SOME FARM PESTS OF PIONEER TIMES[1]

When the first Iowa settlers tilled their small fields in the midst of a sea of waving grass, they upset an arrangement of life forces long established. The wild creatures fitted by nature for this prairie environment had remained undisturbed for centuries. Some of them were present in large numbers. Individual animals fell victims to their natural enemies, but the various species found conditions favorable for maintaining a balance over long periods. Such life as was present had been in contact with other life of the region for so long as to successfully defend itself from extinction. The rate of increase was sufficient to meet the vicissitudes of the environment and maintain the equilibrium of all, a status quo of nature.

The abundant grass supplied food for grazing animals such as deer, elk, and bison. These in turn provided food for wolves, bears, wildcats, and the Indians. Wolves hung about the herds awaiting an opportunity to drag down the stragglers. Vultures soared overhead ready to devour the refuse when the wolves had satisfied their appetites. Everywhere it was eat or be eaten. Toads devoured the grasshoppers and were eaten in turn by the garter snakes. Snakes were swallowed by the bitterns who must needs be wary to avoid capture by birds of prey.

Wonderful indeed is the balance that nature maintains among her creatures. Species with but few natural enemies increase but slowly, while those, such as the rabbit, which are a prey to many others, increase with a fecundity that would fill the world, were there no check on the output.

[1] This article is an excerpt from a manuscript entitled "The Conquest of the Prairies", by Frank C. Pellett of Atlantic, Iowa.

The coming of the settlers into this animal paradise disarranged things, with the result that for a time there was a great increase in numbers of some species, later to be followed by their destruction or near extinction. The sowing of fields of grain, the planting of gardens, and the coming of pigs, poultry, and cattle brought new elements into this long established natural community and disturbed the equilibrium of nature. Many wild creatures found a new food supply and were quick to take advantage of it. The settlers lacked suitable buildings and fences to protect their crops and livestock and their losses were often serious. Later the increasing number of farms, the turning of the sod on large areas of wild land, and the destruction of the breeding places of wild animals and birds caused many species to vanish entirely from the settled areas, but during the period of transition and at times in later years the farmer found himself in competition with natural forces whose interplay of life he only vaguely understood.

At times, it seemed as though the whole kingdom of nature had combined against the settler and so it had. He was an intruder and he provided new sources of food. An abundant supply always attracts consumers.

Thus it was that the pioneer had to fight for everything he raised. Situated far from markets and depending directly upon the soil and upon his own labor for everything he used, he found it a hard matter to maintain himself until a new balance of the forces of life was formed to meet the conditions which settlement had imposed. As water finds its level so nature sooner or later finds a balance of the creatures that compose her chain of life. But for years the farmer waged a constant and often unsuccessful war on his enemies—insects, birds, and, to a lesser degree, larger animals.

One for the blackbird, one for the crow,
One for the cutworm, and two to grow.

So ran the couplet recited to many a pioneer lad and lassie to impress upon them the importance of dropping five kernels of corn in every hill. Not only did the blackbird, the crow, and the cutworm take toll of the meager crops but many other species did likewise. From the day the seed was planted until the last of the harvest was garnered there was a fight to retain some portion of the crop for food for men and domestic animals. There seemed to be something ready to deprive the settler of the fruits of his labor, no matter what the crop.

No sooner had the corn been planted on the newly turned sod than the ground squirrels, or spermophiles, began digging it up. The five kernels had provided no tribute for them but they took it just the same. They were pretty little creatures, often seen sitting on their haunches beside their burrows and whistling as the corn was dropped. They did render some service also in the destruction of the cutworms and grasshoppers which might have taken their toll.

Many a patch of corn was replanted after the rows could be seen, because of the gaps in the stand where these busy, striped rodents had dug out the seed. The ground squirrels bothered for only a few days, however, for they lost taste for the growing corn.

No sooner did the ground squirrel turn its attention elsewhere, than the cutworm started a campaign. Its demands had been anticipated but it showed little consideration for the planter's computation when making its selection. Instead of taking one stalk from each hill, it sometimes took them all. The cutworm spent its days beneath the soil, coming forth at night to feast on the tender stalks. The housewife likewise found her tender tomato and cabbage plants cut down. When she viewed the wreck of her gar-

den, the hungry pest that had caused her disappointment was safely out of sight beneath the clods.

The plagues of the pioneer were by no means limited to seven as they were in Egypt. Any settler on the prairies soon learned that there was a new one for every crop and for nearly every day. Devastating hordes of insects swept down upon him. Grasshoppers, chinch bugs, army worms, Colorado potato beetles — a never ending tide of competition. Birds, insects, animals — everything seemed to join forces to destroy the promise of abundance which the fertile soil yielded so readily.

In 1864, the loss from chinch bugs in Illinois was estimated at more than seventy million dollars. Chinch bugs have a beak fitted to pierce the tissues of plants and suck out the sap. They take no other food. On the uncultivated prairies, apparently, they had not found conditions favorable to undue increase in numbers, or if they did, the fact was not noted. The farmer's fields, however, furnished them an ideal nursery and they appeared in such numbers as were beyond description. Hiding beneath the sheaths of the leaves of corn or wheat, they punctured the tissue and drank their fill. When the insects were few, the plants were partially able to overcome the handicap and produce some grain. Too often they came in such numbers as to destroy the crop almost entirely.

