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FARM SPIES

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FARM SPIES

HOW THE BOYS INVESTIGATED FIELD
CROP INSECTS

BY

A. F. CONRADT

PROFESSOR OF ENTOMOLOGY, CLEMSON AGRICULTURAL
COLLEGE

AND

W. A. THOMAS

ASSOCIATE PROFESSOR OF ENTOMOLOGY, CLEMSON
AGRICULTURAL COLLEGE

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TO THE LATE
COL. R. W. SIMPSON

PENDLETON, S.C.

IN RECOGNITION OF HIS WISE COUNSEL AND HIS
UNSELFISH DEVOTION TO THIS CAUSE

445098

FOREWORD

IN our work with boys and girls in the public schools and with college students in agriculture we have found that the greatest interest was taken in subjects that answered the following question, "What am I going to do with it?" They are not satisfied with the life history and habits of insects unless the methods are explained by which they may be controlled, provided the methods given are practical.

The stories in this book are written for the boys and girls and for those persons who know nothing about insects and how to fight them. The authors have tried to write them in simple language and no attempt has been made at exhaustive discussions. The control measures have been confined to such as may be readily employed by any one troubled by the insects treated. Though the articles have been written in story form to assist the teacher and parent to interest the child, the facts

in regard to insects are correct, while nearly every incident mentioned has at some time or other come within the experience of the authors.

The articles are action stories and the figures as far as practicable represent action. It has been the aim to make each story sufficiently complete to give the reader a clear view and a working knowledge of the subject. The same plan of presentation is not adhered to in order to avoid monotony. Plans for investigating insects have been embodied in a few of the articles to enable the child to understand how the facts were obtained.

The boys and girls constitute the greatest asset in our national life. There is no greater force on earth available by which we can induce parents to adopt better practices than the boys and girls. In shaping our agriculture for the future the progress made will be in direct proportion to the extent to which we can interest them.

In the preparation of these stories we are indebted to the work and writings of entomologists past and present. Especially helpful has been the work of the Sections of Southern Field Crop Insects, and Cereal and Forage Crop Insects, Bureau of Entomology, U. S. Department of Agriculture; Dr. W. E. Hinds, Entomologist, Alabama Experiment Station, and Dr. S. A. Forbes, State Entomologist of Illinois. A number of the illustrations

were obtained from various sources, due credit being given in each case.

In the preparation of the manuscript and a number of negatives the authors are indebted to Mrs. A. F. Conradi for valuable assistance.

A. F. C.
W. A. T.

CLEMSON COLLEGE, S.C.
June 1, 1916.

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FARM SPIES

THE BOLL-WEEVIL

A GREAT FIGHT TO SAVE THE COTTON

MANY years ago the Southern soil was ruled by a king whose name was Cotton. Not only did he rule the soil, but the people also, because there was no other cultivated plant on the farm so abundant as cotton. The people depended on the cotton-crop for their money with which to buy food, clothing, and other things they needed or wanted. People, for that reason, spoke of the cotton-plant as King Cotton.

One day Mr. Corn visited the South and saw how much the people loved cotton, and no matter in what direction he looked he saw nothing but cotton, cotton, cotton. "I never saw anything to beat this," Corn said to himself. "People are surely interested in Cotton, and no other cultivated plant seems to have a chance on the farms down here because no one believes that there is anything so good as Cotton. I do not see how this can go on much longer. I know it does not do in my section of the

country, where Corn is a great crop, and I believe I will speak to Cotton about it sometime."

One day King Cotton and Mr. Corn were walking down the street together talking to each other.

"People surely love you in this section of the

FIG. 1. — "People are surely interested in cotton."

country," said Mr. Corn to King Cotton. This pleased the king, and he smiled and answered, "Yes, that is true, and they have every reason to feel proud of me, and all my fellow-plants. If it were not for me, the people would have to starve.

This is surely my country, and no other plant need ever try to get started here, ahem!!”

King Cotton had said this in such a haughty way that it made Mr. Corn angry, and he replied :

“It seems to me you are taking a great risk.”

“What do you mean?” King Cotton asked gruffly.

“To grow nothing but cotton over such a large area as the cotton-belt must sooner or later make more cotton than the people can use, and when that happens the cotton will bring a very poor price; it would be a bad thing when so many people depend on it for their living. Now look at it in another way: year after year you have the same kind of plant growing on the same soil, and all the plants eating the same kind of food; this must be starving the soil. You are taking plant-food from those soils without putting any back. I don’t care how much money a boy has in his bank, if he keeps taking away day after day without putting any back, his bank will become empty in spite of what he may think about it. Will the crop ever fail? It is possible that the cotton-crop may fail some bad season, and then how are the people going to make a living till another crop can be made? In my country the farmers always have more than one crop, so if one or the other should fail they will not suffer an entire loss.”

While Mr. Corn was talking, King Cotton looked

at him as if he was angry enough to bite him. Then he scolded Mr. Corn, saying: "It seems to me you are taking a great risk talking to me the way you do, but a big and powerful king like me would call

(From Bur. of Ent., U. S. Dept. of Agr.)

FIG. 2. — "He thought that he was the biggest bug on earth."

your talk only childish prattle. Do you not know that my territory extends from ocean to ocean and from the Gulf of Mexico northward half-way across the United States? I and my country are known the world over. Every year I furnish food for millions, build railroads, highways, and waterways. During

my reign not an enemy appeared in the cotton-fields that did not soon become very sorry for having come, because we whipped every one of them. When the cotton-leaf worm came he thought that

he was the biggest bug on earth, but he did not stay with us long because he said that the Paris green we treated him to was a little too strong for his stomach, ha, ha, ha, ha, ahem! And he was mighty careful about coming again. I do not see what on earth could be strong enough to force me to take notice of it."

When they came to the cross-road they parted, and as Mr. Corn was walking along one road he said to himself, "That Cotton has the big-head and there is no doubt about it. He is just a big egotist, and that's what he is. So far he has had fairly good luck, but I have never yet seen a road that does not turn sometime."

At the same time King Cotton, walking along another road, was scolding in an undertone: "Doesn't Corn think he is somebody? The idea! — trying to tell me what to do. If he ever gets as big and powerful as I, then he will not have time to listen to such childish prattle as he was giving me."

In the year 1892 the road turned. Sometime during that year there came across the Rio Grande river a veteran army of many wars. Fifty years ago their ancestors had fought King Cotton in Mexico, and, it is said, they won. When this army came to Texas, Cotton was much surprised. A little plant at the edge of the field looked at a taller

plant, and asked, "Who are those fellows with those long noses?"

"Sonny," the tall plant answered, "that is the boll-weevil," and they both looked very grave. "What scares me," the older plant continued, "is the way the rascals work. They make no fuss about

it, but every time they start their jaws to work on a square it is almost certain death. I do not mind having a leaf or two eaten by some caterpillar; that does not injure me. I do not mind having a bug come and

(From Bur. of Ent., U. S. Dept. of Agr.)

FIG. 3. — "Sonny, that is the boll-weevil."

eat a square or a boll, because I can stand that, as I have plenty of others left to make a crop; but these rogues bore holes into the squares or bolls, and every time they puncture a square it is almost sure to drop to the ground; sometimes they remain hanging on the plants and dry up. It looks like a dreadful thing to me," said the plant with a long sigh.

Yes, Cotton had bragged that there was nothing strong enough on earth that could make him take

notice of it, but he surely seemed to take notice of the boll-weevil.

Mr. Corn was talking to Miss Cowpea about it one day, and said, "Miss Cowpea, have you noticed King Cotton lately?"

"Yes, I have, and he seems terribly nervous about something," Miss Cowpea replied.

"Do you know what ails him?" Mr. Corn asked.

"No, what is it, do you know?" Miss Cowpea asked.

"Why, that boll-weevil has him frightened almost into a fit," Mr. Corn said.

"Is that boll-weevil as bad as all that?" Miss Cowpea asked.

Mr. Corn explained: "He is a bad one, let me tell you. Those boll-weevils are the smartest beetles that ever visited a cotton-patch. They work so differently from other insects that have attacked cotton heretofore. They do not eat the foliage as the cotton leaf-worm or the grasshoppers do. They do not display themselves on the plants as the 'fool' leaf-worms do, but they stay behind the little leaves you see around every square and boll."

"How do they feed?" asked Miss Cowpea.

"You know that they have beaks that remind you of little elephants' trunks. At the ends of

these beaks are the mouths. With these they make cavities into the squares and bolls and eat the insides," Mr. Corn explained.

"Don't they eat the outside of the squares and bolls?" Miss Cowpea asked again.

"I guess I have told you. No, they do not eat the outside except for a tiny hole as big as an ordinary pin."

(From *Bur. of Ent., U. S. Dept. of Agr.*)

FIG. 4.—"With these they make cavities into the squares and bolls."

Old Mr. Crabgrass had now become interested, and looking up, said, "I have been watching the performance for some time, and I am sure I do not see how Cotton is going to manage it.

But speaking about

those cavities, do you notice they leave some of them open and others they close very carefully. I wonder why they do that?"

Mr. Corn replied, "Those that are left open are used for food only, but when they want to lay their eggs they make the same kind of cavity, and after the egg has been laid into it they seal it very care-

fully; this must be quite a protection to the egg from enemies and it must prevent the square from drying."

"But look at all those squares lying on the ground. Who does that?" Miss Cowpea asked.

Mr. Corn, who had been watching very closely, explained: "That is because many of the squares will drop to the ground within a week after they have been punctured either for feeding or for egg-laying. A few days after the eggs are laid they hatch into

(From Bur. of Ent., U. S. Dept. of Agr.)

FIG. 5.—"Those that are left open are used for food only."

(After Bur. of Ent., U. S. Dept. Agr.)

FIG. 6.—"They hatch into little footless grubs."

little footless grubs which feed on the inside of the squares. When the grubs become full-grown they change to pupæ, from which a few days later the young weevils emerge. The time required from egg to full-grown weevil is from two to three weeks."

FIG. 7. — "They change to pupæ."

"Let me tell you something more," Corn added; "this is going to be a great war. That boll-weevil army is something terrible, but people think so much of Cotton that they will fight as no farmers have ever fought before."

Wherever the weevils were at work one could see the buds and blooms

lie on the ground. No one had ever seen anything so destructive. When Martin Hentsel's boys came from the field one day at dinner-time they told their father about it. He answered, "Well, I had better go and look at it myself after dinner." The way he said it made his son Jim rosy, and he replied rather curtly, "The damage will be just the same."

"What!" his father retorted, "did you ever see anything that could stump me, heh?"

"I am afraid I have; I think I saw it this morning, and it is the little boll-weevil. If you know how to get us out of this trouble, then I am willing to believe that there is nothing on earth that can stump you."

"We will see about it," Mr. Hentsel answered with importance.

It is true that Mr. Hentsel was a bright man and a good farmer and always seemed to find some way to get over trouble, so when he came to the cotton field after dinner several of the neighbors saw him and came also. After he had looked at the cotton carefully, he turned to the other men and said, "Let me tell you something." Everybody listened, thinking that a bright idea had occurred to him. "This is terrible," he said, and walked home.

"We have known that for several days, haven't we?" George Carnes said. "We may as well go back to our plows."

And so it was with the best farmers. They saw that, in spite of anything they said or tried to do, the weevils became more and more destructive. Year after year they became more numerous and kept on spreading over more plantations. In 1900 they had spread over the greater portion of east Texas and had entered Louisiana. Cotton and his

supporters saw nothing but gloom ahead. Soon after the weevils had been discovered, entomologists of the United States Department of Agriculture came and studied the pests. Cotton saw them busily working day after day, night after night; they never made any noise and they would not talk. One day when Cotton was talking to Corn he said: "I never felt so bad. I always thought that I was so strong that I had nothing to fear, but I tell you I am being beaten by those pests, and nobody can help me."

"Go easy," answered Corn; "those entomologists are at work, and they are the men who will get you out of this trouble if anybody on earth can do it."

"I don't know about that," Cotton replied. "Those men are too quiet; they will not talk. Oh, I admit they are busy enough, but why don't they talk and tell us something. I have no faith in them. Other men come around and they make speeches and the people cheer them, and I think that they will help me if anybody can."

"Don't you pay any attention to those speech-makers. This is not the time for speech-making. It is wasting breath. Those entomologists are members of the staff of Dr. Science, and I have endless faith in the old Doctor. You have not had enough experience with him to know; he has his men work slowly and carefully, and they say noth-

ing until they have something to say. Dr. Science and his staff have been of untold help to us in the corn-belt, and you can take my word that before long you will find that those entomologists are the best friends you have, and that they will find a way to save you. Don't listen to the talkers, they are mostly men who do that to get into politics. You put your faith in Dr. Science, and mind what I tell you."

A short time after Cotton and Corn had this talk the entomologist said: "We have found that the weevils suffer heavy losses in winter and are so weakened by spring that it is necessary for them to increase their numbers greatly before they can do great damage. We must force the cotton to get ahead of the weevil. To do this we must prepare our land in the fall and winter. The seed-bed must be well prepared and plant-food must be given intelligently. After the cotton is up, keep the weeds down and cultivate often and shallow in order to keep a blanket of loose soil at the surface; this prevents the soil from drying out and is called a soil-mulch. We must save the soil-moisture because the cotton needs it when the hot and dry weather sets in. If you allow the surface of the soil to pack or let a crust form by rain, you will lose the soil-moisture quickly and the plants will suffer.

"The soil-water helps to bring the plant-food in

the soil into solution so that the plant can take it; plants, as you know, cannot take solid foods. This will enable the cotton to bloom and form bolls before the weevil-army, weakened by winter, can become strong enough to puncture all the squares before they bloom and form bolls."

When Cotton saw people beginning to practice this and that it helped, he felt more cheerful. He said to Corn: "You know I feel somewhat better. I thought that my end had come, but those quiet entomologists have gained a point in my favor. Those men are here, there, and everywhere, studying every movement of the weevils to see if these movements cannot be made into weapons to fight the bandits. I agree with you now that the entomologists are the best friends I have. Who would have thought that they could take winter and line it up as an enemy against the weevils? Planting early kinds of cotton as early as is safe and forcing them as they told us, surely helps."

There came upon the scene of action another band of workers whose existence had never been dreamed of. They were led by another great American who was an expert in farm-management, and his band of workers were called demonstrators. Every important discovery which the scientists made they not only told Cotton, but they went to the farms and showed the farmers how to use it.

The people began to prepare their lands better and better. As they showed them these things they talked to the farmers, saying: "The soil needs air and water. You let your lands lie idle during winter, with stalks and stubble and weeds on them; the results are land-washing and the loss of plant-food, and it has been shown that the weeds and stalks provide shelter for the boll-weevils in winter. If possible plow your land well in the fall to enable the soil to store up moisture; cover-crops should be sown to prevent the loss of this moisture, to avoid the leaching away of the plant-food, and to keep the soil from washing. Good crops for this purpose are rye, oats, and wheat, but whenever possible crops should be used that have the power to add nitrogen to the soil, because this is one of the most important and most expensive plant-foods."

The people who had listened became very much interested, and asked, "What are some of the plants that have the power to make nitrogen?" They were told that good examples were vetch, cowpeas, clovers, alfalfa, and others; that the vetches and some of the clovers made good cover-crops. Some asked, "How can any plant make nitrogen in the soil?" The entomologist replied: "One day when Dr. Science was walking across a field he heard a vetch-plant and a bacterium talking together, and he listened.

“‘How do you do?’ said the bacterium to the vetch-plant.

“‘Not very well,’ answered vetch. ‘I cannot get enough nitrogen. You know that every meal I eat I must have potash, phosphoric acid, and nitrogen; I can get enough of the first two, but I am starving for nitrogen, and so I feel very bad. Nitrogen, you know, is hard to keep in the soil, and as it costs so much, farmers are not willing to supply enough of it.’

“‘That is very funny,’ answered the bacterium; ‘with me it is just the other way. I have all the nitrogen I need because I have a very cheap way of making it, but I cannot get enough potash and phosphoric acid, and as I have to have them on my table as well as you, I am starving.’

“Dr. Science then stepped forward and asked the bacterium, ‘You say you have an easy way for making nitrogen; will you explain it to me?’

“‘With pleasure,’ the bacterium replied. ‘Three-fourths of the air is nitrogen, and God has given me the power to draw on this vast storehouse and change it so that it can be eaten by plants.’

“‘Wait a minute, Mr. Bacterium,’ said Dr. Science; ‘would it be possible for you two to get together and trade?’

“‘I have an idea,’ exclaimed the vetch-plant; ‘we can live together; the bacterium can live on my

roots and supply me with nitrogen and I furnish him with phosphoric acid and potash.'"

This was agreed upon, and now the bacteria live in colonies in little nodules on the roots of vetch. Being asked about it later, vetch answered, "It

FIG. 8. — "The little houses may now be found on the roots of vetch, clovers, beans, peas, alfalfa, and other legume plants."

works fine." The little houses may now be found on the roots of vetch, clovers, beans, peas, alfalfa, and other legume plants.

"Use vetch or clover for winter and cowpeas for summer and rotate your crops," said the demonstra-

tors. So the people planted rye and vetch in the cotton lands in the fall. Some planted oats and vetch, or clover. Some farmers would plow this under in the spring to add green manure to the soil;

(Photo by Harper, S. C. Exp. Sta.)

FIG. 9. — "And cowpeas for the summer." Cowpeas in the foreground.

others let it grow in the spring and later cut it for hay or grain. Some of the land where the winter cover-crops were plowed under was planted in corn, and the corn was followed by cowpeas at the

last working. The corn-land was again planted in cover-crops in the fall to be plowed under again in the spring to add more vegetable matter. Where the cover-crops were cut for hay the land was planted in cowpeas, and in this way the soils that had been idle a large part of the year were made to work every month of the year.

The boll-weevils were mad now. They had a spite against the entomologists and the demonstrators. "The way those fellows are going at it is surely hard on us," they said; "farmers used to plant nothing but cotton, and we had no trouble to find plenty of food everywhere, but now many of the same fields are planted in corn and other crops which we cannot eat. Shucks, what decent bug would eat corn, — that old tough stuff; and those cowpeas that we tried to eat the other day, — why, it made our stomachs sick; there is no taste to them, oh, hum," they sighed.

The weevils were now forced to scatter to find food, and when winter came they found that the fields had been handled differently from the old custom. Two weevils were talking one day.

"How are you getting along?" one asked.

