THE BATTLE WITH THE BUGS By BERT E. POWELL

dERE is an underworld not invaded by novelist or play-Yet in it occur strange and often subtle dramas of survival and destruction. Nor is it a noiseless underworld. Every evening after a hot sunset it forms an orchestra which shrills out its prowess and flaunts

its coming achievement. And in all the world there is no orchestra so well paid. To be sure It gets little in the matter of attention, but in ways more substantial it is rewarded handsomely. For it is permitted to levy toll upon the corn and the wheat, the cabbage and the apple, as they grow. It is allowed to eat the profits of the miller and the grain dealer. Certain members of the shrilling tribe go farther and demand greater concessions in their greed. Not satisfied with money tribute, they exact human lives. Their gruesome tracks are made upon the faces of little children. Then from places where poverty forces women and babies into filth and sickness, they take wing and they bear their death message into homes fair and clean-homes where the inmates cannot concern themselves with life's wretched ones. And so nature in her inexorable circle from which neither the proudest nor the poorest can escape, herself supplies the link which brings the miserable home to the fair one.

But reducing it to a dollars and cents basis which all of us understand, what would you say the insects of this country cost us each year? Millions of dollars! More in fact than our entire system of public school education, from the kindergarten to the univer-

Moreover whole sections intended by nature for the production of particular crops often are compelled to ahandon them for no other reason than insect infestation. This is especially true of horticulture. Myriad, indeed, are the insect foes that infest vegetables and fruit. If ever the life of this underworld is brought upon the stage as that of the barnyard has been, it may well open with this plaint of the truck grower:

The inserts are busy in clover and grass. A-hatchin' out sorrer fer my garden sass, They're happely hummin' this giddy re-The old mule will still be your airy-o-

Now the farmer has found himself helpless before this foe which must be fought with microscopes and laboratory mysteries. Consequently he has appealed to the man of science whom everyone despises in the day of prosperity and rushes to consult when

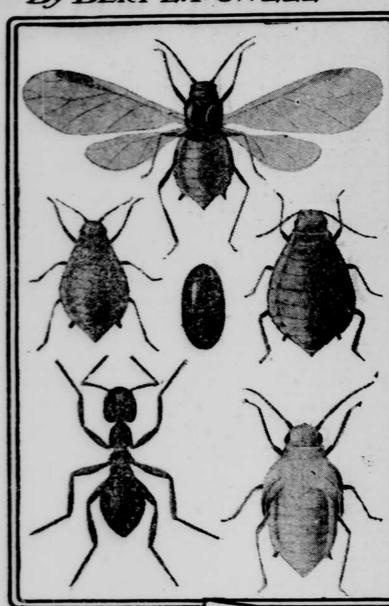
the world is awry. Let me tell you of what has been accomplished by one man with a microscope. His name is Stephen A. Forbes and he is state entomologist of Illinois. His chief work in this position is to exterminate "economic insects," as those which damage the growing things are called. He is also head of the fessor of entomology in the University of Illinois. He has held these offices 25 years. which means that he has spent a quarter of a century fighting the predaceous instincts of economic insects, barring an occasional short lapse to fight the economical instincts of state legislatures. Naturally he is on intimate

terms with a vast number of bugs. For a practical knowledge of an insect, the ability to recognize it in all its phases is a mere beginning. Its dietary must be known, not only what it prefers but what it likes next best and what it will eat to escape starvation; how the weather affects its health, its temper, and its power of multiplying; is it subject to contagious diseases? If so, how may it be induced to catch one? Also it is well to know how its neighbor bugs regard it. Whether the sight of it arouses the instinct to protect or the instinct to kill. For there are bugs so kindly disposed toward other bugs that they will carry them to their food supply, hatch their eggs for them, and bring up their offspring. The sole duties they leave to those they protect are breathing, eating and multi-

First let me tell you about the fight against the chinch bug. As everyone knows, the chinch is a devil-devastator whose evil intentions are backed with energy and resourcefulness. When it starts to take what it wants from the farm there is just one thing it leaves-the mortgage. For more than a generation scientists in all parts of the country directed their intelligence against its instinct; and instinct won the victory. It seemed that reason could not fathom the cause of the outbreaks nor find a way to prevent them. In despair the men of science were for saving-as did the old Irish woman of the rain that spoiled her potatoes, There's no raison in it, it's just the will of

