

The Rocky Mountain Locust.

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The Red River Valley, all the way from Wilkin county to Kittson county, is suffering from an attack of grasshoppers. The Rocky Mountain Locust, or grasshopper, is very generally present, especially in the southern part of the valley. Much damage, however, is being done in some localities where this species is not present. The distribution over this region is quite general, though the grasshoppers are much worse in spots. At Moorhead and Ada they are present in numbers sufficient to do great damage if conditions favor their work. Fortunately the farmers have been assisted in their work of combatting the insects by two important conditions; one is the cool weather which has restricted the activities and dampened the ardour of the grasshoppers; the other is that the grasshoppers are quite generally parasitized by red mites which attach themselves to the animal's wings or to the back beneath the wings and there thrive on the substance of the hopper beyond the

influence of the weather. In some situations, however, the grasshoppers have cleaned up many acres of young wheat, flax and potatoes. Since the rains many of these fields are recovering, but others are still suffering severe trimming at the edges. It is not uncommon to see great fields as bare as they were before the seed was sown. As a general thing, however, the grasshoppers have been more of a menace and an annoyance than a veritable scourge, but all must admit that the possibilities of the situation are immense, and that it is worthy of the most vigorous treatment.

The damage is mostly being done by two closely related species, the Rocky Mountain Locust and the White Mountain Locust. Both are migratory; both are destructive, and both may breed in the Red River Valley. They are very much alike in appearance, and it takes an expert to distinguish between the two. The Rocky Mountain Locust is a little the larger, and is said to be the more voracious. The destructive abilities of the White Mountain Locust and of other native grasshoppers is very generally underestimated. Several times in the history of agriculture in Minnesota it has proven to be very destructive, and where favored by weather conditions, may cause great damage. A small flight of grasshoppers was seen last fall to come into Otter Tail county from the west, but almost all of the grasshoppers doing damage in Minnesota this year were bred in Minnesota. Other small swarms probably crossed the state line from the Dakotas, where they breed permanently. The Red River Valley should be regarded as the eastern limit of the breeding ground of this species.

The Rocky Mountain Locust begins egg-laying about the middle of July and usually lays about three egg-clusters at intervals of two or three weeks. The whole egg-laying period extends from the middle of July to the middle of September, though most of the eggs are laid in August. The White Mountain Locust, which is also present in destructive numbers in the Red River Valley, deposits its eggs considerably later in the season than the Rocky Mountain Locust. In fact it

may deposit eggs up to the beginning of cold weather. Hence it is clear that the time to plow with the expectation of preventing the eggs from hatching is late in the fall or early in the spring. The eggs are laid in an orderly arranged mass about $\frac{3}{4}$ of an inch long and $\frac{1}{4}$ of an inch in diameter. The number of eggs laid at one time is somewhat variable, but the number is approximately 30, so that the whole number of eggs laid by one female during the season is in the neighborhood of 90. The female grasshopper prefers firm soil rather than a plowed field in which to lay her eggs, and after laying the eggs in the ground, leaves a hole for the exit of the young.

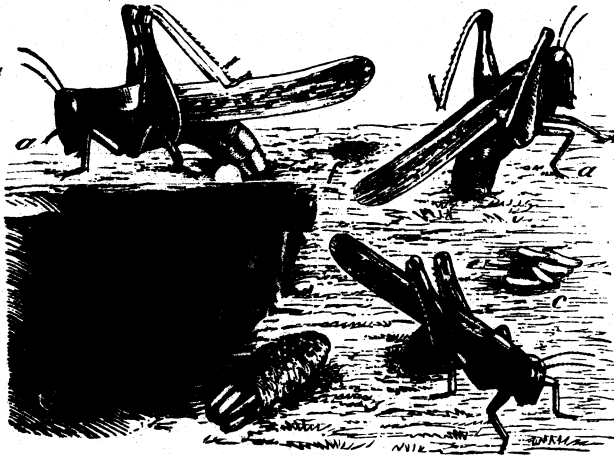


FIG. 1.—Rocky Mountain Locust, in the act of laying eggs. (After Riley.)

