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The Striped Ground Squirrels of Colorado

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The Striped Spermophiles or Ground Squirrels of Colorado

(Citellus tridecemlineatus pallidus and *Citellus tridecemlineatus parvus)*

By W. L. Burnett

ACKNOWLEDGMENTS

The writer wishes to offer the following acknowledgments of assistance in his work: to Professor C. P. Gillette, under whose direction I have worked, and who has at all times given his advice and criticism in the work; to Mr. C. J. Elliott, of Wolf Creek, who entertained me several days at his ranch and gave all the assistance possible in the work of collecting squirrels on his place; to Mr. E. H. Thomas, of San Acacio, who gave his time and the hospitality of his home while the writer was working on the little striped ground squirrel, *Citellus tridecemlineatus parvus;* to Mr. L. C. Bragg, of the Department of Entomology, Colorado Experiment Station, and Mr. George M. List, Deputy State Entomologist, who have kindly assisted in the identification of the insects found in a majority of the stomachs.

One hundred letters of inquiry were sent out to the ranchmen in different parts of the state for their opinions concerning the food habits of the striped ground squirrel. We received in reply seventy answers. The correspondents are too numerous to mention by name, but I extend to them my appreciation for prompt replies and thoughtful consideration of questions asked.

INTRODUCTION

Throughout the State of Colorado large numbers of small rodents live in burrows and runways, and in sections where forage or grain crops are raised they cause serious loss to the ranchmen and stock-growers by the destruction of crops. These rodents are of herbivorous habits, but almost all eat flesh to some extent. For the past three years the writer has devoted considerable of his time to the study of the food habits of these destructive rodents, and has collected data relative to their distribution and economic importance from the farmer's standpoint. Along this

line of work the following circulars have already been issued from the office of the State Entomologist:

No. 6, "Rodent Investigation for 1912."

No. 8, "Prairie-Dog Investigation in Colorado."

No. 9, "The Wyoming Spermophile or Ground Squirrel."

No. 10, "Pocket Gophers."

The present circular on the striped ground squirrels describes the first attempt, to the writer's knowledge, to get together a number of stomachs for examination of the food habits of this squirrel. The eastern form, *Citellus tridecemlineatus*, has been the subject of several circulars from different experiment stations and the United States Department of Agriculture. No doubt the food habits of the two are practically identical. The number of stomachs examined for the present paper is far too small to arrive at a definite conclusion as to their food habits, but may serve as a basis for further investigation.

No attempt has been made to study the food habits of the smaller form of this squirrel, *Citellus t. parvus*, but the description and distribution have been added for the purpose of calling the reader's attention to the two forms found in the state.

The striped ground squirrel, *Citellus t. tridecemlineatus*, of which our pale-striped ground squirrel, *Citellus t. pallidus*, is a subspecies, was first described in 1821, from a specimen taken in central Minnesota. Some fifty years later Dr. Allen separated the species and named the squirrel found on the arid plains *pallidus*.

DESCRIPTION AND DISTRIBUTION

According to Warren ("Mammals of Colorado"), "*Citellus tridecemlineatus* with its subspecies has a range from Saskatchewan on the north to northern Texas on the south, and from northwestern Utah, Colorado, and Wyoming to Michigan." The present subspecies inhabits the arid plains from Montana, Wyoming, and Nebraska to Texas. In Colorado it is found over most of the plains country of the eastern part of the state, from the foot-hills east, and inhabits every county of that part of the state. "It is found in South Park, and has been taken at Twin Lake, near Leadville." (Warren's "Mammals of Colorado.")

Cary reports it from "North Park, Wet Mountain, and Huerfano Valley, and near La Veta in the Cucharras Valley." ("North American Fauna," No. 33.)

In this state we have records, at the office of State Entomologist, of its occurrence in practically all the plains country north of the Arkansas River. The writer has taken this squirrel near Log Cabin P. O., Larimer County, at an elevation of 7,200 feet, but it is not at all common at that elevation. In Moffat, Rio Blanco, and Garfield Counties, and in most of the San Luis Valley, this ground squirrel is replaced by the smallest member

of this group, the little striped ground squirrel, *Citellus tridecemlineatus parvus.*

According to records in the office of State Entomologist, this squirrel has been reported from the following localities in the state:

