

ALABAMA
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AUBURN.

**FACING THE BOLL WEEVIL PROBLEM
IN ALABAMA**

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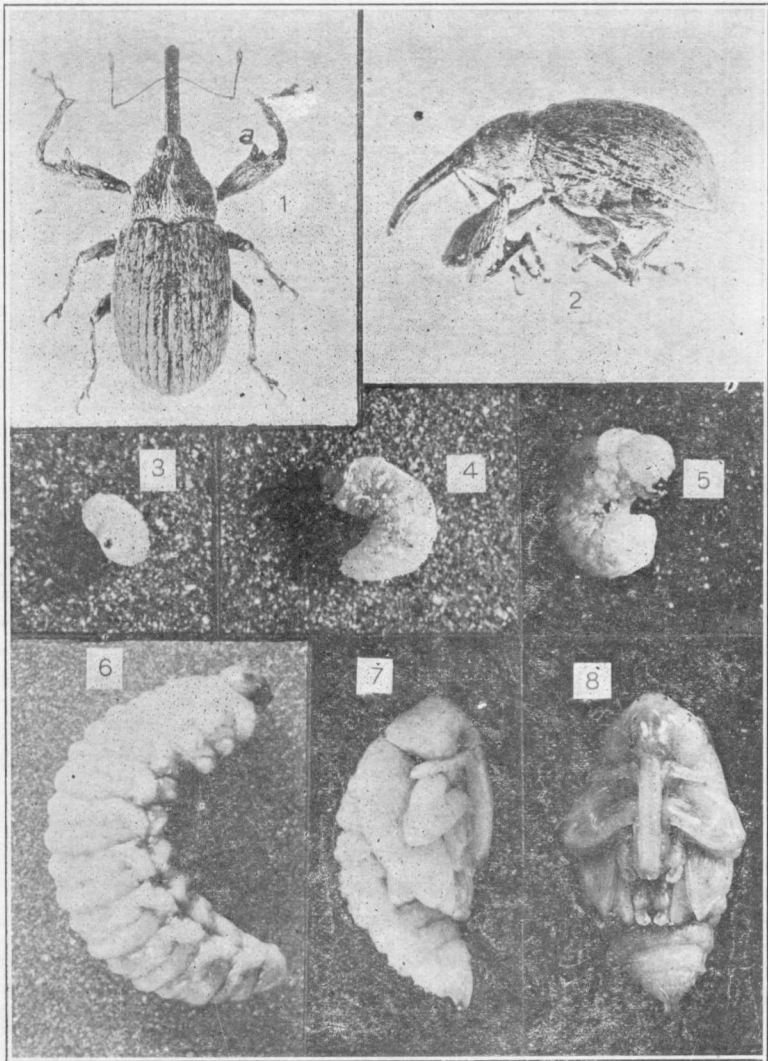
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PLATE I.



THE BOLL WEEVIL AND ITS STAGES.

Fig. 1, Adult boll weevil, viewed from above; *a*, two teeth on fore femur; fig. 2. adult weevil, side view; fig. 3, egg of weevil; fig. 4, grub about two days old; fig. 5, grub at entrance to second stage after shedding first skin, about three days old; fig. 6, grub fully grown, about ten days from egg; fig. 7, transformation or pupal stage, side view, snout, legs and wings forming; fig. 8, pupal stage, front view of fig. 7. Figs. 1, 2, 6, 7 and 8 enlarged about ten diameters; figs. 3, 4 and 5 enlarged about twenty diameters. (Original).

FACING THE BOLL WEEVIL PROBLEM IN ALABAMA

INTRODUCTION.

That within three years the Mexican cotton boll weevil will have entered Alabama is as certain as it is that cotton will continue to be produced in this and adjoining states before that time. The certainty that the cotton planters of Alabama will soon have to contend with an enemy more difficult to fight and more destructive to the crop than anything which they have ever been forced to face should be a matter of deep and immediate interest to every citizen of the state regardless of his occupation. If we shall meet this grave problem in a manner to result in a minimum of loss to all branches of commercial and professional as well as of agricultural life, it is essential that we improve to the utmost the few years which may intervene in direct and united preparation for the great changes in agricultural practice and in economic conditions generally which the presence of this pest has invariably caused wherever it has gone. We may well be willing to profit by the experience for which our sister States of Texas, Louisiana and Mississippi, particularly have paid so large a price. We should by all means begin immediately to put into active operation some of the fundamental improvements in agricultural practice which have been worked out during the past few years as a direct result of the fight against the weevil. If these practices are advisable and profitable anywhere with the boll weevil present they may be made even more so here and now before the weevil arrives. The great opportunity for gaining experience and determining the immediate applicability of any of these practices to our local conditions is evidently the period before the weevil comes and while we do not have to suffer the losses which it is very certain to inflict wherever it exists.

It may be pardonable in this case to mention a few per-

sonal facts which may enable the reader to judge of the writer's competency in this subject. From July 1, 1902, until September 30, 1907, he was engaged constantly and exclusively under the U. S. Bureau of Entomology in the investigation of the Mexican cotton boll weevil in Texas. The seasons of 1902, 1903 and 1904 were spent principally in South Texas where the weevil had been abundant for several years and where it was doing great damage. The seasons of 1905, 1906 and 1907 were spent in north Texas, in a region which was then but recently infested. In this work he was associated with Mr. W. D. Hunter who has been in direct charge of the boll weevil investigation from 1901 to the present time. The most important of the boll weevil publications are referred to in the Bibliography, see page 100.

