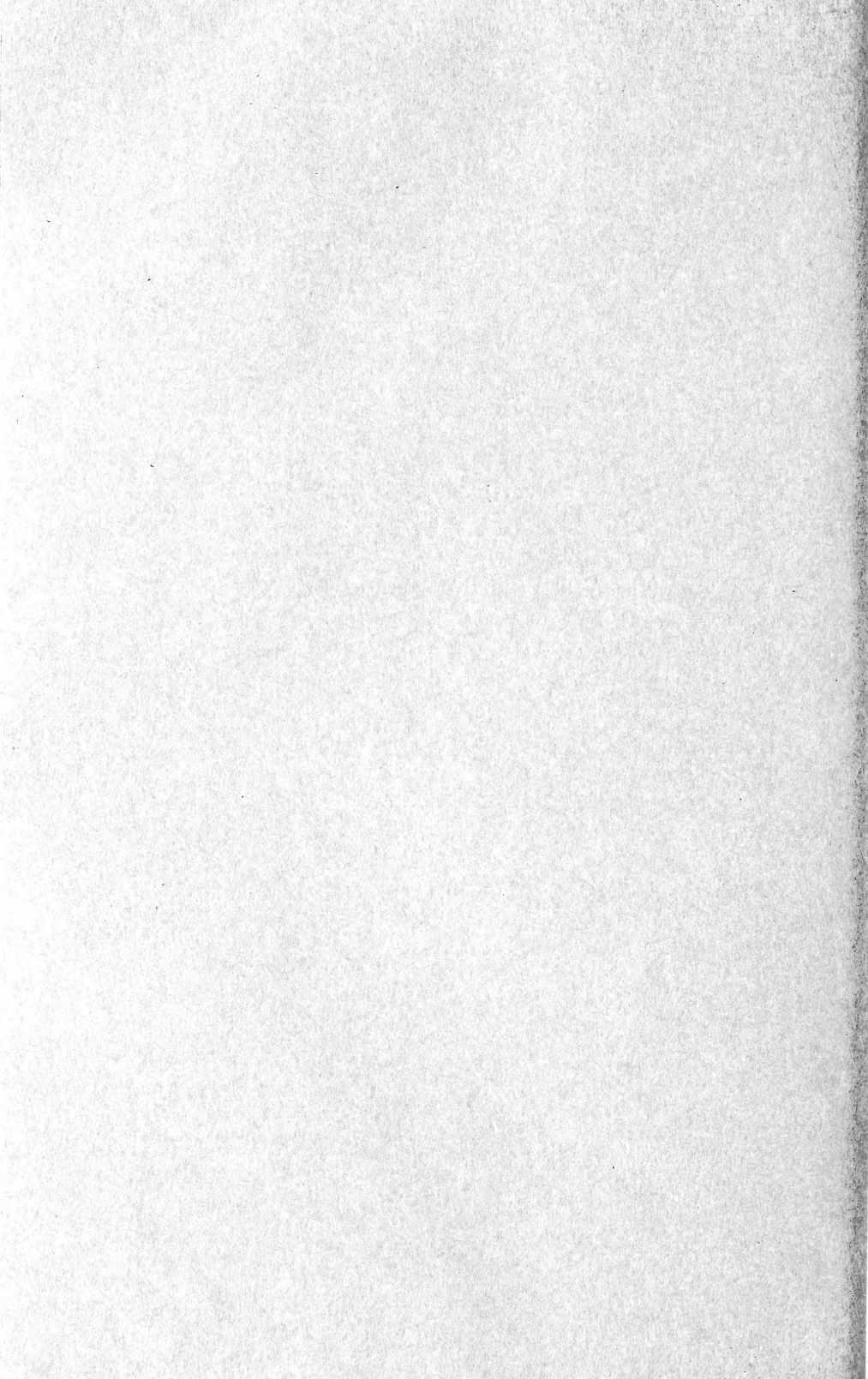


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## THE HOUSE RAT

By JAMES SILVER, regional director, Bureau of Biological Survey

### CONTENTS

	Page		Page
A public menace.....	1	Relation to health—Continued.	
Classification.....	1	Typhus fever.....	14
Introduction and spread.....	2	Spirochetal jaundice.....	15
Description.....	3	Rat-bite fever.....	15
Breeding and other habits.....	3	Food poisoning.....	15
Abundance.....	4	Tularemia.....	16
Economic status.....	6	Rabies.....	16
Destruction of food and other property.....	6	Trichinosis.....	17
Annual losses appalling.....	7	Other rat-borne diseases.....	17
Relation to health.....	11	Rat utilization.....	17
Bubonic plague.....	12	Repression of rats.....	17

