The Western Cricket.

LIFE HISTORY AND REMEDIES
—by—
C. P. GILLETTE.

MIGRATORY HABITS
—by—
S. ARTHUR JOHNSON.

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THE WESTERN CRICKET.

(Anabrus simplex Hald.)

LIFE HISTORY AND REMEDIES.

BY C. P. GILLETTE.

This so-called cricket, which is really a grasshopper with very short wings, attracted attention as an injurious insect in Colorado for the first time last year. The insect is not in any sense new, for it was here long before any white man set foot upon American soil. This grasshopper and its habit of marching in great armies have been written about for more than 50 years.* Judging from many published reports, this insect occurs in greatest numbers over the sage brush plains and hills drained by the Snake river and by Great Salt Lake, in Southern Idaho, and Northern Nevada and Utah. The occurrence of large swarms of the "crickets" in Southwestern Wyoming or Northwestern Colorado is not common, to say the least. Where it was most numerous in Routt county the past summer in the vicinity of Eddy, Dunkley and Hayden, the ranchmen declared that the visitation of the past two or three years in that region is the first in the memory of the oldest inhabitants. Such an unusual invasion is not likely to continue through many years.

When the seriousness of the Routt county invasion became known to this office, Mr. S. A. Johnson started on an overland trip through the infested area to learn as much as possible of the migrating habits and the past history of this insect, and the writer went directly to Steamboat Springs, Eddy and Dunkley to study the habits and possible remedies where some of the worst injuries were being inflicted. I was fortunate in falling into the hands of Mr. John A. Whetstone and Mr. W. W. Miles of Eddy, who showed me

every courtesy and gave valuable assistance in carrying on my in-
vestigations.

I reached Steamboat Springs, July 24th, where I found nearly
everyone had heard of the swarms of black crickets that had over-
run the town of Hayden, and had invaded various ranches between
that place and Eddy, and were wanting to know if there was
any danger of their reaching Steamboat Springs in their eastward
march. I left for Eddy on the morning stage of the 25th of July,
but was soon met by Mr. John A. Whetstone, who took me to his
home near Eddy, where there was a rather large swarm of the
crickets camping upon a large "hog back" just west of his ranch.
The crickets had been down to an irrigating ditch along the west
side of the ranch, but had not crossed in sufficient numbers to do
any harm, though there was no telling how soon they might do so.
Mr. W. W. Miles, postmaster at Eddy, was also afraid that the
crickets might destroy his crops, and they did do considerable in-
jury to a field of oats and a field of rye belonging to him. This
swarm had ceased its regular migrations, and for some two weeks
Mr. Miles said the hoppers had been wandering about, going down
the hills to a ditch or stream of water and then returning to the hill
tops. The swarm was one of medium, or rather large size, and as
near as I could estimate, when all moving in one direction, they
covered an area about 300 yards across by half a mile in length.
This seemed a favorable location, so I stayed a few days to make
observations and try a few experiments.

APPEARANCE OF THE CRICKETS.

At the time of my arrival at Eddy, the crickets were all quite
dark in color; a casual observer would call them black. I was told
they were more reddish in color, earlier, and probably this is spe-
cially true just after molting (shedding their skin). The real color
was a dark brown, tinged with olive green and more or less
mottled, especially upon the abdomen and legs, with yellowish
brown. Specimens from Nevada, sent me by Professor Doten
were distinctly more rufous in color. Both males and females
measure from about 1-1/3 to 1-1/2 inches in length. The female
are easily distinguished by the long "tails," or ovipositors, measur-
ing about 1/3 of an inch in length and nearly straight, but slightly
curved. See Plate I, Fig. A, which shows the female life size. In
place of the ovipositor, the males have a pair of double hooks, or
clasping organs, with which they hold to the female during copula-
tion. These are shown at E in the same plate. The wings are
very small, the front pair being largest, and are used by the male
for the purpose of making the chirping or squeaking noise that
always heard when one disturbs or frightens them. The noise
made by rubbing one wing over the other. Ordinarily the wing
are entirely hidden by the large cape, or pronotum, back of the
head, but this can be raised, exposing the wings to view. The an-
terior pair of wings of the male are shown twice natural size at
Plate I, Fig. F.