Within the limits of this brief paper it is impossible to touch upon many of the important and interesting points in the discovery, introduction, life history and control of this insect.

It spread into the Southern part of Texas from Mexico about 1892 and from that time to this nothing has occurred to more than temporarily check its annual advance into new cotton growing country. Its annual spread is mainly by flight and cannot be prevented by human effort. The best that can be done is to guard against assisting in the spread of the pest and to do everything possible to avoid and to minimize the injury which its very presence involves. As soon as the weevil entered Texas it became apparent that the investigation of methods for its control constituted a National, rather than a State problem. Since 1901 Congress has been making special appropriations for the investigation of the boll weevil and from one to twenty trained men have been giving their time constantly to the study of this most serious problem. The writer was personally engaged in this work for more than five years. Naturally the damage which it has done has increased from year to year with the increase in the area infested. It is safe to say that the loss which it now occasions cannot be less than \$25,000,000 each year,

The National government has spent more than \$1,000,000 in the investigations which have been made to discover effective methods of controlling the pest, and the various states affected have also expended large sums. The information and recommendations given in the following pages are gathered from the best that has been learned in this great struggle. A few of the important publications concerning the weevil are referred to in the Bibliography on page 100.

Since 1892 the weevil has spread Northward through Texas and the Southern half of Oklahoma and Eastward, crossing Louisiana, the Mississippi River and into Mississippi. From the infested territory each year it spreads ever onward as wave after wave spreads outward when a stone is cast into water. The old territory is not abandoned since only part of the host of weevils which is developed by fall will leave the field to seek new territory. Undoubtedly many fly back into previously infested fields where their presence is lost sight of but those which happen to fly in to new localities quickly establish a new line of infestation which can be quite readily marked.

The distance through which they have thus advanced has averaged fully fifty miles each year. The first weevils crossed the Mississippi River in the fall of 1907 and during the fall of 1908 eighteen counties in the western part of that State became either wholly or partially infested. The area now infested constitutes more than one third of the cotton growing area of the United States and produces nearly one-half of the annual crop. The limits of the infestation, the relationship which this bears to the entire commercial cotton growing area, and the annual progress of the pest during recent years are plainly shown upon the accompanying map, Fig. 1, which was prepared by Mr. W. D. Hunter during the fall of 1908 from data collected by the numerous field agents of the Bureau of Entomology investigating the spread of the boll weevil.

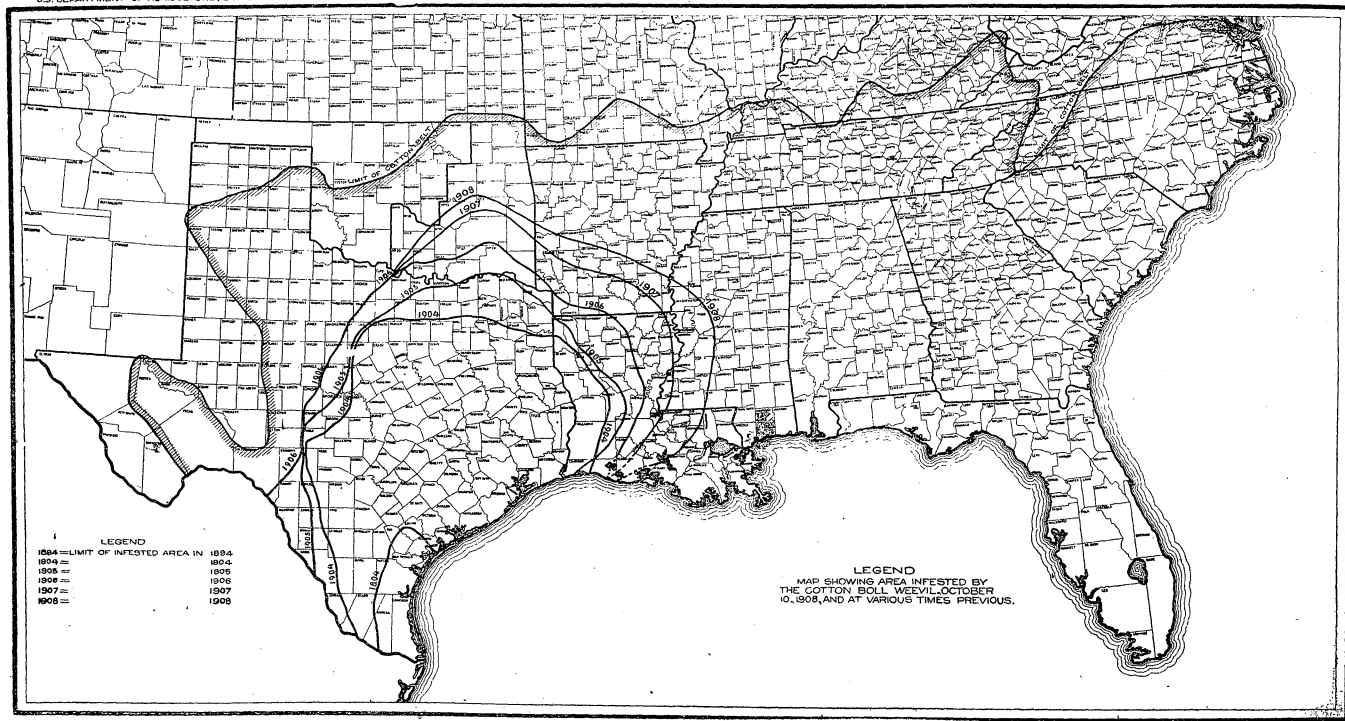


Fig. 1, The cotton growing area showing the area infested by the boll weevil during various years. (After Hunter, Farmers' Bul. 344.)