Masses of crawling bugs would concentrate along the edge of a field until the plants were nearly covered with them. When these plants withered and died, the bugs moved on into the field to continue their destruction. Against such an attack, the settler was well nigh helpless. The bugs appeared in moderate numbers in spring when the crops were showing green across the fields. The females soon began laying, each depositing from 100 eggs upward to 300 or even 500. In about two weeks the eggs began

hatching and by late May or early June real trouble was at hand. In two months more, this generation matured and a second generation followed.

The Mississippi Valley seems especially pleasing to chinch bugs as a place of residence and they have tortured the farmers on the prairies from the beginning even until today. In many places, the growing of spring wheat was entirely discontinued, at least for a time after the destruction of a few crops from this cause. Fields of wheat were sometimes burned in mid-summer to destroy the bugs and save the fields of corn nearby. The extent of the injury to the wheat stalks is shown by the fact that the crop would burn at that season.

Not only did the settler find many new and hitherto unknown plagues in the new environment; old ones which had pestered his ancestors in other areas migrated to trouble him again. The army worm is native to a large extent of the eastern United States. It is recorded that in 1743, settlers in Massachusetts were beset with "Millions of devouring worms in armies, threatening to cut off every green thing". Another report gave this account:

> In the summer of 1770 this whole section was visited by an extraordinary calamity, such a one as the country never experienced before or since, . . . It was an army of worms, which extended from Lancaster, N. H., to Northfield, in Massachusetts. . . . They were altogether too innumerable for multitude. Dr. Burton, of Thetford, Vt., told me that he had seen whole pastures so covered that he could not put down his finger in a single spot without placing it upon a worm. He said he had seen more than ten bushels in a heap. They were unlike anything which the present generation have ever seen! . . . They filled the houses of the inhabitants, and entered their kneading-troughs as did the frogs in Egypt. . . .
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> There were fields of corn on the meadows in Haverhill and Newbury, standing so thick, large, and tall that in some instances it was difficult to see a man standing more than one rod in the field

from the outermost row; but in ten days from the first appearance of this Northern Army nothing remained of this corn but the bare stalks![2]

The reporter added that but for the pumpkins which grew abundantly in the fields after the corn had been destroyed, many people would have died during the following winter for lack of food.

The pioneer on the prairies had probably not heard of this strange experience of his forebears of an earlier time, and when he suddenly found his fields covered with marching armies of worms, devouring the leaves of wheat, oats, and corn, he was at a loss to account for the sudden visitation. The amount of food consumed during the first few days of an insect's life was small and they were unnoticed until they attained considerable size and began to do serious damage.

The marching worms moved in masses in one direction as does an army of men upon the move. Entering a field of grain, they would strip all the leaves and in the case of wheat or oats cut off the stem just below the head. If the crop was young and tender, they would devour it down to the ground. In some cases, the advance was continued for several miles, leaving the ground behind as bare as though a fire had passed over it. During one of these "worm years", it is said that they were so numerous that they could be shoveled up by bushels and that they fell into the wells in such numbers as to foul the water so that it could not be used.

The author remembers only one such invasion but that one is not likely to be forgotten. Imagination can scarcely picture the teeming masses of squirming millions of worms moving across the fields. A crunching sound as their man-

[2] *Third Report of the United States Entomological Commission* (Part II), pp. 92, 93. This is also found in *House Miscellaneous Documents*, Forty-seventh Congress, Second Session, Vol. XV.

dibles cut the leaves in feeding could plainly be heard. Such numbers of loathsome caterpillars offer anything but a pleasing sight, even to a naturalist.

Ditches dug beside the fields offered temporary barrier to such invasions, but they were soon filled and the army marched on over the bodies of their companions. Fortunately the time of their sojourn was short. Completing their growth in the larval state, they entered the ground for their transformation.

The settler, being unacquainted with the life history of the pest, did not know that the parent was a reddish gray moth with a wing spread of about an inch and a half. The changes taking place over the face of the earth for the moment favored this mother moth which flew forth in the night carrying in her ovaries a mass of from six hundred to eight hundred eggs. With the checks removed which normally would have controlled her offspring, it is easy to see that a few generations would bring forth an incredible number of descendants. As usual, however, the resource of nature soon concentrated enemies in the path of the gray moth and her progeny, and serious outbreaks did not long continue.

As the season advanced and the grain approached maturity, the young blackbirds were trying their wings. The birds were congregating for a general carnival before departing southward on their migration. It was not so much the food habits of individual birds that made trouble for the farmer as their tendency to come together in immense flocks. On the whole, these birds are generally regarded as beneficial, but when millions of them settled in a small field and stripped it bare of grain, the farmer was in no mood to consider the number of cutworms and grubs that had been consumed during the long months previous. The service which had been rendered to the community as a whole re-

quired its compensation from his small store and left him little for his own labor.

The Mississippi Valley and the Canadian prairies were the breeding grounds of several kinds of blackbirds. Three species were especially well known to the settlers. The yellowhead confined its nesting to wide marshes where it hung its nest among the cattails or coarse grasses. Settlers found it abundant in the marshes of northern Illinois but it retired when the marshes were drained and has been little known in that State for many years. The author's first acquaintance with these blackbirds was in northwest Iowa where the yellowheads congregated in flocks comparable to those of the redwings and crow blackbirds or bronzed grackles. Now it has moved on from that region also, but it still nests in smaller numbers in the wet valleys of northern Nebraska.

The redwing blackbird or swamp blackbird had a much wider distribution and still occupies, in limited numbers, the greater portion of its former breeding grounds. Like the yellowhead, it hangs its nest among the rushes or bushes in wet places, but is content with a mere excuse of a bog when no marsh is within easy reach.