OBSERVATIONS ON HABITS.

Breeding Habits. From about 8 o'clock in the morning until
noon or a little after, I noticed many of the females carried about
with them, at the end of the abdomen, a large mass of white, jelly-
like material (See Plate I, Figs. C and D). Suspecting that this
phenomenon was connected in some way with the breeding habits
of the crickets, I made observations which resulted in learning that
this white, blubber-like mass is received entirely from the male
while in copula. So, whenever these white bodies are observed,
one may know that the egg-laying season is already on or about to
begin. Mr. W. W. Miles told me that he saw a great many of the
females with these masses attached to them on his ranch on June
27. This would indicate that egg-laying begins about the first of
July, which agrees well with observations by Mr. John L. Yoast,
who told me that egg-laying began in 1903 about July 1st, and
lasted till the 10th of September, at least.

The crickets were laying eggs freely during all the time of my
visit. Dr. W. P. Headden was in Routt county in August, and
reported the females depositing eggs freely on the hills between
Trout Creek and Grass Creek, two miles northwest of Dunkley,
August 17.

The Eggs, when ready to be deposited, are dark chocolate
brown in color, but when the surface has dried off, the color is
a uniform light gray. The eggs are about one-quarter of an inch
in length by one-sixteenth of an inch long, and are nearly straight.
They are not deposited in compact clusters, but are distributed
loosely to the depth of about an inch, those at the surface often
protruding a little. They are shown, natural size, at Plate I, Fig.G.

The eggs are deposited anywhere that the female is able to in-
sert her ovipositor as the crickets are wandering about after the
active migrating season is over, but they prefer hill tops or hill
sides, and soil that is not very hard. On the hills near Eddy, where
the swarm under observation was staying, I saw, on different days,
one favorite area of several acres where the females were busy egg-
laying. The ground was literally blackened with them, but at my
approach, they would draw out their ovipositors, which are in-
serted almost vertically, and go hopping away. Two samples of
surface soil were taken at random from the top of this hill and the
eggs counted. In one instance there were over 2,000, and in the
other over 3,000 eggs to the square foot of surface. If the eggs
should all hatch, there would barely be standing room for the young
hoppers, and the egg-laying season was only nicely begun.
How many eggs a female may lay was not accurately determined, but in one female I counted 133 eggs in different stages of development. The eggs are not all deposited at one time, neither do the eggs seem to develop in sets or broods, for in a single female would be found ova that were very small, and all gradations between these and those that were fully grown and ready to be deposited. On July 27, I counted the eggs in the ovaries of a number of females that were carrying about the sperm masses and found the immature eggs to range between the numbers 34 and 46, and the mature eggs to range between 10 and 35.

The Chirping, or squeaking, which is done entirely by the males, has two objects—to attract the females, and to serve as a note of warning. Early in the morning one standing quietly among the crickets, will hear the constant chirping of the males, but in the middle of the day or in the evening all will be quite, as a rule, until a step is taken or a motion is made, when the chirping will suddenly begin, and all the crickets within a radius of 20 feet or more will begin hopping or running away as if frightened. When traveling without being frightened, they always walk. When night comes on they climb into the bushes in great numbers and remain until morning. They are very shy, however, and will drop from the bushes and weeds on the approach of a moving object.

Their food is quite varied, but they have their preference. They were seen eating the leaves of sage brush (*Artemisia tridentata*), but they seemed to prefer more succulent food, either weeds or cultivated plants. Oats, rye, wheat, alfalfa, potatoes and most garden vegetables were eaten greedily by them, but I was told that peas and timothy were hardly eaten at all. They are very cannibalistic; in fact, they seem to prefer a struggling, dying companion to anything else that can be given them as food. Mr. Miles told me that he killed a rattlesnake near a swarm of the crickets and a day after, he was passing the place and noticed the clean skeleton of the snake, which the crickets had completely stripped of all its flesh. After dining upon mountain trout with Mr. and Mrs. Miles and family, I asked Mrs. Miles if I might have the bones many of which carried considerable meat, to feed to the crickets. She gave her consent, and the hoppers ate of the fish with apparent relish. They are also very fond of fresh horse manure and often eat cattle dung. Mr. J. H. Yoast said they ate greedily of corn meal which he gave them. An insect with such food habits is not likely to die very soon of starvation.

