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SOME COLORADO RODENT AND BIRD PESTS WITH SUGGESTIONS FOR CONTROL

By W. L. BURNETT



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GEORGE M. LIST, State Entomologist

Contents

	Page
Introduction	3
Prairie Dogs	4
Wyoming Ground Squirrel	4
Striped Ground Squirrel	5
Kangaroo Rats	8
Rabbits	8
Poisoning Jack Rabbits	9
Repellents	10
House Mouse	11
House Rat	11
Kinds of Bait	12
How to Prepare Baits	12
How to Distribute Baits	13
Red Squill	13
Pocket Gophers	14
Methods for Control	14
Trapping Pocket Gophers	15
English Sparrow	16
Pinon Jay	19
Magpies	20
Ring-Necked Pheasant	20
Formula for Rodent Control	21
Fumigation for Rodents	23

SOME COLORADO RODENT AND BIRD PESTS WITH SUGGESTIONS FOR CONTROL

By W. L. BURNETT

Early settlers in Colorado, as well as other western states, found the country inhabited with various forms of wild life. Prairie dogs, ground squirrels and other rodents had their underground burrows in the choicest grazing land, while predaceous mammals roamed freely over mountain, plain and valley. These predaceous mammals fed on the rodent population and were Nature's provision for keeping in check undue increase in these forms of mammalian life.

Raptorial birds, hawks and owls also fed extensively on rodents. With the coming of the settlers, conditions were changed. Hawks and owls were killed by the hundreds, because tradition says they are enemies of barnyard fowls. Later on, the extermination of predaceous mammals was started, and is now going on as rapidly as possible, a procedure with which we are not wholly in sympathy.

With the raptorial birds reduced to a minimum, and the total extermination of predaceous mammals in sight, we are now facing the problem of rodent control for the protection of farm crops and pastures from a new angle, namely, mechanical control.

In former years, when the range was open, there was forage enough for both cattle and rodents, but at the present time, conditions are different. This vast open range is almost gone. The fight is now on to see which will get the grass first, the rodents or the cattle, on what is left of the range. The settler who is now farming this land, besides drouth and wind to contend with, must also fight the rodents.

It is true in the irrigated section, the prairie dogs have been driven to the higher ground, and under these conditions are increasing, unless artificial means have been taken to reduce their numbers. It is also true that on the irrigated land, ground squirrels, field mice, and pocket gophers, are finding conditions ideal for increasing in numbers.

With the facts facing us that the annual loss from rodent pests alone, in Colorado, cannot be computed in thousands, but in millions of dollars, it is very important that the best possible methods for control must be placed in the hands of the ranchmen of the state, so they may combat these pests in an intelligent manner.

Prairie Dogs

Three species and one subspecies of prairie dogs occur in Colorado as follows:

Plains Prairie Dog, *Cynomys ludovicianus ludovicianus*.

White-tailed Prairie Dog, *Cynomys leucurus*.

Gunnison Prairie Dog, *Cynomys gunnisoni gunnisoni*.

Zuni Prairie Dog, *Cynomys gunnisoni zuniensis*.

The distribution as given here varies somewhat, but will serve our purpose in this circular.

From latitude 105 degrees east to the Nebraska-Kansas line, occurs the Plains prairie dog, *Cynomys ludovicianus ludovicianus*.

The White-tailed prairie dog, *Cynomys leucurus*, occurs in the following counties: Jackson, Routt, Moffat, Rio Blanco, Mesa, Delta, Eastern Montrose and Ouray.

The balance of the infested territory is inhabited by the Gunnison prairie dog, *Cynomys gunnisoni gunnisoni*, and its subspecies, the Zuni prairie dog, *Cynomys gunnisoni zuniensis*.

Hollister, (N. A. Fauna, No. 40) gives the distribution of the Zuni prairie dog in the state as follows: "Southwestern Colorado north in Western Colorado to Montrose County."

He lists specimens from the state from the following localities: Cortez, Montezuma County; and Coventry, Montrose County.

Statements are often made by ranchmen and others that prairie dogs raise more than one litter in a season, but we have no evidence to substantiate these statements. From records we have in the Office of the State Entomologist, the young of the plains prairie dog are born during the month of April, and possibly the first part of May. The number of young varies from 3 to 6.

The breeding season may extend over a period of 3 or 4 weeks. In a number of gravid females examined on the same date, the size of the embryos varied from that of a currant to that of an English walnut.

Our Formula No. 46 is very effective for all four forms of dogs, and is superior to other formulas we have tried for the Zuni prairie dog of the southwestern part of the state.

Wyoming Ground Squirrel

Citellus elegans

This is the ground squirrel of the northwestern counties of the state, where it is commonly called "gopher," and is the most serious mammalian pest the ranchmen have to contend with in that section. It is also called picket-pin gopher, gray gopher and whistling gray squirrel.

The Wyoming ground squirrel is about two-thirds the size of a prairie dog, with a short tail, more or less bushy. General color is brownish.

It adapts itself to varied environmental conditions, making its home on the hillsides, in meadows, along the roadsides and on ditch banks, and is not readily driven out by irrigation.

It is a prolific breeder, with one litter a season. The young vary in numbers from 1 to 11, averaging 6.6 in 44 females examined.

This squirrel is active only about 5 months in a year. The balance of the time it is in a state of aestivation or hibernation. This period of inactivity varies to a considerable extent in different localities in the state.

This ground squirrel occurs in the following counties: Jackson, Routt, Moffat, Rio Blanco, Eagle, Grand, Summit, Clear Creek, Garfield, Pitkin, Larimer, Northwestern Weld, Lake and Park.

