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# Report of the entomologist

Harcourt Alexander Morgan

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# BULLETIN

— OF THE —

# AGRICULTURAL EXPERIMENT STATION,

WM. C. STUBBS, PH D., Director.

## REPORT OF THE ENTOMOLOGIST.

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PECAN CATERPILLAR.
THE LEAF-FOOTED BUG.
MAGGOTS ATTACKING MAN.
A NEW CORN INSECT.
INSECTICIDES.
BRED PARASITES.

— BY —

H. A. MORGAN, ENTOMOLOGIST.

ISSUED BY THE BUREAU OF AGRICULTURE AND IMMIGRATION,
J. G. LEE, COMMISSIONER.

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LOUISIANA STATE UNIVERSITY AND A. AND M. COLLEGE,
OFFICE OF STATE EXPERIMENT STATION,
Baton Rouge, Louisiana.

Major J. G. Lee, Commissioner of Agriculture and Immigration, Baton Rouge, Louisiana:

DEAR SIR—The following report of Prof. H. A. Morgan, entomologist of the experiment stations, covers the work done recently in his department. Attention is called to the Act 129, passed by the General Assembly "to prevent the introduction, propagation or distribution in this State of any fruit trees or fruit growth affected with any infectious disease or infectious insects injurious to fruit growth, and to provide penalties for violation of same and the necessity for its enforcement."

The life-histories, with remedies, of many insects exceedingly injurious to our horticultural and agricultural interests, are herein given and will prove of great value to our people. I ask that this report be published as Bulletin No. 48.

Respectfully submitted.

WM. C. STUBBS,
Director.

# ENTOMOLOGICAL REPORT.

During the year, which has just passed, there has been a marked increase in the interest manifested by the planters, farmers, fruit growers and gardeners of the State in this division of the Experiment Station over that of previous years. This has been due very largely to a more definite knowledge on the part of those who carry on the work of this department of where assistance could be most effectively given to the farmer, etc., and of the many influences which cause failure of applied preventives and remedies in this State which have in other places been followed with excellent results. A more accurate knowledge, too, on the part of those who were benefited, of the objects of economic entomology, has been of great assistance in increasing the usefulness of entomological work in the State.

Through the Experiment Station bulletins, the monthly reports of the Bureau of Agriculture, the agricultural press, the meetings of the different agricultural societies and farmers' institutes of the State and an extended correspondence, we have been able to disseminate such entomological information as the needs of the State demanded.

## LEGISLATION.

In submitting this report I wish to call attention to an act No. 129) of the General Assembly of the State of Louisiana at the regular session of 1894, which is as follows:

"SECTION 1. Be it enacted by the General Assemly of the State of Louisiana, That it shall be unlawful for any person to bring into this State any fruit trees or vines, shrubs, scions, cuttings, buds, grafts, fruit pits, or any kind of fruit growth affected with any infectious disease or insects, injurious to the growth of fruit, or propagate the same, or offer the same for sale or in any way distribute or attempt to distribute the same in this State.

"SEC. 2. Be it further enacted, etc., That all fruit trees, vines or shrubs, scions, cuttings, buds, grafts, or fruit pits or any tree growth of any kind brought into this State, or offered for sale, or distributed in this State, shall be properly labeled with the name of the owner, agent, shipper or grower, and the locality where grown, and shall be subject to the inspection of the Entomologist of the State Agricultural Experiment Station.

"SEC 3. Be it further enacted, etc., That it shall be the duty of the Entomologist of the State Agricultural Experiment Station, at the request of the Director of such Station, to visit any section of the State, when such visit can be made without expense to the State, where there are diseased fruit trees or any tree growth infected with disease or insects injurious to tree growth, to examine and report on such diseased fruit, growth or infected tree growth, and if such examinations prove the infected trees perniciously infected, it shall be the duty of the owner, agent or possessor of such diseased fruit trees or infected tree growth to at once disinfect or destroy the same.

"SEC. 4. Be it further enacted, etc., That any wilful neglect or violation of this act shall subject the offender to a fine of not less than five dollars, nor more than one hundred dollars, or imprisonment in the parish or city jail of not less than one day nor more than three months, or both at the discretion of the court, and the provisions of this act shall be enforced by the district attorney in any court of competent jurisdiction on the complaint of any party in interest, and all moneys derived from the enforcement of the provisions of this act shall, after the payment of all fees allowed by law, be paid over to the State Agricultural Experiment Station to carry out the inspection provided for by this act."

This act grew out of the fact that within the last ten or twelve years the scale insect pests of the orange groves of this State have been quadrupled in number of species, and with this increase in numbers there has been introduced pests, not only very destructive to the orange tree, but to many other fruit trees as well. While this act was especially designed to protect the orange groves from importations of uncompromising insect ene-

mies, yet the recent introduction of many species of insects, heretofore unknown in this State, such as the pernicious scale (Aspidiotus perniciosus), the walnut scale (Aspidiotus juglans regiæ) and the barnacle scale (Ceroplastes ciripediformis) which are pretty general in their attack upon fruit and shade trees, would point to a general interpretation of this enactment if the work of inspection be well executed.

There are important reasons why this act is particularly opportune, namely:

1. There are being imported almost daily a great many varieties of oriental plants (fruit and ornamental trees).

2. The extreme freeze of February, 1895, destroying many groves and nurseries of orange trees is necessitating the introduction of many plants, buds and scions from other States and countries.

3. Many agriculturists of this State are adopting a greater diversification of crops and the planting of a few fruit trees has become more general, these trees being most usually obtained from nurseries outside of the State.

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## OBSERVATIONS ON THE COTTON MITE.

During July, 1893, a small mite was found in great numbers upon a single cotton plant at the Experiment Station. The season being dry the increase in numbers of this new enemy became enormous and somewhat alarming, spreading as it did from plant to plant and from plot to plot, until soon the entire crop of cotton under experiment was seriously infested. At once many remedies were undertaken, but with little success. The leaves assumed a very rusty appearance and soon began to drop, and when the rains began early in August nearly three-fourths of the entire crop of leaves had fallen. The rains soon diminished the number of mites and suggested a means of keeping their destructive work in check. This extreme attack was the only one observed during the season of 1893. The summer of 1894 was a wet one, and while the mite was present yet the

rains kept it in subjection and no great injury was experienced. In June of 1895 it appeared again.

During the summers of 1894 and '95 experiments were instituted in order to secure accurate information as to the life history and habits of this mite.

Of the many experiments carried out to determine the life-cycle of this arachnid, the following is about an average of the many results obtained: On July 17, 1894, several immature specimens were put in different cages, one in each cage. On July 18 most of the specimens had reached maturity, and in one or two instances eggs had been deposited. On July 19 all were depositing eggs (for nearly all happened to be females), the number varying from eleven to twenty five. On July 20 the young began to appear, and on the 23d all had hatched, while those which appeared first had spun a very light web on and immediately above the surface of the leaf, and upon its upper threads were quiescent preparatory to shedding the first moult. By July 25 all had moulted once, and the earlier appearing members of the brood were preparing to moult a second time. Careful examinations were made a couple of times each day, and on July 27 the whole brood had moulted a second time, by the evening of the 28th nearly all had reached maturity, and on the 29th some were depositing eggs. The old females disappeared one by one at different dates; no traces of their bodies could be found. It was discovered by isolating females immediately after reaching maturity that they lived from five to seven days.

From the dates given above it will be seen that the entire time required to complete the life cycle of a brood was from July 18 to July 29, or twelve days being the greatest period consumed. Some matured July 27. In one experiment on another occasion mature forms were developed from eggs in eight days. From the above and other data it is safe to conclude that an average of three broods are produced during the months of June, July, August, September and October, if the season be moderately dry.

A POPULAR DESCRIPTION OF THE COTTON MITE.