### A PUBLIC MENACE

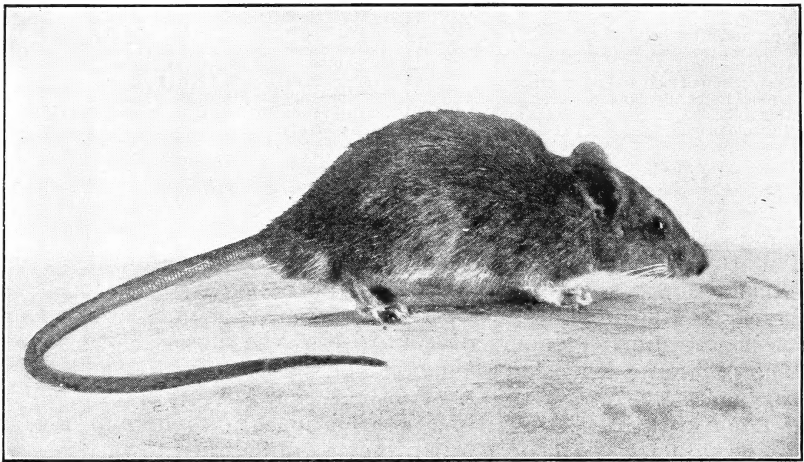
An attempt to name the animal most useful to man would give rise to considerable discussion, but there is no doubt as to the one most inimical to the human race. Standing alone, not only as the most destructive animal economically but also as the most serious menace to the public health, is the common house rat. Of all pests, therefore, the rat is the one above all others that should be kept under strict control. Facts regarding its relationship to human welfare must be understood in order to promote intolerance toward it, for, except as reduced by disease, the number of rats allowed to live will always be in inverse ratio to man's resistance to them. To cope successfully with the rat it is also essential that the fundamental characteristics and habits of the animal be known. It is the purpose of this circular to make such information available.

### CLASSIFICATION

Two kinds of rats that come into intimate contact with the people of the United States are included in the general term "house rat." These are the brown rat (*Rattus norvegicus*) and the black rat (*R. rattus*). The latter, also commonly called roof rat and ship rat, occurs only in comparatively limited areas, chiefly at seaports and in the Gulf States, so that most of the people of the United States know only the former. Various other common names that are applied to the brown rat—depending upon the locality where it is found and often influenced by its size, color, or environment—are barn rat, wharf rat, sewer rat, gray rat, and Norway rat. Its variation in size and color commonly gives the impression that there are a number of entirely distinct species of rats around city and farm

buildings, but, with the exception of the black rat, all are referable to *R. norvegicus*, which has not been further subdivided into races, or subspecies (fig. 1).

The house rat is a vertebrate animal of the class Mammalia, warm-blooded animals that derive their name from the fact that the young are nourished by milk from the mammary glands of the mother. The mammals are divided into several related orders, of which Rodentia is the largest both in numbers of species and numbers of individuals. Rodents are distinguished from other mammals principally by their long, curved incisor teeth with sharp chisellike cutting edges that are admirably adapted for their primary function of gnawing. The house rat belongs to the order Rodentia, which in turn is further divided into families. The ratlike or mouselike family of this order is known as Muridae, and the house-dwelling rodents within this



B2526AM

FIGURE 1.—The house rat of the United States (*Rattus norvegicus*).

family are grouped in the subfamily Murinae. This subfamily contains only two genera: *Rattus*, including the two species of house rats mentioned, and *Mus*, represented in the United States by the single species *Mus musculus*, the common house mouse.

#### INTRODUCTION AND SPREAD

Both species of house rats apparently originated in the Orient, though the black rat was the first to invade the Western World, having migrated to Europe in the twelfth century. The date of its arrival in North America is not recorded, but inasmuch as the black rat is the common ship rat and formerly few vessels were free from it, it is quite likely that it was introduced at the time ships first moored on the American shores.

The brown rat did not reach Europe until the beginning of the eighteenth century, and according to many authors it first made its appearance in the United States about the beginning of the American Revolution—in 1775. From the various seaports where the brown rat gained foothold in the United States, it gradually spread

inland, driving out the smaller black rat as it progressed, until now it infests every State in the Union. It followed closely on the heels of the early settlers, except in the high and dry mountain sections of the West, where its progress has been relatively slow. Though entrenched in some of the larger towns in Colorado and New Mexico by 1890, it did not reach Wyoming until about 1919, and Montana until 1923.

As the house rat is largely dependent upon both the food and shelter provided by man, its spread into new territory has been nearly coincident with that of people, except at higher altitudes and in extremely dry areas. The brown rat thrives best in the Temperate Zone, where it has almost completely replaced the black rat, but in the Southern States, particularly in Florida and in the southern parts of the States bordering on the Gulf of Mexico, the black rat has held its own and predominates in some places.

#### DESCRIPTION

House rats are too common and well known in the United States to need detailed description. The brown rat may be distinguished from the black rat by its relatively larger size, more robust build, shorter, thicker ears, and shorter tail, which, when bent forward, does not reach the tip of its nose, whereas that of the black rat extends considerably beyond. The rather soft fur of the brown rat is usually a grayish brown, fading to a dirty silver gray or pale yellowish white on the belly. Individuals may vary in color from an almost pure gray to a blackish or reddish brown, and partial albinos are not rare.

The black rat in the United States may be either a pure or a mixed descendant of two geographic races, or subspecies. One of these (*Rattus rattus rattus*), described from specimens taken in northern Europe, is distinguished only by color from the other (*R. r. alexandrinus*), which developed a lighter coloration through long residence in the warm climate of northern Africa. The former is a uniform dusky black with a white or cream-colored belly, whereas the latter is a gray with only slight tinges of brown and a pale-colored belly.

The average adult weight of the common house rat is about three-quarters of a pound. Individuals weighing 1 pound may be considered unusually large. Occasionally a much larger rat is reported. The heaviest specimen of which the Bureau of Biological Survey has record weighed 25 ounces. The average length of adult brown rats is 16 to 18 inches, including the tail, which is 7 to 7½ inches long.