We have always been able successfully to control these squirrels with our Formula No. 46 at any season of the year when they were active, no matter how abundant other foods were.

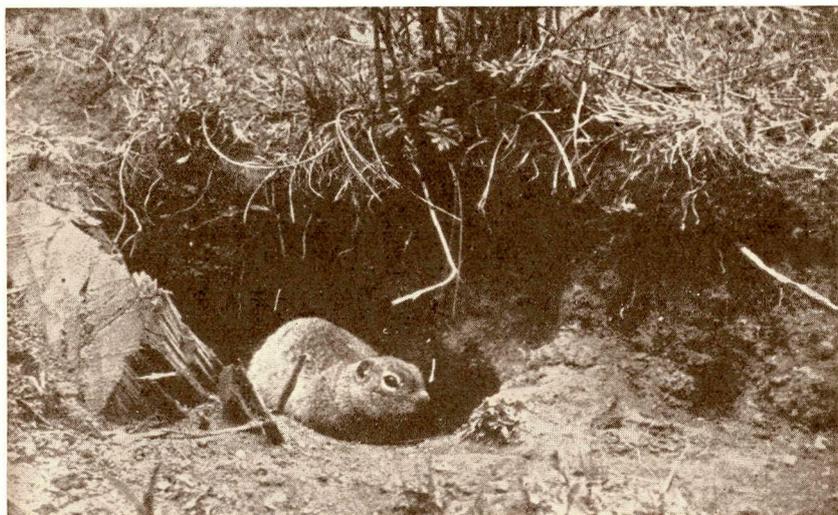


Fig. 1. *Citellus elegans elegans* at mouth of burrow, near Redfeather Lakes, Larimer County.

(Photo by A. B. Klots, Cornell University.)

Striped Ground Squirrel

Citellus tridecemlineatus pallidus

This squirrel is known locally as "gopher" and "striped gopher," and is found in the plains regions of Eastern Colorado. It occurs sparingly in the eastern foothills up to about 9,000 feet eleva-

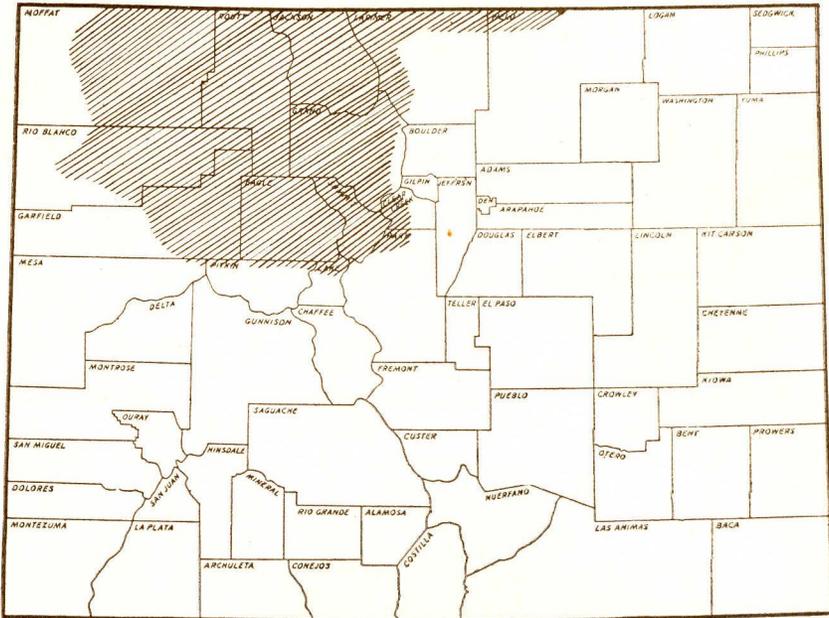


Fig. 2.—Known distribution of *Citellus elegans elegans* in Colorado, 1930.

tion, and in Jackson County, west of the Medicine Bow Range. 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, *Citellus tridecemlineatus parvus*.

The food of this squirrel consists of seeds, grain of all kinds, grass and grass roots, but it has a decided preference for corn, especially where newly planted, which it digs up by following the planted rows. It also feeds on grasshoppers and other insects. The greater damage done by this ground squirrel is in the cultivated fields, as

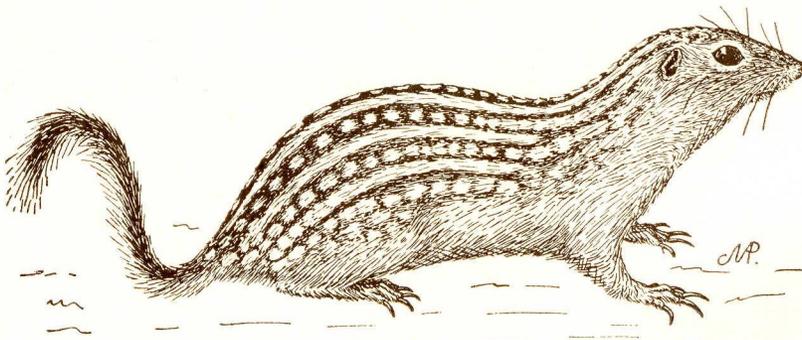


Fig. 3.—Striped Ground Squirrel (*Citellus t. pallidus*.) From a specimen taken at Fort Collins, in May. Original. M. A. Palmer, delineator.

the damage done on pasture land cannot be very great, for, unlike the prairie dog, it destroys only what it eats. Around the prairie dog holes, the grass is always killed for several feet, but 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 striped ground squirrel presents an economic problem that is somewhat difficult to solve. It is, no doubt, a pest in the dryland sections, and the damage done to crops is very noticeable. On the other hand, damage done in the irrigated districts is not so noticeable, and from our observations and examination of stomachs, the food in these sections consists largely of grasshoppers and other insects, as first reported by C. P. Gillette, in Bulletin 6 of the Iowa Experiment Station for that state.

