


Dhananjayrao Gadgil Library

GIPE-PUNF-015835

Bombay Municipality

REPORT

BY ·

J. A. TURNER, M.B., D.P.H.

EXECUTIVE HEALTH OFFICER

ON

HISTORY OF PLAGUE IN BOMBAY

From 1896 to 1907.

Bombay:
PRINTED AT THE TIMES PRESS.

1907.

L 396:4241.231.No7

D7

15835

A Report by the Executive Health Officer, Bombay, on History of Plague in Bombay from 1896 to 1907 with summary of the measures taken and suggestions for the prevention of Plague on our present Knowledge of the Disease.

PLAGUE in the present epidemic was first noticed in Bombay in August 1896. In spite of all attempts to prevent it, it spread all over the island, and from the island to mainland. The disease may be said to become indigenous in Bombay from 1897. In 1898 a Plague Commission was appointed to enquire into the cause, &c., of the disease. The Commission spent four months in India and returned to England, and in 1901 issued a report of their investigations.

History.

Evidence was taken from everyone in India, who was considered to have had any experience of the disease. In addition to this Commission, deputations were sent from Austria, Germany, France, Russia, Turkey and other countries to investigate the disease. The whole of the inquiries have been published, which comprise much that is of value. But the actual results so far as controlling the disease or throwing any light to its origin, its method of infection, and measures to prevent its spread in India have been practically nil as is instanced by the virulence of the disease during the last few years in India.

1st Plague Commission.

How the disease was brought to Bombay in the first instance is still unascertained. Several theories have been advanced, the most important being as follows :—

- (1) The disease may have been brought to Bombay by sea from Hongkong or from the infected parts in Southern China.
- (2) It may have been conveyed from the Persian Gulf, the disease being endemic in Mesopotamia.
- (3) The infection may have been carried from Kumaon and Garhwal Hills to Bombay by pilgrims.
- (4) Another theory that it was brought by pilgrims from Jeddah. It has been suggested that the infection may have been carried by rats, merchandise, infected clothing, food and grain.
- (5) A reference to the map of Southern China, India and Arabia will be of interest with regard to the theories suggested. It will be seen that in August 1896 plague first appeared in Bombay after an interval of 200 years. Plague was reported in Hongkong in 1894, 1895 and 1896; also in Arabia and China in 1893, 1894, 1895 and 1896.

Introduction into Bombay.

Bombay is a large and important port and city on the west coast of India, and in constant communication with Arabia and the Persian Gulf and the Red Sea Coast, Assyr, &c., where plague is endemic.

The disease first appeared at Bombay and spread inland to India, west to east. The disease did not come overland across the continent of India to Bombay. It is reasonable then to assume that it was introduced by shipping. The trade between Bombay and Hongkong is small compared with the other Indian Ports as Calcutta, Rangoon and Singapur, &c. Ships trading between Hongkong and Bombay touch at many ports before reaching Bombay, but no history of plague is known previously at any of the ports of India and Burma previous to the outbreak of plague in Bombay in 1896, nor did plague appear at any city inland between Kumaon and Bombay. It appears therefore more than probable that the disease came from the Persian Gulf or Arabia, either by pilgrims who come and go to the extent of 20,000 per annum, or merchandise or grain, rats or vermin. The disease appeared first in grain merchants' quarters near the docks.

Once introduced in Bombay with its large population, all conditions were ready for its rapid diffusion.

Plague thoroughly established, thrives when suitable conditions are found for its sustenance, and when the people are overcrowded in dark, dirty, ill-ventilated, badly lighted houses; when the sick and the healthy live together, when the conditions of climate, atmosphere and temperature and moisture favour its propagation, and when the habits and customs of the people prevent measures being taken to prevent the spread of the disease; when the houses and rooms are so dark as to require a light in the day time, the floors, walls, ceilings and collections of the rubbish in the houses form a suitable rendezvous for rats, fleas and all sorts of vermin; when the primitive method of night-soil removal and drainage facilitate the accumulation of filth and garbage, and provide a happy hunting ground and food supply for rats.

Condition of life
of the poor in Bom-
bay.

The poor in Bombay live an artificial life in houses and under conditions to which they are unsuited, and which render any attempt at sanitation most difficult. It is the custom for several families to live, cook and sleep in the same room.

The large chawls of 4 to 5 floors separated from one another by narrow gullies and containing 200 and 400 rooms, with a population of several hundreds of people living under the most insanitary conditions as to air, space and light, and the presence of filth inside and around the rooms, constitute in themselves a source of danger to health, and when the outbreak of plague or other infectious diseases occurs, either by being introduced by human agency or animal agency, dust or filth, the disease will spread rapidly amongst the inmates who are huddled together in a very limited area in contravention of all sanitary principles, and when once the disease gets its foothold, it is difficult to displace.

The occupation of chawls of many floors and rooms is opposed to the habits of the people of an eastern city. The people cannot be supervised or regulated. Every room in a house is occupied generally by more than one family. All the refuse and water is thrown out into the streets and gullies; intercommunication between families when infectious disease occurs is impossible to control.

The incidence of plague follows closely insanitary surroundings, absence of domestic personal hygiene, overcrowding insanitary areas, want of ventilation and light, and the presence of filth—in fact, the incidence of disease is directly related to the insanitary domestic surroundings. When plague attacks sanitary areas, it is more easily controlled and can generally be traced to previous cases introduced there from without.

Sanitation.

Sanitation properly applied influences the spread of plague. Sanitation is the result of bacteriological, clinical and epidemiological investigation into the cause of disease and embraces the whole of practical preventive medicine as well as the every-day work of practical sanitation. I do not for a moment suggest that insanitary surroundings I have mentioned are the causes of plague; but what I mean is that the insanitary condition of the people, due possibly partly to poverty and ignorance, is the cause of the persistence of plague; that plague is now practically confined to that class, and that when it is contracted by those who pay more attention to sanitation, the disease is easy to control.

The sanitation I speak of includes not only the provisions of sanitary houses and streets and proper method of drainage and water-supply, but every thing which tends to improve public health and to prevent the spread of disease, including the investigation into the causes of sickness and death, the provision of hospitals, medical relief, health visitors and instructions in personal hygiene.

The development of sanitation and its effect on the health of the people during the past fifty years has been very marked, and is nowhere more striking than in the investigation into the cause and prevention of the spread of infectious disease.

The term "sanitation" has become of such widespread and extensive signification, that it may be defined as any measure, method or means which tend to lessen the incidence of disease and produce healthier surroundings, increasing the value of life and reducing the risk of sickness; it deals with the personal, domestic and public surroundings of the individual and of the people, beginning with the work of cleaning the streets and removing excrementitious matter; it has become the school master of the age, developing in some fresh direction; its sphere extends from the sanitary shave in the barber's shop to the practical work of stamping out disease under all conditions and in all climates, and the extermination of rats, fleas, mosquitoes and other insects.

Insanitary surroundings may then be termed anything or any condition which tends to impair health, and one of the great factors is poverty and ignorance. Of the total influences which these surroundings exert on the health of the people exposed to them, no exact statement can however be given. That they produce certain disease and a certain amount of disablement is undeniable, but it is only so far as the varying incidence of such sickness is ascertained and the disease kills, that the effect can be represented in numbers.

Insanitary surroundings may be divided into external and internal—

- (1) External conditions are sanitary defects in areas, dense aggregation of houses, congested areas, and as a result inadequate open spaces about dwellings, insufficient light and air.
- (2) Dampness of soil.
- (3) Want of drainage or defective drainage leading to pollution of soil.
- (4) Defective means for removal of excreta and polluted matter, street sweepings, trade and domestic refuse.
- (5) Defective sanitary laws and their difficulty of application.
- (6) Habits and customs of people, religious and other prejudices with regard to exposure of infected persons and things.

Internal conditions with regard to overcrowding in houses and rooms—

- (1) Ventilation of rooms.
- (2) Dampness of rooms.
- (3) Lighting of rooms.
- (4) Character of the floor and wall.
- (5) Conditions as to cleanliness.
- (6) Method of collecting rubbish in rooms.
- (7) Conditions of harbouring of vermin on bodies and clothes.
- (8) Conditions of clothing of persons.
- (9) Conditions of washing and bathing.
- (10) Conditions of occupation and habit.
- (11) Conditions of skin disease, due to climate and clothes, and habits inducing facilities for contracting plague.
- (12) Conditions of custom in the preparation of food and their food stuff.

Such insanitary conditions are, as is well known, powerful predisposing causes in the production of phthisis, pulmonary diseases other than phthisis, diarrhoeal diseases and fevers and epidemic diseases generally, and a reference to any statistical table in the report of various health departments all over the world will show that in areas with such insanitary surroundings, the sickness and death-rates are considerable above the average, and when those areas have been improved by sanitation, the mortality and sickness, both general and zymotic, have much improved.

Conveyance of the disease.

Certain diseases may, and doubtless do, depend upon highly specialised obligate parasites, incapable of thriving except in the tissues of hosts. Such organisms, though themselves a product of evolution, may have been evolved in the remote past under conditions of environment never since, and perhaps never again to be, reproduced.

Notwithstanding, therefore, that all pathogenic micro-organisms are doubtless, especially as regards their pathogenic function, subject from time to time to minor variations within the limits of the species, yet many species of such organisms may have long since attained a high degree of fixity of type, and thus exhibit how but little tendency to variation beyond such limits. That such is actually the case with regard to the microphytic causes of some of the diseases, there seems ample epidemiological evidence to show.

Cond
of the
bay.

In this connection it is important to note that occasional difficulty in tracing particular attacks of a given disease to previous cases is far from justifying hasty conclusion that such attacks have had another origin. The probability of such being the case must depend upon a comprehensive view of the ascertained facts with regard to the disease in question at least, that is, pending definite knowledge of the life-history of the microphyte upon which the disease depends, the multifarious ways in which infection may have been carried and the difficulty of tracing its carriage by man, such ways must be fully taken into account. Allowance must also be made for errors of diagnosis, untreated and concealed cases, which largely add to the difficulty of following out the casual association between successive and connected attacks. If this difficulty is met with in the early cases of an outbreak, the possibility of tracing back the outbreak to some previous prevalence in a more or less remote neighbourhood, to which it may in reality have been due, is entirely prevented.

Certain diseases have special seats of invasion. Certain diseases appear to have special seats or points of invasion, that is to say, the viruses upon which they depend usually attack the body by some special channel or channels, and possess little if any ability of primarily establishing themselves elsewhere. This appears to be the case with regard to the poisons of diarrhoea, cholera, and enteric fever, which make their assault upon the intestinal mucous membrane, and with regard to the poison of pneumonia which attacks the lungs, and diphtheria which attacks tonsils and throat.

These facts are of considerable importance with respect to the spread of such diseases, for it is not sufficient, in cases of the kind, that the poison should simply be brought to the body, but it must be conveyed also to the particular part of the body which is vulnerable to it. Here we find an analogy in the behaviour of the parasitic fungi which produce the diseases of plants. Some of these attack the flowers, some the fruit, and some the roots.

Take for instance enteric or cholera, we know that these diseases are caused by a poison introduced directly into the intestinal canal either by mouth or rectum. We know that the food or water-supply is infected directly or indirectly from a previous case of the disease by these channels, and this knowledge has enabled us to prevent the spread of these diseases by sanitary precautions outside the dwellings; with regard to plague, we have no such knowledge to guide us. In fact up to a short time ago our knowledge on this point was negative. If our view of pathology of the disease is correct, we can eliminate food and water. Bubonic plague is a direct contagion and contact with the body either through the mucous membrane of the mouth and thorax or other mucous membrane or by the skin is necessary for invasion, and it is this which makes me take the view that the personal surroundings of the individuals are the factors which contribute to the spread of plague.

First case of Plague in Bombay.

The first official intimation of plague in Bombay was made on 23rd September 1896. In August of that year however cases had occurred. On 6th October the Municipal Commissioner issued a notification informing the public that special measures would be taken as to removal to hospitals and disinfection and segregation.

This created a sort of panic and all sorts of rumours were set about, and the Arthur Road Hospital was attacked by some mill hands. Another notification was issued on 30th October informing the people that no cases would be removed where isolation and treatment could be carried out on the premises on the production of a medical certificate.

In the commencement the measures for the control of plague was under the Executive Health Officer and the Health Department. In September 1896 the number of plague deaths was 79, while in the next month it rose to 313 and then in December to 1,271, in January 1897 it went up to 2,188, in February 3,241, declining in March to 2,448, it went down to 43 in June. The ratio of death to attack was 86·94. Measures adopted in 1896.

In February 1897 Government issued a proclamation declaring that no passenger shall leave a train coming from Bombay until they have been examined and certified free from plague. Passengers leaving Bombay by sea were examined and those arriving from infected ports. In February Government issued a notification empowering the Municipal Commissioner to take special measures with regard to sanitation, &c.

In March 1897 Government appointed a Plague Committee, and the control of plague measures was placed in their hands with General Gatacre as the Chairman of the Committee with very full powers. The City was divided into 10 districts and Medical Officers and Nurses appointed.

The work was carried on by the Committee until June 1898, when Government handed over the control of plague administration to the Municipal Commissioner and provided the appointments of a Special Deputy Commissioner and Special Medical Officer.

This arrangement continued until October 1901, when the control of all plague measures was handed over to the Executive Health Officer and the Health Department under the Commissioner. Both the Deputy Commissioner and Special Medical Officer and all the military and other officers who were previously working were relieved, and their work has been carried on since then by the regular staff of the Health Department as part of its duty.

From 1896 to the present time, *i.e.*, up to 31st May 1907, the number of deaths registered as due to plague in Bombay has been 157,891.

The total number of Plague admissions into different Plague Hospitals from 1896 to 31st May 1907 was 45,629 out of which 31,680 died.

The population of the City was in 1896	...	...	821,764
Do. do. 1906	...	...	977,822
Total area	...	...	22·48 sq. miles.
The number of houses	...	43 800	Number of miles of streets ... 196
Average density per acre	...	67·09	Do. of sewers ... 106

The expenses connected with the measures in Bombay City have been in all about Rs. 97,40,985.

The number of deaths occurring annually in Bombay and India are given below :—

Year.	Total mortality in Bombay.	Plague deaths in Bombay.	Plague deaths in India.
1896	33,451	1,936	2,219
1897	47,896	11,003	53,816
1898	51,961	18,185	116,286
1899	56,434	15,796	139,009
1900	79,350	13,285	92,807
1901	59,495	18,736	283,788
1902	48,414	13,720	583,937
1903	50,513	20,788	865,628
1904	42,676	13,538	1,143,993
1905	47,762	14,198	1,069,140
1906	52,874	10,823	332,181
1907 up to 31st March	11,790	3,169	379,705

In 1897 Dr. Yersin came to Bombay from the Pasteur Institute and undertook the preparation of a plague antitoxin serum which was discontinued in 1902.

Monsieur Haflkine came in 1896, began inoculating persons with a vaccine prepared by himself from the cultures of plague bacilli in a suitable fluid.

A large number of inoculations were done, and the vaccine was supplied in large quantities all over India and has been very beneficial. Commissions composed of experts of all countries have visited Bombay.

March 1897 to
June 1898.

To give an idea of the enormous staff employed in the early days of plague and the thoroughness of the operations, it may be stated here that there were 12 District Officers, 42 Sectional Medical Officers, 21 Military and other Officers, 21 Nurses, besides other minor staff. In 10 months 10½ lakhs of rupees were spent by the Committee.

The plague operations are now in charge of the Health Department, and the work is managed for the last 5 years by the Health Department staff with the assistance of only 12 Disinfecting Sub-Inspectors, 1 Hospital Assistant and 1 Camp Muster and some other minor staff. In addition to this Dr. Turkhud has been recently engaged for plague investigation work and rat extermination.

At present our measures are confined to—

- (1) Voluntary evacuation from infected places.
- (2) Voluntary removal to hospital.
- (3) Notification of infectious disease.
- (4) Disinfection with insecticide where infected rats are found.
- (5) Destruction of rats and examination of all dead rats and evacuation of rat-infected areas.
- (6) Inoculation.
- (7) The improvement of insanitary areas.
- (8) Investigation into the epizootic, and measures to check it.
- (9) Free medical relief.

A glance at the duties of the District Plague Officers of the Plague Committee's time shows how and what plague measures were prevalent in these days, and with that view I append a copy of instructions issued to them in those days.

Duties of District Plague Officers.

The District Plague Officer is the Chief Local Plague Officer in his District, and is invested with the general control of all plague operations in his district, ward, or division of the City of Bombay.

His duties fall under the following heads :—

- (a) To distribute his charge into suitable major and minor inspection units.

On the correct division of a district, the success of plague measures mainly depends. As a rule the scheme of local sub-divisions should be worked out either in communication with, or with the approval of, the Committee.

- (b) To arrange and enforce regular daily and special house-to-house visitations. These house-to-house visitations are of four classes :—

- (1) Justices' visits.
- (2) Visits by local officers.

(3) Occasional district visitations where more than one party combine to search considerable area.

(4) Special general visitations in which a large area is cordoned by police or troops, and many parties unite in searching a whole district.

The discovery of cases greatly depends on the zealous inspections by Justices and local officers, together with the occasional examination of large blocks or areas.

(c) To employ and organize a body of informers paid by the month, or better, by results, for the discovery of concealed or other cases of plague.

The successful plague management of any badly infected section of Bombay depends to a very great extent on the exertions of an active staff of informers.

(d) To discover all local deaths.

Deaths are discovered—

(i) By local Plague and Health Staff.

(ii) By cemetery returns.

To ascertain daily all deaths in his charge and to satisfy himself whether plague is the cause of death is the fundamental duty of a District Plague Officer.

(e) To secure that all rooms where plague cases occur are disinfected, and that all members of the infected family are segregated as contacts.