#### BREEDING AND OTHER HABITS

The number of young in the litter of the brown rat varies all the way from 6 to 22, the average being 9 or, in the North Temperate Zone, probably 10. The number of litters produced in a year is reported to vary from 3 to 12. The young are blind and naked at birth, but grow rapidly and breed when only 3 to 4 months old. The life span of a rat is probably between 3 and 5 years. Abundant evidence demonstrates that the house rat breeds every month in the year, and there is one record of 7 litters in 7 months from a single

pair. The number of litters under average conditions, however, probably varies from three to six a year. The period of gestation is considered to be 21 to 25 days. Accurate data on the white rat, which is an albino form of the common house rat, show that the period varies from 21 days and 15 hours to 22 days and 16 hours. The nests, built of scraps of paper, rags, grasses, or any other soft material, are placed in underground burrows or under floors, wood piles, or any other structures or accumulations that afford shelter near an available food supply.

The rat's tremendous reproductive potential offers a great temptation to writers to dilate at length on the increase possible in the rat population. Using the above averages, but ignoring the death rate, the progeny from one pair of rats could exceed 350,000,000 in 3 years. This figure is of value, however, only as it indicates the ability of the rat to recuperate quickly from any unusual depletion in its numbers and as it shows how persistent man's resistance must be to this pest if it is to be kept under control.

The common house rat, or brown rat, is naturally a burrowing rodent. At times it may be found in open fields and particularly along ditch banks and water fronts, but by far the greater number live in burrows under or adjacent to buildings or within man-made structures. Although not physically adapted for extensive burrowing, the rat is communistic in its mode of living, and cooperation in extending underground runways sometimes results in an extensive maze of tunnels interspersed with nest chambers, though the burrows rarely extend downward more than 18 inches. As many as 281 rats have been taken from a single system of burrows under one small chicken house.

The brown rat is an expert climber, although in this respect it is not equal to the black rat, which lives largely in the upper parts of buildings and in trees. Although frequently found in the upper stories of buildings, the brown rat goes there for the most part only upon foraging expeditions and retires during the day to the lower floors and basements or to its burrows under the floors. It is also an excellent swimmer and does not hesitate to take to the water in cases of necessity. It is extremely quick but is not able to run so fast as some of our native rodents of the same size. Tests have shown that it can jump vertically to a height of 25 inches.

It is difficult to keep rats out of a building in which food supplies are stored unless the building is constructed of masonry or metal, as rats readily gnaw their way through wooden partitions. They are practically omnivorous and will take almost any food that either man or domestic animals eat, which explains the great ease with which they adapt themselves to almost any environment.

#### ABUNDANCE

Although it is obviously impossible to count rat noses, rough estimates of the number of rats in the United States are made possible by the many available statistics and local observations on their abundance. The number varies locally from year to year, though there is now no known cycle of rat abundance. Under favorable conditions, however, rats increase amazingly, reaching plague-like proportions in some sections, followed by a few years of relative

scarcity. They subsist largely upon food produced by man and are consequently most abundant where foods for human consumption are raised and stored in greatest quantity. Their number therefore can be expected to be more or less proportionate to the number of people, except in the larger cities.

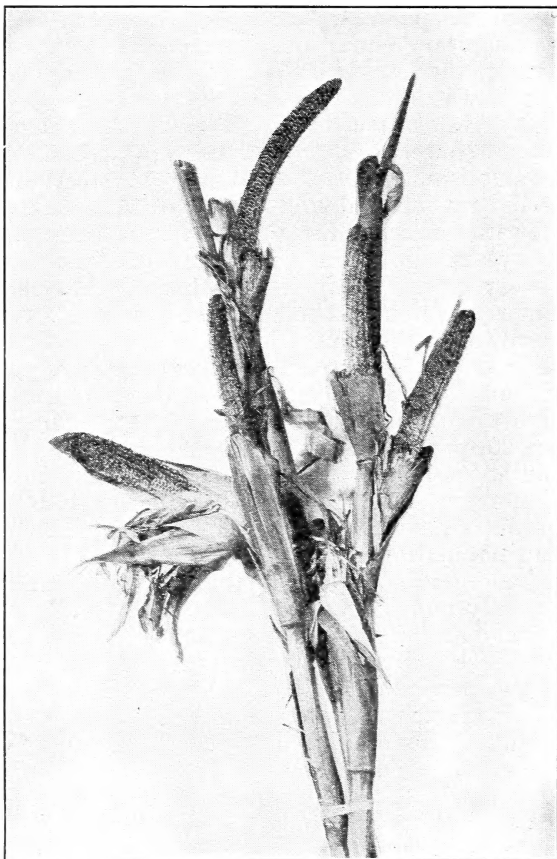
In large cities rats have declined at a very gratifying rate—probably 50 percent or more—in the past 20 years. This has been due to the generally improved sanitary conditions, to modern ratproof construction, to the passing of the horse, to the improved packaging of foods, to the elimination of waste food products, and to the greatly increased resistance of city residents to rats. Twenty years ago markets, livery stables, commission houses, grocery stores, warehouses, and most other business establishments supported large numbers of rats. Today customers avoid rat-infested stores and patronize establishments where they know the merchandise will be kept clean and uncontaminated. Twenty years ago there was easily one rat for every person in almost every city. Today it is estimated that the ratio has declined to not more than one rat to each two persons.

In the smaller agricultural towns the picture is different. Although much improvement has been made in rat control, progress has been much less rapid. Proportionately less concrete is used than in cities, and facilities for disposing of garbage and trash are often lacking. Also, many town dwellers keep chickens and other domestic stock, and thus the insistence on strict municipal cleanliness is sometimes less pronounced. This is not true of all small towns, of course, but it is the average condition. In small towns the rat population probably equals the human population.