WHEN WILL THE WEEVIL REACH ALABAMA?

A brief study of this map with the facts stated relating thereto should be enough to convince anyone that the advance of the boll weevil will most certainly continue. The present northern limit of infestation is farther North geographically than is any portion of Mississippi, Alabama, or Georgia. The existence of the boll weevil depends primarily upon the occurrence of cotton which is its only known food plant. Besides its dependence upon this food supply the continued existence of the weevil depends also upon its ability to survive the winter climatic conditions in order to pass from the crop of one season to that of the next. The weevil has already shown that it can withstand successfully temperatures reaching nearly if not quite to Zero F. which is as low as is likely to occur anywhere in the cotton belt.

The eastward spread of the weevil therefore promises to be as certain and as rapid as was its northward spread through Texas and Oklahoma until ultimately it shall infest cotton wherever grown commercially in the Southeastern States. Its spread may be accomplished in two general ways.

In the first place the weevil will continue to spread by its own unaided flight which man is powerless to prevent. The entire area embraced within a line passing through the outermost points thus reached each year must be considered as constituting the "area of general infestation" although the weevil may not occur at many of the places included within but near the outermost edge of this area. The line referred to is "the line of general infestation" and this is what we reckon with in the annual spread of the boll weevil. It may be shown that this line has been steadily advanced through an average distance of about fifty miles each year. We may expect this rate to be maintained as the weevil continues eastward to the Atlantic Coast. From this basis we may easily and quite certainly determine that in two seasons more, that is by November 1910, we may expect the line of general infestation to reach the Mississippi-Alabama boundary. It is quite likely that some of the western tier of

courties in this State may then become partially infested. It will require only about three years more for the weevil to spread over the entire State and to reach Western Georgia. Therefore we may consider it practically certain that throughout the western third of Alabama by the summer of 1911, through the central third by 1912, and through the eastern third by 1913, and in each case constantly after those dates, every cotton planter will have to reckon with the presence of the boll weevil and some degree of injury by it.

In the second place, we must consider that the boll weevil is *liable* to be brought into the State at any time ahead of the general infestation by the various methods of transportation, principally by railroads, with persons, household goods, cotton and its products, or with any other articles which may contain or shelter them. This danger naturally increases as the line of infestation approaches more closely. In numerous instances in Texas, Louisiana, Mississippi and elsewhere it has been clearly established that the weevil has been carried long distances in shipments of cotton seed from infested areas although fortunately it has not yet happened in the direction of uninfested territory. Infested cotton produced in the edge of the infested area has been hauled considerable distances beyond for ginning and planters bringing their cotton from other directions have carried away weevil-infested seed with them. Tenants and cotton pickers moving from infested to uninfested territory are very liable to carry weevils with them and thus establish new centers of infestation. These are among the considerations which have made necessary the establishment and strict enforcement of quarantine measures to guard against the accidental introduction of the weevil.

QUARANTINE REGULATIONS AGAINST THE BOLL WEEVIL.

Alabama passed such a law in 1903, and placed the enforcement of the act in the hands of the State Board of Horticulture, as at that time there was no special Entom-

mologist connected with the State Experiment Station.

TEXT OF ALABAMA BOLL WEEVIL LAW.

AN ACT to prevent and prohibit the importation of seed from cotton affected with the Texas boll weevil.

SECTION 1. Be it enacted by the legislature of Alabama, That no person shall import or bring into the State of Alabama any seed from cotton affected with what is known as the Texas boll weevil, nor the seed from any cotton from any place where the cotton has been affected with said boll weevil.

SEC. 2. Any person who violates the provisions of section 1 of this Act shall be guilty of a misdemeanor, and on conviction shall be fined not less than ten dollars (\$10.00) and not more than five hundred dollars (\$500.00).

(H. 877, No. 559, approved Oct. 6, 1903.)

In addition to the above, the State Board of Horticulture organized by Act of the Legislature No. 121, approved March 5, 1903, has established regulations governing the shipment into and through the State of cotton products, packing materials, household goods, etc. The text of the regulations which are at present in force is as follows:

RULES AND REGULATIONS

GOVERNING THE IMPORTATION OF ARTICLES LIABLE TO CONTAIN
THE MEXICAN COTTON BOLL WEEVIL.

RULE 11. In accordance with an act of the Legislature of the State of Alabama entitled: An act to Further Protect Horticulture, Fruit Growing and Truck Gardening, and to Exclude Crop Pests of all kinds in the State of Alabama, approved March 5, 1903; the following rules and regulations relative to the Mexican Cotton Boll Weevil were adopted:

(a) That in order to prevent the introduction of the Mexican Cotton Boll Weevil into the State of Alabama, a rigid quarantine is hereby declared against all infested localities in Texas or Louisiana, and of other sections that are or may hereafter become infested.