The bronzed grackle was abundant over all the prairie region, but built its nest in trees and thus confined its breeding grounds to the vicinity of streams where trees were present, or to the groves which the settler planted about his home.

Yellowheads and redwings often congregated together in immense numbers and were sometimes joined by other blackbirds also. One who has not seen the flocks of these birds as they appeared during the years of early settlement of the prairies can scarcely imagine such numbers as came together in summer. The flocks would appear at the time when the farmer was harvesting his wheat and oats. Flocks

of yellowhead blackbirds have been seen alighting on the shocks of grain in Dickinson County, Iowa, so as to nearly cover the shocks. While each bird took but little, the total was sufficient to consume the grain in the heads exposed to view.

The use of exaggerated terms is so common among Americans that "millions" does not mean anything in particular to the average individual. Careful estimates, however, have shown that there were, in fact, millions of blackbirds congregated in single flocks. Charles Rollin Keyes, writing in *The Auk*[3] in 1888, described an immense flock of blackbirds which congregated in the marsh lands across from Burlington, Iowa, and fed both east and west of the river. He stated that the flocks were often a quarter of a mile in width and occupied more than an hour in passing. Three or four such flocks might be in sight at a time. After making liberal deductions to allow for overestimating, he concluded that the number of individuals in one of these flocks could not be less than twenty million. The reader who has an aptitude for figures may amuse himself by computing the number of bushels of grain necessary to feed them. Three species — redwings, rusty blackbirds, and bronzed grackles — composed this flock.

Whole families of the settlers would spend hours in the fields in an endeavor to frighten away the birds, but against such numbers, the men were well nigh helpless. Driving them from one spot only served to move them a short distance to another. A farmer might kill a dozen or more birds at a shot, but he could make no apparent diminution in the numbers. It became a more serious matter to save the grain after it had been raised than it was to raise it. The hazards of production seemed innumerable and interminable.

[3] *The Auk*, Vol. V, pp. 207, 208.

Not only did the birds take toll of the oats and wheat; they visited the cornfields also. When the kernels were in the milk, the blackbirds began their feeding and continued until their departure for the South. The losses of the settlers from many different causes represented millions of dollars in value but year after year the toll taken by the blackbirds probably exceeded any other. They were so numerous over such great areas, remained to feed for so long each season, and their destructive activities continued for so many years that the total damage of the potato bugs or grasshoppers was small in comparison.

All this is now changed, except in exceptional locations. The flocks are smaller and the area of the fields is so much greater that their toll is no longer missed. The farmer can now appreciate the service rendered in the destruction of noxious insects and weed seeds and welcome the small flocks that come to visit him.

Watching a big flock of blackbirds getting settled for the night is a never to be forgotten experience. I remember one such occasion when I gave over an afternoon and evening to watching them. About four o'clock in the afternoon, big flocks of them began flying toward the willows along the lowland. They flew first one way and then another, alighting in the largest cottonwood trees and keeping up a constant chatter. They settled only to take wing again and fly to another tree.

It was difficult to make even an approximate estimate of the number of birds in a flock. A cross section would often contain more than a hundred birds, so a small section of a single flock would contain many thousands. As night approached, the number of birds increased and it appeared to me that there must be a million birds flying about within a mile. They gradually concentrated among the trees along the river. As it grew darker, they took to the smaller wil-

lows in the thickets, but continued to move from tree to tree and from branch to branch in the most restless manner, apparently looking for a more satisfactory perch. Always they seemed dissatisfied with what they had.

When daylight faded, I crept into the thicket to see them close at hand. They reminded me of a lot of boys in a boarding-house bedroom trying to get settled at night. There was a constant movement and chatter and they were long in becoming quiet. Several times the sound of a gun not far distant would quiet them for a moment, but soon they would be as noisy as ever.

Most of the birds chose to roost only ten to fifteen feet from the ground in the dense willow thicket. When the day was growing late and they were taking shorter flights, they wheeled about in the air at times until I was reminded of black smoke belching from a stack of a moving locomotive and rolling away behind. Not until it was entirely dark did they cease their twittering. With the coming of dawn, they were quickly on the wing again.

But after all the hazards mentioned, the farmer's corn was not yet ready for the crib and until the last ear was safely put away, he could not be sure how much would be left for him. When the fall migration of the ducks began, they likewise came in immense flocks and tarried in the cornfields to secure their food. The prairie hens were abundant also and they also loved corn. From the wild meadows far and near they collected in the cornfields when the grain was ripening. Nor were they adverse to making a meal of beans from the housewife's garden.

Early pioneers also complained of the herds of deer which foraged in their fields if harvest of the corn was delayed by snow. Even the rabbits invaded the orchards in the winter and stripped the bark from the young trees. No sooner did the fruit trees planted about the house show

signs of fruiting than flocks of birds made ready to consume it. The fruit-hungry pioneers prized their cherries but it was difficult to get them. As soon as they turned red, the red-breasted robin made free with them, as did the catbird, the red-headed woodpecker, the blue jay, and other birds. All kinds of devices and scarecrows were constructed in a vain attempt to frighten the birds from the trees.

No less difficult was it to raise domestic animals and poultry. The wolves carried off young pigs and lambs and sometimes very young calves. One early writer states that the wolves even took a fair share of the melons. This seems something of a departure from the usual food habits of a carnivorous animal. However, later reports of coyotes eating watermelons verify the settler's complaint.