There are considerably more rats on farms than in cities and towns, because of the normally more abundant food supply and the greater opportunities for rat harborage. Although many farms are kept free from rats, experience gained in organizing rural antirat campaigns indicates that the percentage of rat-free farms is small. There are many records, in fact, of several hundreds, and even thousands, of rats being taken from individual farms. The participants in a rat-killing contest in one county in Texas some years ago turned in, by actual count, 153,720 rat tails in 6 week's time. The human population of the county was only 35,000. In January 1934, during a campaign for rat control in connection with typhus-fever control in Georgia, Alabama, and Texas, 623,071 rats were trapped on 230,737 premises after the bulk of the rats on the premises had been destroyed by poisoned bait. It was estimated that in all more than 7,500,000 rats were destroyed on 747,608 premises treated, or approximately 2 rats per person living on the premises. Not all the rats were killed, of course, and the premises treated included town as well as rural properties.

The rat population of farms is greater in the northern than in the southern part of the United States. This is explained by the fact that in the South a larger proportion of nonedible crops, such as tobacco and cotton, are produced, that southern farm families more frequently live in towns, and that their houses and other structures are often built on posts well above the ground, thus eliminating the acceptable underfloor rat harborage. The number of rats on farms has diminished to some extent with the increased intolerance of their

presence, with the erection of better buildings, with reduced use of horses, and with improved rat-control methods, but progress in elimination has been slower than in cities or in small towns. The total rat population of farms in the United States, which is fully double the human farm population, may be estimated at 60,000,000.



B815

FIGURE 2.—Rats are good climbers, and corn on the stalk is an acceptable food supply.

Adding to the 60,000,000 rats on farms, the 34,000,000 rats in nonfarm country residences and in towns of less than 10,000 population (1 rat per person) and the 29,000,000 rats in cities of 10,000 and over (1 rat to each 2 persons), the estimated grand total rat population for the United States amounts to 123,000,000, which is close to the popular statement that the rat population approximates the human population.

#### ECONOMIC STATUS DESTRUCTION OF FOOD AND OTHER PROPERTY

In estimating the losses chargeable to rats, one must take into consideration not only the food they consume and waste, but also the other property they destroy and the cost of controlling them.

About 50 pounds of grain or its equivalent are required to maintain one rat for 1 year, representing a minimum annual cost of 50 cents per rat for food actually consumed. On the farm, although much waste grain that has no value is eaten by rats, yet the great bulk is taken from corncribs and granaries, from shocks and sheaves (fig. 2), and from mangers, pig troughs, and poultry yards. To offset the waste grain eaten, rats usually eat just the germ of the corn kernel, polluting the residue so that it is unfit either for seed or for feed. The 50 pounds thus actually consumed represent probably an additional 100 pounds of corn wasted. Also, some of the grain taken is planted seed (fig. 3), so that the cost of the labor in planting and replanting must be added to the grain cost.



Other feeding habits are even more destructive, such as the killing of baby chicks. When certain rats start killing chicks they often go to extremes, apparently purely for the lust of killing. Rats have been known to destroy several hundred baby chickens in a single night (fig. 4). Even full-grown hens and ducks, baby pigs, and lambs are killed, and large quantities of eggs are commonly destroyed.

In the destruction of fruits and vegetables (fig. 5) the actual consumption does not reveal the true extent of the losses. For example, many farmers complain that rats are destructive to apples in storage. In the majority of such cases the rats cut into the apple to get at the seeds, and in a single night one rat can ruin a large number of apples, not only those cut into but others as a result of the rot following.



B232-M

FIGURE 3.—Spotty sprouting in cornfield where planted seed corn has been dug up by rats.

Rat damage to property includes holes gnawed in many articles, such as lead pipes (fig. 6), grain bags, boxes, doors, furniture, and books; flooding, caused by burrowing in embankments; fires, caused by gnawing and short circuiting of electric wires (fig. 7); and the undermining of the foundations of buildings.

#### ANNUAL LOSSES APPALLING FARMS

Another big item on the debit side is the expenditure of large sums of money in combating rats on farms. In an attempt to obtain more definite information about rat losses on farms, questionnaires were sent to farmers participating in cooperative antirat campaigns in the Northeastern and Midwestern States, conducted largely by Biological Survey district agents. To these, 14,650 replies were received, reporting annual losses that averaged \$35 per farm. It is evident,



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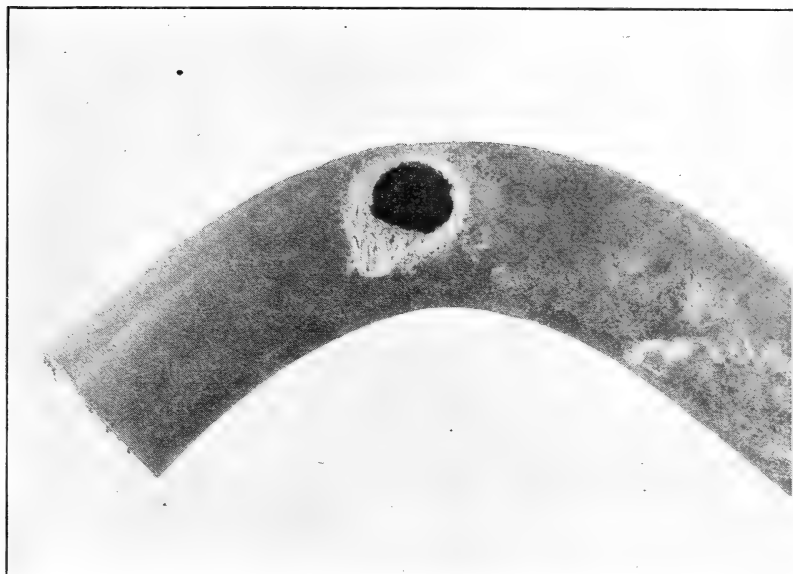
FIGURE 4.—One night's kill by rats—188 chickens of frying size.