Much of the damage to crops attributed to this squirrel in the regions adjacent to the foothills is done by that foreign invader, the ring-necked pheasant.



Fig. 4. Kangaroo rat burrows.

This ground squirrel may be successfully controlled with our Formula No. 46. If one prefers, he may substitute whole corn in place of oats.

Recent experiments with caged striped ground squirrels in the laboratory have demonstrated that a very small amount of our Formula No. 46 is required to kill this squirrel. Ten grains of the poisoned oats are always fatal, and in some cases as few as 5 grains have killed.

Kangaroo Rats

Also called field rats, sand rats and pinto rats.

Wherever sandy soil and suitable conditions exist in the state, one can usually find kangaroo rats in more or less abundance. From our present knowledge, they reach the height of their abundance in the San Luis Valley, the Arkansas Valley south of the river, and along Big Sandy Creek in Eastern Colorado.



Fig. 5.—Kangaroo Rat (*Dipodomys richardsoni*.) Original in Circular No. 25, Office of State Entomologist, M. A. Palmer, delineator.

Kangaroo rats are nocturnal and prefer moonlight nights for their frolics.

Their homes are usually along the fences and ditch banks. In some sections they honeycomb the ditch banks with their burrows to the extent that the banks must be repaired each spring before they will hold water.

Kangaroo rats are fond of grain and seeds of all kinds, and in the fall store large quantities of available food. They are easily controlled with poisoned grain prepared from our Formula No. 46. The poisoned grain should be placed in small piles at the entrances of the burrows, and in the runways which extend from one burrow to another, often at a considerable distance.

Rabbits

Technically, rabbits are not rodents, but on account of their similar habits are classed as such in this circular.

Rabbits and hares are distributed over practically the entire

United States, but reach the height of their abundance in the West.

Jack rabbits and snow-shoe rabbits are technically hares, as the young are brought forth in forms under brush, and, when born, are well-furred, with eyes open, while the cottontail and brush rabbits usually bring forth their young in burrows, and, when born, are naked and blind.

Economically, rabbits are of vast importance from the standpoint of food and the destruction of various crops.

Poisoning Jack Rabbits.—Jack rabbits cannot be poisoned as economically as prairie dogs or ground squirrels, but they may be poisoned at a cost that is negligible compared with the amount of damage they do to crops when present in large numbers.

In speaking of prairie-dog control we use the word exterminate, and extermination is possible with these rodents. However, with jack rabbits, on account of their habits and manner of living, extermination is hardly possible. The only thing we may hope for is to reduce their numbers so they are no longer a menace to the agricultural interests of the state.

Much is yet to be learned concerning poisoning methods for jack-rabbit control in Eastern Colorado before the cost of poisoning operations can be reduced to a minimum. We say Eastern Colorado because practically all our experimental work has been done in that section. However, we have reports which leave little doubt in our minds that, under the same conditions, the poisoning methods advocated in this circular may be used as successfully in other sections of the state as in the eastern part. It is no longer a question of finding a successful poison, but the placing of it in the best place and at the right time to insure results.

For some time we have been carrying on experimental work for jack-rabbit control with poison. We have used a number of different combinations of grains, and salt and strychnine mixed. From our experimental work we are convinced that jack rabbits may be successfully poisoned at all seasons of the year, possibly with best results in the winter months. Of all the experiments tried for either winter or summer poisoning, Colorado Formula No. 46 (using a good quality of heavy oats) has given the best results. It has been effective at all seasons and with all crops. The rabbits will eat it readily even when their natural green food is plentiful. Another advantage of our poisoned oats and method of putting it out, is that prebaiting is not necessary, thereby saving time and expense.

In poisoning jack rabbits with oats as a carrier, local conditions surrounding each individual plot must be studied so that the poisoned grain may be placed at the most advantageous points. Study the field and determine the place where the rabbits are entering, then

place the poison where they will easily find it. The place where they enter is usually from native pasture land, or a place that affords the rabbits shelter and a hiding place during the day. It is advisable to poison around fence posts, under sagebrush, weeds, and where rabbit forms are seen along the edge of the field; also, down the corn or bean rows where the rabbits are feeding. While it is advisable to poison these places, to reduce the number of rabbits, the place to make the greatest kill with the smallest amount of grain is near the path where they enter the field. The one idea should be to place the poison where the rabbits will find it. When it is around the edges of a field or down the crop rows, the chances of the rabbits finding it are less than when it is placed at a point where the greatest number of rabbits are entering the field. In entering a field rabbits generally use well-beaten paths which may be on bare ground, or in winter on snow that has been packed hard.

The following salt and strychnine formula we have used with fair success, but it is not as successful or as reliable an all-season poison as our Formula No. 46.

Salt	3 quarts
Strychnine (alkaloid powdered)	1 ounce
Mix and dampen.	

On account of this mixture being very poisonous to stock, the following method, slightly modified, is in general use in Eastern Colorado:

Plow a shallow furrow across the end of field where the rabbits are coming in; make it shallow enough so rabbits will not jump it. Place the poisoned salt in piles of about a tablespoonful each about a yard apart in the furrow. Before putting down the salt, tamp a place with your foot so as to have an even surface and not allow the salt to mix with the fine dirt in the furrow. When thru with the poison, plow the furrow under which prevents all danger to stock.