THE YOUNG CRICKETS.

On December 4, Mr. J. H. Yoast of Dunkley, collected and sent me a large quantity of the eggs of the cricket, and on the following, Mr. W. W. Miles of Eddy, collected and sent a lot.
soon as received, a number of the eggs were opened and the little crickets were fully formed and ready to emerge. On Dec. 12, the young crickets began hatching and seemed perfectly normal and active for a time, but artificial conditions did not agree with them and all died after living a few days.

A letter from Mr. J. H. Yoast, dated March 13, 1905, stated that the young crickets had already hatched in millions on the hilltops on the south side, where the snow was off.

DESCRIPTION OF YOUNG CRICKETS.

When first hatched, the crickets are a light flesh color throughout, except the black eyes, but soon become quite black with a broad, flesh-colored stripe the entire length of the back. Along the middle of this light dorsal stripe are two black lines separated by a narrow line of the flesh color. The hind margin of the cape, or pronotum, immediately above the front pair of legs, is very conspicuously light yellow, almost white. Antennæ somewhat longer than the body and black.

MEANS OF CONTROL.

NATURAL ENEMIES.

The greatly increased numbers of this grasshopper are probably due to continuous favorable conditions for their development, especially proper climatic conditions during the winter and spring months, and to a decreased number of natural enemies, such as insect parasites, birds and certain mammals. We have bred no parasites from the crickets and have found none in their bodies upon dissection. Bears and coyotes feed upon them, but birds destroy them in greatest numbers. The birds I most noticed were hawks, sage grouse, and blackbirds. The blackbirds were specially destructive, as they would gather in large flocks, and they did not devour the crickets entire, but would eat only a small part of a single cricket, as a rule. Ptarmagin and gulls have also been reported as feeding freely upon the crickets, and Mr. John H. Yoast wrote me last winter that the horned larks were very active about Dunkley devouring the eggs.

ARTIFICIAL REMEDIES.

This is a difficult insect to cope with successfully and yet the writer is satisfied that much can be done to prevent its depredations to cultivated crops. The remedial measures may be divided into two classes—preventive, and destructive.

PREVENTIVE MEASURES.

Herding. One of the simplest and most common of these is
“herding” or driving. This consists in going in front of the swarm and conducting a flanking movement to turn the line of march to the right or left. I am told by the ranchmen that it is useless to try to turn the swarm back, but it may be deflected to one side. This is done in various ways: sometimes men, women and children go ahead of the swarm with bushes that they use by beating the ground as they travel back and forth; often saddle ponies are ridden back and forth, and sometimes bells are jingled, and tin cans are beaten with sticks or stones. From some tests that I made, it seemed to me that the hoppers cared little or nothing for noises, but they are frightened by an object in motion. Ropes and chains are also used to drag behind horses or between men walking or riding.

Ditching with vertical banks next to the field which is to be protected, and with frequent deep holes like post-holes in the bottom into which crickets will fall and pile up, have been used with some success, but it is doubtful if there are many cases where it would be practical to turn aside or destroy the crickets in this manner, unless a rapid flowing stream of water can be kept running in the ditch, in which case the holes in the bottom of the ditch would not be necessary.

Fencing. The crickets have the reputation of being able to climb a window pane or any other vertical surface, no matter how smooth. This was not true of the adult crickets that I made observations upon at Eddy. I was unable to get one to climb up a vertical surfaced board until it was inclined to a considerable angle, and they were utterly unable to cling at all to vertege tin, glass, corrugated iron roofing, oilcloth, or ordinary glazed wrapping paper, such as is used everywhere in meat markets and in other stores to wrap goods in.

