The Plague Problem in the United States

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Plague is a rodent disease which affects man, causing a high death rate. Three hundred and thirty-eight of the 520 reported cases in the United States through January 1950 have resulted in death. The disease is caused by a bacterium called *Pasturella pestis* and is contracted commonly from three distinct sources:

a. Directly from domestic rats (figure 1) or from the bite of one of their fleas (especially of the oriental rat flea, a species peculiar to domestic rats).
b. Directly from certain native rodents of the fields and woods or from the bites of their peculiar species of fleas.
c. From persons in whom plague has affected the respiratory tract and is thus transmissible by sputum droplets.

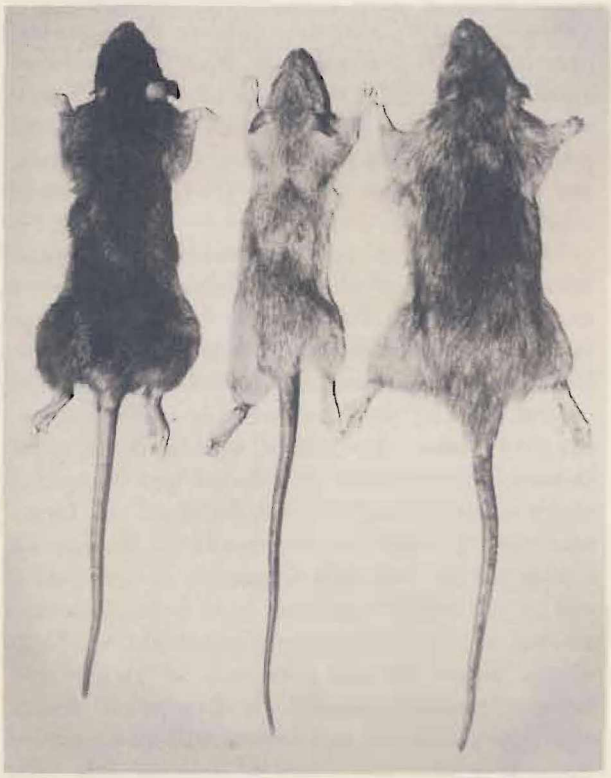


Figure 1. Domestic rats: Chief source of human cases of plague in the United States. From left to right: black Norway rat, brown climbing rat, brown Norway rat. Note that the climbing rat, although smaller, has a tail relatively longer than the Norway rats.

When contracted by way of sputum droplets, plague is referred to as "pneumonic." When present in domestic rats, it is referred to as "murine," and when present in native wild rodents, as "sylvan" or "campestral"* plague. It is transmitted from native rodents to domestic rats and from these rats to the native rodents by fleas. When acquired by human beings from murine or campestral sources, it may result in pneumonic infection.

PROGRESS OF SPREAD OF PLAGUE

Experts disagree to some extent concerning the origin of plague in North America. Some believe that, since it is a disease of similar rodents in Asia, it must have existed among native wild rodents in North America for many centuries. They point to the fact that, though investigators believe that plague drifted slowly eastward from a point of introduction in California about 1900, those investigators did not conduct their surveys in such a way as to prove their belief.