(b) That cotton lint (loose, baled flat or compressed) cotton seed, seed cotton, hulls, seed cotton and cotton seed sacks (which have been used) and corn in the shuck, originating in cotton boll weevil infested localities, shall be excluded absolutely from the State of Alabama.

(c) All shipments of household goods from infested areas shall be prohibited unless the same is accompanied by an affidavit, attached to the way-bill stating that the shipment contains no cotton

lint, cotton seed, seed cotton, hulls, seed cotton and cotton seed sacks or corn in the shuck.

(d) All shipments of quarantined articles, mentioned in section (b) above, through the State of Alabama shall be made in tight, closed cars.

(e) No common carrier shall use for bedding, or feed for live stock, any of the quarantined articles when the shipments originate in regions infested with the cotton boll weevil.

(f) All railroads, steamboats, express companies and other common carriers, and all private vehicles, boats, etc., entering the State of Alabama from the states of Texas or Louisiana, or passing through the State of Alabama from any of the infested districts of the States of Texas or Louisiana, are especially enjoined to comply with the requirements of this order and of laws of the State of Alabama governing the same.

RULE 12. The State Horticulturist is hereby charged with the enforcement of the rules and regulations relative to the Mexican boll weevil.

The form of affidavit accompanying the waybill with shipments of household goods should specify the prohibited articles as not included, as follows:

State of....., County of

Before meNotary Public in and for said State and County, personally appeared

..... who being duly sworn states on oath that the shipment of waybill of which this affidavit accompanies, does not contain any cotton lint, cotton seed, hulls, seed cotton and cotton seed sacks or corn in shuck.

Sworn to and subscribed before me this.....day of 190..

(Seal) Notary Public.

At the bottom of all law lies the general consideration that the safety and welfare of the public is more important than the convenience or interest of any private individual. It is certainly of public advantage that every possible precaution be taken to prevent needlessly hastening the spread of so dangerous an insect pest as this. The advance of the weevil will gradually transfer states, counties, and localities from the uninfested to the infested territory and thus reduce the area in which quarantine measures apply. Within five years, therefore, the boll weevil quarantine may become a thing of the past in this State. In the meantime it

is of highest importance that we be able to definitely establish the limits of infestation and determine just where the application of the quarantine will do good instead of harm. Obviously no restriction of personal or commercial movement is justifiable or desirable if no protection or benefit may result. We therefore urge upon all concerns or individuals to whom the provisions of this quarantine may apply that they continue to give it their cheerful and complete support so long as may be necessary. More detailed information will be furnished all who may request it upon any specific points by the "Entomologist to the Experiment Station, Auburn, Ala."

DESCRIPTION OF THE BOLL WEEVIL.

It is of extreme importance that we learn of the presence of the weevil anywhere in the state as quickly as possible after its arrival. For information on this point we must necessarily depend principally upon the reports of cotton planters and others directly interested in this subject. As a rule we cannot depend for this information upon newspaper reports, even when these are vouched for by some planter who "came from the boll weevil country". With the boll weevil, as with most other insects, the ordinary casual observer fails to notice any but the most obvious characters on account of their small size. Therefore the characters noted are more than likely to be only those which are common to a group including hundreds of closely related species rather than those distinctive of a single species. By careful attention to the following brief description and to the illustrations given herewith we believe that the reader of average intelligence may be able to distinguish the boll weevil from the numerous other insects occurring on cotton, which are often mistaken for it (see appendix) and to recognize its attack on the plant with a reasonable degree of certainty. In any case of doubt specimens should be sent immediately in a strong, tight, tin or wooden box, with a letter of explanation to the Entomologist, Alabama Experiment Station, Auburn, Ala. He will gladly determine

such specimens and report to the sender entirely free of cost.

The boll weevil is a beetle belonging to a large group, all of which are characterized by having part of the head in front of the eyes greatly extended to form a long slender snout. There are many hundreds of species of these insects, all of which are commonly called "weevils", but the Mexican cotton boll weevil is the only one of these many species which is at all serious as an enemy of cotton. While other species may be found upon cotton plants, their occurrence there is mainly accidental. Rarely indeed does any other species breed upon cotton. The boll weevil breeds upon cotton and upon nothing else. Like all other beetles the boll weevil has four distinct stages in the development of each individual. These are the egg (Pl. I, fig. 3), which is only about 1-30 of an inch long, white and delicate. This is always deposited in a cavity which the female eats in the square or boll and upon no other part of the plant. From the egg there hatches in a few days a white, legless grub or worm (Pl. I, figs. 3-6) which does not at all resemble the beetle which it may finally become. The grub of the boll weevil resembles very closely that of the "plum curculio" which is so familiar a pest in peaches, plums, cherries, etc., working in the fruit and usually around the stone. The boll weevil grub grows steadily from its initial length of about 1-25 of an inch until it becomes fully grown and measures from 1-5 to 2-5 of an inch in length. The body is strongly curved in the form of a crescent, in this respect being more curved than the "worm" in peaches, etc. (Pl. I, fig. 6.)

In order to attain the beetle form the grub must pass through an intermediate "transformation stage" which is known as the "pupa." (Pl. I, figs. 7 and 8.) In this stage no food is taken, and there is a complete change of the appearance and of structure. The grub sheds its skin and instead of the legless, wingless, snoutless worm, the pupa appears with all of these organs forming in sheaths closely applied to the body. In this stage the insect is very delicate,

and perfectly helpless. It, as well as the egg and grub stages, is passed wholly within the interior of the square or boll. These three constitute the immature stages in the life of the weevil, but are as characteristic of the insect as is the adult form.