Professor Aldrich, in Bulletin 41 of the Idaho Experimental Station, reports the use of boards eight inches wide, placed edge-wise, end to end, about a garden, with a strip of tin on the upper edge projecting horizontally two inches as a barrier, that the crickets can not crawl over. Professor Doten of the Nevada Experiment Station, printed a letter from Prof. Kellogg of Stanford University, which says that in Washington state six-inch boards are used effectually in the same manner, except that the tin strip is about five inches wide and is placed vertically and recurved outwardly. I tried the fence as described by Prof. Aldrich, and found it quite satisfactory. Care must be taken to have the tin projecting fully two inches. It seems to me that the ideal way would be to have this fence along the border of a ditch on the side next the crop, so that the crickets would fall back in the water and be carried down stream. Surfaced boards would be best, but if only rough boards were at hand, these could be covered with oilcloth or glazed paper.
Plate I. ANABRUS SIMPLEX.

A, adult female; B, a comparatively straight ovipositor; C, blubber-like mass clasped by the vulva of the female; D, the mass removed immediately after copulation, showing the two small lobes that are clasped by vulva of female; E, end of male abdomen from above, showing clasping organs; F, wings of adult male; G, a cluster of eggs in the ground, the upper one protruding above the surface. All natural size, except E and F, which are twice natural size. Miss Miriam A. Palmer, artist. Original in Entomologica Nova, December, 1914.

Figure I.

Figure I. Young of the Western Cricket (Anabrus simplex) only a few hours from the egg; enlarged six times. Miss Miriam Palmer, artist.
Plate II. MIGRATIONS AND DISTRIBUTION OF THE WESTERN CRICKET IN ROUTT COUNTY, COLORADO.

The arrowheads show the direction in which the migrations took place. The dates near them record the years that they passed the given location.
THE WESTERN CRICKET.

Where it is obtainable, long, narrow strips of corrugated or other sheet iron could be used alone.

DESTRUCTIVE MEASURES.

While I was only able to make a few tests in a small way of any means of destroying the crickets, it seems to me that it is here that we shall find some of the most promising methods of keeping these destructive insects in check. First, and perhaps most promising among these methods, I will mention the use of

Coal Oil or Petroleum on Water. I find some who have used coal oil on water, report good success and others report failure. One party who used the oil at Hayden last year said, "We killed them all right when we used enough oil." I am confident that wherever a vertical ditch bank or a fence upon one of the above plans can be used to tumble the crickets back into the water of a ditch that they are crossing, that they can be killed in enormous quantities with the oil, as follows:

Throw a dam across the ditch, arranged so as to allow the water to escape through an opening near the bottom of the dam, but not allowing it to run over the top. The water will back up and can be covered with a heavy film of oil that will not run off, and, as the crickets accumulate above the dam they could be raked out and shoveled into a pile. They would make an excellent fertilizer.

Poisoning. I tested white arsenic, dissolved, and as a powder, and Paris green for the destruction of the crickets. I found that it was necessary to use the poisons freely in order to kill at all quickly. I found that the dissolved arsenic was most satisfactory in its results. I also found that the crickets are very fond of sugar and took the poisons more freely when sweetened. The poisons were put upon green vegetation, such as cabbage leaves and beet leaves, and upon fresh horse manure. It seems probable that poisoned baits of green food placed in the track of the crickets, especially in the early morning, might be quite effectual in destroying them. I would use the poison in the proportion of about 1 pound to 10 gallons of water, and thoroughly moisten the food with it. Enough sugar to sweeten the bait a little will make it more acceptable. Poisoned sweetened water put anywhere in the way of the crickets might serve to kill them.

Where the crickets are marching into a field of oats, potatoes or other cultivated crop, I believe an arsenical poison in the proportions mentioned above, sprayed upon the plants along the border of the field where the crickets first enter, would destroy a large proportion of them. The first that die will be eaten by their comrades, and so one dose may do double duty. It might be practical to poison the native food-plants where the young feed before taking on their marching habit.
If it is desired to dissolve the arsenic, this may be done by boiling a pound of it in a gallon of water with two pounds of salt soda. This may then be diluted to 10 gallons. If living plants are to be sprayed, it will probably be better to use the arsenic or the Paris green without dissolving; simply mix them with the water.