"I am getting along all right if I could only find a place to stay over winter. It beats all. I never heard of my parents having trouble this way; they always found plenty of old stubble, rubbish, grass,

and leaves, but now the farmers clean up the fields so that it is impossible to find lodging. Even the woods are cleaned up, and the nice underbrush along the creeks and branches where my ancestors used to spend the winters in comfort are grubbed out and

FIG. 10. — "They always found plenty of old stubble, rubbish, grass and leaves."

everything cleaned up. Well, I must hurry, or cold weather will catch me in the open. I must find cover for winter." An old cotton-plant, that was left for an experiment, heard what the old weevil said, and he laughed and laughed. "Whoopee," he exclaimed, "we are getting you on our wagon, old boy."

All this time the entomologists had been hard at work and had learned that the weevils cannot go into winter quarters until driven by the cool weather. They told the people about it, and said: "No army can fight unless the soldiers have their stomachs full. You must pick fast and as far as you can, destroy the cotton-stalks about two weeks before the first killing frost. If you can, plow them under. This will force the weevils to starve before they can go into winter quarters, for they must have cotton to feed on until that time." Many people who had been waiting for the entomologists and demonstrators to find some spray to kill the weevils saw that the many different kinds of sprays that had been tried were failures. One morning in June a number of those people were sitting in front of Miller's store talking about the hard times.

"If these entomologists and demonstrators would only find some simple spray that we could use, then we could fight the weevils," they said.

Just then Jim Conley, one of the best farmers of that section, came along and heard what they said.

"I hope they will never find a spray," he said.

"What!!!" those people roared. "What do you mean?"

"If somebody should find such spray, you would depend on it instead of good farming. You would just keep on growing nothing but cotton and wear

out your soils," and he walked on, because he was a good farmer who did not have time to stand around the street, arguing.

Since the weevils came to this country many insects and birds have become their enemies and are destroying them. Even the cotton caterpillar, that athlete among insects, has been of help in fighting them, by eating the leaves late in the season when no more squares may be expected to mature; this kills weevils by starving them or by forcing them into winter quarters before they are ready.

Mr. Hentsel says: "The boll-weevil is a bad one, and I wish he had never come, but he is here, and we might as well forget when he came. He has done us good. Since he came to the South we have found out that we are better farmers than we thought we were. When that long-nosed rogue came he thought he would just walk over us and starve us, but I tell you, gentlemen, Americans are hard to beat."

THE BLACK BILL-BUG OF CORN

JOHN DRAKE had complained several times that something was injuring his corn, but was unable to find out what was causing it. One evening he came home with his face looking somewhat like a thunder cloud, and it did not require a second look for any one to conclude that he was in a very bad humor. His right hand was closed as if he were carrying something, and the children were wondering what he found that displeased him so. He walked to the dining room and laid two black beetles on the table.

FIG. 11. — "And laid two black beetles on the table."

"I have caught them in the act," he said. "These rascals are the cause of my corn's dying. I found them in an old stalk, and you ought to see what they did to the inside of the stalk. They just about made sawdust out of it," and striking the table with his fist he looked at Mrs. Drake and the children about him.

"They are not rascals; they are beetles," said Johnny, who was too young to understand how his father felt. If Johnny had been old enough to be responsible for a corn crop, he might have understood.

"What??" Mr. Drake thundered.

Johnny in his innocence thought that he was asking for information, and so he repeated, "They are beetles. They have hard wing covers and —"

"I don't care what they are — they are killing my corn — they have killed it, and it made no difference to them what I said or did," his father roared.

Johnny had by this time realized that he made a mistake when he spoke and that his father was in no frame of mind to listen to a story on insect structure. His father had discovered that these insects had killed his corn, and he wanted revenge.

"How are they injuring the corn?" Mrs. Drake asked.

"They are not doing any injury now because the corn is ready to gather, but what they did do is enough. I am going to get ready for war, and if necessary I will catch every one of them and twist their heads off. Yes, sir, that is what I will do," he said, sitting with his chin in his hands and a grouchy look on his face.

To the children it looked comical, and they would

have laughed had they considered it safe. No one laughed, you may be sure, or if he did he took good care that his father should not see him, because he was not in a humor to see anything funny about this.

Johnny had to go to school the rest of the week, and he saw farmers all around him harvesting corn. When he came from school the first evening after his father had found the beetles, he asked him whether he had found any more.

"No," his father answered, "I cut dozens of stalks open to-day, but I did not find another beetle."

So it was the rest of the week. His father had been cutting stalks but had found no more beetles. On Saturday morning all the corn had been gathered, and only the stubble were left in the fields. There was much other work to do at this time of the year, so that the beetles were soon forgotten. One very cold morning in January, as Johnny started to school,

FIG. 12. — "But what they did do is enough."

he met Frank Welden on the road, and they walked along together. Mr. Welden was one of the oldest farmers of that neighborhood, and was very fond of Johnny.

"Well, Johnny, this is a cold morning, but when a man has plenty of good kindling-wood, plenty of meat, potatoes, and fruit in the cellar, and his barn full of fodder, he does not mind it so much. That is what I like about farming; we farmers always get along better than many of the people living in town." So Mr. Welden talked to Johnny and Johnny listened to every word he said. When they came to where they could see Mr. Drake's cornfield on the right of the road, Mr. Welden said, "Johnny, tell your father that he should not be leaving the corn stubble on the field over there the way he does."

"Why?" asked Johnny.

"It is a bad thing to do. It is only common farming. Those stubble somehow make lots of bugs next year," Mr. Welden explained.

Just at this time they came to the cross-road. "I will tell him what you said," Johnny called as he left Mr. Welden.

When Johnny came home that evening he told his father what Mr. Welden had said.

"Mr. Welden believes that all kinds of insects stay in those stubble during the winter," his father replied.

"Do you believe that?" asked Johnny.

"I don't know whether I do or not. It looks to me as if any bugs trying to stay in those stubble would freeze to death during the winter," Mr. Drake replied.

"I have been thinking about it," Johnny con-

FIG. 13. — "Those stubble somehow make lots of bugs next year."

tinued; "the little bugs have no houses with warm stoves and I have wondered many times what they do through the long cold winter when there is no food. I should certainly hate to be a bug." At this remark by Johnny the whole family laughed.

"What makes you think that the bugs live during the winter?" asked his mother. "I thought that they all died in the fall."

"My teacher told us that bugs lived during the winter in a quiet, sleepy condition called hibernation," Johnny replied; "during the winter, she said that they did not have to have food, and that from the bugs that stay over winter the insects come the following year."

"All right, Johnny," said his father with a laugh, "I give you a job for next Saturday. You go over the old corn stubble in the field back of the barn, cut them open and examine them closely to find out if there are any bugs in them."

"I'll do it," answered Johnny. They all laughed, and no more was said about the subject that evening.

On Saturday morning, Mr. Drake saw Johnny going across the field. "Where are you going, sonny?" he called.

"I am going to hunt for the bugs you told me about the other evening," Johnny answered.

Mr. Drake, laughing with a "guffaw," said, "Well, well, boy, go easy now and don't catch them all, because if there happened to be no bugs next year it would surprise me so that I could hardly get down to business, and then the weeds would cover my cornfield."

"That is the time I would plow the corn for you," Johnny answered, laughing, and walked on.

When he arrived at the cornfield he confessed to himself that he had little faith in finding bugs in

the corn stubble, and if he failed the folks at home would laugh at him. Starting in a half-hearted way he selected the biggest stubble he could see and putting his right foot on one side and his left on the other he stooped over and began pulling with both hands as hard as he could, — in fact he pulled so hard that he grunted. While pulling he bit his tongue between his teeth and drew his face out of shape as if he were suffering severe pain. When he had pulled, twisted, grunted, and looked painful for some time, the stubble, root and all, came so suddenly that Johnny was not prepared, and he fell backwards, almost turning a somersault, with earth flying all over him. He remained on his back a few moments as if to catch his breath, then got up, stiffly, like an old man, and sat rubbing his eyes. He put his hands down, winked hard a few times, and then rubbed his eyes some more. He kept on spitting and sneezing, wondering if he would ever get rid of all the pieces of earth that had lodged in his eyes, nose, mouth, and ears. Then he slowly drew his knife from his pocket and split the stubble and root. What do you suppose he saw as he laid the two pieces on the ground very quickly and looked at them with bulging eyes? He thought that he saw three bill-bugs partly hidden in little nests in the dried and rotten pith of the inside of the stubble.

“I must have fallen pretty hard, for I never see

such things except when I dream at night. I wonder if the fall hurt my eyes." He rubbed them once more, quite thoroughly this time. He looked again, and, sure enough, the bugs were still there. He broke a piece from another stubble, and getting down on his knees he pushed the beetles and turned them over.

FIG. 14. — "He looked again, and, sure enough, the bugs were still there."

"My eyes are all right, and those are bill-bugs as sure as I live. I bet they are dead, or maybe asleep, — no, I saw that one move." He pointed to one of the beetles which he saw move its legs. After a few moments he saw the others move slightly.

"Hm, they act like boys when you wake them up in the morning, except that they do not yawn.

Maybe they do, but their mouths are so small that I cannot see them. To tell the truth I do not know yet at which end the mouth is located." So Johnny spoke to himself, at the same time carefully studying the beetles. He saw the eyes and feelers, and then was sure that the mouth was at the end of the little beak. Looking at them gravely, he said to himself: "They look like elephants except that they are blacker, much smaller, have no tails, no lopping ears, — well, I guess they are not like elephants after all. Why should my looking at them have reminded me of elephants? Oh, I see now, those little beaks did it, because they remind one of elephants' trunks. That is it. Well, well, well," he sighed and looked about him. "I am going to pull some more, and I will surely take some home to show to father. See here, I did not come to practice for a circus, so the next stubble I am going to dig up, and then there will be no danger of my turning somersaults without knowing it until it is all over." He went to a near-by fence, broke off a good-sized sliver, and with it he dug up many more stubbles. With his knife he split these open. Finding beetles in most of them, he was no longer discouraged, but felt that he was being well repaid for his trip. It was a great relief that they could not laugh at him when he

FIG. 15. — "They look like elephants, except —"

returned home, because he had a discovery to report and the bill-bugs in the stubble to prove it.

Did you ever discover anything, and do you remember how good you felt about it? Here in these innocent-looking corn stubble was the winter home of the corn bill-bug. There the little insects slept throughout the long winter when the ground of the

FIG. 16. — "Johnny, that cold-frame back of the chicken-coop I give you for an insect breeding-cage."

stubble-field was frozen and icicles hung from the eaves.

When he came home and showed them what he had found, they all became very much interested. "Johnny," said his father, "that cold-frame back of the chicken-coop I give you for an insect breeding-cage. It is my cold-frame, but you clean the glass in the sashes well, and then get more stubble from

the place where you got these and put them in the ground in the cold-frame just as they were in the field ; do not cut the stubble. Please get the stubble to-day, because I am going to plow them up and remove them from the field. I'll warrant that they will not stay there this winter to breed the bugs to eat the corn next summer. It begins to look to me as if I have been breeding bugs to eat my corn. No more of that ; I am going to see the neighbors and tell them about this and ask them to destroy the stubble."

Johnny got the stubble as his father had directed, and put them in the ground under the glass sashes. Not a day passed that Johnny did not look into the cold frame. It took much tedious waiting through many weeks because the insects would not stir as long as the tang of frost was in the air. Johnny said he thought it was the longest winter he had ever spent. When at last the warm weather of spring set in, the insects woke from their long sleep and left their winter homes to find something to eat.

"I do not blame them," said Johnny, "because such a long nap would make anybody hungry."

During the first few days they did not seem to be able to get their appetites in good condition even though Johnny had been so thoughtful and planted five hills of corn in the nice rich soil of the cold-frame. They wandered about as if uncertain what

would be the best thing to do. Sometimes several beetles would gather near the same spot with their heads close together. One morning a funny thing happened; seven of the beetles had gathered near the same spot with heads near together. When Johnny saw them he laughed outright and called his father. Mr. Drake came, pulled his spectacles from his vest pocket, put them on his nose, and slowly and awkwardly set the bows over his ears, in the meantime drawing his face out of shape as though the putting on of spectacles was a painful piece of work. Johnny got impatient, because he was afraid that the bugs would leave their positions before his father would get through putting his spectacles on.

"It does take dad a long time to get ready before he can look at anything carefully," he said to himself very impatiently.

Mr. Drake at last got his spectacles where he wanted them, and looked at the spot which Johnny pointed out to him.

"They must be plotting," his father said in a low, careless tone, and putting his spectacles back in the vest pocket he walked to the barn, where he had some work to do. Johnny's eyes followed him, searching him from head to foot until he disappeared from sight through the barn door; then, turning around he spit on a chip with much emphasis and grumbled to himself: "I didn't learn much, did I?"

He seemed to be short about it. Maybe, though, he had had no opinion about it, and if that was the case he said enough." He looked at the beetles again and they were still in the same position. "I

FIG. 17. — "They must be plotting."

must be getting ready for school," he said, and left the insects to themselves.

The next day Johnny saw that they were beginning to feed, and he watched them as carefully as he could day by day. They attacked the tender little

cornstalks near the surface of the ground. With their beaks they would slit them and eat the juicy parts on the inside, which would soon kill the bud, leaving a few green leaves at the bottom of the stalk. There was not very much excitement in this for Johnny. "Because," he said, "the beetles just kill the young corn and that ends it." However, his curiosity had been aroused, and so he kept watching. It was well that he did, for later in the season he had a chance to see something that stirred his blood. He saw them attack the corn in a field where the plants were from ten to twenty inches high, and the way the plants battled for life was as good an example of perseverance and true courage as he had ever read about in his books. "And this is a living example right before my own eyes," he said.

When the plants had become twisted and distorted from the hard attacks of the bill-bugs and growth seemed no longer possible, each plant threw out suckers near the ground as if to say, "If I must die, then maybe these young sprouts will succeed in making corn." Often these suckers were attacked, but being as brave as the old stalks from which they came they were determined not to give up the fight, but before they died produced a second set of suckers. In their heroic struggle for life the plants continued to produce suckers, until at last

the old dying plants were surrounded by a mass of sprouts that made the field look very odd. Many of the plants were so riddled by the repeated attacks of these pests that they could not succeed in making grain. Johnny sat down by one of these masses of suckers and examined it very closely. Looking at the dying shoots he shook his head gravely and said: "Old fellows, you have taught me a lesson that I will not forget as long as I live. You were true to the farmer who so carefully prepared the land and planted the seed from which you came. He hoped to make a crop, and that it cannot be done is no fault of yours. You fought bravely, but the enemy was stronger than you; you had to go down in the fight, but you went down fighting like heroes."

Johnny found later that when the corn had grown to the height of four feet the beetles could no longer injure it seriously. He thought that the battle was over, and was greatly surprised afterwards when he found that he had seen only part of the fight.

(After Kelly, Bur. of Ent.,
U. S. Dept. Agr.)

FIG. 18. — "Each
plant threw out
suckers."

"Why, man," he said to his little friend Willie Burns, "those beetles were but the skirmishers of the bill-bug army."

He had forgotten about the eggs the beetles had

(After Kelly, *Bur. Ent.*, U. S. Dept. Agr.)

FIG. 19. — "The eggs were laid in tiny holes."

been laying on the corn. He had noticed the egg-laying from June 1 to July 1. The eggs were laid in tiny holes which the mother beetles had made with their beaks, and they had laid anywhere from one to ten eggs in a stalk. One reason why he had paid no attention to this was

(After Kelly, *Bur. Ent.*, U. S. Dept. Agr.)

FIG. 20. — "The eggs had hatched into little whitish, humpbacked grubs."

because those stalks were not damaged like the others. He had just taken it for granted that these stalks would go through the season safe, but when he found that the eggs had hatched into little

whitish, humpbacked grubs eating the pith he felt that they had not only outwitted the corn but himself also, and this hurt him very much.

The little grubs were gluttons, eating all the pith from that part of the stalk where they worked, leaving only the outer woody wall of the stalk. This, of course, cut off the flow of sap and killed the plants. It was a dry season, and the attacks were so deadly that much of the corn was killed even after silking and tasseling.

"This beats everything," said Johnny; "they played it on me this time, but I am going to watch them closely after this, and if they do

succeed in 'stealing another march on me,' it will not be on account of my being asleep."

Johnny did see their next move, but it was not until they had become full-grown grubs. They made little cells from chewed pith in the stalks and in them they changed to the quiet or pupa stage. Johnny had read about such things in his books, but this was the first time he had ever seen it. From these pupæ the full-grown bill-bugs escaped. Few of them came out of the stalks, and as winter approached nine out of every ten beetles remained in the stalks just as Johnny had found their parents in the corn stubble last January.

(After Kelly, *Bur. Ent.*, U. S. Dept. Agr.)

FIG. 21. — "They changed to the quiet or pupa stage."

When Johnny told Mr. Welden what he had seen, the old man asked: "Where do they stay? I have never been able to find any."

Johnny answered: "The beetles are unlike boys, because these little pests are early risers. They enjoy a good breakfast and supper, but during the hotter parts of the day they hide in shade or just underneath the soil at the base of the plants."

"That must be the reason that I never saw them; I looked at the wrong time of the day," Mr. Welden replied. "But see here, sonny," he continued; "it seems to me that when we move the stalks from the field after harvest we are taking the beetles with them; don't you think so?"

"Right there is where the the beetles get the best of us, because they do not stay in the stalks. I have cut hundreds of them open and never found a single insect, but if you will cut open the stubble or root, you will have no trouble finding them. When we carry our stalks away we must take stubbles and roots also," Johnny explained.

Old Mr. Welden was now as tickled as a school-boy who has had good luck. He had such a broad grin on his face that Johnny wondered how he could do it without hurting his face.

"Sonny," he said, "do you remember when I told you to destroy your corn stubble? I have farmed all my life and I have noticed that where you leave

the stubble during the winter the bugs are worse on your corn the next year. I was not able to 'ferret' it out, but you see now that the old man was right. And I can tell you another thing, sonny; I never plant corn where I had corn the year before,

FIG. 22. — "I have made crops when others failed."

and whenever I can do it I plant as far away as possible from where corn was before. You don't believe that this is important, do you?"

"I do, Mr. Welden," Johnny replied; "you are one of the very best farmers of this section, and I

have seen you make crops when the other farmers failed. I like to hear you talk."

