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February 1962

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INFECTIOUS DISEASE HAZARDS TO PEST CONTROL OPERATORS

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INTRODUCTION

One of the primary reasons for controlling most vertebrate pests is the role these creatures play as links in the infection chain of certain agents pathogenic to man. It is reasonable to assume that the persons engaged in the eradication or removal of pests are at some risk of contacting zoonoses - diseases transmissible from animals to man. Unfortunately, histories or epidemiological data of occupational infections among pest control operators are not available; perhaps this society may become a future assembly point for statistics in this field. The hazards therefore have to be approached theoretically: diseases known to be associated with vertebrate pests must be studied as to their prevalence in the animal reservoir, ease of transmission, and the particular mode in which control operators would most likely become exposed.

The data on individual diseases which follow, although by no means complete, should serve as an introduction to the study of zoonoses affecting pest animals.

RABIES

Although rabies in most areas of the world is historically associated with dog populations, in recent years the rabies

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problem in the United States has centered around the wildlife reservoirs. Dog rabies has dramatically decreased in incidence during the past decade, a result of widespread anti-rabies immunization of owned dogs and improved stray dog control programs. During the same period, rabies in the principal wildlife vectors of the U.S., the foxes and the skunks, has increased in incidence (Tierkel, 1958). Wildlife rabies has accounted for an increasing proportion of the rabies total (see fig. 1); foxes and skunks alone accounted for about half of the 3,427 cases confirmed in 1960.

Rabies in foxes is an important problem of the eastern and Gulf States in an area extending from New York, along the Appalachian Mountains to northern Florida and westward into Texas. The skunk is the principal rabies vector in the Great Plains States and in California (fig. 2). Since 1953 when rabies in bats was first confirmed in the U.S., there have been about 400 bats proved infected with rabies; 36 States have reported one or more bat rabies isolations (see fig. 3). Some 20 species of bats have been proved infected.

The pest control operator thus may encounter rabies infection in at least three groups of pests specifically discussed in this meeting: foxes, skunks, and bats. It is well known that rabid animals often do not fear man and will bite when approached or disturbed. Rabies virus is shed in the saliva; and, thus, a bite

caused by a clinically rabid or suspicious animal must be considered potentially infectious. Wild animals acting abnormally friendly or playful should be handled with extreme caution, and no opportunity to bite should be allowed. Of course, one should also be careful not to injure the hands on teeth of animals being removed from traps; and, in general, infectious saliva should be prevented from contaminating pre-existing wounds. In case of bite or other exposure, it is most important immediately to wash the wound very thoroughly with soap and water, using copious quantities of both. A physician or public health official should then be consulted in order to evaluate the advisability of post-exposure anti-rabies vaccine treatment. The use of nerve-tissue anti-rabies vaccine in man carries some risk of undesirable side-reactions and thus should not be used indiscriminately. A reduced regimen of vaccination before exposure occurs, using avian embryo-origin vaccines, is now being developed for persons who may be at greater-than-ordinary risk from rabies: for example, dog wardens, predator control specialists, veterinarians, and rabies-laboratory workers. The procedure is a basic immunization using the embryo vaccines; if the response to it is satisfactory as judged by serologic test for neutralizing antibodies, then a future suspected exposure may necessitate only a booster of the same avian-embryo vaccine, rather than the classical Pasteur treatment. Some individuals engaged in vertebrate pest control in the wildlife rabies areas may well consider this pre-exposure vaccination procedure.

LEPTOSPIROSIS

Human disease due to the various leptospira presents a variety of symptoms and may range in severity from mild or inapparent to extremely severe and occasionally fatal cases. Significant proportions of human cases develop liver damage and jaundice and therefore, may be confused with infectious hepatitis. Other symptoms commonly encountered are eye inflammation, fever, small hemorrhages, muscle pains, and severe headache. Leptospirosis may be caused by about 40 or more different and distinct species. Of these, three are the most important in the United States: L. icterohemorrhagiae, L. pomona and L. canicola (Turner, T. B., 1958).