And right there it seemed the problem would have to rest. But an occasional persistent brain was unable to accept this solution. Observations went on not only week by week but day by day, and often even hour by hour. Even so it was a work that proceeded slowly. The chinch bug was hard to make rules for. Indeed, it seemed more an exception to rule than the French language. For finstance, scientists flattered themselves that one thing was proved concerning his chinchship viz., the abandonment of wheat culture meant an end to chinch bug ravages. But farmers made the sad discovery, quite unintentionally, you may be sure, not at all for the sake of enlightening the men of science, that the abandonment of wheat may even increase the chinch devastation. For if they have become numerous and can find no wheat, they will accept outs, burley, grass or corn. The abanconnect of wheat to be effective against the chinch, must take place at the beginning of

Therefore Dr. Forbes straightened his mortarboard, polished his microscope and prepared for wholesale slaughter. He was going to wade deep, not in gore but in bug juice. The



CORN ROOT APHIS AND ITS ATTENDANT ANT : Winged Female, Two Wingless Females, Egy and Pupa of Aphis, and Worker Ant.

first plan was to present the chinch with a contagious disease. It had been observed that it was subject to a fungous disease similar to that of the common house fly, which left the dead covered with a white mould. Why not spread it? It tried upon the was university fields and the bugs took it most obligingly and most successfully. Before it could be considered more than an experiment, however, it was necessary to try it on a larger scale.

Consequently letters were sent among the ering the way to conquer a pair of these farmers, asking for boxes of sound bugs. These bugs were to be given the disease and returned with directions for spreading it. The response was surprisingly immediate. Boxes of bugs poured into the express offices and yet more boxes of bugs. Farmers from neighboring states beard of the offer and they, too, went bug hunting. The express companies worked overtime. The assistants in the entomologist's office became mere undertakers for bugdom. The mouldy bugs were sent out on their beneficent mission of destruction. Then the results came in. They varied; they did, indeed. Some thought the entire entomologist's office should be fitted out with a golden, glorious halo as the rescuer of its country; others alas! thought a fool's cap would fit the case more exactly.

White Grub in its

Egg, Grub and Pur .

Four Stages : June Reetle.

But although the disease project could not be called a complete success, means were found which make it possible to raise grain even in the very worst of the chinch outbreaks. The barrier methods and sprays with a kerosene emulsion will catch them every Just after harvest the scarcity of food in the wheat fields arouses in the chinch an instinct to migrate. On foot it sets out to get an appetite for corn. This is the time to make a ridge beween the infested field and the field the chinch desires to infest. This is done by plowing a backward furrow which is packed with a light roller or by hand and has a line of tar poured upon it from a can with a tubular spout. Post holes are dug at intervals of about twenty feet. By keeping the tar line fresh his chinchship cannot cross, but will follow it to the posthole, into which he speedily tumbles. It then is merely pleasant recreation for the farmer to travel out and pour a weak solution of kerosene upon his accumulated enemies. Kerosene is an excellent death dealer for these pests. When they get into the cornfields the farmers of Illinois sally forth with an emulsion containing four per cent. of kerosene and half as much whale oil soap mixed by five minutes simple beating with a stick. This is flirted by hand upon the corn in the cool of the day when the insects feed most thoroughly and when there is less danger of injury to the corn. Sometimes a single application does the work; when the infestation is very bad two and even three may be required.

Now let us talk about corn exclusively for a while. With that staple at its present price and with the grave gentlemen who produce statistics as hens produce eggs-the louder the cackling, the smaller the statistic-assuring us that it is on its lofty perch to stay, it seems that the farmer will have to cultivate automobiles and bad habits as obesity cures for his bank account. But, halt! Nature provides several. There is the weather, more exasperating and with less regard for a poor



Corn Bill-Bugs, Grub of same and Corn Plant showing Bill-Bug injury.