"I always knew that you were a sensible boy," said Mr. Welden; "and now let the old man tell you another thing. I have made crops when others failed because I had planted my corn just as early as it was safe from frost in March. You can't always do it on account of weather, but whenever I can do it the bill-bugs won't get my corn as bad as that which is planted later."

"Is that so?" Johnny inquired.

"That is so, Johnny, and now I have to be going. You take what I told you and make your pa put it in his pipe and smoke it." At this they both laughed heartily and parted.

"Mr. Welden is a good friend and he is a smart man, too," Johnny mused as he was walking down the road. Suddenly he stopped as if he had forgotten something. "What about that early planting for bill-bugs? I bet I know. If you can get your corn to silking and tasseling before the beetles lay their eggs, the corn is then strong enough to win the battle." He walked on some distance when he suddenly stopped again. "What did that speaker say at the farmers' meeting last month? He said 'the right planting date for bill-bugs often is food for bud-worms.' What did he mean? Gosh! there is a lot to be learned yet about this bug business, but I bet I'll know that too, some day."

WHEN CORN IS FOX-EARED

DID you ever see fox-eared corn? If not, then you must go to the cornfield in April when the plants are still small and you will surely see it. You may not see any on uplands, but if you will go to a creek-bottom, or some other low place, you will have no trouble finding them. You may not call such plants fox-eared, but John Grimes and many other good farmers do.

John Grimes lives on his farm in the northern part of South Carolina. He is a very tall man with square shoulders and he has the longest beard that we have ever seen. Should any of you ever pass him on the street we are sure that you would stop for a second look, for such men are not often seen. He has three boys, Fred, Harry, and Joe; and when any one who knows their father meets them, he knows immediately that they are John Grimes's boys because they look so much like their father. All the neighbors say that Mr. Grimes is a good farmer and one of the best neighbors any one could have. He would go out of his way day or night to do you a favor, and his boys are just like him.

They love the farm and are a great help to their father. Hardly a day passes, when they are out in the field, that he does not tell the boys something new about plant-growth, birds, or insects.

One night in April there was a nice warm rain and Mr. Grimes was pleased. "This will make the corn grow, boys," he said the next morning when he came to breakfast. It being too wet to work in the field he walked over the farm, but when he returned he looked as if something had gone wrong. "A lot of our corn is fox-eared," he said to the boys in the yard. "As soon as the ground dries off we must take the planters and replant all the fox-eared stalks."

The boys looked at him for some time as if to ask, "What is fox-eared corn?" At last Freddie said, "We don't know what you mean."

"If you will come with me, I will show you," the father replied. Soon they were on their way, and when they reached the cornfield they saw the rows of young corn and they thought it a pretty sight. "They are cute little plants," Harry exclaimed. "Look at their leaves; they remind me of the big feathers in our white rooster's tail. Don't they you?"

Fred and Joe agreed, with a laugh.

"That is right," said the father, "and those are healthy plants, that will grow, but there are many that do not carry their leaves that way."

"Here is one, is it not?" said Joe. "Look at it; the leaves are standing up almost straight. What is the matter with it?"

Their father asked them to walk over the field with him to find out whether there were many plants like it. As they were walking over the hill, they saw very few, but when they arrived in the bottoms they saw many with straight leaves.

"Now," said the father, "all the plants that you see with the leaves standing up and not dropping like the big tailfeathers of our white rooster, I call fox-eared, and they will never

FIG. 23. — "They remind me of the big feathers in our white rooster's tail."

produce corn; we might as well replant them now."

"They surely have their leaves standing up like the ears of a fox," Freddie remarked. "What makes them fox-eared?" he asked.

"Worms down in the bottom of the stalk," their father replied.

"If we replant them now, won't the worms get into the young plants that come from the replanted seed?" the boys asked.

"I never knew it," their father answered, almost as if angry.

The boys thought it very strange that these worms would not attack the young corn coming from the replanted seed.

FIG. 24. — "What makes them fox-eared?"

"Why don't you find the worms in all the plants?" Joe asked.

"I guess it is because there are not quite enough worms," Mr. Grimes replied with a sickly smile.

So the boys returned from the field where they had seen fox-eared corn, caused by worms down in

the bottoms of the little stalks. They talked about it all that day, and that evening they told Mr. Smith, the demonstration agent, when he visited at their home. Mr. Smith smiled, because he had never heard such corn called fox-eared, but said, "That is a very good name for it." Boylike they told Mr. Smith all they knew about it, and when he saw that their father looked so grave about it he was ready to believe that the worms were doing very serious damage.

The next morning before taking time to find out how much damage the worms were doing, he saddled his horse and rode over to Mr. Watson's farm, where an entomologist was studying another pest. Mr. Smith explained to him what he had been told about the worms in Mr. Grimes's field. "It has spoiled his stand of corn and much of it has to be replanted," he said.

The insect man, whose name was Henry Colby, went with him, and together they looked at the corn. Mr. Colby pulled up some of the plants with great care, examined the roots and also that part of the plant which had been underground; then he looked at the rest of the plant. With his pocket knife he split the stem, and with a smile he laid the plant in Mr. Smith's hand. "Just what I thought," he said.

"A worm," Mr. Smith said, surprised. "Mr.

Grimes was right, then ; he said it was a worm, and so did the boys. What is it ? ”

“It is the bud-worm of corn,” Mr. Colby replied.

The boys and their father, having seen Mr. Colby and the demonstrator enter the field, had come and joined them because they were anxious to learn something about the worms.

“Why do you call it the bud-worm ? ” they asked Mr. Colby.

“They do not seem to be in the bud, but in the plant below the ground,” Mr. Smith remarked at the same time when the others asked their question.

(After Chittenden, Bur. Ent., U. S. Dept. Agr.)

FIG. 25. — “It is the bud-worm of corn.”

Mr. Colby then told them that the injury to

the bud was not from the outside like a worm eating the leaves, but from the inside where one cannot see it without cutting the plant. “These little worms,” he continued, “known as larvæ, because they are the young of insects, and are not really worms, bore into the tender stalk of the young corn plant, usually at the base where the roots come out. There they feed, cutting off all of the inside of the stalk except one or two of the outer layers, and this causes the bud to die, leaving one or two green leaves at the bottom of the stalk standing up like the ears of the fox. After killing the bud, the larvæ feed

upwards or they may feed downwards into the root. No matter in what direction they feed, the small bud dies and the growth of the plant is stopped, and this is the reason why we call them bud-worms."

"Oh, we see now," said the boys; "when we gathered our corn last fall we saw holes in the grown stalks, and when we cut the stalks open we found worms in them and they must have been bud-worms."

(After Chittenden, *Bur. Ent., U. S. Dept. Agr.*)

FIG. 26. — "Usually at the base where the roots come out."

"No, they were not; they were corn-stalk borers, and were very different from these bud-worms,"

FIG. 27. — "No, they were not; they were corn-stalk borers."

Mr. Colby explained. "After young corn-plants have grown about twelve inches high and are

healthy, these bud-worms can no longer seriously harm them. They merely gnaw the outer skin about the same place as in the young corn, as you see here. In some cases it checks the growth, but it is rare that it kills the plant, and the larvæ never reach the soft inside part or pith of the stalk."

"You speak of it as the larva of an insect, Mr. Colby; what insect is it that makes the larva?" Mr. Smith asked.

Mr. Colby then told him that the insects making the bud-worms are the common twelve-spotted cucumber-beetles which, no doubt, they all had seen many times in their gardens. "There is one now, sitting under that clod; see it?" Mr. Colby said, pointing to the ground.

Yes, they all saw it, and then they remembered that they had seen thousands of them before.

"We never knew that this beetle injured corn!" they all exclaimed. "Why," said Joe, "I have seen them everywhere, in our orchard and garden, and last year, I remember I saw a lot of them in Aunt Sallie's flower garden in the city, but I had no idea at that time that they were such rogues." At this they all laughed.

"They looked very good, didn't they, Joe?" Mr. Colby said; "but remember after this when you meet them that they are not as innocent as they appeared to be when you saw them in that flower garden, but they are the cause of much loss

to farmers by laying their eggs, which make the little bud-worms in the corn. The eggs are laid by the mother beetle in the soil at the base of the young corn-plants. The eggs hatch into little worms, such as you see here, which bore into the tender stalks and kill the buds as I have told you. When they become full-grown larvæ they leave the stalk and make a small earthen cell in the soil near by. Inside of this cell they change to a resting-stage called pupa.

(After Chittenden, Bur. Ent., U.S. Dept. Agr.)

FIG. 28. — "They change to a resting stage, called pupa."

(After Chittenden, Bur. Ent., U.S. Dept. Agr.)

FIG. 29. — "There crawls out of it an active beetle."

During this resting-stage they are really not resting, just because they are so still, but a great change takes place. You remember the little verse you learned in school? It says,

"Action is not always gain,
Crystals form when left at rest."

"During the pupa stage they change from the simple little larva, such as you see here, to a beautiful twelve-spotted cucumber-beetle, having wings, wing covers, feelers, and legs; after a week or ten days this little cell opens, and instead of a little bud-worm wiggling out of it, as you would suppose, there crawls out of it an active beetle!"

"They had all listened to Mr. Colby with intense interest, and when he finished they stood spell-bound. After a few seconds, Mr. Smith broke the silence by asking,

"Where do they stay in winter when no corn is to be had?"

"In this part of the country they do not go into real winter quarters, like so many other kinds of insects, but when cold weather begins they find shelter under the leaves of weeds and other suitable places, and from there they come out and feed during warm weather. They —"

"What can they feed on in winter?" Mr. Smith interrupted.

Mr. Colby explained, "There are several food plants, but there are two kinds of wild weeds known as life everlasting, which are common on the farms of this section throughout the winter; during warm spells these furnish food, and during cold weather their leaves furnish shelter for the insects."

"Then it looks to me as if there is no way of getting rid of these little pests," Mr. Smith complained.

"It is not quite so bad as that," Mr. Colby replied; "it is very important where they give trouble that the corn be planted at the right time to prevent damage."

"That sounds good enough, Mr. Colby, but how

do we know when the right time has arrived?" Mr. Smith asked.

"This must be determined for the different sections of the South," Mr. Colby told them; "in this section we have studied the life and habits of this insect very carefully and find that the first eggs are laid early in March and hatch during the first week in April. The earthen cells and pupæ have been formed about May 19, and the full-grown beetles come out beginning about May 24. Now, if the weather is such that you can plant in March, the corn has a chance to get a good start before the worms can do severe injury."

"How about planting in April?" Mr. Grimes asked.

"I have just said that the eggs hatch during the first days of April, and to plant your corn at that time would be like feeding the worms, don't you see? If you wait until the worms have become full grown or have changed to pupæ, they do not feed, and that is a good time to plant, to give the corn a chance to get a good start. In this section they change to the pupæ, as I have said, on May 19, and for that reason about May 19 would be a safe date to plant to avoid injury."

My brother, who lives in the southern part of this state, has this trouble also; would you recommend the same date for him?" Mr. Grimes asked.

Mr. Colby replied, "In the middle portion of our

state the pupæ is formed about May 12, and in the southern portion about May 5. We should say then that the dates should be as follows where one cannot plant early:

Upper South Carolina, May 19.

Middle South Carolina, May 12.

Lower South Carolina, May 5.

FIG. 30. — "Here is a map."

"Here is a map we have prepared for farmers in this state who lose corn by bud-worms." Mr. Colby handed Mr. Grimes a map.

During the last four years Mr. Grimes has been very careful about the time he plants his corn. Not only has he learned how to escape bud-worm

injury, but the knowledge gained that day in the old cornfield has set him to thinking, and you see improvements on his farm and in his farm-practice everywhere. The neighbors have noticed it, and often come to ask him questions or talk over their farm problems with him. Always ready to help his neighbors, always willing to listen to what others say, and always ready for improvements, he has become a great leader in his section. Should you ever meet him, be sure to ask him whether he is losing much corn from bud-worms. The big bearded face will smile all over, and he will answer you, "I am losing very little corn from bud-worms now. They used to do me a great amount of damage, but I learned how to outwit them. Plant early if you can, but if the weather does not let you do that, then plant at the right time."

Then he thoughtfully strokes his long beard, and turns his face toward the old cornfield where he met Mr. Colby some years ago.

THE BLACK CORN-WEEVIL

THE town of Flanders and the country around it has always been known for its good people. Old Uncle Jerry Miller was born and reared just one mile east of town many, many years ago on his father's farm, and he has lived and farmed on the old place all his life. Uncle Jerry knows everybody in town and every farmer in the country around it, and all the people know him. It was he who said, "There is no finer country than that around Flanders. It is level and the soil does not wash away as it does on the hillsides. I would not live in a hilly country anyway, because it seems to me that people must be wearing themselves out walking up the hills and then down again. We have good churches, fine schools, and first-class people. Everybody says so. The people here have a lot of sense, too. Talk about farming, our people have always known better than to raise nothing but cotton and wear the land out. Our farmers raise corn, oats, and hay; and there is not a home near or in Flanders that hasn't a family garden. The farmers plow intelligently and they are always ready to learn; they are not the kind who think they know it all."

Uncle Jerry spoke the truth when he said that the people planted other things than cotton. They always made good corn-crops and were proud of it. They always made as good corn-crops as were made anywhere, but they could not keep the corn because an army of black weevils had come into their corn-fields from somewhere and caused much loss to the golden ears. The habits of these little pests were so different from any they had ever found it necessary to fight, that the farmers did not know what to do. In the fields, as well as in the cribs, these little rogues would stay in hiding under the shucks like so many bandits in ambush. Unseen, every soldier of this black weevil army was busily eating into the kernels of the corn, and the farmers felt very bad about it. Every day you would hear some one say, "If somebody does not find some way of stopping these little black thieves, then all our corn will be eaten in the crib."

(After Chittenden, Bur. Ent., U. S. Dept. Agr.)

FIG. 31. — "Soldier of this black weevil army."

"In the crib!" exclaimed John Matthews, who was one of the best farmers of Flanders; "it is not in the crib alone that they do so much damage, but I know when I gathered my corn in my river bottoms last month they had eaten into some of

the kernels on nearly every ear, and some ears were not worth hauling into the crib."

"Shucks," said Fred Hamilton, "I never saw them in the corn in the field; you must be mistaken, John."

"Mistaken?" answered John; "it seems that you do not know what you are talking about, Fred."

(After Smith, N. C. Exp. Sta.)

FIG. 32. — "And some ears were not worth hauling into the crib."

They were in every field of corn I examined a couple of weeks ago before any of the corn of this section was put into the cribs."

"It seems to me that I do remember having heard some people say that the weevils were eating their corn in the field," said Fred.

"You must have," said John, "because everybody has been talking about it." And so they agreed that

this pest was becoming more destructive every year and that it was necessary to have something done to save the corn.

Joe Henderson, the bank president, had listened to these complaints about the weevils. Mr. Henderson was a successful banker and farmer; he was more than that, for he was a fine business man who was big enough to have the interest of his community at heart. Everybody knew this, and whenever he spoke, the people listened. One day they had a meeting to discuss ways for getting rid of the weevils.

Mr. Henderson said, "Gentlemen, corn is a great crop and must be saved. Every other crop must be saved, and the business men of Flanders will help you. This is a farming section, and the success of this town and its business men depends on the crops made by the farmers of the surrounding country. Without the backing of the farms this town could not be here, and now the people of this town must help the farmers to find some way of getting rid of this pest. The step for us to take right now is to get an entomologist down here to study this black weevil, and maybe he can find out how to kill the thief."

"An entomologist?" asked Bob Griggs. "What is that?"

"It treats of the structure of words, Bob," exclaimed Ben Gray, anxious to show what he knew.

Several who knew better laughed outright, and

this made Ben very angry. "What are you laughing at?" he retorted, turning red in the face. "The dictionary says that it is the derivation of words; I looked it up — now laugh, will you?"

This had the effect of making them laugh louder, which, in turn, made Ben's face turn redder.

Mr. Henderson relieved Ben when he said, "You are thinking of *etymologist*; I said *entomologist*, which is taken from the Greek *entom*, meaning insect, and *logos*, a study. An entomologist is one who studies insects."

"I never knew that there were men who made it a business to study insects," said Bob Griggs.

"Yes, sir, they are called entomologists," Mr. Henderson replied.

Soon after this meeting an entomologist arrived at Flanders who worked like a trained spy among the black bandits. The weevils were at work everywhere, on the low wet bottom-fields, on uplands, in near-by woods, but the entomologist was there also, and it was a common sight to see him crawling out of a crib with corn silk over his face and clothing. After he had worked a long time and had studied the habits and lives of the pests, he asked the farmers and business men to meet at the corn-crib on Jack Smith's place on the following Saturday morning at ten o'clock sharp, when he would tell them what he had found out about the weevils.

FIG. 33. — "His big grove back of the barn was 'chuck' full of mules, wagons, automobiles, and people."

At the day and time set for the meeting the farmers came from far and near, over all kinds of roads, some on horseback, others on foot, and others came in big farm wagons. Some of the business men came in automobiles. Jack said that his big grove back of the barn was "chuck" full of mules, wagons, automobiles, and people. He said, "I am sure glad that my place is a little hilly, for if it were flat there would not be room for them all."

The entomologist came out of the crib and spoke

to them: "This black weevil is by far the worst enemy the corn crop around here has to face.

FIG. 34. — "Into these they lay their eggs."

We have found out how these pests keep up their great numbers. The females bore little holes into the kernels, and into these they lay their eggs. One egg is laid in each hole, and the mother does everything she can so that no harm will come to the eggs or the little grubs that hatch from them. The holes into which the eggs are laid the mother drills with her little beak, which looks like a tiny elephant's trunk. The mouth being at the end of the beak makes it a very handy tool for digging. They make the hole as deep as the beak is long, and then the mother moves forward and puts into it her egg-

guide or sting and the egg is pushed down into the hole. The sides of the hole are not straight, as some of you may think, but the cavity has the shape of a hen's egg with the larger end down in the kernel."

"If the opening of the cavity is smaller than the cavity, how can the weevil put her egg into it? Either the eggs must be soft or the cavities are bigger than they need be," Sam Sprague remarked.

"Both of your ideas are correct," the entomologist answered. "The eggs are soft so that they can be squeezed through the opening, and they do not quite fill the cavity."

FIG. 35. — "The sides of the hole are not straight, as some may think."

"Ha, ha, she don't make good fits, then, does she?" Sam laughed.