After a few days the pupa sheds its skin and becomes the fully formed adult weevil as shown in Pl. I, figs. 1 and 2, having the legs and snout free and usable, as are also the wings, which are folded back, under and protected and hidden by, the hard wing-covers, which meet in a straight line over the middle of the back of the beetle. For a few days the adult also remains protected within the square or boll while it becomes hardened and more able to care for itself. It then cuts a circular hole just the size of its body in the wall of its cell in the square, and through this opening makes its escape into the outer world, where from that time on it leads a free and active life.

The adult weevil, therefore, is the form most commonly seen around infested cotton, and this stage needs a more detailed description. The full grown weevils vary considerably in size and in color. In length they range between 1-8 and 3-8 of an inch, while the breadth of the body is approximately 1-3 of its length. The general color is uniform over the body and varies from a chocolate brown in the darkest specimens, which are usually below average size, to a grayish or yellowish brown in the lighter colored larger forms. The lighter colors are due to light colored scales or modified hairs which occur most abundantly in the larger specimens. If these are undeveloped or become rubbed off, then the dark brown ground color of the weevil appears. The slender snout is only slightly curved and is about 1-2 as long as the length from the head to the tip of the body. Neither the size, nor the structure or general appearance of the weevil changes at all after its emergence from the square or boll in its adult form. The adults feed and mate and the females then deposit eggs. This completes the "Life Cycle" and starts another generation all within a period of from three to four weeks.

THE EFFECT OF WEEVIL WORK ON COTTON.

The recognition of the presence of the boll weevil may depend upon the identification of the adults or the immature stages in squares and bolls or just as certainly upon the recognition of its feeding injuries or the effect of its work upon the fruiting of the cotton, as these are also characteristic. No other insect produces at all similar injuries to cotton.

The excrement deposited by the adult weevils on the squares upon which they work is of a bright orange color and so forms a conspicuous sign of boll weevil presence. The egg punctures, like those made for feeding, are eaten out but are only made large enough to receive the egg which is placed just inside of the floral coverings and usually near the base of the bud. The natural tendency of the green parts of plants to heal wounds in which decay does not occur causes a growth of plant cells to more than fill the canal leading to the egg cavity. The excess of this growth bulges outward so that it forms a distinct "wart". This "wart" is therefore characteristic of a boll weevil egg puncture. As the grub feeds and grows inside the bud it destroys the very heart of the square, until when about half grown its injury thereto becomes so great as to cause the destruction of that bud. The leaflets enclosing the bud spread apart, or "flare" as it is called, and the whole square turns yellow, wilts and is shed as are leaves when they can be of no further use to the plant. It is Nature's surgery in removing a diseased and useless member. Upon the ground the development of the grub continues and its transformation through the pupal stage to the adult beetle takes place. Practically one-half of the developmental period is spent in the square on the plant and the other half in the square after it has fallen to the ground. Badly infested cotton produces few, if any, blooms, while the infested squares shed by the plant as fast as they form are thickly scattered beneath it on the ground. Squares may be shed as a result of adverse cultural or climatic influences, but

when shed from such causes they show no signs of weevil or other insect injury such as have been described.

RECOGNITION OF THE WEEVIL.

We may summarize briefly the most important characteristics upon which we may depend for the prompt recognition of the weevils' presence in Alabama:

1. The adult beetles (Pl. I, figs. 1 and 2) probably found on cotton only, are about 1-4 inch long, with slender, slightly curved snouts, of dark brown, ashy-gray, or yellowish brown color.

2. The crescentic grubs (Pl. I, fig. 6) about 3-8 inch long and the pupal stages (Pl. I, figs. 7 and 8) occur only in squares and in bolls. This is the only insect which breeds in this way in cotton.

3. The occurrence of open cavities 1-16 to 1-20 inch in diameter and reaching down to larger excavations among the pollen sacs, the presence of "warts" marking the egg punctures of the weevil, the occurrence of the orange-colored excrement on the buds, the abundant shedding of squares and the consequent scarcity of blooms without accompanying rain or cultural conditions to cause the shedding; these are among the most conspicuous signs of boll weevil presence and injury.

Whenever any specimens of weevil or cotton squares or bolls showing weevil stages or the signs of their work are discovered anywhere in Alabama in advance of the general infestation by the weevil, it is of the utmost importance that they be immediately submitted to the Entomologist, Auburn, for positive identification. We must depend upon the hearty co-operation of cotton planters in this work, as upon the promptness with which the first occurrence of the weevil in a locality is discovered and reported to the Entomologist

depends entirely the possibility or advisability of undertaking any measures for the extermination of the weevil which might prevent the infliction of damage to that locality for several years before it would necessarily occur through coming within the area of general infestation.

Undoubtedly during the next few years local newspapers, as well as the leading papers of the State, will frequently receive reports of the occurrence of the boll weevil in their vicinity. Editors, before publishing such items, should secure specimens and forward them to the Entomologist and await his report as to their genuineness. Published statements, if untrue, can only do harm among their readers, and for a time the harm will be as great as though they were true, as they will affect all agricultural and business interests. This is too serious a matter to permit of the creation of undue excitement through the circulation of misleading impressions. The situation should be faced calmly, intelligently and courageously to safeguard the best interests of all who may be affected by whatever effects the production and sale of cotton. If faced in this spirit there is absolutely no need for the existence in Alabama of the feeling of "panic" which has heretofore accompanied the weevil during the first few years of its occupation of new territory.