Locality	County	Locality	County
Keysor	Elbert	Hillrose	Morgan
Elbert	Elbert	Wiggins	Morgan
Hargisville	Elbert	Deer Trail	Arapahoe
Elizabeth	Elbert	Strasburg	Arapahoe
Matterson	Elbert	Littleton	Arapahoe
Stonehan	Weld	Byers	Arapahoe
Grover	Weld	Franktown	Douglas
Pierce	Weld	Leader	Adams
New Raymer	Weld	Comanche	Adams
Sligo	Weld	Julesburg	Sedgwick
Hudson	Weld	Chivington	Kiowa
Kuner	Weld	Arlington	Kiowa
Nunn	Weld	Wild Horse	Cheyenne
Kutch	Lincoln	Cheyenne Wells	Cheyenne
Arriba	Lincoln	First View	Cheyenne
Hugo	Lincoln	Berthoud	Larimer
Rago	Washington	Howard	Fremont
Abbott	Washington	Flagler	Kit Carson
Cope	Washington	Kit Carson	Kit Carson
Thurman	Washington	Springfield	Baca
Orchard	Morgan	Montclair	Denver
Hoyt	Morgan	Atwood	Logan

Over practically all the range of the striped ground squirrel it is known as the "striped gopher;" a name which in no way is appropriate, as the true gopher is an entirely different animal, having external cheek pouches and living beneath the surface of the ground; while the ground squirrels have internal cheek pouches and spend their season of activity above ground, seeking their burrows for hibernation, and using them as storehouses for food and as places to bring forth their young.

Of the nine species and subspecies of ground squirrels found in Colorado, the striped one is probably best known. Although of a rather shy and retiring disposition, it seems to enjoy the company of man, and it is not unusual to see one dart into its hole under the sidewalk in the residence part of town. It is very common on the campus of the State Agricultural College, where several pairs have been living for the past year or two around and near the Museum building.

With its smooth coat, bright eyes, and great activity, it is the handsomest of all our ground squirrels.

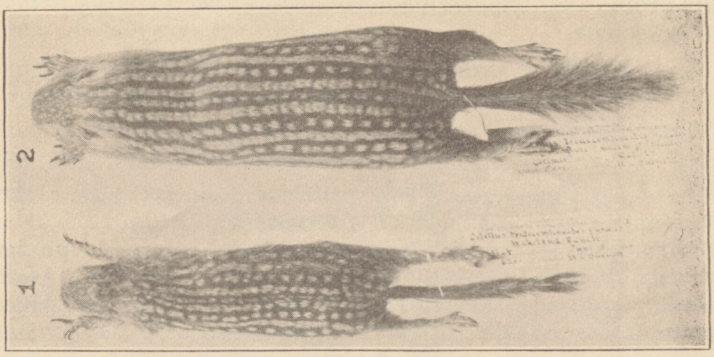

Figure 1, little striped spermophile *(Citellus tridecemlineatus parvus)*; figure 2, pale striped spermophile *(Citellus tridecemlineatus pallidus)*.

Description of Citellus t. pallidus (from Warren's "Mammals of Colorado")—

Striped above, six light and seven dark longitudinal stripes; the light stripes a yellowish gray color, some at least of the hairs black-tipped; dark stripes a dark brown, almost black sometimes; all the stripes, except outer one on each side have a row of spots in center, of same color as light stripes; outer dark stripes unspotted and ill-defined; top of head irregularly marked with color of back; flanks somewhat rusty; buffy ring around eye; sides and upper surface of feet and under parts similar color to light stripes, but somewhat lighter and more yellowish white; latter color on tips of hairs and on tip of tail; under surface of tail same color as under part of body.

The scientific name of this ground squirrel, *Ci-tel'-lus tri-de'-cem-lin-e-a'-tus pallidus*, is from the Latin, and the meaning is as follows: *citellus*, diminutive of *citus*, swift; *tridecem*, thirteen; *linea*, line; *pallidus*, pale.

If you will count the lines on the back and sides of these squirrels, you will find seven broad stripes and between them six narrow stripes, thirteen in all.

Hibernation.—In Colorado these squirrels spend about five months of each year in their underground homes. The important factors in the control of the extent of this hibernation are climatic conditions and altitude.

For several years we have kept a record of their appearance in the spring and their disappearance in the fall. Our earliest spring record is March 23, and our latest fall record is November 9.

Abundance.—They are more abundant than one would suppose; for they are very shy, especially in the spring of the year. In walking over the ground, you will seldom see a specimen; but trapping on this same ground will always bring good results in a few hours.