As nearly everyone is familiar with the "red spider," so common on plants in any part of the State, an excellent popular description of the cotton mite can be obtained by comparing it with the red spider. They so closely resemble, that even in technical identifications they have pronounced the same species. (Tetranychus telarius.)

The eggs are almost transparent when first deposited, and as the young develop they become more opaque, in some instances with a slight tinge of red, in others of green. In this condition they differ from the red spider, as all the eggs which have been under experiment, and all that have been examined are of a dark red color.

The *larva* (representing the young between hatching and the first moul ) possess three pairs of legs and are of a light color.

The nymph (representing the young between the first and second moults) have four pairs of legs and are somewhat darker in color, this being chiefly due to the differentiations taking place within the large liver of the mite. During the moulting period the young forms attach themselves to a thin web just above the surface of the leaf. On this web the most of the moulted skins (exuviæ) may be found.

After the second moult there is a gradual but rapid change in the color, from a light grey tinged with green to a deep red. The males, which are few in number, do not assume so deep a coloring, neither are they so large, and may be thus distinguished. There is more difficulty in distinguishing mature males from immature females.

HABITS OF THE COTTON MITE.

The adults are to be found congregated along the ribs and in the depressions or grooves on the under surfaces of the leaves of the cotton plant. Some few mites have been found to deposit eggs on the upper surface of the leaves and appear quite at home there, but this is by no means even a frequent exception.

The web spun over the portion of the leaves on which the

mites feed, is, until the leaves become dry, very thin; upon it eggs are found, although the majority of the ova are deposited below the web either immediately in contact with the epidermis of the leaf or resting upon the leaf hairs. Upon the higher strands of the web the young mites remain perfectly quiescent when moulting.

As long as the leaves remain green the mites, young and old, confine themselves to particular areas of the leaf, and while there is constant activity yet they seldom move outside of these selected portions of the leaves. Just as soon as the leaves become hard and dry the web is very much increased as if an effort were being made to incorporate in it fresh leaves, and thus the old leaves become covered with strands of silk upon which are to be found moults and dead adults. Migration did not take place until the first attacked leaves became worthless as food. This habit seems to account for the attack being generally confined to the old leaves. Specimens, however, which were given only young and tender leaves seem to thrive as well upon them as other specimens upon old leaves.

The fact that there is but little tendency to migrate from one plant to another is important in considering the means of destroying this mite.

Having removed, singly, immature forms to separate cages and the eggs of these specimens when mature being fertile, suggested the probability of the females being parthenogenic. This thought was partially confirmed when so few males could be observed. In order to test this matter more thoroughly and to avoid all chances of error, eggs were taken, placed separately in different cages and were watched carefully until the adult stage was reached. All proved to be females and each soon began depositing eggs, the hatching of which determined definitely the agamic nature of the mite.

Regarding the hibernation of the cotton mite nothing is definitely known. During the experiments of 1895 many black eggs were found, particularly when the food plant became dry and worthless. Up to the present we have not been able to hatch any of these so-called eggs, but the very hard shell, well

adapted to withstand unfavorable environments, seems to suggest a probable method of hibernation.

MEANS OF OVERCOMING THE COTTON MITE.

The failure of this enemy to gain a substantial foothold during wet seasons suggested the application of plenty of water to the plant. This had a controlling effect but did not destroy all of the specimens. According to the observations made during last summer (1895) moisture greatly retarded reproduction, influencing the period of incubation and in some instances destroying the eggs. Water is used in controlling the red spider in plant propagating houses and conservatories.

Of the many insecticides tested nothing was comparable to "flowers of sulphur" dusted upon the plants with Leggett's paris green gun. This was found convenient to apply and in every case relieved the plants of further attack.

On September 3d, 1895, there was found feeding upon the red spider which was abundant upon a plant of Citrus trifoliata, a very small black "lady bug" (a species of Pentilia). This coccinelid was present in such numbers and fed to such an extent upon the red spider the introduction of it among the cotton mites was suggested, and in a limited experiment we found that it also preyed upon the cotton mite. Opportunity was not afforded for field experiments with this beetle, but judging from the results of laboratory experiments (and laboratory and field tests in this case could not vary much) it is safe to predict this a valuable enemy to the cotton mite.

ADDITIONAL OBSERVATIONS ON THE COTTON MITE AND RED SPIDER.

In comparing the broods of the cotton mite and the red spider, and after determining a great similarity in life history and habit, exchanges of food plants were made and it was found that while the red spider thrived well upon the cotton leaf, the cotton mite did not do well upon the plant (*Citrus trifoliata*) upon which the red spider was found. There was a strong tendency to migrate, and in several instances the mites left the leaves upon which they were placed, which fact did not occur when they

were placed upon cotton leaves. This choice of food plant and the absence of the deep red color in the early stages are the only popular characteristics separating the cotton mite from the red spider.

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## A NEW PEACH INSECT.

(*Artace punctistriga*).

Late in October, 1894, there was found upon peach trees in the vicinity of Baton Rouge some very peculiar looking caterpillars and a few white cocoons. The caterpillars were confined to a breeding cage, and in a few days assumed the pupa condition, spinning a cocoon identical to those which had been taken from the peach trees.

Two specimens which had already reached the pupa condition, when collected, emerged as moths during November, 1894, one on the 9th and the other on the 17th. Both proved to be females. A few eggs were found attached to the top of the cage, which of course never hatched.

The eggs are about the size of a small pin head, spherical in shape, and present under a low magnifying glass a honeycombed appearance; the coloring may properly be called speckled (dark and light).

The caterpillars when found were nearly full grown and exemplify to a most remarkable degree the influence of the natural selection of colors and to some extent form, in developing perfect mimicry, we have never seen this more forcibly shown as a careful and continued hunt among the branches was about to be abandoned when accidentally catching hold of a small twig the hand was placed upon a caterpillar, which revealed its presence by a wriggling of the body. Additional effort was made to discover other specimens, and while others were found it was not without the closest search that their presence could be detected. The presence of quite a number of cocoons indicated that this insect was somewhat abundant, yet the caterpillars were never observed until the white cocoons became numerous among the branches.

The full grown hairy caterpillars are about two inches long, of a grey color, with a few light spots distributed over the body. The long hairs arising from just above the pro and thoracic legs completely encircle the small twig upon which they rest, producing a remarkable similarity to a lichen covered twig. On the dorsal side of the last thoracic segment a dark semi circle occurs, which is intersected near the median line by two yellow spots. It is evident that these caterpillars receive more protection on trees upon which lichens are permitted to grow, as no pupæ were found on very young and on clean trees.

The pupa is tolliculate, possessing a cocoon of white, thickly spun silk, and becomes attached by its entire length to the twig. The cocoon is more or less cylindrical in the center, but tapers towards each end, due to the silken attachment extending beyond the insect, and is about one and one-half inches long and two-fifths of an inch at its greatest diameter. See fig. 1. Fig. 2 represents the female moth.

Hubbard in his work entitled "Insects Affecting the Orange," takes the following account of this insect from the report of the Commissioner of Agriculture for 1880, p. 252:

"There is occasionally to be found upon the orange a fusiform white cocoon an inch and a half in length. From this cocoon there issues in the spring a thick bodied woolly white moth, the female measuring an inch and three-quarters and the male an inch and one-quarter across the wings. Each fore wing has five transverse rows of small black dots. We have not seen the caterpillar which spins this cocoon, but from an examination of the cast off skin to be found at the end of the pupa, and from other facts we may readily state it to be a rather thick larva, about an inch and a half in length and covered with long mixed black and whitish hairs, giving it a greyish effect. These cocoons are not confined to orange, but are also found upon the grass at the foot of the tree, and one specimen received was evidently found upon cherry, as pieces of the bark still adhered. The species seem to be comparatively rare, but as we have said before of other species, it is liable at any time to increase and

become injurious; therefore the sooner it is treated the better. As one of the causes of its rarity we may mention the existence of a large ichneumonid parasite, which we have not been able to breed owing to the fact that it in its turn is parasitized by a chalcid, of which we have bred thirty six specimens from a single cocoon, all having made exit, as usual, from a single hole. It is possible that this chalcid may also be a primary parasite. The specimens were referred to Mr. Howard for study, and decided to be a new species of the genus Encyrtus of Dalman." Mr. Hubbard adds: "It was described as Encyrtus Artaceæ n. sp."