District Plague Officers should give special attention to the question of contacts, that is, of members of the family or others who have lived in the room with a plague case. The necessity of isolating contacts is undoubted. The practical difficulties in the way of enforcing the necessary isolation are serious. The concessions found advisable in Bombay are shown in the Contact Rules. Since the passing of these rules, experience shows that unless worked with energy and strictness, only a small proportion of contacts are isolated. A considerable and probably the most seriously infected class of contacts go with patients to hospital. All hospitals have accommodation for one or two relations of each inmate. Even making allowance for this safeguard, the number of contacts in Government Camps (about 400) and in community houses (about 100) falls short of the total which should be isolated. The question of securing the isolation of a greater number of contacts without causing public dissatisfaction is one of the most difficult with which the District Plague Officer has to deal.

(f) To remove to the contact camps or houses all contacts whether discovered after or before the death of the plague case.

The remarks under (e) apply to this head. But difficult cases occur. As a rule the correct procedure is to despatch all members of the family found in the sick room to a contact camp or house at the same time as the patient is sent to hospital.

(g) To disinfect infected houses.

(h) To vacate infected houses—

(i) To see the house is vacated and closed and marked with the letter V.

(ii) To hand all unclaimed property to the police or other authority.

(iii) To see that the inmates with their belongings are taken to the segregation camp.

(i) To condemn vacated houses incapable of improvement.

- (j) To pay close attention to all rumours and complaints regarding sick or dead rats. To satisfy himself of the correctness of the information. To have the dead rats burned and to secure that every effort is made to stop the progress of rats by flushing drains and closing openings with cement.
- (k) On such subjects as the flushing of drains and the removal of nuisances, the District Plague Officer should communicate direct with the Health Officer to the Municipality.
- (1) A Plague District is well administered—
- (i) When all deaths are accounted for.
 - (ii) When the bulk of plague deaths occur in hospital.
 - (iii) When the number of attacks, that is, of cases discovered before death falls little short of the total of probable plague deaths.

I have thus briefly sketched the conditions existing in Bombay up to 1905.

Research into plague.

In 1903 I suggested to the Corporation the necessity for the continued research into the cause of plague. The Corporation addressed Government on the subject, and proposals were also made to the Secretary of State for India by the Lister Institute in September 1904 with regard to the desirability of further investigation of some of the problems concerning plague. The Secretary of State in January 1905 placed the direction of such an inquiry, and the administration of an annual grant with an advisory committee. The advisory committee appointed a working committee and asked for the sanction of Major Lamb and Captain Liston, I.M.S., also Drs. Petrie and Rowland of the Lister Institute. Dr. Martin of the Lister Institute came to Bombay in May 1905, and under his directions the work of the Commission was organised (See introduction in the 1st report of the Commission which gives the constitution of that body).

Present knowledge.

I will now try and explain what our present position is and our knowledge of the cause of the continuance of plague. In order to do this I will have to draw deeply from the report of that Committee, in addition to personal observations and the work done by the Health Department, and my object is to, as far as possible, explain what we really know, so that this knowledge may filter down to the people who are so intimately affected by the disease, hoping that when they understand how the disease is conveyed, they will realise the necessity of combining to remove the cause.

Rat and Plague.—The association of the rat with plague is no new theory.

The mortality amongst rats preceding a plague epidemic has been quoted in the history of the most of the plague epidemics for many years. Since however the discovery of the plague bacillus by Kitasato 12 years ago, and the presence of the bacillus in the rat during the plague epidemics, the relation of rat plague and human plague has been more clearly demonstrated.

The relation of the epizootic and epidemic plague has been carefully studied in outbreaks of the disease in Hongkong (Hunter), South Africa (Blackmore and Mitchell), Sydney (Ashburton Thompson), and other places, and was early recognised in India by Simond, Hankin, Weir, and the German Commission.

The possibility of insects playing some rôle in the transfer of plague from rat to rat and rat to man occurred to many investigators: Yersin 1894, Hankin 1897, Nuttal 1897, Ogata 1897, Simond 1898 and Liston in 1903 recorded their observations, that whilst sucking, fleas were in the habit of discharging the contents of their intestines upon the skin in the neighbourhood of the puncture, and in consequence infected material might subsequently be rubbed in during the relief of the irritation (see report of Commission). Liston in his work on plague rats and fleas in 1905 made many valuable observations and experiments. But during the past 2 years the Plague Research Committee, working in Bombay, have made extensive observations regarding the relationship of rat plague and human plague, and the results of their work has supplied us with the data which place us in the position we are now in.

The following is a summary of the experiments made by the Commission:—

TRANSFERENCE OF PLAGUE FROM RAT TO RAT.

Section A.—Transference from Rat to Rat by proximity without contact in the presence of Fleas.

The experiment is to show that plague may be spread from plague-infected rat to a healthy rat confined in a close proximity, but in such a way as to prevent contact with the body or excreta of the sick rat. Special cages were used so as to prevent all outside connections.

On 30 occasions has a healthy rat contracted plague in sequence to living in the neighbourhood of a plague-infected rat under circumstances which prevented the healthy rat coming in contact with either the body or excreta of the plague-infected rat. In all cases a fairly abundant supply of fleas was present; these could pass freely between the two rats, and, except for "aërial contagia," formed the only apparent means of communication between the animals. The presumption is that plague was transferred from the sick to the healthy rat by the agency of the fleas.

To exclude aërial infection, attempts were made to conduct a similar series of experiments in the absence of fleas. This was, however, found to be impracticable, as we could not with the greatest care ensure that animals were entirely free from fleas. Experiments were, therefore, instituted in which the fleas themselves were taken from a sick rat, and placed on a healthy animal.

Section B.—Transference of Plague from Rat to Rat by transference of Fleas.

Bombay rats were inoculated with a virulent culture of *B. pestis*, placed separately in flea-proof cages and supplied with rat fleas. In the event of any of these rats dying of plague, and if their blood contained any bacilli on microscopical examination, the fleas were caught and transferred to a fresh flea-proof cage, in which was placed a healthy rat. The flea supply for each healthy rat was always obtained from two or more septicæmic rats. As in the first series of experiments a careful *post mortem* examination was made of all uninoculated rats which died. The position of the buboes was noted; smears from the bubo, spleen and heart's blood were stained and examined; and cultures were made from the liver and heart's blood. The resulting growths were tested both as regards their cultural and animal re-actions.

All rats which had not died after three weeks were killed with chloroform and examined.

Summary of Section B.

In twenty-one experiments out of thirty-eight (55 p.c.), healthy rats living in flea-proof cages have contracted plague in sequence to receiving fleas collected from rats dead or dying of septicæmic plague in another cage. The possibility of the rat flea (*P. cheopis*) carrying plague from one rat to another is therefore demonstrated directly.

EXPERIMENTAL PRODUCTION OF EPIDEMICS AMONG GUINEA-PIGS.

The following experiments, which had as their object the determination of the relative importance of the Indian rat-flea (*Pulex cheopis*) and of actual close contact in the absence of fleas, in the dissemination of plague from animal to animal, were carried out in a series of small "godowns" or cabins which were built especially for this purpose. These godowns were designed by Lt-Colonel Bannerman and Captain Liston, and built under their supervision. They were completed before the present Commission began the work in May 1905. For a proper understanding of the experiments which are to be detailed below, a description of the structure of the godowns is necessary.

Guinea-pigs and also two monkeys were used for these experiments, as it had been shown by Liston (1905) that the rat-flea we have to deal with in India readily attacks these animals in the absence of its natural host.

Construction of Godowns.

The photograph (Plate V) and plan (Fig. 1) show that they are six in number and are built in a row. It will be seen that they are numbered 1, 2, 3, 4, 5 and 6, from left to right. The walls, 9 inches thick, are built of brick and mortar, while the floors are of concrete on the top of a high plinth. The walls and floors are therefore impervious to rats. The interior of each godown measures 7 ft. by 6 ft., while the inside height of the back wall is 9 ft. and of the front wall $7\frac{1}{2}$ ft., thus giving the roof a slope of about 1 in 4. Each godown is entered by a wooden door fitting tightly and measuring $6\frac{1}{2}$ ft. by $2\frac{1}{2}$ ft. The door opens inwards into an inspection chamber, that is to say, a space measuring $3\frac{1}{2}$ ft. by 3 ft., separated from the rest of the interior by means of wire netting, carefully fitted on to a wooden framework and extending up to the wire netting, which, as we shall see immediately, covers the inside of the roof. This netting, as also that under the roof, is made of stout wire, and has a mesh of half an inch. A door, also of wire netting, gives access from this inspection chamber into the interior of the godown.

Experiments in which epidemic plague did not occur when healthy guinea-pigs lived in close contact with plague-infected guinea-pigs under conditions, where access of fleas was prevented, but in which, under otherwise similar conditions, plague spread among the healthy animals in places where fleas were abundantly present.

Summary of Conclusions.

The following conclusions appear to us to be justified as a result of the experiments:—

- (1) Close contact of plague-infected animals with healthy animals, if fleas are excluded, does not give rise to an epizootic among the latter. As the godowns were never cleaned out, close contact includes contact with faeces and urine of infected animals, as well as with pus from open plague ulcers. This conclusion is justified from Experiments I and II, and especially from Experiment VI, in which close contact with infected animals was maintained for nearly a month. In Experiment I the animals were inoculated cutaneously, and in many cases had developed ulcers at the site of inoculation.
- (2) Close contact of young, even when suckled by plague-infected mother, did not give the disease to the former.
- (3) If fleas are present, then the epizootic, once started, spreads from animal to animal, the rate of progress being in direct proportion to the number of fleas present. Thus, in the experiments during the months of December, January and February, the epizootic was very rapid in those godowns, namely, Nos. 1 and 2, Experiments IV and V, in which the flea population was abundant and was kept up by a natural supply from the roof: it was much slower in Experiment VII, godown No. V, in which the flea supply was kept up artificially; and, finally, it was slowest of all in godown No. VI, Experiment VI, in which there was no definite natural supply of fleas, and from which the fleas were daily removed for a period of 6 days, after which removal only a comparatively small number could be caught.
- (4) An epizootic of plague may start without direct contact of healthy animal and infected animal. Thus, in the case of Experiment V in godown No. 1, the healthy guinea-pigs were not put in until the last inoculated guinea-pig had died and been removed.
- (5) We have in Part II shown by direct experiment that the rat-flea can convey plague from rat to rat. Further experiments (Experiments VI, VII and XI) of a similar nature with the fleas removed from infected godowns are now recorded.

- (6) Infection can take place without any contact with contaminated soil. Thus in godowns Nos. 1 and 2 (Experiments VIII and IX), guinea-pigs, placed in wire cages 2 inches above the ground, developed plague; also the monkey in godown No. 2 (Experiment VIII) was never in contact with the ground.
- (7) Aërial infection is excluded. Thus, guinea-pigs suspended in a cage 2 ft. above the ground did not contract the disease, while in the same godown those animals allowed to run about and those placed two inches above the floor became infected. Further, the monkey, surrounded by tangle-foot, was exposed as much to aërial infection as the control animal which contracted the disease.

EXPERIMENTS IN PLAGUE HOUSES IN BOMBAY.

We have definitely shown above that the infection of plague can be conveyed from animal to animal by means of the rat-flea. We now propose to detail some observations which go to prove, both indirectly and directly, that in a plague-infected house the infection may be due to the presence therein of rat-fleas, which are capable of transmitting the disease to animals.

In choosing the houses for our present purpose, we took a certain amount of care to ensure that they were really plague-infected. Thus for the most part only those rooms were used in which two or more people were suffering from the disease, or in which rats infected with plague had been found, or in which there was a history of dead rats having been discovered. While, then, there is a presumption that in every case the house really did contain the infection of plague, it is not by any means certain that this was so. For, with the disease so widespread throughout Bombay, it is, of course, possible that two cases found suffering or dead in a room may both have received their infection elsewhere. It is also possible that the infection may have been got in the passages of the buildings or in another room of the building, for it is not an uncommon practice among natives immediately to vacate a room in which two or three people have become attacked and occupy another room of the same building. Further, it is possible that the rats which were found dead and not examined may not have died from plague. This is all the more likely, as at the time of the present epidemic, a vigorous poisoning crusade against rats was being carried on by the Health Department of the Municipality. In some cases there was absolutely no doubt about the house being infected, while in the case of others the above possibilities must be kept in mind.

Series I.

EXPERIMENTS WITH GUINEA-PIGS RUNNING FREE IN PLAGUE HOUSES WHICH HAD BEEN DISINFECTED.

Summary.

Guinea-pigs allowed to run free in plague houses acted as good traps for fleas, on an average 20 per room being obtained. These fleas were mostly rat-fleas. In 29 per cent. of these plague rooms, the guinea-pigs left in for from 18 to 40 hours contracted plague. The situation of the bubo in these animals was, in the great majority of cases, in the cervical region.

Series II.

EXPERIMENTS WITH GUINEA-PIGS RUNNING FREE IN PLAGUE HOUSES WHICH HAD BEEN PREVIOUSLY DISINFECTED.

Summary.

Plague houses, which have been disinfected by the ordinary means, still contained fleas in large numbers, an average of 40 fleas per house having been taken in 31 observations. Further, 29 per cent. of these disinfected houses were infective for guinea-pigs allowed to run free in them. The situation of the bubo in these animals was, in the great majority of cases, in the cervical region.

Series III.

EXPERIMENT WITH FLEAS CAUGHT ON PLAGUE-INFECTED RATS FOUND IN HOUSES.

Summary.

On three occasions, namely, every occasion on which the experiment was made, fleas transferred from plague-infected rats found in houses in Bombay were able to transmit the disease to healthy animals in flea-proof cages in the Laboratory. Three guinea-pigs thus infected had the bubo in every instance in the cervical region.

Series IV.

EXPERIMENTS WITH FLEAS CAUGHT ON GUINEA-PIGS AND OTHER ANIMALS WHICH HAD BEEN LEFT FOR SOME HOURS IN PLAGUE HOUSES.

Summary.

In a certain number of plague houses, fleas can be trapped on guinea-pigs, which fleas are capable of giving plague to fresh animals in the Laboratory. The situation of the bubo in these animals was, in the great majority of cases, in the cervical region.

Series V.

EXPERIMENTS WITH ANIMALS IN CAGES UNPROTECTED AND PROTECTED WITH FINE WIRE GAUZE, PLACED IN PLAGUE HOUSES.

Summary.

Forty-two experiments were done, in which two animals, one protected from fleas by means of a wire gauze curtain, the other not so protected, were placed side by side in a plague-house. Both animals were protected, both from soil infection and from infection by contact with animals outside, but were equally subject to aerial infection. While not one of the protected animals contracted plague, four of the unprotected ones died of this disease. The number of fleas caught on the unprotected animals was very many times less than the number taken on the guinea-pigs running free in the experiments of the first group. No fleas were caught on the protected animals. The position of the bubo in the guinea-pigs which developed plague was in every case in the cervical region.

Series VI.

EXPERIMENTS WITH ANIMALS IN CAGES, ONE SURROUNDED WITH "TANGLE-FOOT," THE OTHER NOT SO PROTECTED, PLACED IN PLAGUE HOUSES.

Summary.

Animals protected from fleas by means of a sufficiently broad layer of "tangle-foot" and placed in plague-infected houses do not contract plague, but the control animals, not so protected, on several occasions (24 per cent.) developed the disease. Out of 247 fleas caught on the "tangle-foot," 60 per cent. were human, 34 per cent. were rat, and 6 per cent. were cat fleas. Plague like bacilli were demonstrated in the stomach, contents of one out of 85 human fleas dissected, and of 23 out of 77 rat-fleas.

General Summary and Conclusions.

(1) Guinea-pigs allowed to run free in plague houses in many instances attracted a large number of fleas, which fleas were mostly rat-fleas. A certain percentage (29) of these animals contracted plague and died from the disease. The position of the bubo in the great majority of these cases was cervical.

(2) If a plague house had been previously disinfected by the ordinary means of disinfection, fleas were still caught in large numbers on guinea-pigs set free in them. Further, a considerable number (29 per cent.) of these animals died of plague. The bubo in the great majority of these cases was again in the cervical region.

(3) Fleas transferred from plague-infected rats found dead or dying in houses were able to transmit plague to healthy animals in flea-proof cages in the Laboratory. The bubo in all cases was in the cervical region.

(4) Fleas transferred from guinea-pigs and other animals which had been placed for a few hours in plague houses were able to transmit the disease to fresh animals when fed on these in flea-proof cages in the Laboratory. The situation of the bubo in these animals was, in the great majority of cases, in the cervical region.

(5) Animals were placed in plague houses in pairs, both protected from soil and contact infection, and both equally exposed to aerial infection, but one protected from fleas by means of a fine metallic curtain and the other not so protected. None of the protected animals contracted plague, while several of the unprotected animals died of the disease. The position of the bubo in every instance was in the cervical region.

(6) Animals were placed in plague houses in pairs, both protected from soil and contact infection, and both equally exposed to aerial infection, but one surrounded with a layer of "tangle-foot" and the other surrounded with a layer of sand. The following observations were made:—

- (a) Many fleas were caught on the tangle-foot, a certain proportion of which were found on dissection to contain in their stomachs abundant bacilli microscopically identical with plague bacilli. Out of 85 human fleas dissected, only one contained these bacilli, while out of 77 rat-fleas, 23 were found thus infected.
- (b) The animals surrounded with tangle-foot in no instance developed plague, while several (24 per cent.) of the non-protected animals died of the disease.

WORK OF THE HEALTH DEPARTMENT.

