokes, shafts, and the like.

This office is ready to indorse the borax remedy for cockroaches or croton bugs, having met with complete success with its use after trying without good results various other remedies.

Lachnosterna spp. has been extremely injurious this season, working not only on sod, but also on the roots of wheat and barley, and has been found by the writer killing, in nurseries, the Colorado blue spruce, a tree which brings nurserymen from $2 to $5 when 4 feet high. The species has been identified in some instances as *rugosa*, and other specimens are now in the breeding cage awaiting transformation. One nurseryman told the writer that he had lost some years ago through the agency of this genus every small evergreen tree except his cedars.

This has been a bad year for potato beetles, it being claimed that they have not been so numerous for a number of years.

The horn fly, as was to be expected, has been troublesome on cattle and other stock.

Of the leading pests of Minnesota—grasshoppers, the chinch bug, and Hessian fly—we have to report very little injury from the first, which in 1902 made themselves conspicuous in the northwestern corner of the State. I refer to the native form *Melanoplus atlanis*, which was quite destructive last year, but hardly heard from during the season just passed. This is undoubtedly in part due to the fact that a grasshopper law was passed by the legislature last winter obliging the owner or lessee of land declared infested with grasshopper eggs to plow said land. Farmers and others promptly took care of large tracts of land which had lain fallow for several years in the northwestern part of the State, the same being known to have been a frequent breeding ground of the pest previously. The few cases of injury reported this season could be traced directly to one or two plats of land which had not been plowed, the bill becoming a law too late to be effective in these cases this season. Weather conditions have done much to influence the work of the chinch bug, which, with the exception of Stearns and adjoining counties in the central part of the State, has not caused any special injury. But in the counties above mentioned, particularly in Stearns County, it has been more troublesome than for many years, farmers losing all the way from 10 to 50 per cent, and in some cases their entire crop of wheat.

The Hessian fly, now spread over our entire wheat-growing regions, was not serious in the northern part of the State, partly on account of extreme dryness in that portion during the spring and early summer,

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[a] Now recognized as *Lyctus unipunctatus* Hbst., common to both continents.—F. H. C.

but one found its ravages more apparent upon coming south through the Red River Valley.

The number of broods of this pest varies of course with the season, depending on whether the season be dry and warm or moist and cool; nevertheless that the Hessian fly has normally more than one brood has been for some time such a firm conviction in the mind of the entomologist that this season a serious attempt was made to put the matter beyond doubt with gratifying results. It has seemed to the writer that the "flaxseeds" found in stubble in the autumn could hardly account for the immense injury done the crop the ensuing year, unless the fly was more than one-brooded.

Professor Lugger, our predecessor, always claimed but one brood in this latitude, and none of his reports indicate that he had changed his mind after making this statement. In one of the reports he said: "Not one fly issued from stalks gathered as soon as injury became visible. This assuredly seems to indicate that the flies do not issue during the autumn, as they do farther south, but remain in the culm until the spring." He further found no larvæ or puparia in volunteer wheat growing near fields that had been badly infested. We have found facts this season warranting us to take exceptions to the last two statements.

The following are in brief the results of this year's work in this direction. Although able to state them briefly, they represent an immense amount of work in examining plants.

On June 25 larvæ of Hessian fly in second stage were brought to the laboratory, and one fly (and it is to be noted, only one), a female, emerged July 19; she lived two days, depositing about 90 eggs on the green blade of wheat. July 1 one larva in first stage, found in field, brought to laboratory, but did not live. On second day larvæ in second stage were secured and placed in breeding jar; July 8 they developed puparia, and on August 16 one (and only one), a female, emerged. On October 18 puparia were found on volunteer wheat growing in the stubble after harvest in the northern part of the State. It would seem then that there is normally in Minnesota more than one brood of Hessian fly. The observations, however, of this season are not to be taken as criteria necessarily for every year.

Regarding the imagos emerging from puparia which wintered over as the first brood, the breeding experiments above outlined would indicate a second brood of adults July 19, approximately, and a third brood about the middle of August. But what I call the second brood may be supernumerary to the first or to the brood which I call the third. The plants upon which these observations were made were placed in moist sand, thereby seemingly securing favorable conditions for the development of the fly. Volunteer wheat plants growing in stubble or on the plowed land and along edges of fields, which

have hitherto been disregarded as a possible source of the pest, now figure in a different light. From an economic standpoint we may say that although Minnesota may sometime raise more winter wheat than it does now, it being claimed that a yield may be obtained three years out of every five, as long as spring-sown wheat is practically the chief wheat crop, these facts have no decided bearing beyond that of showing the need of plowing under the volunteer wheat. We would naturally suppose, however, that puparia would be found in the fall upon the fall-sown rye, and that said rye would show injury the following spring. As a matter of fact no complaint whatever reaches us regarding injury to rye.