The housewife found it no easy task to maintain her flock of hens. The skunks would find the nests hidden in the grass and eat the eggs. Great horned owls would carry off the chickens at night when they were roosting in the trees. Muskrats, minks, weasels, and even rats would catch the young chicks as well as the older ones. By day the Cooper hawk frequently swooped down upon the unsuspecting flock and carried away a victim. Later the construction of vermin-proof houses and pens and the reduction of the numbers of predatory animals and birds changed all this, but at the start poultry raising was a heart-breaking business.

The settlement of the prairies, as has been said, brought many great changes to the wild life of the region. Many species of animals and plants were greatly reduced in numbers or disappeared altogether. A few made a corresponding increase and seemed to thrive under the new conditions. One of the most remarkable examples of ability to prosper because of the change was the Colorado beetle or "potato bug" which soon spread over most of the United States east of the Rockies, and then made itself at home in the potato fields of Europe.

When Thomas Say, a naturalist with Stephen H. Long's exploring expedition to the Rocky Mountains, found on the upper Missouri a new beetle with stripes of black and yellow, he little dreamed what a commotion it was to make among American farmers. To him it was probably just one more new species and when he gave it the name of *Doryphora decemlineata,* there was no hint that newspapers of the largest cities would one day give front page space to the affairs of the insect which soon came to be known as the Colorado beetle, although the farmers of the Middle West called it the "potato bug".

At the time of the visit of the exploring party which found it first, the insect fed on the buffalo bur, sometimes called the sand bur (*Solanum rostratum*), a member of the nightshade family common to the sunny plains. Since the spread of the plant as well as the insect has been changed by the settlement of the region, there is some question as to the extent of the range of both the plant and the insect at the time when first discovered. Asa Grey gives the range of the buffalo bur as the "Plains of Nebraska to Texas".

When settlers began moving into the region west of the Missouri, a remarkable change took place in the habits of the Colorado beetle. Settlers brought with them the potato, a *solanum* related to the wild plant on which the insect had previously fed. The beetles found the potato quite to their liking and at once took advantage of the new food supply. Instead of a chance plant scattered here and there over the plains, they now found large areas devoted entirely to the culture of the potato. Such fields provided an abundance of suitable food and offered ideal conditions for the reproduction of the insects.

"Potato bugs" begin their work early in the spring when the young plants are tender. The females lay their eggs on the under side of the leaves soon after they first appear

above ground. Sometimes they burrow beneath the surface to work on the tender sprouts before the leaves unfold. Clusters of from a dozen to three dozen eggs are deposited together. The larvae of the beetles hatch in less than a week and in two or three weeks they have attained their growth and are ready for their transformations. Only about a month is required from the time the eggs are laid until the mature beetles appear. A single female lays several hundred eggs; Charles V. Riley says from five hundred to one thousand. Since three broods are produced in a single year, in the latitude of Missouri, it is easy to see that if unchecked, there will be an enormous reproduction.

When these insects found a settler's potato patch, it is not surprising that they made short work of it. Soon all the leaves were stripped from the stalks and even the stems were partially devoured. Bare stalks furnish poor support for growing tubers underground, and too often the farmer secured far less potatoes in the fall than he had planted in the spring.

With the change of environment came also a change of habitat. The potato beetle left the region where it had lived for untold years and moved eastward. In 1861, it crossed the Missouri River into Iowa. Probably the first publication of an item concerning the damage to potatoes appeared in the *Prairie Farmer,* on August 29, 1861, when J. Egerton, of Gravity, Iowa, wrote that they devoured the vines as fast as they grew. Nebraska and western Iowa were largely unsettled at that time, although there were a few prosperous settlements along the streams. In 1865, only four years later, the beetle crossed the Mississippi River and entered Illinois. By this time, there were several lines of the insects moving eastward, and they entered Illinois from across the river in at least five different points from Iowa and Missouri.

The agricultural papers during these years were giving much space to the insect, telling of its destruction of the potato crop, and discussing ways and means for its control. For some reason, the eastern movement was more rapid in the north than farther south. By the close of 1866, the Colorado beetle had invaded the greater part of the cultivated regions of southern Wisconsin and northern Illinois. In 1868, it crossed into Indiana, and in 1869, it appeared in Ohio.

As the insects moved eastward, there was a phenomenal increase in the rapidity of the movement and in the number of "bugs". Finding an abundant food supply ready for their use in a region where for the time being they were free from their natural enemies, great swarms of the mature beetles soon appeared. C. V. Riley, then State Entomologist of Missouri, wrote that during the spring and summer of 1871, the Colorado potato beetle was unprecedently numerous. In March of that year, "the beetle was turned up in great numbers while the ground was being plowed, especially in fields that had been planted the previous year to late potatoes; and it subsequently swarmed on the wing in the streets of St. Louis."

That same year the Detroit River was literally swarming with the beetles, and they were crossing Lake Erie "on ships, chips, staves, boards or any other floating object". Ontario was soon overrun as were the States of Pennsylvania and New York. In 1874, the insects reached the seaboard at various points from Connecticut south to Virginia.

In September, 1875, the beach at Coney Island was covered with them for miles, the sand hills and hummocks which compose the Island were reported as literally alive with them. Riley quotes from J. J. Dean of New York who visited the Island and was much puzzled that they should desert the fertile fields for the barren acres of Coney Island.

Apparently they were borne eastward by an irresistible impulse which carried them to the ocean, the first barrier that they had been unable to cross.[4]

But even the Atlantic did not stop them permanently, for soon they appeared in Europe and their appearance aroused so much interest that Riley was called upon for information concerning the pest which threatened the potato crop of all America, if not of the world. The result was the little book, already quoted, *The Colorado Beetle,* published in London in 1877.