On January 15, 1895, there issued from one of the cocoons a large ichneumonid (Ophion macrurum) and on March 15, 1895, another specimen of the same species emerged from another cocoon. These were the only parasites found.

Neunmœgen and Dyar (Journal of the New York Entomological Society, vol. 2, page 157) give the habitat of this insect to be, "Southern States to Mississippi Valley, to New York."

As the attack upon peach trees was not a vigorous one and was not observed until late in the season, no remedy was applied. There is no doubt, however, that an application of paris green (1 lb to 500 gals. of water) would destroy the caterpillars. Less paris green should be used upon the peach tree, as the leaves are more susceptible to burning than other fruit trees.

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## THE FIG BORER.

(*Ptychodes trivittatus*).

It has been four years since attention was first called to this insect as a pest of the fig tree. The exact life history has not been definitely determined, but it is known that the broods are not at all regular in appearing.

The eggs as yet have not been found by us, but very young larvæ have been noticed, and these being solitary would indicate that the eggs are deposited singly.

The footless *borer* or *larva*, when full grown, is about one and a third inches in length, contains fourteen segments, including the head and the three thoracic segments. The larva pre-

sents a flattened appearance the effect of this being increased by the segments becoming extended at the sides. The mouth parts are light colored and flesh-like, except the mandibles, which are very horny, resembling in color (dark brown) the remainder of the head. The pro or first thoracic segment is large and, although light in color, possesses considerable chitin or horny matter; the size and flattened shape of this segment has won for the insect the name of "*flat headed* borer." This name, however, has been applied to other borers and is not to be relied upon. The second and third thoracic segments are narrow and resemble in structure more the abdominal segments, although they are much narrower and do not contain breathing pores (spiracles). The abdominal segments, all but the small caudal segment, possess extensions on either side, which gives the lavra more of a flattened appearance. Upon the dorsal and ventral surfaces of each of the first seven abdominal segments are to be found worty tuberosities resembling degenerate prolegs. A few light colored hairs are to be found upon the body, but more are seen upon the prothorax and upon the sides of the segments than elsewhere. See fig. 3.

The beetle is about one inch long and possesses antennæ about twice as long as the body. The coloring is very distinct, being a light brown with three longitudinal white stripes, the two at the sides passing from the compound eyes along the thorax back to nearly the distal end of the wing. The middle band starts just behind the head, on the prothorax and runs along the inner margins of the wing shields to nearly their extremities. Small yellow spots are present over the brown portions of the wing covers. See fig. 4.

As to remedies for this insect, very little can be done after the borers have penetrated the branches except to dig them out with a sharp knife. Much more can be accomplished it something is applied to the tree to prevent the young from entering it. Perfectly healthy trees are not so subject to the attack of borers as those of varieties that have been weakened by inadaptation or by injury. Freezing nights followed by warm days cause death of that portion of the trunk and branches most

# PLATE II.

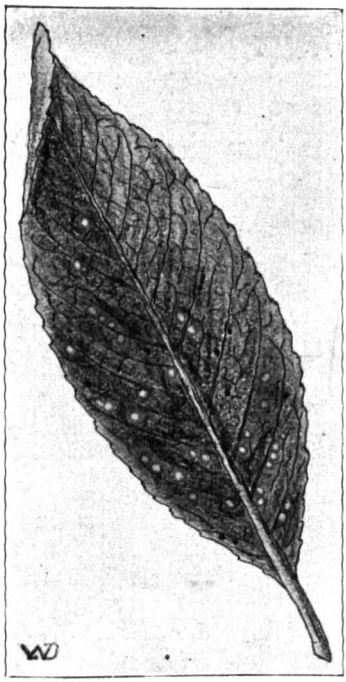

Fig. 6

Fig. 7

Fig. 8.

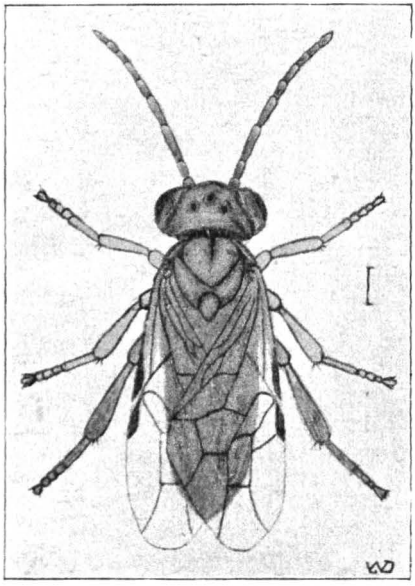

Fig. 9.

# PLATE III.

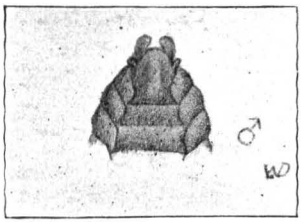


Fig. 10.

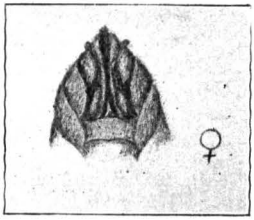


Fig. 11.

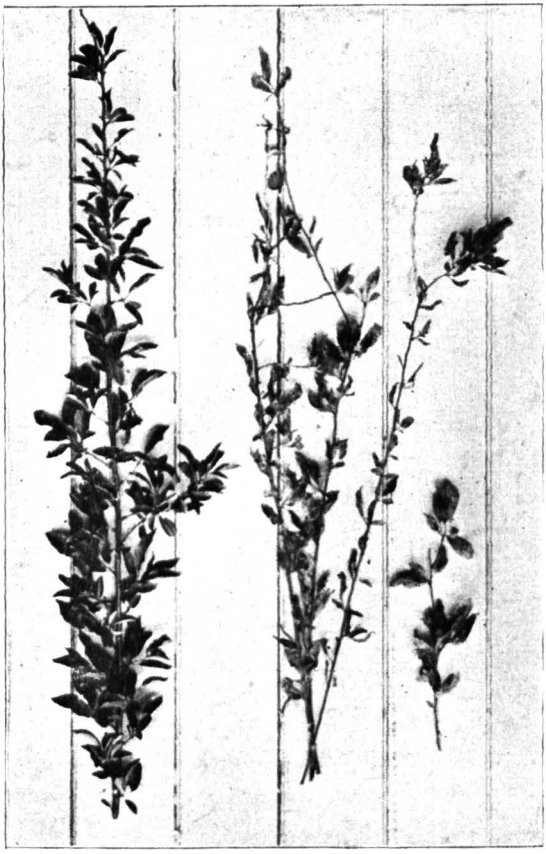

Fig. 12.