Combined with the experiments in the Laboratory a large amount of work has been done outside with a view of gaining information as to the epidemiology of the disease. This will appear in the report of the Commission. The City of Bombay, for the purposes of administration of the public health, is divided into 3 divisions and sub-divided into 10 districts known as Registration Districts. In each division there is a Divisional Health Officer and in the sub-division a qualified medical man who is known as District Registrar, and under him two Hospital Assistants known as Sub-Registrars. The work of these Registrars and Sub-Registrars comprises the registration of births and deaths, enquiring into the cause of every death and verifying it, collecting births and registering them, and the enquiring into infectious diseases, including plague, and the measures of disinfection, isolation, removal to hospital and segregation in the Health Camps. Each office has also a Municipal dispensary and a female visiting nurse. At every office the map of the different parts of the respective districts are kept, and on these maps are entered every infected rat, and the species with date and every case of plague with date, etc. Members of the Commission daily visited the offices of the District Registrars, and their staff were instructed to give them every possible information. The staff of the Health Department are daily engaged in poisoning and trapping and collecting rats. All rats caught or collected are

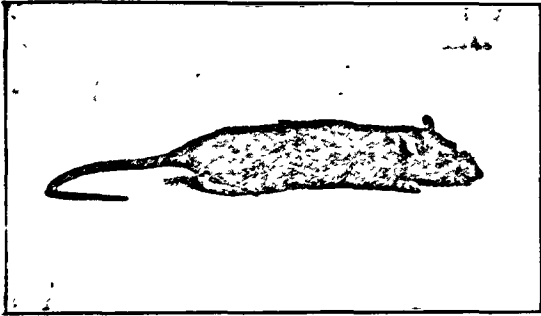
Work of the Health
Department.

at once despatched to the Parel Laboratory for examination. Next morning the place where these rats are picked up is disinfected with pesterine, the spot being marked P.R. and date on the house, and the spot on the map of the section also marked. If the rat is found in a house, the house is pesterined and the people kept under observation. It is thus possible to ascertain the probable course the disease will take, and the map and charts included in this report clearly show that infected rats are found some 10 days to a fortnight previous to the case of plague in human being.

The total number of rats collected and the number of rats found infected from 1st July 1905 to 30th April 1907.

Month.							No. of rats collected.	No. of rats examined.	No. of rats found infected.	Percentage of infected rats on the number examined.
July	1905	...	...	...	...	...	7,141	42,142	838	1·98
August	"	...	...	...	...	...	7,176			
September	"	...	...	...	...	...	9,739			
October	"	...	...	...	...	...	10,671			
November	"	...	...	...	...	...	11,177			
December	"	...	...	...	...	...	17,556			
January	1906	...	...	...	...	...	27,106	22,622	2,144	9·47
February	"	...	...	...	...	...	29,031	22,096	4,244	19·20
March	"	...	...	...	...	...	24,387	15,423	5,570	36·11
April	"	...	...	...	...	...	18,920	11,220	3,269	29·13
May	"	...	...	...	...	...	12,038	7,117	1,068	15·00
June	"	...	...	...	...	...	7,875	4,422	191	4·31
July	"	...	...	...	...	...	8,675	5,454	145	2·65
August	"	...	...	...	...	...	9,527	5,758	209	3·62
September	"	...	...	...	...	...	12,662	6,156	210	3·41
October	"	...	...	...	...	...	20,281	11,812	337	2·85
November	"	...	...	...	...	...	27,046	10,103	449	4·44
December	"	...	...	...	...	...	33,844	9,139	736	8·05
January	1907	...	...	...	...	...	33,180	10,763	1,850	17·18
February	"	...	...	...	...	...	26,086	9,604	3,156	32·86
March	"	...	...	...	...	...	31,433	11,051	4,530	40·99
April	"	...	...	...	...	...	24,873	7,812	2,522	32·66
							410,374	212,694	31,468	14·87

RATS.



MUS DECUMANUS.

Size.—Comparatively large

Colour.—Brown.

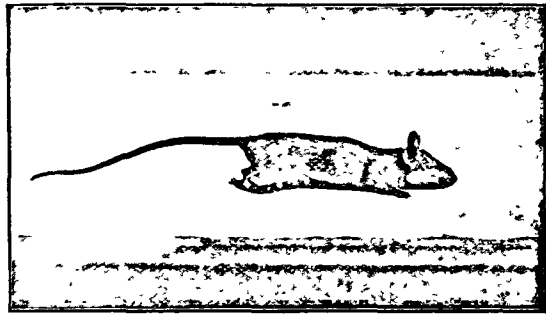
Head.—Thick and short.

Ears.—Small.

Coat.—Rough.

Body.—Longer than the tail.

Habits.—Burrowing in its habits and lives chiefly in drains and cellars.



MUS RATTUS

Size —Comparatively small

Colour.—Dark.

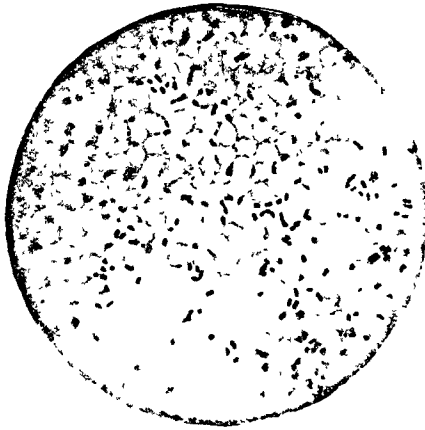
Head.—Small and pointed.

Ears.—Large.

Coat.—Smooth.

Body.—Shorter than the tail.

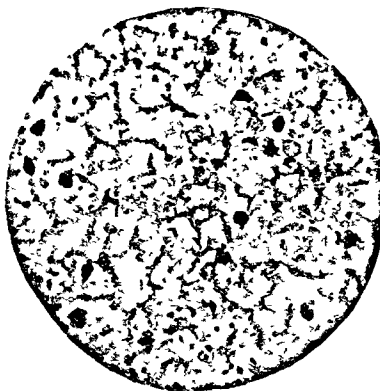
Habits.—Prefers to live in roofs of houses and is more domestic in its habits.



Blood of plague-infected rat containing plague bacilli.



Stomach contents of flea showing plague bacilli.



Faces of flea showing plague bacilli.

PULEX CHEOPIS.



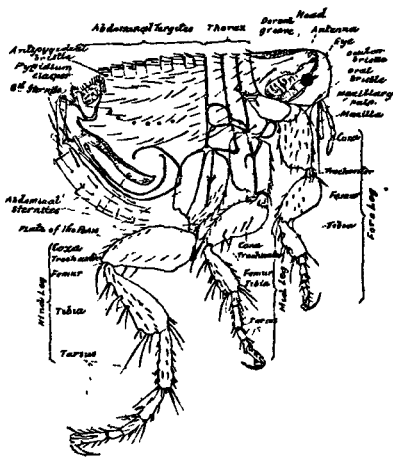
Male.

PULEX CHEOPIS.

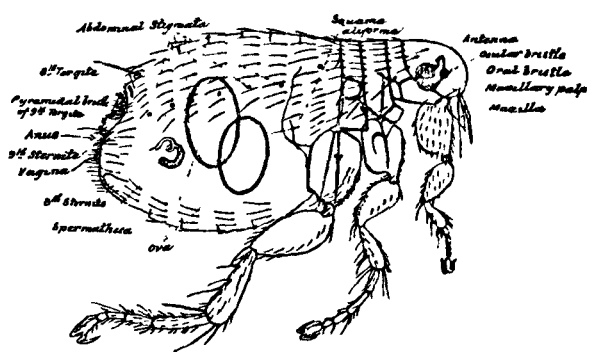


Female.

♂ *PULEX CHEOPIS*, ROTHSCHILD



♀ *PULEX CHEOPIS*, ROTHSCHILD



P. CHEOPIS



P. IRRITANS



P. CHEOPIS



P. IRRITANS



P. FELIS



C. FASCIATUS

MALE FLEAS



P. FELIS



C. FASCIATUS

FEMALE FLEAS

During the past 2 years, 410,374 rats have been collected and 212,694 have been examined, and the ratio of infected to examined is shown in the table, by which it will be seen that the infection in the rat begins in December, gradually rises to March and falls in May with the fall in disease in the human beings, rise and fall in the same way only 14 days later.

Killing of Rats.

We learn by experiments carried on by the Commission in the Laboratory, and in the houses in Bombay, which show that an infected rat can infect a healthy rat only by the direct conveying of the virus by the flea or by feeding on each other. We have shown that plague bacilli are in the stomach of the flea. That the plague bacilli passes out of the stomach in the fæces of the fleas. That the plague bacilli may remain in the stomach for 20 days and are virulent in a flea which has been removed from an infected rat for 15 days.

How fleas spread plague.

FLEAS.

There are different kinds of fleas, chiefly distinguished by their size and colour, the shape of their claws, and the presence of bristles at particular parts.

Besides having structural differences, fleas vary in their preferences for different hosts. The rat flea generally remains on the rat, but when hungry may attack man or animal.

The flea seems to pass some time on the host, and the remainder amongst dust and dirt and sand. The eggs, about 12 in number, are laid amongst dust and dirt, and sometimes in the hair or fur of animals, and hatch out in about 50 hours or more. The young larva is a pearly white fourteen segmented grub (about 1.5 mm. in length) with a large brown head. The larvæ live about 7 days, and then spin cocoons and develop into chrysalids while in the dust. These chrysalids remain in the cocoon for about 8 days, so that about 17 days altogether are occupied in the growth and development of the flea. (Pearse on Insects and Diseases—*Calcutta Medical Journal*.)

Pulex cheopis (the Indian rat flea)—

Small size, bright coloured. Loves the dark and is very sensitive to light. At first sight like the human flea. No bristles behind head, but bristles on posterior extremity of abdomen. Has elegant sickle-shaped claws.

Pulex irritans (Human flea)—

Large size, bright coloured, eyes distinct. Found in dark and dirty habitations. No bristles behind head, but bristles on posterior extremity of abdomen. Claws large and scythe-like.

Pulex felis (Cat or Dog flea)—

A small flea of dark colour. Not nocturnal in habits and frequently found in light places. Lives on dog, cat, rat, man and monkeys. Has combs behind head and teeth-like bristles around mouth.

Ceratophyllus fasciatus—

Found on common European rat. Has combs behind head, but no bristles around mouth.

The flea then after having fed on an infected rat escapes from the dead body of the rat and searches for fresh food; in its passage from the place where it is deposited by the dead rat, it comes in contact with human beings, and being hungry will attack man. Now it is not asserted that the bite of the flea alone is sufficient to convey the disease, although it is possible, but the flea having lived on a plague-infected rat contains in its stomach a large number of plague

bacilli and the bacilli are deposited where the flea abides. It is thus possible for fleas to gain access into rooms, clothes, and bedding of human beings, and then to bite and deject the bacilli, which gain entrance to the skin either by the pricking and irritation of the bite or by the breaking of the skin or wound. The habits of the people who sleep on the floor with scanty clothing, their uncovered feet and bodies constantly exposed to infected material make them ready victims to this method of attack.

It has not been however clearly shown that it is absolutely necessary for the flea to actually bite or live on the human being, and I would suggest that it is possible for the plague bacilli in the dirt or the body of the rat or in the faeces of the flea to gain access to the human being.

Disinfection should
continue.

The Committee's experiments show that the life of the plague bacilli in rooms artificially impregnated with plague bacilli is very short. They have also shown that bacilli, if they escape from the body of a human plague case, rarely, if at all (except pneumonic plague), are the cause of conveying the disease, they even go so far as to say human plague, except pneumonic, is not infectious in the ordinary meaning of the word, and that no ordinary disinfection or isolation of plague cases is necessary. I am not prepared to accept this statement in its entirety at present, and would prefer to be on the safe side and destroy the germs which may have been given off from the lungs and kidneys and discharges of buboes and faeces of fleas as a preventive measure until this point is more thoroughly investigated.

I quite agree that a quite simple case of bubonic plague will not spread the disease to those in attendance, but the means which may have been the cause of the case may still remain if not removed either by disinfection or by the insecticide or vacation of the premises.

To make my meaning clear—Plague makes its appearance in a city, village or house. The rat mortality has given warning and steps are taken to destroy rats and clean up the houses and search for rats; then a case occurs amongst the people in a house near which rats have been found. We assume that the connection between the human case and the rat epizootic is established.

Action to be taken.

What is then our action. Anticipate the first rat mortality. All the dead rats should be examined, and if infected, the whole house and the adjoining houses should be searched for rats and treated with pesterine. This however should be continued whenever rats are found, the inmates removed while this is being done.

If a case of plague occurs amongst the inmates, the patient should, if possible, be removed to hospital and the room treated, if not, the patient may remain, but the house vacated until it has been examined and treated.

Figures will be given by the Plague Committee to show that it is not common for more than one or two cases to occur in the same room, and much evidence will be brought forward to prove that one case of plague in a house will not create another. I accept the statement that the human case *per se* may not be able to convey plague to another person, but it is shown by experiments that the plague bacilli can live and multiply in the stomach of a flea for 20 days if the flea is fed on normal blood, and that the plague bacilli in the stomach of the flea remains virulent from 10—15 days if the flea is fed on normal blood. A stomach of a flea is .5 mm. in capacity. A rat-flea imbibing blood can contain 5,000 plague bacilli, which multiply rapidly. 35 to 50 per cent. of fleas found in infected houses contained plague bacilli. Now an infected rat is found in a house, a case of plague occurs from 7 to 10 days afterwards. The fleas from the dead infected rat searching for food either attack other rats or human beings. Infected fleas are found in a house up to 10 days after a case of plague has died or

recovered, and even after the room has been disinfected with perchloride and sulphur (see my report on Pesterine), but not after disinfection with pesterine.

Assuming that the room is not treated in any way and the case of plague remains, and the relatives remain in the same room and the fleas remain, and the other rooms are occupied, does not the danger of infection to the other people remain from the same cause? Even if, as stated, the bacilli dejected by the flea cannot live outside the body of the host for more than 24 hours (Report by Plague Commission, Journal of Hygiene, page 517), 35 to 50 per cent. of fleas found in infected house contain plague bacilli and retain infection for 10 days, and they may infect rats or human beings. For this reason I do not think we are at present justified in saying that nothing should be done but to kill the rat.

What we want to know is how to prevent the disease being conveyed or spread, and to do this more information was required. In order to determine whether dead infected fleas could convey the disease, and whether the fæces of infected fleas could also, by coming into contact with abraded skin, convey the disease, and how these two sources of convection could be prevented, I made the following experiments in houses in Bombay during the mild plague season in the months of May, June and July 1907. Houses were selected where two cases of plague had occurred.

In order to ascertain whether fleas were present, live guinea-pigs were placed in the rooms and allowed to remain 36—48 hours. They were then examined and the fleas taken off them. 10 rooms were thus examined. In all except 2 rooms fleas were found, one of which had been vacated 48 hours before, and the adjoining rooms had been treated with pesterine, and in the other 3 cases of plague occurred, but the room had recently been treated with pesterine before experimenting. 11 fleas from 2 guinea-pigs were bruised up in a mortar with a drop of sterile bouillon. A small quantity of the emulsion was rubbed on the shaved skin of the abdomen of a guinea-pig.

In six days the guinea-pig died of plague. The part where the flea emulsion was applied was swollen and inflamed. On making a *post mortem* the vessels and lymphatics in the immediate neighbourhood of the part of inoculation were inflamed and swollen. The result of the inoculation could be traced by a chain of enlarged lymphatics to the nearest gland in the groin which had enlarged and suppurated. All the organs contained plague bacilli.

Cultures were made from the blood, spleen, lungs, liver, &c., with a positive result. A minute drop of the heart-blood was injected into a rat, a mouse, and a guinea-pig, all of whom died of plague in 2, 3 and 7 days afterwards.

The photographs (between pages 14 and 15) show the plague bacilli in the blood and tissues of rat and fæces and stomach of the flea.

Hamal Lane : Fleas.

31st July.—Five fleas were received from Hamal Lane and were kept in the test tube up to next day, 1st August.

1st August.—The fleas were removed from the test tube and one to two drops of sterile bouillon put in the tube and rubbed with a sterile glass rod with the fæces. From this, cultures were made in bouillon and in agar. In agar tubes 4 colonies developed consisting of large and small cocci. In bouillon microbes showing bipolar staining were found besides other bacteria and cocci.

2nd August, at 3-15 p.m.—A mouse was inoculated with a trace of bouillon culture subcutaneously on the thigh.

5th August.—The mouse was found dead, under microscope plague bacilli were detected in all the organs.

The next experiment was to show whether the faeces of infected fleas conveyed the disease in the same way. Fleas from an infected guinea-pig were taken and kept in a sterile glass tube for 24 hours and were then removed, and the faeces were collected into a drop of a sterile bouillon and rubbed into the skin of guinea-pig in the same way.

Experiments with faeces of infected fleas showing that fleas from a guinea-pig recovering from plague may yet infect another animal.

On 25th July 1907 two guinea-pigs were inoculated with a pure agar culture of plague by rubbing the culture on the shaved skin of the abdomen on a slight abraded surface. On the 29th both guinea-pigs were ill and had buboes in the groins. On the 29th plague-free fleas were put on the guinea-pigs in flea-proof cages. On the 30th one guinea-pig was found dead in the cage and a *post mortem* examination and microscope and cultured examination showed typical plague. On the 31st the fleas from the other guinea-pigs were put in a sterile test tube and allowed to remain 24 hours. The fleas were then removed and two drops of sterile bouillon added to the test tube and mixed with the faeces.

The emulsion in the test tube was rubbed on to the shaved skin of the abdomen of a guinea-pig. On 7th August 1907 the guinea-pig had a bubo in the groin and was ill. A sterile glass pipette was inserted into the bubo and the contents taken out and examined and plague bacilli detected. A small drop was injected into the skin of a mouse which died in 5 days with all *post mortem* microscopic and cultural appearances of plague. The guinea-pig died on 14th August 1907 with typical plague, having all the *post mortem* and microscopical and cultural appearance of plague.

On 14th August 1907 the other guinea-pig of the two inoculated with plague on 25th July 1907 was still alive. It was killed on that day, *i.e.*, three weeks after it had been inoculated; two large buboes were found, on *post mortem* examination, in both groins which were caseating; the microscopical examination of the blood and bubos gave involution forms of plague bacilli.

These experiments were carried out in the Municipal Laboratory by myself and Dr. Ghadially, the Municipal Analyst, and Dr. Turkhud during the months of May, June, July and August during the heaviest monsoon on record. Similar experiments have also been carried out by the Plague Committee on previous occasions and have appeared in the 2nd report since received.

The following is an example of how plague is conveyed and the necessity of disinfection with an insecticide:—

Hamal Lane.

A case of plague was reported from a house in Hamal Lane on the 20th July 1907 in a room on the first floor which was afterwards disinfected with pesterine on the 23rd.

