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AGRICULTURAL COLLEGE.

BULLETIN NO. 114.

THE ORIENTAL MOTH
A RECENT IMPORTATION.

JANUARY, 1907.

The regular Bulletins of this Station will be sent free to all newspapers in the State and to such individuals interested in farming as may request the same. Technical Bulletins are sent only to those persons interested in the subject treated of in each case.

HATCH EXPERIMENT STATION

OF THE

Massachusetts Agricultural College,

AMHERST, MASS.

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The co-operation and assistance of farmers, fruit-growers, horticulturists, and all interested, directly or indirectly, in agriculture, are earnestly requested. The Bulletins will be sent free to all newspapers in the State and to such individuals interested in farming as may request the same. General bulletins, fertilizer analyses, analyses of feed-stuffs, and annual reports are published. Kindly indicate in application which of these are desired. Communications may be addressed to the

HATCH EXPERIMENT STATION, Amherst, Mass.

DIVISION OF ENTOMOLOGY.

A New Oriental Moth in Massachusetts.

Cnidocampa flavescens (Walk.)

H. T. FERNALD.

DISCOVERY OF THE INSECT.

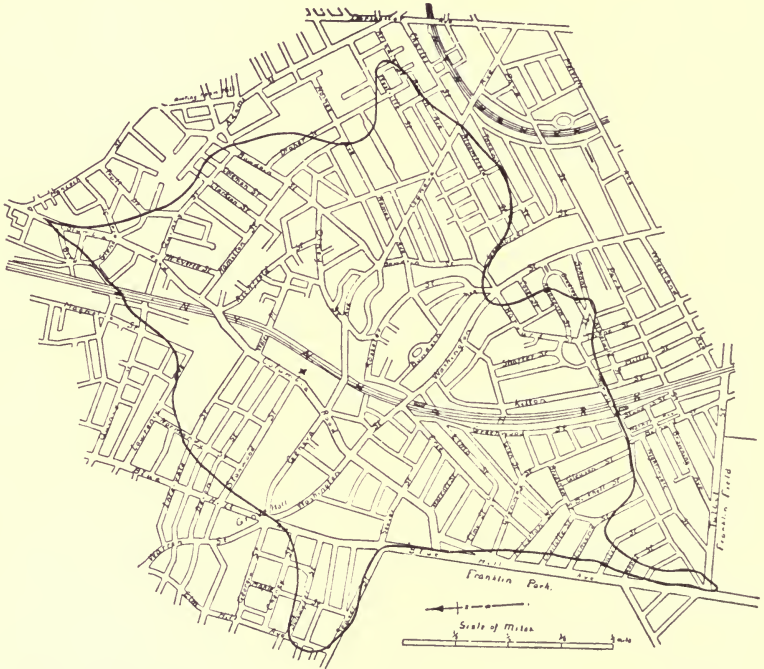
In February, 1906, peculiar cocoons discovered on several kinds of fruit trees in Dorchester were sent to the Gypsy Moth Commission for identification, and as they were not at once recognized were forwarded by Mr. A. H. Kirkland, Superintendent of the Commission, to the Hatch Experiment Station for examination.

Prolonged study of these cocoons showed that nothing like them had ever been reported in Massachusetts, and that it was probable that they were cocoons of some foreign insect and they were preserved in order to obtain the moths, which began to appear about the twentieth of June. These were also carefully studied and finally identified as probably a Chinese and Japanese moth, known in Japan as "Ira-mushi," but in order to make the identification positive specimens were sent to Sir George Hampson of the British Museum who confirmed the identification.

At this time the cocoons had been reported as occurring in three small house lots only, but through the kindness of Mr. Frank A. Bates and Mr. Joseph Silva of the Gypsy Moth Commission, a further examination was made, which showed that it was present over a considerably larger territory, and a study of its distribution through Dorchester was begun.

DISTRIBUTION.

Dorchester, formerly a town adjoining Boston, is now a part of that city and is mainly a residential district, well provided with shade and fruit trees. Quite a portion of the Public Park system is in this region, Franklin Park, Franklin Field and Columbia Road being portions included.



Map of infested region as located Nov. 1906 is shown by the heavy line. The probable original center is marked by a spot.

An examination of the infested region made in November, 1906, as determined by the presence of cocoons on the trees, showed that these were most abundant in a neglected Pear orchard on Columbia Road, close beside where there was once a Japanese nursery. This nursery was removed several years ago, and the lot has since been built on, but the great abundance of cocoons of this insect around the place, together with the fact that it is a Japanese insect is very suggestive as to the way in which it may have reached this country.