Repellents.—The trunks of trees may be protected with the following repellents:

Lime Sulphur Wash

Unslaked lime	20 pounds
Flowers of sulphur	15 pounds
Water	50 gallons

Add a little salt to increase the adhesive property of the mixture. The lime, sulphur and about one-third of the water are boiled together for at least 1 hour, then the full quantity of water is added. Apply to trunks of trees with a brush.

House Mouse (*Mus musculus*)

House mice have been introduced into the New from the Old World, and are now found in all the settled portions of the country. In Colorado, they are found all over the state, and are frequently caught in traps set for field mice far from settlements. I found them not uncommon at Corona, Boulder County, altitude 11,660 feet.

The following method for poisoning has been used successfully:

Wheat	5 quarts
Strychnine (Alkaloid powdered)	¼ ounce
Saccharine	¼ teaspoonful
Baking soda	¼ ounce
Petrolatum oil	⅛ pint
Water	½ pint

Dissolve strychnine in one-fourth pint cold water, then add one-fourth pint of warm water, stir in soda, saccharine, and oil, and put over fire, and heat almost to the boiling point, stirring constantly; remove from fire, stir in flour to make a creamy paste, pour the poisoned solution over the grain and thoroly mix. When mixed the grain is ready to use, and should be placed in small piles where it will be accessible to the mice.

House Rat *Rattus norvegicus*

The house, or Norway rat, on account of its destructiveness to crops and property, and as a carrier of infectious disease germs which are transmitted to man with fatal results, is one of our oldest known rodent pests.

The house rat is not a native of the United States, but an immigrant from the old world, being brought in ships in the early part of the eighteenth century.

While rats have been a familiar pest along the Atlantic Coast and middle western and southern states for a number of years, their invasion of Colorado is of comparatively recent origin. It is true that rats have been known in Denver and Pueblo for a number of years, but it has been only in the past few years that they have invaded the smaller towns and villages, and at the present time are found over all the plains regions of the Eastern Slope. At the present time, we have no positive record of their occurrence on the Western Slope.

One of the most discouraging features of the control of rats is their adaptation to any and all environmental conditions. Not only do they adapt themselves to different conditions, but they eat anything that may be classed as food.

That house rats at the present time present a serious problem

to the inhabitants of the state, cannot be denied. We regret that from our own experience and the experience of other workers, we are not in a position to offer satisfactory control measures. They are very suspicious of both poisoned bait and traps.

Traps, if used persistently, will greatly reduce the number of rats, but the bait should be changed from time to time to secure the best results. The traps should be handled with gloves and dipped occasionally in boiling water. Any type of guillotine trap may be used with better results than steel traps.

There has recently been placed on the market in Denver a rat trap called the "spring bottom trap." In our opinion, this is one of the best rat traps on the market, however, it may or may not be used successfully. Success depends largely on the operator and place of operation. The directions should be followed carefully.

Construct buildings as near rat proof as possible; use closed garbage cans and grain bins, and keep all food out of reach of the rats. These measures will do more to reduce rat population than anything else.

Bear in mind that most formulas will kill a few rats, but none of them will kill all the rats.

In all probability, from the standpoint of safety, expense and efficiency, barium carbonate is one of our best poisons to use for rat control. It is a mild poison and, since it is tasteless, care must be taken to keep it away from other animals as well as children.

In U. S. D. A. Farmers' Bulletin No. 1533 directions are given for preparing and distributing the poisoned bait as follows:

Kinds of Bait

"A variety of baits used separately gives the rat a choice of foods and increases the chances of the bait being taken. One kind of each of the following classes of food mixed separately with barium carbonate is recommended:

"Cereals, such as bread, corn meal, and rolled oats.

"Meats, such as Hamburg steak, sausage, sardines, or eggs.

"Fruits and vegetables, such as apples, melons, and tomatoes.

"Bait should be fresh and of good quality. Fresh kitchen scraps or garbage can be worked into the ration to advantage, but in such case it is desirable to run meat scraps and other hard food thru a chopper to facilitate mixing with the poison.

How to Prepare Baits

"The powdered barium carbonate should be thoroly worked into the soft cereal or ground-meat baits with the hands or with a spoon, in the proportion of 1 part to 4 parts of the selected food. Add water when necessary to make the baits moist. In dry weather baits moistened to the consistency of soft mush are particularly acceptable to rats.

"Barium carbonate should be sifted over sliced fruit and vegetable baits and rubbed well into them with the fingers or a knife. The slices should be thin and should be moistened, if necessary, to attain as nearly as possible the 1 to 4 ratio.

How to Distribute Baits

"A teaspoonful of the prepared mixture is a sufficient quantity for the average rat bait. Put the baits in places frequented by rats, preferably where they have been observed to feed.

"A convenient and successful method of exposing baits is to wrap teaspoonful quantities in small squares of newspaper or place them in small paper sacks and to close them by twisting the tops. When a variety of baits is used, wrap each kind separately and expose one of each kind in groups, or in sequence, to give the rats a choice. In public places, where there is a possibility of their being disturbed, baits should be wrapped and the packages labeled POISON.

"It is important that a sufficient number of baits be distributed at one time to provide an ample supply for every rat on the premises; otherwise the resulting mortality will arouse the suspicion of the rats that are unharmed and will render subsequent baiting less successful. It is much better to prepare an excess of bait than not enough.

"Baits should be distributed in the evening, so they will be fresh when the rats are feeding. Uneaten baits should be picked up the following morning and destroyed, as stale baits usually are unattractive to rats and as the acids resulting from souring baits render barium carbonate bitter and objectionable.

"If the poisoning has been carefully carried out, a high mortality may be expected. It often happens that the destruction of a large proportion of rats on premises results in frightening away the remaining few, so that moderately successful poisoning sometimes results in a complete clean-up. Should the poisoning operations not be wholly successful, it is well to wait two weeks or more before repeating with other baits."