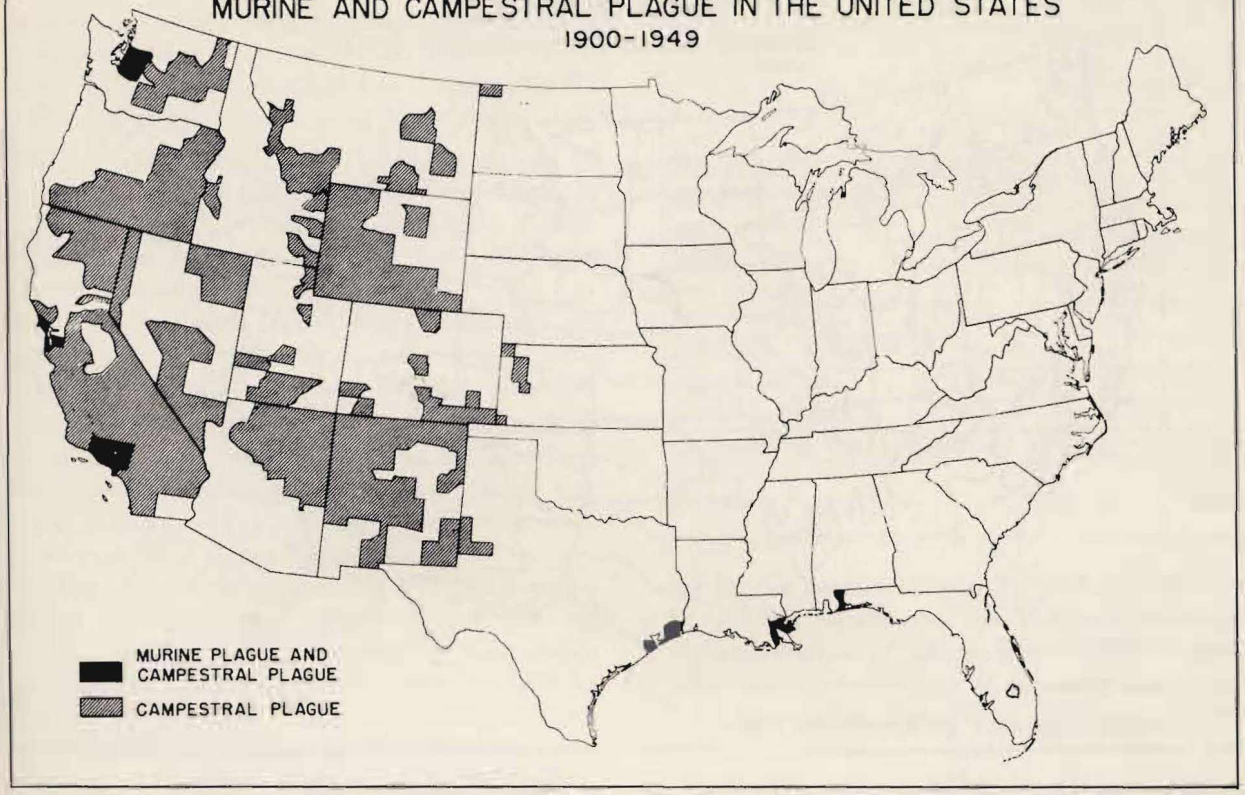
Others believe that plague was introduced from the Orient by way of infected rats brought in on ships. They point to the fact that it was so introduced into Hawaii and the Gulf Coast States, as well as into other parts of the world, and that it affects certain native rodents in a way which would be expected only of a disease completely new to them.

Whatever the case, plague among wild rodents now is distributed widely in the United States (figure 2). Various species of native wild rodents and their fleas are known to be infected. However, only a few of these rodent-flea combinations or "teams" are capable of supporting plague. Perhaps the best known of the native wild rodent-flea combinations capable of harboring plague are those of prairie dogs, California ground squirrels, and certain species of wood rats or pack rats. Sagebrush voles and certain species of meadow mice are probably equally important. In the Hawaiian

*The term "campestral" is probably more appropriate than "sylvan" inasmuch as rodents of the plains, prairies, and fields are more commonly infected than those of woods.

Figure 2

MURINE AND CAMPESTRAL PLAGUE IN THE UNITED STATES
1900-1949



Islands, a semidomestic species, the Hawaiian rat, and its peculiar fleas constitute a primary reservoir.

CAMPESTRAL PLAGUE CONTROL

Since plague was first recognized in 1900, only about eighty cases have been reported as having been acquired through handling of native wild rodents or bites of their fleas.

It is impractical to control plague among native wild rodents or their fleas sufficiently to prevent occasional cases, although dusting with DDT to control fleas and poisoning of wild rodents is feasible in limited, heavily used areas like school yards and parks.

Generally the best way to avoid infection is to avoid handling native wild rodents.

