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Agricultural Experiment Station

OF THE

Alabama Polytechnic Institute

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W. E. HINDS,
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THE MEXICAN BEAN BEETLE

A NEW PEST IN ALABAMA

By
W. E. Hinds, Entomologist

Insect Pests Introduced From Mexico

Three of the most important insect pests now occurring in Alabama have come undoubtedly from Mexico where they originated upon native food plants there growing wild. Of these the Colorado potato beetle came first and has now spread throughout the country wherever Irish potatoes are grown. The fight against this beetle brought about the first common use of an arsenical, Paris Green, as an insecticide. A potato crop can hardly be produced now anywhere in the United States without keeping the plants poisoned to protect them from this pest. The second immigrant, the Mexican cotton boll weevil, crossed the Mexican boundry into extreme southern Texas in 1892. In less than thirty years it has spread steadily until it now infests every cotton growing state and most of the cotton growers of the country now pay heavy tribute to the "Mexican cotton bandit—Billy Boll Weevil." The boll weevil attacks only cotton and therefore affects directly only the cotton growing states by reducing the yield of the cotton crop on an actual area of about 30,000,000 acres annually. It will never spread outside of the Cotton Belt. Fortunately the boll weevil has been a most persuading promoter of better farming and better living wherever it has gone.

Now last, but by no means least, comes the Mexican Bean Beetle. This insect attacks all varieties of table beans, including all of the kidney beans, whether of the common snap, or shell varieties; cornfield beans; California black-eyed peas and all other cow peas; and soy beans. Some of these crops are grown in practically every home garden and by most of the truck growers in the entire country and form a very important item in the food supply of the nation. Cowpeas and soybeans constitute two very important forage crops and both are grown very extensively as soil-building crops. The Mexican bean beetle therefore threatens the national agricultural system in three very important ways: In food supplies, in forage crops and in limiting the growth of these legume crops for the increase of soil fertility.

The Mexican bean beetle has been known in the semi-arid, mountainous region in Arizona, Colorado and New Mexico for more than fifty years. There the insect is said to survive at altitudes up to 7000 feet and under winter temperatures as low as 30 degrees below zero. It has apparently been confined in that area because of the absence of its necessary food plants in the

wide stretch of range and arid country surrounding it there, but now that it has escaped from that area to the more humid sections where its food plants are grown everywhere, there seems to be no natural or effective barrier to prevent its steady spread throughout most, if not all of the states of the Union.

Bean Beetle Introduced Into Alabama

The introduction of this bean pest into Alabama appears to have occurred through commercial shipments and the strongest probability seems to be that some of the hibernating adult beetles were brought into this section in carload shipments of alfalfa hay coming from the western home of the species. The first occurrence of the species in Alabama seems to have been around Birmingham and Blocton, possibly in 1918 but certainly not later than 1919. The first report of its arrival reached the Entomologist in the form of specimens sent in for identification in midsummer, 1920, and investigation of the pest was begun immediately by the Entomologists of the Alabama Experiment Station. The people of Alabama also must soon become familiar with this new enemy. Therefore, some description of the insect in its various stages with illustrations of its stages and work are given herewith.

Bean Beetle Stages

The insect in all stages is conspicuous in appearance and easily distinguished from all other bean pests. As with all beetles, there are four stages in the development of each individual beetle. The adult or parent beetle (Plate I. figs. 1-1B) is about one-fifth inch long and nearly hemispherical in form. The color varies from a bright yellow to a copper color with sixteen black spots arranged in three lines across its back on its wing covers. These adults can fly and the spread of the species by this means is just as certain as was that of the boll weevil. The females lay their eggs in groups averaging about 50 on the under sides of leaves, (Plate II, fig. 2) as do the potato beetles. One female may produce 1500 eggs.