Columbia Road is a wide double street with a central strip of lawn and young trees, a row of which is also on each side, and the cocoons

were found on these trees for a distance of nearly a mile and a half. Streets crossing Columbia Road were then followed until no cocoons could be found for several blocks, and the approximate outline of the infested territory was thus determined. This is very irregular in form but as a whole extends farther south-west from the probable center of infestation than in any other direction, and the longest distances in the territory are almost two miles in a north-east, south-west direction by a mile and a half at right angles to this.

This territory is rolling ground, with several hill-tops perhaps a hundred feet higher than streets an eighth of a mile away, and it was very noticeable that on the hill-tops in most cases no cocoons could be found. This and the fact that where the infestation is slight most of the cocoons are not high up in the trees would suggest that perhaps the moth does not fly high under usual conditions.

FOOD PLANTS.

The cocoons were almost invariably present on Norway maples which may be considered their preferred food. Other kinds of maples were occasionally infested to a slight extent. Near the outer limits of the infested area the Norway maples were almost always the only trees infested, but toward the center others were added. So far as could be judged by relative abundance of the cocoons the Norway maple, pear, apple and cherry (cultivated and wild) were the most favored food plants though cocoons were also found on the crab-apple, willows, black birch, cut-leaved white birch, oak, American elm, Wahoo elm, blackberry, beech, poplar, mountain ash and buck-thorn. One cocoon found on a rose bush was probably accidental as this bush was directly under a cherry, and was the only infested plant of its kind though large numbers were examined. Cocoons were not found on the peach, hickory, sumach, horse chestnut, gingko or spruce though these were frequently met with in the infested area.

ABUNDANCE.

Near the apparent center of infestation the cocoons were very abundant, as many as a hundred being found on a tree in some cases. Judging from the distribution of the cocoons the eggs are not laid in clusters but perhaps half a dozen or less on a tree by a single moth and the larger numbers would represent the deposition of eggs by quite a number of insects.

DATE OF INFESTATION.

A determination of the time when this insect was introduced into Massachusetts is impossible to make with any certainty and only conjectures can be offered. If it was brought in on Japanese nursery stock it was undoubtedly before 1902, as official inspection of the nurseries was begun in that year and none of the inspectors observed these cocoons either then or during subsequent inspections till the present summer. Before 1902 the Japanese nursery in this locality was inspected for a year or two at the request of the owners by Mr. A. H. Kirkland and if it had been present then, it would certainly have been discovered. These facts taken in connection with the rather large area over which the insect now occurs lead to the opinion that if it was introduced on nursery stock it was probably before the year 1900.

LIFE HISTORY.

The life history of *Cnidocampa flavescens* does not seem to have been fully worked out in the Orient, and has thus far not been completed here.

The insect passes the winter in the cocoon but does not pupate until spring, retaining during the winter its larval form but losing most of its color. The moths emerge from the cocoon during the latter part of June and first of July and one in confinement laid about fifty eggs on the side of a breeding cage but these failed to hatch and were undoubtedly infertile. The length of time spent in the egg therefore cannot be stated nor the time during which the larva feeds, but it is probable that cocoon making occurs during the latter part of September or the first of October, and it is evident that there is but one brood a year.

DESCRIPTIONS.

Egg. The unfertilized eggs referred to above were regularly oval in form, measured one and three-eighths mm. by three-fourths mm. and were creamy white in color. The chorion showed a slight pearly luster under a lens, but no markings or micropyle were perceptible with this magnification. The eggs were laid side by side, touching each other, on the wood of the frame of the breeding cage though leaves and twigs of trees were available.

Larva. The larva is one of the "slug caterpillars" but as it has

not thus far been reared here the following description has been prepared from inflated specimens removed from the cocoon and will certainly need modification when compared with feeding larvæ.