MURINE PLAGUE CONTROL

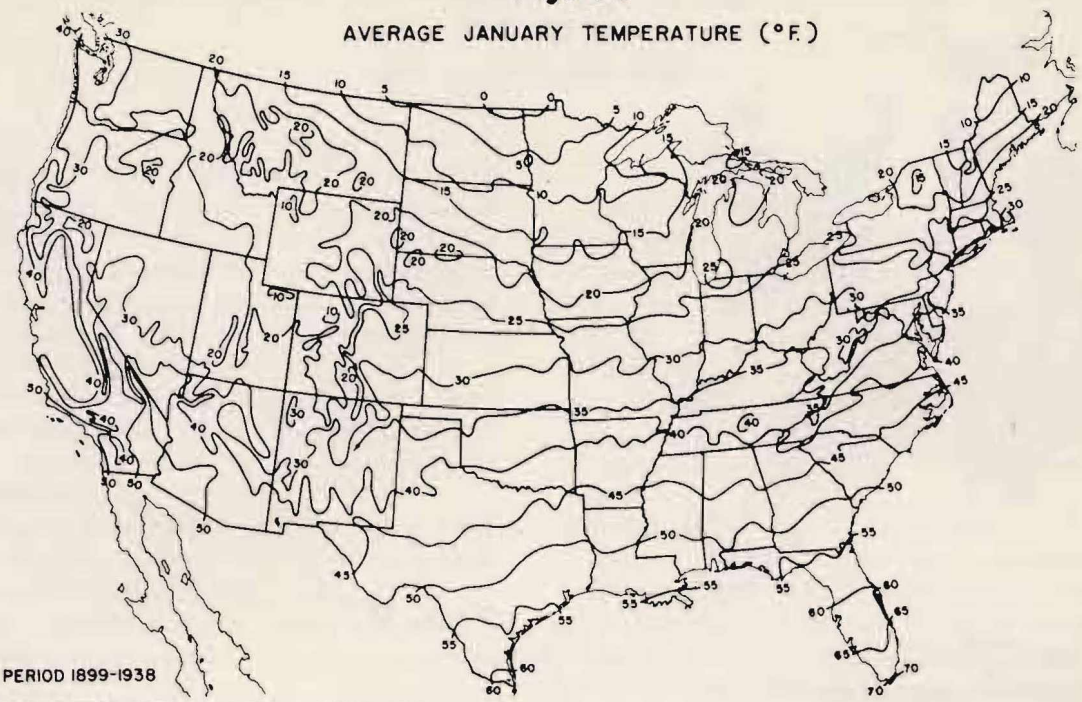
Over eight hundred human cases have been acquired from domestic rats, mainly through bites of the oriental rat fleas which parasitized them since plague first was recognized in the United States. About half of these occurred on the mainland and half in Hawaii.

The danger of acquiring plague from domestic rats depends partly on the degree of association of persons with rats, and partly on the size and distribution of oriental rat flea populations inhabiting these rodents. A general abundance in any given locality of at least one oriental rat flea per rat usually is regarded as the minimum required to support plague among domestic rats and thus to cause considerable danger to humans. In New Orleans, for example, the general midwinter level of oriental rat flea population was about one and a half per rat during the plague years. During the summer, the level was over four.

In the United States, no plague outbreaks or cases due to bites of the oriental rat flea have occurred where the midwinter temperature is lower than 45° F. (compare figure 2 with figure 3) or where the mean relative humidity at noon in July is less than about 60 percent (compare figure 2 with figure 4). Nevertheless, in climates where in summer the rat flea population exceeds one per rat despite a lower winter population, some danger conceivably can exist and must be guarded against. A study of oriental flea populations on domestic rats indicates that the danger may be considerable

Figure 3

AVERAGE JANUARY TEMPERATURE (°F.)