The eggs are yellowish in color and stand on end close together (Plate I, fig 2). The eggs hatch in about five or six days and the beetle grubs begin the process of devouring the under surface of the leaves. They feed ravenously and grow rapidly reaching full size in about two weeks (Plate II, fig 3). Their effect upon the bean plant may be hardly noticeable during the first week and then the crop may be completely destroyed during the second week after a brood hatches out (Plate III, fig. 1). The very thin upper membrane of the leaf is left almost entire (Plate II, fig.6, Plate III, fig. 3) so that the insects are protected largely by it from storms, from hot sunshine and from the attack of birds, or from the applications of poisons, etc., for their control. When fully grown the grubs are about one-fourth to

three-eights of an inch long, of a bright yellow color and covered by a heavy armor of spines which are branched and colored black at their tips (plate I, figs. 3-3B). No other grub of similar appearance is found upon bean plants. When ready to change from the grub to the beetle stage, the grubs seek some sheltering leaf and the leaves of morning glory or other weeds, may furnish this better than the beans on which the leaves have been practically destroyed. These transforming insects may be found singly, or in groups numbering up to more than fifteen on a single leaf (Plate II, fig. 5).

As it begins its transformation the grub attaches itself firmly to the leaf by the rear end of the body and this holds it until the beetle emerges. The skin then splits over the head and back and is pushed back to the tip of the body where it remains as a partial protection and maintains the attachment to the leaf (Plate I, figs. 4-4A). In four or five days the development of wings, legs, etc., has been completed and the adult breaks out, or emerges, from its last covering. At first the color is a very pale yellow and the black spots are not visible but these develop in a few hours and the beetle becomes hard and ready to lead a free and active life. The adult beetles also feed upon the leaves in much the same ways as do the grubs.

The entire development of the insect from egg to beetle takes place in between three and four weeks. Reproduction continues steadily in this climate from the blooming time of the early bean crop until the plants have all been killed by frost.

Protected Against Enemies

Even where it has occurred so long the bean beetle has practically no parasites or other natural enemies to hold it in check. The adult beetles are protected against predaceous enemies by a repellent fluid secreted by glands at the knee joints. When disturbed the beetles drop readily from the plants and as they do they fold their legs quickly and exude a drop of this repellent yellow fluid at each knee so that they are practically surrounded by a repellent ring. Wild birds do not seem to touch them and even hungry poultry may refuse to eat them. There are reports however of poultry learning to eat them readily.

New Food and Breeding Habits

It frequently happens that when insect species escape from their original homes to new climatic and food surroundings they take on suddenly what appear to be new habits and become far more serious pests than formerly.

The Mexican bean beetle has already done this in Alabama. In attacking the cowpea it has taken on a new and extremely important food plant. Other new food plants may be found but at present it seems that velvet beans and peanuts will not be attacked.

Another very significant change is found in the breeding habits. In the semi-arid West it has produced only two generations each season. Here in the Southeast with a much longer growing season, lower altitude and more humid atmosphere and food plants everywhere throughout the season, it appears certain that breeding will continue steadily from late spring until killing frosts occur, and that we shall have to fight three, four or possibly more generations—instead of only two. The capacity for damage here is therefore immeasurably increased with even less prospect for natural control than has occurred with the boll weevil.

Prospects For Damage

In its western home under high altitudes, short growing seasons and semi-arid conditions, this insect is said to have caused the discontinuance of bean growing in many sections.

From the reports of Alabama bean growers who have now had experience with this pest for one or two years, from the consideration of changes in food and breeding habits, and from a study of the character and value of the food plants in this State, we may form some estimate as to the future prospects for damage. First, the destruction of kidney bean crops (snap and shell beans) has commonly been complete after about the first of July. Only a part of the early spring crop has been secured and the late planting of beans has proven useless. One truck farmer who saw the first of these insects in 1919 reports that he lost $1000. worth of beans in that season and fully $1800 worth in 1920. He has produced practically no beans since the insects became established in 1919 and will not attempt to grow beans in the future until effective control methods have been found. Another truck farmer had none of the bean beetles in 1919 and made an excellent late fall crop. In 1920 he planted no early crop but about August first planted two acres of late snap beans. The first beetles coming from neighboring gardens into which they had spread during July, 1920, were noticed in the two-acre field about the middle of August. By the first of September the plants were so completely destroyed that not a bean matured and the entire area was plowed up and replanted to other crops (Plate III, fig. 1). Lima, or "butter" beans are usually less completely destroyed and a partial crop may be secured but destruction has been complete in many cases (Plate III, fig. 4). Pole and "cornfield" beans have been completely destroyed as a rule. Apparently the loss in our table bean crops may exceed 70 per cent.