On the 26th and 29th two more cases of plague were reported dead from the same room. On going to the house to disinfect, from enquiries the District Registrar found that these two cases were ill on the 23rd, but had been locked up in another room and no information given of their illness.

The room in which these cases occurred was pesterined on the 23rd and again on the 26th.

It will be thus seen that three cases were attacked living in the same room, between the 20th and the 23rd, two of which had been hidden in another room and brought back.

Two other cases occurred in two different rooms in the same house, one on the ground floor and one in the second floor, on the 26th and 28th. One of these was related to the family in the room on the first floor. Neither of these two rooms were disinfected, the patients remaining in them.

On the 31st July guinea-pigs were placed in the room on the first floor and also in the room on the ground floor in which a suffering case was isolated. No fleas were found in the room on the first floor which had already been disinfected, but in the room in which the patient was lying, five fleas referred to in the above experiments were caught and found infected. On the 31st, the day of the experiment, the wife of the man suffering in the room on the ground floor took ill of plague. Both these cases recovered. The guinea-pigs died of typical plague on 18th August 1907.

The infection was evidently in house itself as dead rats were found about the 15th July and were as usual thrown away. On the occurrence of the first two cases, none of the inmates would admit having found dead rats, and the cases were concealed on the chance of not being detected to avoid disinfection or possible removal to Hospital. On the occurrence of the last three cases, a recent arrival in the house, having had the information from others, admitted that dead rats were found about 5 or 6 days before the first case.

This room on the ground floor was again examined for fleas on the 5th August, two guinea-pigs having been put in two days before, but no fleas were found.

We therefore know these facts that these bacilli remain infective in the stomach of a flea from 10—15 days. The bacilli are present in the faeces of the fleas. Fleas pass their faeces on the rat, or on the host on which they may be found, or on floors, walls, clothes, bedding, food and in a room in which they may be present.

The dead infected flea or the faeces of any infected flea rubbed on the skin of an animal or man conveys the disease either directly into the place where the flea has pricked on the skin or into an abraded surface or wound. That the bubo develops in direct relation to the point of abrasion.

Plague bacilli, however, will not survive very long outside the animal body exposed to external influence, and this accounts for the difficulty in tracing cases of plague and for the apparent absence of direct infection, as had it been otherwise, the number of cases and deaths from plague in overcrowded houses would have been enormous. But plague bacilli remain virulent outside the body for 24 to 48 hours and remain virulent for 10—11 days inside the stomach of the flea. Millions of bacilli are deposited on rats by the fleas, and in places where rats have access and continue to be deposited unless destroyed, and some of these may come in contact with an abraded surface of the body. To prevent this the remedy is disinfection with an insecticide and a germicide to kill the flea and destroy bacilli recently deposited.

The argument that disinfection is useless is therefore, to my mind, not satisfactorily proved. We know that fleas can be killed by crude petroleum or pesterine. We also realise that the same room 48 hours afterwards can be re-occupied and re-infected by rats or by fresh cases being introduced.

But in what way do other infectious diseases, small-pox, measles, scarlet fever, tuberculosis differ? A case of either of these diseases occurs, and the room is thoroughly disinfected and the clothes and bedding sterilized; and the room, white-washed and painted, will not, as a rule, remain infective. But what is to prevent a fresh case from being introduced 24 hours afterwards or another case occurring in the same family. Would we hesitate to disinfect for fear of either of these occurrences?

Again, disinfection with an insecticide in plague means examining and removing everything which may harbour rats, cleaning out the room and vacating it for 24 hours. The mere fact of doing this has a beneficial effect on the insanitary surroundings.

I am not for a moment suggesting that the treatment of an infected room with pesterine or perchloride of mercury will prevent another case occurring in that room knowing, as I do, the habits of the people and the conditions of life and their ignorance in hiding cases and withholding information; but I do maintain that it is part of the measure for controlling the spread of plague which for its educative and cleansing influence alone cannot be relinquished. Disinfection therefore includes removing insanitary material both directly infective and indirectly assisting in the spread of disease.

Sanitary Precautions.

That the ordinary disinfectants will not kill fleas when used in rooms is proved by experiments, but even accepting the rat as the only means of conveying plague, we must still treat the house and room as an infected place, and not only use a parasiticide, but go further; we must search the house, remove everything that will harbour rats, vacate the house and render it rat-proof and destroy rats. The last two items of this measure, viz., making the house rat-proof and destroying rats are the most difficult.

It may be easy to build a house which could be rat-proof, but it would be a difficult task to make it remain so in India.

High plinth, impervious floors and walls, and roof, stairs outside, no drains inside, all can be effected, but the habits of the people, the way they live, the collection of boxes, rags, firewood in the house, the open privies and drains into which food is constantly found, all this conduces to the presence of the rat.

The protection of the people against rats by these methods is a matter of time. Bombay cannot be rebuilt at once, and the habits of the people cannot be changed in a generation. Much can be done by showing the people how to protect themselves.

Inoculation.

Inoculation is a preventive to the human being, and is most valuable in preventing the spread of the disease.

Evacuation.

Evacuation is a temporary remedy during an epidemic. To kill the rat is to diminish the means of conveyance.

Without the infected rat the flea is harmless. The rat cannot live where the surroundings are sanitary and where food is not available, and where the rat cannot come in contact with the human being the risk of contagion is reduced to a minimum. It has been said—*take the man away from the rat and he will not get plague*. The converse of this is equally good or better—*keep the rat away from the habitation of man and the rat cannot live*.

It has been ascertained that rats breed very fast. One female can produce 5 litters a year and about 5 at a time. Rats to breed must have a suitable breeding place and food. Both of these are found in Bombay. The grain godowns and the gullies between the houses provide food, the roof, floor, and the collection of rubbish provide shelter.

Ships and rats.

No doubt many rats are imported into Bombay by ships, but possibly an equal number leave by the same means, and I think the one balances the other.

The question we have to face is how to reduce the rats as to control plague. This is an economic question of the greatest importance. Plague is a disease in Bombay which is only severely prevalent amongst the very poor and badly-housed people, the class of people who are obliged to live in close proximity to the rat. The conditions under which they live are insanitary. Their houses provide food and shelter for rats.

STATEMENT showing the number of Attacks and Deaths from Plague during the epidemic period from 1897-1907.

Months.	1897.		1898.		1899.		1900.		1901.		1902.		1903.		1904.		1905.		1906.		1907.	
	Attacks.	Deaths.	Attacks.	Deaths.	Attacks.	Deaths.	Attacks.	Deaths.	Attacks.	Deaths.	Attacks.	Deaths.	Attacks.	Deaths.	Attacks.	Deaths.	Attacks.	Deaths.	Attacks.	Deaths.	Attacks.	Deaths.
January	2537	2110	3654	2931	1879	1591	2455	1718	1971	1609	1631	1299	1996	1695	1111	954	1263	1071	185	144	199	171
February	3532	3349	5351	4493	3476	3088	3023	2491	4420	3850	3245	2531	3959	3492	2788	2472	2787	2376	708	605	690	591
March	2694	2424	5764	4969	5723	4758	4067	3125	5128	4697	4325	3609	6571	5865	4655	4098	3545	3078	2877	2530	2773	2407
April	1866	1309	2718	2172	3007	2315	3092	2367	2860	2459	3247	2800	6362	5737	3578	3086	4272	3727	4507	3989	2220	1962
May	448	345	687	523	1204	1008	1511	1141	1339	1152	1245	1178	1719	1581	1118	1008	2378	2544	2356	2552	753	652

The epidemic in Bombay in 1907 was the lowest for the past 10 years. This may be a coincidence, but the figures and statements given are very striking.

PREVENTION.

It is very difficult, in many cases of plague, to ascertain definitely where the patient contracted the disease, as the people who now contract plague are those who live in the most insanitary condition and take no precautions. They rarely seek medical advice in the early stage of the disease, and the information given by their relatives as to their mode of life is not of much value. With regard to the rat, all dead rats are examined and information is received that the dead rats picked up are infected or not on the day they are picked up, and the place is treated with pesterine within 24 hours; but when a human case of plague occurs and the history of dead rats is enquired into, accurate information is not forthcoming, and the house in which a case occurred is necessarily not treated with pesterine until some days after dead rats have been found. In some instances it is possible to trace the history of the infected rat and its relation to the patient, and our records and maps show the approximate locality where dead rats have been found and plague cases occurred. Referring to the maps it will be seen that rats were found in certain localities, but it is difficult to exactly locate the room or house in which any particular rat died, as the dead body is thrown out into the street or passage or into the dust-bin cart. In some instances, however, it was possible to locate the place, and I fully believe that when the people understand the value of this information, it will be readily given, but they do not like the trouble of turning out while the rooms are pesterined, as it is inconvenient, but they do not resist it; in fact there are many cases where it has been much appreciated. The native is very slow at accepting any measure, and we shall not get rid of plague until the people themselves see the advantage of co-operating with us in our fight against the disease.

The best time for using pesterine, so that it may prove to be of the greatest value, would appear to be just when rats begin to die; for this is the time when fleas commence to leave the bodies of the dead rats and go in search of fresh blood which is generally available among the surrounding human beings.

To do this efficiently, however, it is most essential in the first place that the Health Department should receive active co-operation and help from the people, and that the intimation of dead rats should be sent as early as possible. It is very seldom, however, that people will come forward and give this information to the Health Department staff. If dead rats are found, they are very seldom handed over to a Municipal bigari, and although the public have been repeatedly informed, by means of lectures, notices, and pamphlets, what they should do under the circumstances, the dead rats are thrown out in the adjoining gully or the nearest dust-bin cart, whence they are often carried away by crows or kites before the Municipal bigaries can get at them; some of the residents, who are nervous when they find dead rats, quietly shut up their houses and go away to reside elsewhere, while others pay no attention whatever to dead rats; they do nothing and continue to reside in the same house. In this way, an important piece of evidence, which would have helped to check the spread of the infection to human beings, is lost, and the infected fleas remain free to help to spread the disease. When a plague rat is found in a gully and enquiries are made at the adjoining house with a view to ascertain where the rat came from, the residents generally at first deny all knowledge of rat mortality, and it is only after a few days when plague makes its appearance in such houses in an epidemic form that the residents acknowledge previous history of dead rats. It is then too late for disinfection; the fleas have already done all the harm they can and have moved on elsewhere.

Such instances are extremely common, and have come to our notice not only among the labouring and illiterate classes who, as a rule, are averse to submit to the slight inconvenience caused on account of disinfection, but similar instances showing a peculiar apathy have been met with among even some of the better educated classes.

Towards the end of January 1907, rats died in a house in Girgaum Road. The residents, who were all educated people, threw them out, gave no information to any one about them, did nothing themselves in the way of disinfection and continued to reside in the house as if nothing had happened.

On the 5th of February the first case of plague occurred among the residents of the house, and within a couple of days altogether 7 persons were attacked and 5 died. After even a fortnight infected fleas were found in this house.

Another instance occurred at Queen's Road. Here rats died in the month of February 1907. The residents, however, collected them in a room and then set fire to them and watched the performance. They destroyed the rats, the source of infection as they thought, but not the fleas, the carriers of the infection, for, within 10 days, 6 persons were attacked, and out of them 4 died. These cases also occurred among the educated people.

Such instances are numerous and appearing as they did among the educated classes, is it any wonder that plague should go on unabated?

The general tendency on the part of the inhabitants of not reporting mortality amongst rats, considerably handicaps the work of checking the spread of plague-infection by disinfection. This failure to report dead rats is, no doubt, due among the lower classes, in some cases to avoid removal of the patient and the inconvenience of disinfection, but the apathy shown by the better educated classes, from whom certainly more help and co-operation is expected, is inexplicable. In the absence of assistance from the people, the work of combating plague becomes a very difficult matter.

It is much too soon to venture an opinion as to whether the measures adopted of killing rats and the use of pesterine are responsible for the diminution of plague in Bombay, as many circumstances have to be considered and many fallacies may arise. I simply make a statement of facts, leaving it for further experience to say whether these statements will be borne out by the result of the next epidemic; we must not rely on killing rats and using pesterine alone. Improved sanitation and education of the people should be our aim and object. Government and Municipality can and will continue to carry out measures of sanitary reform, but this is naturally slow. With the knowledge now available, the assistance of the people in destroying rats and in keeping their houses free from accumulations which harbour vermin should be insisted on.

Sanitary laws, building regulations to improve houses, water-supply, drainage, and ventilation will continue to be enforced. Scavenging and cleaning of the outside of the houses can be carried out by the Health Department.

For years the people of Bombay have been asked to assist. The Health Department has published and distributed leaflets in all languages on the various customs and prejudices affecting public health, and instructed the people how to act. The Sanitary Association distributes pamphlets and gives lectures and provides health visitors. The Corporation provides the necessary authority and means to enable the Health Department to sweep and clean, lay poison and traps, disinfect and limewash. The Improvement Trust will in time render many parts of the city more sanitary and provide houses, but it is to the people we have to look for immediate assistance in controlling plague. Now they know and can see for themselves what should be done. It is not too much to ask them to assist us in our fight against plague.

With the knowledge now available of the channels by which plague is spread, it must surely be possible by judicious administration to find some means for reducing the rat population, and thus relieving the suffering of the people of India without increasing ill-feeling, resistance or friction of the community if properly carried out. Extermination of rats.

The extermination or reduction of rats, previous to the anticipated outbreak of plague and the cleaning and disinfection of the haunts of the rats and houses with pesterine, is a practical measure, founded on scientific lines placed at our disposal by the most recent investigations.

By all means continue our scientific investigations, but in the meantime use the knowledge we have and try to overcome the difficulties in the way.

To kill rats is part of our programme, and many suggestions have been made, but to prevent their living should be our whole aim and object, for, in doing this, we by sanitation improve the health and happiness of the people, and we encourage a feeling of interest and security in the minds of the people, that when there is a healthy house and healthy surroundings, plague cannot survive.

THE RELATION OF THE EPIZOOTIC AND ENDEMIC PLAGUE IN 3 CENTRES IN FORT NORTH.

As it was impossible to include the maps of the whole of Bombay for each section for 18 months, I have selected parts only of one ward.

For the purpose of explaining the relation between epizootic and epidemic plague and the investigation, I have chosen three centres in Fort North, and Dr. Malegaumwalla, District Registrar, has supplied me with a short sketch of the history of the plague, human and rat, for the past 18 months with the map of the particular centres. Every District Registrar in the Health Department has kept up maps of this kind of his own district, but these three centres have been chosen, because they are well known. They are very thickly populated and occupied by various classes, for the most part in dark, dirty overcrowded houses, and are on the fringe of the most modern and improved part of the city, having the harbour on one side and Hornby Road on the other, and these special centres are affected year after year. The places where infected rats were found and cases of plague occurred have been marked in ● and + respectively in red ink in the three centres.

Description of Fort North.

Fort North, is bounded on the *South* by Church Gate Street and Elphinstone Circle.

North.—Fort Street and Bori Bunder.

East.—Eastern Foreshore.

West.—Hornby Road.

It consists of two distinct portions :—

- (a) The portion which was originally included within the ramparts of the demolished Fort, bounded by Hornby Road on the west, and Mint Road on the east, Church Gate Street on the south and Bori Bunder on the north.
- (b) The portion known as the Eastern Boulevard between Mint Road on the west and the Eastern Foreshore.

(a) The portion within the limits of the original walls of the Fort is the oldest portion of Bombay, and naturally on the account of the limited space available, the houses are overcrowded and thickly packed side to side without any external open spaces for ventilation or for drainage purposes, the drains running through the basements of the houses. The old masonry drains have however been recently replaced by pipe drains.

As a rule, the smaller houses have only two rooms on each floor, the back room being generally dark and ill-ventilated and used as a cook room, leading out of which is a privy of the old fashion type in the case of the houses occupied by Parsis. Only the front rooms are well lighted and ventilated.

The bigger houses with more than two rooms have, as a rule, an inner open space or "chowk," which, not being big or wide enough, do not admit sufficient light, and the back rooms are consequently ill-lighted and ventilated.

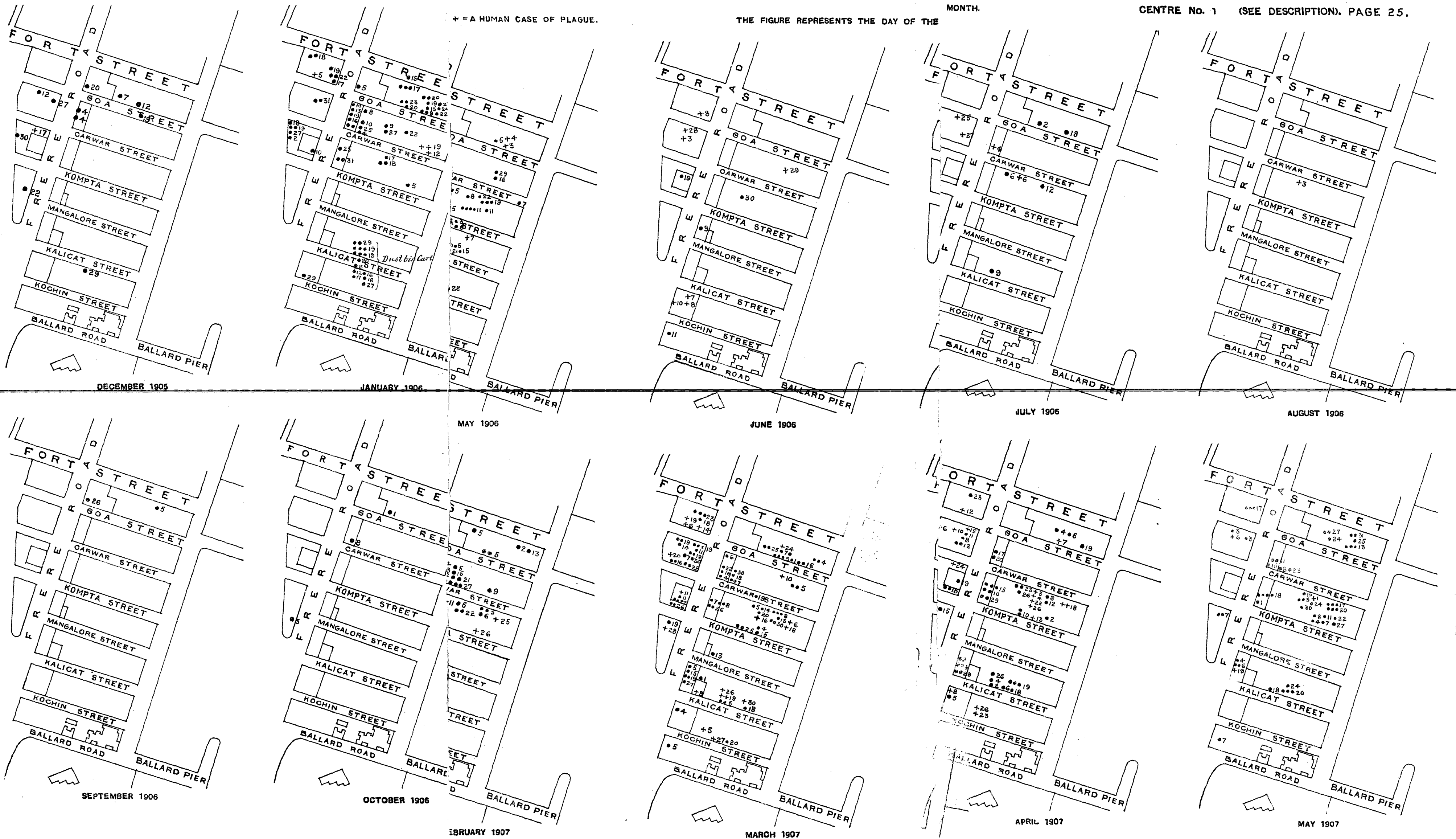
MAP SHOWING RELATION OF EPIZOOTIC AND EPIDEMIC OF PLAGUE IN THREE C

CENTRE No. 1 (SEE DESCRIPTION). PAGE 25.