# PLATE IV.

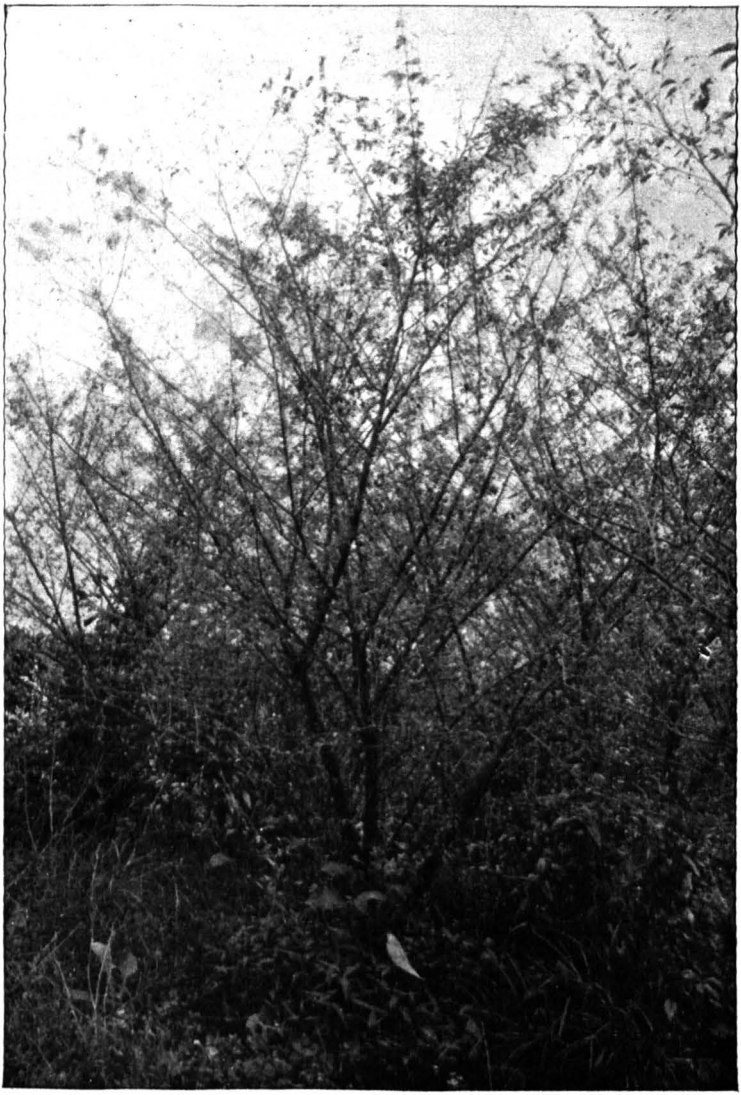

Fig. 13.

# PLATE I.

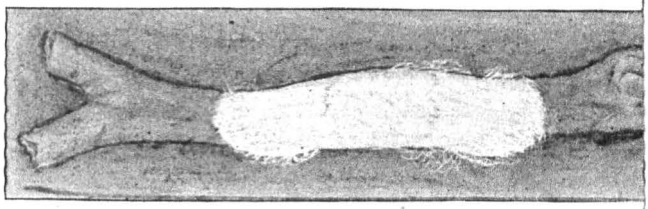

Fig 1.

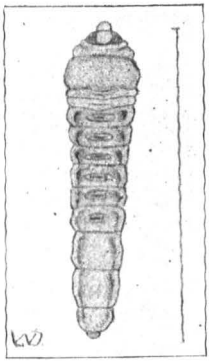

Fig. 3

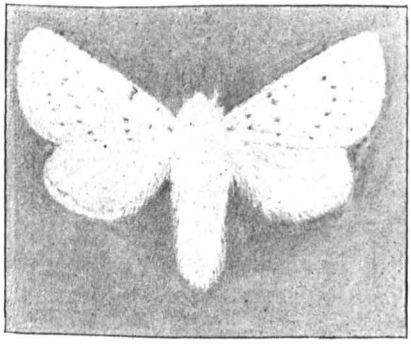

Fig. 2.

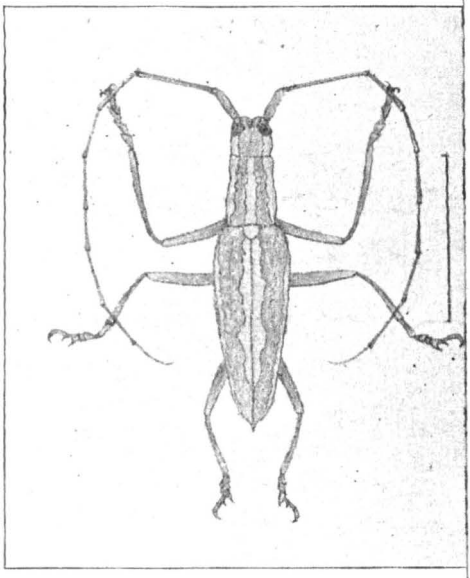

Fig. 4.

exposed to the sun. This is not true of all varieties of figs, as the Lemon and Celeste have proved hardier than other varieties, escaping more frequently the injuries from frost and have seemingly resisted better the attack of insects. Of course trees may suffer injuries during cultivation, or during picking and pruning operations, which will cause decay of the injured parts and borers will thus be attracted. The remedy in all such cases is the proper trimming away of all decayed or injured parts, and dressing them with something that will preserve the plant from further decay and will destroy the eggs or young larvæ should they appear.

The pine tar insecticide smeared over the branches and trunks acts as a repellant and destroys eggs that may be deposited.

We cannot recommend the use of dendrolene or raupenleim for the fig borer.

## THE HARLEQUIN BUG.

(*Murgantia histrionica*).

Among the worst enemies of the cabbage, turnip, mustard and other plants of this family is the harlequin bug. The general appearance of this insect in all stages may be gotten from fig. 5. Eggs are deposited in batches usually numbering eleven and twelve eggs to the batch. During our experiments last year it was found that one female would deposit as many as five lot of eggs, the time between each period of deposition ranging from two to five days. During the egg-laying period mating took place four times. The incubation period ranged from three and one-half to five days, while the time required to complete the entire life cycle

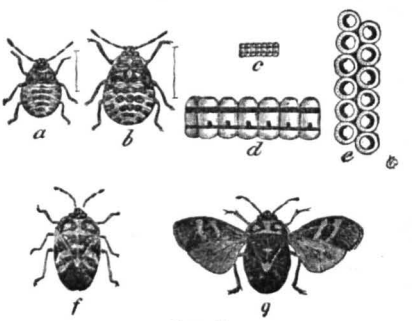


FIG. 5.

*Murgantia histrionica*: *a*, young; *b*, half grown; *c*, egg cluster; *d*, same from side; *e*, same from above; *f*, adult, wings closed; *g*, same, wings open; *c*, *f*, *g*, natural size; *a*, *b*, slightly enlarged; *d*, *e*, considerably enlarged. (From Riley.)

(from egg to adult) ranged from fourteen to eighteen days, adults lived from July 22d to August 7th, and hence mature specimens from the first batch of eggs appear before the old ones die.

EGG PARASITE.

A few years ago there was found in North Louisiana a minute insect which laid its eggs within the egg of the harlequin bug. The young hatching from the egg of this parasite devoured the contents of its host. Of the many eggs sent to this division of our Experiment Station work about all were parasitized. There has been a gradual dissemination of this parasite, for eggs collected in many parts of Louisiana and in Mississippi last year were found to contain parasites. It is to be inferred from this that the natural distribution of these minute friends is quite rapid.

Before knowing that the original parasite (Trissolcus murgantiæ) had reached Baton Rouge, experiments were made with another species of the same genus, Trissolcus podisi, which had been bred from other hemipteron eggs. Our main object was to get this species to deposit within the eggs of the harlequin bug, which was accomplished, and within a small bottle containing the eggs, T. podisi were induced to oviposit within them and thus were we assured of two enemies to the eggs of this pest. Later in the season Trissolcus podisi was bred from eggs collected in the field, but the majority of parasites found were T. murgantiæ.

In the rearing of these parasites information was sought along four lines, viz:

1. The length of cycle of the parasite.
2. At what period of incubation the parasite preferred its host.
3. How many eggs a single female would deposit.
4. The possibility of artificially disseminating these minute friends.