Second, crops of cowpeas and soybeans, while usually less severely injured thus far, have in some cases been riddled about as completely as the table beans.

The reduction in yield of cowpea hay has been as high as one-third of its normal weight and the loss in feeding value would be an even greater proportion. As the bean beetles become more thoroughly established the damage to the important

forage crops, cowpeas and soybeans, is likely to be far greater than has yet been seen. These crops are grown largely also for soil improvement as well as forage. The increase in production of the legumes in Alabama including also velvet beans and peanuts, has been more than 1000 per cent in the past ten years, largely through the diversification movement on account of the boll weevil. It looks as though the Mexican bean beetle will undo in many respects the good results of this fight against the boll weevil and make that fight more difficult for the future.

Those who have studied the situation most closely seem agreed that the entire agricultural system of the United States, in food and forage products and in the renewal of soil fertility, has never been so seriously menaced by any native or introduced insect pest as it is now by the spread of the Mexican bean beetle.

Infested Area

While not known outside of Jefferson and Bibb counties in 1919, this insect had spread by November, 1920 into all or parts of thirteen counties centering around Birmingham. The known infested area at that date covered at least 4500 square miles (See map. Fig. 1).

Fig. 1.

The infestation extended northeasterly from the eastern part of Tuscaloosa county for a distance of fully 150 miles and was nearly half as wide in the broadest part of the area. The limits of flight have not yet been determined but an average advance of more than 30 miles per year appears probable.

Quarantine Measures

Quarantine measures have been instituted by the Alabama State Board of Horticulture. These apply to the known infested area and also to an adjoining Safety Zone approximately twenty-five (25) miles in width.

These regulations are designed entirely to prevent the unnecessary spread of the bean beetle by commercial means and to protect other states and uninfested portions of our own State against the advent of this pest as long as may be possible. These regulations may be obtained in full detail by addressing the Board named, at Auburn. Briefly, they prohibit, under penalty, the shipment, or transportation by any means, to points outside of the Quarantined Area of certain specified dangerous articles which have been grown, or which originate, anywhere within the Quarantined Area.

Of course the annual dissemination of the bean beetles by flight is certain to continue in spite of all quarantines and the Quarantined Area will have to be extended year after year accordingly. Fortunately, the main consuming center in Alabama, Birmingham, is located in the heart of the Quarantined Area and all shipments of quarantined articles may be made at any time to that point without restriction or certficate, or to any other points likewise located within the Quarantine Line. The usual hardships of quarantine measures will therefore be greatly reduced in this case and full compliance with the requirements stated will obviate the necessity for a multiplicity of varying and drastic State Quarantines by many other interested states.

Hibernation

The bean beetle passes the winter in only the adult stage. Most of the beetles continue feeding until frosts occur to kill the foliage. As high as fifteen adults have been found on a single leaf of lima beans at that season, and thousands have been collected within a distance of a few rods (Plate III, fig. 4). With cold weather the beetles crawl under or into some convenient shelter near where they have been feeding. Adults have been found hiding under fallen dead leaves and other trash, in rock piles, under bark of trees, around fences and out-buildings (Plate IV, fig. 1). Apparently with late fall breeding and favorable winter shelter immense numbers of beetles will survive to start the destruction of the next bean crop. Evidently two of the most effective methods of checking the bean beetle will consist, first, in the prevention of late fall breeding and second, in the removal or destruction of favorable winter shelter (Plate IV,). Clean up the bean areas thoroughly.