HOW THE BOLL WEEVIL MAY BE SUCCESSFULLY CONTROLLED.

The great difficulty in fighting the boll weevil has arisen from the fact that the peculiar habits of the adult and the protection of the immature stages within the squares and bolls render it practically useless to attempt to destroy them by any usual methods of insecticidal treatment. Hundreds of remedies have been tested and found ineffective for the above reasons, if for no others. As in human warfare, one of the most effective measures of subduing an enemy consists in destroying their food supplies, so it is equally true in the case of an insect which is dependent upon one species of food plant as is the boll weevil. That the weevil can be effectively controlled and the culture of cotton continued at fully as great profit as has usually been realized without the weevil, has been proven possible through the practical application in many thousands of cases in the weevil area of improved methods in cotton culture and in general agricultural practice. Some of these measures take advantage of and increase the effectiveness of certain factors of natural control. Most of them, however, are merely **steps in a system of cotton culture** which prepare the way for the application of the **one most effective direct method of destroying immense numbers of weevils by cutting off their food supply at the only season of the year when the destruction of cotton is possible, practicable and most effective in reducing the number of weevils.** The final step is the complete destruction of all green cotton at least three or four weeks before the usual date for the occurrence of the first killing frost in the fall. This has often been called the most important single step in the cultural system of controlling the boll weevil. It may seem to many that it cannot be successfully applied under the conditions existing in Alabama. That has been claimed

also in Texas, Louisiana and elsewhere, but it has been found always that **it is possible under almost all conditions if the necessary steps leading up to it are also employed.**

We must remember that the presence of the boll weevil inevitably produces a change in the conditions of cotton growth. Practically, there can never be "late cotton" in the infested area. The only portion of the crop to escape the weevils and mature is that which develops early in the season before the weevils have reached their maximum abundance. Therefore the very presence of the weevil tends to limit cotton production to the early crop and to clear the way for the proposed and necessary destruction of the stalks.

The effectiveness of this practice has been most positively established by the repeated experience of planters on large as well as upon small scales, and also through Nature's object lessons whenever through the effects of unusual climatic conditions or when by the defoliation of the plants by the cotton leaf caterpillar or cotton worm there has resulted the practically complete destruction of cotton at an unusually early date in the fall. In every such case the fall destruction has been followed by larger crops, less weevil injury and a great increase of net profit in the crop of the following year.

We have not room in this paper to give details regarding any of these great demonstrations, but can merely state that in many cases where the work has been conducted most carefully with adequate checks **the value of the increase in the crop on the area where stalks were destroyed has been from \$15.00 to \$20.00 per acre, as compared with the yield on the check areas on which the stalks were allowed to stand until the usual time of preparation for planting in the spring. In all other respects both areas received similar treatment and were grown under like conditions,**

STEPS IN THE CULTURE OF COTTON FOR CONTROLLING THE BOLL WEEVIL.

The immediate adoption of such improved agricultural practices, as rotation and diversification of crops, better culture and more careful selection of seed for cotton **as soon as the weevil is known to be within less than 100 miles of any locality.**

In order to practice early destruction of stalks it is essential that part, at least, of the other steps be also adopted as they are of prime importance in leading up to the early maturity of the crop. It is impossible for us here to attempt to describe these steps at all fully. Much more can be learned regarding them from a study of the publications referred to in the brief Bibliography on page 100.

If we begin this work for the control of the weevil in the fall, as is desirable for securing its greatest effectiveness, it may involve the sacrifice of a small amount of cotton from the late maturing bolls. It is not necessary to make this sacrifice until the first year that the weevil is likely to reach the locality. After that time the possible loss of a few pounds of "scrappings" should not be allowed to count as against the necessity for and larger benefits of early destruction.

DESTRUCTION OF STALKS.—The best method of destroying the stalks is by uprooting and burning them. The roots, if cut, should be cut below the surface to prevent their putting out sprouts later. The plants should be thrown into windrows or piles while still green so that the leaves, squares and bolls may not be scattered but will remain on to assist in the early burning of the stalks and also because it is desired to destroy immediately the immature stages which may be present. Sometimes it will be found worth while to apply crude oil to facilitate the burning before the stalks have time to fully dry.

ADVANTAGES OF EARLY BURNING.—1. It stops absolutely the development of weevils late in the fall by destroying the immature stages then present in squares and bolls. 2. By

the complete removal of their only food it forces the dispersion and starvation of the weevils already adult. Obviously the longer the period between the destruction of all green cotton and the occurrence of the first killing frosts, at which time the weevils may go into winter quarters with most assurance of survival, the more complete will be the destruction of the adults. 3. It removes a large amount of rubbish within which those weevils which escape destruction would find the most favorable conditions for their successful hibernation. 4. It prevents the development of adults emerging shortly before frost. These are the weevils which ordinarily stand the best chance of living through the winter. Where one weevil may live through the winter if stalks are destroyed by the 15th to the 20th of October, there will be at least ten survivors if the destruction of stalks is delayed until the middle of November. There is a constant increase in the percentage of survival between these dates.