B1195M

FIGURE 5.—Carrots fresh from the garden are a delicacy for hungry rats.

however, that this figure is too high, since those farmers who take part in antirat campaigns are the ones who are most troubled with rats. Taking all farms into account, however, experience indicates the average annual loss to be at least \$10 per farm, or about \$63,000,000 for all farms in the United States. On the basis of 2 rats to each of the 30,000,000 people living on farms, this would make the annual loss occasioned by each rat close to \$1, which is probably a conservative but dependable figure.



B2041M

FIGURE 6.—Lead pipe gnawed through by rats that probably were attracted by the sound of running water.

#### TOWNS AND CITIES

In towns and cities, as contrasted with farms, a higher percentage of rats live on waste products, particularly on garbage (fig. 8), on trash and sweepings at the rear of stores, restaurants, and residences, and on organic material found on dumps. On the other hand the useful products consumed have a much higher value, the waste caused and the amount of property destroyed being proportionately much greater than on the farm. To get at food in the cities rats usually must gnaw through some type of container. In doing so they usually ruin the whole package (fig. 9), although only a little of the contents is taken. In warehouses, feed stores, and mills, sacks of grain and stock feeds (fig. 10), and bags of flour are highly subject to rat damage; the rats gnaw holes in the bags and spill and foul the contents. In wholesale and retail grocery stores they gnaw into breakfast foods, crackers, bread, candies, and almost every other food product packaged in cardboard cartons, paper, or wood. When sides of beef, hams, and sausages have been eaten into by rats, the whole piece should be discarded.

Numerous articles of doubtful food value, also, such as soap, paint, bone, and leather (figs. 11, 12, 13, and 14), are destroyed by their gnawing.

In dry goods and furniture stores rats can figuratively destroy their weight in gold by gnawing for nesting material through bolts of



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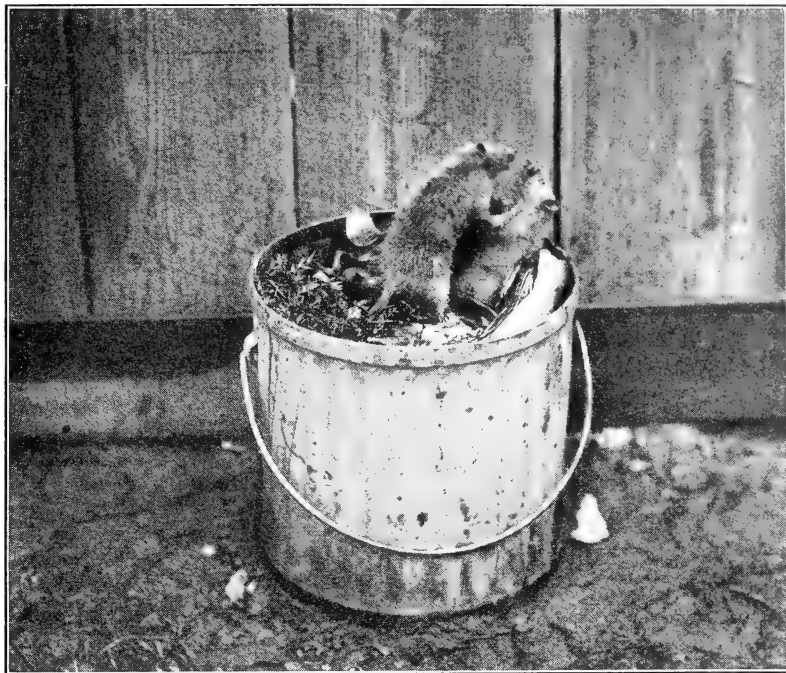
FIGURE 7.—Rat damage to wires explains some interruptions to telephone service.

silk and into expensive upholstery. Even in office buildings and libraries they have caused serious losses by using valuable paper for their nests and by eating the glue from book bindings.

After making a careful rat-loss survey in Washington, D. C., and Baltimore, Md., in 1907, D. E. Lantz, of the Bureau of Biological Survey, stated that he could conservatively place the yearly rat loss for Washington at \$400,000 and for Baltimore at \$700,000, which was not much more than \$1 a year for each of the human population. With 10 years' added experience and because of advancing food and property prices, Lantz saw fit to raise this figure in 1917 to \$2 per year per rat (estimating equal numbers of rats and people), and since then this figure has been accepted generally by students of the subject. As a result of rat-loss surveys made in Winston-Salem,

N. C., in 1928, and in Dallas, Tex., in 1931, a Biological Survey representative fixed the loss in the former city at \$100,000, or nearly \$1.50 for each human inhabitant, and in the latter city at \$356,000, or \$1.35 for each person. On the basis that there is only one rat for each two persons living in these cities, the loss caused per rat would

amount to \$3 and \$2.70 respectively. In 1930 one of our leading health authorities, having had much to do with rat destruction in combating plague, placed the annual damage in the United States at one-half billion dollars, or approximately \$4 for every resident of the country. The experience of Biological Survey investigators would indicate that Lantz's figure of \$2 per year per rat is more nearly correct for cities and towns.



B31217

FIGURE 8.—Uncovered garbage cans furnish food for many rats and contribute greatly to rat abundance in residential districts.

#### TOTAL LOSSES

To summarize the yearly losses caused by rats on the different bases discussed there should be added to the \$63,000,000 loss on farms a loss of \$68,000,000 to people living in small towns and non-farm country residences and a loss of \$58,000,000 to city residents, which would make an estimated annual grand total for the United States of \$189,000,000—an appalling sum.