+ = A HUMAN CASE OF PLAGUE.

THE FIGURE REPRESENTS THE DAY OF THE

MONTH.



The cross streets are few in number, intersecting this portion of Fort North, from west to east, and the existing ones are narrow and tortuous, with high buildings four or five stories high flanking with them. Even the main arteries from north to south are narrow, tortuous and with high houses on either side.

The southern portion of this section is occupied mostly by Parsis, and the overcrowding in these closely packed houses is rather less. The northern portion is occupied mostly by better class Hindus.

The houses being very old, with old roof, and country tiles, afford good harbour and protection to rats, and their close proximity enable rats to travel from house to house and into other houses, at the back, abutting on another street.

(b) The other portion of Fort North, east of Mint road, is of recent growth, about 30 years, and the houses are built on Port Trust property. The Port Trust not having compelled the houseowners to leave wide open spaces, as is now done by the Improvement Trust, the houses have been built according to Municipal requirements, leaving only a sweeper's passage or gully on either side, from 2 to 4 feet wide only, with the consequence that, with the exception of the front rooms, the back rooms have to depend for light and air on windows opening into these narrow gullies, which are, as a rule, filthy on account of the habits of the people. These windows are therefore more often than not kept closed; and the rooms, as a rule, are dark and ill-ventilated, and in this respect are often worse off than those in the old portion of the Fort, which depend for light and air on internal open spaces which are generally kept clean.

A portion of this section known as Port Trust section is occupied by Parsis and better class Hindus, and the rest by a miscellaneous set of people and low-caste Hindus.

"Fort North."

The epizootic started in three different centres in the 1st week of December 1905.

I—The first centre was in the north-east corner of the district bounded by—

1st Centre.

North—Fort Street.

South—Ballard Road.

West—Mint Road.

East—Eastern Foreshore.

Two infected rats were found on the 4th of the month on Frere Road in the gullies between Carwar and Goa Street, followed by another on the 7th on the north side of Goa Street. Within the next fortnight three more were found on the same side of Goa Street on the 12th, 19th and 20th.

On the other side of Frere Road, just about opposite, one infected rat was found on the 12th in 30 Frere Road.

The infection spread outwards and infected rats were found on the confines of this centre on the 22nd at the junction of Frere Road and Mint Road, on the 29th in Kalikat Street, and on 30th in Mint Road (see map). There were no plague cases up to the end of the month except a doubtful death on the 17th in the vicinity of the infected portion in which the cause of death appeared to be plague. The first plague case now appeared on the 5th of January in 10 Goa Street.

The epizootic continued to spread round the points where infected rats were originally found. On Frere Road, in the gullies between Carwar and Goa Street and to the east of it, 7 more infected rats were found during the 1st fortnight with a plague case on the 12th in 46—48 Carwar Street, followed by two more on the 19th in the same house.

Three more infected rats were found in this block up to the end of the month. In the adjacent block to the north, 17 infected rats were found, including 9 from the dust-bin carts in Goa Street, evidently from the surrounding houses. By the end of the month, the epizootic seems to have declined considerably in the spots which were originally infected in the first week of December (see map). On the other hand the infection reached its highest point in this month round the spots in Mint Road and Kalikat Street, where the infection started late in the latter end of December (see map).

Fresh blocks were affected in this month and the infection reached its height in these blocks in the next month, *i.e.*, February, whereas the original blocks affected in the 1st week of December had quite cleared up as will be seen from the map for February. It appears therefore that the epizootic runs its course in any particular block in about two months.

The number of plague cases in this centre increased in February and seven cases were registered. One on the 5th in 117 Mint Road, two on the 16th in 85 Frere Road, three in 33 Carwar Street on the 14th and 19th, and one in 29 Carwar Street on the 28th.

In March the epizootic continued to spread and increased in fresh blocks, whereas it cleared up in other blocks previously affected. The number of plague cases, however, increased and 15 were registered in almost all the blocks.

The epizootic was at its height in March in three particular blocks; the two blocks between Goa Street and Fort Street and a third bounded by Goa and Carwar Streets and Frere Road and Mint Road (see map), but the epidemic amongst human beings in these particular blocks was at its height in the following month of April when the epizootic had almost disappeared (see maps for March and April). It would appear therefore that plague cases generally follow the first appearance of infection amongst rats in about three weeks.

In April the epizootic had declined in almost all the blocks, but plague cases had increased particularly in the three blocks specified above in which the rat infection was at its height in the previous month. The number of plague cases had increased to 27.

The epidemic now started declining in May, and 19 cases in all were registered in this month. The number of infected rats continued to decrease, and the infection was clearing up in almost all the blocks,

In June only a few sporadic cases of plague and of infected rats were found. The number of plague cases were 7 and that of infected rats only 4.

They were not confined to any particular block, but were distributed all over.

In July a few plague cases and infected rats showed here and there. Only 4 plague cases and 5 infected rats.

In the intervening months the epizootic seems to have been kept up right up to December for two infected rats were found in September, three more in October and one in December. No plague cases however occurred in September, October, November and December 1906.

2nd Centre.

The second centre of infection was in the middle of the district, bounded by—

• *West*—Bohra Bazar Street,

East—Mint Road.

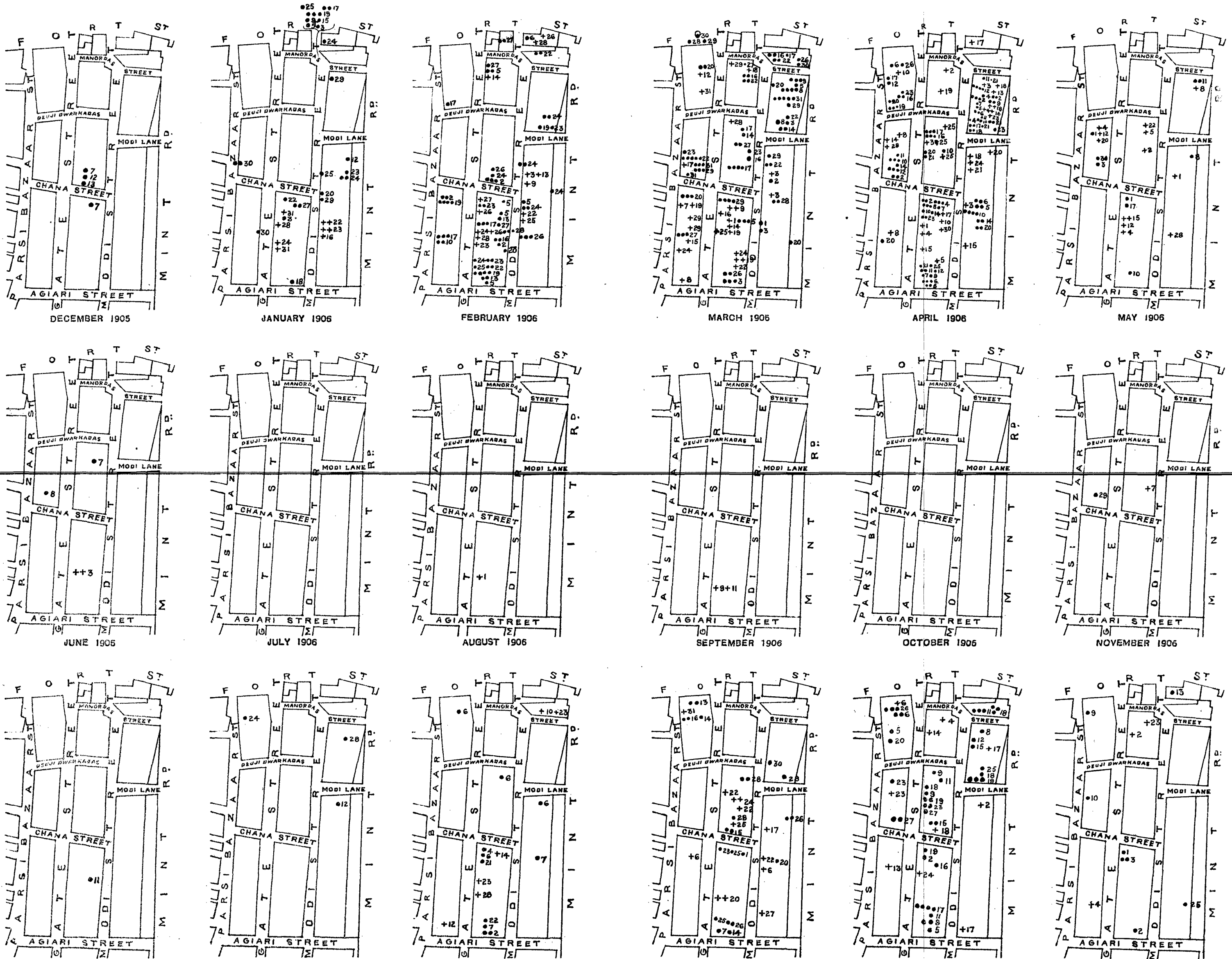
North—Fort Street.

South—Agiary Street.

Infected rats were found in this centre also in the first week of December. Two rats on the 7th on either side of Chana Street, one in 25 Chana Street, and the other in 28 Chana Street, followed by two more in the latter on the 12th and 13th.

MAP SHOWING RELATION OF EPIZOOTIC AND EPIDEMIC OF PLAGUE IN THREE CENTRES OF FORT NORTH, A WARD, AND EXTENDING OVER 18 MONTHS. EACH SEPARATE DIAGRAM REPRESENTS ONE MONTH CENTRE NO. 2 (SEE DESCRIPTION). PAGE 26.

● = A DEAD INFECTED RAT. + = A HUMAN CASE OF PLAGUE. THE FIGURE REPRESENTS THE DAY OF THE MONTH.



There were no plague cases up to the end of the month nor any more infected rats.

In about a month from the first appearance of infected rats on the 7th December, the epizootic had spread to the northern boundary of this centre, for, in the first week of January, we find infected rats on the 3rd, 5th and 9th at the junction of Manordass Street with Mody Street, followed by eight more during the course of the month on the 15th, 17th, 19th and 25th, found in the dust-bin cart in Manordass Street, evidently from the surrounding houses.

By the middle of January the infection had also spread to the eastern boundary to the block east of Mody Street, for one infected rat was found on the 12th between 80 and 86 Mint Road, followed by four more in the vicinity.

The first plague case registered in this centre was on the 16th of January in 95 Mody Street, at some distance to the east of 25 Chana Street, the first infected house on the 7th December, *i.e.*, about five weeks after, but allowance has to be made for the time taken by the epizootic to have spread to Mody Street. Dead rats had been found prior to the plague case, but they were not sent for examination. Four more plague cases occurred in the same house, two on the 22nd and two on the 23rd. These were followed by four cases in the adjacent block abutting on Bazar Gate Street, where two cases occurred in 155 Bazar Gate Street, one on the 24th and another on the 31st; one in 181 Bazar Gate Street on the 28th, and one in 193 Bazar Gate Street on the 31st.

In all 9 cases occurred in January in this centre.

The epizootic continued to increase in February, until the whole block between Chana Street and Agiary Lane was thickly studded with infected rats (see map for February). Plague cases also continued to occur in this block, but they were few in proportion to the number of infected rats, which amounted to about 28, whereas there were only six plague cases, one in 155 Bazar Gate Street on the 23rd, three in 181 Bazar Gate Street on the 24th, 26th and 28th, one in 193 Bazar Gate Street, and one in 197 Bazar Gate Street.

The infection had now spread to the adjacent block abutting on Bohra Bazar Street, where 10 rats were found and also to the block between Mody Street and Mint Road in which 9 rats were found with four cases of plague, one in 153-155 Mody Street, one in 147 Mody Street on the 9th, one in 129 Mody Street on the 22nd, and one in 127 Mody Street on the 25th (see map).

These three blocks, which were so thickly studded with infected rats, had quite cleared up in March (see map for March), but the epizootic was at its height in two other blocks—one abutting on Bohra Bazar Street between Chana Street and Dwarkadass Lane with 13 infected rats, and the other between Mody Cross Lane and Manordass Street, in which, and in its immediate vicinity, 33 infected rats were found.

The number of plague cases had now increased in the three blocks in which the rat mortality had gone down considerably; 11 cases occurred in the block abutting on Bazargate Street between Chana Street and Agiary Lane (2 in 25 Chana Street, 3 in 193 Bazar Gate Street, one in 181 Bazar Gate Street, one in 197 Bazar Gate Street, three in 102 Mody Street, and one in 98-100 Mody Street).

Seven more cases occurred in the adjacent block to the west abutting on Bohra Bazar Street (one in 155 Bohra Bazar Street, one in 211-13 Bohra Bazar Street, one in 182 Bohra Bazar Street, one in 140 Bazar Gate Street, one in 210 Bazar Gate Street, one in 154 and one in 120 Bazar Gate Street).

In April the number of plague cases had increased in the block between Mody Cross Lane and Manordass Street, where the epizootic was at its height in the previous month; eight cases had occurred (one in 49 Manordass Street, one in 142 Mint Road, one in 128 Mint Road and four in 126 Mint Road).

The epizootic seemed to be on the decline in the blocks latterly affected, but the plague cases kept up in these blocks.

In May there was a sudden drop both in the epizootic and the epidemic in the whole of this centre, in marked contrast with the conditions in April (see maps for April and May).

There were only a few sporadic cases of infected rats, in the whole centre only nine, and 13 cases of plague distributed amongst all the blocks.

In June the plague cases dropped to two cases. No infected rats were found in this centre in July, August, September and October, until one was again found on the 29th of November and one in December.

There were no plague cases in July, but one case was found in August and two in September. In October, November and December there were no plague cases (except a doubtful one in November).

3rd Centre.

The third centre of the epizootic was in the south-west corner of Fort North, bounded by—

East.—Parsi Bazar Street.

West.—Hornby Road.

North.—Gunbow Street.

South.—Church Gate Street.

The epizootic started in this centre also in the first week of December on the 4th in 34 Gogha Street. By the 13th it had spread to both sides of Cawasji Patel Street to the north and south of the first infected point, for two infected rats were found on this date in 82 Cawasji Patel Street and two more on the opposite side of the street in 39 Cawasji Patel Street. These were followed on the 23rd by two in 28 Cawasji Patel Street. By the 30th it had travelled further eastwards as far as 37 Gogha Street.

There were in all 8 infected rats in the month, but not a single plague case, but in the following month, in January, plague cases began to appear, and two were registered on the 9th and 14th in 82 Cawasji Patel Street, in which infected rats were found on the 13th of last month, *i.e.*, about 3 weeks before.

Within a month of the commencement of the epizootic, it had spread to the southern boundary, for we find an infected rat on the 5th of January in 20 Church Gate Street and at the other end, almost to the northern outskirts, for two infected rats were found on the 6th in 114 Cawasji Patel Street. About the same time it had reached the north-east corner, for, on the 9th, an infected rat was found in the dust-bin cart in Parsi Panchayat Lane.

Two blocks next to the first seat of infection were badly affected in this month, one abutting on Cawasji Patel Street between Barber Lane and Gunbow Street, in which 9 infected rats were found. The other block, also abutting on Cawasji Patel Street between Gogha Street and part of Nanabbai Lane, known as Banaji's Pole, had 17 infected rats in it during the course of the month.

A portion of Gogha Street was also badly affected, particularly a lane between Nos. 60 and 64, in which 10 infected rats were found from the 13th to 28th. There were no plague cases up to the end of the month in these two blocks.