"Oh, yes she does," the entomologist answered, "but she makes the cavities of that shape and size purposely, and I am sure it prevents the egg from being pushed out when the corn dries and shrinks. The eggs do not touch the walls of the cavity at all points, and this is of help to the little grubs when

working their way out of the eggshell at hatching time. When the egg has been pushed into place, the mother seals the opening of the cavity and that hides the egg and young grub from enemies that might be lurking about the corn."

(After Smith, N. C.
Exp. Sta.)

FIG. 36. — "They are white, hump-backed, and legless."

"You mean to say that the little white grubs you find in the corn are the young of the black weevils?" asked Sam Dixon.

"Most of the grubs you find around here are," the entomologist replied, "but there are a number of white grubs in corn that do not make weevils. You can tell the weevil grubs without any trouble because they are white, hump-backed, and legless. The grubs eat the inside of the grain, and when they become full grown they change to a quiet or resting-stage, called pupa, and from this pupa the full-grown weevil comes. In warm weather the time required from egg to full-grown insect is from five to seven weeks, but in cool weather a longer time is required."

FIG. 37. — "The grubs eat the inside of the grain."

"It puzzles me," Sam Dixon interrupted, "how these little mischief-makers can eat the inside of the seed, and yet when I plant it most of the seed comes up. It would seem that they would kill the germ."

(After Hinds, Ala. Exp. Sta.)

"Yes, you bet," Frank Hamilton added, "I have noticed that weevily seed will come up pretty well, but it does not make a stand of corn like sound seed."

FIG. 38. — "From this pupa the full-grown weevil comes."

"That is what I say," Bill Green spoke up. "I have found that out, and I will not plant any more corn that has weevils in it."

FIG. 39. — "Weevily seed will not do as well as clean seed."

"Very often the weevils will not hurt the germ," said the entomologist, "but the gentlemen are right

when they say that weevily seed will not do as well as clean seed. The fleshy part of the seed is the young corn plant's first food when it comes up, and when this is taken away the young plants will be weak and often die."

"It has been found that corn which ripens late is less damaged in the field than early corn," the entomologist continued.

"That is a good point. I am going to plant late corn after this," said Tom Jackson.

"Go easy, Mr. Jackson," said the entomologist; "you are dealing with an army of bandits too wise to be easily fooled. If you planted late corn only, I am sure you would find the damage greater than we found it where both early and late corn occurred. We believe that the early corn could be used as a trap to attract the weevils when they appear in the field to lay their eggs. The early corn would be ready for them, while the late corn would not be. If there were no early corn, we are sure that this would not cause the weevils to starve. It might be well to plant late corn for your main crop and plant early corn for the weevils. Of course this trap corn should be gathered by itself and not stored in the same crib with the main crop."

"Why not store it in the same crib?" George Sanders asked.

"If you stored it in your main crib, it would be

full of weevils by the time the main crop comes in. It would be just like saying to the weevils, 'Here is some more corn, help yourselves.' If they could, they would smile all over and say, 'Mr. Sanders, you are a gentleman.' You see you kept the weevils off your main crop by planting the early corn; now, would it be wise to gather the early crop, give the weevils a free ride to the crib, and then bring the rest of the corn to them to save them the trouble of flying to it? That would surely be treating the weevils kindly."

"Ho, ho, ho," many laughed.

"Put your thinking cap on, George," several exclaimed.

The entomologist continued: "Select for your seed-corn such ears as give a good yield and have tight and close-fitting shucks. The ears should not stand up straight, but hang down to prevent water from entering the shucks during rains."

Will Lane now interrupted the entomologist: "I have studied about that myself and always thought that the shucks had something to do with the number of weevils, but I met Sam Faulkner in town the other day and he said that he did not think much of it. He said he had an army of corn ear-worms in his corn last year and that the weevils got into the shucks through the holes made by these worms when they left the ears to go into the ground.

I always thought a heap of it, but then that is what Sam said."

"It is quite true," the entomologist continued; "the holes made by the corn ear-worms would offer a way for the weevils to get to the ears even when covered by tight-fitting shucks, but I have never seen a bad case of weevily corn in the field where the shucks were tight-fitting, and covered the ears, even where the corn ear-worms had made holes through the shucks. It is only in some years that this worm is very bad, and the holes they make do not offer as easy a way for the weevils to get in as the loose, short shucks. It may be that this Mr. Faulkner, of whom you speak, happened to look at a few of the worst ears, in which case it would not be fair to speak that way for the whole crop.

"Do not sweep your wagon beds near the crib after your corn has been unloaded. Many weevils are in that rubbish, and sweeping them on the ground near the crib would be helping them to get to the crib easier."

George Brown now interrupted the entomologist: "I am glad that I am here; what we have been told is of great value to us, but what are we going to do right now, gentlemen, when our corn is stored in the crib and the little six-legged thieves are making meal out of it? They are ruining my corn in the crib right now and I do not even dare to feed it to my mules."

"Oh, fudge," exclaimed Fred Hamilton, "Tom Morrill gave me a simple remedy the other day and he said it worked fine. He tried it last year and he said his father always used it. He wets the corn with salt water when he puts it in the crib."

"I tried it, and it works fine," a voice was heard.

FIG. 40. — "Sweeping them on the ground near the crib would be helping them."

"I tried it, and it did not do any good whatever," several gentlemen remarked.

The entomologist smiled and said, "You, who have tried it, seem to disagree."

"What do you think about it?" several asked.

"We have tried it," the entomologist answered, "and while the salted shucks seem to taste better

when eaten by stock, yet in our trials the loss was greater in the salted crib. Where salt or salt water was used it softened the corn in damp weather and the weevils seemed to like it better. There was even loss in weight."

"Does heat kill the weevils? that is, could you haul the corn in wet or wet it after it is in the crib and let it heat to kill the pests?" one farmer asked.

"Where heat is under control it is no doubt the surest way for killing all kinds of stored grain insects, and in seed houses where steam coils are installed we recommend the use of heat. To obtain that heat by hauling corn in wet, we do not advise," the entomologist answered.

"How much heat does it take to kill them?"

"The entire crib must be heated to a temperature of 123 degrees F. for several hours."

"Does that injure the germ of the corn?" another asked.

"No, sir," the entomologist answered. "The germ stands a much higher temperature for a much longer period without injury."

"Don't many of the weevils freeze to death in the winter?" Ed Green asked. "I have heard people say that the weevils cannot stand the cold weather."

"I do not think that in our corn-cribs it ever gets cold enough to freeze many weevils. This may kill them farther north, where the winters are much

colder. During cold weather in the South the weevils become numb and quiet, and this has led many people to believe that the little rogues were dead."

John Matthews said that most of the weevils are in the cribs during the winter and wished to know how they got to the fields. "Do they travel from the cribs to the cornfields?" he asked.

The entomologist told him that no breeding places had been found in the fields in the spring, and as the weevils leave the cribs when the corn is badly eaten, he thought that the pests traveled from the cribs to the fields. He also explained that breeding in the fields did not begin in earnest until the corn had begun to harden after the roasting-ear stage. He said further: "At this time the corn that may be still in the cribs is so badly weevil-eaten that in many cases the pests are forced to find something to eat; one will notice this during June and July, and during this time most of the weevils leave the crib. In the spring the weevils have been found in the fields eating other things, but the numbers found at that time could not very well account for the large number laying eggs in the fields when the corn hardens."

"Let us come back to the question George Brown asked some time ago," exclaimed Fred Hamilton. "Is there anything we can do right now to save

the corn that is in our cribs? After that we can talk about the things we should do next season to prevent the thieves riddling our corn on the stalks before it is put in the cribs."

"Yes," the entomologist said, "there is something you can do; go home and make your cribs just as tight as it is possible to make them. In brick cribs, or in wooden cribs that have been made very tight by the use of heavy tarred paper between two layers of sheathed boarding for the walls and ceilings, use about seven pounds of carbon bisulphide for every one thousand cubic feet of space. In cribs not so tight a much larger amount may be necessary.

"Carbon bisulphide is a liquid which looks like water and has a foul smell. When the liquid is exposed to the air it changes to gas very rapidly. This gas is heavier than air and sinks in the crib — it does not rise like most gases you know. It goes down, sideways, and eventually upwards. To fumigate with this gas, level off the surface of the corn in the crib and make holes by pulling out some ears. The holes should be about three feet apart each way and from one to one and one half feet deep. The liquid is then poured into the holes, using about an equal amount for each hole. The corn is then thrown back into the holes to help hold the gas, and the crib closed tight. Fire must be kept away from the liquid, and if any is left after

enough has been put in the crib, it should be kept in a cool place."

"Is one treatment enough?" someone asked.

"Often it is if everything is just right when the liquid is put into the crib. Be sure and have the crib ready before you put the gas in. Some people forget and then have to open the crib every little while to fix something that should have been done before. One can soon find out if the first dose was not strong enough; if not, then a second and stronger one should be given. In most cribs it is best to give one dose in the fall as soon as the corn has been put in, and another in the spring. This should be done on warm days. The crib should be kept closed from twenty-four to forty-eight hours."

"Can I go into the crib with a lighted lantern when the gas is in?"

"There is just a bare possibility of an explosion, and we would advise you not to carry fire of any kind near the crib at that time."

"How do you air the crib when you want to open it again?" some one asked.

The entomologist answered, "Unless you have a brick crib, or a wooden crib very, very tight, it is not necessary to air it, because the gas will disappear in a day or two. In case of a tight crib, just open the door and the gas will soon disappear."

"I tell you, gentlemen, this gas business looks

too dangerous to suit me," said Orrin Doyle. "Were I to put that gas in my crib, then I could not go near the barn with a lantern, and what is worse, I could not even smoke my pipe near the crib for fear of having my head blown off. I think I will let the bugs eat my corn and not take the risk of burning down my barn."

"That is what I say," added George Brown; "that plagued stuff will blow your head off. I believe I am scared of it."

The entomologist answered, "You are evidently expecting your barn to burn down at any moment; at least, that is the way I would feel about my barn if I were in the habit of smoking in or near it. If you are used to smoking near the barn couldn't you, for the sake of your crop, your family, and your stock, smoke elsewhere for a day?"

This caused an uproarious laughter, and the gentleman wished that he had not said what he did about smoking near the barn.

The entomologist then assured him that there was no more danger than in the use of gasoline, so common in every home. He said further, "If you use the same care you would with gasoline, then you will not have any trouble. The liquid itself will not hurt the skin when it touches it, and the inhaling of a small amount of the gas would not injure any one."

"How about using it in a crib which has wet corn in it and the corn has heated?" a farmer asked. "Would it cause an explosion?"

"In a very tight crib I should be afraid to use it, but in most cribs there would be no danger," was the entomologist's reply.

A little man somewhere in the crowd exclaimed: "Bill Crane said that when he was in Fort Worth some of the big millers used this gas, and the people told him that they could taste it in the bread made from the flour of grain so fumigated."

"I have known of such cases before," the entomologist replied. "People know that it has a foul smell, but it is funny that they never taste it in bread when they don't know the gas was used."

"I have a newspaper clipping here where it speaks of two other things that have been tried for killing weevils. The names are terrible; I guess I won't try to read them because it is after four o'clock now and I shouldn't be able to get through pronouncing one of them before sundown," and the farmer who said this came forward and handed the clipping to the entomologist.

"Both of these have been experimented with by the United States Department of Agriculture; the first¹ one mentioned is rather expensive, but the second² seems to give promise. One point strongly

¹ Carbon tetrachloride.

² Para dichlorobenzine.

in their favor is that they do not burn like carbon bisulphide."

So the meeting kept on, one question after another being asked by the farmers. They found out that Jim Blair had used this gas, and when asked about it he explained how he had used it. He told them that he had made his crib very tight and that he put the gas in on November 8. Mr. Blair said that he chose a warm, sunny day to put the gas in, and that he was very much pleased when he looked at his corn the next spring and found very few weevils in it. "Of course," said he, "I would not come to a conclusion after just one trial, because it might have been a light weevil year, but I know of a half dozen other farmers who used it for several years with good results.

"Do not try to depend on treating corn in the crib to control weevils. The first step is to select your seed corn in the right way at harvest time. When selecting, look for type of plant, height of ear, yield, sound grain, tight shuck, and hanging ears. The tight shuck prevents the weevils from getting to the grain, but in most seasons the tip of the shuck will not be tight in ears that stand up because the soaking of the silk during rainy weather followed by drying in hot weather makes it so that weevils can get to the grain. Take pains to harvest your corn dry and put it in good cribs. Then if you

find that it is necessary to fumigate, find out the best thing by writing to the experiment station or by asking the farm demonstration agent. There are so many things tried at present that we may soon have something that will take the place of carbon bisulphide."

"Gentlemen," said John Matthews, "it is getting late, and most of the people have to go home. I am going home to tighten my crib. I am going to select

(After Hinds, Ala. Exp. Sta.)

FIG. 41. — "When selecting, look for type of plant, height of ear, sound grain, tight shuck, and hanging ears."

my seed corn more carefully after this. I know that I can grow a crop of corn, and after this I am going to save it."

"So am I," a dozen or more voices were heard.

The meeting was over, and a little later you could see men, women, children, teams, and cars going in almost every direction.

The people of Flanders have put these things into practice, and they have improved the corn of that community very much. Fred Hamilton said a few

weeks ago that he had always regarded the black weevil as a terrible pest, but that he had changed his mind, "Because," he said, "that insect has done more to improve the corn around Flanders than anything else that ever came to this town."

Joe Henderson is still president of the Bank of Flanders and one of the town's best citizens. Everybody says that the best thing he ever did for that section was when he started the movement for having the black weevil studied which led to the long-remembered meeting at Jack Smith's corn-crib.

GRASSHOPPERS

WHEN Mrs. Emerson was sitting in the library of her home one June afternoon reading an interesting book, she heard a great noise outdoors. "Those are the Blake boys; I wonder what has happened," she said to herself, and started reading again. In a little while the noise broke out again, much louder than before. The Blake boys lived next door to her and were very noisy at times, but this time it sounded to her as if something terrible had happened and that the boys were calling for help. She ran across the hall and through another room to that side of the house where the noise came from, to find out what the trouble could be. As she put one hand on the closed shutters to open them she called, "What is the matter, boys?"

The boys answered at the top of their voices, "Mrs. Emerson, Mrs. Emerson, don't open that blind, and don't look out!"

"Well, what can the trouble be?" she asked herself, nervously, and then called very loud: "What is the trouble? Is there a rattlesnake out there in the rosebushes?"

"Mrs. Emerson, do not open," came the reply again, "because there is an awful big hopper-grass on your window-shutter!"

"Is that all?" said Mrs. Emerson, giving a big sigh of relief; and, bursting into a laugh, she returned to her book. She could not get over the funny side of it, and every little while during the afternoon she would burst out laughing. When her boy John came home and saw her he thought that she must

(After Washburn, Minn. Exp. Sta.)

FIG. 42. — "There is an awful big hopper-grass on your window-shutter."

be reading a very funny story.

Willie and Freddie Blake were raised in the city and, of

course, did not know much about grasshoppers except what they had read in their story-books. It was, therefore, not surprising that, when they saw an unusually big one, they should be just a little scared.

Their father had been reared on the farm and knew most of the common insects and other animals. As a boy he had watched the bumblebee make her home in an old mouse-nest; he had seen the mud-daubers build their mud-nests on the rafters in the garrets; and he had often noticed and watched the squirming in manure heaps of maggots that made

house-flies and stable-flies. He could have told the boys about the big grasshoppers which they in their excitement had called hopper-grass, but he was not at home.

About a week after they had scared Mrs. Emerson, Willie was pulling weeds in the garden and he saw

FIG. 43. — "He saw a large number of grasshoppers eating on their sweet corn."

a large number of grasshoppers eating on their sweet corn. He stopped and sat very still for a long time, watching them. "What big mouths they have; I wonder why they have to be so big?" he asked himself. He talked to one of the grasshoppers, saying: "If my mouth was as big as yours according to the size of my body, what a sight I should be.

It would be terrible, and everybody would be afraid of me. I tell you what people would say when they looked at me; they would say, 'That boy is a frightful looking thing; I always thought that Frank Stevens's bulldog had an ugly mug, but it is nothing to that of Willie Blake,' he, he, he," he laughed.

Just then he saw something that took his attention from that grasshopper; at the edge of the garden

(After Riley.)

FIG. 44. — "He is stuck fast in the ground."

he saw another grasshopper sitting quietly with its abdomen, or rear half of the body, halfway in the ground.

He crept away quietly and called Freddie, saying, "Freddie, come here and look what happened to one of the grasshoppers."

Freddie came and they both looked. "He is stuck fast in the ground, Freddie," said Willie.

"Why, Freddie, he surely is; poor old long-legs, I wonder how that happened."

Just then their father came to the house and the boys called him. He came, and after taking a good look, said, "What is the matter with that grasshopper do you think?"

"We do not know," Freddie answered. "The poor thing is stuck in a hole there, but how did he get in? Do you suppose that it is an ant-hole?"

"No, boys," the father explained, "that grasshopper made that hole and is laying eggs. Grasshoppers lay their eggs in the ground, and the hole in which they are placed they make themselves by means of prongs they have at the rear end of the body." Picking up another grasshopper he showed the boys the prongs and the way they are used for digging.

"The thing for you to do now, boys, is to watch these grasshoppers this afternoon and find some more that are laying. You can then mark the spots and you can dig some of them up to-morrow and see how they look. If

(After Riley.)

FIG. 45. — "That grasshopper made that hole and is laying eggs."

you will then take good care of the eggs, you will have a chance to see them hatch and you can tell your boy friends how the little grasshoppers come into the world," the father told them.

That entire afternoon the boys spent in the garden watching the grasshoppers. They saw three others laying. They marked the spots very carefully, as their father had told them, so that they would be

able to find them again the next day. "Hello, Pete," Freddie called to the old family horse which stood near by looking at the boys across the garden fence. "Pete, what are you looking so grave about? You could not have heard what father said when he was here in the garden some time ago. If you had seen us watching and pitying an old grasshopper for having gotten fast in an ant-burrow when it was merely laying eggs, you could not stand there and look as sober as you do." The boys had a good laugh over what they had nearly forgotten; and, answering their mother's call, they went to the house.

"I am glad that father has forgotten about it," Willie said as they were passing through the garden gate.

"So am I," remarked Freddie.