The little green leaf-hopper, *Empoasca mali* Walsh, must not be overlooked in an account of the year's insects. This pest has been extremely injurious in nurseries in southern Minnesota during the past season, affecting apple trees particularly and checking their growth to a marked degree, though found on other trees as well as on the apple.

In discussing this paper Mr. Fletcher stated that he was much interested in the number of broods of the Hessian fly in Minnesota. He thought that Mr. Washburn finding two broods was an exceptional occurrence. In Manitoba he had only been able to find a single brood.

The summer "flaxseeds" do not develop flies until the following spring, and as no fall wheat is grown it is only occasionally that there is rain enough to start volunteer wheat early enough for the eggs to be laid upon it. In case there were a second brood in Manitoba, the larvæ would have nothing to feed on, and although this insect has been recorded as feeding on timothy and wild grass in Russia this fact has never been observed in America. In his opinion the conditions under which the second brood was found in Minnesota were artificial, and he hoped that further observations concerning this point would be carried on.

Mr. Washburn called attention to the fact that he had found "flaxseeds" on volunteer wheat growing in stubble in October.

A motion was made and carried that the remaining papers, which had been sent to the meeting by members who were unable to be present, be read by title. These papers are as follows:

(1) Early Western Entomologists, by Mary E. Murtfeldt, Kirkwood, Mo.
(2) An Experiment with Black Flies, by C. M. Weed, Durham, N. H.
(3) The Brown-tail Moth in New Hampshire, by C. M. Weed, Durham, N. H.
(4) Some British Fruit-tree Pests Liable to be Introduced into America, by Frederick V. Theobald, Wyecourt, England.
(5) Insect Notes from Georgia for the Year 1903, by Wilmon Newell, Atlanta, Ga.
(6) Insect Notes from Connecticut, by W. E. Britton, New Haven, Conn.

Numbers 2, 3, 5, and 6 are published herewith; number 4 in Bulletin 44 of the present series.

INSECT NOTES FROM GEORGIA FOR THE YEAR 1903.

WILMON NEWELL, *Atlanta, Ga.*

As in previous years, the San Jose scale has been the most serious pest in Georgia and has received by far the most attention. Experiments conducted by W. M. Scott, former State entomologist, have shown the lime-sulphur-salt wash to be more effective and much safer than the treatments with crude oil and kerosene. As a result, these latter treatments have been for the most part abandoned by the commercial peach growers, and the great majority of scale-infested orchards in the State will the coming winter be sprayed with the lime-sulphur-salt. In many of the larger orchards outfits have been prepared for boiling the mixture by means of steam, these outfits in many cases using boilers of from 15 to 30 horsepower. Several modifications of the lime-sulphur-salt wash have been tested, but none have been found as effective as the regular formula of 30 pounds lime, 20 pounds sulphur, 15 pounds salt, and 60 gallons of water.

The colony of Asiatic lady beetles (*Chilocorus similis*) secured by Professor Scott from the Division of Entomology at Washington, D. C., in August, 1902, and introduced in a scale-infested orchard at Marshallville, Ga., has increased to a remarkable extent during the past season. A number of colonies have been sent to other parts of the State as well as to entomologists in other States. During the latter part of the summer their beneficial work could be plainly seen in the Marshallville orchard. They did not, however, become abundant enough to destroy the San Jose scale in proportion to the rapidity with which the latter bred, so that the possibility of their successfully controlling this pest is still a matter of conjecture. It was noted that this species hibernated much earlier than the native species. By October 16 very few adults and no larvæ or pupæ could be found upon the trees, while up to November 1 most native Coccinellids were plentiful.

Next to the San Jose scale, the peach borer (*Sanninoidea exitiosa*) is perhaps the most destructive insect pest occurring in the State. Very few peach orchards can be found in which these insects are not abundant. No effective remedy—aside from the tedious and expensive "worming"—is at hand, and the only chance of effectively reducing the numbers of this pest appears to be in the enforcement of stringent laws for bird protection.

The fruit-tree bark-beetle (*Scolytus rugulosus*), or "shot-hole borer," as it is more commonly called in the South, occurs generally in the peach orchards of the State, and while the damage is scattered, yet in the aggregate it amounts to considerable. Our observations upon this species in Georgia have not substantiated the popular idea that this pest attacks only trees which have been weakened from other

causes. We have often found them working upon trees otherwise perfectly healthy so far as examination of the entire tree, roots and all, could determine. Wherever a badly infested tree is found in a peach orchard, the adjacent trees invariably show the work of this insect, indicating that they are by no means confined to diseased and dying trees.