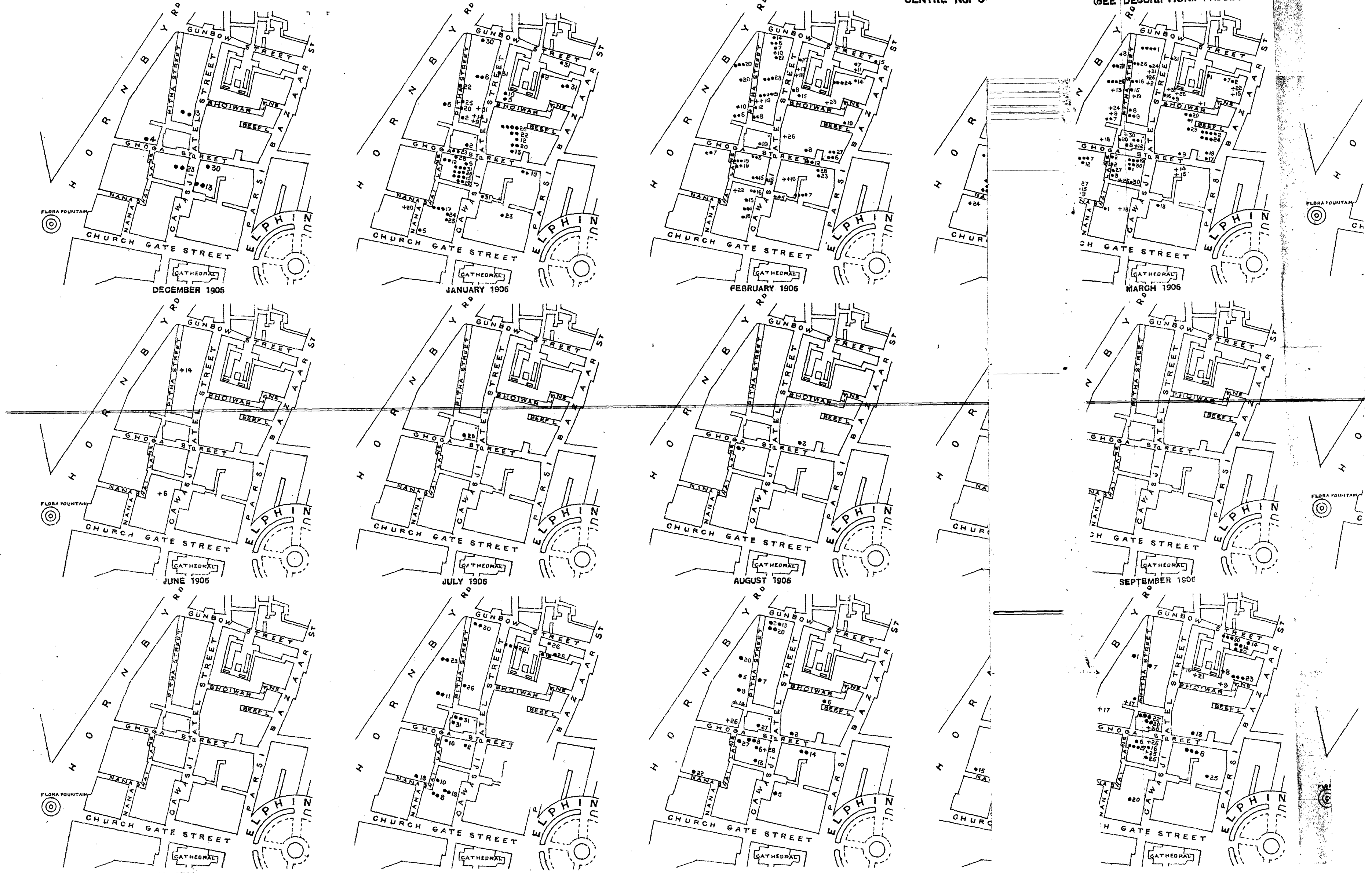
There were in all only four cases in this centre in January. The two specified above in 82 Cawasji Patel Street—one in 90—92 Cawasji Patel Street and one in 11 Nanabbai Lane (in portion known as Cama Moholla).

In February the epizootic continued to rage in the block between Barber Lane and Gunbow Street with two more plague cases on the 19th in 21—23 Pittha Street and 17 more infected rats. It had cleared up from 60—64 Gogha Street, but had travelled further down to

MAP SHOWING RELATION OF EPIZOOTIC AND EPIDEMIC OF PLAGUE IN THREE CENTRES OF FORT NORTH, A WARD, AND EXTENDING OVER 18 MONTHS. EACH SEPARATE DIAG
CENTRE No. 3

GRAM REPRESENTS ONE MONTH.
(SEE DESCRIPTION). PAGE 28.

● - A DEAD IN



82 Gogha Street, where four rats were found. Rats were also found in three particular spots, one in a passage behind 21 Cawasji Patel Street where 6 rats were found, and the other between 12 and 14 Cawasji Patel Street, where four more were found, and a third in a lane between 11 and 13 Gogha Street where five rats were found. There were only 9 plague cases in February, four of them in the block between Bhoiwar Lane and Gunbow Street, one in 5 Parsi Panchayat Lane, two in 107 Cawasji Patel Street and one in 62 Bhoiwar Lane.

In March the epizootic was considerably on the decline. It was prevalent in almost all the blocks except the southern portion which consists of office premises, but the number of infected rats was considerably reduced (see map).

Plague cases continued to occur in all the blocks except those on the south which consist mostly of office premises. There were in all 21 cases of plague in March, distributed all over. A number of dead rats were found round about Beef Lane, 11 in all, four on the 2nd between 4 and 8 Beef Lane. Three more were found in the same lane on the 24th, one on the 29th near 12 Beef Lane, but there were no plague cases.

In April there was a sudden drop in the epizootic (see map) and only 18 infected rats were found all over this centre. Plague cases now occurred in the houses in Beef Lane where infected rats were found last month. Three infected rats were found on the 24th and 29th of last month near 8 and 12 Beef Lane, and plague cases occurred in the same houses, the first on the 14th April in 12 Beef Lane, *i.e.*, about three weeks later and another on the 28th April in 8 Beef Lane.

The epidemic began to decline in this month, and 15 cases in all were distributed all over the centre.

In May there were only a few sporadic cases of plague and of infected rats. Only 7 cases of plague.

In June only two plague cases were found. The infection among rats seems to have been kept up in the intervening months between June and November, for an infected *mus rattus* was found on the 26th of July in a gully next to 46 Gogha Street. Evidently the rats within the house continued to be infected.

Again in August two infected rats were found—one on the 3rd between 60 and 64 Gogha Street and another on the 7th between 11 and 13 Gogha Street. Then again two more were found in October on the 2nd between 12 and 14 Cawasji Patel Street. In November 1906, the epizootic seems to have burst out afresh, for the number of infected rats had increased suddenly to 12, and infected rats were found almost in every block and dropped again in December, for no infected rats were found in December (see maps for November and December).

This recrudescence seems to have been confined to this centre only, for we do not find any such increase in the other two centres, where no infected rats were found in No. I and only one rat in No. II centre. Though the infection seems to have been kept up amongst rats in these intervening months, no plague cases occurred in the months of July, August, September, October, November and December.

Centre No. I, 1907.

In January 1907 the epizootic started afresh, for it increased from one infected rat in December 1906 to 28 infected rats in January 1907. It also started a month later than the last epizootic which had started in December.

The epizootic started again in the same spot as last year, for an infected rat was found on the 2nd of January between 83 and 85 Frere Road, and another two days later in the same

gully. The one on the 2nd was a *mus rattus*, showing that the rats within the house were early infected. In this and the adjoining gully seven rats were found in the course of the month.

By the first week of January it had spread as far south as Kalikat Street, for on the 4th an infected rat was found between 12 and 14 Kalikat Street, followed by two more in the same gully on the 22nd and 31st.

Two other spots where infected rats appeared repeatedly were one in the east corner of Goa Street, where 6 rats were found in all on the 21st, 28th and 31st. The other spot was near 30 Frere Road, where 4 infected rats were found on the 15th, 18th and 31st.

It had also spread to the blocks on the west and between Carwar and Kumpta Streets.

The first case of plague now appeared on the 10th of January in 40 Goa Street, after an entire absence of the same for the last 4 months. Another case was found on the 26th in 111 Mint Road. These were the only two cases in January.

In February the epizootic had intensified in the original spot between Carwar and Goa Streets, for infected rats were repeatedly found in the course of the month in the gullies between 83—85 and 87 Frere Road, and in all 17 infected rats were found in these gullies.

Two plague cases occurred on the 11th of February in 29 Carwar Street, from the gully of which infected rats were found on the 25th of the previous month, *i.e.*, about three weeks before. Another case also occurred on the 25th in 57 Carwar Street, in the vicinity of which infected rats were found on the 30th of the previous month.

The number of infected rats had increased in this month to 40 and the plague cases to 9, 4 of which were in one block between Kumpta and Carwar Streets.

In March the epizootic had increased considerably and had spread to all the blocks. It continued unabated in the blocks first affected, except the gullies originally infected between Carwar and Goa Streets, where it had markedly diminished.

The block between Kalikat and Mangalore Streets abutting on Frere Road was badly infected this month, for six infected rats were found in the gullies between Nos. 47—49 and 51 Frere Road, with a few more infected rats on the south side of the block in Kalikat Street, followed by 5 plague cases in two houses, namely, Nos. 8 and 14.

The epidemic had spread to all the blocks and 18 cases had occurred in the month of March, an increase of 9 over those in the last month.

In April the epizootic was on the decline, though it still lingered in some of the old spots markedly between Carwar and Kumpta Streets in the gullies between 83—85 and 87 Frere Road; in Kalikat Street, where it was prevalent last month round about 14 Kalikat Street in the gullies between 47 and 49 Frere Road, and about the middle of the block between Kumpta and Carwar Streets.

Eight cases of plague followed in this latter spot in Nos. 29, 47 and 59 Carwar Street, and a house at the back of these, No. 30 Kumpta Street, where the epizootic was at its height in the previous month of March.

The number of plague cases kept up in April and 18 cases occurred.

In May there was a sudden drop in the epidemic for only 3 cases occurred.

Centre No. II, 1907.

In centre No. II the epizootic began to increase in January, for the number of infected rats increased from one in December 1906 to three in January 1907. The first infected rat was found in 102 Mint Road on the 12th, and by the end of the month the epizootic had spread to the outskirts of the centre, for two more were found on the 24th and 28th in 315

Bohra Bazar Street and 142 Mint Road. It had spread also to the southern boundary, for almost about the same time two infected rats were found on the 2nd of February in a gully next to 24 Agiary Lane.

There were no plague cases in January.

In February the number of infected rats had increased to eleven, four of these were found in a gully next to 24 Agiary Lane on the 2nd, 7th and 22nd, and three more in Chana Street between Nos. 17 and 19.

The first plague case now appeared in 148 Mint Road on the 10th of February, after an entire absence of the same for the last four months. Another case followed on the 23rd in the same house. The first infected rat found in this spot was on the 28th of the previous month in 142 Mint Road, *i.e.*, two weeks previously.

Four more cases followed, making a total of six in February. Three of these occurred in a block between Chana Street and Agiary Street (see map). One in 25 Chana Street on the 14th close to the spot where an infected rat was found on the 4th. The second on the 23rd in 181 Bazar Gate Street, and the third in 155 Bazar Gate Street on the 28th.

In March the epizootic had increased and had spread to almost all the blocks, and the number of infected rats had increased to 24 in all; but it was much less severe than what it was in centre No. I in the same month (see map).

It still kept up in 24 Agiary Lane, for infected rats were repeatedly found in the gully in the course of the month.

It also lingered about Chana Street.

The epidemic was more wide spread in this month and 13 cases in all had occurred in March.

Five of these occurred in a block between Chana Street and Dwarkadass Lane and abutting on Mody Street. The remaining cases were distributed amongst the other blocks.

In April the epizootic was still on the rise and the number of infected rats found in the month went up to 45 from 24 last month.

The epidemic had however spent its force, for the number of plague cases was reduced to 10. These did not occur in any particular spot, but were distributed here and there, all over the centre.

The epizootic seemed to cling to certain spots, for, as in the previous months, infected rats continued to be found in the gully next to 24 Agiary Lane, and seven rats were found in this gully.

Some more were found in the old spots on either side of Chana Street.

Infected rats were repeatedly found also in two gullies between 257—261 and 263 Bazar Gate Street; 7 were found here.

In May there was a sudden drop in the epizootic, for the number of infected rats went down to 8. It still clung to the old spots in Agiary Lane and Chana Street (see map).

Centre No. III, 1907.

The epizootic started afresh in this centre in January, for the number of infected rats found in January went up to 24, whereas there were none in the previous month.

It started on the 2nd at the junction of Gogha Street and Cawasji Patel Street in No. 58 Cawasji Patel Street, close to the spot where it had started last year. It spread southwards to Nanabhai Lane in a week, for on the 8th and 10th three infected rats were

found in the gullies between 11, 13 and 15 Nanabhai Lane. By the 19th it had spread to the northern limits of the centre, for an infected rat was found in the dust-bin cart in Parsi Panchayat Lane. The blocks on the west of Cawasji Patel Street were affected, but those between this street and Parsi Bazar Street on the east remained free.

No plague cases occurred up to the end of the month.

In February the epizootic had spread to the other blocks and it increased in the block first affected, but the total number of infected rats had not increased, but remained about the same as last month. Four infected rats were found on the 2nd, 13th and 20th, all in the same gully between 5 and 7 Gunbow Street.

The epidemic now made its appearance this month after an entire absence of the same for the last six months.

A case was found on the 14th in No. 11-13 Pitha Cross Lane, followed by a doubtful one on the 26th in 20 Gogha Lane.

A third case occurred on the 28th in 60 Cawasji Patel Street, next to the house in which an infected rat was found on the 6th of the same month, *i.e.*, about three weeks before.

There were in all three plague cases only in February.

In March the number of infected rats increased, but the infection seemed to have centred in two particular blocks at the junction of Cawasji Patel Street and Gogha Street (see map), for out of a total of 31 rats for the month, 13 were found in these two blocks on either side of Gogha Street.

Another spot where rats were repeatedly found was a gully between 69-71 Gunbow Street and a gully in the rear, where seven infected rats were found between the 14th and 30th. The remaining were distributed here and there over the other blocks, which seemed to be almost free from infection.

The epidemic continued to increase, but there was not a great rise, as only eight cases were found, and four of these were confined to the blocks north of Bhoiwar Lane (see map). Two cases again recurred in Nos. 58 and 60 Cawasji Patel Street, which were originally affected, both by the epizootic and epidemic.

In April the epizootic was on the decline, but it still clung to the block first affected at the corner of Cawasji Patel Street and Gogha Street, for five infected rats were found there on the 17th, 20th and 25th.

The epidemic was also on the decline, and a few sporadic cases were found all over the centre. The total number was reduced to five.

In May the epidemic was practically at an end. There were four cases, but three of these were confined to one house, 14-16 Barber Lane, in which all the cases occurred. The infected rat found nearest this house was one in 78 Cawasji Patel Street on the other side of the lane, about opposite this house, on the 11th of the previous month, whereas the first case occurred on the 12th May. Some allowance has to be made for the epizootic to travel to the opposite side of the lane.

A comparison of the epidemic and epizootic in the two years could be best effected, and more definitely so by giving the actual number of infected rats and the number of plague cases in the two years.

The two following tables give the figures and show the rise and fall and the severity of the infection in the two years :—

Number of Infected Rats in Fort North.

Months.							1905.	1906.
December	...	...	...	...	...	...	27	16
							1906.	1907.
January	...	...	...	...	...	...	187	64
February	...	...	...	...	...	...	279	110
March	...	...	...	...	...	...	383	171
April	...	...	...	...	...	...	251	163
May	...	...	...	...	...	...	107	92
Total							1,234	616

Number of Plague Cases in Fort North.

Months.							1905.	1906.
December	...	...	...	...	...	...	2	2
							1906.	1907.
January	...	...	...	...	...	...	20	5
February	...	...	...	...	...	...	61	22
March	...	...	...	...	...	...	123	66
April	...	...	...	...	...	...	115	43
May	...	...	...	...	...	...	73	16
Total							394	164

The number of infected rats in 1907 was less than half that in 1906.

The number of plague cases was much less than half the number in 1906.

Though the epidemic was not so severe or intense, the virulence of the disease had in no way abated.

DISINFECTION.

The general disinfectant used until August 1906 for disinfecting the houses where cases of plague occurred or where plague rats were found was perchloride of mercury. The gullies in which infected rats were discovered, used to be flushed and treated with izar or disinfectant fluid.

These disinfectants, however, were found by experiments to be of no use in killing fleas. The best insecticide for the purpose is "Pesterine," the use of which therefore was adopted for disinfection from the month of August 1906 in all the districts and circulars and pamphlets were issued to all the District Registrars and Inspectors as to the mode of using it. For facility of description "Pesterine" is the name given to the residue of the distillation of crude petroleum; it has been found to be very efficacious in destroying fleas.

Statement showing the Disinfection Experiments with Pesterine (Crude Petroleum).