Eggs pierced July 20th, 1896, produced adults on July 30th, 1896. A period of ten days is thus sufficient to complete the life cycle of these parasites.

To obtain information relative to the period of incubation the parasite preferred its host, experiments were undertaken with T. murgantiæ by placing females in with eggs that had been deposited one, two, and three days, and a brood of parasites was obtained every time from eggs only one day old, but none from eggs older.

In testing how many eggs a single female parasite would deposit, our experiments were incomplete, yet in one instance one specimen pierced each of twelve harlequin eggs and a fully matured specimen was developed from each.

During July a few eggs were sent to the Experiment Stations of Kentucky and Mississippi and later on to Ohio, some of which were parasitized in cages, others in the field. The safe arrival of the eggs was announced and the parasites had already emerged. It may take several seasons to establish this insect in States far North. More eggs will be sent out this year, and it is hoped that where the broods of the harlequin bug are fewer than they are in Louisiana, that the parasite will prevent its general spread.

During August of 1896 eggs were collected to determine the possible influences of this parasite in checking the ravages of the harlequin bug, and of those collected over sixty per cent. contained parasites.

REMEDIES FOR HARLEQUIN BUG.

By collecting eggs and placing them in small bottles, it may be easily determined if the parasite is present or not. In case no parasites be found they should be artificially introduced.

In collecting the eggs for experiment purposes it was found that without much trouble the numbers of the pest could be reduced by simply gathering the eggs, and when handy, collecting the immature and mature bugs in a pan containing coal oil. This is thoroughly practicable in the early season. Dilute solutions of kerosene emulsion may be frequently applied with good results.

Using mustard which has been planted very early as a bait, has been recommended by other stations. This should be operated in conjunction with hand picking of eggs and adults.

## PEACH AND PLUM LEAF SAW-FLY.

(*Caliroa* [*Selandria*] *obsoletum.*)

Of recent years the plum and peach saw fly has been steadily becoming more numerous, until now it may be considered one of the worst enemies of the plum and peach trees in the State.

The following is a sample of the many inquiries which have recently come to the Bureau of Agriculture and Experiment Stations:

ELMER, LA., May 21st, 1897.

*Hon. J. G. Lee, Commissioner of Agriculture, Baton Rouge, La.:*

DEAR SIR—I send you some peach and plum leaves containing a small green worm that is rapidly killing all of our plum and peach trees. It first appears on the under side of the leaf, and leaves it a skeleton. After they get through with a peach or plum tree it looks right white, as you see on leaves sent. We notice a small black fly among the leaves. I think the worm comes from eggs laid by it.

In about two years they kill an orchard effectually. I have tried lime and sulphur thrown among the leaves, and while these stick to the worm they do not stop the depredations. Some kind of a spray might get away with them.

I wish you would look into the matter and suggest some means of keeping orchards clear of these intolerable pests.

Yours very truly,

I. T. BLACKWELL.

The eggs are usually deposited on the under surface of the leaves along or near the small ribs (see fig. 6). They are nearly transparent when first deposited and become more opaque near the hatching time. They are very small and are not easily seen, especially when freshly lain, are convex above and flattened below and are surrounded by a mucilaginous secretion which extends beyond the real egg and produces a much larger surface for attachment. This is easily recognized after hatching.

Hatching takes place the third day after the deposition of the eggs. The larva at first is light colored and very thin skinned, for the color of the food within the alimentary after feeding has gone on a few minutes causes the larva to appear as if possessing a green stripe down the back. The light brown

color of the head, which contains a black eye like spot on each side, and dark colored mouth, the enlarged condition of the thorax with the light brown tipped thoracic legs, the green outline of the food contained within the alimentary canal as seen through the transparent skin, and the slimy, glistening appearance of the body are the chief descriptive features of the larval stage. See figs. 7 and 8. The insect in this condition begins feeding as soon as hatched and continues eating on the under or protected side of the leaf. The slugs, as the larvæ are sometimes called, are seldom seen on the upper surface of the leaf, unless it happens to have its under side upward. The entire leaf is destroyed except the ribs and the epidermis of the opposite side from which the slug is feeding.

Larvæ emerging from eggs on May 29 matured on June 10, during which time but two moults were observed. After the last moult and just previous to entering the ground for pupation, the body loses is slimy condition and assumes a slightly yellower color. It seems fortunate for the insect, but not so for the plum and peach grower, that the body should become dry just before entering the earth, otherwise the dust and small particles of earth would cling to the surface of the slug and close the breathing spiracles, and thus wipe from the face of the earth this species. The duration of the pupa condition, which is spent from one-half to two inches below the surface of the ground, is nine days (June 10 to June 19).

The adult insects may be seen at any time from middle of March until cold weather in the fall, flitting in and about the plum and peach trees. They show little timidity, and if examined closely will be found to be not more than one-fifth of an inch long, to have a black shining body, dusky wings, and the two pairs of front legs below the knees white. See fig. 9. *Figs. 10 and 11 illustrate the ventral side of abdomen of male and female.*

The life-cycle of this saw-fly was completed in twenty four days within the breeding cages, and this result corresponds very closely with observations made upon trees in the horticultural grounds of the experiment station, for from the last of March until the last of November, 1896, greater numbers of adults were observed toward the close of each month than at any other time. Of course there were always a few straggling specimens occurring between the broods.

This insect hibernates in the pupa condition below the ground.

The attack of this insect upon the American type of plums, such as Mariana, and the almost entire immunity of the Japanese varieties is very noticeable. Peaches seem worse affected upon the lighter soils of the State.

NATURAL ENEMIES.

Two species of mud daubers were found to visit constantly trees infested with slugs and to carry away full grown and nearly full grown larvæ.

A species of bug to which some have given the common name of the Bordered soldier bug, and which comes to the technical call of Stiretrus pulchella, was found with its beak pierced into the bodies of the slugs, destroying them.

An egg parasite (Trichogramma minutum) of very diminutive proportions, was observed piercing the eggs of the saw-fly, within which the life of the parasite was completed in eight days (May 22 to May 30, 1896).

REMEDIES.

There are many insecticides which will destroy this slug, but since there are many fungous diseases upon the plum and peach which require treatment, the best results may be gotten by using the following combined fungicide and insecticide :

| | |
|---|---|
| Copper sulphate | 6 lbs. |
| Fresh quicklime | 4 lbs. |
| Water | 50 gals. |
| Paris green | 4 ozs. |

The copper should be dissolved in warm water by hanging it in a sack so as to just touch the top of the water. In another vessel slake the lime by slowly adding water to it. Dilute the lime and the copper sulphate separately with the required amount of water (enough to make 50 gallons in all). The dilution should be done slowly. After this add the copper sulphate solution to the lime solution and to these combined add the Paris green.

This preparation sprayed upon the trees at least once every two weeks will entirely prevent the attack of the slug. Trees

grown upon the horticultural ground of the Experiment Station have never suffered from this insect, as they are carefully sprayed every two weeks. See cut of sprayed and unsprayed plants, Fig. 12.

Fig. 13 is from photo of plum orchard almost completely defoliated by the saw fly larvæ, May 22, 1897.

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## PECAN CATERPILLAR.

(*Datana integerrima.*)

Especially in Southern Louisiana this caterpillar works greater destruction to pecan trees than any of the other enemies attacking this species of nut. It may be somewhat misleading to use the term pecan caterpillar to this species, since there are many others which attack the pecan pretty vigorously, but since this name seems well fixed as a common name it may not be wise to suggest another. Then, too, in Louisiana this caterpillar is, by far, more common, and a great deal more destructive than any other species occurring on the pecan. The web worm (Hyphantria cunea) and the caterpillar of a species of Catocala may be confounded with the Datana caterpillar by those not familiar with insects, yet the web of the Hyphantria and the only occasional appearance of the Catocala may serve to differentiate them.