Their escape from the soil is a somewhat difficult matter, and if the whole egg-mass and its little exit to the surface are inverted and buried to a depth of five inches, the young locusts find themselves hatched into this world under very discouraging circumstances. Very few, indeed, reach the surface. Fall plowing also breaks up many of the egg-masses and allows them to rot during the winter. Plowing is by far the best remedy we have for the grasshopper difficulty. There is but a single brood of grasshoppers each year, and no mature hoppers live over winter. Hence a single fall plowing insures the destruction of all the grasshoppers present in the land. The

area infested with grasshoppers this year is so great that an inspection, by the State Entomologist, of every field to ascertain whether or not eggs have been deposited and whether plowing is necessary, is quite out of the question. The following recommendations, however, ought to be of value to the farmers.

Both species of grasshoppers doing damage in the Red River Valley this year prefer solid soil in which to lay eggs. Stubble fields are ideal localities for this purpose. *All stubble fields and other cultivated land should be plowed.* Regarding other fields, such as meadows, they may be selected by the grasshoppers as egg-laying grounds especially if the sod be thin. If your neighborhood has been infested with grasshoppers you should carefully examine all your meadows to see if the eggs are present in the surface inch of soil. If in doubt as to whether they are grasshopper eggs send them to the State Entomologist, who will tell you at once. In case they are to be found in your meadow it is best that the sod be turned under. If you cannot afford to lose the pasture, provide yourself, as soon as the eggs are discovered, with hopperdozers with which to catch the young. If you wait till spring to get a hopperdozer you will probably be so busy with seeding that you will be delayed until every one else wants hopperdozers made and further delay is likely to occur, during which the hoppers are eating and spreading. Every Red River Valley farmer should have a hopperdozer on hand anyway so that he may take advantage of every favorable moment to use it. History proves that he is very likely to need one.

During the growing season of crops the method uniformly adopted for combatting the grasshopper has been destruction with hopperdozers. This is the most satisfactory of the many ways that have been tried for preventing damage to the crops. The hopperdozer may be used successfully to catch the very young as well as the winged grasshoppers, and may be run over the grain until it is more than a foot high without break-

ing it down. After the grasshoppers have matured and laid their eggs we have the best chance of all to stamp out the pests. Grasshopper eggs are laid in the surface inch of the soil. By plowing them under to a depth of five inches the whole trouble is ended so far as the next year's brood is concerned for such of the young as hatch the following spring will not be able to reach the surface. By plowing round and round a field just after the grasshoppers have hatched in the spring a great number may be buried in the furrows, especially in the middle of a field where they will be concentrated in a small area.

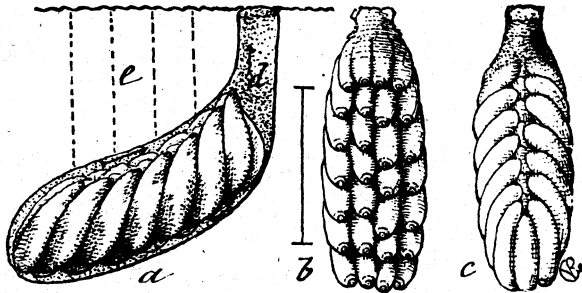


FIG. 2.—Egg-mass of Rocky Mountain Locust—*a*, from the side, within burrow; *b*, from beneath; *c*, from above; enlarged. (After Riley).

Many styles of hopperdozers have been used in different localities, and they differ widely in the effectiveness and the economy with which they perform their work. As the oil is somewhat expensive, it has been found that the most perfect hopperdozer is in the end much the most profitable. The best form seen in use this year is made at Moorhead. It consists of a pan of galvanized iron 20 inches wide, 4 inches high at the back and 3 inches high at the front. Four inches of iron are turned up at the front as at the back, but the front is curved in at the top so as to prevent slopping of the oil when passing over rough ground so that the front of the pan is only 3 inches high. As to length, the pans are made in lengths of 8, 12 and 16 feet. For level country the 16-foot pan is best. Cross partitions are riveted and soldered into the pan to strengthen it and to keep the oil from running

down to one end of the hopperdozer when in use on sloping ground. Two pieces of 1x4 are nailed to the pan, one on each end, and holes are bored in the projecting ends through which to run the rope used in drawing the hopperdozer. A strip of 1x4 is also nailed to the back of the pan to strengthen it. At the back of the pan is a wooden frame two feet high and covered with white oil cloth. The white color of the oil cloth attracts the grasshoppers; they fly against it, and failing to get a foothold fall into the oil below. A very little oil is needed in the pan and this may be made to go a long way by the addition of water. A very slight touch of the oil will eventually kill the grasshopper. Many succeed in jumping out of the pan, probably as many as 90%, but if they once have been in the oil they die in a few minutes. Five gallons of oil is enough to kill all the grasshoppers that one is likely to catch in a 16-ft. hopperdozer during one day. One 16-ft. hopperdozer will cover about 40 acres in a day. As the grasshoppers crawl up the stalks of wheat in the evening, more can be caught in hopperdozers at this time than earlier in the day. This hopperdozer is not provided with runners and sits flat upon the ground. It is light and does not hurt the grain until after it begins to joint. When the grasshoppers are young one horse may draw the hopperdozer, but when they are winged they will fly away from one horse in front of the middle of the pan so two horses are used, hitched, one to each end of the pan. This drives the hoppers towards the middle of the pan.