Red Squill

In Leaflet No. 65, the United States Department of Agriculture recommends red squill powder for rat control in part as follows:

"In using powdered red squill to destroy rats the choice of bait is most important. The goal is to destroy every rat at one application; otherwise survivors become suspicious and are hard to dispose of later. This requires an ample supply of baits that will appeal strongly to the appetites of the rats. Unfortunately, the tastes of rats, like those of human beings, vary, so that it is not possible to appeal to the palate of every rat with a single food. In order to obtain the best results several kinds of bait should be exposed at the same time, so that every rat will have a choice of foods. The following directions for preparing baits are the result of long experience of specialists in rat control:

Fish.—Fresh fish ground in a meat chopper is one of the most attractive baits for rats. If fresh fish is not available, a cheap grade of

canned salmon, canned mackerel, or sardines in oil may be used. Mix 1 ounce of powdered red squill with a little water to form a thin paste free of lumps, add to 1 pound of fish, and mix thoroughly.

Meat.—Mix 1 ounce of powdered red squill with a little water to form a thin paste free of lumps, and add to 1 pound of fresh ground meat and mix thoroughly. Hamburg steak is most commonly used.

Cereals.—Mix together dry 1 ounce of powdered red squill and 1 pound of cereal meal, such as oatmeal, graham flour, corn meal, or bran. Add 1 pint of sweet milk or water and stir to a mushy consistency.

Fruits and Vegetables.—Using a pepper shaker, dust powdered red squill over thin slices of fresh fruit or vegetables and stir or shake as the powder is applied to insure even distribution. A small muskmelon, for example, should be cut into about 16 slices and each slice cut into 3 sections. This will require 1 ounce of powdered squill and will make 48 baits. Three medium-sized tomatoes or three bananas, each cut into about 16 sections, may be similarly used for each ounce of squill powder."

Pocket Gophers

The main runways of pocket gophers are always open, and the animals use them as a means of traveling back and forth. In excavating these runways, the gophers throw the dirt backward, and when a sufficient amount has accumulated, the gophers push the soil to the surface with their forefeet and nose thru a lateral leading up from the runway. The soil is deposited on the surface in mounds, which vary greatly in size. When the gophers are thru using the laterals they close them tightly from the runway to the surface.

Methods for Control.—The Bureau of Biological Survey, U. S. Department of Agriculture, recommends the following:

"For ridding alfalfa fields, orchards and long stretches of ditch embankments, a very successful method is to poison them by placing baits of sweet potato or of parsnips in their underground runways. The bait should be cut about an inch long and a half inch square, and washed and drained. From a pepper box, slowly sift $\frac{1}{8}$ ounce of powdered strychnine (alkaloid) and $\frac{1}{10}$ of this quantity of saccharine (ground together in a mortar) over about four quarts of the dampened bait, stirring to distribute the poison evenly.

"The runways, which are usually 4 to 8 inches beneath the surface, can be located by means of a probe made of any strong handle, an inch in diameter and 36 inches long. One end should be bluntly pointed. Into the other should be fitted a piece of $\frac{3}{8}$ inch iron rod, protruding about 12 inches and bluntly pointed. A foot rest aids in probing in hard soils. By forcing down this iron rod near gopher workings, or a foot or two back of fresh mounds, the open tunnel can be felt as the point breaks into it. The blunt end of the instrument is now used to carefully enlarge the hole, a bait or two is dropped into the run, and the probe hole closed."

This poisoned bait as recommended, has been used successfully thruout the state, and the probe method of placing the bait works well with the mountain gophers or any of the forms of *Thomomys*, but the probe, as far as our experience goes, is impracticable for locating the runway of the plains gopher, *Geomys lutescens*, as the depth of the runway of this gopher varies from 12 to 24 inches below the surface.

We use and recommend the following method of locating the runway of the plains gopher:

After locating a fresh mound of dirt thrown up by a gopher, notice on the surface of the mound a slight depression where the dirt was brought up thru the lateral from the main runway. This depression is seldom in the center of the mound, but to one side, as the dirt is thrown out in front of the gopher. Just back of this depression should be the main runway.

For locating this runway we use a 15-inch iron spoon with a prod attached, working from the depression down thru the mound until the runway is located. Clean all loose dirt out with the hand, and place the poisoned bait as far back in the runway as possible. Close the opening at the surface with a piece of sod or newspaper, and cover over with dirt. (See Figures 6 to 12.)

Trapping Pocket Gophers

After 15 years of experience trapping pocket gophers with a number of different makes of traps, taking all points into consideration, we are satisfied that the Macabee gopher trap is the most satisfactory one we have used. If your local dealers do not handle this make of traps, they may be secured from the manufacturer, Z. A. Macabee, 110 Market St., Los Gatos, California. The price of the standard sized trap has been \$2.00 per dozen, delivered.

For our Colorado gophers, we do not agree with the manufacturers in the directions they recommend for setting these traps. They make the following statement:

"The hole thru which the trap is introduced in the lateral or the main runway should be left open. The Macabee trap is sprung when the gopher pushes against the trigger-pan in its effort to stop the opening."

From our experience, this is just the opposite of what should be done as the gopher in bringing dirt to stop the opening, springs the trap with dirt and fails to get caught.

After the gophers are thru using the external opening or lateral for a passage for removing the dirt accumulated from digging, they pack it solidly down to the main runway, which is always kept open. (See Figure 6.)



Fig. 7.—Locating a pocket-gopher lateral.