Address and Description of Room.	Plague History.	Date of Disinfection, etc.	REMARKS.
1 Morland Road, Block B, Room 26. A well ventilated room, with cemented floor. No loft.	One plague case only. Attacked on 26th April 1906, died 5th May 1906.	Disinfected on 7th May 1906 and 2 guinea-pigs kept running about in the room on 8th May 1906. They were examined on 9th May 1906. No fleas were found.	Source of infection doubtful. Live rats seen moving about in the room.
2 Morland Road, Block 13, Room 61. A well ventilated room, with cemented floor. No loft.	8 live rats were kept in cages and poisoned with Rat Exterminator. Number of fleas were seen on the dead rats.	Disinfected on 8th May 1906 and 2 guinea-pigs were kept in the room on 10th May 1906. They were examined on 11th May 1906 and no fleas were found on them.	There is no doubt about the presence of the fleas in the room before disinfection.
3 20, Agripada. Room on ground floor dark insanitary, under the stairs. Floor cutcha.	3 plague cases. 1st attacked 28th April 1906, died 8th May 1906. 2nd attacked 7th May 1906, died 14th May 1906. 3rd attacked 9th May 1906, died 13th May 1906.	Disinfected on 12th May 1906. The first pair of guinea-pigs kept in the room was found killed by some animal. The 2nd pair kept in on 16th May 1906. Examined 17th May 1906. No fleas were found.	A plague rat was found in the gully of the house on 20th April 1906.
4 16, Agripada. Room on 1st floor under the roof. Ground cutcha. Plank partitions.	2 cases in the room. 1st attacked 7th May 1906, died 10th May 1906. 2nd attacked 9th May 1906, suffering.	Disinfected on 13th May 1906, and 2 guinea-pigs were put in on 14th May 1906 and examined on 15th May 1906. No fleas were found.	History of dead rats in the house. A portion of G.F. vacated for dead rats.
5 Morland Road, Block B, Room 50. A well ventilated room with cemented floor. No loft.	2 plague cases, Attacked 12th May 1906, suffering.	Disinfected on 17th May 1906 and 2 guinea-pigs were put in the same night. They were examined on 18th May 1906. No fleas were found on them.	Afterwards a medical man who saw these cases said that they were not plague cases.
6 115, DeLisle Road, the room on ground floor, with cemented floor.	2 cases in the room. 1st attacked 10th May 1906, suffering. 2nd attacked 10th May 1906, died 15th May 1906.	Disinfected on 17th May 1906. 2 guinea-pigs were kept in the same evening and examined on 18th May 1906. No fleas were found on them.	.....
7 295, Arthur Road. A small room on ground floor. Floor of koba. Loft in the room.	Dead rats in the room 3 days before the first case and a mummified rat was found on the loft at the time of disinfection. 2 plague cases, 1st attacked 10th May 1906, died 16th May 1906. 2nd attacked 12th May 1906, suffering.	Disinfected on 19th May 1906. 2 guinea-pigs were kept in on 20th May 1906 and examined on 22nd May 1906. One flea (dead) was found on one of them.	.....
8 104, Parel Road. Room on first floor under the roof. Floor cutcha (of mud).	2 plague cases. 1st attacked on 5th May 1906, died 14th May 1906. 2nd attacked on 12th May 1906, died 18th May 1906.	Disinfected on 19th May 1906, 2 guinea-pigs were kept in the same evening. They were examined on 22nd May 1906, when one flea was found on one of them.	The roof was out of reach and was not disinfected.
9 73, Gunpowder Road. Room on ground floor under the roof. Floor of mud.	2 plague cases. 1st attacked on 7th May 1906, died 13th May 1906. 2nd attacked 6th May 1906, died 16th May 1906.	Disinfected on 9th May 1906. 2 guinea-pigs were kept in the same evening, and examined on 22nd May 1906. No fleas were found.	.....
10 120, Dadar Road. Room on ground floor under the roof. Koba floor. Loft in the room.	2 plague cases. 1st attacked on 14th May 1906, died 17th May 1906. 2nd attacked on 14th May 1906, died 17th May 1906.	Disinfected on 21st May 1906. 2 guinea-pigs were kept in on 22nd May 1906, and examined on 23rd May 1906. No fleas were found.	There is a history of these 2 young boys handling live rats.

Address and Description of Rooms.	Plague History.	Date of Disinfection, etc.	REMARKS.
11 24, Kalachowki Road, Room on first floor with mud floor.	2 plague cases. 1st attacked on 17th May 1906, died 19th May 1906. 2nd attacked on 18th May 1906, died 21st May 1906.	Disinfected on 23rd May 1906. 2 guinea-pigs were kept in on 24th May 1906, and were examined on 25th May 1906. No fleas were found.	.....
12 84, Ripon Road. Room on ground floor with koba floor.	2 plague cases. 1st attacked on 14th May 1906, died 17th May 1906. 2nd attacked on 16th May 1906, died 20th May 1906.	Disinfected on 21st May 1906. 2 guinea-pigs were put in the same day and examined on 23rd May 1906. No fleas were found.	.....

In order to ascertain the existence of fleas at the time of the decrease of plague, a final test was made on the 7th June 1906, and the following result was obtained :—

Address and Description of Room.	Plague History.	Date of Disinfection, etc.	REMARKS.
13 187-191, 1st Nowroj Hill, S. ground floor room, with stone floor, well ventilated.	1 plague case in the room, attacked on 5th June 1906, removed to hospital on 7th June 1906.	2 guinea-pigs were kept in the room on 6th June 1906 before disinfection. One of them was examined on 7th and was found full of fleas. The place was disinfected with "Pesterine" on the same day, and the same pair of guinea-pigs with the fleas was put in the room after disinfection. As a control two other flea-free guinea-pigs were put in the room after disinfection and all 4 guinea-pigs were examined on 8th morning. No flea was found. The guinea-pigs put in the room before the application of pesterine afterwards died of plague, while the other two remained alive.	There is no doubt of the existence of rat fleas in the room before disinfection.

Pesterine was started as a general disinfectant for plague from the month of August 1906, and the following table shows the total number of disinfection done with it in all the districts from the commencement until the end of April 1907; these being all done for cases of plague or as a precautionary measure. These figures do not include the number of gullies which were also treated with pesterine whenever infected rats were found in them.

Table showing the total number of disinfections done with pesterine from August 1906 to the end of April 1907 :—

District No.	Total number of disinfections with pesterine.	Total number of rooms pesterined.
I	480	1,139
II	677	768
III	649	925
IV	979	1,790
V	400	901
VI	278	433
VII	913	1,230
VIII	726	1,212
IX	500	758
X	488	1,191
Total	6,090	10,347

The following are the details of the work of disinfection with pesterine done in the various districts :—

District No. I.

In this district the total number of disinfections with pesterine up to the end of April 1907 was 480, out of which 306 were done for plague cases, 78 were undertaken as a precautionary measure, and 96 for dead rats. The total number of rooms disinfected was 1,139.

In 19 instances plague cases were found to have recurred after disinfections; in 10 cases in houses which has been previously treated with pesterine as a precautionary measure; and in 9 cases in rooms which had been disinfected for previous cases of plague.

The following shows the 10 houses mentioned under the former category :—

House.	Date of disinfection as precautionary measure.	Date of 1st case of plague.	Date of subsequent disinfection.	Dates of subsequent cases of plague.	REMARKS.
318 BohraBazaar Street.	28-11-06	14-3-07	14-3-07	25-3-07	Both cases in different rooms.
13 Police Court Cross Lane.	26-1-07	28-2-07	28-2-07	Nil.	Plague case after a month.
4—6 Thomas Street ...	5-12-06	4-3-07	4-3-07	17-4-07	Both cases in different rooms.
45 Thomas Road ...	15-12-06	20-4-07	20-4-07	Nil.	
42—44 Bohra Street ...	24-12-06	1-4-07	1-4-07	9-4-7 & 17-4-07	All cases in different rooms.
32—36 Bohra Street ...	29-12-06	21-3-07	21-3-07	Nil.	Plague case after 18 days.
60—62 Hamal Street ...	5-1-07	23-1-07	23-1-07	Nil.	
35 Victoria Bunder ...	16-3-07	30-4-07	30-4-07	Nil.	Plague case after 17 days.
5 Victoria Bunder ...	13-4-07	30-4-07	30-4-07	Nil.	
31—33 Bohra Street ...	2-1-07	13-5-07	13-5-07	Nil.	Plague case after 17 days.

It will be seen that in 4 instances, viz. :—

- 13 Police Court Cross Lane,
- 60—62 Hamal Lane,
- 35 Victoria Bunder, and
- 5 Victoria Bunder,

the subsequent cases of plague occurred from within a fortnight to a month after disinfection. The source of infection could not be traced, but was evidently not in the houses as no subsequent cases occurred.

In the remaining 6 houses, the subsequent cases occurred after 3 or 4 months after disinfection.

Out of the 78 houses treated with pesterine as a precautionary measure, 68 houses therefore remained free from plague.

In 9 instances cases of plague occurred in rooms which had been disinfected for previous cases. From the following statement it will be seen that in two rooms only, viz., in 35 Victoria Bunder and 13 Pitha Cross Lane the subsequent plague cases occurred respectively after a fortnight and a month, while in the remaining 7 instances the subsequent cases occurred within the incubation period.

It is interesting to note that the whole of 35 Victoria Bunder chawl was treated with pesterine about the middle of March, and subsequently, with the exception of a case that occurred within a fortnight after disinfection, no more cases of plague have been reported from the chawl.

House.	Date of first case of plague.	Date of disinfection.	Date of 2nd and subsequent cases.		REMARKS.
			Date of report.	Date of attack.	
12 Maruty Cross Lane ...	7-2-07	8-2-07	13-2-07	10-2-07	During incubation period.
13 Pitha Cross Lane ...	14-2-07	14-2-07	17-3-07	12-3-07	After nearly a month.
14 Kalikat Street ...	26-3-07	26-3-07	30-3-07	27-3-07	During incubation period.
25 Victoria Bunder ...	3-2-07	3-2-07	9-2-07	6-2-07	Do. do.
35 Victoria Bunder ...	20-2-07	20-2-07	7-3-07	6-3-07	After a fortnight.
35 Victoria Bunder ...	28-2-07	3-3-07	9-3-07	8-3-07	During incubation period.
18 Guncarriage Street ...	12-3-07	12-3-07	16-3-07	13-3-07	Do. do.
81 Bazaar gate Street ...	7-4-07	7-4-07	16-4-07	13-4-07	Do. do.
10-12 Bomanji Street ...	26-4-07	7-5-07	14-5-07	11-5-07	Do. do.

In the year previous (1905) the following houses were disinfected with perchloride of mercury, and the accompanying table shows the number of cases of plague that occurred in them subsequently :—

House.	Date of disinfection.	Dates of plague cases which occurred subsequently.
45 Thomas Road ...	24-10-05	12-1-06, 19-4-06, 20-4-06.
42-46 Borah Street ...	30-10-05	28-12-05, 24-3-06, 21-4-06, 23-4-06.
13 Police Court Cross Lane.	7-11-05	19-1-06, 13-3-06, 13-3-06.
318 Borah Bazar Street ...	28-11-05	2-3-06, 7-3-06, 7-3-06, 17-3-06, 25-3-06, 30-3-06, 8-4-06, 11-4-06, 12-4-06.
32-36 Borah Street ...	15-12-05	7-3-06, 19-3-06, 26-4-06, 27-4-06, 27-4-06.
43 Hamal Lane ...	19-12-05	2-3-06, 27-4-06, 5-5-06.
35 Victoria Bunder ...	23-12-05	29-1-06, 13-4-06, 14-4-06, 23-4-06, 25-4-06, 28-4-06, 28-4-06, 29-4-06, 3-5-06, 30-5-06.
60-62 Hamal Lane ...	24-12-05	8-2-06, 14-2-06, 26-3-06, 29-4-06, 20-4-06.

District No. II.

The total number of disinfection with pesterine up to end of April 1907 was 677. The total number of rooms pesterined was 768. The following 5 houses were thoroughly treated with pesterine as a precautionary measure :—

House.	Date of precautionary disinfection.	* Date of subsequent plague cases.
30 II Koliwada Lane ...	1-10-06	25-1-07.
10 II do. do. ...	29-9-06	Nil.
54 Carnao Road ...	4-07	Nil.
18-20 Jambli Street ...	4-07	Nil.
50-52 Do. ...	4-07	Nil.

Only one case of plague occurred in 30 II Koliwada Lane, nearly 4 months after the precautionary disinfection.

Out of the 768 rooms pesterined, in the following 4 rooms only cases of plague occurred after disinfection :—

House.	Date of first case of plague.	Date of disinfection with pesterine.	Date of subsequent plague cases.
117—119 Memonwada Road...	6-4-07	6-4-07	12-4-07
49 Kolsa Street ...	9-4-07	9-4-07	11-4-07
405—407 Shaik Memon Street ...	19-3-07	20-3-07	6-4-07
345—1 Kalbadevi Road ...	23-3-07	24-3-07	21-4-07

It will be seen that the first two cases occurred within the incubation period. As regards the third case, the District Registrar reports "there is a distinct history of fresh infected rats found after the first disinfection," while as regards the last room, he finds "that the second case was due to infection from the adjoining room on the same floor where a case of plague (death) occurred on 18th April 1907, viz., three days previous to the case under consideration."

District No. III.

The total number of disinfection done with pesterine up to the end of April 1907 was 649. The total number of rooms done was 925. Out of these, in the following 4 instances only plague cases were found to have recovered in rooms which had been treated with pesterine for a previous case. It will be seen that all these cases occurred within the incubation period :—

House.	Date of first case of plague.	Date of disinfection with pesterine.	Date of second case of plague (date of report).
225 Chinch Bunder Road ...	9-3-07	11-3-07	22-3-08
32 First Nowroji Hill South Cross Lane ..	4-9-06	6-9-06	9-9-06
132-134 First Nowroji Hill South ...	30-3-07	1-4-07	6-4-07
125-127 Nishimpada Road ...	25-3-07	28-3-07	8-4-07

In the following houses the precautionary measure of treating the whole house with pesterine was taken after the occurrence of the first case of plague. These houses were not vacated for disinfection ; no subsequent cases of plague occurred in them afterwards :—

House.	Date of 1st plague case.	Date of precautionary disinfection.	Date of subsequent plague cases.
23 Umerkhadi Road ...	5-9-06	17-9-06	Nil.
10—12 Jail Road North ...	15-11-06	6-12-06	"
31—33 Do. ...	27-2-07	8-2-07	"
51—53 Umerkhadi Road ...	17-3-07	19-3-07	"
80—83 First Nowroji Hill North ...	13-3-07	13-1-07	"
15 Valpakhadi ...	10-1-07	10-1-07	"
17 Do. ...	20-3-07	24-1-07	"
51—53 First Nowroji Hill South ...	21-2-07	4-3-07	"

District No. IV.

The total number of disinfections done with pesterine in this district, up to the end of April 1907, was 979. The total number of rooms pesterined was 1,790.

The total number of precautionary disinfections done was 45. In 26 out of these no cases of plague occurred, while the remaining 19 showed one or more plague cases.

Out of these 19—

9	showed only	...	...	1	case.
4	„	...	...	2	cases.
3	„	...	...	3	„
1	„	...	...	4	„
1	„	...	...	5	„

While No. 39 1st Marine Line showed 10 cases of plague—the cases occurring after 1½ to 5½ months after the precautionary disinfection, and all in different rooms. This place consists of separate chawls, and the residents are chiefly labourers, and employed in working elsewhere. It was not possible therefore to ascertain the source of infection in these cases. But as no two cases occurred in the same room, it is most probable that the source of infection was not in the chawls. A number of infected rats, however, were constantly found in the adjacent gully.

Up to the end of March 1907, 17 houses were disinfected in this district with pesterine as a precautionary measure. These showed a total of 42 subsequent cases of plague or 2·4 cases per house.

Ten of these same houses were disinfected in 1903-04 with perchloride of mercury as a precautionary measure, and showed 40 plague cases, *i.e.*, 4 cases per house.

These very 10 houses (with 2 exceptions) were treated in 1905 with sulphur fumigation and showed 42 plague cases, *i.e.*, 4·2 cases per house.

The following table shows the number of rooms in which plague cases were found to have recovered after disinfection with pesterine:—

House.	Date of 1st case of plague.	Date of disinfection with pesterine.	Date of second and subsequent cases.	REMARKS.
41 Sonapur Street	26-2-07	27-2-07	2-3-07	During incubation period.
			27-4-07	Brought from outside.
198 Kika Street	26-3-07	26-3-07	6-4-07	During incubation period.
71 Masjid Street	26-2-07	4-3-07	8-3-07	Brought from outside.
15 Kolbhatwady	8-3-07	8-3-07	25-3-07	Do.
43 Zaobaswady	8-3-07	9-3-07	20-3-07	During incubation period.
40 Kolbhatwady	23-3-07	24-3-07	30-3-07	Do.
39-41 Masjid Street	2-2-07	4-2-07	10-3-07	Infected rat on 8-3-07.
5-7 Fanaswady	19-3-07	19-3-07	28-3-07	During incubation period.
262 Bapu Khote Street	11-4-07	12-4-07	20-4-07	Brought from outside.
232 Do. do.	10-4-07	10-4-07	17-4-07	During incubation period.

Thus 10 rooms showed recurrence of plague after disinfection with pesterine.

Out of these, in 6 instances the subsequent plague cases were found to have occurred during the period of incubation.

In 3 instances the subsequent cases were brought from outside. The third case that occurred in 39 Sonapur Street was also brought from outside.

In 39—41 Masjid Street there was most probably a fresh introduction of infection after over a month after disinfection, as a plague-infected rat was found on 8th March 1907.

District No. V.

The total number of disinfections with pesterine done in this district, up to the end of April 1907, was 400. The total number of rooms done was 901.

Twenty-seven houses were treated with pesterine as a precautionary measure. 11 out of these showed subsequent plague cases and 16 remained free. Out of these 11 houses, 4 showed only one subsequent case of plague, and the remaining 7 more cases than one.

On referring to the accompanying table it will be seen that one house, 132 Khetwady Back Road, showed the first case during the period of incubation. All the other houses showed their first cases after a period varying from a month and a half to nearly 5 months :—

House.	Date of pre-cautionary disinfection	Date of 1st plague case (Date of death).	Date of subsequent disinfection.	Date of subsequent cases of plague.	REMARKS.
12 Khetwady 9th Lane...	17-11-06	21-2-07	21-2-07	12-4-07	Both cases in different rooms.
418 Grant Road ...	21-11-06	13-4-07	19-4-07	Nil.	Nearly 5 months after disinfection.
365 Falkland Road ...	28-12-06	10-2-07	12-2-07	3-3-07, 9-3-07, 19-3-07, 25-3-07	All cases in different rooms.
116 Trimbak Parshram Street ...	17-1-07	9-3-07	10-3-07			4-4-07, 26-4-07	" "
132 Khetwady Back Road	7-2-07	19-2-07	19-3-07	28-3-07, 8-4-07	The first case within incubation period.
227 Kumbharwada Street	22-1-07	26-3-07	28-3-07	Nil.	Two months after disinfection.
299 Duncan Road ...	9-11-06	10-3-07	11-3-07	14-3-07, 30-3-07	The second case in the same room occurred within incubation period.
72 Packmodia Street ...	30-11-06	6-4-07	9-4-07	7-4-07	Both cases in different rooms.
62 Khoja Street ...	9-12-06	4-4-07	6-4-07	10-4-07, 29-4-07	All cases in different rooms.
57 Duncan Road ...	30-12-06	8-3-07	8-3-07	Nil.	
57 Packmodia Street ...	30-1-07	29-3-07	31-3-07	Nil.	