The eggs of this insect are deposited in large batches of from 500 to 1200 in each, in a single layer over the under surface of leaves upon the lower branches of the trees. They are usually to be found upon large leaves where the growth is most dense. The incubating period we have not been enabled to determine accurately, but from data at hand believe it not to be longer than five days. The eggs when first deposited are of a light green color, which, upon exposure, become whiter and whiter, so that at hatching time they appear a marble white, especially the upper quarter, which seems to cap the rest of the egg. In the centre of the convex surface of the cap is located a minute opening, the micropyle. The larvæ emerging from the eggs usually break off the entire cap, while a parasite coming forth from the egg seems only to enlarge the micropyle. The examination of a

single egg shows it to be cylindrical in shape, the diameter a little less than the length, flattened below and convex above, the general surface, except the cap or upper end, glistening.

The young on hatching differ materially from the full grown caterpillar. The body is light colored, with long irregular pinkish red splotches distributed over the dorsal surface; head, prothoracic plate, and anal plate, black; behind the thoracic plate, running longitudinally, are six rows of black spots, which, together with the head, and anal and thoracic plates, bear long white hairs. Length of this stage at hatching one eighth of an inch.

The second stage, or that following the first moult, was not observed. After the second moult the caterpillars are more generally red. head, the small thoracic plate, thoracic legs, spiracles, anal plate, and a longitudinal stripe on each proleg, black; the four dorsal, longitudinal, light stripes, and the broad one just below the spiracles becoming noticeable; the hair distributed over the body, white, those on the prothorax four times as long as diameter of body. Length of body about one half an inch.

After the third moult there is some change in the general appearance of the caterpillar. The prothoracic and anal plates are smaller, the dark stripe has gone from the prolegs, and the light hair over the whole body is as long as it was on the prothorax after second moult. There are four light longitudinal stripes on each side of the back, but the first and third, counting from the middle line of the back (dorsimeson) are very faint, in fact traces of the third can only be seen. Length of larva after the third moult is about one inch.

The color of the caterpillar after the fourth moult is the one the general observer of this insect recognizes, and it is to this stage that the common name of the "pecan caterpillar" applies.

Immediately after the fourth and last moult the caterpillar is a pale red, with head and thoracic plate very light red, the faint traces of lines one and three are still present, but in a short time (one half to one hour) the whole body has darkened; the two white lines on each side of body, especially the broad one below the spiracles, and the long white hair distributed over the body

become prominent. This deepening of the color of the body occurs a short time after each moult, but after none is the contrast so striking as the last.

The length of the full grown caterpillar is one inch and one-half.

The adult moth is buff colored; head light brown, prothorax darker brown; forewings with four transverse brown stripes. These, with the base and outer margin of the wings divide them into five areas, the first is triangular and about the same color as the band-like third and fourth areas, the second is darker brown than the rest of the wing and outlines a distinct band across it. Length of body little over one half inch, expanse of wings one inch and three quarters.

## GENERAL HABITS.

The method of depositing the eggs has already been mentioned. The larvæ on hatching feed on the parenchyma of the leaves, leaving the epidermis of the opposite side of leaf on which they are feeding. After the first moult they begin eating the entire tissue of the leaf between the large ribs, and after the second moult even the large ribs will be eaten if the food be scarce. The caterpillars are gregarious throughout all of the larval life, except toward its close, when they may be found feeding singly. This may be accounted for by their feeding a little as they wander about the branches previous to descending the tree for pupation. There is little wandering from one limb to another until just before pupation. In a few instances the caterpillars have been observed to change from one branch to another, but this was just preparatory to moulting, when more or less restlessness is manifested. The caterpillars are not easily shaken from their feeding places, but will when disturbed raise the fore part of their bodies and suddenly jerk them from one side to the other. Perhaps one of the most significant habits connected with the development of this insect is that when about to moult the last time they descend to the trunk of the tree and there bunched together upon the rough bark, ecdysis takes place. As soon as dry the caterpillars ascend the trees again and feed for

a short time, when they repair to the ground and below the surface at different depths, from one to six inches, earthen cocoons are constructed, in which they pass their quiescent stage. At the end of this condition the moths emerge, and the life-cycle is completed.

NUMBER OF BROODS PER SEASON.

The period of incubation and of the first two larval stages has not yet been accurately determined, but an approximation has been reached which places the incubation period at about five days, first larval stage at three days and second larval at five days. The third stage of specimens under experiment was from August 17th to August 21st (a little over four days); fourth stage from August 21st to August 25th (a little over four days), while the last larval stage was completed in four days (August 25th to August 29th); from pupa to adult, August 29th to September 12th (fourteen days) making a total of about forty days. We found that specimens from the same brood placed upon trees, and thus under normal conditions, did not reach maturity within three days as soon as those fed in cages, hence it is safe to conclude that nearly one and one-half months are consumed in the completion of the life-cycle. As we have not found the insect attacking pecans earlier than the last of May, there will not be more than four broods per season. A common observation last year was that the pecan trees were defoliated three different times.

NATURAL ENEMIES.

Upon the bodies of the caterpillars a fly (Tachinoides hystricoides)—a little larger than a house fly—deposits eggs which hatch and the maggots live within the bodies of their host until the host reaches maturity and enters the ground for pupation, by which time the maggots are full grown and have about evis cerated the caterpillars. They then crawl from their host, pupate and soon come out as adults.

Another larger fly is found to live within the caterpillars, and only differs from the first in habit in that but a single maggot lives within one caterpillar, and that the pupa stage is

undergone within its host, which itself has entered the ground for pupation.

An egg parasite (Telonomus gossypiicola) was found abundant last season. From one batch of twelve hundred eggs every one was parasitized. In another batch, from which both larvæ and parasites came, the latter reached maturity and emerged six days after the former.

The yellow billed cuckoo or Rain Crow (Coccyzus Americanus) was found to habitually visit pecan trees for the purpose of feeding upon the caterpillars. Nearly one hundred young caterpillars were placed upon a young pecan tree for the purpose of getting parasites, and the entire lot was devoured by cuckoos.

REMEDIES.

To fight the pecan caterpillars steam spray pumps will have to be introduced, for the caterpillars succumb readily to applications of paris green, which cannot be applied economically to large trees without the aid of steam. A large hand force pump with a sufficient length of hose attached may be used by having the man who handles the hose located well up among the branches of the tree being sprayed.

As the eggs are usually deposited among the lower branches of the tree, they may be readily collected. This means of checking the ravages of this insect will apply particularly to young pecan groves.

The habit of the caterpillar of congregating upon the trunk of the trees preparatory to the fourth moult sufficiently near the ground to be destroyed, affords an excellent means of killing the larvæ should they have been allowed to so nearly reach maturity.

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## THE LEAF-FOOTED BUG.

(*Leptoglossus phyllopus.*)

This insect has become a serious pest to the globe artichoke in Louisiana. Several inquiries were received last year from the southern part of the State, and arrangements were made to determine as far as possible its life-history.

The eggs are deposited in a single row along the rib of a

leaf, and in a few days hatch, the young remaining together usually in a concealed region of the plant. The nymphs moult four times before reaching maturity. The first stage from hatching to first moult, September 3d to September 6th ; second stage, September 6th to September 11th ; third stage, September 11th to September 15th ; fourth stage, September 15th to September 23rd. After the fourth moult the specimens were mature. The adult insect is about three quarters of an inch long and may be easily recognized by its chocolate brown color, a light band across wing covers and the broad leaf like tibia of the hind legs just below the knee. See fig. 14.