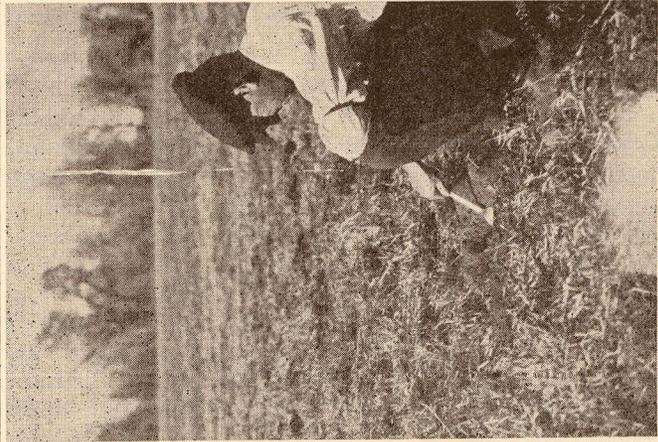


Fig. 8.—Cleaning out the lateral to the runway.

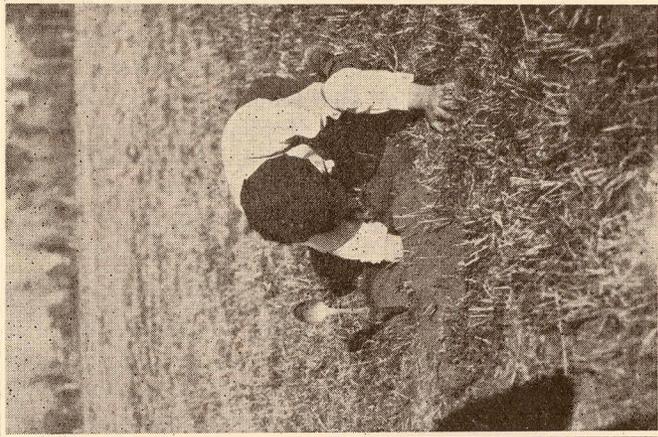


Fig. 9.—Cleaning out the runway with the hand.

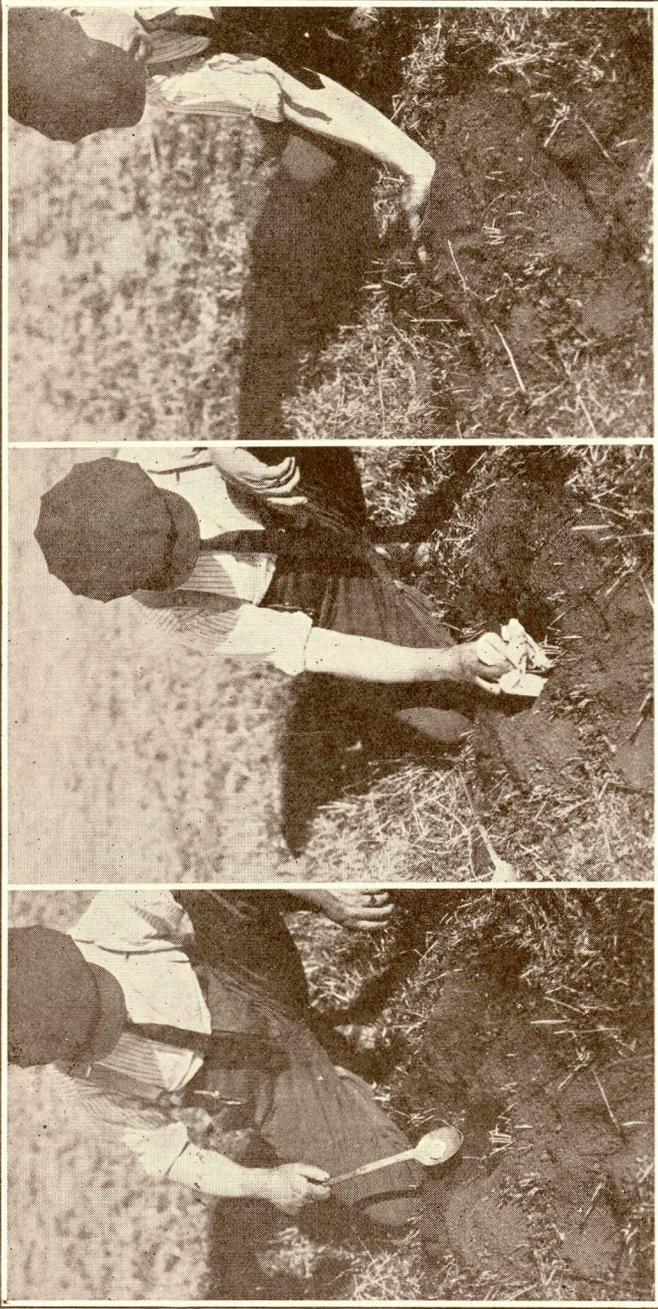


Fig. 10.—Placing the poisoned bait.

Fig. 11.—Closing the opening with a newspaper.

Fig. 12.—Covering the opening with dirt.

If two traps are set in this open main runway, facing in both directions of approach, and the lateral closed with a piece of newspaper and covered over with dirt, the gopher will, in travelling back and forth, spring the trap with its head or body.

Our recommendations for setting the traps are as follows:

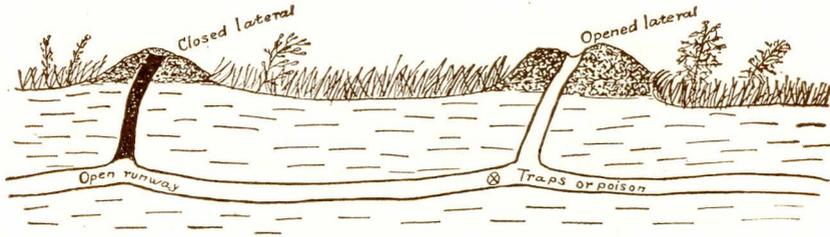


Fig. 6.—Pocket Gopher Burrows. Original in Circular No. 23, Office of State Entomologist, M. A. Palmer, delineator.