After supper that evening their father asked, "Did you find any more grasshoppers stuck fast in ant-holes, boys?" The boys, after a rather sheepish laugh, told what they had seen since their father left them in the afternoon. Freddie, it seems, had paid especial attention to the food of the insects. "I never should have believed that anything on earth could be as big a glutton as Mr. Stevens's bull terrier. I have seen him gulp down a plate of potatoes so fast that I have often wondered how he did it. I thought he was about to bust when he turned around and gave a large piece of an old ham,

which Mrs. Stevens had thrown out, exactly the same treatment, and within five minutes afterwards I saw him punished for stealing and eating a loaf of corn bread. I tell you that the terrier is not in the same class as the grasshoppers. I watched them when I should have been pulling weeds. I could not help it, because I fell into watching them before I knew it."

"There is not a plant in our garden which they failed to sample," interrupted Willie.

"If you call that sampling, Willie, then I should like to see them eating in earnest. They are stripping our sweet corn, and leaving nothing but ribs to our cabbage. They are chewing everything to pieces, and they do not seem to give the weeds any more consideration than our garden plants. It seems that they prefer the young tender buds, but when they are eaten it does not seem to worry them any,—at least not judging from the way they look."

"And did you notice how much they can spit?" Willie interrupted. "It is as brown as tobacco juice, and where it all comes from is a puzzle to me. Look on my sleeve here and you can see the brown spots; I wonder if it will wash out. When you catch one he sets his big mouth to work, and with all the parts in action it reminds me of a mowing machine thrown into gear. His saliva runs over your fingers and you need not figure that he will do this

for a little while and then stop, but he keeps it up until at last you just have to let him go."

"If I could spit like a grasshopper I would soon stop those cats screeching below my window every night," said Freddie.

"How would you do it?" the others asked.

"How would I do it?" Freddie asked soberly. "I would just turn over in bed with my face toward the window and spit. That would settle it, because it would drown every cat engaged in that choir." At this they all laughed.

Their father interrupted, "Maybe the grasshoppers are like some people. When they get nervous they allow their jaws to exceed the speed limit, when you had better keep your distance if you don't want to get into a shower-bath."

Freddie whispered something to Willie, which set the boys laughing with an uproar.

"What are you laughing at, boys?" their father asked with a knowing smile.

Willie answered, "Freddie said that you must have been thinking about old Mr. Bill Grimes down by the creek."

This created another general laugh, after which they all retired.

The next morning at about ten o'clock Mr. Blake saw the boys coming from the tool-shed; Willie carried a spade and Freddie a pickaxe over his shoulder.

"What are you going to do ; what are you going to do ? Are you planning to dig a well ?" asked Mr. Blake.

"No," Willie replied, "we want to dig up some of those grasshopper eggs," — and then they stopped as if stunned, watching their father laughing. He almost doubled up several times, and the boys wondered if he would ever get over it. When at last he seemed to conquer his laughing, a glance at the boys, armed with spade and pickaxe, would set him off again, and soon the boys found themselves joining in the laugh, although they did not know what it was about.

"Boys," their father said at last, "when you want to pick your teeth after dinner, would you take a fence-rail ? If you want to shoot a squirrel, would you use a cannon ? The only tool you need for finding the grasshopper eggs is the small blade of a pocket knife, because the eggs are not more than a fourth of an inch below the top of the earth. Put those tools back where you got them and don't be borrowing trouble."

The boys did what he told them. When they had disappeared in the tool-shed, they looked about as sheepish as ever any boys looked.

"Freddie," said Willie, "we might have known that those eggs could not be very deep, especially when you consider the size of the insects."

"I did know it, of course, but I just forgot to stop and think about it," answered Freddie with disgust.

They went to the garden and began digging very carefully with their knife-blades and soon uncovered the eggs. They were little, reddish, podlike bodies laid in a little earthen chamber which had been made by the female with the prongs which their father had pointed out to them the day before. They found the eggs a solid mass and adhered to each other as if glued. When they noticed how nicely the eggs were covered over with soil so that no trace of the chamber could be seen on the surface of the soil, they were very glad that they had marked the place as their father had told them. They counted the eggs and found that there were ninety-four in the mass.

"They are good layers," remarked Willie.

"Yes, they are," Freddie agreed, "and I do not understand how any of our Plymouth-rock hens can look at a grasshopper without blushing. If those old hens would only lay ninety-four eggs at one sitting, we could go into the poultry business."

The boys talked the matter over and decided

FIG. 46. — "They were little, reddish, podlike bodies."

FIG. 47. — "In a little earthen chamber."

that they would put these eggs in a tumbler so that they might see the little grasshoppers hatch. "We want to see them come out of the eggshell," they said. This done, they tried to find other grasshoppers in the act of laying. They worked all over the garden and found four more egg-chambers, and every one of them was near the edge of the garden. They noticed that they were not laying in the ground that was cultivated and concluded that they must have wise little heads because they would not risk to lay their eggs where they would be in danger of being uncovered by the plow or hoe. After the places had all been carefully marked they put little cages over them just as their father had explained to them. Their mother did not have enough cheese-cloth for all the cages, so they made as many as they could from this material and used muslin for the rest. Their row of cages looked pretty, and many people passing the garden stopped and looked at them. They felt proud when people asked questions about them, but old Mr. Grimes made them angry when he said: "What foolishness is that, boys, putting up a cemetery in the garden? Those little white cages look just like headstones. I would not have them on my place." Although this made them rosy, they could not help looking at each other and grinning, because they recalled their father's remark about nervous people.

"How soon will the eggs hatch?" the boys asked.

"I do not believe that they will hatch before the warm weather sets in next spring. They will stay where they are throughout the winter. At least, I hope they will," their father continued, "but I am afraid your cages are in the way when I plow up the garden."

"But you will not plow the garden until spring, will you?"

"Not on the left side where the cabbage and other winter vegetables are, but the side where your cages are will be plowed, because we could not afford to let that land lie that way all winter."

"Why not?" the boys asked, very much worried that their cages might be disturbed.

"Because," their father explained, "part of it has grown to weeds and they give shelter to insects and diseases. Those weeds will die when cold weather begins, and if there are no living plants on that soil to take up and hold the plant-food, it will wash and leach away. Part of the garden has the soil bare, and this would wash during the wet weather. Now, we will not allow any of those things to happen because it would be very bad farm-practice. I am going to plow that side and sow it to vetch or clover. It would be called a cover-crop, and will prevent the soil from washing. Few insects can feed on such

plants, and by keeping the weeds down it would be a cleaning-crop at the same time."

"Why do you use vetch or clover? Could you not sow oats?"

"Yes, I could, and it would do about what vetch and clover do, but oats has not the little nodules on the roots which contain the little bacteria that have the power of changing the nitrogen of the air so that plants can use it for food. It is this nitrogen that makes up the ammonia in the fertilizer and is the most expensive part. When I grow these plants I need less of that kind of fertilizer and there I am not only saving money, but when I plow this cover crop under next spring I add a lot of nice vegetable matter to the soil which decays, making plant food, making the soil hold water better, and allowing the air to circulate through the soil. Soils having these conditions are most productive."

"That is very interesting," the boys remarked.

"When I plow this fall I will also uncover the grasshopper eggs that may be in that ground and they will die during the winter. Of course, the greatest numbers of eggs are along the edge of the garden. They prefer to lay their eggs in slightly sandy soil along hedges, roadways, and other places where no cultivation occurs. Where your cages are placed the greatest number of eggs are found, and I want to work that soil to kill them. I don't know what we had better do with the cages."

The boys knew that their father would often say things with a sober face even when he was joking, and they were not sure what he would do in this case. The truth is that he would never have allowed those cages to be disturbed, as he was glad that the boys were studying the grasshoppers. The next day he had forgotten about this, and did not know that the boys remembered it and were talking it over every little while to find some plan by which they could keep their father from plowing up the land where the cages were placed.

One afternoon they visited their old friend Captain Shelby and, among other things, they told him about the danger threatening their breeding cages. Captain Shelby knew Mr. Blake well, and was sure that he was merely joking when he talked to the boys, but being a wag, he tried to help the boys with a scheme that would make their father keep away from the cages with his plow.

"Boys, I tell you," he said, "this is the time of the year to plant turnips, and I never saw anybody that liked them so much as your father. I have plenty of seed and you can sprinkle it all around the cages and rake it with a garden rake. You can also sow a strip two feet wide on that side of the cages farthest away from the fence. The seed will come up, and when your pa gets ready to plow, he will see the turnips and he will not plow them up."

The boys went home with the turnip seed in their pockets, and the next morning when their father had gone to town they sowed it. Mr. Blake was busy with his corn-crop and so he did not get back to the garden for nearly three weeks. One morning he decided to plow the garden. As he went through the gate the boys followed him and when he saw the turnips he was greatly surprised.

"What is this?" he asked.

The boys explained that they had sowed turnips there because they thought he liked them.

"I do," answered Mr. Blake, "but where did you get the seed?"

"From Captain Shelby," they answered.

A pleased smile crept over his face as he said: "I see through it now. That is a game of yours, and the Captain helped you. Boys," he continued, "I would never have disturbed your grasshopper cages, but I am glad that you sowed the turnips, and even if I had intended to plow that ground, your game would have caused me to change my mind."

The boys watched their tumbler under the old apple tree and the cages by the garden fence, hoping that the eggs might yet hatch before the cold weather set in. But September passed and October came with its colors of russet, gold, and red. The golden-rods and the frost-flowers covered the earth, and the cornfields rustled in the autumn breezes.

"Willie," Freddie said at last, "I hope they will not hatch."

"Why?" snapped Willie.

"Because it is just as father said," answered Freddie; "he said if they hatched now, they would make the greatest mistakes of their lives. It seems to me it would be their first as well as their last mistake, because they could not live long, as winter is almost on us. In our reader it says that in those sections of our country where they have very mild winters, they may be found at any time of the year, but I am sure they could not live through the kind of winters we have here. I think that they had better stay where they are, under the ground in their eggshells, and if they have any sense they will do so."

Freddie's idea about this matter did not cause Willie to lose hope, but when December came with a snow-flurry, he was satisfied that there would be no hatching till spring. Often during the winter when the ground was frozen and sleet beat against the window-panes, they would talk about the grasshopper eggs in the cold ground in the garden. The night following January 22 was the coldest of the winter. A light snow had fallen and the wind blew bitter cold. The boys had to retire to a cold room for the night and this they could not enjoy, no matter how hard they tried.

"I wish I had just a little of the grit of those

grasshopper eggs so that this would be easier," said Freddie.

"So do I," Willie agreed.

With short days and daily school-work, time passed rapidly and they might have forgotten about their eggs in the cages, but one balmy morning their attention was attracted by the high notes of a Kentucky cardinal. "Cheo-cheo-cheo-cheo," he repeated over and over from his high perch in the tree-tops, and it filled the boys with a longing to be out-doors. They were sure that spring had come and that they might expect their grasshopper eggs to hatch at any moment. This was on the morning of March 20, and being Saturday and no school, they had a chance to see what they had been waiting for so long. That day they saw many young grasshoppers come out from the eggs and sit wondering at the great world about them.

The boys put into the tumbler whatever green vegetation they could find, and in a day or two they all began to feed. The tiny little insects resembled the full-grown grasshoppers except that they had no wings. For a period of twelve days they did not change except that they grew larger.

"This subject is getting to be so dry that it is no longer interesting. They just eat and grow a little and that is all," Willie said.

On the thirteenth morning after hatching some-

thing did happen that made Willie feel sorry for his remark. One of the grasshoppers had fastened his little feet firmly to a leaf in the cage and sat so still that the boys thought he was sick. After a while they saw the skin split over his back, and before noon the insect dropped helplessly to the ground, leaving his outgrown skin hanging on the leaf.

"Whatever this is, it seems to make him feel bad. You see he does not feed like the others," they said.

In an hour, or maybe a little longer, the new skin had hardened and the young grasshopper joined the others, and seemed to be extra hungry.

"I was mistaken," said Freddie, "because I see now that he feels better for having lost his skin. Who would have thought that an animal can lose its skin and live?" continued Freddie. "That is a great deal more than you can do. I wonder if papa knows about this."

So they went and told their father about it, and he explained to them that this is called molting. He assured them that if they kept their eyes open, they would see the others do likewise, and that all grasshoppers do it a number of times.

By this time they saw young grasshoppers everywhere, in their cages, along the garden-fence, and along the roadside. When walking over the short grass they could see hundreds jumping in every direction. They had no trouble now to find plenty

of them to watch. They found that they molted about every two weeks, and after the fifth time a full-grown grasshopper with full-grown wings would appear.

In the meantime the boys learned that the grasshoppers had begun to do very much damage to the farm crops and gardens of that section and people spoke very unkindly about them. The little hordes of grasshoppers that had hatched along the edges of fields, in pastures and in waste places, had grown and spread to near-by fields, so that some farmers were worried about their crops. It was getting worse every day, and the boys lost their love for these creatures. They began to look upon them as enemies to every man. John Conelly said that they ate every kind of plant that came within their reach, and he had even seen them gnaw the wooden parts of his mowing-machine. George Hyde said they had nibbled on the hard handle of his garden fork which had been left in an upright position in the garden for several days.

The boys became very bitter against the insects which they had given such protection and sympathy during the winter. One day they noticed that the food in one of their cages had been eaten or dried up long ago.

"Say, Freddie," Willie called, "we forgot to feed them in this cage and they must surely be dead."

After careful examination they found some of the insects still alive, one eating another grasshopper.

"This is the limit!!!" cried Willie. "They are cannibals. Why, Freddie, there is no knowing what they might not be guilty of."

"To kill them you would have to put one in a cage without any kind of plants or other insects," said Freddie.

"That would not do," retorted Willie; "they would gnaw the wood. It would be necessary to put one in a metal cage."

"There is one use we could put that old pile of tin cans to," said Freddie.

"What do you mean?" asked Willie. "Put a bug in each tin can and let it starve?"

"Yes," replied Freddie. "If I got near enough to catch him I would 'lambast' him with a stick and it would beat your method."

"What beats me is the way they live," explained Willie. "They don't live like common folks, but they remind me of those rich people just outside of Waverly. They eat a late breakfast and then eat again in the middle of the afternoon, while the working-man eats three square meals a day. These grasshoppers prefer the tender buds and leaves and remain near the tops of plants from early morning till about ten o'clock; then they leave for the lower portions of the plants and remain there till

about three in the afternoon. During rainy weather and cold nights they remain on or near the ground. They have strong wings but fly very little."

On July Fourth, the neighbors of that section had all gone to the picnic in Millers' grove. There were races, speeches, and fireworks. During the afternoon a number of farmers had gathered under the old elm tree near the well and were talking about the hard times on account of the large numbers of grasshoppers. Most of them believed that it was the worst grasshopper year they had ever seen. William Carnes listened to what they said, and when he began talking it acted on that group of farmers like a whirlwind on a pile of dead leaves. Some walked away in disgust, others stopped and looked at Mr. Carnes in surprise, that such a good man and splendid farmer should talk so. It is well that some stayed, because when evening came some of them had different ideas about farming, and these were better than any they had before.

"There are not enough grasshoppers, and that is what I am sorry about," he said. It was this remark that had that lightning effect on the group. Those who stayed looked at Mr. Carnes and thundered, "What is that ! ! !"

"You fellows make me tired. I can see how the grasshoppers can be terrible pests in the West and South where the country is thinly settled and the

wild and waste lands are not yet brought under cultivation. Right here we are in one of the oldest sections of the country and few people have more than they could handle properly if they would."

A general dispute had arisen by this time, in which everyone wanted to be heard, and it sounded something like the cackling of a flock of geese that had been suddenly disturbed.

"Be still there, gentlemen," called Jim Ferguson. "I have never known a time when Will could not back his judgment, and I bet he can do it this time. In spite of all the grasshoppers, he has made about as good crops as if the grasshoppers had not been here. We all know that he is a farmer in a class by himself, and I want to hear him explain what he means by saying that he wished there had been many more of them."

The group listened, and then quieted in order to give William a chance to explain.

Mr. Carnes continued: "Many of you still farm as the Pilgrims did when they landed in New England nearly three hundred years ago. In early days it was believed that when a boy was not fit for anything else he was the boy to stay on the farm. That time has passed, but maybe you never noticed it. Farming, to-day, requires an entirely different class of men from what it did a hundred years ago. We can no more afford to have a sleepy-head at the

head of a farm than to have a sleeping man at the throttle of the engine of a fast train. Farming is a business which requires education, training, and skill. You do not use foresight. We had a severe grasshopper outbreak last year, and you had every reason to suspect that there would be one this year. You never thought of watching where they laid most of their eggs. You noticed last spring that they first appeared in large numbers in pastures, along hedges, roadsides, and in waste places, but you never tried to do anything to stop them. When they had spread over your crops and destroyed them, you sat down and grumbled about the hard luck and the hard times."

"Now, Will, tell us just what you did this summer to keep those pesky things out of your crops," Jim requested.

"I did many things this summer, Jim," Will explained. "Many of them I expected to do, but equally as many came up unexpectedly. You see a farmer has to watch everything on the place and do what is necessary from time to time, even if he has not planned it that way. I do not farm by rule. So, the first thing I did was to have as little waste land as possible. I watched the grasshoppers last season, and during the winter I knew where they would come from in case of an outbreak. The absence of much of the waste land gave me fewer grass-

hoppers to start with in the spring. I do not leave my stubble and rubbish on the fields in the winter, but I plow them and plant cover-crops on them. I pull the stumps because they are not only wasting land and very inconvenient, but they are among the worst things to offer winter shelter for various pests. Sometimes I cannot do all the plowing I want to do, and then I disk or drill the cover crops between the rows. I do not let my oat and wheat stubble stand after harvest, but disk them and plant the land in peas. This gives me hay, adds nitrogen to the soil, and protects my field from washing and drying. When I see that the grasshoppers are very abundant, I keep myself in readiness, and by the time they advance to the crop I have that crop sprayed. It often is necessary only to spray a strip on that side where the attack will begin. The chief damage is done by the full-grown insects, and we must act while they are still young. I find by experience that whatever you do it is best to do it when they are still young."

"You said spraying; what do you spray?" one asked.

"I use arsenate of lead mainly; some use Paris green; and in some sections they use arsenite of soda made up with water and syrup. The arsenite of soda is cheaper and acts very quickly, but in our moist, warm climate of the South I am afraid to

use it on some crops for fear that it will burn the leaves. Arsenate of lead is safe, and whenever I am in the least in doubt I use it."

"How about London purple?" others asked.