In 1876, the insects swarmed over New England and eastern Canada in such numbers as to alarm the farmers and to amaze others. At Milestone, Connecticut, Riley states that they were washed ashore in such numbers as to poison the air. The captain of a New London ship found them coming aboard in such numbers while at sea, that he found it necessary to close the hatches.[5]

At first there seemed no remedy for the beetles on the potato vines except to pick them off by hand. This task, in many cases, fell to the boys and girls. Barefoot youngsters with tin pails in hand walked wearily up and down the rows in the hot sun, picking "bugs", crushing them between their fingers, or carrying them to a fire to be burned. The task seemed unending for the rows were long and the insects abundant. For those of us who served our turn at the job in youth, picking potato bugs will ever remain a vivid memory. At times, whole families would thus be employed and bonfires would be kept burning in which to dump the insects as gathered.

An occasional report of some one injured from handling the insects gave rise to the report that they were poisonous and the matter was widely discussed. Reported injuries

[4] Charles V. Riley's *The Colorado Beetle* (London, 1877), pp. 18, 19.

[5] Riley's *The Colorado Beetle,* p. 20.

were probably mere cases where open sores or scratches became infected at the time when they chanced to be handling the insects. Serious and even fatal cases were recorded which only added to the terror brought by the appearance of the insects in such great numbers. The number of persons who handled them with impunity was pointed out as evidence of the fact that the wild stories of poisoning could not be true. C. V. Riley explained the occasional poisoning as — "not from the juices of the body, but from the exhalations resulting from the *bruising* or crushing of large masses; especially by burning or scalding large quantities at a time."

As would be expected, the price of potatoes advanced during the first years of the insects' presence in the Mississippi Valley. Not only was the crop greatly reduced by the ravages of the beetles, but farmers gave up cultivation of potatoes on an extensive scale and substituted some other crop instead. In 1873 potatoes reached $2.00 per bushel wholesale in St. Louis; beyond the reach of the modest purse of many a frontier family.

Such a widespread pest attracted the attention of hundreds of investigators and hundreds of devices were tried for its destruction. Mechanical traps proved ineffective but poisons served better. It was soon learned that Paris green, mixed with flour or plaster and applied when the plants were wet with dew, would kill the insects without injury to the plant. This method of control was soon generally adopted and made possible once more the growing of potatoes which had become a staple article of diet. But poison was not the only remedy.

Mother nature is very resourceful and does not long permit any serious maladjustment of her forces. As the presence of the potato furnished a new and inviting supply of food for the Colorado beetle, which led to phenomenal in-

crease of the insects, so the presence of the insects offered similar attractions for creatures of a different kind.

As the insects increased in number as they moved eastward their natural enemies likewise increased in the same region. Only a few years elapsed until nature had accepted the newcomer and provided him his proper and permanent place in the scheme of things. Crows, quail, and other birds fed liberally on the abundant insects. Toads gorged themselves with them. Ladybirds and other parasitic insects likewise availed themselves of abundant food.

The list of enemies that found prosperity in following the path of the new potato pest is a long one. Nature has but little regard for the individual or even the species. Each seems designed but to supply food for some other, as stated by the oft quoted lines:

> So, naturalists observe, a flea
> Hath smaller fleas that on him prey;
> And these have smaller still to bite 'em;
> And so on proceed *ad infinitum*.

Parasite preys upon parasite. Voracious appetites must be satisfied and food is the pressing demand of all life. The beetles coming by untold millions furnished easy prey and easy living for many other insects as well as the birds, skunks, etc. Ground beetles and soldier bugs took toll of them in enormous numbers but it remained for the beautiful little beetles known as ladybirds or ladybugs to attack them in such a manner as to really check their phenomenal increase and bring them within the ability of man to control.

The ladybirds laid their eggs alongside those of the potato beetle's. There were several species, all of which devoured the eggs of the potato beetles, thus reaching them at the most vulnerable point. Young ladybirds as well as adults are bloodthirsty individuals. They devoured large numbers of eggs and killed the larvae of the beetles in such

quantities that within a very few years potato bugs were no longer the formidable foe they had at first appeared to the settler.

The most conspicuous example of nature's adjustment, however, was furnished by the rose-breasted grosbeak, a beautiful bird not hitherto especially common in the region. Naturally the public was watching very closely everything which promised any hope of relief from the potato beetles and every remedy as well as every enemy was widely discussed. The habit of the grosbeak, once it turned to the new food supply, was promptly noticed. Reports from many widely different localities were published about the same time.

Riley mentions having received a letter from Professor C. E. Bessey of Iowa, and also from E. H. King of the same State calling attention to the usefulness of the grosbeaks. Observers in several adjoining States published similar statements. A bulletin issued by the United States Biological Survey[6] asserted that the "rosebreast actually exterminated the potato beetle in many patches it patrolled."

The birds gorged themselves until they could scarcely fly and as they were continually on duty did far better service than the weary children who had attempted to remove the insects by hand picking them from the vines. Numerous observers reported that they were unable to find any beetles left in the potato patch after the birds had been busy for a few days. The birds, however, were slow in appreciating the Colorado beetle as a staple diet and the years when the insects were new to the region were years of great tribulation to the potato grower.