Select a fresh mound, and by working down the lateral thru the mound with an iron or hardwood prod, locate the main runway. Clean the opening to the runway with a long-handled spoon or with the hand. Should the runway branch two ways, set two traps facing up the runway in opposite directions. After setting the traps, secure them with a stake, chain or cord, and close the opening as directed above.

With these methods, our catch ranges from 75 to 90 percent, while with the other method, the effectiveness of the traps has been reduced fully 50 percent.

English Sparrow

(*Passer domesticus*)

English sparrows were first introduced into the United States from England on the Atlantic coast, in the early fifties, and have gradually extended their range westward. The writer first observed them in the fall of 1894, when a flock of 12 or 15 was seen near Fort Collins. They were also reported from different sections of the state about the same time.

The English sparrow is an example of the danger of introducing foreign birds into this country. Our native birds have been placed here by Nature to fit each environmental condition, and if the money and energy were spent on their protection that has been spent on the introduction of foreign birds, it would not be necessary for us to look to the old world for birds that may prove a curse instead of an economic blessing.

There is no doubt that English sparrows consume a large amount of noxious weed seeds and injurious insects. On the other hand they eat more grain than our native sparrows.

If total extermination were possible it would indeed be a blessing, but this we cannot hope to do, but we can, at least, keep them under control by shooting, trapping and the use of poison.

The formula as given under "House Mice," may be used successfully for these pests.

The sparrows should be baited for a few days until they become accustomed to the feeding place. Then put out the poisoned grain. The dead birds should be picked up, from time to time, so as to avoid suspicion.

Pinon Jay

(Cyanocephalus cyanocephalus)

Other names are pinon squawker, pinon bird and cedar bird.

Any of the names may be used, but we prefer pinon jay, as this is a true jay belonging to the family Corvidae, the family which includes jays, magpies and crows.

The food of the pinon jay consists of insects, pinon nuts, juniper berries, etc.

In their native haunts jays do no harm, but when they invade the grain fields they become serious pests. Of grain they are very fond, and corn seems to be their favorite. They begin to feed on the corn when it is in hard roasting ears; stripping off the husks, they eat the kernels and leave nothing but the cob. They invade the corn-fields in large flocks.

The following formula for poisoning these birds is recommended by this office, and has been used successfully in the state:

Whole corn	16 quarts
Strychnine (Alkaloid powdered)	1 ounce
Saccharine	1/8 ounce
Baking soda	1 ounce
Water	1 pint
Flour	1/2 pint

Directions: Dissolve the strychnine in one-half the prescribed quantity of cold water, then add the other half in warm water; stir in the saccharine and soda; put over fire and heat almost to the boiling point, stirring constantly; remove from the fire; stir in flour making a creamy paste; pour the poisoned solution over the grain and thoroughly mix.

When the grain is mixed it is ready to use. Scatter around the edges of the fields, or where the birds are feeding.

Magpies

Magpies may be successfully controlled with our poisoned grain used as follows:

Colorado Formula No. 46.....	1 quart
Ground meat (Hamburger)	4 ounces

Thoroughly mix, spread out on the roof of outbuildings, or on boards nailed in trees, or any place where the birds are congregating.

The board method in trees is probably the most successful one. Fall and winter months are the best times to poison, as this is when the birds congregate more than at other times.

The following method of poisoning magpies is recommended by the U. S. Department of Agriculture in Technical Bulletin No. 24:

"Indian corn (whole)	2 quarts
Beef suet (ground in a meat grinder or thoroughly crushed)	½ pint
Strychnine (alkaloid powdered)	⅓ ounce

"The corn and ground suet are placed in a metal container set in a vessel of hot water. This is kept hot while corn and suet are stirred until the latter is completely melted. The strychnine is then added and, after thorough mixing, the corn is cooled and spread out to prevent the kernels from sticking together."

All poisoned-meat baits are dangerous to flesh-eating animals, and due care must be taken in the use of the bait.

Ring-Necked Pheasant

From the farmer's standpoint, the ring-necked pheasant, where abundant, must be classed as a pest. Unlike the English sparrow, magpie and pinon jay, pheasants are protected by state law. We have a number of inquiries each year as to some method of treating seed corn to act as a repellent to prevent pheasants from digging up the newly planted seed. The following from U. S. D. A. Bulletin No. 621 suggests the use of coal tar to prevent crows digging up seed corn and may be of value in this connection:

"Kerosene, crude petroleum, copperas, crude carbolic acid, fish oil, and spirits of camphor, when used in sufficient quantity or strength to impart an odor to the corn, seriously injure the germinating powers of the grain. To treat the seed with any of these substances in such small quantity or dilute form as not to injure the germ is a waste of time, for the slight taste or odor imparted is soon dissipated in contact with the soil.

"Mixing pulverized gum camphor with the dry grain and storing it in a closed vessel for some days has been recommended as an efficient treatment. With us the results were entirely negative. Little or no odor was imparted to the grain. Pine tar was used in our experiments. It has a strong odor, but leaves the grain too sticky to work in a planter.

"Coal tar makes an ideal coating of a rich brown color and a persistent, gassy smell. It dries nicely, is not in the least sticky, and will work well in a planter. Wet the grain with a little warm water before stirring in the tar. A teaspoonful of the latter will be sufficient for a peck of corn. The mass must be thoroughly mixed and then dried before attempting to plant."