Head small, 3 mm. in diameter, its clypeus and sides brown of varying depth, the top and front down to and at the sides of the clypeus light; with a light spot or sometimes an elongation of the light color into the brown of the side at about the level of the top of the clypeus. Anterior margin of the labrum deeply and broadly notched, dark brown. Eyes placed in a dark spot. Legs pale resinous yellow, very small, their claws dark brown. Second (prothoracic) segment rather small; prothoracic shield rounded triangular, with a pair of quite large brown spots in front, a small pair behind, and a few minute brown dots on the sides. Subdorsal row of horns well developed and bearing spines; small on the third, much larger on the fourth, and very large on the fifth segment, the spines on these three segments being black except at their bases. The subdorsal horns and their spines are very minute on the sixth and tenth segments, larger on the seventh, eighth and ninth, their spines being pale, tipped with black. Horns and spines of this row on the eleventh segment about like those on the fifth; those on the twelfth and thirteenth about like those on the third. Lateral horns and spines small on the third segment and quite near the subdorsal ones; those on the fourth larger, lying only a short distance in front of and above the first abdominal stigma which has moved upward nearly to the line of the lateral horns. Lateral horns absent on the fifth segment; fairly well developed on the sixth to tenth segments inclusive, but not very noticeable, only the tips of the spines being black; much larger on the eleventh and twelfth segments and with more black on the spines. Stigmata pale brown, slightly oval. Below each stigma a short distance are two or three small, slender hairs. There are no traces of prolegs. As regards the colors and their distribution Dyar says: "Purplish brown dorsally, including a diffuse white dorsal band with dark edges, distinct only centrally. Sides green, just covering the lateral horns of joint 4, reaching up to the subdorsal horns on joints 7 to 9, retreating to the lateral horn on joint 11, but covering joints 12 and 13 and with an angular patch about the subdorsal horns of joint 11; green spots below the subdorsal horns of joints 4 and 5. A white broken lateral band with dark edges; subventral edge pale, with a dark line above."

Length of inflated specimens about 25 mm.: greatest diameter (at the fourth and fifth segments) about 8 mm. These measurements are probably greater than would be obtained from a living caterpillar.

Cocoon. The cocoon is about 14 mm. in length and 10 mm. in width, the smallest one found in a lot of over a hundred measuring 17 mm. by 8 mm. It is almost perfectly oval in outline though there is sometimes a very slight constriction near one end marking the line of attachment where the lid of the cocoon which separates from the remainder when the moth escapes, joins the main portion. The cocoon is whitish and brown, often so mingled as to present a rather striking pattern and suggestive of certain oriental designs. In time, as the cocoon weathers, the brown seems to fade, giving a dirty grayish color to the structure. The lid in fresh cocoons is nearly always quite uniformly brown in color.

The cocoon is very tough and firm and is so solidly fastened to the tree that it is frequently broken in the attempt to remove it. Its location varies but the preferred position seems to be in or beside an axil between a branch one-half or three-quarters of an inch in diameter and a smaller twig. Occasionally one will be found attached to the side of a twig near its tip where the diameter of the twig is considerably less than that of the cocoon, and in a few cases they have been found on the larger limbs, no attention in these cases being paid to the presence of any small branches which might offer axillary attachments. In one case a cocoon was discovered on the side of an erect trunk which was at least four inches in diameter.

The tendency to place the cocoons toward the tips on the smaller branches is very strong, probably four-fifths being in this region. In one case a fresh cocoon was found on the surface of a fresh winter tent of the Brown-tail moth, and as the latter during the fall of 1906 did not complete their tents till about the tenth of September this gives some indication as to the probable time of cocoon making.

Within the cocoon the caterpillar assumes a short, stout form somewhat resembling a fullgrown Ox Warble though smaller. It loses its colors, becoming yellowish white, and in this condition it hibernates, transforming to a pupa sometime later than March of the following spring.

At emergence from the cocoon the lid is in some manner separated from the rest of the cocoon, leaving a circular opening with smooth even edges from one to three millimeters from the end. Through

this opening the pupa works its way partly out, then stops and the moth escapes, generally leaving a portion of the empty pupa case protruding from the opening of the cocoon.

Adult. The only descriptions of the moth published have been the original one by Walker and a still briefer one by Butler. More complete descriptions of the genus *Cnidocampa* (new name for *Monema*, preoccupied) and of the species, are accordingly given here.

Genus *Cnidocampa* Dyar. Body short, stout. Head rather small, bent somewhat downward below the axis of the body, frons rounded, densely clothed with scales which project forward above and between the eyes and also in a vertical median line between the eyes, forming a T-shaped ridge. A narrow strip just in front of the tongue bare, pale straw yellow, glistening. Labial palpi upturned, nearly as long as the head and thorax together, the first segment short, the second nearly twice the length of the third, thickly clothed with rather long appressed scales. Maxillary palpi absent. Tongue short, naked at base where it separates into two distinct unconnected halves; apparently not functional. Eyes large, nearly hemispherical, their inner margins converging somewhat downward. Ocelli absent. Antennæ extending about two-thirds the length of the costa of the fore wing, filiform, the central two-thirds having a very slightly greater vertical diameter than the base and tip; perceptibly thicker in the male than in the female; without pectinations but quite thickly covered with minute scales.