Plowing. Some times the eggs are deposited in great numbers where they may be turned deeply under by plowing. This would probably prevent the escape of the little crickets when they hatch.

Burning. Whenever there is enough dry vegetation to burn on the hills where most of the eggs are laid, fire could be used to advantage.

Crushing. When a swarm is on level ground, great numbers can be killed by running a roller over them.

Great numbers can often be killed by driving sheep about over the swarm.

In mentioning remedies, I have been unable to speak from any practical experience, having had none. I have done what I could to collect information from the experiences and reports of others and have made some observations and tests in the field in the vicinity of Eddy and Dunkley, and offer the above remedies as suggestions. I would like to speak more definitely, positively and encouragingly of some remedy, but can not as yet. If the cricket should continue to increase the present year, I hope, with the cooperation of the ranchmen, to carry on some tests of remedies in a more practical and extensive way in the field the coming summer. I shall be glad to be kept fully informed of the conditions and movements of the crickets during the present season. If anyone should test any of the remedies suggested, or others, I should be very glad to be notified of the results, whether successful or not. Valuable information gained by the Experiment Station will be given out to the ranchmen, and in these ways we may be mutually helpful.
DISTRIBUTION AND MIGRATIONS.*

BY S. ARTHUR JOHNSON.

An extended trip, occupying nearly two weeks, was taken in the summer of 1904 through that part of Routt county which is subject to invasion by the western cricket. Special attention was given to securing data and observations on the migrations and habits of these insects.

This species was studied to some extent during the seventies and early eighties by the Entomological Commission of the U. S. Government.* *

The observations made at that time confirm the conclusions arrived at last summer, that the cricket has its permanent home in certain dry hills. They live and prosper there every year, but success comes to them as it does to other insects, in liberal proportions on certain years. The young have a curious and unexplained habit of migrating. These events appear to have only slight connection with the abundance of food, though the most numerous bands travel the greatest distances. On reaching a desirable pasture they first eat ravenously and then resume the march. The latter part of the army crowding upon the leaders causes them to move forward. If the band is very large, the crowding will give rise to a more rapid pace than where the numbers are smaller.

The migrations appear to have a marked relation to the distribution of the species. The successful breeding grounds are dry hills, which are often at considerable distances from each other. Since the insects are unable to fly, it would be next to impossible for isolated individuals to reach new territory. This can be, and is, accomplished by the armies, which even pass considerable streams in their march.

The homes, so far as we can learn, appear to be of two kinds: permanent, where the insects are always more or less abundant; and temporary, where the migrating hordes reach a new locality.

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* A more detailed account of this phase was presented to the Association of Economic Entomologists at their last meeting and will appear with the proceedings of that body.

which is favorable to the laying of eggs. In the latter case the new grounds furnish a resting place, where the insects may be found for a greater or less length of time. If they are successful here, they may invade new territory, or, on the other hand, they may be overcome by enemies and adverse circumstances and disappear.

A trait of this species, as well as some others of the same genus, is to travel in bands of greater or less magnitude. When the eggs hatch well, these bands assume almost incredible proportions. Prof. Bruner states: "As a rule, they collect into lines varying from a few to hundreds of yards in width, and from a few hundred feet to a mile or more in length." These armies migrate in different directions from the breeding grounds, as if by common consent. The sight of an army on the march is one of the most wonderful in the insect world. The heads are all in one direction; the troops move along in a steady and orderly fashion without confusion or much noise, the members traveling on "all sixes." The sight of a band in its progress reminds one of the movement of a full stream. There is the same steady motion and ceaseless flow. So far as we observed, it was only when alarmed that the insects began to jump, and the sharp, warning notes of the males set the surrounding members in commotion and precipitous flight. Most observers state that the line of direction is not changed; that the insects will cross streams and ditches, climb cliffs and grove over houses and fences, rather than change their purpose. This can be true only in part. It is well known that many separate armies have followed rather tortuous courses during their periods of wandering. They are commonly diverted from entering cultivated fields by herding. Many original armies appear to have been split into different bands and thereafter to have pursued widely diverging lines. All of the things mentioned above are true, but their persistence in a distinct direction in any particular case is probably due to the pressure of their companions on all sides, which makes a change impossible.