"It is more uncertain as to burning the leaves than Paris green, but I use it sometimes when the grasshoppers are confined to weeds, which I do not mind killing."

"How does it kill the grasshoppers?" some asked.

"It poisons them. All the sprays I mentioned are poisonous and must be handled with care."

"How do you put the spray on?" Jim asked.

"I have a spray pump. I can use it for my orchard or garden and I have a row spraying attachment which I can use in spraying field crops or potatoes."

"If you sprayed meadows or pastures, should you not be afraid of poisoning the stock that eats the grass or hay?" a number of farmers asked.

"For treating meadows or pastures I use the bran mash or grasshopper mixture, made strictly according to directions. On alfalfa I scatter this broadcast. You must not forget the lemon or orange juice, for this helps very much to attract the insects. In small pastures this can be put out on shingles so that it can be removed, for in this way it will not poison cattle. When this happens to be near the home, poultry must be kept in the pen or they will eat it. In the West they use grasshopper catchers

on pastures and on field-crops. I have not used one, but my brother, who lives in Utah, has told me about them and he says 'They sure catch them.'"

"I am going to watch where the grasshoppers stay on my place over winter," said Jim as the company broke up.

"So will I," said several others as they walked down the road.

Johnny Parker had sat throughout the conversation and he took in everything that was said as a sponge takes water. He had not said one word; he did not have time, because he was listening as hard as he could. As he started to go he said to Mr. Carnes, "William, I am coming over to your house the first chance I get to look at your pump."

"All right, Johnny, come over and I will show it to you," Mr. Carnes replied.

CHINCH-BUGS

IT was on a Saturday afternoon in December when five boys of the neighborhood had gathered at the home of Sammy Sprague. The day was lovely — one of those warm, cheerful winter afternoons; the ground was dry and it seemed that everything was just in the right condition for boys to have a good time. While they were playing in the yard Mr. Sprague came and opened the corn-crib to get some corn for the mules. Billy Burnet, who was near the door at that time, did just what any other boy would have done had he been there instead of Billy,— he peeked into the crib. That Billy did that was no sign that he was a bad boy, nor was it a sign of bad manners, but he was a healthy robust boy, full of life, and full of boy-curiosity. Like every other healthy boy he found the world full of interesting things; he was always afraid that something might happen that he would fail to hear or see. For this reason he was continually peeking into, over, and around everything and continually asking questions. Did you ever see a boy like Billy?

When he peeked into Mr. Sprague's corn-crib he said, "Great goshens! you have a lot of corn, Mr. Sprague. Did you make it all on your farm or did you buy some of it?"

"No, my boy," Mr. Sprague answered, "I raised that corn on my farm, and if it had not been for the chinch-bugs I should have more than you see here now. Those beggars surely damaged my corn severely; I judge they ruined nearly one-fourth of my crop." While he was picking up the corn he noticed that Billy was eying him from head to foot with grave, wide open, questioning eyes. When he had stepped through the door again and had fastened it he saw that Billy's eyes were still on him.

Bursting into a laugh he looked at the boy and asked: "Why are you looking me over so gravely, sonny? I am Sam Sprague, your old neighbor, who used to joggle you on his knees when you were a little 'shaver.'"

Billy, without changing his manner, asked, "What did you say damaged your corn?"

By this time the other boys had crowded around, because they had heard Mr. Sprague and Billy talking, and boylike, feared that something interesting might happen without their knowing about it.

"Chinch-bugs," Mr. Sprague replied.

"I never heard of their eating corn," said Billy. "I thought they lived in houses only."

"Haw, haw, haw," Mr. Sprague laughed. "Who ever heard of chinch-bugs in houses?"

The boys had become interested, and were looking for some argument, but Billy could not see anything funny about having his question laughed at, because he was sure that they lived in houses. He turned red in the face and retorted: "Why, Mr. Sprague, you must be joking; just the other day old Aunt Amy was scolding like a guinea because she said that these bugs were all through her house. She was scrubbing her bedsteads with soapsuds so strong that it made my eyes water. She was scolding and scrubbing and sweating to beat the stir, and after watching her awhile I made up my mind that these bugs deserved careful attention. I told her to fumigate with sulphur, and explained to her how my father did it, but she was too angry to listen to any explanations."

"What did she call the bugs?" Mr. Sprague asked.

Billy replied, "She called them chinch-bugs,—well, no, she didn't either; she called them chinchies for short."

Mr. Sprague laughed some more and walked toward the barnyard fence where the feed-troughs were located; the boys followed him.

"Billy," he said, "we are both right, but the trouble is that you are talking about one thing and

I about another. I am talking about chinch-bugs, which are field-bugs, but you are talking about chinchies, which are bedbugs. They are both interesting kinds of bugs, but while yours is merely a sleep and peace-destroyer, mine is a bread-destroyer. If I had my choice, I would rather have your bug in my house than my bug in the cornfield, because I know how to get rid of chinchies but do not know how to control the chinch-bugs."

"Mr. Sprague, do you know that bedbugs carry diseases?" Frank Gates asked.

"I did not know that, Frank; is that so?"

"Yes," all the boys answered; "we learned that in school and since then we would not allow one of those bugs around our house if we knew it was there."

"Well, I guess you are right then, boys," Mr. Sprague answered.

"Talking about the chinch-bugs, are they large enough for one to see them when they are on the corn?" the boys asked.

"They certainly are," Mr. Sprague assured them.

"How do they look?" they asked.

"With their eyes, I reckon," Mr. Sprague answered with a mischievous smile. The boys laughed, but insisted that he describe them. Mr. Sprague then told them that the full-grown ones were black with whitish wings and the young were reddish and wingless.

By this time Harry Fulmer had become interested. Although Harry was one of those boys who said very little, he was a great favorite with the boys. He had the habit of not talking or asking questions until he had made up his mind what he wanted to find out. He would then ask his questions direct and in a way that could not be mistaken.

(After Webster, *Bur. Ent., U. S. Dept. Agr.*)

FIG. 48. — "That the full-grown ones were black with whitish wings." Enlarged.

"Did you say there were many on your corn last summer, Mr. Sprague?" he asked.

"Yes, plenty of them," Mr. Sprague answered.

(After Webster, *Bur. Ent., U. S. Dept. Agr.*)

FIG. 49. — "While the young were reddish and wingless."

"Did they bother your corn the summer before last?" he asked again.

"Yes, very much. Ever since I can remember they damaged corn once every two or three years, but during the last three years they have been very bad every summer, owing to dry weather."

"Do you expect them next year?" Harry asked.

"I surely do unless we have a wet season."

FIG. 50. — "Unless we have a wet season."

"Where are the bugs now?"

Mr. Sprague laughed, "I do not know, but I reckon they all died last fall or froze to death when we had that cold snap early in December."

"If they are all dead, then I do not see where your bugs can come from next year. If there are to be any bugs next year, then there must surely be

some of them staying somewhere over winter, if what we are taught in school is correct."

"Now, Harry, that looks like good sense to me," Mr. Sprague replied. "Where are the bugs now? Where do you suppose these frail creatures could hide to be able to live through snow, sleet, and ice, such as winter brings? What shelter protects them from the frosty air and biting winds? Now, boys, answer quick."

Every boy looked from one to the other, but no one could answer the question.

"Listen, boys, there will be a farmers' picnic in the grove back of the town hall at Kingston on January 4. I would like to find out where the chinch-bugs stay during the winter, and if you boys can find it out for me I will take all of you in my car and drive you to that meeting; it is twenty-one miles from here."

"Hurrah!" they yelled, and threw their caps high in the air, each boy catching another boy's cap. "We will surely find the bugs," they said.

Ten minutes later, when Mr. Sprague was sitting in the house reading, he missed the noise of the boys' playing. He looked through the window and saw a sight that made a big smile creep over his face. Under the old water oak sat the five boys, each and every one looking as grave as an owl and talking about a subject which, judging from their looks,

they must have thought a very weighty one. Mr. Sprague had entirely forgotten that he had asked them to find the bugs, and also his promise to take them to the farmers' meeting. "Hm, boys will be boys," he murmured to himself, and turned again

FIG. 51. — "Under the old water oak sat the five boys."

to his reading. If he ever recalled his promise and thought that the boys had taken it in jest, as he meant it, he was mistaken. They were holding a powwow for the purpose of devising ways and means for finding out where the chinch-bugs stayed during the winter. They had to go to school during the week, but all of them felt sure that they

could meet under that water oak the following Saturday morning to start for a bug-hunt. It was getting late, and having completed their plans they left for their homes.

On the next Friday morning it was raining, and by noon the air had become so cold that every rain-drop froze to ice. When the boys went to their beds that night they could hear the swishing of the frozen rain among the ice-covered branches of the trees. It did look as if there would be no bug-hunt the next day.

On Saturday morning when they awoke the sleet had stopped, the sky was clear, and the sun was rising in all his splendor. It was a beautiful world, with rainbows glittering on every ice-covered tree and bush. After an early breakfast they started for the water oak. During the week they had interested Mr. Minter, the pastor, in what they were trying to do, and he was waiting for them at the oak tree when they arrived.

They started for Mr. Blakeley's farm because it was the most slovenly looking farm in that section, and they felt sure that it was the best place to look for the chinch bugs. "There is plenty of rubbish on his farm for the bugs to hide under during the winter," they said. When they came to the pasture bottom they found it flooded, with only a narrow ridge of dry land left by which they could reach

the uplands, where they expected to find the bugs. That ridge, however, was held by Jim Blakeley's flock of geese. There were six mean ganders in the flock, and the way they hissed at them led the boys to believe that the geese were determined to defend

FIG. 52. — "There is plenty of rubbish on his farm."

that ridge. It became a question of taking the ridge by storm or retracing their steps and reaching the uplands by a long route. They might have stopped to think it over, but Harry Fulmer had made up his mind, and waving his stick high above his head he called "Charge! ! !" Up the ridge they

rushed like a pack of wolves. The geese, flapping their wings, began a retreat which soon became a rout. They scattered pell-mell off the ridge into the water below and swam away. When the boys reached the uplands they stopped and waited for Mr. Minter. When he came up he said, "Boys, I wish that they had been chinch-bugs."

"We should be heroes then," the boys replied.

"Yes," said Harry, "we should have earned our ride already, for we surely routed them and scouted them, nor lost a single man." The boys all laughed and walked on.

When they came to a wire fence at the edge of a cotton field Sammy exclaimed, "By the way, boys, I nearly forgot something. I have with me here little bottles with dead chinch-bugs in them, one bottle for each of you. The other evening papa happened to recall that he had gathered a lot of them last summer and put them in a bottle. He put them in these small bottles and asked me to give each of you one of them so you would know chinch-bugs when you met them and not make the mistake of taking a chipmunk or a field-mouse for one of them."

With much laughter the boys took the bottles, agreeing that this was very thoughtful of Mr. Sprague. Each boy examined the bugs in his bottle with squinting eyes.

When they had crossed the wire fence they were in a thick growth of bermuda grass. "It looks to me," said Mr. Minter, "as though this would be a good place for them to spend the winter."

"Under the ice?" the boys asked, surprised.

Mr. Minter explained, "There are many tufts of grass here that have not been soaked by the weather and under them the bugs find shelter. Put your sticks into action and make a search."

With the sticks they had cut when they started, they whipped the ice from the tufts of grass, then got down on their hands and knees to make a careful examination. After they had worked on that grass for a while Sammy called that he had found one. They all ran to the spot, and after they had compared the bug which Sammy found with those in their bottles they all agreed that it was a chinch-bug. Not being able to find more there, they crossed another fence into Mr. Blakeley's old corn-field, full of stumps. Around every stump there was a mass of weeds and old dead grass and many of the stumps were covered with loose, shaggy bark. The boys were now happy, for they soon saw that their ride was earned. Under rubbish, matted grass, under stones and in the refuse on the terraces and in the field they found the chinch-bugs in abundance. Willie Foy found a lot of them in the old husks and behind the dried leaf boots of old corn-stalks that

were left in the field. When they had finished this field it was dinner-time, and they found a nice place on the old covered bridge to eat their lunches. They spent the afternoon roaming over a large part of the country, and when they came back to Sammy's

FIG. 53. — "And they found a nice place on the old covered bridge."

home with their bottles full of living chinch-bugs, Mr. Sprague was very much pleased. "You certainly must have found their winter homes," he said with much surprise. "It means that we must clean our fields better in the fall than we have been doing," he said.

Mr. Sprague was so much pleased that he had learned so much about the winter homes of the chinch-bugs that he would never get through talking about it. When he met one of his neighbors he would say, "Do you expect to be bothered with chinch-bugs next year?"

"Yes, unless we should have a wet season," the neighbor would reply.

"Well, let me tell you something," Mr. Sprague would then say; "we do not give enough attention to the cleaning up of our fields in the fall."

Of course the neighbor would then ask, "What has that to do with the chinch-bugs next year?" and laugh, thinking that Mr. Sprague had lost track of the subject.

Mr. Sprague would then explain how the bugs wintered in and about the old rubbish, grass, and refuse of crops left in the field. Nearly every neighbor who listened to this story would, after a little thinking, exclaim, "That looks sensible to me because the worst spots in my fields always appear near stumps, stones, trash, and along terraces."

Mr. Sprague would then call attention to the importance of knowing more about this bug, and urge that they all attend the farmers' meeting at Kingston. "They will have a train there, showing livestock, grains, farm-machinery, and bugs; there will also be speakers," he said. Some would then

say that the speakers at those meetings were book-worms and did not know how to guide a plow. Mr. Sprague would then tell them that most of the men that came as speakers from the Agricultural College had been reared on farms and had learned to plow and to do every other kind of work necessary on the farm. It takes a different man to run the farm. "They have no business to plow now," he would say. "If plowing were their business, they would not know any more about bugs than I. I believe that I am a fairly intelligent man, and what I want is facts; when I have them I can put them into practice as well as anybody, and those fellows who spend their lives studying bugs know the bug facts even if they do not know how to guide a plow. If they spent their time plowing, they could not know so much about their special subjects. They are experts; do you get me?"

In most cases they did get his idea, and nearly every farmer of that neighborhood was at the farmers' meeting. The day was lovely, and the boys enjoyed their ride in the big touring car.

Sure enough, among the speakers was a bugman, and this tickled the boys. When the program had been finished the chairman said that the meeting was open for any questions that any one wished to ask. It was surprising how many questions were asked about bugs, and especially chinch-bugs. The

boys listened closely to all the questions and also to the answers by the speakers.

"I am so glad to see that Mr. Jim Blakeley is here; I did not think that he would come," said Mr. Sprague when the meeting was over.

"He and I were chatting down there in the grove a little while ago. I never saw any man so interested. I asked him how he liked the meeting, and he said that it was fine and that he had learned a number of good things. He seemed to feel satisfied that his old stump-field needed cleaning up, because he was sure, from what was said at the meeting, that it must offer the best kind of shelter for the bugs to pass the winter."

About two weeks after the meeting Mr. Blakeley called at the home of Mr. Sprague. Will Brown, Walter Carey, and Fred Conner happened to call at the same time to spend the evening.

When a few neighbors meet like this to spend a pleasant evening, you know that generally every kind of subject is discussed, but this evening the talk drifted to chinch-bugs, and Will Brown said afterwards that he had never before believed that one could spend so pleasantly an evening talking about bugs. It was Mr. Blakeley who started it, and, in fact, he had come on purpose to talk to Mr. Sprague about this matter.

Mr. Blakeley said, "The last two weeks I have

hardly done anything except clean my fields. I found the bugs all right, and I have a notion that the 'bugfeller' at that meeting knew what he was talking about. He said that when the warm weather came along these bugs would fly away and hunt growing grasses, oats, wheat, and such for food. When they have found it and have settled down they lay eggs which hatch into the little reddish, young bugs that have no wings. Well, he said that they did much less damage in wet seasons; I have noticed that myself, and now, ahem! if we should have rainy spells I reckon I have done all the cleaning for nothing."

"Very likely not," said Mr. Sprague, "because there are other bad insects passing the winter in the same way. Then again, it is like insurance; you never know when your buildings may burn down, but you pay for the insurance just the same. If we only knew beforehand what the weather would be, then we could plan everything just right, couldn't we?"

"Yes, of course," Mr. Blakeley agreed, but continued, "that 'bugfeller' said that three different things could be done. One was the destruction of the winter quarters by cleaning, burning, plowing, and the like. Well, I did that, but the second thing he spoke about was burying. I don't see how that could be done. Bury all the bugs? Piffle!"

The other men could hardly keep from laughing at this. "He did not say burying," Will Brown explained, "but he said barriers. When the wheat and oats are harvested the bugs spread to the corn-fields for food. The young bugs cannot fly and have to crawl, and that is the reason that he suggested barriers between the bugs and the corn. The barrier may be a deep furrow thrown toward the bugs so that they have to climb its steep side before reaching the corn. The furrows can be improved by digging holes with a posthole digger about fifteen or twenty feet apart in the bottom of the furrow. The furrow must be kept clean and in good condition."

"The best barrier, he said, was prepared as follows: around the field where the bugs are, and before they start to travel, make a smooth path and pour upon it a narrow line of road-oil, tar, or creosote. This line the bugs cannot, or will not, cross, provided the line is freshened from time to time. On the side of this line next to where the chinch-bugs are, postholes should be dug about twenty feet apart and from eighteen inches to two feet deep. The mouth of each hole should slope a little and should be so made that it will touch the line of road-oil, tar, or creosote. The material may be poured from a pot with a spout, in a stream about one-half inch thick."

"I understand that," said Mr. Blakeley, "but what was that spray?"

"Sprays have to be used when the corn is attacked by the old bugs as they come from winter quarters and by the young hatching from their eggs; also when somebody has been asleep and let the bugs travel to his corn from another field and has not stopped them with a barrier. He said that a good spray could be made with one-fourth ounce strong tobacco extract, one ounce good laundry soap, and one gallon of water. The tobacco can be omitted if it cannot be obtained. The bugs should all be wet, but care should be taken not to fill the 'curl' at the top of the corn with the spray."

At this moment Sammy came into the room, yawned, and threw himself down in a large chair.

"Sammy," said his father, "didn't that speaker say that there were two kinds of chinch-bugs?"

Sammy had fallen asleep, but woke when his father asked the question and answered with a sleepy "No."