Control Measures

It would seem at first that for a leaf eating beetle all that would be needed to accomplish control would be to apply some arsenical poison to the foliage. This, however, as shown by field work during the fall of 1920, is not satisfactory with the bean beetle for three reasons: First, because the insects are mainly repelled instead of killed, by the poison and move in search of some unpoisoned leaves, which must always occur. Second, because of the difficulty of applying any insecticide with a crop like beans so as to coat the under surface of each leaf and reach the insects and their feeding places. Third, because of the rapid growth of the young bean plants before the injury becomes great, thus quickly providing fresh unpoisoned food areas, and because the plants rarely recover from the effect of the insects feeding after the attack has progressed far. Furthermore, bean foliage is extremely tender and itself liable to burning by a treatment that might kill the insects.

Hand picking of adults upon their first appearance on the

plants in the spring has been recommended but seems impracticable for any considerable or commercial areas. No really effective and satisfactory measures of control are yet known and this subject must receive first consideration in the future study of this pest. Undoubtedly careful "clean up campaigns" during the winter will reduce the damage next season (See Plate IV). These campaigns should be extended through schools and by communities. Many other garden insect pests besides the bean beetles will be reduced in numbers by this means. Every effort in this direction is commended.

After considering the situation carefully with many parties a general program of recommendations has been adopted which should, we believe, be adopted by all bean growers, both commercial truckers and home gardeners as well wherever the insect occurred in the fall of 1920. These recommendations are stated below as briefly and plainly as possible. All parties are urged to cooperate in carrying out this program, at least until future experience reveals a better way of fighting the bean beetles.

MEXICAN BEAN BEETLE CONTROL RECOMMENDATIONS

1. *Fall and Winter Clean-Up Program*:
   A. Plow under early in fall or winter all bean crop areas, including home and truck gardens, corn-field bean fields, cowpea fields and soybean fields, to bury all hibernating insects and to save the vegetable matter for the enrichment of the soil. Practice deeper plowing than usual, especially where the surface is fairly level and winter washing will not be serious.
   B. Clean up, remove or burn over trash, sprout patches, ditch banks and uncultivated terraces, etc., to destroy the shelter that would be most favorable to keeping the beetles alive through the winter. Remove stumps and stone piles from cultivated areas. They interfere seriously with the best use of the land and always favor insect damage.
2. *Forage Disposal*:
   A. Feed out pea vine or soybean hay, grown where the insects occurred before the first of April, as many insects are likely to hibernate in the hay and escape to the fields after warm weather begins in the spring.
   B. Corn forage from stalks where corn field beans were grown should be disposed of as recommended for pea vine hay, and for the same reasons.
3. *Bean and Pea Planting Program for Infested Areas*:
   A. For garden beans, plant only for an EARLY CROP. Use bush, or bunch varieties of both snap and lima beans, planted as early as possible.

B. Field crops of cowpeas and soy beans may be planted as usual until further experience shows what changes may be necessary with these crops.

C. Avoid the use of corn field beans and late planting of snap or butter beans, as the loss with these crops is likely to be complete, especially where the beetles occurred in the previous season.