PREPARATION OF THE LAND FOR COTTON.—This should be more thorough than is usually given. On light soils fertilizers are needed for cotton, and those containing a relatively large percentage of phosphoric acid tend to promote the early maturity of the crop.

PLANTING.—Let this be done as soon as danger of frosts is passed. Early planted cotton invariably does better than even medium planted where the weevil occurs. It is desirable that the planting in a locality should be done as near the same date as possible, so that all of the cotton will be coming on together. The weevils thus have no chance to get a start upon any of the fields. Plant the rows at such distance apart as has been found to give best yields in any field.

CHOPPING.—Chop to a stand early, as this gives the plants that are left a better start. Space the plants as has been found best for yield in any field.

CULTIVATION.—This should be frequent and shallow. Its first object is to keep the soil in favorable condition for producing a steady and rapid growth of the crop. The destruction of weeds is accomplished incidentally. The surface

crust that may form after rains should be broken up as soon as possible.

HARVESTING.—Let this be done as quickly as the bulk of the crop is open. Every effort should be made to have ready the necessary labor supply for this work as soon as it may be done. Remember always the need for keeping a winter cover crop on the soil and for clearing the way for the early destruction of the stalks. The earlier these may be destroyed the better. **Their destruction constitutes the last step in dealing with the cotton crop each year where the boll weevil is present and is also the first step in preparation for the next crop of cotton, even though the cotton may occupy some other field through the system of rotation.**

CONCLUSION.

We hope that we have made plain that the coming of the boll weevil is assured, and that we shall very soon have to reckon with it constantly in the culture of cotton. We hope also that what we have said may help the cotton planters of the State to face this serious question more intelligently and more courageously than they would otherwise have done. In spite of the admittedly serious nature of the weevil as an enemy of cotton, there is no need for a "feeling of panic" if the recommendations given herewith are put into practice immediately. Their general application will improve the conditions of farm life, increase the value of farm property and multiply profits to both owners and tenants. In most sections where the weevil has already gone there have been heavy losses during the first two or three years of infestation because planters have been slow in adopting just the changes in cotton culture which have been outlined herein. They have thought at first that they were perfectly familiar with the best methods of raising cotton, and that no "scientists" could tell them anything about it. As a result, they have been finally forced to give up cotton altogether, or to adopt part, at least, of the methods which

have been described. With the adoption of the improved practices the control of the boll weevil has ceased to be an exceptionally serious problem, and they have found that in this way it is entirely possible to raise as much, or even more, cotton per acre as they were accustomed to raise before the coming of the weevil. The diversifying of crops has helped to make the farmers of the boll weevil area more independent of cotton as a single crop, and in many sections they are now more prosperous than ever before. In many respects the advent of this pest has resulted in greater final benefits than its injuries, and there has been brought about within five years a greater agricultural development than would have been likely to have come in two or more times as long but for the coming of the weevil.

If it shall lead to the immediate application of many of the improvements herein recommended, then the coming of the boll weevil shall bring a blessing and not a curse to this State. May every agency be united in a helpful co-operative campaign of progressive education that shall prepare us to best meet and to most effectively overcome the boll weevil in Alabama.

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This is intended to be only a very partial list of the publications relating to the boll weevil, but to include those available which may be most useful to the planters of Alabama.

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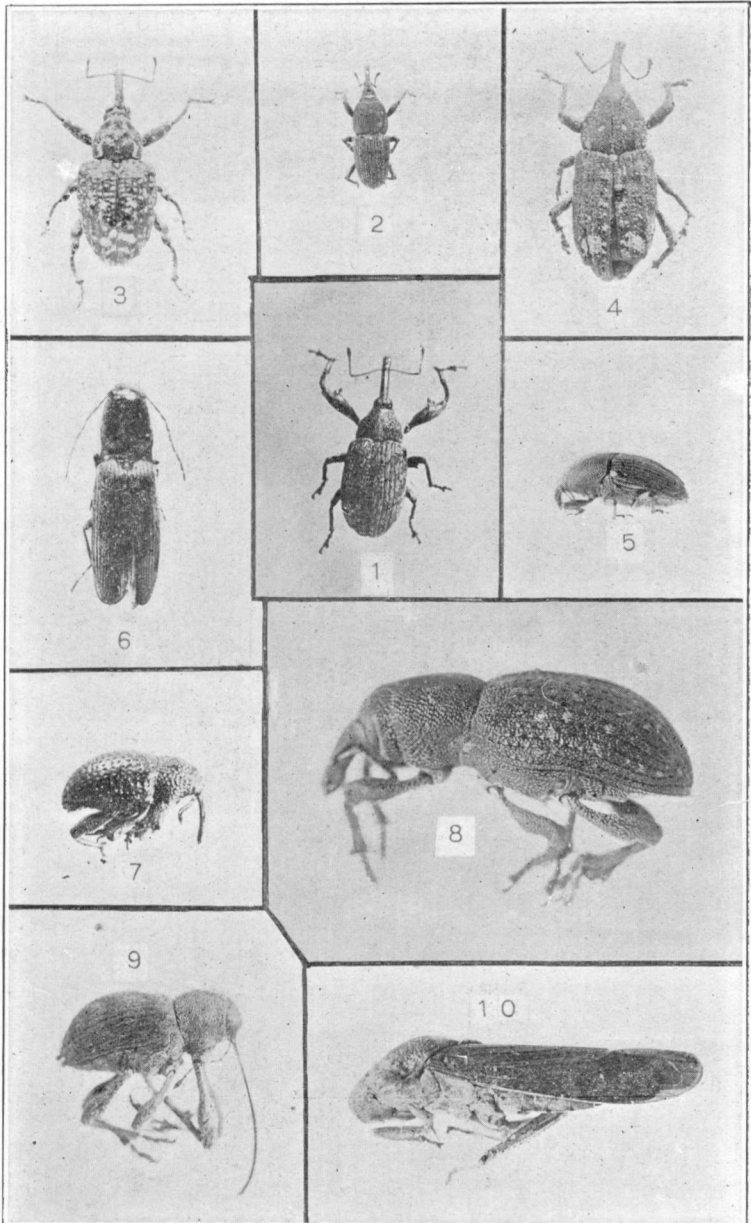
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INSECTS OFTEN MISTAKEN FOR THE BOLL WEEVIL.