The first recognized animal reservoir of leptospirosis was the rat. This pest has been known to be a carrier of leptospirosis for over 50 years. Rats are likely to be parasitized by the species L. icterohemorrhagiae which is considered the most pathogenic for man. The epidemiology of rat-borne leptospirosis is particularly conducive to transmission to man, because individual rats may shed bacteria in their urine for long periods of time although they may not be clinically ill. This rat-to-rat transmission is frequent, and domestic animals as well as man may become infected by contact with rat urine. It has been reported that up to 50 percent of the rats in the U.S. are naturally infected with leptospirosis (Steele, 1958). Many other wild animals have been found infected with leptospirosis, including opossums, foxes, raccoons, and skunks (McKeever et al., 1958).

If the conditions are suitable, leptospiras can survive for long periods of time in stagnant water, puddles, moist earth, and similar wet environments. Man is probably infected by the entrance of the organism through broken skin, scratches, or wounds and also through the conjunctiva of the eye or abraded mouth surfaces. To prevent transmission, care should be taken in handling rats and other wild animals as well as objects soiled by their excreta. Rubber gloves may be advisable; these can be washed in hot detergent solution after use. Splashing of potentially contaminated water into the eyes is also to be avoided.

PLAGUE

This disease has probably influenced the history of man more than any other. It has in the past depopulated nations and continents and has also been responsible for basic advances in preventive medicine stimulated by the great fear of its presence. The large epidemics of the past were brought to man by rapidly spreading rat infection mediated through infected flea vectors. Rat-borne plague is still an important problem in parts of Asia and Africa.

In the United States, rat-borne plague caused focal outbreaks at the turn of the century, particularly in California. The high year was 1907, when 191 human cases, resulting in 96 deaths occurred.

The last year when human plague affected a sizable population in the U.S. was 1924: a local rat-borne epidemic in Los Angeles

with pneumonic person-to-person spread accounted for 40 cases and 36 deaths. Since then, the yearly incidence has ranged from no cases to a high of 5 in 1935. These were all associated with wild rodents or their ectoparasites. Sylvatic plague may be present in a variety of rodents; epizootics have been observed in squirrels, prairie dog, rabbits, and pack rats. Many other rodent species have been found infected in survey collections. Geographically, the disease is present in the 15 western States extending as far east as Kansas, Oklahoma and Texas (see fig. 4). (Meyer, 1958, Kartman et al., 1958).

The risk of plague involved in eradication of the rodent pests, even in areas known to harbor infection is probably not great. Since the disease is very severe, however, precautions are recommended. Transmission may occur either by bite of an infected flea or by contact with infected rodents. The latter is easily prevented: removal of dead rodents is to be done carefully, using rubber gloves or tongs; the carcasses should be autoclaved, incinerated, or buried in quicklime. Rodent fleas may not feed on man under ordinary circumstances, but may bite if deprived of usual blood meals. It is therefore advisable to use insecticide as well as rodenticide if large scale eradication of potentially infected species is in progress. In addition, when conducting pest control in the field it is wise to use effective repellents on exposed skin and clothing.

The presently available vaccines have to be given frequently, usually twice a year, for measurable protection. Their use is therefore limited to highly endemic plague areas. Early diagnosis and intensive treatment are most important, and any suspicion of disease should be immediately reported to a physician,

ENDEMIC (MURINE) TYPHUS

This rickettsial infection, caused by Rickettsia prowazeki var. typhi (R. Mooseri) should not be confused with classical epidemic louse-borne typhus. The disease considered here is considerably milder than epidemic typhus; it is not transmitted from person to person but is usually contracted by the bite of the infected rat flea, Xenopsylla cheopis. Human cases in the U.S. have in recent years been confined to 11 southeastern States; over 90 percent of cases have occurred south of a line drawn from Charleston, S. C, to Dallas, Texas, (see fig. 5). Commensal rats in the rural areas of this region probably represent the most important reservoir of the infection; at certain times of the year, especially late spring and summer, up to 30 percent of captured rats in the endemic region show serologic evidence of typhus infection. There is indication that rural typhus may be controlled by intensive rat-trapping and insecticide application: 41.7 percent of farms treated in this manner became rat-reinfested within 3 years, but

typhus infection could not be confirmed in any of the "new crop" rats at the end of the 3 years (Smith, 1957, 1958). As far as the danger to pest control operators is concerned, it would be greatest at the time of inspection or visit to rat infested premises; the danger of flea-bite is of course increased if rat poison or traps are effectively used without concurrent insecticide application.