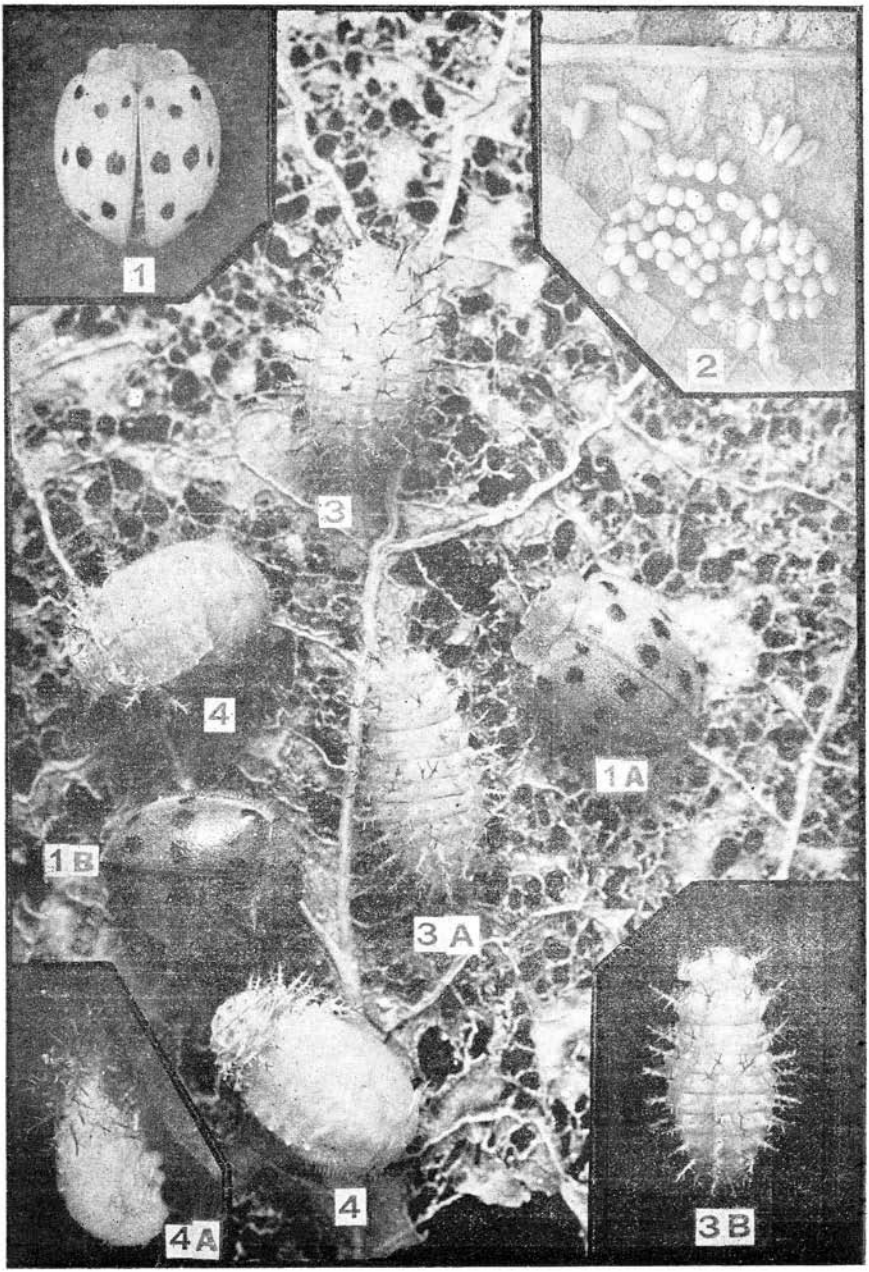
D. Avoid planting climbing beans along permanent board fences or against out-buildings where the removal of exceedingly favorable conditions for the insects is impossible (See Plate III, fig. 4). Avoid planting in close proximity to rock piles, etc.

E. If desired to grow beans for home canning, or for the market, depend henceforth only upon the earliest crop. Do not expect to produce a late crop, at least until methods of controlling the bean beetle have been worked out better than they are at present.

4. *Disposition of Remnants of Early Bean Crops*:

A. Destroy all remnants of these early crops as soon as the usable portions have been removed. Plow under vines completely and replant the ground to some other crop than beans, cowpeas or any other crop that would furnish a food supply for this pest during the fall season.