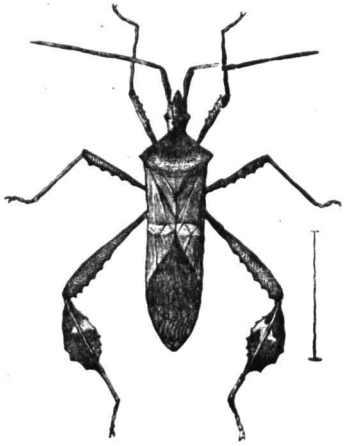

FIG. 14

The Station has received specimens of this bug from fruit growers of Hammond, La., who say that it pierces the fruit, plum particularly, causing it to become more subject to fruit rot. As this habit of piercing plums is a new one, the Station will be glad to hear from others if such a habit has been noticed elsewhere.

REMEDIES.

As the large thistle is abundant in Louisiana and is a close relative of the globe artichoke, and seems to be the most general food plant, little relief can be expected in connection with the ravages of this insect upon the artichoke as long as the thistles are permitted to grow, and act as breeding grounds for these pests

This insect gets its food by sucking, and poisons applied to the plant will not affect the bugs, as might be the case with insects such as caterpillars which feed upon the leaves. Kerosene emulsion applied to the plants was found to have some effect only when the bugs were stupid, due to influences of cold weather, when they are unable to fly from the plant. Better results may be obtained by collecting in a net or pan the bugs when in this stupid condition. During the hot weather this insect is very active and but few specimens can be collected.

Hibernation takes place in the adult condition, and since but few survive the winter, collecting in the spring on cool mornings will prevent the destructive work of the late broods. It is very necessary to collect the few appearing in the spring from thistles occurring near artichokes, in which case it is quite possible to use the thistle as a bait or trap plant.

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## MAGGOTS IN THE ALIMENTARY CANAL OF MAN.

A number of instances of the presence of certain maggots in such food material as catsup, partially decayed potatoes, and other decayed vegetables, have been brought to the notice of the department.

Figure 15 is a cut of one of the maggots found in the intestine of man and agrees in every particular with the larva of a fly, Hermetia illicens, which was bred by Mr. Weed, of the Mississippi Experiment Station from Irish potatoes. The presence of these larvæ in food material, and their occurrence in the alimentary canal of man, as evidenced by the accompanying letter from Dr. D. A. Gray, of Little Rock, Ark., is the occasion of this note of warning. A little precaution, and all danger may be avoided. In the case of the appearance of these insects in catsup it was due to the fact that this condiment was kept in barrels, the oozing of the catsup through small openings attracted the flies and eggs were deposited. Young maggots are so small as to easily enter the barrel through the smallest crevice. The keeping of such food stuff in well sealed bottles will prevent all danger.

On April 11 I received from Dr. Gray the following letter:

LITTLE ROCK, ARK., March 25, 1897.

*Mr. H A. Morgan, Baton Rouge, La.:*

DEAR SIR—Your esteemed favor of the 17th ultimo is to hand, for which allow me to thank you.

I send you to day under separate cover specimens of the larvæ, in regard to which I would very much like to have your opinion. I will give you a synopsis of the case.

Male aged about 30 years, railroad engineer on St. L., I. M. & S. R. R. Came to me complaining of great pain about the bladder, with difficult urination. I endeavored to use a sound to ascertain if stricture existed, but the operation was so painful I was compelled to desist. After a few days of treatment he began to complain of the lower bowel becoming sore, and one morning told me that he had passed some strange looking worms, and by my request brought me several, which were still alive. I was taken by surprise and did not know what to say or do. I made an experimental prescription of croton oil, chloroform, turpentine, etc., giving very generous doses, and gave him a "heroic" purge, causing the patient to pass myriads of these maggots in all stages of development, the largest of which I send you. Had I known at this time what I had I should have watched the development, but it was some days afterward that I was told by a professional friend of what he had seen in Texas cattle, and not being able to find anything in our text books about the matter, I was referred to you by the U. S. Entomologist of Washington, D. C.

I again thank you for your courtesy, and would like to know if any similar case is on record. Yours respectfully,

D. A. GRAY, M. D.

From the fact that Hermetia illicens has been found feeding upon decaying vegetables, it is quite likely that the engineer ate lettuce or some uncooked vegetable green on which had been deposited eggs or very young maggots. The condiments used upon such foods usually cover a multitude of deficiencies. The fact of there being all sizes of these maggots would indicate one of two things, either that the man got successive doses of eggs, which might easily occur, or the maggot became pædogenic under its new conditions.

Fig 16 represents the adult fly.

# PLATE V.

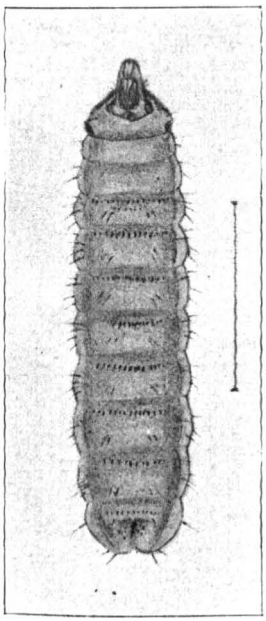

Fig. 15.

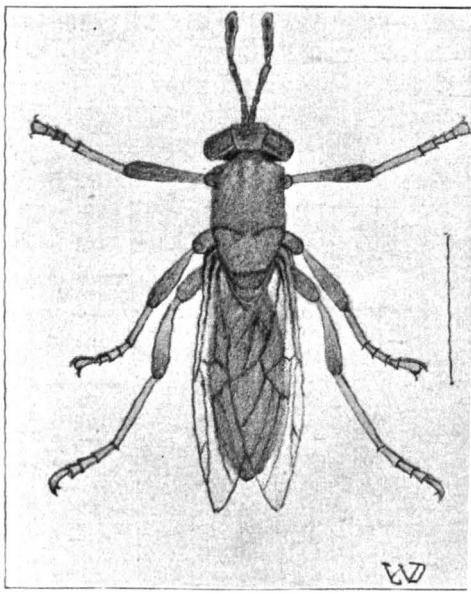

Fig. 16

## A NEW INSECT ATTACKING CORN.

(*Delphax maidis.*)

During August of last year the Mexican June corn growing upon the Sugar Experiment Station at Audubon Park, New Orleans, became infested to such an extent with a louse like looking insect that the entire portion under experiment was threatened. Attention was first drawn by the yellowing of the corn and upon examination it was found to be covered with a light colored, active insect. Myriads of ants were attracted by the juices flowing from the wounded stalks of corn, and indicated by their presence, as they usually do, that some other insect is infesting the plant they attend. We have collected this new corn insect upon grasses in sweeping over the fields, but have not heard of a single instance of its attacking corn in Louisiana previous to last year. Dr. W. H. Ashmead tells of this insect attacking corn at Jacksonville, Fla, (Psyche March–April, 1890). He says of it: "The natural food plants of hosts of insects are destroyed, and these are compelled, by changed conditions, to seek among the plants brought by civilization such food as will sustain existence and perpetuate their species. Under these civilizing transformations, therefore, new insect pests are continually being brought to notice, appearing on some well known crop previously entirely exempt from their attack, do great injury, cause the planter anxiety, attract the attention of the entomologist and require skill and prompt measures for their destruction and the saving of the crop."

A fact brought out by Dr. Ashmead in this same article, that Prof. Westwood illustrated in an article published in London, Eng., a number of years ago, an insect closely related to this corn species, which he found attacking sugar cane, may cause us to look upon our new pest with greater suspicion. Should the new habit of this insect become established sufficiently and domestic plants become its food, it may become troublesome to sugar cane. There is no doubt but that variations in food habit are brought about under the same laws as variations in form, and that as with variations of form these new habits have

ut a limited beginning and
is at this point that heroic
ttacks upon such pests are
be made.