I spent three days at the Elliott ranch in Arapahoe County this spring, being constantly in the field during the day, and failed to see a live specimen of this squirrel in that time; yet

trapping brought an abundant harvest. I found it occupying pastures of native grass, as well as cultivated fields.

The soil was sandy, and all parts of the ranch were full of burrows.

I also found the little spotted ground squirrel *(Citellus obsoletus)* living in the same vicinity. Traps set only a few feet apart would yield both species.

Breeding.—According to Warren ("Mammals of Colorado"), "the young are born in May or June and are from five to eleven in number." We have very few data at this office on the breeding habits of the striped ground squirrel. In the breeding season the females are difficult to secure for examination. Of fifty specimens of this squirrel trapped in the months of May and July, only nine were females.

From what information we have, the period of gestation is about thirty days, and the young are born about the first week in June, and number from nine to eleven.

The young are born in the underground burrows. There has been, to our knowledge, only one exception to this rule recorded—that by Mr. R. B. Rockwell, of Denver. He writes as follows in *Journal of Animal Behavior*, May and June, 1912:

> Some fifteen miles northwest of Denver is a small lake leased by a number of Denver men for duck shooting. The so-called club-house is a frame structure of one room, which serves the manifold purpose of kitchen, sleeping-room, storeroom, etc. It is occupied but one night during the week for only a few weeks in the spring and fall, and is overrun with house mice. The shooting season closed April 15, and the house was not again occupied until the night of June 3. On this evening the writer, with a companion, reached the cabin some time after dark, and preparations were made to retire. In the corner of the cabin was a pile of three folding spring cots, and on top of these was a camp mattress.
>
> The cots and mattress were taken out of doors and set up (for we were outdoor sleepers), and the writer promptly turned in. I had no sooner become quiet than I heard a chorus of tiny squeaks coming from inside the mattress, and an examination revealed a warm nest in the padding, containing eight tiny, naked, blind creatures whose eyes were not yet opened. Supposing them to be young mice, they were ruthlessly disposed of, as mice usually are, and I prepared to resume my slumbers.
>
> I was aroused a few minutes later by my friend (who had not yet retired) calling me softly to hurry into the cabin; and, once there, a sight met my eyes that I will long remember.
>
> Under where the cots had been piled was a knothole in the floor. This, however, was not directly under the portion of the nest, which was rather toward one side of the mattress, but more to the other side of the space which had been covered by the cots, and both were well toward one end of the latter. Emerging from this hole was the mother of the little ones we had just assassinated, but, instead of a mouse, it proved to be a large, handsome pale-striped ground squirrel (*Citellus tridecemlineatus pallidus*). As this species is, to the best of my knowledge, strictly diurnal, and the time was between 10 and 11 p. m., it seems probable that the animal had been frightened from the nest by our entrance and was now returning.

FOOD

From an economic standpoint, the striped ground squirrel presents a problem that is somewhat difficult to solve. In some sections of the state it is no doubt very injurious to corn and newly planted seeds of various kinds, while, on the other hand, in other sections it is beneficial by the destruction of grasshoppers and other injurious insects, cut-worms, etc. This is especially true throughout the irrigated districts, where in former years grasshoppers have been such a scourge. From our observations, the striped ground squirrel prefers grasshoppers to any other food, and where these insects are abundant it will eat them almost to the exclusion of all other foods. Just where to draw an arbitrary line between the evil and the good is a difficult matter. Mr. W. E. Snyder, in writing about the food habits of the eastern striped ground squirrel, says:

> In Wisconsin their principal food is grain and seeds. One killed on August 11, 1894, had 181 kernels of barley in its cheek pouches. (List with the notes of the mammals of Dodge County, Wisconsin. Bulletin of Wisconsin Natural History Society.)

In 1889 Professor C. P. Gillette, at that time entomologist to the Iowa Experiment Station, examined twenty-two stomachs of the striped ground squirrel, *Citellus tridecemlineatus*. These squirrels were taken from April 19 to August 2.