man's purse than a visit, there is the fretful soil which gets sour like a colicky baare sturdy, hun-Over two huntack corn, forty capable of doing notable damage. It is in discov-

precious rascals that Dr. Forbes has made his most valuable single contribution to science. They are the corn field ant and the corn root-aphis or, as it is better known, the corn root louse. For a long time they were the particular scourge of the corn grower who supposed that they operated each on its own account. Through the research of Dr. Forbes it is now known that one is helpless without the other. The resourceful and industrious ant is entirely unable to extract the coveted sap from the corn root, and the stupid aphis would, if left to itself, starve in the very presence of the corn. But the ant can carry the aphis to the corn root and deposit it thereupon; the aphis can extract the sap and then exude it, thus passing it on to the ant. Therefore it was not a problem of exterminating two foes but of outwitting the clever little ant. Were it banished, the aphis would soon disappear. The wretched little soft-bodied hunk o' creation can do nothing for itself except lay eggs and suck corn sap. The ant gives it a home in its own burrows, hatches its eggs for it, carrying them to the warm surface if they are slow, bearing them farther into the ground if they threaten to hatch before its food supply is ready. And this protection extends through the anhis' life. If, because of plowing or other inadvertence, the ant finds its charges scattered, it will cheerfully collect them and reconstruct its home if that has been molested also. The ant has nothing else to do and it is as active as an outraged Puritan conscience. However, methods of control have been found. The use of the disk and crop rotation will exterminate them. The root-aphis refuses entirely to occupy ground planted to oats, so this crop is of the greatest importance in clearing fields of them. Also by disking two or three times with a 20-inch disk in spring, especially on a sunny day when the ants are likely to have their charges near the surface, they will be killed and scattered and their nests so broken up that even the enthusiastic little ant cannot reconstruct the colony.

Another enemy of the corn that Dr. Forbes has caught by cultivation is the bill bug, as certain beetles are called because of their long, hard snouts, which they poke into the farmer's business to ruin it. This time the cultivation must be with the plow instead of the disk and in the autumn instead of spring and in the fields of grass where the bill bugs breed. These bugs are distinguished by a belligerency which is only equaled by their strength of claw. One variety appeared in Illinois which looked so large to the harassed farmers that it was christened "elephant bug." Chickens turned isto the fields to feast upon them fled in flapping, comical flight, unable to relieve their terrified souls by a squawk, as their bills were ilchtly held together by the As for sprays, the bugs throve upon Dr. Forbes had his assistants in the fields before was found that plowing the infested grass in the autumn would practically do away with the pest. Of all the foes which the agricultu-

encircling claws of

what were meant to

be their banquets.

rist must fight, none presents a more difficult problem than the white grub. For one thing, there are many species. Illinois has about thirtv-differing in habits, but all endowed with an original and hard working brand of natural cussedness They attack plants at the roots, and it is not at all uncommon to find whole acres of grass

be rolled up like a carpet. By preference they rich relatives on devastate grass, but if the supply is scant, they are willing to ruin small grain, corn, strawberry plantations, woodlands, and, indeed, many other situations. They are especially difficult to combat because the life history is hard to follow by, and there from the first to the last stage. Only a single specimen has been bred from the egg to the beetle and its life cycle occupied three years. So far the best remedy has been found to dred of these at- be in cropping, especially in planting the infested ground to clover. Well-known enemies deal of work has been done by exper-

> crows and crow blackbirds. Occasionally a farmer notices that a field side on its own merits and relief which has been brown from a grub ravage be sought through the most promising comes green and alive. He is inclined to think channel. it a clear case of the Lord remembering the One of the favorite remedies is arrighteous; as a matter of fact another insect senic bran mash. This is made by has appeared and is working out another set mixing one pound of white arsenic of instincts. This is the Tiphia, a member of with 25 pounds of bran. The arthe solitary wasp family. It stings the grub senic is so near the color of the into submission and then glues to its thick hide flour in the bran that it is not easy to an egg which in a few days hatches into a tell when the mixing is well done. To