The life history of this
ew corn pest (see fig. 17)
as been partially studied
y Dr. Ashmead. The eggs
re deposited in the leaf or
talk in an incision of ei-
her, which has been made
y the ovipositor. The inci-
ion is made to contain but
wo eggs, and is cemented
ver after oviposition; on
atching the young moult
ve times before reaching
naturity, which is attained
n about one month.

The adult, a very small
nsect, not more than one-
uarter of an inch long, is
greenish brown color, with
vings nearly transparent,
nd when at rest the wings
re placed in a roof shaped
osition over the back. The
emale is a little larger than
he male.

In treating this corn in-
ect all of the badly infest-
d stalks of corn should be
ut out and burnt. As the insect begins its work in limited
reas it will be well to keep close watch and destroy the first
roods by liberal applications of kerosene emulsion.

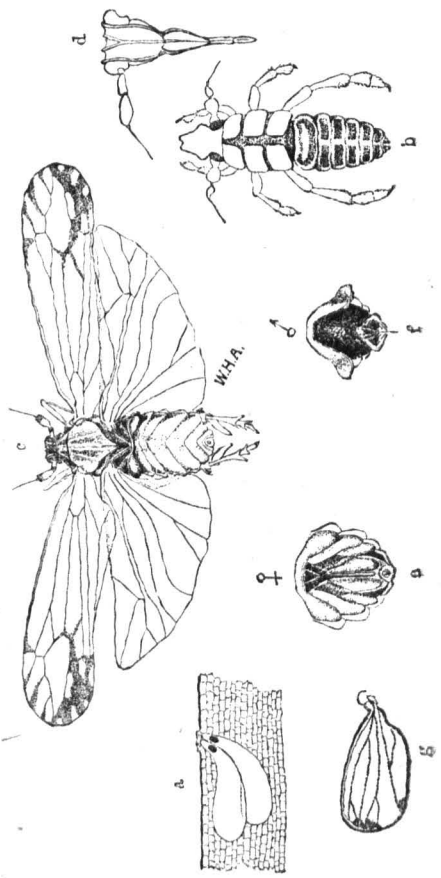


FIG. 17.

*a*, eggs inserted within tissue of corn leaf; *b*, newly hatched larva; *c*, adult; *d*, sucking mouth parts; *e*, ventral view of caudal end of abdomen of female; *f*, same of male; *g*, aborted wing.

## LIGHTS IN COLLECTING BOLL WORM MOTHS.

For a number of years experiments have been carried on with the use of lights in attempting to collect boll worm moths, with one result, that few if any moths have been caught.

Last season in collecting by an electric light on the University campus, under which the crab grass had been permitted to grow and go to seed, great numbers of a light colored moth were seen perched upon the head and stems of the crab grass, from twenty to fifty feet from the arc light. Upon collecting a few they were found to be specimens of the boll worm moth (Heliothis armiger). With the great numbers present and the ease with which they were gathered it may be suggested that just such conditions might be secured near cotton and corn fields and thus many of these moths collected.

During the whole evening not a single specimen was seen to fly up to the light, but all remained some distance from it.

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## INSECTICIDES.

During the last couple of years, especially since the horn-fly made its appearance in the State, there has been a great inquiry for formulæ of emulsions of fish oil and coal oil. In the preparation of these emulsions after the oil has been added to the soap and water, a vigorous agitation is necessary in order to produce a thorough union of the ingredients. There always has been a difficulty in securing apparatus which will emulsify the substances. Pumps are used, but the hot material injures the valves, which invariably cause loss of time and give much annoyance.

As the value of an emulsion depends altogether upon the complete emulsifying of the substances (the failure to procure this accounting very largely for the irregular results obtained), I have had made an implement which is simple, cheap, and which produces a perfect mixture. See fig. 14. It consists of a tin cylindrical vessel eighteen inches long and four inches in diameter (fig. *c*) and a plunger or piston twenty-two and one-half inches long, as shown in fig. *b*. About one inch from the lower

In the trial of Dendrolene in this State upon fig and peach trees the results were very unfavorable, as a single application to large branches and even to the trunks of trees succeeded in killing the branches, and where the application was made to the trunks the trees died. The fig was found to be more susceptible to injury than the peach and showed signs of injury by the wilting of the leaves a few days after the application of the Dendrolene to the branches.

As the use of the Dendrolene has been recommended, we would caution our fruit growers as to its effect upon the peach and fig. From the decided results gotten from the trials made upon the Station, it cannot be used with any safety for fig and peach borers.

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## A PINE TAR INSECTICIDE.

From the destructive distillation of pine knots, Mr. E. Koch, of New Orleans, has succeeded in procuring a very promising insecticide. We have used it in connection with the red spider, leaf eating beetles, and caterpillars, and find that it kills and repels. It has a slight burning effect upon young foliage, but Koch hopes to overcome this drawback during the coming season. This substance readily mixes with water, and its slight greasy and sticky properties make it more durable. We have used it upon young elms, smearing the entire trunks with the undiluted material, and found it excellent for borers and insects infesting the trunks of trees. A very serious objection to its use for this purpose is that it washes off easily during wet weather.

We hope to give this substance a thorough test during the coming season.

## BRED PARASITES.

(*Hymenopteron.*)

| | | |
|---|---|---|
| Cryptus nuncius | Telea polyphemus | From cocoon. |
| Apantales congregatus | Phlegethontius carolina | From larva. |
| | Phlegethontius celeus | From larva. |
| | Darapasa myron | From larva. |
| | Empretia stimulea | From larva. |
| Euplectrus comstockii | Heliothis armiger | From larva. |
| Telonomus gossypiicola | Datana integerrima | Eggs. |
| Trissolcus murgantiæ | Murgantia histrionica | Eggs. |
| Trissolcus podisi | Murgantia histrionica | Eggs. |
| Trichogramma minutum | Caliroa obsoleta | Eggs. |
| Podogrion mantes | Phasmomantis carolina | Eggs. |
| Tetrasticus sp ? | Hyphantria cunea | Larva (hyperparasite). |
| Aphidius sp ? | Milo maize aphis | Nymphs. |
| Aphidius sp ? | Grape aphis | Nymphs. |
| Aphidius sp ? | Orange aphis | Nymphs. |
| Chalcis ovata | Pomegrate bag worm | Larva. |
| Telonomus podisæ | Hemipteron | Eggs. |
| Antigaster sp | Hemipteron | Eggs. |
| Orphion macrurum | Artace punctistriga | Cocoon. |
| Sympiesis dolichogaster | Smoke tree leaf roller | Pupa. |
| Asecodes albitarsis | Smoke tree leaf roller | Pupa. |
| Cratotechus (Eulophus) basaloris | Helesidota tessellata | Larva. |
| Asecodes albitarsis | Helesidota tesellata | Larva. |
| Apanteles congregatus | Helesidota tesellata | Larva. |
| Apanteles scitulus | Estigmene acræa | Larva. |
| Cocophagus flavoscutellum | Lecanium hesperidum | Young. |
| Cocophagus orientalis | Lecanium hesperidum | Young. |
| Comys bicolor | Lecanium hesperidum | Large young. |
| Telonomus new sp | Lepidopterous eggs | |

(*Dipteron.*)

| | | |
|---|---|---|
| Hemimascera | Protoparce cingulatus | Larva (full grown). |
| Undetermined Tachina | Dictyophorus reticulata | Adult. |
| Tachinoids hystricoides | Datana integerrima | Pupa. |
| Undetermined specimen | Detana integerrinna | Pupa. |

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## ERRATA.

On page 131, instead of "On July 19 all were depositing eggs (for *nearly* all happened to be females)," the sentence should read: "On July 19 *nearly* all were depositing eggs (for all happened to be females.)"

On page 132, first paragraph should read "they have *been* pronounced," instead of "have pronounced."

On page 146, fourteenth line from top, semicolon after 'red' instead of period.

On pages 155 and 156, "fig. 14" should read "fig. 18."