In summing up the results of these examinations, we quote him as follows:

> Insects certainly constitute a large proportion of the food of the striped squirrel. The insects upon which the squirrels feed are almost exclusively injurious species, chief among which seem to be cut-worms, web-worms, and grasshoppers.
>
> As grass, clover, and other green stuff has been abundant wherever the squirrels were taken, and as their stomachs were often gorged with insects that must have given them much trouble to catch, it would seem that they prefer the latter food.
>
> From the above facts it seems certain that the squirrels must be a decided benefit to lawns, meadows, and pastures.
>
> If ground containing cut-worms, web-worms, and wire-worms is to be turned over to corn, the more squirrels that can be harbored upon it up to planting time, the less will the crop be damaged by these insects.
>
> The squirrels would be a most valuable adjunct to any corn field after planting, if some methods could be devised to prevent them from taking the corn.
>
> By combining the percentages given and dividing by twenty-two, we find that forty-six per cent of the contents of these stomachs was insects. (Contents of these stomachs not given in this paper.)
>
> If we add together all of the cut-worms and web-worms found and divide by twenty-two, we get thirteen as the average number. If we suppose that the amount found in the stomachs represents, on an average, one-half of the daily food, this would give twenty-six as the average number of these worms consumed by a single squirrel each day from April 19 to August 2, and 2,730 as the total number. These figures multiplied

by the number of squirrels living upon a given piece of ground will give some idea of the amount of benefit derived from them.

This, without saying anything of the large number of grasshoppers, wire-worms, and other noxious insects eaten, makes a very large credit account to be placed over against the debits chargeable to these squirrels. (Bulletin No. 6, Iowa Experiment Station, August, 1889.)

In 1892 Professor J. M. Aldrich, at that time assistant entomologist to the South Dakota Experiment Station, examined fifteen stomachs of this same species of squirrel, and, after quoting Professor Gillette's paper mentioned above, summed up his results as follows:

Summing up the insects, we have nineteen or twenty cut-worms, eleven other lepidopterous larvae, three grasshoppers, and two crickets, all of which may be set down as injurious. The number of beetles of all kinds could not be definitely ascertained, but was thirty to thirty-five. None of them are species which were noted either for benefiting or injuring the farmer. Those marked Carabid and Harpalus belong to a family that are in general beneficial, while those marked Chrysomelid and Chrysomela belong to the leaf-eaters, of which groups many species are injurious.

As the beetles found in the gophers' stomachs were of both classes, there is no great preponderance on either side. As far as our observations go, they do not give the gopher as favorable a showing as Professor Gillette's did. (Bulletin No. 30, South Dakota Experiment Station, March, 1892.)

Mr. Vernon Baily, in a summary of eighty stomachs examined, states that more than half of their contents consisted of insects. The percentage of animal matter was 52.9, of vegetable matter 44.4, and of indeterminate matter 2.7.

The cheek pouches contained 100 per cent vegetable matter, being filled exclusively with grain and seeds of various plants. (Bulletin No. 4, Division of Ornithology and Mammalogy. United States Department of Agriculture, Washington, D. C., 1893.)

The following letter just received from Mr. A. C. Maxson, entomologist for the Great Western Sugar Company, refers to the eastern form of the striped ground squirrel *(Citellus tridecemlineatus)*:

LONGMONT, COLO., September 10, 1914.

Mr. Burnett, Fort Collins, Colo.

DEAR MR. BURNETT: In compliance with my promise, I will give you the account of my brother's experience with gophers as chicken-killers.

My brother's farm is located in central Minnesota, in a timber country, about seventy-five miles north of St. Paul.

This spring about sixty brooder chicks were placed in a lot about one hundred feet square. This lot was bounded by a pasture, a potato field, and the house and barnyards.

Soon after the chicks were placed in the yard they began to disappear. A search for the cause revealed the fact that the common striped gophers were taking them. Forty chicks about two weeks old were taken in one day. The next day twenty gophers were killed in the lot, and no chicks were taken.

So far as could be ascertained, there was not a gopher burrow in the enclosure. The gophers came from the pasture and border of the potato field.

Hoping that this record may be of value to you, I remain,

Yours truly,

ASA C. MAXSON.

A striped ground squirrel which we captured alive and kept in a cage at the College Museum for several months would eat all kinds of grain, dry bread, cake, and meat, and had a great liking for mice, which it would catch, kill, and eat with great eagerness. The caged squirrel was very fond of grasshoppers, and, no matter what kind of food was in the cage, he would leave everything else for grasshoppers, and would eat nothing else until the supply was exhausted. We placed the grasshoppers in the cage alive, and the squirrel would catch and eat them, sitting up on his hind legs in the characteristic pose of ground squirrels while feeding. He would seize them with his fore feet, bite off their heads, and begin feeding at the head. The legs and wings were bitten off and dropped to the bottom of the cage. Large sphinx larvae were also eaten in the same manner, with great relish.