"Well, what did he say?" his father asked, and they listened. From halfway down in slumberland they heard Sammy's voice, and he answered as though he was speaking his piece in school, "He said there were two races of chinch-bugs, the long-winged race having wings as long as the body, and the short-winged race, having the wings much

shorter than the body when full grown. He said that the short-winged form was more inclined to grasses and the long-winged race is chiefly a corn-pest."

"Have you seen both in your bug-hunts around here?" they asked. After waiting some time they heard a faint voice, "All that I have seen were the long-winged."

"How many broods did he say there were during the season, Sammy?" Mr. Sprague asked again.

Sammy's reply was a faint snoring, as if some one was sawing wood about half a mile away. They all laughed with considerable noise, but Sammy kept on snoring and did not hear it.

"I remember he said there were two broods, one in the small grain and the other in the corn," Will Brown answered for Sammy.

Sammy's snoring reminded the men that it was already late, and so they parted for their homes.

The people of the Sprague section had learned something very useful and interesting. They knew the habits and life of the chinch-bug and also the ways for controlling the pest. Some try to use all the methods, and others find that one or the other properly used holds the bugs in check. Mr. Blakeley's farm looks like a different piece of land; he has cleaned up the brier patches and has pulled the stumps, and his fields, which looked so slovenly the

day when the boys stormed the ridge, now look cheerful and prosperous. "If these bugs intend to stay on my farm during the winter, they will surely have to be keen hunters to find a place for shelter," he says.

"We used to think that the chinch-bugs would drive us out of business," Mr. Sprague says, "but it looks now as if we have put the bugs out of business. Not only that, but it has set us to thinking, and we are better farmers than we used to be. Of course, we still have chinch-bugs, but they are much more polite and considerate than they were several years ago."

And all this good work started when Billy Burnet peeked into Mr. Sprague's corn-crib that lovely December afternoon.

THE COTTON ROOT-LOUSE

It was in the spring of the year. The sun was sinking on the western horizon, and trees and bushes cast long shadows over the landscape. Every living thing was hopeful, and the farmers of the Gardner section were more hopeful than usual because the spring weather had been fine; they had all prepared their fields well and had finished their spring plantings. The cotton was just coming up and with the eye, when helped a little by the imagination, one could trace the rows across the fields. Every one of the farmers in that section knew that a cotton-crop well planted in a thoroughly prepared seed-bed was half the battle. Even Si Fletcher, who rarely agreed with anything, said that this was correct, provided good seed was planted.

Joe Gardner was the youngest, most active, and most progressive farmer of the neighborhood, and as he had planted earliest of the other farmers his cotton was the tallest in the community. But Joe stood by the old bars at the edge of the cotton-field this evening and was very angry. Joe's neighbors told him that he was foolish to be so angry about

something that he could not have prevented and to worry about things that he could not change. The truth is that they had noticed nothing wrong with their cotton except that they had very broken stands; they did not think much about it because they said that it had been that way every year as long as they could remember, and that it was natural. When Joe would not agree to this some of the older men said it was because he was so young. "Wait till he is a little older and he will know better," one old neighbor said. His close friends, however, did not talk that way, but shook their heads gravely and said, "Joe does not often make a serious mistake."

Will Gray was, no doubt, the most successful farmer next to Joe, and even he had not been able to see why Joe should be so discouraged.

Joe explained, "I took great pains and did everything I thought ought to be done in preparing my land for this planting and the cotton came up beautifully, but now the stand is broken everywhere. You can find a number of places in some rows where nearly every plant is dead or sickly over a distance of a hundred feet."

"You are grumbling over spilled milk, Joe," said Will.

Just then Bill Green, who lived near the old bridge on a knoll on the south bank of Clear Creek, came along the road and heard the conversation. Bill

was born and reared where he lived and, being over seventy years old, felt that he knew everything that could be known about the country around there. He said to Joe, "I hev' seen it afore and it come all right ag'in."

Joe replied, "I had just a little of it last season, but what there was of it did not come all right again. The little cotton died and stayed dead. This year much of the cotton looks sickly just like that last year, and I am satisfied that it is going to die."

Bill did not like Joe's reply, and with an air of wisdom told Joe that it was the moon. "When the moon changes the cotton will grow, and you will make your crop all right," he said.

Mr. Gardner hesitated, not that Mr. Green's answer satisfied him, but he was big enough to know that the ways of nature are often beyond understanding and that even the wisest and oldest men are often unable to foresee what the results may be.

Sam Drake came along the road, stopped, and joined in the discussion. After the situation had been explained to him he looked at the cotton carefully with, what he proudly believed, knowing eyes. After wrinkling his forehead for a while, he turned to Joe and said: "You made a mistake; I done knew hit and said hit when I come down the road a couple

weeks ago and seen you a-plantin'. I had all my land ready to plant, but I didn't, because the signs weren't right. You planted by the dark of the moon and you shouldn't have done it. That is what I say."

Joe answered that he did not believe that to be the cause of the cotton's dying.

"Hold on here, Joe," Bill interrupted, very much vexed that a youngster like Joe should reject the decision of his old neighbors; "you are going altogether too fast; you are exceedin' the speed-limit; me and Sam here are old farmers and remember the day you was born. We have lived here all our lives, and if we don't know this country then I would like to know who does. Me and Sam have grown as much as forty acres of cotton a year, and we always had enough cotton to sell that we could buy all the corn for meal and we made our own bacon. You are but a young feller and have a heap to learn yet."

Joe replied, "I want more than a little corn bread and bacon if I stay on the farm. Then I don't care how old you men are or how long you have lived here, I do not believe that the moon has anything whatever to do with this cotton's dying. There is some good reason for it, and I am going to find out if I can."

When Bill and Sam drove on they did not look as

if they were laughing, and Joe, paying no further attention to them, started for the home of George Elliott, the farm demonstration agent, and told him the trouble. Joe knew that Sam and Bill did not think very highly of the demonstration agent, "Because," they said, "that fellow is too young to tell us old farmers anything. We knew him when he was a little shaver going to the old field school down by the crossroads. He has lived here all the time, except for a short time when he was to what people call college. No, siree, Georgie has to wait a while before he can teach us anything about farming."

Joe knew that the demonstration agent did not presume to know everything, but he said to himself, "He always has a way of finding out when he does not know."

The farm demonstrator went to the fields and examined the cotton and said, "I do not know what the trouble is, Joe, but I will send some of those plants to the State agent at the agricultural college, who will have one of the experts examine it."

Some of the older men who heard what the demonstrator said looked at each other with a wise smile and remarked, "Didn't I tell you; that demonstrator does not know. He planted by the dark of the moon; that is the trouble, ahem!"

Mr. Elliott wrote his letter and sent the plants, and a few days later he received a report that the plants

had been examined and that the experts found them attacked by root-aphids and that one of the experts would be at the farm of Joe Gardner and would advise any one interested what to do.

The man who came there was an entomologist; that is, he was a man who made a study of insects. Early on that Wednesday morning many farmers, old and young, came to hear what the entomologist had to say. When they first saw him, many of the older men were very much disappointed because he appeared so young. The young entomologist carefully examined the plants. When he could find nothing on the leaves and stalks he took a trowel and drove it into the ground and lifted the plant out, roots and all, together with the soil about the roots. After he had scratched the earth away from the roots with great care, they saw many little bluish, soft-bodied, sucking insects. "What are they?" several of them exclaimed with surprise. "We never saw such bugs on the roots of cotton," others said.

"That is, no doubt, correct," the entomologist answered.

Another farmer exclaimed, "My cotton is dying the same way, and I have examined the roots of many of the plants, but I don't find any of these bugs, so I know that this is not the trouble with my cotton."

"Did you dig up your plants as I did this one?" the entomologist asked.

"Why, no," answered the man, "I did not take time to dig them up; I just pulled them up, examined them, and had done with it."

The entomologist replied. "That is very likely the reason that you did not discover these bugs when you examined the plants. These insects are cotton root-aphids, or what some people call root-lice. They occur mainly on the small feeding roots as you will notice when you look at this plant which I have dug up. You see they have their beaks fastened in the tissues, and when you pull up a cotton plant the little feeding roots are torn off, leaving the aphids in the ground. When a few occur on the main stem they will be pulled off when the plant is drawn through

FIG. 54. — "These insects are cotton root-aphids."

the soil to the surface. If, therefore, you pull a plant instead of digging it up, you may not see the aphids, then you come to the conclusion that the roots are clean. In the way I lifted the plant from the soil, the roots are retained by the plant and will bring the aphids to view if there are any."

At this time Jake Wheeler relieved his mouth of

a load of tobacco juice which he had let unconsciously accumulate while listening to the entomologist, and approaching Bill Green, said in an undertone which was almost a whisper, "Say, Bill, I believe that young fellow knows what he is talking about."

Bill, who had been watching and listening with interest to what the entomologist said and did, removed his corn-cob pipe from his mouth long enough to reply, "He sure does, Jake. In them good clothes, and appearin' young-like, he looked like one of them city fellers, but he sure talks so we can understand him. He sure does."

Joe, who had become greatly interested in what the young entomologist had said, asked, "How in the world did all these aphids get there so early in the season? They certainly could not have been there during the winter because there was nothing green on the fields."

"The habits of these aphids are quite well understood," the entomologist started to explain;

FIG. 55. — "How in the world did all these aphids get there so early in the season?"

"entomologists have worked on what we believe to be the same kind of aphid for many years. Some get to the cotton by flying, as a certain number of them get wings. Most of them are carried by the little ants that you see so abundantly here on the ground."

"Carry them there! carry nothing!" exclaimed old Jack Terrell.

"Don't carry them there? What makes you say that?" the entomologist asked.

"They eat them, and that is just what these ants are good for," Jack answered. "If it wasn't for those ants these little bugs would not let us grow a single stalk of cotton."

"Have you ever seen an ant actually eat an aphid, or, have you at any time seen an ant eat an aphid anywhere?" asked the entomologist.

"No-o-o," Jack replied hesitatingly, as though by reflecting he must recall having seen it; "but," he continued, "I have seen the ants have these lice in their jaws and that is enough, is it not? The ants eat the lice or aphids as you call them, and that is what I say."

"No doubt you have seen them between the jaws of the ants, but if you had watched them long enough your conclusion would have been an entirely different one. Had you watched long enough you would have found the ants, which you believed

were eating the aphids, in the act of carrying them to some desirable food plant. They were not eating the aphids, but they were merely transferring them from a poor food-plant or from their burrows to another or better food-plant, just as the mother cat carries her kittens from one place to another."

Jack stood and stared at the entomologist, with his mouth wide open. Then the entire group of farmers burst into a laugh which angered him.

"Piffle," he exclaimed. "Nonsense! I have been farming all my life and you can't make me believe such a fool thing as that." Thereupon he turned on his heels and went straight home. Just what he said when he arrived home no one has been able to find out exactly.

The entomologist looked serious, and did not know what to think of such a performance, when Joe turned to him and said, "Don't mind him, because when he has a notion you nor anybody else could get him away from it. Go on and tell us more about the ants and aphids. What object has the ant in being so plagued hospitable to the aphids?"

The entomologist continued: "This question of ants attending aphids is an old one and is quite well understood, not only in regard to these particular ants but with others as well. These are known as the corn or cotton-field ants because they are so common and so well known to everybody. They

are so much interested because they enjoy eating the sweet liquid or honey-dew made by the aphids. The ant does not require this honey-dew because it has been shown that she can live without it, but the ant loves it just as a boy loves ice-cream or the mosquito loves blood. The ant is willing to put itself to a great deal of trouble attending the aphids in order to get the honey-dew."

Joe asked, "You say that the aphids are carried there by ants, and when the plant upon which they feed fails they carry the aphids to other and healthier plants, all for the honey-dew?"

"That is correct," he replied.

"Now, then," Joe continued, "this goes on throughout the summer and fall when it is warm and there are growing plants on the field, but what happens when winter comes, when the plants all die and the ground becomes chilled?"

"It does appear as if this might be a serious matter, especially to those who have not studied the ways of ants," the entomologist replied, "but the ants have more foresight than most people are willing to give them credit for. The ants realize that the aphids are the machinery for making honey-dew, and for this reason must be protected. When the food-plants die in the fall the ants invite the aphids to their warm burrows of their own underground homes. The aphids never seem to hesitate in accepting this

invitation and the ants seize them in their strong jaws and carry them to their homes. This is what Jack Terrell saw, and it led him to the conclusion that the ants ate the aphids. In the underground homes of the ants the aphids are at ease. Although ants are somewhat eccentric about who shall, and who shall not, be allowed the liberties and protection of their burrows, yet the aphids are free to visit any chamber. Not only do they enjoy free passes to go where they wish, but the ants even show them every courtesy and no occupant of the ant-home is allowed to molest them."

"How do the aphids get their food during the winter, for they surely have no means of support in the ant-homes?" inquired Will Gray.

The entomologist answered, "Nature has so provided that during this period of indolence, which lasts from two to three weeks, the aphids can fast. In the meantime the ants are very active, scouting the field in every direction in search of desirable food-plants, principally life-everlasting, and as soon as these are located small channels or galleries are constructed about the tender roots; the burrows around the roots of life-everlasting are then connected with the channels of the ant homes by underground passages, and they transfer the aphids to these tender roots undisturbed by frosty air and biting winds. The aphids immediately insert their

beaks into the roots to satisfy their hunger, at the same time making delicious honey-dew which they yield to the ants willingly in pay for coming between them and destruction at the approach of winter. In most cases this arrangement provides sufficient food until the spring plants appear again."

Joe had become excited. "In the spring the ants carry the aphids to the young plants as they come up, do they?" he asked.

(After Forbes.)

FIG. 56. — "The little wingless creatures."

"Well, yes, but there is a faster way," the entomologist explained. "Nature has so endowed the aphids that in the spring when the winter food-plants fail in their supply of sap, the little wingless creatures produce a

large number of winged individuals, which, driven by impulse, leave the homes of their protectors and fly through the air in every direction in search of the sweet juice of the young cotton plants."

"How in the world do the ants find the aphids again after they let them fly away?" Sam Drake asked.

"I was just going to tell you about that," the entomologist replied. "It seems that even before

the aphids acquire wings the ants foresee what is coming, and are very active in the cotton-fields. By the time the aphids reach the fields the ants are there to receive them. The little rogues have already finished the tunnels, and, running in every direction, they discover the aphids and carry them to the roots of the young cotton through the tunnels made for that purpose. Here the aphids find plenty of food and are soon surrounded by little family groups."

"Gentlemen," said Joe Gardner, "this is a treat. I never knew that these little bugs were so wise. Could you tell us what we

(After Forbes.)

FIG. 57. — "And fly through the air in every direction."

might do to prevent them from killing our young cotton? There are plenty of other plants here to which they are welcome. They can have my whole wood-lot pasture over there and I would watch them work whenever I had time. They are cute and hard working little fellows and they are welcome to live on my farm, but I cannot let them have my cotton merely to satisfy their thirsty little throats for honey-dew."

"Put something in the fertilizer," exclaimed Will Gray. "Can't you do that?"

“That is the same old question asked over and over again until it is almost worn out. We have tried everything we could think of, hoping that we might be able to kill them in the soil or drive them away from the plants. Among the many things experimented with none has so far proven effective. We have made up our minds that the only remedy so far known is hard sensible farming. That, we know, does control them.

“The first step is to keep the aphids off the field for at least one year, or, in other words, drive them away from the field.”

“How can you do that?” several exclaimed.

The entomologist continued: “We have studied the food-plants and we know quite well on which plants the aphids can live and also those on which they cannot live. For this reason we keep their food-plants off the field which is to be planted in cotton; this forces them to leave and allows the cotton to get a good start before enough aphids can be brought back to harm the plants. It will never do to let your land, on which you wish to plant cotton, lie idle during the winter, because that gives the wild food-plants a chance to grow on such land, and I have already explained to you how well the ants know how to make use of them.”

“What are some of those wild food-plants you are talking about?” several farmers asked.

"There are a number, but the plants known as life-everlasting are the most important. There is one," and the entomologist pointed to a plant on the ground.

FIG. 58. — "Life-everlasting are the most important."

"What are some of the plants on which they cannot live?" they asked.

"Among our farm crops are oats, rye, barley, wheat, vetch, clover, and peas, and these are all plants which you know well and which you are growing on your farms," the entomologist explained.

"When you plant a heavy cover-crop of one of the

plants on which the aphids cannot feed, the weeds have little chance to grow during the winter. They are cleaning crops because they clean the fields of weeds and aphids. Many farmers call them cover-crops because they will take up the plant-food and hold it so it cannot waste during the winter; they

FIG. 59. — "The weeds have little chance to grow during the winter."

also hold the soil-moisture and keep the soil from washing during heavy rains. You can see how important it is to use these cover-crops even when you have no aphids. Let us take, for example, this farm on which Mr. Gardner grows cotton, corn, and oats as the main crops. Oats planted in the fall keep down the weeds during the winter, and since

the aphids do not feed on oats, the ants would not care to keep them there just to starve. If the ants figure on getting into the field after the oats are harvested they are badly mistaken, because the oats are followed by cowpeas, which is not a food-plant for the aphids. To make matters still worse for the ants and aphids, you follow the cowpeas with oats, rye, vetch, or clover for winter cover; as none of these is a food-plant there will be few aphids on that field by spring. Then is the time to plant the field in cotton."

"Why not plant that field in corn?" one farmer asked.

"Because," answered the entomologist, "there is no crop on the farm that suffers so much from these aphids as cotton, and for that reason you should give cotton the first chance after the field is clean."

"In regard to cultivation," the entomologist continued, "as soon as the cotton is large enough, begin and give it frequent shallow cultivation until the plants have a good start. This cultivation nettles the ants very much because they do not go by sight as you or I do, but they seem to go from one place to another by following trails made before. Just think, Mr. Gardner, if you were an ant and wished to go home you would have to follow some trail you made when you came to the field before, instead of looking and seeing your house and then walking

to it. Should anything have destroyed the trail you would lose your way and be as much nettled as the ant. There! watch that ant crossing from one row to the other," he said, pointing to an ant crawling on the soil; "she does not go in a straight line and doesn't it look as if she is following an old trail? Let us see if there is any sense in my thinking so." The entomologist then rubbed his fingers over the ground in front of the ant, and sure enough, when she came to his finger-mark she stopped and was vexed.

"Now," continued the entomologist, "think of a harrow or some other shallow tool going through this row, how it must confuse the ants and how impossible it must then be for them to care for the aphids. I have often thought how the ants must smile when a farmer does not cultivate as he should. To control this aphid is a case of humbugging an ant. The best way is to rotate crops intelligently, and to give thorough shallow cultivation when the plants are young."