Trees, both those in natural forests and those which have been planted, "noble and those which have been planted, "noble and those which have been planted, "noble and those which have been planted, between the planted and those water. Put in just enough to make the fattening hog should not be althose which have been planted, to quote Dr. water. Fut in just enough to make helpless products of nature," to quote Dr. the particles stick together. This lowed to root, as the exercise consightly death through insect infestation. Have you never late in May or in June noticed upon shade trees little wads of cotton? Each wad, you will see, if you look, projects from a brown cap, which is the female maple scale. It is a native insect parasite of the soft maple. It will infest, besides the maple, the linden, box elder, elm and honey locust. These cotton wads are the soft bed in which the careful female lays her eggs, and each female can be relied upon to deposit something like 3,000 eggs in her own particular little wad. Dr. Forbes found after considerable experiment that a kerosene emulsion was effective in disposing of these pests. A 20 per cent. emulsion could be used in winter if the roots of the trees were protected, and a 10 per cent, in summer. It is made by dissolving one pound of common soap in one gallon of water by boiling. This is removed from the fire and two gallons of kerosene poured in. With a spray pump the mixture is then forced back into itself for about five minutes, when it will look like a thick cream, and no longer separates on standing. Seventeen gallons of water from a bulletin of the Ontario De low for this purpose, hence during the added to the three gallons thus prepared will partment of Agriculture and shows early months of growth the water give a 10 per cent. solution. The cost will how the water table of the soil de stands as indicated by the dotted line be 4.3 cents a gallon and three or four gallons pends on the location of drains. If in AXB. Consequently root development will save a large tree from destruction.

Doubtless you have noticed upon the apples deep a number of holes are dug it not enough. There are two ways to you brought home in a paper bag and those would be observed after a heavy rain remedy the defect, either to dig A that fell from your own cherished tree a crescent mark. This means that a busy little curculio water would remain. In the hole sit- half way between has had its beak in your apple before you and uated half-way between the drains at has probably laid an egg at the sign of the C would hold considerable water for crescent curculios. A spray compound of 121/2 a few days. ounces of acetate of lead and four ounces of arsenate of soda to fifty gallons of water, if used three or four times, will catch practically all these orchard destroyers.

Among the insects injurious to health the amon houseffy takes first rank. Dr. Forbes has found that 75 per cent. of the common houseflies breed in horse manure. As the remedies that will kill the housefly maggots are too dangerous to be used in stables, except boiling water, which is hardly practicable, the only protection seems to be in screening stables against fies as we do our houses and in careful

> Proof Positive. Blox-Theorists are fools.

mental, and as I said before I repeat

Knox-Then we will let it go

WAGON BED CONVERTED INTO DIFFERENT USES

Agriculturist Has Often Found It Hardship to Be Obliged to Buy or Build Number of Vehicles Required on Farm.

for carrying live stock, and with equal service.

A convertible wagon bed which can | The agriculturist has often found it be changed into 15 different kinds of a hardship to be obliged to buy or build bodies for different uses around a a number of wagons for the multifarifarm, without adding to it or taking ous requirements incident to the opfrom it a single piece, has been de- eration of a farm. The wagon that signed and is undoubtedly the most could serve to carry boxes or crated radical improvement made in farm vegetables and berries to market wagons for a decade, says Popular Me would not be of any use when having time came around. When it was neces-In a few minutes it can be trans- sary to carry calves or live stock, still formed from a hay rack into a wagon another wagon must be called into

quickness it can be converted into a While reapers, threshers, and other rehicle for carrying a large number of farm implements have been continually passengers who can be provided with improved, the farm wagon has re-







picnicking, etc.

comfortable seats along the sides for | mained practically at a standstill. Perhaps the fact that the automobile has The remarkable versatility of the made such wonderful progress has new wagon bed is secured by hinged served to overshadow the humble beast malleable iron pieces attached to the of burden and his reliable wagon. Old sides. These support two folding sec Dobbin may be a second rater now, tions on each side. The strain which but he will continue for some time to is put upon these pieces when heavy fill his particular sphere of endeavor loads are placed on the wagon makes with a faithfulness which the moit imperative that they should be of | tor car cannot always be relied upon to give.

whole acres of grass where the sod can RIDDING FARM OF GRASSHOPPER

Favorite Remedy, Recommended By Colorado Agricultural College Is Arsenic Bran Mash.

strong, dependable material.

(By S. ARTHUR JOHNSON, Colorade Agricultural College.)

spite of the fact that a great of the white grub also are the festive porker, iment stations on grasshoppers, no which will dig a foot for a nice fat one, and royal road to control has yet been found. Each attack has to be con-

veritable vampire. It sucks from its host its overcome this difficulty, the arsenic

tle dry paint.