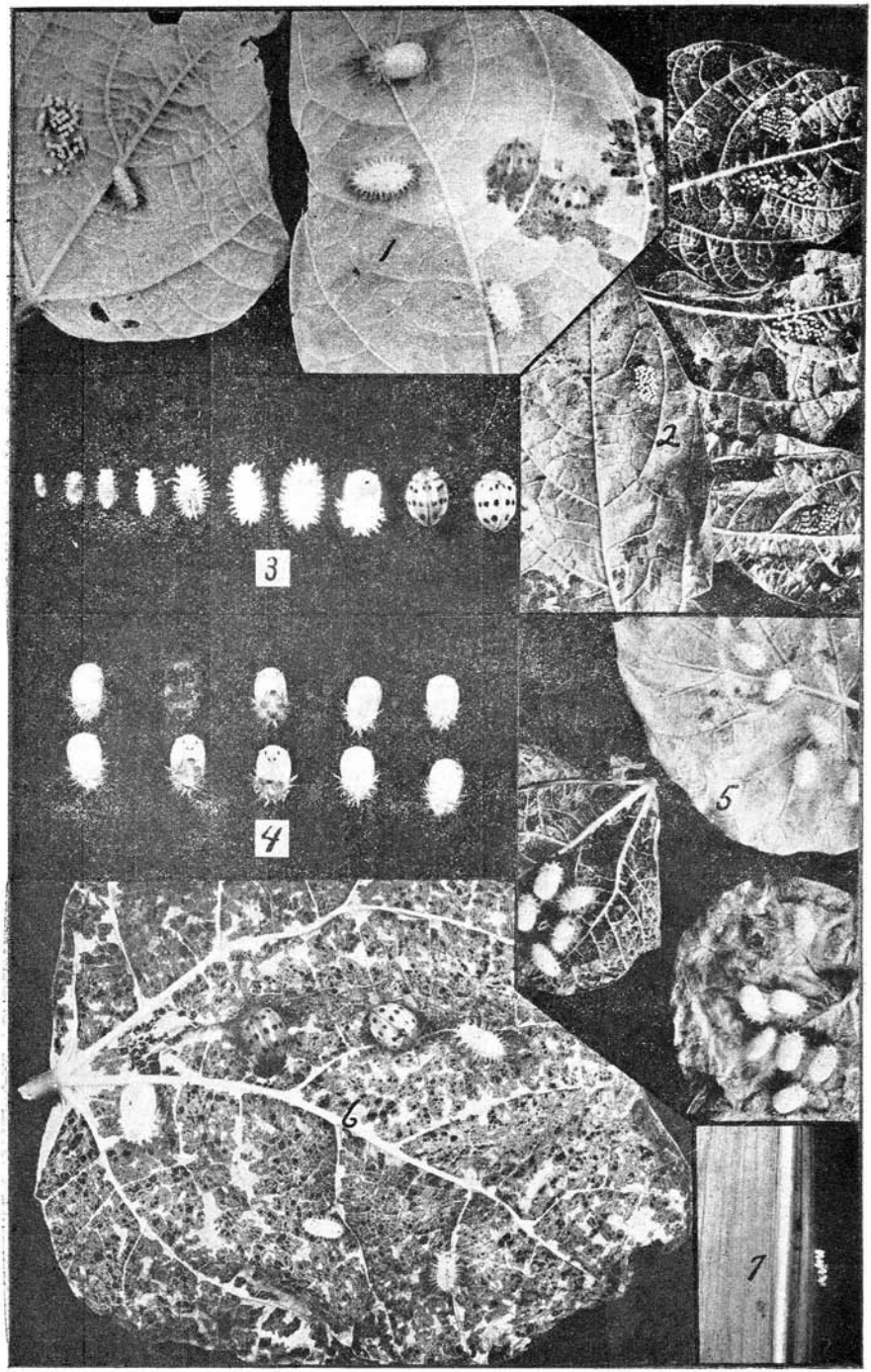
5. *Cooperate*: Cooperate, as a good citizen in your community, in this entire program, and thus help to reduce the loss from this pest to yourself and to your neighbors.



MEXICAN BEAN BEETLE STAGES ENLARGED

Figs. 1, Adults: 1, Light yellow; 1B, Brownish yellow; 1B, Copper-colored adult; fig. 2, Egg group; fig. 3, Larvae or "grubs"; 3B, same as 3A showing spiny protective coat: figs. 4, Pupae; 1A Side view. All original. All enlarged five diameters.

PLATE II.