We lack definite data regarding the exact period in the insect's life when the migrations begin, but observers say that when they are first herded they are of all sizes, and some report that at the first appearance the insects are very small.

The length of time employed in travel depends largely upon the time of maturing of the insect. During the summer of 1904, the forward march was not continued beyond the middle of July. The visitation, however, was said to be earlier than usual, owing to the nature of the spring, which caused the eggs to hatch at an early date.

When the egg-laying period is reached, the insects retire to the dry hills, where they spend their time providing for their off
spring. The migrations after this period begins consist only in short trips from the breeding grounds to feeding places and back. When in the neighborhood of water they have been observed to go to it, drink and retire. The gregarious habit still prevails. The bands, though somewhat scattered, still maintain their entity. Usually the lines marking the margins of a group are sharply defined and only a few stragglers are to be found beyond its limits.

The distances to which the insects may travel during the migrations and the rate of travel vary greatly. The bands which reached Eddy and came within five miles of Steamboat Springs may have traveled between fifteen and thirty miles. It is not altogether certain where the starting point was. The band which reached Lay, traveled much farther. With regard to the rate of travel we have one authentic record. The army which found its resting place at Pagoda was reported by telephone from four miles up the fork a week before it reached that place. That is, it traveled at the rate of something over half a mile per day.

The traveling, so far as we observed, was done entirely by daylight. At night the insects mass themselves upon the sage brush or other vegetation and remain there until daylight. The Entomological Commission records that the invasions were made at night, but such was not our observation. Reports were made, however, of insects being found in the houses in large numbers early in the morning.

Several localities were found where the insects were ovipositing. They were invariably dry knolls, which were nearly or quite barren of vegetation, and where the soil was soft and usually clayey. The eggs did not appear to be numerous in any locality west of Dunkley. At Pagoda four counts were made of separate deposits which contained 18, 4, 9 and 14 eggs, respectively.

There is but little doubt that the western cricket is permanently located in the Danforth hills (See map) south and west of Axiel. A lady living there reported that on her ranch seven miles east, it was necessary to fight the insects almost every year. They come in from the west and travel east and up canons, and are kept off the crops by herding and noise. The insects are sometimes quite young when they appear, and the invasions are liable to continue until they are full grown and retire to the hills.

At Hamilton, a town perhaps twenty miles east of Axiel on the William's Fork of Bear river, we were able to obtain definite data regarding them.

The first observations were made by Mr. T. H. Hamilton in 1879. He kindly gave me the following notes: From here the insects travel northeast, and to accomplish this it is necessary for them to cross William's Fork, which flows quite rapidly at this point. In making the attempt, immense numbers were drowned
and floated down the river, but the rest succeeded in crossing. A glance at the map will show that they found themselves immediately in the William's River mountains. Here they located and laid eggs which hatched the following spring as soon as the snow began to melt. The young endured the rigors of the season without apparent inconvenience. Frequently at night they would freeze, only to thaw out the next day and renew operations. Sometimes they were buried beneath the snow, where they remained until that was melted.

Three years later (1882), a horde visited Hayden, a town north and east of Hamilton on the opposite side of the William's River mountains. During this visitation they did considerable damage to gardens and crops, which at that time, however, were not so important a feature as they have since become. It seems probable that the drove which visited Hayden were the descendants of those at Hamilton three years before. The first brood may have found a temporary home in the William's River mountains, in which they gathered sufficient strength to make the invasion into Hayden.

We have two records of the next great migration, which occurred in 1895. They were made at Hamilton and at Lay. The first was observed by Mr. Hamilton, and the second by Mrs. Callahan. Lay is located thirty miles west of Hayden and seven miles north of Bear river. The drove, which was not very large at this place, came from the southwest and went north. The remarkable feature is that the insects must have come across Bear river, since there are no hills between this and the river where they are located. The original brood must have been enormous, for even the large numbers at Hayden this year failed to effect a crossing. The band was evidently following up the valley of Juniper creek. It is not an uncommon habit for the insects to follow a river valley when migrating. The general direction of the broods must have been more northerly than usual, for this is the only record we have of a visit to this locality.