Whatever the pioneer settler on the western prairies may have thought of the Bible story of Jonah and the whale, it

[6] See *Food Habits of the Grosbeaks* in *Bulletins of the Bureau of Biological Survey*, No. 32.

required little imagination on his part to accept the literal occurrence of the seven plagues of Egypt, especially the one of locusts which is described in the tenth chapter of Exodus:

> And the locusts went up over all the land of Egypt, and rested in all the coasts of Egypt: very grievous were they; before them there were no such locusts as they, neither after them shall be such.
>
> For they covered the face of the whole earth, so that the land was darkened; and they did eat every herb of the land, and all the fruit of the trees which the hail had left; and there remained not any green thing in the trees, or in the herbs of the field, through all the land of Egypt.

While grasshoppers had long been known to the farmers and at times their numbers were such as to do some damage to crops, it was only after the pioneers had pushed west of the Mississippi River that they met the migratory locust. This species, known to entomologists as *Melanoplus spretus,* took wing in countless multitudes and migrated for hundreds of miles. Suddenly alighting in a prosperous region where crops were abundant, a swarm of locusts would strip every leaf from the cornfields, the vegetables from the gardens and defoliate the fruit trees within a few days. Then it would take wing and move on again. Against these hordes the settler was helpless and in spite of his greatest efforts must see his crops utterly destroyed and his fields left bare.

The appearance of the locusts at varying intervals held the settlers in constant fear. For several years the country might be free of them and then they would come. In midsummer the farmers would scan the sky anxiously watching to see whether there was any sign of flying insects. When they did come they might pass over a particular neighborhood and do no harm, or they might devastate an immense area completely as happened many times during the early

settlement in western Iowa, Missouri, Minnesota, Kansas, Nebraska, and southward to southern Texas and Louisiana.

The migratory locust was at home in the high altitudes of the Rocky Mountain region and in the plains to the eastward. It bred in immense numbers in the high pasture lands of Montana, Wyoming, and the Dakotas, and northward in British America. In the valleys of the Upper Missouri and along the Yellowstone River it found congenial environment.

The female laid her eggs in hard ground in late summer, excavating a cavity in which she placed a mass of perhaps two dozen eggs. She would then fill up the narrow neck of the passage to the surface with light material which the young could easily penetrate but which furnished good protection in the meantime. The same female deposited several of these egg masses at different times and places.

The eggs began hatching in the month of May. When the little locusts appeared they at once began eating such vegetation as was available. The great number of insects soon exhausted the food supply in one area and they began moving slowly in a southeasterly direction. Growth was accompanied by a series of five molts at which times they attached themselves to a weed or grass stem and split open the old suit down the back and crawled out. The empty case, left behind, looked for all the world like the grasshopper which had filled it. As their growth increased more and more food was necessary to sustain them. By the middle of July they had reached maturity, attained wings, and were ready to begin their journey.

It is probable that the insects had occupied this region for thousands of years and followed the same course from time to time in seasons when their numbers were greatest. However, there is little information available concerning their migrations prior to the beginning of settlement in the path

which they followed. From the traditions of the Indians, we learn that immense flights of locusts had always occurred periodically in this territory.

In 1856, there were serious locust outbreaks in Minnesota and Iowa. In 1857, the damage was serious in Manitoba and also in Texas. In the latter State, they devastated an area of 12,000 square miles where every green thing cultivated by man is reported as having been entirely destroyed. Over an area of 150 miles in breadth by 80 in width, including the whole valley of the Guadalupe River, Riley reports complete destruction of crops. The flight reached as far east as central Iowa that year.

In 1860 there was extensive damage in Kansas and in 1864 damage is reported from Manitoba, southward through Iowa. Colorado suffered a fearful devastation also. In 1866, the damage was widespread and attracted nation wide attention. By this time settlement was advancing far toward the West, railroads had been built and trains were often delayed by the immense numbers of insects swarming along the tracks.

In 1867 and again in 1869, there were outbreaks over a smaller expanse of country. In 1870, 1871, and 1872, there were loud complaints from smaller areas but in the year 1873 there was a repetition of conditions of 1866 when a great expanse of country was covered. This was followed by an even greater one in 1874 concerning which Riley wrote:

> We now come to the locust visitation of 1874, which will long be remembered as more disastrous, and as causing more distress and destitution than any of its predecessors. The calamity was national in its character, and the suffering in the ravaged districts would have been great, and famine and death the consequence, had it not been for the sympathy of the whole country and the energetic measures taken to relieve the afflicted people — a sympathy beget-

ting a generosity which proved equal to the occasion, as it did in the case of the great Chicago fire.[7]

The last great outbreak occurred in 1878. Although there have been several smaller flights since that date, when limited areas were devastated, no great expanse of territory has since been covered. The changes incident to the settlement of the country, the breaking up of their breeding grounds, and destruction of their eggs have resulted in the disappearance of this pest along with the buffalo, the antelope, and other denizens of the plains.

By the middle of July the young locusts, having acquired wings, left the breeding grounds in Montana and Alberta and started eastward. Choosing a time when the wind was blowing toward the direction in which they wished to go, they would face toward the wind, rise to a great height, and then fly rapidly to the southeast. By this time, advancing summer with a tendency to dry weather was reducing the forage available and they went toward better pastures. By the end of September, they had reached Texas, thus covering an average of about twenty miles per day for a distance of more than 1500 miles. Along the way they would stop to feed for a few days at a time, moving on when the wind was favorable and the food supply exhausted.

If the wind was from the wrong direction, they would remain quietly feeding until it changed when they would move on again. Each season the flight started in this manner. But only in exceptional cases over long or short intervals did the devastating hordes sweep over such an immense area as happened during the years mentioned.