These squirrels have been reported as a nuisance from the fact that they dig up seed beans and peas. The one we had refused to eat both dried beans and peas. It is possible that the squirrels eat them when they are dug up at planting time, after the seed has germinated.

The squirrel is also fond of ground beetles (family *Carabidae*), a family of predaceous insects very common in the state. The caged animal, referred to above, refused to eat blister beetles (family *Meloidae*). These beetles are used for making blister plasters, the one most commonly used being a European one known as Spanish fly. No doubt these beetles are ill-tasting.

In the early part of the summer of 1912 the wife of the superintendent of the college farm called our attention to her patch of sweet corn and said that the striped ground squirrels were destroying it. The corn was at that time some eighteen or twenty inches high, and down by the side of almost every stalk of corn was a hole made by these ground squirrels. After watching for several days, it became evident that they were doing no damage to the corn stalks. I was of the opinion that they were after cutworms, but ten specimens trapped near this corn field failed to show any of the worms in their stomachs, and no trace of corn, except in two stomachs. The corn found in them was hard and flinty, and not kernels that had germinated, and all the stomachs contained remains of grasshoppers. This corn was not injured in any way that we could see from the work of this squirrel, and matured at the proper time.

On pasture land the damage done by the striped ground squirrels cannot be very great, for, unlike the prairie-dog, they

destroy only what they eat. Around the prairie-dog holes the grass is always killed for several feet. Not so with this squirrel. You will often find the grass up to the mouth of the holes, making them at times difficult to see.

The burrows of the striped ground squirrel, as a rule, descend for a short distance almost perpendicularly, and then branch off horizontally. These squirrels do not always live in burrows made by themselves, but at times occupy the deserted burrows of other animals—prairie-dogs, kangaroo rats, etc.

In years past, when the vast plains of Colorado were still virgin soil and the hand of man had not been raised against it, the balance of nature was so evenly regulated that the predaceous birds and mammals—hawks, owls, coyotes, badgers, skunks, and weasels—kept in check any undue increase in destructive rodents; but now the hand of man is reaching out farther and farther into these vast plains. He is encroaching on the ground squirrels' domain, and with the march of civilization, in his thoughtlessness, he is destroying these predaceous birds and mammals that serve to keep in check the rodents that feed upon his crops. With the destruction of the natural enemies of these rodents, and furnishing them with a new source of food supply, it is no wonder that they are increasing.

Different Foods Reported Eaten by *Citellus t. pallidus*

Sunflower seed
Grass seed
Dandelion seed
Pumpkin seed
Sugar beet seed
Watermelon seed
Muskmelon seed
Young chickens
Squash seed
Speltz
Beans
Grasshoppers
Crickets
Alfalfa roots and leaves
Corn
Cane
Oats
Wheat
Kaffir corn
Rye
Milo maize
Peas
Barley
Peanuts
Beetles
Field mice

Contents of Stomachs

The stomachs of the striped ground squirrel *(Citellus tridecemlineatus pallidus)* mentioned below have been examined to determine the food contents. These stomachs were taken from squirrels trapped in alfalfa fields, native pastures, cultivated fields, and along ditch and railroad embankments. Unlike the birds, which swallow the food whole, the ground squirrel, like all rodents, thoroughly chews its food before swallowing, so that the soft parts of the insects are in such shape as to be almost impossible of identification; but, as a rule, enough of the legs and antennae remains so that one can be sure of the order, and in

some cases the family and genus, to which they belong. The identification of vegetable matter, as a rule, is not so difficult. Just after corn-planting time, stomachs should have been examined; for at this season of the year the greater damage is done. At this time, however, other field work claimed our attention. The evidence is so conclusive as to their injury to the corn that there can be no question as to their destructiveness at that time.

Stomach No. 1.—Adult female; trapped July 7, 1912, at Fort Collins, along railroad embankment: stomach full of remains of grasshoppers.

Stomach No. 2.—Adult male; trapped July 7, 1912, at Fort Collins, along railroad embankment: stomach nearly full of grasshoppers and caterpillars.

Stomach No. 3.—Male, about two-thirds grown; trapped July 7, 1912, at Fort Collins, along railroad embankment: stomach full of grasshoppers.

Stomach No. 4.—Female, about two-thirds grown; trapped July 10, 1912, at Fort Collins, along railroad embankment: stomach full of grasshoppers and a small amount of corn.