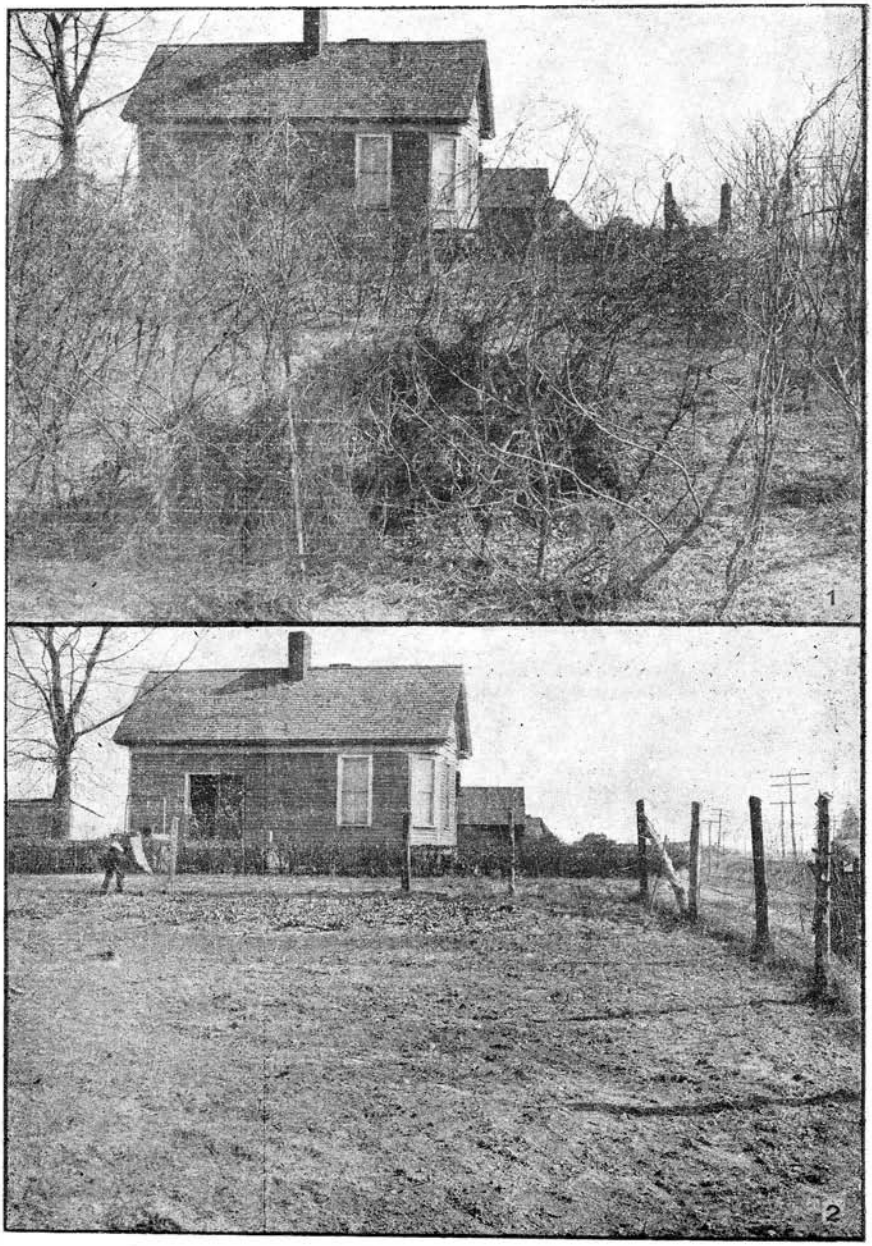


MEXICAN BEAN BEETLE STAGES NATURAL SIZE

Figs. 1, Four Stages on under side of bean leaves; fig. 2, Five egg proups; fig. 3, Development and transformation after hatching; fig. 4, Group of pupae (the transformation stage); fig. 5, Pupation occurring on bean and morning glory leaves; fig. 6, Stages and work on under side of bean leaf; fig. 7, Eggs (side view) deposited on corn leaf. All original. All natural size.

MEXICAN BEAN BEETLE INJURIES

Fig. 1, Two-acre field of late snap beans 100% destroyed; fig. 2, Typical plant from field above; fig. 3, Skeletonized leaf showing characteristic feeding work; fig. 4, Lima bean row completely defoliated: 4000 adult collected from section shown. All original.



CLEAN-UP OF HIBERNATION SHELTER

Fig. 1, Lima bean vines, poles and trash offering very favorable shelter to bean beetles duing winter season; fig. 2, Area cleaned of trash in one hour, reducing chances for beetles to survive the winter. Original.