The cotton caterpillar (*Aletia* [*Alabama*] *argillacea*) appeared in considerable numbers in fourteen counties of southwestern Georgia during August. Experiments were at once inaugurated against the pest at Montezuma, Ga., in which several strengths of both Paris green and arsenate of lead were tested, together with methods of applying them.

These experiments resulted in the adoption of a mixture of one part Paris green and five parts air-slaked lime, distributed from thin cotton sacks by laborers on foot. It was found that each laborer could in this way poison from 12 to 14 acres per day. The method, frequently recommended, of distributing Paris green from sacks attached to a pole and carried upon horseback, was found entirely impracticable, resulting in danger to both man and beast and making an equal distribution of the poison impossible, especially in a breeze or light wind. For showery or rainy weather arsenate of lead, used at the rate of 2 pounds to 50 gallons of water and applied with a knapsack or autopump, was found most satisfactory, although more expensive, as only about 4 or 5 acres per day could be covered by each hand.

Although both eggs and moths were abundant in the fields during the last week in August, the large brood of caterpillars expected to ensue during September did not appear. The weather during the first week of September, when the eggs were hatching, was exceptionally hot and dry, and it appears very probable that the small larvæ were killed by the extreme heat. Unfortunately, the pressure of nursery inspection work at this time prevented us from personally visiting the fields; but our view is materially strengthened by the fact that from several hundred Aletia pupæ reared to maturity in the laboratory but two parasites were secured.

During the early part of July the chinch bug (*Blissus leucopterus*)—an unusual insect in Georgia—appeared in the rice fields near Savannah and occasioned some little alarm. However, the remedy was already at hand, the rice fields were flooded, and nothing more was heard of the chinch bug.

April 25 specimens of the Hessian fly (*Cecidomyia destructor*) were received from Harmony Grove, Ga. This species has not been sufficiently abundant so that the egg-laying periods could be determined, although if obtainable they would furnish data for an interesting comparison with the habits of the insect farther north.

To prevent the possible introduction of the Mexican boll weevil (*Anthonomus grandis*) the Georgia State Board of Entomology has

adopted and put in force a regulation prohibiting the importation of cotton seed from points in Texas or Louisiana unless such cotton seed is accompanied by a certificate, signed by a duly authorized State or Government entomologist, stating that it has been fumigated in such manner as to kill all adults, pupæ, or larvæ of the boll weevil that may be contained therein.

October 23 the writer found a number of pines dead and dying upon a ridge near Cornelia, Ga., which showed the work of a scolytid. The work was identified by Prof. A. D. Hopkins as that of *Dendroctonus frontalis.* So far as we are informed, this is the most southern point from which this destructive species has been reported. The outbreak at Cornelia is at present being investigated by Mr. W. F. Fiske, of the United States Division of Entomology.

Various insects of minor importance have appeared in greater or less numbers during the year.

INSECT NOTES FROM CONNECTICUT.

By W. E. Britton, *New Haven, Conn.*

Plant-lice have been extremely abundant the past season, and especially the green apple plant-louse (probably *Aphis pomi* DeG.), which caused much damage to nursery stock and young orchard trees. This pest attacks the leaves and stems of the new shoots, causing the leaves to curl and noticeably checking the growth. Most of the nursery stock this season is below the usual size on account of the injuries caused by this aphis. In one large nursery the tops of the trees were dipped in kerosene emulsion to kill the lice, but most nurserymen think that they can not afford to apply any form of treatment to growing nursery stock. The green pea louse (*Nectarophora pisi* Kalt.) was less abundant than during the preceding season, though many late peas were injured.

Pear trees were greatly injured by the pear psylla (*Psylla pyricola* Först.), which was unusually abundant, and many trees dropped their leaves completely during July and August. As this is a difficult insect to combat, very little is usually done by the fruit growers. We found, however, that a large proportion of the nymphs and some of the adults could be killed by a careful spraying, even in July, with soap and water (1 pound in 4 gallons).

Lady beetles of nearly all kinds were abundant during the season.

The San Jose scale insect has increased with great rapidity, and many trees that were very slightly infested in early summer are now completely incrusted. At the date of this writing (December 1) the young are still crawling, though we have had freezing weather for a week or more. The lime, sulphur, and salt mixture was used last winter on more than 40,000 trees in Connecticut, mostly in orchards, with

very satisfactory results. It has been found that the time of boiling can be shortened somewhat and the quantity of lime lessened without impairing the effectiveness of the mixture. There is still a demand, however, for a mixture that can be prepared and applied easily without boiling. In a small way the potassium sulphide and lime mixture fulfills these requirements, but it is altogether too expensive for use on a large scale. The potassium sulphide is simply dissolved in water and the lime slaked in separate barrels, and when all lumps have disappeared put the two liquids together and sulphides of lime are formed. The proportions used in our experiments were 20 pounds potassium sulphide, 20 pounds lime to 40 gallons of water.