The best preventive measures similar to the situation in plague would be use of DDT powder or spray, or similar residual insecticide either prior to or concurrently with anti-rodent operations. Insect repellents are also highly recommended, especially in the endemic foci. In addition, persons at risk in the endemic areas may be immunized periodically against typhus.

ORNITHOSIS

Many mild cases of psittacosis or ornithosis probably remain undetected, or are classified simply as atypical pneumonia, influenza, or "colds," The reservoirs responsible for most confirmed cases in the U.S. are parakeets, turkeys, and pigeons. Thus, pigeon control may under certain conditions entail the risk of ornithosis.

This disease is caused by one of the group of organisms designated as Bedsonia (Meyer, 1953). They have certain biologic properties similar to viruses and rickettsiae but are sufficiently distinct to be a separate genus.

Pigeon ornithosis is common in feral and loft pigeons: serologic evidence of infection was found in 60 percent of over 4,000 birds examined over a period of 15 years; Bedsonia were isolated in 19 percent of the cases attempted (Meyer, 1959a, 1959b).

Circumstantial evidence seems to indicate that cases contracted from pigeons are comparatively mild; most human cases respond favorably to treatment with broad spectrum antibiotics. Some severe cases and deaths have been recorded especially prior to the discovery of tetracyclines.

Man contracts ornithosis by inhalation of infective droplets or dry particles. Aerosols of dried droppings and bird exudates, created by commotion of birds or by careless dusting of premises are especially infective. Pigeon control operations can thus be conducted more safely by avoiding aerosols and their inhalation;

- 1) face masks or respirators may be worn when entering enclosed pigeon spaces that are pigeon-infested;
- 2) dusty, feces-covered surfaces may be wetted down with disinfectant solutions such as lysol or quaternary ammonium compounds before clean up.

GENERAL DISCUSSION AND SUMMARY

The disease briefly described above are by no means the only infections which may be harbored by the various pest species encountered by control operators; they do represent a variety of causative agents, modes of transmission, and reservoir characteristics which make them adequate models for the other possible infection hazards. We can thus make certain general preventive recommendations applicable to pest control operations. The most important preventive measure is that each operator

should become acquainted with the zoonoses harbored by the pests in his area of occupation. A recommended reading list will be found at the end of this discussion. In addition, local and state health departments should be consulted for specific history of the particular area where control is to be conducted.

If rabies is present, special care should be exercised to avoid bites and injury which may introduce infectious saliva. If such injuries occur, thorough washing is very important, with subsequent medical consultation and examination of the biting animal in the laboratory. Similar preventive measures would be applicable to rat-bite fever, a bacterial disease; and contact transmissible diseases such as leptospirosis, ringworm, plague, and tularemia are avoided by wearing rubber gloves and boots and by washing exposed, possibly contaminated skin surfaces with soap and antiseptic solutions after work. Insect vector-borne diseases are best prevented by insecticidal operations carried out prior to or concurrently with the vertebrate pest control; under this category plague and tularemia may be again considered, and also typhus, Rocky Mountain spotted fever, and relapsing fever. Air-borne infections should be guarded against by the use of some type of air filtration, such as gauze masks, respirators, or *pas* masks; also use of dry aerosols should be avoided. Antiseptic wetting procedures and prompt burial or autoclaving of droppings and similar matter are other preventive measures. Ornithosis is the

best example of an air-borne zoonosis. Histoplasmosis, a fungus disease caused by Histoplasma capsulatum, is also air-borne but is not a true zoonosis; it is not known to be transmissible directly from animals to man, but is probably a soil organism. It seems to thrive best in soils enriched by bird or other animal droppings. Thus, many persons contract the infection in confined areas where dirt and droppings are found, such as chicken coops, basements, attics, etc. (Furcolow, 1957, 1961).