#### RELATION TO HEALTH

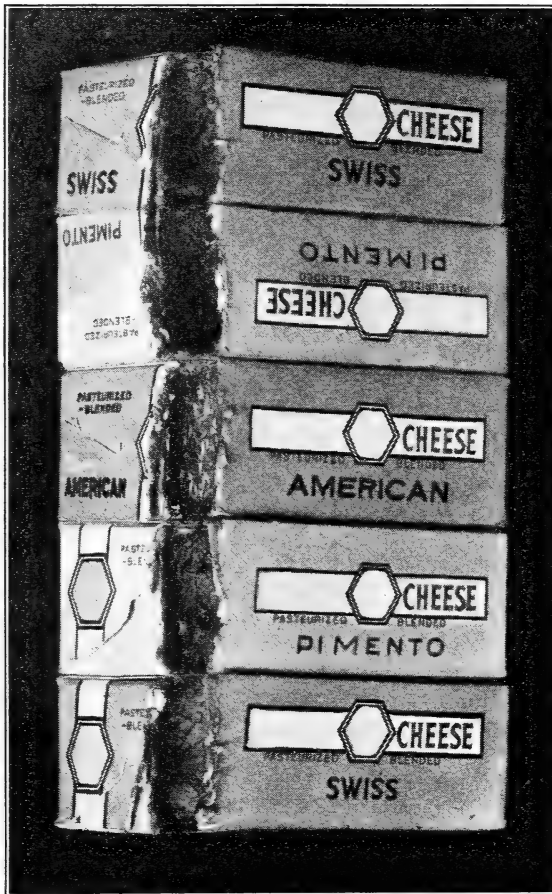
Because of the close association of rats with man and domestic animals and because rats are scavengers, living on both filth and edible foods, frequenting alternately sewers and grocery stores, privies and pantries, running from places where disease organisms abound to places where otherwise sanitary conditions prevail, carrying the disease organisms on their feet (fig. 15) and in their fur

and stomachs, it is no wonder that rats play an extremely important role in the spread and dissemination of disease. Nor do they serve only as mechanical carriers of bacteria and other parasites. A number of their own diseases are transmissible to man and domestic animals,<sup>1</sup> and in turn rats are subject to certain human and live-

stock diseases, which they acquire and then transmit to other animals, thus contributing to the spread and perpetuation of the diseases.

#### BUBONIC PLAGUE

Of the rat diseases transmissible to man, bubonic plague is by far the most important. In fact it is one of the most fatal and most dread of all diseases. In the fourteenth century the plague, or "black death" as it was called, devastated Europe, taking the lives of 25,000,000 people, or a fourth of the total population. Since the discovery that bubonic plague is transmitted to man by fleas from rodents and that its spread can be stopped by exterminating the rat, it is not the awesome disease it once was, although the death rate is still tremendous in India and certain other countries.



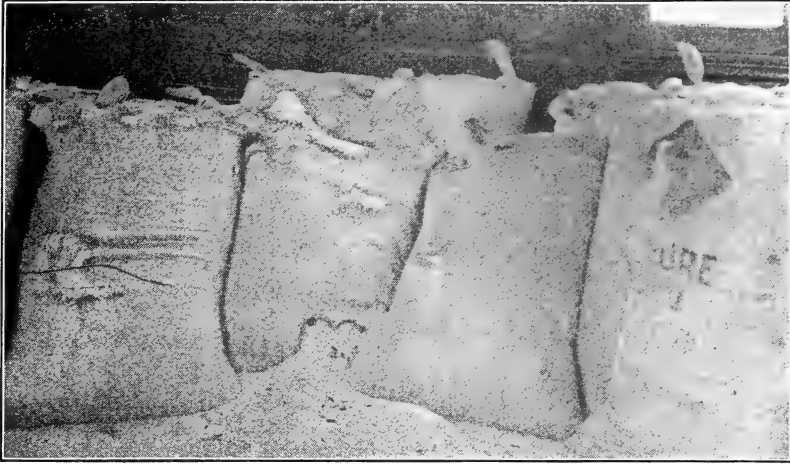
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FIGURE 9.—Under modern storage and warehouse conditions rats seeking food usually have to gnaw into some type of container and thus ruin far more food than they actually consume.

The present pandemic started in India in 1894 and spread to all continents and to nearly every country of the world. During the period from 1898 to 1923 there were 10,822,331 deaths from plague recorded from India alone. Plague outbreaks have alarmed the people of the United States on several occasions, notably those at San Francisco in 1907, New Orleans in 1914, and Galveston in 1920, but fortunately with the role of the rat known, the Public Health

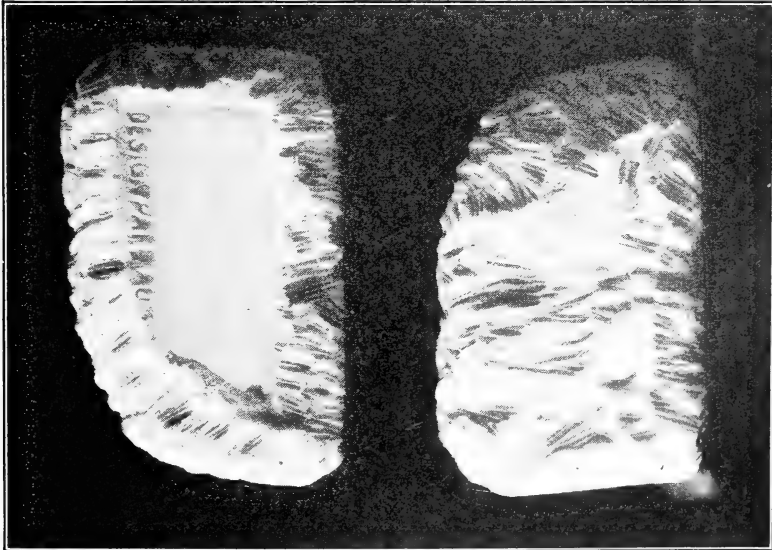
<sup>1</sup>Additional details on rat-borne diseases may be obtained from the following: Hull, T. G. DISEASES TRANSMITTED FROM ANIMALS TO MAN. 150 pp., illus. Springfield, Ill. 1930.