Eulecanium armeniacum Craw. is becoming quite common in Connecticut, and is found on a variety of trees. Not only fruit trees are attacked, but white ash trees from the woodlands of Windsor were quite badly infested, and it has been received on ash from West Cornwall. *E. tulipiferæ* Cook. occurs on Liriodendron, both native and on cultivated grounds. *Chionaspis pinifoliæ* Fitch has been found several times in various parts of the State on *Pinus strobus* and *P. mughus.*

Serious injury to onion fields has been caused by the onion thrips (*Thrips tabaci* Lindeman), a 3-acre field having been destroyed near New Haven.

As has already been reported (see Second Report of Connecticut State Entomologist for 1902, p. 174, and Canadian Entomologist, Vol. XXXV, p. 188), the twelve-spotted asparagus beetle (*Crioceris 12-punctata* Linn.) has been taken a number of times in Connecticut, and may now be considered as having become established here, though it is not as yet very abundant. The larvæ and adults of the common asparagus beetle (*Crioceris asparagi* Linn.) were killed by spraying the plants on the station grounds June 3 with arsenate of lead, $1\frac{1}{4}$ pounds in 20 gallons of water. This adheres to the slender foliage and stems better than most insecticides.

The elm leaf beetle (*Galerucella luteola* Müll.) did less damage to shade trees than for several years.

The tent caterpillar (*Clisiocampa americana* Harr.) was abundant throughout the central and northern portion of the State. The larvæ appeared very early (about April 1).

During August the larvæ of *Cingilia catenaria* were numerous at Terryville and devoured the leaves of sweet fern, huckleberry, sumac, scrub oak, and other low-growing plants. These pupated during the latter part of August, and the adults appeared nearly a month later. These were also very abundant.

There are good reasons for believing that the Chinese mantid (*Tenodera* [*Paratenodera*] *sinensis* Saus.) has been introduced into Connecticut directly from Japan and has become established here. Egg

cases of the European mantis (*Mantis religiosa*) have been procured from central New York, and we hope that this species may soon aid in checking some of our troublesome species of plant-lice and other insects.

THE BROWN-TAIL MOTH IN NEW HAMPSHIRE.

By Clarence M. Weed, *Durham, N. H.*

Eastern Massachusetts has been for some time the home of two insect pests of special interest to the country at large. I refer, of course, to the brown-tail moth and the gypsy moth. As the first of these has within the last four years been gradually invading New Hampshire, I have thought a few notes concerning it would be worth bringing before you.

At our last meeting I reported to you that apparently the brown-tail moth was first introduced into New Hampshire in 1899 by means of a severe gale which carried the moths along the eastern coast of Massachusetts. A winter nest of the insect was found in the town of Seabrook, N. H., in December, 1899, by Mr. F. C. Moulton, of the gypsy moth commission.

Upon the passage of our nursery-inspection law last March I took steps to ascertain to what extent the insect had spread in the southeastern corner of the State. It very soon became evident that all the towns along the coast, at least, were already infested, and that the insect was slowly but surely spreading. Later investigations showed that very few moths were in the State away from the coast.

The region about Newburyport is very generally infested by the brown-tail moth. The evidence in hand indicates that the electric cars running from there to Portsmouth and Exeter have been the most important means of distribution, as the nests have been quite generally found along the car lines. This is what might be expected from the fact that these cars are continually coming from regions where the caterpillars are abundant on the trees overhanging the streets through which the cars run. Such caterpillars, frequently dropping as they do, might easily be carried on the cars themselves, or on the persons or effects of passengers. In a less degree the freight and passenger cars of the railroads may readily serve to distribute the pests, as well as various other sorts of vehicles, especially automobiles, which pass in great numbers through the infested area to regions in New Hampshire now uninfested.

One of the most serious effects of the presence of the brown-tail moth in a community is that of the peculiar skin disease it may produce. The hairs of the caterpillars are furnished with minute barbs. When the caterpillars molt these barbed hairs are shed with the skin,

and as the skins become dry and are blown about by the wind the hairs may be quite generally disseminated. When the hairs alight upon the human skin they cause an irritation which, upon rubbing, may develop into inflammation. In New Hampshire this phase of the insect's presence has already become in evidence. At Portsmouth a clothes reel was near a tree infested by the caterpillars. The family were greatly troubled through the summer by extraordinary irritations of the skin, for which they were unable to account, but which were doubtless due to caterpillar hairs blown from the pear tree. In the same city a gentleman in removing a caterpillar which had landed on his neck scattered some of the hairs, which produced an eruption similar to but considerably worse than that produced by poison ivy.