The third great migration reached Hamilton in 1900 and a second wave followed in 1902. Both crossed the William's Fork as the previous broods had done. During the last trip they destroyed twenty-five acres of grain belonging to Mr. Hamilton, who herded them off the garden with partial success. Attempts were made to poison the insects with Paris green and to kill them with kerosene oil, but owing to the immense numbers these methods were of little avail.

Eggs were laid again in the Hayden divide and apparently, at least, gave rise to the unprecedented numbers of 1904. It is not quite certain how long the insects have been located on the Hayden divide. Some say that they have been there for the past ten
years, which would throw their existence back to the brood of 1895. Observations by ranchmen are intermittent and occasional. The country is extensive and seldom visited by the people in every locality. Owing to the gregarious habits of the pest, it is quite possible that small bands could exist in the hills for years without being observed. In any case, the migrations of 1900 and 1902 must have been an important factor in overpopulating the breeding grounds.

The spring of 1904 opened very early, and in the first part of summer the hordes began to come down among the ranches from the Hayden divide. Judging from the directions in which the broods traveled, eggs must have been deposited the previous year over a large proportion of the range.

At Hayden the insects appeared about the first of June, traveling east and northeast. On reaching the ditch between the hills and cultivated fields, they leaped into it and crossed. Many dead and living floated down the ditch, where they lodged against a dam, making a mass forty feet long, one foot deep and perhaps four feet wide.

The chief injuries were to potatoes, alfalfa and young clover. No remedies were effective. Coal oil was permitted to drip from the bottom of a can into the ditch. This, floating over the surface of the water, did good service, but the price of coal oil in this locality is so high that the remedy is an expensive one.

The army traveled on until it came into contact with a bend in the Bear river, when it was deflected from its course, and, following the current of water, visited Hayden a second time a few weeks later. At the time of our visit, during the latter part of July, the adults were to be found in considerable numbers in the hills south of Hayden, where they were ovipositing. Search was made for eggs, but they did not appear to be abundant.

Swarms, coming apparently from the eastern end of the divide, invaded the country toward Eddy and Steamboat Springs. There seems to have been several divisions of this migration. At Dunkley, Mr. Yoast herded them off his crops for weeks, after which they seemed to retire to the Hayden divide, which is contiguous to this place. An immense swarm reached Eddy and located in the hills at that place, where eggs were laid in greater abundance than was noted at any other locality.

Still another band, taking a northeasterly direction, made its way to within a few miles of Steamboat Springs.

A very large band entered the valley of the William's Fork and followed it, traveling west to Pagoda, at which place it was within twelve miles of the spot where the original migrants crossed the fork at Hamilton. The numbers were so great that they were piled in the road several inches deep. Numbers died in the ditches,
but others entered the alfalfa fields, which they destroyed for a distance of thirty or forty feet, eating the leaves and tender shoots, but leaving the bare stems standing. Garden crops suffered severely and a field of oats was eaten almost to the ground. They were herded off the crops with bells and riding horsemen, but this was only partially successful. The insects persisted in their attacks for two weeks, after which they retired to the hills.

As already stated, the Entomological Commission studied this insect in the latter seventies. Prof. Packard records its injuries from 1865 to 1879 in Utah, Idaho and Nevada, and states that the insects were becoming less destructive than formerly. From that time until recently but little attention has been given to them. In March, 1904, Prof. Aldrich devoted a portion of Bulletin 41 of the Idaho Station, to its injuries and control. It appears that the insect gives some annoyance in parts of Southern Idaho almost every year.

In Eastern Nevada the crickets have been very common and destructive for several years. Prof. Doten, in Bulletin 56 of the Nevada Station, has given an excellent account of the life habits and suggests remedies.

The reasons for the periodic outbreaks of the pest are unknown, but it is probable that they are mostly climatic. Spring, which are favorable to the hatching of the eggs, followed by scarcity of food in mountain valleys, are doubtless important items.