It was now late in the afternoon and the people started for their homes.

Since this meeting in Joe Gardner's cotton-field many of the farmers of that section have greatly improved their lands by intelligently rotating the crops and giving cotton rapid shallow cultivation when it is young. George Elliott, the county demon-

stration agent, is still there, and he says that where the root-aphids used to kill the cotton nearly every spring, they do no damage now. Whenever some one says that the agent is too young, Joe and the other good farmers always reply, "He is doing more good helping the farmers of this county than anybody else. It was he who got the entomologist to come and tell us about the root-aphid, and we now know how to humbug this pest."

Although this happened many years ago the old bars are still there, and whenever Joe passes through them going or coming from the field he recalls with a smile that evening when he stood there so angry because he did not know what was killing his cotton.

WINDFALLS OF CORN

MR. GEORGE WHITNEY lives in the foothills in the northern part of South Carolina. He is now a very old man, but until he was seventy years old he farmed. His farm contains one hundred and forty acres and is known far and wide as the Whitney farm. If you ever visit that neighborhood, you will hear people tell of the wonderful crops that were made on that farm in the days when old man Whitney was young.

One day Frank Sellars and his father started in an automobile to visit Frank's uncle, who lived near Mr. Whitney. About twelve miles from home one of the tires deflated and they had to stop to repair it. It happened directly in front of Ed Cherry's house and Ed came out to talk to Frank's father. When everything was in readiness to go, Frank's father said, "Have you made good crops this year, Ed?"

"Yes, I have had good luck this year," Ed replied.

"Does that field across the road there belong to you?" Mr. Sellars asked, looking at an old cornfield where the stubble were left, at the same time cranking his car.

"No, indeed not," answered Ed with disgust. "If it were mine, it would not be lying there with all the stubble on it; it is a regular breeding cage for windfalls next year."

Calling good-by, Frank and his father drove on.

FIG. 60. — "If it were mine it would not be lying there with all the stubble on it."

Frank was in deep thought, and when they came to a smooth road where his father was not so busy guiding the car, he asked, "What did Ed mean by saying that the stubble-field across the road from his house is a breeding cage for windfalls for next year?"

"I don't know," his father answered, "I have thought about it and wish I had asked him."

Frank continued, "He said if it belonged to him it would not be lying there as it is. It is nearly Christmas time. What do you suppose Ed would do to that field this time of the year?"

"I suppose he meant that he would plow it and plant something in it," Mr. Sellars continued, "but he talked as if the field lying there the way it does, made it a breeding-cage; that is what I do not understand."

They arrived at the home of Frank's uncle about noon. After dinner Frank told his uncle what Ed had said about the old corn stubble-field across the road from his house, but his uncle did not seem to know what he could have meant. "In this section we consider it bad practice to leave the corn-stubble on the field over winter — in fact we do not allow our fields to lie bare over winter; we always put cover-crops on. We are satisfied that such fields as the one Ed was talking about make vermin for the following season, but I don't know about wind-falls. It is worth while to think about it, because you know Ed is a smart fellow and a 'crack' farmer," Frank's uncle explained.

Frank's father then spoke up, saying, "I bet old George Whitney knows if anybody around here does."

"He very likely does, but whether he would tell us or not is another question," said Frank's uncle

with a smile. "You know he is a peculiar man," he added.

"Frank," said his father, "you can go and ask Mr. Whitney, if you want to."

"All right," Frank answered, and started down the road to Mr. Whitney's home.

Frank's father and his uncle sat on the front porch watching Frank going down the road. Frank's uncle said, "I am not sure whether the old man will answer his questions; let me see, Frank is twelve years old now and Mr. Whitney has never been much of a man with boys. There is no better farmer for miles, and he would do anything for you in trouble, but he is peculiar. When you ask him a question he may answer it or he may not, or he may give you a good scolding. He and I are good friends, and when he finds out that Frank is my nephew, he may be real nice to him." Mr. Sellars wondered how this visit might come out.

Frank was a bright, cheerful, winning boy, with a smile for every one he met. When he arrived at Mr. Whitney's home a large collie came running towards him, barking; he spoke to the animal and they became friends immediately. Mr. Whitney was sitting on a chopping-block under the lean-to of the old barn.

"Good evening; is this Mr. Whitney?" Frank said.

"That is who I be, sonny," he answered, and his look betrayed his curiosity as to who that boy might be.

The boy spoke again: "That is a lovely big dog you have, Mr. Whitney. I like dogs and he is about the finest fellow I ever saw."

The frankness with which this was said pleased the old man, and he became interested in his young visitor. "Yes," the old man explained, "he is all you say; I raised him myself; he was born in that old kennel you see over there under that tree. His mother came from South Carolina and was as fine a dog as you or anybody else ever saw. What may be your name, sonny?"

"My name is Frank Sellars and my father and I are visiting Fred Collins. Mr. Collins is my uncle," said Frank, wondering in the meantime what the old gentleman meant by saying that the dog came from South Carolina, the State in which he was now living.

"So you be visitin' your uncle Fred Collins. Well, Fred is a mighty fine man and a good neighbor. Have a seat, sonny. Git that box leanin' thar against the tree and bring it over here and set down."

When Frank went for the box he could but admire the tall and stately elm against which the box leaned. When he came back he said, "What a beautiful elm that is, Mr. Whitney. There are none prettier on

the Capitol grounds at Washington. I looked at them last summer when we were visiting there."

Mr. Whitney looked at him and remarked, "So you visited Washington; that must have been nice."

"Yes, it was," said Frank, "and we also had a boat ride to Mt. Vernon, where we visited the tomb of Washington."

"Visited what?" Mr. Whitney asked quickly.

"The tomb of Washington; Washington's grave." Frank repeated.

"Well, well, well, why that is news to me. I did not know he was dead. When did he die?"

Frank, not sure whether this was ignorance or second childhood, answered hesitatingly, "Why, Mr. Whitney, he has been dead a long time."

"That is strange," the old man replied, "I saw a paper only about a month ago and it said that Washington was dressed up for the inauguration. How came you to visit him; do you know him?"

"We visited Uncle John; he is a congressman," Frank replied.

"So be I!" Mr. Whitney asserted emphatically, hitting his right knee with his fist. "I am a congressman and a Wilson man. Them two are the biggest men who ever lived. Even the Americans say so."

Frank thought to himself, "Mr. Whitney may be a very good farmer, that is, he may know how to

make good crops, but I would call him a very ignorant man." He wondered whether there would be any use to ask him about what Ed had said.

Like every boy, Frank was never at a loss for words nor schemes for getting what he wanted.

"Mr. Whitney," he said, "you have a very nice farm. How many acres are in it?"

"One hundred and forty," Mr. Whitney replied promptly. He said nothing more, and Frank saw that a few more well-planned questions might lead to the one he wished to ask.

"You know, Mr. Whitney," Frank continued, "when father and I came down the road this morning we saw several cornfields that had the stubble left on them. I do not see any fields like that on your farm."

"Of course you don't; I never allow it." Mr. Whitney said curtly.

"I have to keep on asking questions to get him to talk," Frank thought. "There was a corn stubble-field across the road from Mr. Ed Cherry's place and if nothing is done don't you think it will breed windfalls?" Frank asked this question not knowing what he meant by it, but he thought it would at least bring him nearer to the question he wished answered.

"Yes, it will; yes, it will," the old man managed to say, but not another word.

"He surely is a hard man to get started, but I am going to try again," he said to himself.

"Isn't it funny, Mr. Whitney, that old stubble left on the field during the winter breeds wind-falls?" Frank asked again.

"Not at all, sonny, not funny at all when you understand it," and again he stopped.

"I do not understand it, Mr. Whitney," Frank

FIG. 61. — "It is a worm that stays in the bottom of the stubble during the winter."

replied; "is it a disease that breeds in the stubble, do you suppose?"

"I suppose nothing about it, sonny," Mr. Whitney replied. "I know what it is. It is a worm that stays in the bottom of the stubble throughout the winter, and in the spring a candle-fly comes from it. In the spring after the corn has a good start these candle-flies lay their eggs on it, and from these eggs come the worms that bore into the corn-stalks.

This, sonny, weakens them, and during heavy winds, or even rains, in July, the stalks break down and the farmers call them windfalls."

Frank looked at the old man with admiration. "Though short, it is one of the best speeches I ever listened to in my life," he said to himself. Just a moment ago Frank had regarded him as the most ignorant man he had ever met, and yet he could in a few well-framed sentences tell what his father and uncle did not know. Mr. Whitney had now become talkative, and he told Frank many things about farming that he had never known and which he felt few people knew. This mountaineer, so ignorant about the country in which he lived, surely understood better than anyone else in that section how to make crops.

Before leaving, Frank said, "Mr. Whitney, if I knew as much about farming as you, I would farm all my life."

"Sonny," said the old man, patting him on the head, "and if I knew as much as you know now I would be twice as good a farmer." Frank stared at him surprised, but the old man continued: "I am an ignorant old man, while you are young and have life and opportunities before you. When I was a boy of your age I had no chances to get an education. I am making a living and pay my honest debts, but I am too ignorant to enjoy life.

My two boys went to college and I know what I missed."

Frank went down the road to his uncle's home in deep study. He told his father and uncle everything Mr. Whitney had said. When he retired to his bed that night he repeated to himself, "And I thought that he was an ignorant man."

When Frank woke up the next morning he knew that he had been dreaming about candle-flies. He dreamt that he had been in the field across the road from Mr. Ed Cherry's house pulling up corn-stubble, and that in the bottom of nearly every root he had found a worm. "That was a funny dream," he said.

After breakfast he told his father that he was willing to give everything Santa would bring him if he could go into the stubble-field he dreamt about, and examine the roots. "I don't see any stubble-fields around here," he said.

Uncle Fred down by the shed had heard Frank, and called, "No, Frank, you won't see any near here because Mr. Whitney has folks trained around here not to allow stubble on the fields during the winter, but Sam Hoyt down by the river takes no notice of it, and if you go to his place he will show you all the stubble you want to see. Sam is a nice fellow, but he does not believe what Mr. Whitney says about the stubble causing windfalls. If you find any of those worms on his place, I wish you

would show them to him, and maybe he will then do something about it. His farm is only about a half mile beyond those woods. You follow the main trail, starting at the bars, and when you come out at the other side of the woods you will see a white house and an old log-barn. That is his place."

Frank started, and soon arrived at Mr. Hoyt's home. He told Mr. Hoyt his name, where he came from, and what he came for.

"Haw, haw, haw, haw," Mr. Hoyt laughed. The laugh was so hearty and the face of the big fat man so good-natured that before Frank knew it he was laughing with him, as hard as he could.

"Sure, you can examine my stubble," Mr. Hoyt continued, "but if you can find the windfalls in them, then you are a good one. You seem to have gotten some of old man Whitney's notions; haw, haw, haw."

Frank and Sam went to the field and pulled the first stubble they came to. Frank split it with his pocket-knife, and there were two large, yellowish worms in the root. "Great Tecumseh!" Mr. Hoyt exclaimed, and stared at the worms a long time. Frank kept on pulling and splitting stubble, and in nearly every one he found one or two worms and in some even three. He explained to Mr. Hoyt what Mr. Whitney had told him about these worms making candle-flies, and Sam answered with a loud

'guffaw,' and said, "The old gentleman dreamt that or maybe he read some fool story somewhere."

Frank tied together all the stubble he had pulled and split and started for home. When he was almost in the center of the forest on the old trail he suddenly stopped and said to himself: "I am calling these bugs by the wrong name. I remember now in our reader in school it says that young insects are larvæ and that the young of butterflies and moths are called caterpillars. I recall that my teacher told us not to call them worms. All right, I am glad that I remembered that, and so I will call them larvæ or caterpillars after this."

When he returned he said to his father and uncle, "I have the caterpillars, or worms, as Mr. Whitney calls them. He was right so far, and I am going to find out whether they will make candle-flies. I am going to bury the roots of the stubble in that old flower-bed and put a mosquito net over them so that the chickens will not scratch them up."

"I have a big box here with a wire screen on it. I used to keep hens in it. You can turn that over them; it beats mosquito netting," his uncle said.

"What are you going to do with them when we go back home?" his father asked.

"I will take them with me and bury them at home," Frank replied.

"All right, I have window-screening that you can use," his father said.

When they started back home Frank had his corn-stubble packed in the rear of the car, and when he arrived there he buried them back of the woodshed. Several days afterwards he came and told his father, "Bringing the stubble from Uncle Fred makes me laugh."

"Why?" his father asked.

"Because I can find all I want around here," he answered, and they both laughed.

(After Bur. Ent., U. S. Dept. Agr.)

FIG. 62.— "He found a number of chrysalids."

In the spring when the corn was being planted none of the caterpillars had changed to moths, and this puzzled Frank very much. At last when it seemed to him that he could wait no longer he uncovered the stubble and examined them. To his surprise he found caterpillars in only a few of them, but after a somewhat closer examination he found a number of chrysalids. "You know I scratched my head and wondered what became of some of the caterpillars," he said to his father, "but I understand it now; they are changing to chrysalids or pupæ and that means that they will soon become moths; hurrah!"

He kept on watching, and when the corn was large enough to cultivate they had not yet become moths.

He began to think that something was wrong after all. "I know they are not dead because they wiggle just a little when I handle them," he said.

Corn was about five inches high when his first moth came out, and one by one the others followed. They were of a smoky brownish color. "They must be laying on the corn in the field by this time and I am going to the field to see about it," Frank said. He watched several days; and, seeing no moths, he became discouraged but said nothing to anyone about it.

One evening after sundown his father asked him to get a wrench which he

(After Bur. Ent., U. S. Dept. Agr.)

FIG. 63. — "When his first moth came out."

had left at the far end of the farm. It was about dusk, and Frank walked slowly up the driveway to a certain point, then crossed the cornfield to the place where the wrench had been left. To his delight he discovered some of the moths hovering about the corn. "They are laying eggs now, and I am coming here to-morrow to watch them," he said.

The next morning he came early, and although he stayed till noon he saw not a single moth. He went home disappointed and told his father about it.

His father said, "Maybe they lay their eggs at dusk only."

In the evening Frank went back to the corn-field and, sure enough, the moths were there. He marked the places on every stalk where he had seen a moth, and the next morning he found the tiny eggs

FIG. 64. — "I do not understand how the rows of holes get into those leaves."

on the leaves. After a few days the eggs hatched and the little caterpillars crawled down the blades of corn into the bud. He noticed that they ate small holes into the buds, and when later those leaves unfolded there were rows of round or irregular holes across them.

"I do not understand how the rows of holes get in those leaves," Frank said.

"That is quite simple," his father answered, and then rolled up a piece of paper and punched one hole through it with his lead pencil, and when he unfolded the paper there was a row of holes. His father then explained, "The young corn bud consists of leaves folded up, and if you make a hole through

the bud as the caterpillars do, a row of holes will show when the little leaves unfold."

When the caterpillars were about half grown, they left the bud, traveled down the stalk, and ate into it near the ground. When they became full-grown

FIG. 65. — "Left the stalks through the openings they had cut."

each cut a round opening through the outer wall of the stalk, and after plugging it with chewed pith from the inside, crawled to a small chamber prepared in the pith and transformed to a chrysalis. About two weeks later the moths came from the

chrysalids or pupæ and left the stalks through the openings they had cut and so carefully plugged when they were caterpillars.

When the corn was tall enough to tassel and silk, the moths laid eggs on the bottom leaves. The little larvæ bored into the stalk, and like their ancestors, chewed the pith. When the summer winds were blowing Frank noticed that many stalks had been burrowed so that they broke off near the soil.

"Now I know what windfalls are. I wish every farmer knew what caused them." He then went to his father and asked, "Won't the windfalls make corn?"

"No," his father replied, "the milky corn on the windfalls sours and rots."

The larvæ kept on growing in the fallen stalks or in the stubble, and when winter began, unlike their parents, they bored to the tip of the root and there they stayed during the winter, undisturbed by snow, sleet, or wintry winds. The following spring they changed to pupæ, and two weeks later the smoky brown moths appeared to lay their eggs on the new corn-plants.

Frank said that he counted as many as a dozen larvæ in a single stalk of corn.

"That is nothing," John Drake retorted; "I have seen as many as fifty holes in a stalk."

Frank answered, "That is because they some-

times come out of the stalk and go in at another place; so there may often be more holes than larvæ."

John, looking at the larvæ Frank had in his hand, said: "Those are not the same kind that work in my corn during the summer. They look different."

FIG. 66. — "In summer and early fall they are white dotted with black."

Frank explained to him, "In summer and early fall they are white, dotted with black, but when winter comes they change to a cream yellow color, and this leads some people to believe that they are different caterpillars."

FIG. 67. — "But when winter comes they change to a cream yellow."

"I want to know how to kill them," John said.

"We ought to do as they do in the Whitney section," said Frank. "All the farmers around there destroy the corn stubble in the fall. They never

allow them to stay in the fields over winter because they say that they breed windfalls."

"How do they destroy them, do you know?" John asked.

"There are several ways," Frank answered.

"Some harvest the corn, then plow out stalk, root and all, rake it in heaps and burn. Others plow out the stubble, rake them and haul them to the barnyard. Then again some farmers just plow them up and let them lie on the surface. Mr. Whitney, one of the best farmers living in that section, plows his stubble under with a large disk plow and then sows oats and vetch on the land. He says it is the proper thing to do, not only to prevent windfalls but to destroy many other pests as well. He says that his way of sowing the land for winter keeps the soil in good condition because it holds moisture better, does not wash away, and holds the plant-food. 'Always plow your corn and cotton land deep in the fall and sow a cover-crop. If you cannot do the deep plowing, sow the cover anyway, and never let your corn-stubble stay on the field.'

"Mr. Whitney. says, 'Because they do these things in the Whitney section they have no trouble with windfalls.' The farmers around there work together and Mr. Whitney says 'That is what counts.' "

The following year all the farmers in Frank's neighborhood agreed not to leave the stubble on the cornfields over winter, and the next year they had very few windfalls.

One day when Frank was visiting his uncle Fred, Mr. Whitney came in and he and Frank had a long

conversation about good farming. When they parted Frank asked him, "How did you know so much about the worms that make windfalls?"

Mr. Whitney replied, "Some years ago I got a bulletin from Washington; I studied it and it has helped me very much."

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