The whole source of this difficulty is the common practice of summer-fallowing. Western Minnesota will not outgrow its grasshoppers until it abandons this practice. The idea seems to exist that the soil needs a rest after a wheat crop and it is surely true that a stronger straw is produced by land that has been summer-fallowed. Now, just what does this summer-fallowing accomplish? On new land the straw grows so rank that the grain lodges. This is because the soil is so

rich in nitrogen. The virgin soil is too rich in nitrogen to produce the strongest wheat straw. The difficulty is to a measure remedied by summer-fallowing, which from their more stable compounds, liberates all of the so-called essential elements of fertility: nitrogen, potash and **phosphoric acid**. Much nitrogen must escape from the soil through denitrification during this process of the summer-fallowing. This is all wasted. *More humus is lost from the soil during summer-fallowing than is used by the crop.* The phosphoric acid and potash liberated are not lost from the soil to nearly so great an extent. The result is that after the season of **summer fallowing** we have in the soil a greater proportionate amount of phosphoric acid and potash in condition to be used by the crop than is natural to this soil. **Hence it is better for wheat growing.** Now this practice of summer-fallowing is an extravagantly expensive one. You lose the use of the land for a year; you expend an amount of labor about equal to that of preparing the land and planting the crop; you dissipate, in the most reckless fashion, the store of nitrogen in the land which makes the Red River Valley soil one of the most valuable potentially in the United States, and you rear millions of grasshoppers. Instead of turning the grasshopper eggs under in the fall and adding their valuable substance to your land, you allow the grasshoppers to mature and fly away with your crops. Now how else are we to fit this soil for wheat? The problem is an extremely simple one. Raise a crop which demands nitrogen rather than phosphoric acid and potash. Two crops very well suited to this purpose are millet and fodder-corn. The idea that this soil, one of the richest in the world, needs a rest is ridiculous. What it needs is judicious cropping, a system that will draw upon the stock of soil fertility in the proportions in which the various elements become available to plants.

The State Entomologist has been furnishing assistance to the farmers from the funds set aside by the legislature for the purpose of combatting injurious insects. **Though the sum**

appropriated would be insignificant in case of a general outbreak it has been made to cover quite a large territory in the Red River Valley this season. The State Entomologist has made a uniform practice of furnishing kerosene to such farmers as would provide themselves with hopperdozers. The purchase or manufacture of hopperdozers by the farmers is calculated to furnish some assurance that he will use the oil supplied him for the intended purpose. The farmer gets his oil by applying to a county commissioner, selected by the State Entomologist as local agent, for an order upon some dealer in oil with whom special arrangements have been made for furnishing oil to the farmers for this purpose. The farmer signs a promise to use the oil for the killing of grasshoppers by means of the hopperdozers and for no other purpose. Oil has been furnished farmers at various points in the counties of Kittson, Marshall, Polk, Norman, Otter Tail, Clay and Wilkin. In Clay county, where the most serious outbreak exists, the whole community is fighting grasshoppers, and they were caught by hundreds of bushels every day during several weeks. In this county there are enough grasshoppers present to completely destroy the crops and to be a menace another year to the whole state. The farmers of this county have, however, taken hold of the proposition in excellent good spirit, and they have the situation well in hand.

It is hoped that the county commissioners of all the counties in which damage has been done this year will find it possible to arrange for the supervision of the plowing during the autumn of all stubble fields and other ground in which grasshopper eggs have been laid. This is the most general appearance of the Rocky Mountain Locust that has occurred in Minnesota in many years, and the crops of the state must be regarded as in peril until the stubble fields from this year's grain are plowed. We are very much in need of legislation which will make it possible for competent authorities to compel the plowing of fields in which grasshopper eggs have been laid, for they are veritably seeds of trouble.

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