Thorax thickly clothed with long hairs and scales which form a pair of long flattened tufts behind on the upper side and extend backward over the base of the abdomen. A similar flattened tuft arising in front of the base of the fore wing extends backward beneath it, and another, more erect, passes from the side of the body inward in front of the hind coxa and femur concealing these from in front. Tegulæ well developed, extending over the base of the hind wings. Fore wings with a slightly convex costal margin. Outer margin quite strongly, evenly rounded and directly continuous with the slightly less rounded inner margin. Hind wings shorter, but longer than the abdomen, when folded; the base of the fore wing and the base, and that part of the hind wing supported by the internal veins thickly clothed with long hairs.

The venation characteristic of the family Cochlidiidæ, as given by Hampson is: "fore wing with two internal veins; vein 1b forked

at the base. Hind wing with vein 8 arising free, then bent down and usually anastomosing shortly with 7 near the base of the cells; three internal veins." Additional features of the venation in *Cnidocampa* are as follows: Fore wing. Cell completely divided by a longitudinal vein which forks externally, the hind fork joining the base of 5, the other the base of 6. Base of 4 and 5 joined by a faint cross vein, the two veins a little nearer to each other at their bases than are 3 and 4. Vein 3 arising from the median a little more than half way from 2 to 4. A cross vein passes forward from the junction of the anterior fork and the base of 6, to the subcostal. Veins 7 and 10 connate or stalked from the upper angle of the cell; 8 and 9 stalked from near the basal fourth. Vein 11 leaving the subcosta at about the middle of the cell and bending forward, and from a point about opposite the end of the cell onward, running very close to vein 12. Hind half of the cell longer and narrower than the front half. Hind wing. Cell divided by a longitudinal vein from its outer end, which joins the median vein at the inner third of the cell. Vein 2 arising from about the middle of this posterior cell; veins 3, 4 and 5 from near its end, 4 being from its apex. The cross vein forming the external end of the anterior half of the cell arises a little beyond the middle of the posterior half of the cell and passes forward and a little obliquely outward, Veins 6 and 7 from a short stalk from the upper angle of the cell; 5 and 6 approaching each other somewhat then diverging.

Legs rather stout, the under side of the femora quite heavily fringed with hair-like scales. Fore and hind tibia and metatarsus fringed on the outer side with long hair-like scales, longer in the male; the same conditions being present to a less degree on the middle legs, and here too, more developed in the male. Hind tibia with a pair of spurs on the inner side at the tip and a second pair near the middle, all four spurs being nearly of equal length.

Cnidocampa flavescens (Walk.) Expanse of wings 32 to 40 mm. Head, thorax and inner portion of the wings above, dull chrome yellow; outer portion of fore wings light chestnut brown with a yellowish tinge inwardly, darker toward the outer margin. Near the hind margin of the wing in this region the yellowish is replaced by a pinkish tinge. Front of the head below the horizontal bar of the T-shaped ridge of scales, brown - pink; palpi light chestnut, with numerous black scales giving a finely speckled appearance, their tips

black. Antennæ light chestnut with a silky luster. Thorax without markings above except that near the middle line the yellow is a little paler. Fore wings with a light chestnut colored discal spot varying somewhat in size, depth of color, and limits, sometimes blending with the similar color outside. From the costa near the apex a dark brown line passes backward to near a point a little internal to the angle, on the inner margin. This line as a whole is arched outward somewhat, but may be slightly sinuate during its course. A shorter, broader and less sharply defined line arising at the same place on the costa runs toward the center of the wing making a sinuous course, passing external to the discal spot, and terminates near the middle of the wing. The strength with which this line is developed and its exact course vary. The color of the wing external to the outer line is quite uniform but the costa and outer margin are narrowly edged with black. The front half of the wing between the two lines is the portion where the chestnut color is tinged with yellow, while behind, the pinkish replaces the yellow. Internal to the inner line the chestnut varies in the distance to which it extends, sometimes reaching to and blending with the discal spot and behind this extending some distance toward the base of the wing, then retreating to about the middle of the internal margin. There is usually a small chestnut spot near the internal margin, lying in the yellow, about one third of the distance from the base of the wing to the anal angle. The fringe on the outer margin of the fore wing is dull white with a black line running through it. Hind wings above uniformly dull clay. Fringe brown at base, whitish beyond, with two dividing dark lines. Basal segment of the abdomen above, of the same color as the thorax, the remainder brown-pink, without markings. Under surface of fore wings pale brown, lighter near the base and internal margin; with a decided pinkish shade along the basal half of the costa which is very narrowly edged with dark brown. Hind wings beneath of the same general shade as the fore wings, the outer half of the costa slightly tinged with dark. The outer half of the wing is sprinkled sparsely with black scales perceptible with a lens. Body beneath of the same color as the abdomen above but with a decided pink shade. Coxal clothing orange red. Legs light chestnut, sprinkled with black scales, the femora and tibiæ with a pinkish tinge beneath, the tarsi quite grayish.