Stomach No. 5.—Female, about two-thirds grown; trapped July 10, 1912, along railroad embankment: stomach about half full of grasshoppers.

Stomach No. 6.—Female, about two-thirds grown; trapped July 10, 1912, at Fort Collins, along railroad embankment: stomach full of grasshoppers.

Stomach No. 7.—Female, about two-thirds grown; trapped July 10, 1912, at Fort Collins, along railroad embankment: stomach, nearly empty, contained a small amount of corn.

Stomach No. 8.—Female, about two-thirds grown; trapped July 11, 1912, at Fort Collins, along railroad embankment: stomach full of grasshoppers and one caterpillar.

Stomach No. 9.—Nursing female; trapped July 12, 1912, at Fort Collins, along railroad embankment: stomach, nearly empty, contained grasshoppers and one small larva.

Stomach No. 10.—Adult female; trapped August 10, 1912, along railroad embankment: stomach full of grasshoppers and three small larvae.

Stomach No. 11.—Adult female; trapped April 15, 1913, at Fort Collins, in alfalfa field: stomach full of alfalfa.

Stomach No. 12.—Adult male; trapped April 15, 1913, at Fort Collins, in alfalfa field: stomach about half full of alfalfa and one cricket.

Stomach No. 13.—Adult male; trapped April 15, 1913, at Fort Collins, in alfalfa field: stomach full of alfalfa and beetles *(carabidae)*.

Stomach No. 14.—Adult female; trapped April 15, 1913, at Fort Collins, in alfalfa field: stomach, nearly empty, contained some alfalfa.

Stomach No. 15.—Adult male; trapped April 17, 1913, at Fort Collins, in alfalfa field: stomach full of alfalfa and beetles *(carabidae)*.

Stomach No. 16.—Adult male; trapped April 22, 1913, five miles west of Fort Collins, in pasture of native grass: stomach full of grass, dandelions, and animal matter.

Stomach No. 17.—Adult male; trapped April 1, 1914, five miles west of Fort Collins, in pasture of native grass: stomach full of beetles *(carabidae)*, grass, and one spider.

Stomach No. 18.—Adult male; trapped April 4, 1914, five miles west of Fort Collins, in pasture of native grass: stomach full of beetles *(carabidae)*, grass, and spiders.

Stomach No. 19.—Adult male; trapped April 4, 1914, five miles west of Fort Collins: stomach, nearly empty, contained some grass and grass roots.

Stomach No. 20.—Adult male; trapped April 13, 1914, at Fort Collins, in pasture of native grass: stomach, nearly empty, contained some grass.

Stomach No. 21.—Adult male; trapped April 22, 1914, near Wolf Creek P. O., Elbert County, at edge of old corn field: stomach, nearly empty, contained some dry corn.

Stomach No. 22.—Adult male; trapped April 22, 1914, near Wolf Creek P. O., Elbert County, at edge of old corn field: stomach, nearly empty, contained some vegetable matter.

Stomach No. 23.—Adult male; trapped April 23, 1914, near Wolf Creek P. O., Elbert County, at edge of old corn field: stomach full of one bird feather (unidentified), two beetles, one larva, and dry corn.

Stomach No. 24.—Adult male; trapped April 23, 1914, near Wolf Creek P. O., Elbert County, at edge of old corn field: stomach, nearly empty, contained some mammal hairs *(Microtus)*.

Stomach No. 25.—Adult male; trapped April 23, 1914, near Wolf Creek P. O., Elbert County, in pasture of native grass: stomach full of grass, grass roots, dry oat stalks, and weed seed.

Stomach No. 26.—Adult male; trapped April 23, 1914, near Wolf Creek P. O., Elbert County, in pasture of native grass: stomach full of dry oat stalks, grass, weed seed, spider, caterpillar, and beetle (predaceous).

Stomach No. 27.—Adult female; trapped April 23, 1914, near Wolf Creek P. O., Elbert County, at edge of old corn field: stomach full of dry corn and old corn roots.

Stomach No. 28.—Adult female; trapped April 23, 1914, near Wolf Creek P. O., Elbert County, at edge of old corn field: stomach, nearly full, contained some grass, beetle and *Coleopterus* larva.

Stomach No. 29.—Adult female; trapped April 23, 1914, near Wolf Creek P. O., Elbert County, at edge of old corn field: stomach full of remains of a deer mouse *(Peromyscus)*.

