

### XXXIX. INTERIM REPORT OF THE ADVISORY COMMITTEE FOR PLAGUE INVESTIGATION IN INDIA.

The following statement embodies the chief conclusions which have been provisionally reached by the Advisory Committee as the result of the investigations made under their direction from 1905—1909 into the mode of spread of plague in India.

(1) Considerable epidemics of human plague consist almost entirely of cases of bubonic plague and are directly dependent on the occurrence of epidemic plague in rats. The development of the rat epidemic precedes the human epidemic by an interval of about a fortnight. There is no evidence that any animals except rats play an important part in plague epidemics.

(2) *Epidemic plague in rats.*

(a) Rat fleas which have sucked the blood of a plague-infected rat can transmit the disease to healthy rats to which they are transferred. The plague bacilli multiply in the stomach of the flea, and the flea may be still capable of conveying infection three weeks after having imbibed plague-infected blood.

(b) If plague-infected rats are kept in close confinement along with healthy rats, no epidemic of the disease occurs in the absence of fleas. In the presence of rat fleas the disease spreads from the infected to the healthy animals, and the rapidity and severity of the epidemic so produced is in proportion to the abundance of fleas.

(c) Rats may be infected by feeding them upon the bodies of other rats dead of plague. The distribution of the lesions in the bodies of naturally infected rats corresponds with that in rats experimentally infected by means of fleas and not with that in rats infected by feeding.

The Committee, therefore, conclude that *in nature plague is spread among rats by the agency of rat fleas.*

(3) *Epidemic plague in man.*

(a) Bubonic plague is not directly infectious from man to man as is shown by the experience of plague hospitals where there is no tendency for the disease to spread from the sick to the attendants.

(b) Material epidemics of plague in man are always associated with epidemic plague in rats. Epidemic plague among rats provides a large number of infected rat fleas, and, owing to the mortality among the rats, brings these fleas on to human beings.

(c) Rat fleas (*Pulex cheopis*) bite human beings, especially in the absence of their natural host.

(d) Rat fleas containing plague bacilli and found capable of transmitting plague to animals may be caught in plague-infected houses.

(e) Animals susceptible to plague (guinea-pigs, monkeys) placed in plague-infected houses if unprotected from fleas may contract the disease; whereas such animals under the same circumstances remain free from plague, if protected from fleas.

(f) The Commission have also performed numerous experiments with a view of testing other possible modes of infection, and have found that:

i. In the absence of fleas no epidemic resulted when animals susceptible to plague (guinea-pigs) were kept in close contact with infected animals although the animals took their food off floors grossly contaminated by the excreta of their infected companions.

ii. Susceptible animals (guinea-pigs) caused to live upon and feed off floors artificially saturated with plague cultures failed to contract the disease.

iii. The excreta of plague-infected patients may contain plague bacilli, but the bedding etc. of plague patients soiled with excreta containing plague bacilli was not found to be infective to highly susceptible animals caused to live in and upon the bedding.

The Committee, therefore, consider that *in the great majority of cases during an epidemic of plague man contracts the disease from plague-infected rats through the agency of plague-infected rat fleas.*

(4) *The Seasonal recurrence and spread of plague.*

(a) The Committee has obtained no evidence that under ordinary conditions the plague bacillus survives for more than a few days outside the bodies of men, animals or fleas.

(b) In large towns plague may persist throughout the year since a few cases of acute plague in men and rats occur during the non-epidemic plague season.

(c) In villages there is no satisfactory evidence that such persistence is of other than exceptional occurrence and it seems probable that the recurring annual epidemics in such places are due in most cases to fresh importation of the infection.

(d) There is no evidence that plague infection is carried for more than short distances by the spontaneous movement of rats. Plague appears to be commonly imported into a fresh locality about the persons of human beings, though the transference of infected rats and fleas in merchandise must be considered.

(e) In districts which suffer annual epidemics of plague, the rat epidemic, on which the human epidemic depends, occurs during some part of that season when the prevalence of fleas is greatest.