Described from three male and three female specimens.

THE ORIENTAL MOTH IN ASIA.

In the Orient this insect has an extensive distribution. In Japan it has been captured on the island Yezo and from there southward at least as far as Yokohama. On the main land it has been taken at Chabarofoka and Blagoweschtschensk in Amur, north of the fiftieth degree of latitude, and Graeser says that at the latter place cocoons could be found by the hundreds in the gardens and forests. Farther south it is abundant in the province of Chi-li near Peking, it being possible there to obtain the cocoons by the thousand, and this is also true near Shanghai. The most southern point from which it has been reported is on the Yiang-tse-Kiang river just north of the thirtieth degree of latitude.

Such a distribution as this in North America would include all the United States except the peninsula of Florida; northern Mexico and southern Canada. So far as the climate is concerned therefore, it is likely that this insect could live almost anywhere in the United States.

Food plants reported from Asia are the Celtis, birch, elm and Japanese Persimmon (*Diospyros kaki*).

WILL IT BECOME A PEST HERE?

This is a difficult question to answer. The Oriental moth belongs to the family Cochlidiidæ and members of this family are not usually of much economic importance. In this case however, we have an insect which has probably reached this country without being accompanied by any of the enemies which presumably hold it in check in its native land, and it has already shown its ability to live and spread in this climate.

No evidence of the presence here of enemies has thus far been found except that about one cocoon in a thousand has a hole in the side and is empty though the lid is still in place, showing that the moth has not emerged. It is possible that this is the work of birds, but if so the small number of cocoons attacked is not encouraging to the idea that birds will prove important enemies of this insect.

While the writer is of the opinion that the Oriental Moth is not likely to become a very dangerous pest in this country the experience of Massachusetts with the Gypsy and Brown-tail moths has been so serious that the possibility that this may become another enemy of

importance should not be ignored. It is doubtful if five years after their arrival in Massachusetts either of the above named insects had done injury enough to attract any more attention than is the case with the Oriental Moth at the present time and it would be a mistake not to recognize the possibility that we have here the first start of what may perhaps prove to be another serious pest.

ACKNOWLEDGMENTS.

The thanks of the writer are hereby tendered to Sir George Hampson of the British Museum ; to Mr. A. H. Kirkland, Mr. Frank A. Bates and Mr. Joseph Silva of the Gypsy Moth Commission ; to Mr. Samuel Henshaw of Harvard University ; and to Dr. H. G. Dyar and Mr. E. G. Titus of Washington, D. C., for assistance during the study of this insect. To Prof. C. H. Fernald he is indebted for much assistance in all parts of the work and particularly in connection with the descriptions of the adult.

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 Kräpelin (Mitt. a. d. Naturhist. Mus. Hamb., XVIII, 196, 1901) undoubtedly referred to this insect but gave it no name.
 The name *Monema* being preoccupied, this insect was subsequently referred to *Miresa*. Dyar however, does not consider it as referable to this genus and has proposed *Cnidocampa* as a substitute for *Monema*.

EXPLANATION OF PLATE.

[From Photographs by the Author.]

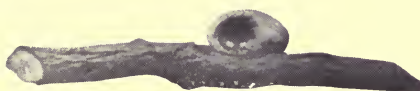
- FIG. 1. Adult moth.
 FIG. 2. Did a bird do this?
 FIG. 3. “The lid is off.”
 FIG. 4. Cluster of cocoons on Norway maple.
 FIG. 5. Cocoon on pear twig $\times 3\frac{1}{2}$.



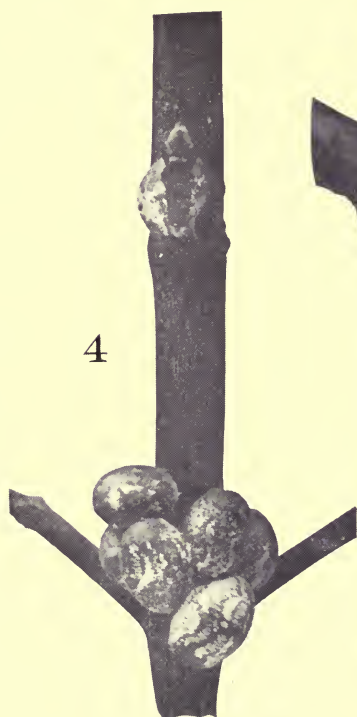
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