Stomach No. 30.—Adult male; trapped April 24, 1914, near Wolf Creek P. O., Elbert County, in pasture of native grass: stomach medium full of grass, grass roots, cricket, beetles, and larva of May beetle.

Stomach No. 31.—Adult female; trapped April 24, 1914, near Wolf Creek P. O., Elbert County, in pasture of native grass: stomach, almost empty, contained small amount of vegetable matter and one small larva.

Stomach No. 32.—Adult male; trapped April 24, 1914, near Wolf Creek P. O., Elbert County, in pasture of native grass: stomach, nearly empty, contained some vegetable matter, beetle, and mammal hairs *(Peromyscus)*.

Stomach No. 33.—Adult female; trapped April 24, 1914, near Wolf Creek P. O., Elbert County, at edge of old corn field: stomach full of a few bugs *(Herimptera)* and a large number of beetles *(Chrysomelidae* and *Carabidea)*.

Stomach No. 34.—Adult male; trapped April 24, 1914, near Wolf Creek P. O., Elbert County, at edge of old corn field: stomach, nearly empty, contained some dry corn roots and beetle.

Stomach No. 35.—Adult male; trapped May 5, 1914, at Fort Collins, in pasture of native grass: stomach medium full of grass and grass roots.

Stomach No. 36.—Adult male; trapped May 6, 1914, at Fort Collins, at edge of alfalfa field: stomach full of alfalfa, one predaceous beetle, one snout beetle, and one larva of meal beetle.

Stomach No. 37.—Adult female; trapped May 6, 1914, at Fort Collins, at edge of alfalfa field: stomach full of alfalfa and one bird feather (unidentified).

Stomach No. 38.—Adult male; trapped May 7, 1914, at Fort Collins, at edge of alfalfa field: stomach medium full of several large larvae.

Stomach No. 39.—Adult male; trapped May 7, 1914, at Fort Collins, at edge of alfalfa field: stomach, nearly empty, contained some alfalfa and grass roots.

Stomach No. 40.—Adult male; trapped May 7, 1914, at Fort Collins, in pasture of native grass: stomach, nearly empty, contained some grass and grass roots.

Stomach No. 41.—Adult male; trapped May 7, 1914, at Fort Collins, in pasture of native grass: stomach full of large number of medium-sized larvae, cut-worms.

Stomach No. 42.—Adult male; trapped May 7, 1914, at Fort Collins, in pasture of native grass: stomach full of two small larvae, beetle, grasshoppers, and some vegetable matter.

Stomach No. 43.—Adult female; trapped May 7, 1914, at Fort Collins, in pasture of native grass: stomach medium full of cutworms, snout beetle, grass roots, and some vegetable matter.

Stomach No. 44.—Young female; trapped September 3, 1914, at Fort Collins, along roadside: stomach, nearly empty, contained some grasshoppers.

Stomach No. 45.—Adult female; trapped September 5, 1914, at Fort Collins, at edge of alfalfa field: stomach, nearly empty, contained some grasshoppers.

Stomach No. 46.—Adult female; trapped September 5, 1914, at Fort Collins, in pasture of native grass: stomach full of grasshoppers.

SUGGESTIONS FOR CONTROL

When ground squirrels are abundant and destructive to crops, the methods of control are poisoning, fumigation, and trapping. Probably the cheapest and one of the most effective means of exterminating ground squirrels is by the use of poisoned grains.

Poisoning

The following formula has been perfected and used by the writer successfully for this rodent:

Whole corn	16 quarts
Strychnine (alkaloid powdered)	1 ounce
Saccharine	1 teaspoonful
Flour	¾ pint
Salt	1 pint
Water	1 quart

Directions for Mixing.—Dissolve the saccharine and strychnine in the amount of water called for in the formula, add the flour and salt, mix thoroughly with an egg-beater, put over fire, and heat until the flour begins to thicken, stirring constantly.

Pour the poisoned solution over the grain, thoroughly mix until each grain is evenly coated, spread, and dry.

Follow the directions carefully. The success of the use of this formula depends upon the careful preparation of the poisoned solution and the thorough coating of the grain.

Three or four kernels are sufficient for each burrow, and experiments made in the laboratory show that one or two kernels of corn treated with this formula will kill a squirrel.