While the average distance covered in the long journey does not exceed twenty miles a day, a single flight has often carried them over a distance of two hundred or three hun-

[7] Charles V. Riley's *The Locust Plague in the United States* (Chicago, 1877), p. 39.

dred miles. It thus happened that some settlers would be passed over while luckless neighbors to both north and south of them would have all crops destroyed. Locusts were capable of moving at a great speed with a favoring wind. Some early writers estimated that they could travel as rapidly as a railroad train, sixty miles per hour not being the highest estimate. Riley's description of flight is of interest in this connection:

> Their flight may be likened to an immense snow storm, extending from the ground to a height at which our visual organs perceive them only as minute, darting scintillations — leaving the imagination to picture them indefinite distances beyond. . . . It is a vast cloud of animated specks, glittering against the sun. On the horizon they often appear as a dust tornado, riding upon the wind like an ominous hail storm, . . . and finally sweeping up to and past you, with a power that is irresistible. They move mainly with the wind, and when there is no wind they whirl about in the air like swarming bees. If a passing swarm suddenly meets with a change in the atmosphere, "such as the approach of a thunder-storm or gale of wind, they come down precipitately, seeming to fold their wings, and fall by the force of gravity, thousands being killed by the fall, if it is upon stone or other hard surface." In alighting, they circle in myriads about you, beating everything animate or inanimate; driving into open doors and windows; heaping about your feet and around your buildings; their jaws constantly at work biting and testing all things in seeking what they can devour.[8]

Thus was the long summer spent in the journey from their breeding grounds, toward the south and east. The distance they traveled depended upon local conditions, the supply of food, the number of insects, and much upon the weather. At the close of the season, the females deposited their eggs wherever they chanced to be. Thus it happened

[8] Quoted from Riley's *The Locust Plague in the United States*, pp. 85–87. Riley's reference for this quotation is "Wm. N. Byers, Hayden's Geol. Surv., 1870, p. 282."

that the locality that chanced to harbor them late in the season was confronted by the appearance of a new generation the following spring. The new generation, however, was smaller and feebler than its parents and as soon as the young hoppers could fly, they started moving westward. Like the Children of Israel in the land of Egypt of old, they turned their faces toward the homeland of their fathers. Again taking advantage of favoring winds, the locusts moved toward the north and west, destroying crops along the way. They reached the former breeding grounds late in the summer following the year of the departure of their parents.

It was an amazing power of instinct. Certainly no one would contend that the locusts knew whence they were going when they left the sunny plains of Montana in July to reach the prairies of Texas in September. Instinct drew them irresistibly toward the better pastures of the southeast and was not concerned by the fact that the farmers who had so recently settled in the valleys of the Missouri, the Kaw, or the Platte, would suffer hunger and privation because of their flight. Neither would anyone contend that the offspring of the next generation, finding themselves in a strange land the following spring, could realize that the region was unsuited to them. How did they know that they could not live permanently in the lower and more moist environment, where they were subjected to numerous parasites which had not harmed their kin in their ancestral home? Again instinct drew them irresistibly toward the breeding grounds where nature was kind and where the species might renew its strength. The number of insects reaching the home grounds the second autumn, following the departure of the parent swarm, was but a handful compared to the millions that had set out on the great adventure. The number, however, was sufficient to reëstablish

the race and soon again would another generation start on the same wild flight.

Those remaining in the lower levels soon disappeared. These locusts seemed incapable of living in the moist and humid valleys, and it was only those individuals who returned to the high and sunny plains of the northwest which could permanently perpetuate the species.

The mystified settler knew nothing of the origin of the locusts nor of their long flights from the northwest in search of better feeding grounds. He only knew that they came without warning and devoured his crops. Immense hordes of insects coming down from the upper air in summer afternoons often completed the destruction of growing corn in less than twenty-four hours. Those who suffered such visitations have related how luxuriant corn which promised a yield of eighty bushels or more per acre, was eaten by the locusts in a single night until nothing but the bare stalks remained. Lacking the pennies necessary to buy a stamp and having no means of securing one, there was no means of communication with distant friends for several months. To such straits were settlers reduced by the destruction of their crops.[9]

In such numbers did the grasshoppers come, that in many cases the country was swept entirely bare of everything which might serve as food for either man or beast. Only the pigs and poultry, which ate the insects, could find subsistence. Fortunately nature is resourceful and within a short time after the departure of the "hoppers" the new grass appeared and new vegetation furnished sustenance once

[9] For an account of the locusts in Iowa and their effect on settlement see John E. Briggs' *The Grasshopper Plagues in Iowa* in THE IOWA JOURNAL OF HISTORY AND POLITICS, Vol. XIII, pp. 349–392; Cyrus C. Carpenter's *The Grasshopper Invasion* in the *Annals of Iowa* (Third Series), Vol. IV, pp. 437–447; and Josephine B. Donovan's *Grasshopper Times* in *The Palimpsest*, Vol. IV, pp. 193–202.

again. Concerning the food habits, I quote again from Riley:

> The Rocky Mountain Locust may be said to be almost omnivorous. Scarcely anything comes amiss to the ravenous hosts when famished. They will feed upon the dry bark of trees or the dry lint of seasoned fence planks; and upon dry leaves, paper, cotton and woolen fabrics. They have been seen literally covering the backs of sheep, eating the wool; and whenever one of their own kind is weak or disabled from whatsoever cause, they go for him or her with cannibalistic ferocity, and soon finish the struggling and kicking unfortunate. They do not refuse even dead animals, but have been seen feasting on dead bats and birds. Few things, therefore, come amiss to them. Yet where food is abundant they are fastidious and much prefer acid, bitter or peppery food to that which is sweet. . . . Vegetables and cereals are their main stay. Turnips, rutabaga, carrots, cabbage, kohlrabi and radishes are all devoured with avidity; beets and potatoes with less relish, though frequently nothing but a few stalk-stubs of the latter are left, and sometimes the tubers in the ground do not escape. Onions they are very partial to, seldom leaving anything but the outer rind. Of leguminous plants the pods are preferred to the leaves which are often passed by. . . .
>
> Of cereals, corn is their favorite; if young and tender, everything is devoured to the ground; if older and drier, the stalks are mostly left; the silk is, however, the first part to go. All other cereals are to their taste, except sorghum and broom corn, which are often left untouched. . . .
>
> Next to vegetables and cereals, they relish the leaves of fruit trees; they strip the apple and sweet cherry trees, leaving nothing but the fruit hanging on the bare twigs. . . . The tender bark of twig and branch and trunk of all these trees is gnawed and girdled, and these girdled trees present a sad picture as one passes through the ravaged country during the subsequent winter. . . . Blue grass is sometimes killed out, but more generally not, and young corn is eaten down so often and so deeply into the ground that it is frequently destroyed. . . . The blossoms and stems of peas are left after the leaves are stripped, and parsnips sometimes remain untouched. All other vegetables are swept off.[10]

[10] Riley's *The Locust Plague in the United States*, pp. 89–92.

The devastation following such a scourge is hard to imagine. In appearance the country looked as though there might mave been a heavy fall of hail. Referring to the ravages of 1875, Riley continues:

> Here and there patches of *Amaranthus Blitum* and a few jagged stalks of Milkweed (*Asclepias*) served to relieve the monotony. An occasional oat field, or low piece of prairie would also remain green; but with these exceptions one might travel for days by buggy and find everything eaten off, even to the underbrush in the woods. The suffering was great, and the people were well-nigh disheartened. Cattle and stock of all kinds, except hogs and poultry, were driven away to more favored counties, and relief committees were organized. Many families left the country under the influence of the temporary panic and the unnecessary forebodings and exaggerated statements of pessimists.[11]

A book could easily be filled with stories of individual hardship and loss. Stories told by eye witnesses as to the number of the insects are almost past belief. We are told of piles of dead locusts in windrows two feet deep, of the ground completely covered with them over large areas. All the writers of that day agree that the air was often filled with such clouds of insects as to obscure the sun.

Every conceivable defense that the mind of man could devise was tried in a vain attempt to conquer the insects. The general devastation led to the establishment of the United States Entomological Commission in an effort, by a study of their habits, to find ways and means of preventing or reducing injury. The Commission has since been replaced by the Bureau of Entomology dealing with a vast number of insect problems.

Men, women, and children went into the gardens or fields with branches and tried to frighten the grasshoppers away, in the hope of saving limited areas. Men on horseback went

[11] Riley's *The Locust Plague in the United States*, p. 44.

through the fields dragging a rope between them to start the locusts into the air. Firearms were discharged when incoming swarms desired to alight in an effort to keep them in the air. Other similar means were tried, all of which appeared hopelessly inadequate to the situation.

Natural enemies did far more to check the advancing hosts than all of man's efforts put together. Great flocks of birds feasted upon them, skunks, badgers, and other small animals destroyed large numbers, while parasites and disease slew multitudes.

Various mechanical devices were constructed with the idea of catching them in large numbers. Burners drawn by horses were moved over the fields and killed great numbers of the insects. These burners consisted of a frame built on runners over which wire was stretched to form a grate. A hot fire was built on this grate and the burner was drawn over the fields in an attempt to scorch the hoppers. Hand burners made of pans attached to handles were sometimes used in the gardens. Long wires, wrapped in rags which were saturated in kerosene and set on fire, were carried over the fields near the ground. Numerous other plans of scorching the locusts were tried. Where conditions would permit, a heavy roller was run over the ground to crush them. All kinds of traps were designed; some of these were mounted on platforms with bags to catch the insects that were disturbed as the device was driven over the fields.

In the case of the young locusts hatched in the fields the spring following a flight, ditching was found to be the most effective method of destruction. As the youngsters all moved in the same general direction, ditches eighteen inches or so in width by two feet in depth along one side of a field would stop innumerable young ones which, having no wings, could not get out.

Spraying with kerosene, catching the locusts in pans

lined with oil or coal-tar, in fact numberless expedients were resorted to with little effect apparent upon the millions of moving grasshoppers.

Ignorant and superstitious individuals, recalling the plagues described in the Bible, regarded the locusts as a scourge sent to punish the people for their sins. The sudden and surprising manner in which they came, the numbers in which they appeared, and their unknown origin, all seemed to sustain the view of a divine visitation to the uninformed.

Community meetings to offer prayers for deliverance were held on numerous occasions. In 1875, Governor Hardin of Missouri by public proclamation, set apart the third day of June as a day of fasting and prayer. All the people were called upon to desist from their usual labors and to assemble at the places of worship to invoke the Divine assistance to remove the impending calamities from their midst and grant instead the blessings of abundance and plenty.

For extreme measures, Minnesota probably led all the States; the various counties offered a bounty of a dollar a bushel for the destruction of the insects. The fact that Nicollet County actually paid $25,053.00 for hoppers presented for bounty will give a better idea of their numbers than any fact so far presented. When it is considered how many grasshoppers it would take to fill a bushel basket and how much trouble it would take to collect them under ordinary conditions, it seems incredible that so many could have been taken for the purpose of claiming a bounty of a dollar a bushel.

FRANK C. PELLETT

ATLANTIC IOWA