Fig. 1, Boll weevil (*Anthonomus grandis* Boh.); fig. 2, rice weevil which breeds abundantly in corn (*Calandra oryzae* Linn.); fig. 3, plum curculio (*Conotrachelus nenuphar* Hbst.); fig. 4, white pine weevil (*Pissodes strobi* Peck.); fig. 5, transverse Baris (*Baris transversa* Say); fig. 6, a click beetle (*Monocrepidius vespertinus* Fab.); fig. 7, cow pea pod weevil (*Chalcodermus aeneus* Boh.); fig. 8, Pales weevil (*Hylobius pales* Hbst.); fig. 9, an acorn weevil (*Balaninus* sp.); fig. 10, sharpshooter (*Homalodisca triquetra* Fab.). All enlarged about five diameters. (Original.)

APPENDIX

The Mexican Cotton Boll Weevil and Some of the Insects Most Frequently Mistaken for it.

For the sake of facilitating comparisons a figure of the boll weevil is included on Plate II. Fig. 1. All figures have been taken at the same magnification of approximately four diameters.

In this list the "rice weevil," (*Calandra oryzae* Linn), Pl. II, fig. 2, has been included not so much because it has been, or may be, mistaken for the boll weevil, as because its size and general appearance may be more familiar to the general reader than any of the other species mentioned. A comparison of the adult insect with the illustration may aid in conveying a more correct conception of the other less familiar species. This weevil breeds very abundantly in corn, but does not injure cotton.

The "plum curculio", (*Conotrachelus nenuphar* Hbst.), Pl. II, fig. 3, which attacks peaches, plums, etc., very commonly, is about the size of the boll weevil but is much darker in color with markings of white or light colored scales on its back and legs. It has a shorter, more strongly curved snout and but a single tooth upon the thigh of the fore legs. It never attacks cotton.

The "white pine weevil", (*Pissodes strobi* Peck.), Pl. II, fig. 4, occurs in Alabama and must attack also some southern species of pine. The body is longer and more cylindrical, while the snout is relatively much shorter than in the boll weevil. Its wing-covers bear each a prominent white spot toward their tips.

The "pales weevil", (*Hyllobius pales* Hbst.) Pl. II, fig. 8, is another species which attacks pine. It is a large species, being from 1-3 to 1-2 inch long. Its color is a dark brown with small spots of light colored scales scattered over the wing-covers. This species is very common in Alabama.

The "cow-pea pod weevil", (*Chalcodermus aeneus* Boh.), Pl. II, fig. 7, is often taken on cotton following a crop of cow peas in the same field or near vicinity. It is the only one of the species mentioned herewith which may do some

slight damage to cotton. It sometimes feeds on the young cotton plants, boring into the main stems or leaf stems and causing the death of leaves and tips, but there is only one record of its having bred in a cotton square. The adults are shining black in color, somewhat shorter and more stoutly built than is the boll weevil, and the back of the body shows numerous small, circular pits arranged in several rows along the wing-covers.

The "transverse Baris", (*Baris transversa* Say), Pl. II, fig. 5, is a small, black weevil much shorter, broader proportionately and flatter than the boll weevil. Its snout is very short and strongly curved. This species breeds in the roots of cocklebur, and the adults occur accidentally upon cotton as may another closely related and similar appearing species that breeds in the roots of ragweed.

There are several species of "acorn weevils" belonging to the genus *Balaninus*. One of these is shown in Pl. II, fig. 9. All have very long, slender snouts, sometimes even longer than the body. All breed in acorns, and are often attracted to lights, as the boll weevil never is.

Some of the "click beetles" have a habit of hiding during the day in cotton squares, and are therefore mistaken for the boll weevil, although they do not resemble it in the least. One of these (*Monocrepidius vespertinus*, Fab.), Pl. II, fig. 6, is most commonly mistaken. In its early stages it lives on the roots of grasses in the cotton field, and the adult hides around the plant, but it does not attack cotton at all. These are all long, slender, flat-bodied beetles which, if turned over on their backs, will spring into the air with a "click" and thus regain their footing.

The last species that we have space to mention here is a bug belonging to a group of insects known as "leaf hoppers". These insects have the habit of sucking sap from the stems of plants and may occur on cotton where they have sometimes been called "sharp-shooters". These are grotesque insects which do not resemble the boll weevil at all. One species, (*Homoladisca triquetra* Fab.), is shown in Pl. II, fig. 10.