Service was able to check each outbreak before it got out of control. In the United States there have been approximately 450 cases and almost as many deaths.



B25100

FIGURE 10.—Typical rat damage to bags, an example of the preponderance of foods wasted to foods consumed.

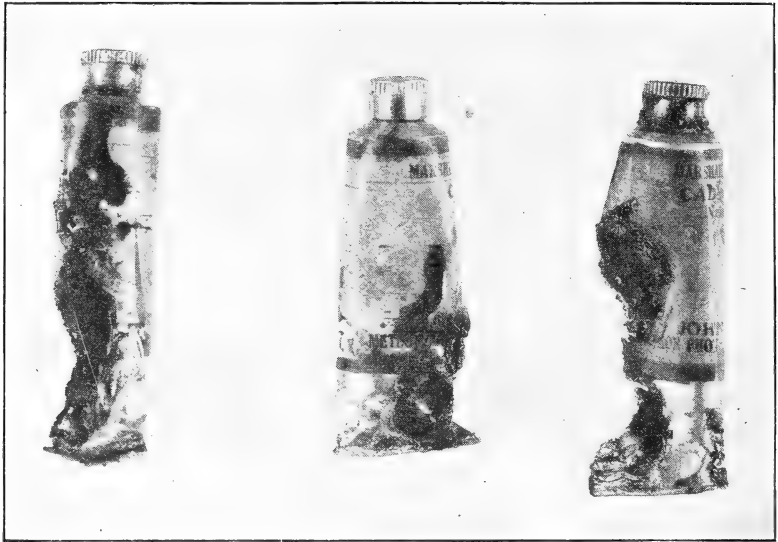


B1177M

FIGURE 11.—The only clean characteristic of the rat is a seeming fondness for soap.

Unfortunately, however, following its first occurrence in San Francisco in 1900, the plague was contracted by ground squirrels of adjacent areas and before this was discovered had become endemic in our native fauna to the extent that it has not been possible to eradicate it. Since its discovery in native rodents in 1908, this form,

known as sylvatic plague, has been gradually spreading and has been identified in several thousand rodents in California, Oregon, Idaho, Wyoming, Utah, Nevada, and Montana, including ground squirrels, wood rats, deer mice, and woodchuck. The sylvatic form of the plague is apparently not highly contagious to man, as an average of only about one human case each year has been reported. The menace, however, remains a most disturbing one because of the ever-present possibilities that house rats may become reinfected in the population centers and that human cases of bubonic plague contracted from native rodents may develop the secondary, or pneumonic, form, which is highly contagious directly from person to person.



B3124M

FIGURE 12.—Tubes of oil paint ruined by rats.

#### TYPHUS FEVER

Another rat-borne disease that is assuming serious proportions in the United States is endemic typhus fever, or Brill's disease. This is related to Old World typhus but is not identical with it. The death rate is not high, but the disease is extremely disabling. Like plague, it is transmitted from the rat to man by means of the rat flea, and may also be carried by the tropical rat mite. These fleas and mites in feeding on infected rats ingest the disease organism and in turn transmit it through biting other rats or human beings. Typhus fever has increased alarmingly in recent years. State health departments reported 332 cases in 1931, 995 cases in 1932, and 1,345 cases in the first 10 months of 1933. At the close of 1933, antirrat campaigns to control typhus fever were undertaken by the Bureau of Biological Survey in Georgia, Alabama, and Texas as a Civil Works Administration project in cooperation with the United States Public Health Service. Rat bait and traps were put out on more than three-quarters of a million premises and the disease, which was there assuming epidemic proportions, was successfully checked.



## SPIROCHETAL JAUNDICE

Spirochetal jaundice, or Weil's disease, is also a dangerous and highly disabling rat disease transmissible to man. It has been suggested that the causative organism (*Leptospira icterohaemorrhagiae*), passed in the urine of the rat, contaminates foods, water, and soil, whence it is contracted by man by ingestion or through the skin. A high percentage of rats have been found infected where outbreaks of the disease have occurred. This disease was not recognized until 1916 and may be more widespread in the United States than is now suspected. Affected rats have been found in many countries. The extermination of rats is the prophylactic measure.

## RAT-BITE FEVER

Rat-bite fever, or sodoku, as it has been called, is transmitted to man by the bite of the rat. Although relatively few cases have been reported in the United States, so many rats carry the organism (*Spirocheta morsus mures*) in the saliva that the danger of infection is always possible following the bite of a rat. Reports of babies being severely bitten while asleep are all too common. The destruction of all rats would remove the danger.