Fumigation

Carbon bisulfid can be used successfully for this squirrel. Directions for the use of this gas are as follows:

Take cotton waste, roll in a small ball, pour on a tablespoonful of crude bisulfid, throw it as far as possible down the burrow, quickly close the hole with earth, and tamp with the foot so as to prevent the escape of the gas.

The best time to use carbon bisulfid is after a rain, when the interspaces in the soil are filled with water.

Warning.—Carbon bisulfid is inflammable and highly explosive. Do not open it near a fire, or where anyone is smoking. Carbon bisulfid should be kept tightly corked, as it evaporates rapidly on exposure to the air.

Mr. George Slater, foreman of the J. O. D. Ranch at Aroya, in a letter dated March 18, 1914, makes the following suggestions as a method of control:

> I hit on a plan a few years ago of killing them, as follows: Soak a part of the corn you intend sowing in a solution of strychnine (about a peck to each two acres), and then mix it with your seed corn and sow it. As the soaked corn naturally germinates first, the squirrels dig it out and eat it, and that ends the squirrel.

The strength of this solution was not given.

Trapping

Where there is only a small corn patch to be protected from these squirrels, and at a season of the year when birds are abundant that are liable to pick up the poisoned grain, persistent trapping will save the crop, as we know of no mammal that is so easy to trap. The guillotine traps, of which there are several kinds and makes on the market, are probably the best all-around traps, as they usually kill instantly, and thus avoid unnecessary suffering for the animal. For these traps use roll oats or grain of different kinds for bait. The ordinary small steel traps can be used very successfully without bait by setting them near the ground squirrels' holes. They usually catch the squirrel by the leg, breaking it and causing it needless suffering, and a great many times the squirrels escape, leaving part of a leg in the trap.

NOTES FROM THE FIELD

As before stated in this circular, we received seventy letters from farmers in different sections of the state, giving their views as to the economic importance of the striped ground squirrel. These writers all declared it a pest and with no beneficial traits.

The following are extracts from a few of these letters from different counties, showing the drift of sentiment against this little rodent:

Elbert County

> The striped ground squirrel is destructive to farm crops—wheat, barley, rye, cane, maize, oats, and corn. It does the most damage to corn. It has no beneficial traits. If it has, I have never been able to find out what they were.
>
> W. B. Miller,
> Keysor, March 3, 1914.

Morgan County

As the most potent enemy of the dry-land farmer, he is hated and hunted. As a destroyer of crops he ranks first among the scourges of this section of the country, taking his place at the head of the list, which includes hot winds, scarcity of rain, early frosts, etc.

This may seem like a broad statement, but I have seen fields of corn, cane, oats, wheat, and other forage and grain crops where, but for the insidious thieving of this rodent, bumper crops would have been raised, but, owing to his depredations, only a few scattering sprays showed their heads above the ground.

Crops that, on account of early seeding, have got a fair start are seemingly not bothered by these mammals, but seed that is planted in late May and June is sure to fall a prey to them.

All crops suffer from their activity, but corn is, I believe, their favorite grain, and wheat holds the least attraction for them.

Thomas J. Fowle,
Orchard, January 12, 1914.

Arapahoe County

The striped ground squirrels are very destructive to the corn crop. I have known of their following the corn planter marks and taking up every hill of corn for several rods. They do not, as a general thing, eat the corn as they take it up, but carry it to their holes.

By harrowing out the marks immediately after planting, they do not seem to be able to find it until the corn comes up. Then they will follow the rows again and dig up the corn, but they do not bother it after it is about four inches high.

Arthur O. Parker,
Deer Trail.

Adams County

We have a great many of the striped ground squirrels around here. They are particularly destructive to our corn crop just after planting, digging up a great lot of it; also beans and peanuts. I have never known of any benefit from them.

W. F. Doss,
Leader, January 13, 1914.

Cheyenne County

The striped gophers are quite plentiful here. Corn is their favorite food. They also eat milo, Kaffir corn, pumpkin, squash, and peanuts. They attack these crops usually about the time they are coming up. After the plant is far enough advanced so the seed is rotted away, they do no more damage.

B. J. Carrigan,
Wild Horse, January 13, 1914.

Weld County

The striped gopher or ground squirrel is quite plentiful in this section. It is very destructive to corn, frequently following the planter rows for considerable distance and digging up the seed. It also digs up the kernels from the roots of the young plants before the plant has become self-supporting, thus destroying the plant. It also does a great deal of damage to gardens in the same manner.

C. L. Morgan,
Sligo, January 13, 1914.