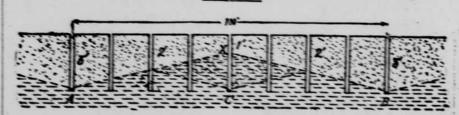
the grasshoppers are thickest. If the insects are invading a garden or potato patch, it is well to scatter the bran mash about the borders. In the fields of alfalfa or grain, the bran should be scattered where the grasshoppers congregate on ditch banks and dry places. All the insects will not find and eat it, but many will and often the crop can be fairly well protected. The writer has never used this preparation against young grasshoppers, but some farmers state that the crops may be completely protected by its use, while others claim that they will not eat it.

Of course, it will not do to scatter his substance where chickens will be likely to pick it up, and none of the mixture must be left where domestic animals are apt to get it or be fed from the vessel.

Good Exercise.

There is no harm in pigs rooting if they are in a field where rooting will do no harm. Pigs can secure much life juices, leaving the shell to crumble back may first be collected by adding a lit. feed by rooting and the exercise will do them good. Where troublesome mixture should be scattered where sumes too much feed and energy.

TILE DRAINS IN CLAY SOIL



350 = dreined soil Be - undrained soil

es a soil undrained when drains are IN feet apart, but drained when they are 50 feet apart

a field that is underdrained three feet is hampered at X, as 1 foot of soil is

In a clay in fairly good condition it will be found that the slope of the the world were to become birdless, in water table is about 1 foot in 25, in nine years' time man could no longer loam 1 foot in about 33. The illus- inhabit it. This seems a very sweep. tration represents a clay soil with ing statement at first glance, but drains A and B 100 feet apart. Wells when we come to reflect upon the are dug 12.5 feet apart. At the end matter we find that it is doubtless a of 48 hours after a heavy rain the true one. Insects and slugs would water will stand about as indicated multiply so fast, notwithstanding all by zig-zag lines, in a gradient of about the sprays and poisons that could be 1 in 25, and hence will be two feet ranufactured to annihilate them, that deeper in the centre well than at either drain. Hence if the drains are ests and crops. The land would be three feet deep there will be three come one vast desert. feet of drained soil over A and B, but only one foot at X. Capillarity and important part in holding the water highest half way between the drains. now, that when I need one I shall put and the gradient 1 in 25 represents it on fearlessly and show the scoffers their combined strength in clay. that I am above such small prejulence after this gradient is reached a general way it is well known that a drainage becomes very, very slow, and farm can be made to pay, and pay the water table stands in this irregu- well, but throughout the length and lar shape until lowered by evaporation

The illustration shown herewith is evaporation, none is drawn from be-

Value of Birds.

A French naturalist asserts that if

Farm Problems

The main problem of agriculture is to show how a farm may be made to pay a reasonable return on the investment and on the labor performed. In breadth of the country there is a woefrom the soil and plants. But during ful lack of knowledge of the existing the months of April, May and some cost and value of production such as times June, when the rains supply at would throw the average business the surface all the water needed for man into despair.

Would Surely Wear A Wig

That is, of Course, When He Needed One, But He Was in No Hurry to Begin Practise.

man, who was not quite as hald as he to do so, and by the same token false

only the correct thing to wear false "When I was young," said an elderly teeth, when necessary, but foolish not pain.

so do they. However, when I was about forty my hair began to thin out little thin enough yet for a wig. Of course, by little, and so quietly that I scarce if I were as baid as some of my friends comes to a man without any physical

to answer the description. I used to finger of scorn and ridicule should not but I did not get one. Somehow or other I didn't think I needed it. There at one, but why wear it unless one that some was not enough to comb, but the brush actually needs it? I don't know why that.

It did to several others of my ac- could still get hold, and I used the wigs are held in such bad repute, for soil resistance to water flow play an quaintances, and I think so yet, and brush exclusively. Now I am sixty they are not only useful but ornaand my hair is still thinner, but not stitute the lost growth with an approly knew it was going. That is the one redeeming trait of baldness, it one redeeming trait of baldness, it are I would not hesitate, but I am not. cessity, and if I do, you may rest assured I will render nature all the assist "By the time I was fifty a wig would ance in my power. A wig is all right for might have been, but still bald enough hair was as correct, and that the have hidden considerable lack of hair, any one who needs it, and far be it

dices.' Knox-Is that your theory.