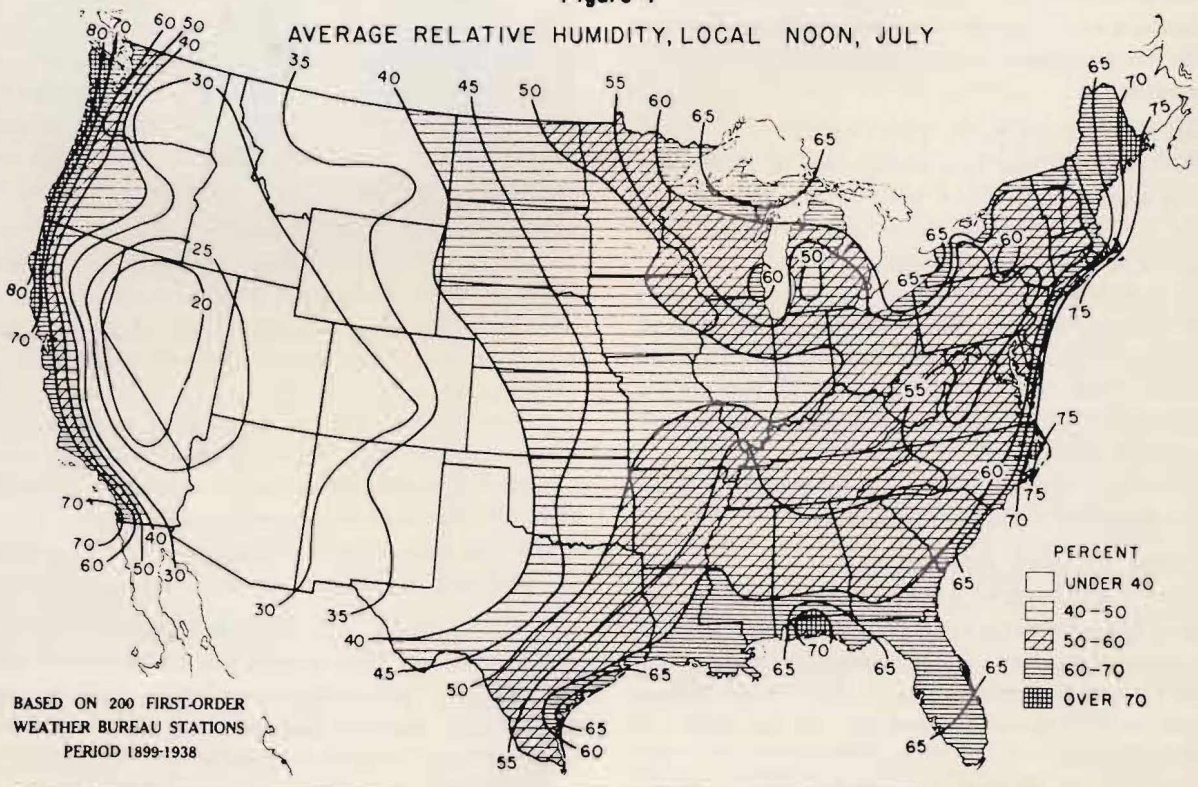


PERIOD 1899-1938

FROM: *Yearbook of Agriculture, 1941*

Figure 4

AVERAGE RELATIVE HUMIDITY, LOCAL NOON, JULY



BASED ON 200 FIRST-ORDER WEATHER BUREAU STATIONS
PERIOD 1899-1938

where the relative humidity is above 35 percent.

The flea population, and the danger as well, is greatest in moist, warm climates; rat-flea cases have occurred in Honolulu, T. H.; Seattle, Wash.; San Francisco, Berkeley, and Los Angeles, Calif.; Galveston and Beaumont, Tex.; New Orleans, La., and Pensacola, Fla., and in Puerto Rico (table 1). Infected domestic rats also have been found in Tacoma, Wash.; in Ventura, Marin, and Contra Costa Counties, Calif., and in Kaui and Maui Counties in Hawaii.

In Pacific Coast States, plague has been reduced to a minimum among domestic rats by anti-rat sanitation and poisoning. By such reduction of rat and rat-flea populations there, the possibility of infected rats being introduced to east-bound commerce is decreased. Nine Western States now have cooperative State-Federal programs to prevent local plague outbreaks.

There is now in progress in the Southeastern States a murine typhus control program with the purpose of keeping down domestic rat and rat-flea populations for the ultimate object of reducing the number of cases of murine typhus. This program involves application of DDT dust for control of fleas, back-lot and alley sanitation, ratproofing, food-establishment sanitation, and finally poisoning for the control of rats. By such reductions of rat and flea populations, the likelihood is reduced of implantation of plague from westward areas even should infected rats be transported eastward.

By keeping the domestic rat and rat-flea populations at a minimum locally, transmission from native wild rodents to human beings by way of domestic rat-fleas can be held to a minimum.

Table 1

HUMAN PLAGUE OUTBREAKS IN THE UNITED STATES

City	Date	No. of Cases Reported	No. of Deaths
San Francisco, Calif.	1900-04	120	114
San Francisco, Calif.	1907-08	186	92
Seattle, Wash.	1907-08	3	3
New Orleans, La.	1914-15	31	10
Oakland, Calif.	1919	13*	13
New Orleans, La.	1919-21	25	11
Pensacola, Fla.	1920	10	4
Galveston, Tex.	1920	18	12
Beaumont, Texas.	1920	14	6
Los Angeles, Calif.	1924	41	34
Total		461	299

Human Diseases Harbored by Domestic Mice and Rats

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Rodents and their ectoparasites are hosts of a number of disease-producing viruses, rickettsiae, and bacteria which affect man, generally in proportion to the degree to which the rodent hosts associate with man. Some of these disease organisms are transmitted directly by the rodent through contamination of man's food, water, and quarters through infected urine and feces, and some by biting. Many are transmitted from rodent to man by their ectoparasites. In some cases, rodents simply appear to be the host of an ectoparasite which is the reservoir of the disease.

Domestic rats and mice* bring ectoparasites and disease-producing organisms closer to man more constantly than do the rodents of the fields and woods, and therefore are responsible for a large number of such illnesses.

Rattus norvegicus, Rattus rattus, and Mus musculus