RECOMMENDED ADDITIONAL READING

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FIGURE 1

RABIES in the U. S.

1939 - 1960

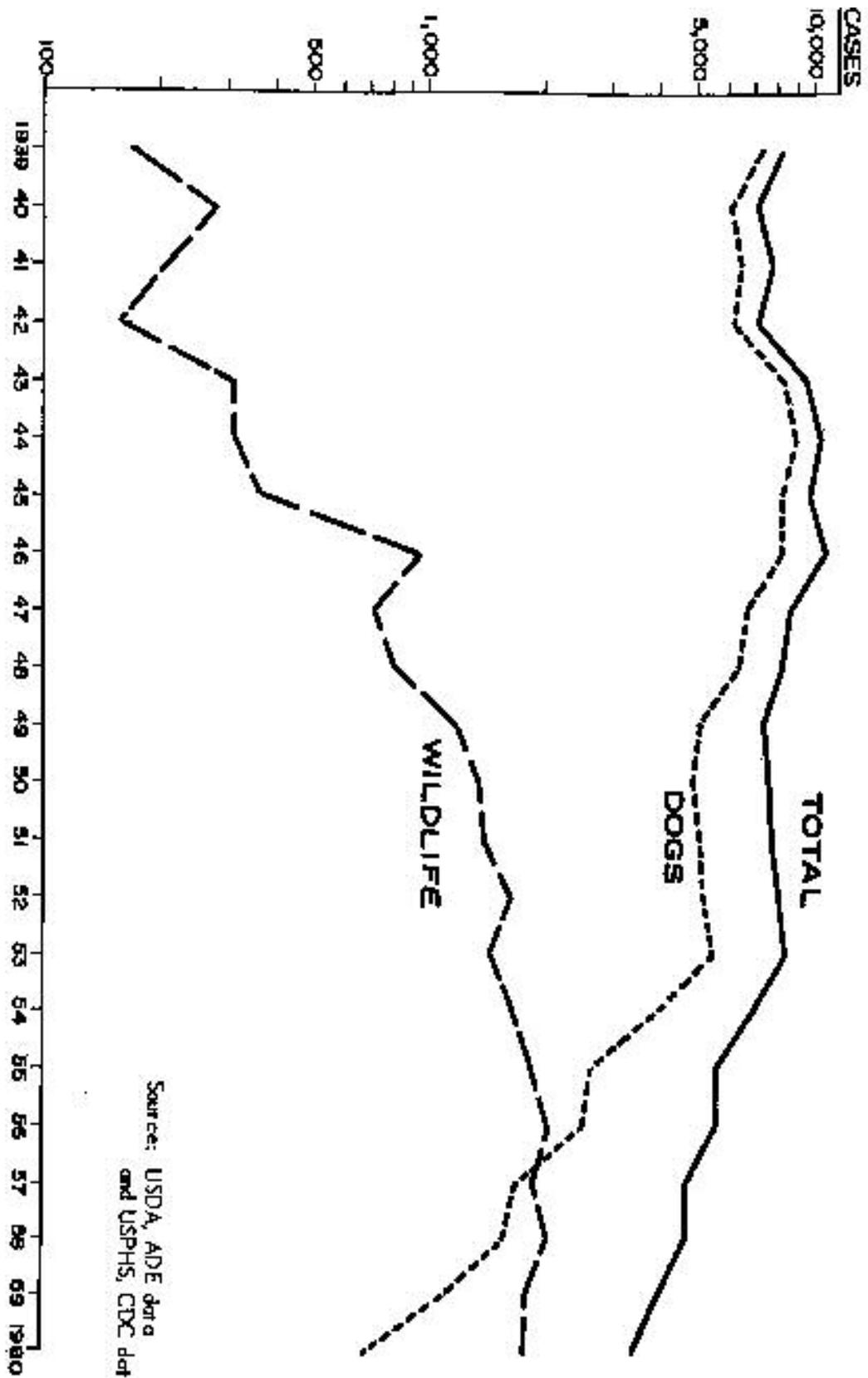


FIGURE 4

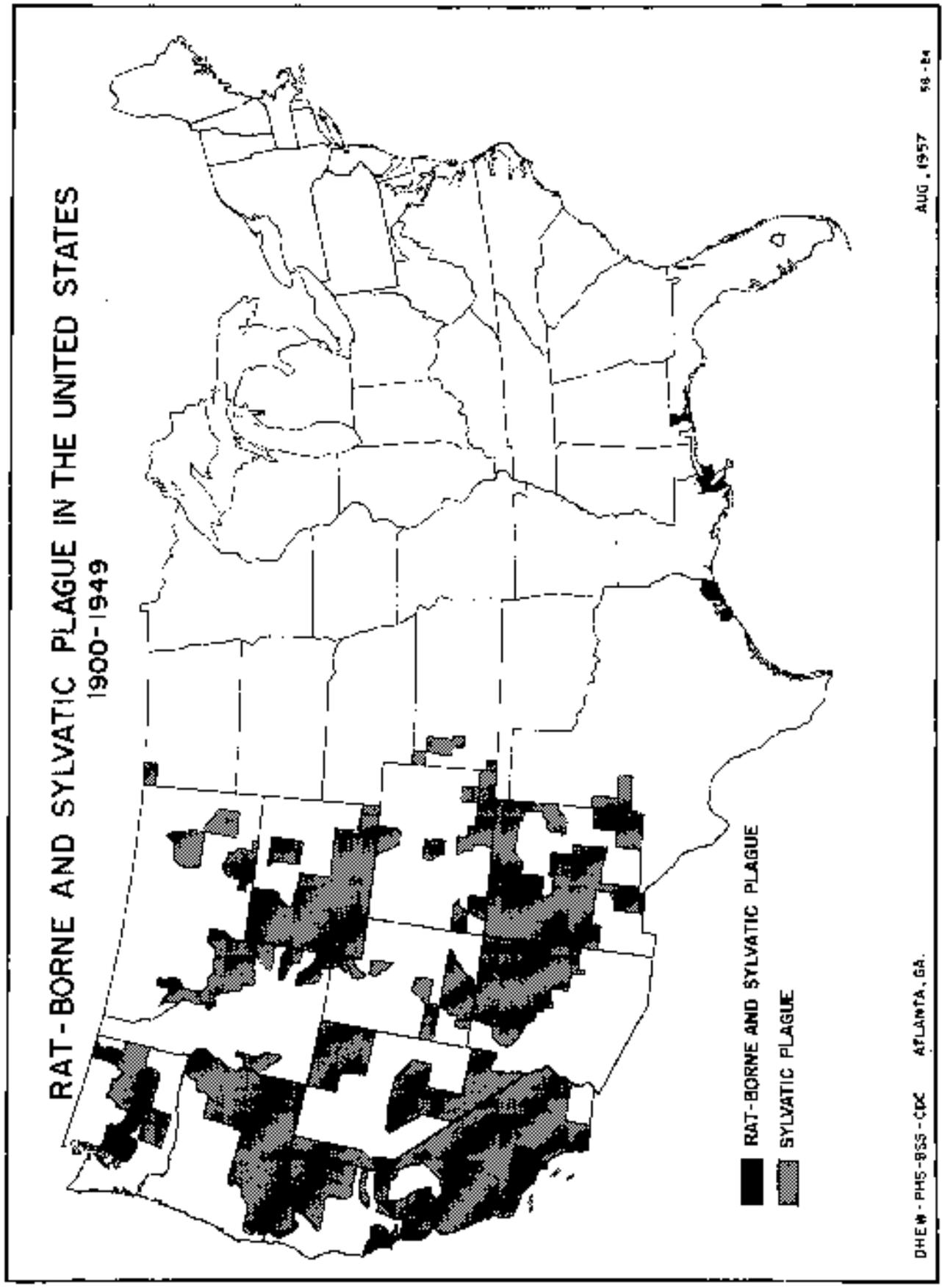


FIGURE 5