## FOOD POISONING

Food poisoning, sometimes incorrectly referred to as ptomaine poisoning, is usually caused by infection with *Salmonella* organisms (*S. aertrycke* or *S. enteriditis*). These are of animal origin and are frequently found in house rats, which transmit them to human food by their droppings. The salmonella bacteria grow rapidly in most foods, particularly meats, with no change in the appearance of the food, and thus the disease is conveyed to man. This type of food poisoning is characterized by nausea, abdominal pains, and diarrhea. Many thousands of cases have been reported in the United States. The death rate is probably less than 5 percent. The elimination of rats from homes and all food establishments would greatly lessen the incidence of this disease.



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FIGURE 13.—Rats apparently find some food value in bone when more palatable food is not available.

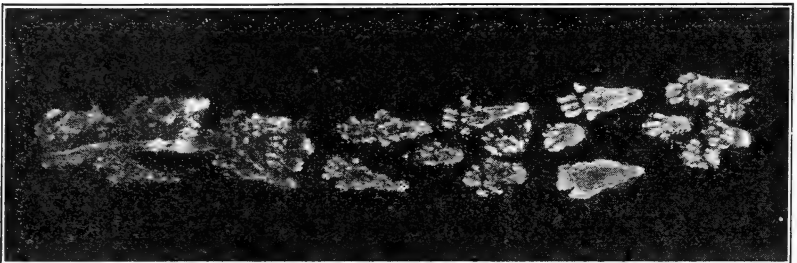
## TULAREMIA

Tularemia is a disease that is extremely fatal to rabbits and hares, and transmissible to man by the bite of an infected tick or other blood-sucking insect, or through contact with the carcass of infected animals. The tularemia organism (*Bacterium tularensis*) has been recognized only since 1921, when it was first described by the United States



B2673M

FIGURE 14.—Even leather is acceptable food to rats on occasion, as one sporting-goods dealer learned to his sorrow.



B2830M

FIGURE 15.—Disease-laden footprints of a rat showing that this rodent is a potential carrier of harmful bacteria to human food. Photograph made by allowing the rat to run across a plate of agar, after which the plate was put into an incubation oven, causing growth of the bacteria deposited by the rat, the organisms outlining on the agar the tracks left by the rat.

Public Health Service. The death rate is only about 4 percent, but the recovery from the disease is slow, sometimes requiring 3 to 6 months. Tularemia has several times been founds in rats—an added reason for rat extermination.

## RABIES

Rabies, or hydrophobia, is primarily a disease of dogs but affects other animals, including rats, and is transmitted by the bite of a rabid animal. Though rats have only a minor role in the spread of rabies, their elimination would remove one possible source of infection.

## TRICHINOSIS

Trichinosis is a disease of animals, particularly of pigs and rats. Man is infected by eating improperly cooked pork containing the cysts of a round worm (*Trichinella spiralis*). Upon reaching the stomach the cysts are dissolved, setting free the tiny worms, which develop and breed in the intestine. The young embryos enter the blood stream and penetrate the muscles. The symptoms in severe cases are sometimes mistaken for typhoid fever. The death rate has ranged from 5 to 15 percent in cases studied. Rats do not transmit the parasites directly to man but are a factor in propagating and perpetuating the disease in pigs. The destruction of rats around all piggeries would lessen the incidence of trichinosis.

## OTHER RAT-BORNE DISEASES

Rats no doubt play a more important part than is generally recognized in spreading various parasites that affect man, including intestinal protozoa and the tapeworm. Veterinarians are finding that diseases and fatalities among domestic animals and livestock are more prevalent where rats are plentiful, and close attention is given the rat in connection with many livestock diseases, including white scour in calves, mastitis, ringworm, contagious abortion, tuberculosis, abortion in mares, joint ill in foals, and others. No owner of valued livestock or domestic animals should take unnecessary chances of losing them through disease transmitted by rats when keeping the rats out would remove the possibility.

## RAT UTILIZATION

There is no known use of the common rat that could offset in any measure its destructiveness. Unlike most other animal pests, it has no saving quality. Even the fact that it may act as a scavenger must be discredited because of the filth it leaves behind and because the harmful organisms it spreads may often be more objectionable than the offal it might consume.

Pelts of the brown rat were at one time used to a limited extent in the manufacture of small toy animals but, so far as known, are not now utilized for any purpose. The house rat, of course, cannot be credited with the services rendered by its domestic brother as a laboratory animal, although in the absence of the albino rat, it could probably be used in the same capacity.

## REPRESSION OF RATS

Because of the great menace of the house rat to human health and prosperity and because of its utter lack of usefulness, it is amazing that it has been allowed to exist as it has in the United States. If everyone understood the true status of the rat, how dangerous and how destructive a rodent it is, not even a single rat would be allowed to exist in or near an abode or place of business. Pride, as well as common sense, should force anyone harboring rats on his premises to make sure of their complete extermination.

In most cases the use of poison baits is the best method for destroying rats, although traps bring good results when skillfully used and

calcium cyanide is highly effective in gassing rats in their burrows and other enclosed places, including such partially open ones as cornercribs. Killing a few rats is only a temporary expediency, however, and usually should be accompanied by the elimination of rat harborage and the rat proofing of buildings. Any one of a number of poisons can be successfully used, but bait prepared with red squill is primarily to be recommended, not only because it kills the rats but because it is relatively harmless to humans and domestic animals. Detailed instructions for preparing and distributing red-squill baits and for gassing, trapping, and otherwise controlling rats are given in Farmers' Bulletin 1533, Rat Control, and methods of shutting rats out of buildings and premises are described in Farmers' Bulletin 1638, Rat Proofing Buildings and Premises. Both publications are available, free of charge, so long as the supply lasts, on application to the Office of Information, United States Department of Agriculture, Washington, D. C.

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