The food preferences of the insect have been shown quite markedly in our observations. Pear seems to be the favorite food plant, with apple, wild cherry, plum, and hawthorn following along in about the order named.

AN EXPERIMENT WITH BLACK FLIES.

By Clarence M. Weed, *Durham, N. H.*

In the resort regions of northern New Hampshire the black flies have long been recognized as one of the most annoying pests for the summer visitor, as well as for the resident citizen. I have had, from time to time, appeals from hotel managers for help in subduing the pest, but until this year have had to confess that I knew of no probable solution of the problem. For several years I have had under observation a colony of black-fly larvæ living on the flat rocks of the outlet to our college reservoir, and have often tried to discover an effective means of killing them.

When studying the recent literature concerning mosquito remedies, the property of phinotas oil, which leads it to sink to the bottom in water, led me to think that possibly here we had an agent for destroying Simulion larvæ. Last June, in order to test the theory, I sent my assistant, Mr. A. F. Conradi, to Dixville Notch, N. H., where these pests have for many years been especially troublesome, with specific instructions to find the breeding places of the flies, and to try the effect of the phinotas oil with which he was provided.

The Dixville Notch region was peculiarly favorable as to situation for an extended experiment in subduing black flies, for it is a comparatively small area, surrounded by mountains over which no flies from other localities would be likely to come. A large part of the encompassed area is taken up by a beautiful lake. Upon arrival Mr. Conradi made a careful survey of the entire locality, finding no flies breeding in the swiftly running shaded streams along the mountain sides, but finding vast numbers breeding in shallow, sunlit waters at

the wasteway from the lake, and in two or three other places. His notes upon the first experiment with the oil treatment are as follows:

At the wasteway, near the lake dam, where the stream is approximately 5 feet wide, one-third of a gallon of phinotas oil was applied at 4 a. m., June 22. The effect was at once noticeable. At 2 p. m., the same day, most of the larvæ were dead, while the remainder were sluggish. On the afternoon of the next day, the conditions were carefully investigated and all the larvæ were found to be dead, not only where the oil was applied, but for 10 feet or so ahead as well.

The oil was applied by simply pouring it over a shingle, thus scattering it somewhat. It sinks and rises, and lingers long about the place. Stones in the water picked up forty-eight hours after the application had a thin film of the oil still on them.

When Mr. Conradi reported the results of his trip it seemed to me that the problem was in part at least solved, the chief perplexing feature being the possible deleterious effect upon fish life of the application of the oil in quantity. From the similarity of the breeding places he found to the one I had been observing, it occurred to me that a little work with stiff brooms in sweeping free the masses of larvæ and then catching them downstream on wire netting stretched in the water might be helpful where the oil could not be applied. Accordingly, I sent to Dixville Notch a barrel of phinotas oil and a supply of stiff stable brooms. When these arrived Mr. Conradi was sent again with specific instructions as to the use of the brooms and the application of the oil, especially in the latter case as to its effect upon fish life. He found that the sweeping method was entirely practicable and offered in some breeding grounds a simple method of destroying the pests. He also found that in a brook 3 feet wide where in June the flies were breeding in vast quantities in which he had poured one-half gallon of phinotas oil, the young stages of the flies had been killed off for a distance of one-eighth of a mile from the place of application. As regards fish, he found that they swam rapidly down stream as soon as oil was applied, and apparently were able to escape without evil results to them.

Shortly after the treatment the adult black flies became so scarce that the hotel managers discarded the smudges which for the last twelve summers had been in daily use for the protection of the guests.

I believe that these experiments justify the hope that in the near future the black fly will be more easily controlled in centers of permanent or temporary population than is the mosquito.

A vote of thanks was extended to Doctor Fletcher for the efficient and impartial manner in which he had presided over the meeting. It was voted that the meeting adjourn to meet at the same time and place with the American Association for the Advancement of Science when it next assembles.

The meeting was then declared adjourned.

A. F. Burgess, *Secretary.*

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Banks, Nathan, U. S. Department of Agriculture, Washington, D. C.
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Saunders, William, Dundas street, London, Ontario, Canada.
Schwarz, E. A., U. S. Department of Agriculture, Washington, D. C.
Scott, W. M., U. S. Department of Agriculture, Washington, D. C.
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