We see no reason why the same method could not be used successfully for pheasants, but the only experimental work that has been done along this line with pheasants, to our knowledge, is some work done by D. J. Leffingwell, in the state of Washington. He treated some corn with coal tar and we quote him as follows:

"I placed a handful of treated grain in a partitioned box, together with some untreated grain, and put it in a cage containing four birds to see if the pheasants would eat it, if no other food was given. The birds ate up the untreated grain the first day, and apparently refused to touch the treated grain during the next two days, after which it was taken out and the birds fed. This experiment was repeated several times with the same results."

Formula for Rodent Control

After several years of experiments, the Office of the State Entomologist and the Colorado Agricultural Experiment Station, cooperating, have developed a formula known as Colorado Formula No. 46, for the control of prairie dogs, ground squirrels, jack rabbits and kangaroo rats.

It is known that in poisoning rodents, different environmental conditions often require different treatments, and formulas successful in one region often need to be modified to some extent for another.

Colorado Formula No. 46 was developed to meet Colorado conditions. We believe it has advantages over a standard formula, which must meet varying local conditions with different species of rodents in the different states.

COLORADO FORMULA NO. 46

Whole oats	16 quarts
Strychnine (alkaloid powdered).....	1 ounce
Baking soda	1 ounce
Saccharine	$\frac{1}{8}$ ounce
Petrolatum oil	$\frac{1}{4}$ pint
Water saturated salt solution	1 pint
Flour to thicken to a creamy paste.	

Directions: Dissolve strychnine in 1 pint of cold saturated salt solution. Stir in soda, saccharine and oil, put over fire and heat, stirring constantly. Remove from fire, stir in flour, making a creamy paste. Pour the poisoned solution over the grain and thoroly mix. When mixed, the grain is ready to use.

As the poisoned solution with which the grain is treated in our formula is in the form of a paste, it is very essential that some measure be taken to prevent dusting off the poison. After experimenting with glycerine, gelatine and other materials without obtaining the desired results, we turned our attention to mineral oils, and in petrolatum oil we found the ideal substance. It is tasteless and odorless, and meets all the requirements of a prevention against dusting. Not only does the oil prevent dusting, but the grain retains a small amount of oiliness, which seems to appeal to the rodent's taste.

Poisoned grain treated with this oil, remains fresh for a greater length of time than grain treated with any other formula we have tried.

In the directions for preparing grain with our Formula No. 46, we say, "Dissolve the strychnine in water." The word "dissolve" is a misnomer, but is used in lieu of a better one. What really takes place is, the strychnine, by constantly stirring until the flour begins to thicken, is held in suspension.

Directions for using this poisoned grain for prairie-dog control are as follows: The amount of grain to be used is about 1 tablespoon, or what may be picked up between the four fingers and the thumb. The grain should be thrown against a hard surface of the ground, on the outside of the burrow, about a foot from the opening. The grain should be scattered enough to prevent stock picking it up.

The first time over the ground it is very important that every burrow be treated, regardless of whether it shows signs of being inhabited or not. On going over the ground the second time it is only necessary to treat the burrows that show signs of life, but the time between the first treatment and the second should be at least 2 weeks.

The advisability of early spring poisoning on the plains depends largely on climatic conditions, relative to temperature, storms and high winds, as it is not advisable to put out poison unless weather conditions are such that all the dogs are active.

It is not advisable to start poisoning campaigns in the western and southwestern parts of the state, where the prairie dogs hibernate thruout the winter months, before April 1, as the process of coming out of the hibernating state is drawn out for a week or two, and while some dogs may be seen out as early as the last week in February or the first week in March, not all the dogs are active at these times.

These are not hard and fast rules, and one should be governed by location and seasonal conditions.

These directions will also apply to the Wyoming ground squirrel found in the northwestern part of the state. To insure success in the use of this grain, follow the directions carefully. Grain thrown down in the burrow is usually wasted.

Oats prepared according to Formula No. 46 are carefully mixed at our laboratory, at the State Agricultural College. We have all the necessary utensils for preparing the poisoned solution in a thoro manner, and the mixing is done in a large revolving barrel churn, which insures an even coating of all the grains.

This prepared grain is sold to the farmers at cost of the ingredients and overhead expense. On account of purchasing our supplies in large quantities, we can probably furnish this grain cheaper than you can prepare it yourself.

The prepared grain we have for sale is put up in 1-, 3- and 5-gallon bags. We do not quote prices in this circular, as they change from time to time. A postal card will bring you the latest price list.

We suggest that communities pool their orders so as to save express charges, as poisoned grain is not mailable.

Fumigation for Rodents

Certain gases may be used successfully for ground-squirrel and prairie-dog control, provided the soil is full of moisture so as to prevent the escape of the gases.

Carbon Bisulphide.—To use this gas take any absorptive material, such as dry horse-manure, corn cobs, or cotton waste, pour on a large tablespoonful of crude bisulphide, throw it as far as possible down the burrow, quickly close the hole with earth and tamp it with the foot so as to prevent the escape of the gas.

Warning: Carbon bisulphide is inflammable and highly explosive. Do not open it near a fire or where anyone is smoking. Do not use a stone to stop the opening of the burrow, as you are apt to strike it with the shovel when throwing on the dirt and the sparks may ignite the gas and cause it to explode. Carbon bisulphide should be kept tightly corked, as it evaporates rapidly on exposure to the air.

For more detailed information write for State Entomologist Circular No. 31, "Food and Food Habits of the Ring-Necked Pheasant," Circular No. 52 "Jack Rabbits of Eastern Colorado," and Experiment Station Bulletin No. 373 "Life-History Studies of the Wyoming Ground Squirrel."