In the houses in which more cases than one were recorded, they all occurred in different rooms, with the exception of 299 Duncan Road. This house was treated with pesterine as a precautionary measure on 9th November 1906. The first case of plague occurred on 10th March 1907, *i.e.*, 4 months afterwards. This room was disinfected on 11th March 1907, and a second case of plague was found to occur in the same room on 14th March 1907, and was obviously in the incubation stage.

In 365 Falkland Road, 5 plague cases occurred subsequent to precautionary disinfection. They all occurred in different rooms, while 4 of them took place in the month of March, and it appears as though they were from the same source of a subsequent re-infection.

In the following 10 instances, cases of plague were found to have occurred in the same rooms after disinfection with pesterine. The accompanying table shows that in all the 10 instances the subsequent cases occurred within the period of incubation. In house No. 233, Doctor Street, however two cases occurred after the period of incubation. The source of infection could not be ascertained.

District No VI.

The total number of disinfections done in this district was 278 ; out of these, 62 were done as a precautionary measure, the total number of rooms disinfected was 433. Only in the following three houses cases of plague occurred after disinfection :—

House.	Date of pre-cautionary disinfection.	Date of 1st case of plague.	Date of subsequent disinfection.	Date of subsequent cases of plague.	Remarks.
17 Sadashiv Street ...	17-11-06 to 19-12-06.	17-3-07	18-3-07	20-3-07 3-4-07	In same room. In different room.
16B Havdachi Wadi ...	20-11-06 to 27-12-06.	27-2-07	28-2-07	12-3-07	" "
16A Do. ..	27-12-06 to 31-12-06.	12-3-07	12-3-07	...	...

In all these houses the first cases of plague did not occur until 2 or 3 months after the precautionary disinfection, and in house No. 70 Sadashiv Street, where two cases of plague occurred in one room, second case occurred two days after the disinfection for the first case, evidently in the incubation stage.

District No. VII.

The total number of disinfections done in this district was 913, out of which 10 being precautionary :—

September 1906	...	...	..	...	...	7
October	...	...	...	...	...	13
November	...	...	...	...	...	6
December	...	...	...	...	...	12 (including 5 precautionary)
January 1907	...	...	...	...	...	11 (" 3 ")
February	...	...	...	...	...	63 (" 1 ")
March	...	..	...	...	...	399
April	...	...	...	...	...	402 (including 1 precautionary)

Total 913

The precautionary disinfection was carried out in the following houses :—

1 Ripon Road, disinfected on	21-12-06
1 Agripada*	12-12-06
23 Do.	13-12-06
117 Do.	9-12-06
154 Do.	3-12-06
2 Do.	6-1-07
16 Do.	21-1-07
20 Do.	24-1-07
1 Do.*	12-2-07
29 Matharpakady	22-4-07

All these houses are very badly affected year after year. This year they were treated with pesterine, with the result that not a single case of plague occurred in any of them, with the exception of No. 20 Agripada. This house has 20 rooms. 19 were treated with pesterine, one room could not be done as it was occupied by a hawker who left very early and returned very late at night. This room was always locked, and in this room a case of plague occurred in March.

The District Registrar observes that "excellent results are obtained by treatment of badly infected houses as a precautionary measure with pesterine, and that pesterine can fairly claim to be a very powerful insecticide and also a preventative against the dissemination of plague." No. 29 Matharpakady was wholly treated with pesterine after the occurrence of two cases of plague in one room. No cases have occurred in the chawl since.

* These two are different houses, although bearing the same number.

The total number of rooms pesterined in this district was 1,230 up to the end of April 1907.

The result of the use of pesterine as a preventive of plague compares very favourably with perchloride of mercury with which some of these very houses were thoroughly disinfected during the year previous as a precautionary measure. The following table shows the result :—

House.		Number of plague cases after precautionary disinfection with	
		Mercury perchloride.	Pesterine.
23	Agripada	4	<i>Nil.</i>
20	Do.	6	"
2	Do.	5	"
1	Do.	6	"
117	Do.	8	"

District No. VIII.

The total number of disinfections with pesterine done in this district was 726, including 6 precautionary. The total number of rooms pesterined was 1,212.

The following are the 6 houses in which the precautionary measure was carried out :—

House.	Date of disinfection as precautionary measure.	Date of plague case.
84 Bapty Road	13-3-07	<i>Nil.</i>
58 Belassis Road	26-3-07	"
6 Tank Street	5-4-07	"
35—189 Stable Street	6-4-07	"
199 New Nagpada	7-4-07	"
5 Bapty Road Cross Lane...	16-4-07	"

No case of plague has occurred in any of the above houses.

House.	Date of first case of plague.	Date of disinfection.	Date of 2nd and subsequent cases.	Remarks.
410 Falkland Road	26-3-07	26-3-07	28-3-07 5-4-07	} During incubation period.
15 Undria Street	14-3-07	14-3-07	20-3-07	
4—6 Tank Street	31-3-07	31-3-07	2-4-07	" "
74 Bapty Road	2-3-07	2-3-07	4-3-07 4-3-07	" "
7—9 Stable Street	19-2-07	19-2-07	24-2-07	" "
144—146 Camatipura 10th Lane	7-3-07 7-3-07	7-3-07	9-3-07 22-3-07 24-3-07	} These two cases were found to have been removed to this room from other places.

The above table shows the number of rooms in which cases occurred after disinfection with pesterine. It will be seen that in all the instances, the subsequent cases occurred during the incubation period. The two cases that occurred in 144—146 Kamatipura 10th Lane, after 15 days after disinfection were, the District Registrar reports, "found to have been removed to this room from other places."

District No. IX.

The total number of disinfections done in this district until the end of April was 500. Out of these, 30 were carried out as precautionary measure, either for dead rats or because these houses are generally badly affected. The total number of rooms pesterined was 758.

In the following 14 houses disinfection with pesterine was carried out as a precautionary measure. In all these cases the residents did not leave the places but were allowed to stay on in them. All these houses were disinfected in the month of January, and no case of plague occurred in any one of them:—

361	Dhakti Sewri.	52	Naigaum Road.
382	"	390	Dhakti Sewri.
362	"	379	"
386	"	376	"
372	"	370	"
388	"	380	"
387	"	381	"

In the following 4 rooms cases of plague recurred after disinfection with pesterine. It will be seen on looking at the dates that in all the instances the cases occurred within the incubation period:—

House.	Date of first case of plague.	Date of disinfection.	Date of 2nd and subsequent cases	REMARKS.
4 Kalachowki Road	26-3-07	27-3-07	4-4-07	During incubation period.
Do.	14-3-07	16-3-07	20-3-07	"
8 Arthur Road	21-3-07	22-3-07	29-3-07	"
6 Government Gate Road	7-4-07	8-4-07	13-4-07	"

District No. X.

The total number of disinfections done with pesterine in this district, up to 30th April 1907, was 488. Out of these the following 10 chawls, each having on an average of 50 to 60 rooms, were treated with pesterine as a precautionary measure. The total number of room pesterined was 1,191:—

House	Date of precautionary disinfection.	Date of plague case.
919 Elphinstone Road	20-11-06	<i>Nil.</i>
140 Dharavi Road	7-12-06	"
187 Agar Bazaar	7-11-06	12th April 1907. Infection brought from outside.
64 Lady Jamsetji Road	14-1-06	<i>Nil.</i>
180 Carrol Road	30-12-06	"
925 Fergusson Road	5-12-06	"
316 DeLisle Road	18-12-06	"
660 (Old) DeLisle Road	31-3-07	24th April 1907. Infection brought from outside.
860 (New) DeLisle Road	16-3-07	<i>Nil.</i>
1114 Fergusson Road	14-1-07	"

It will be seen that all these chawls remained free from plague after treatment with pesterine. The case that occurred in 187 Agar Bazaar was traced to B. B. & C. I. Railway Workshops, and in the case which occurred at 860 (Old) DeLisle Road, the source of infection was from the Dhun Mills. In both these instances no further cases occurred.

In the following three instances cases of plague occurred in the same rooms after disinfection with pesterine. It will be seen that in two instances the cases were brought in from outside, while the third case occurred within the incubation period. The District Registrar reports:—
“Practically there was not a single case of plague that occurred in the very room after it was once treated with pesterine.”

House.	Date of first case of plague.	Date of disinfection.	Date of subsequent plague case.	REMARKS.
860 DeLisle Road	4-4-07	5-4-07	25-4-07	This case got plague in a shed and when delirious and violent was brought into this room.
197 Do.	4-4-07	4-4-07	15-4-07	This case was brought from outside and kept in this room.
191 Do.	16-4-07	17-4-07	21-4-07	This case occurred during incubation period.

J. A. TURNER, M. B., D. P. H.

BOMBAY, 15th August 1907.

Executive Health Officer.

STATEMENT
OF
PLAGUE OPERATIONS
IN THE
PARSEE COMMUNITY
FROM
JANUARY TO DECEMBER 1912.

Published by the Trustees of the Parsee Panchayet Funds and Properties.



BOMBAY:
PRINTED BY
MANECKJEE NOWROJEE AT THE JAM-N-JAMSHED PRINTING WORKS, BALLARD HOUSE, MANGLORE STREET, FORT.

1913.

STATEMENT OF PLAGUE OPERATIONS
IN THE
PARSEE COMMUNITY

From January to December 1912.

The Trustees of the Parsee Panchayet Funds and Properties have, upto now, published the following fourteen short Statements of Plague Operations in the Parsee Community :—

- For 19 months, from November 1896 to May 1898.
- For 13 months, from June 1898 to June 1899.
- For 12 months, from July 1899 to June 1900.
- For 12 months, from July 1900 to June 1901.
- For 12 months, from July 1901 to June 1902.
- For 12 months, from July 1902 to June 1903.
- For 12 months, from July 1903 to June 1904.
- For 12 months, from July 1904 to June 1905.
- For 12 months, from July 1905 to June 1906.
- For 12 months, from July 1906 to June 1907.
- For 12 months, from July 1907 to June 1908.
- For 12 months, from July 1908 to June 1909.
- For 14 months, from July 1909 to August 1910.
- For 16 months, from September 1910 to December 1911.

The present statement comprises a period of twelve months, from January to December 1912.

The Plague operations were mostly conducted in the same manner as during the preceding years, and on the following lines :—

1. The establishment of a special Parsee Hospital during the months of the recrudescence of the epidemic, and of a Special Parsee Ward in connection with the Mahratha Hospital during the other months.
2. The establishment of a Health Camp.
3. Affording monetary assistance to poor families.

Hospitals.

The Parsee Fever Hospital was located, as in the six previous years, in the building kindly built by Bai Jarbai Nawrosjee Wadia in memory of her parents on the land of the Parsee Panchayet at Chowpatti. The Hospital was opened on 15th April 1912 and closed on 20th June 1912.

This is the thirteenth year that the Hospital has been under the medical charge of Dr. Sorab K. Nariman, M.D., B. Sc., L.M. & S., (Bombay), M.R.C.S. (England), L. R. C. P. (London), L.P.H. (Cambridge). The Trustees have the pleasure to thank Dr. Nariman and note again their satisfaction at the efficient and economic way in which the Hospital is conducted. Dr. Jamshedji Nusserwanji Bhada, L.M. & S. and Mr. Ruttonsha Ardeshir Contractor worked as the paid Resident Medical Officers. Mr. Ruttonsha Ardeshir Contractor worked as the Manager of the Hospital also.

During the period of two months and six days, that the Hospital was open, 9 patients were admitted into it. All these were Plague cases. There were altogether 6 deaths. Of the 6 that died of Plague, 2 were adult males, and 4 adult females. The Plague mortality of the Hospital was 66.6 per cent. This is the first year after the break of the epidemic in 1896, during which there were so few admissions into the Hospital. As reported by Dr. S. K. Nariman, the epidemic seems to be dying out.

The Hospital expenses during the above period of two months and six days amounted to Rs. 1,381-3-9. During the year under Report, the Hospital was repaired at the total cost of about Rs. 191.

Relations and friends were allowed to visit the patients at all hours of the day under certain restrictions.

Dr. Sorab K. Nariman's report of the work of the Hospital forms an appendix to this report. The Trustees offer their best thanks to all those gentlemen named in his report, who have helped the Hospital in various ways from time to time.

The Parsee Ward at the Mahratha Hospital was continued during the year under report. It was supplied with the necessary staff of ward-boys and ayahs. It was availed of by 10 patients, out of whom 8 were plague cases, 1 of Para Typhoid Fever and Malaria and 1 of Paralysis. There were altogether 5 deaths, 4 of which were due to Plague. Out of 5 that died, 4 were males and 1 female. The Trustees thank Khan Bahadur Dr. Nusserwanjee Hormusjee Choksey, L.M. & S. (Bombay), M.D. (Honoris Causa, Freiburg, Germany), Special Assistant Health Officer in charge of the Hospital, for his valuable services.

The total expenditure under the head of hospital charges, including the expenses of maintaining the Parsee Ward at the Mahratha Hospital during the twelve months under review, came to Rs. 1,791-6-7.

Health Camp.

The semi-permanent Health Camp erected in 1909 on the Parsee Punchayet ground near the Seth Fardunji Sorabji Parekh Dharamsalla at Chowpatti, was available for those who required its use. As the epidemic was mild, there was no great demand for accommodation at the Camp. The Camp has 25 tiled huts, out of which the highest number occupied at one time, during the year, was 6. The maximum number of people that occupied the Camp at one time was 39.

During the year under report, an arrangement was made, as in the previous six years, to get daily reports about the houses from which patients went to the Parsee Fever Hospital and to the Mahratha Hospital. On such reports being received, letters were written to the heads of the families, which sent in the patients, offering to them and to the other tenants of their houses accommodation in the Health Camp.

The following table gives the districts from which the occupants of the Camp were drawn, and the number of families and persons that had removed to them:—

DISTRICTS	No. of Families.	No. of Persons.
Fort	2	20
Dhobi Talao	3	19
Khetwadi	1	13
TOTAL...	6	52

Special arrangements for the rainy season are made at this Health Camp, which is a semi-permanent one. This Camp was occupied upto 17th June 1912.

The expenditure on the Health Camp during the twelve months under review amounted to Rs. 250-5.

Expenditure.

The total expenditure under all the heads for Plague Operations during these sixteen years of the epidemic has come to about Rs. 3,06,600, out of which about Rs. 2,400, were spent during the year under report.

Mortality Statistics.

Table (A) prepared from the records at the Towers of Silence, presents the mortality in the community according to districts and under the heads of plague and all other causes jointly. It shows that, during the period under review, the total deaths due to plague were 34, representing 2·3 per cent of the mortality. Out of the total deaths from plague, 10 were males (2 being male children under 12 years of age and 8 adults), and 24 females (2 being female children under 12 years of age and 22 adults).

Out of the total number of 34 plague deaths, 1 was of a person inoculated and 33 were of those uninoculated. As to the one inoculated who died, he was inoculated about 12 years ago. He died on 6th May 1912. Table (B) gives the mortality in the Community during the past sixteen years of the epidemic.

Table A showing the mortality in the

DISTRICTS.	January.		February.		March.		April.		May.		June.	
	Plague.	Other causes.	Plague.	Other causes.	Plague.	Other causes.	Plague.	Other causes.	Plague.	Other causes.	Plague.	Other causes.
Colaba	2	...	1	...	3	...	...	...	2	1	...
Fort	17	...	15	2	16	3	15	2	26	...	34
Baharkote	3	...	2	...	5	...	3	...	2	...	7
Bhindi Bazar	2	...	1	...	...	...	1	...	...	...	4
Dhobitalao	1	18	...	21	1	17	2	27	1	21	...	25
Khetwadi	5	...	6	...	5	1	9	...	14	...	19
Girgaum...	2	...	1	1	1	...	1	...	2	...	2
Chowpati	1	...	...	...	2	...	2	1	8	...	2
Walkeshwar	1	...	...	...	...
Mahaluxmi	1	...	...	...	1	...	1	...	...
Mazagaon	1	...	2	...	11	...	1	...	5	...	4
Kamatipura	1
Tardeo	4	...	5	...	3	...	1	...	6	1	4
Grant Road'	9	...	9	...	12	...	12	...	14
Gowalia Tank Road	7	...	1	...	2	...	3	...	2	...	1
Byculla	2	...	...	...	...	...	2	...	3	...	4
Parel	3	...	4	...	8	1	2	...	4	...	6
Naegaum	1	...	...	...	...	...	...	1
Dadar	1	...	2	...	1	...	...	...	1	...	...
Mahim	1	2	1	1	...	2	...	1	...	...
Lunatic Asylum	1	...	...	...	...	...	...	...	1	...	1
Lying-in-Hospital (Fort)	5	...	1	...	9	...	5	...	4	...	2
Parsi General Hospital	6	...	...	...	1
Public Hospitals	15	...	19	1	8	2	18	3	20	2	21
Bandora...	1	...	3	...	1	...	2	...	2	...	2
Other Stations	2	...	1	...	...	...	...	...	3
TOTAL...	1	90	1	98	7	103	9	114	7	137	4	158
GRAND TOTAL...	91	99	110	123	144	162						

community according to districts.

July.		August.		September.		October.		November.		December.		TOTAL.	
Plague.	Other causes.	Plague.	Other causes.	Plague.	Other causes.	Plague.	Other causes.	Plague.	Other causes.	Plague.	Other causes.	Plague.	Other causes.
...	...	...	...	...	2	...	1	...	2	...	1	1	14
1	21	1	13	...	22	...	15	...	21	...	17	9	232
...	3	...	6	...	2	...	2	...	...	...	...	...	...
...	1	...	2	...	2	...	...	...	1	...	2	...	16
1	23	...	19	...	12	...	13	...	20	...	15	6	231
...	11	...	8	...	13	...	11	...	6	...	13	1	120
...	...	...	5	...	1	...	3	...	1	...	1	1	20
...	1	...	5	...	...	...	2	...	2	...	2	1	27
...	1	...	...	...	...	...	...	...	...	...	...	...	2
...	1	...	...	...	...	...	...	...	1	...	1	...	6
...	4	...	4	...	1	...	...	...	2	...	...	...	35
...	1	...	...	...	...	...	...	...	...	...	...	...	2
...	4	...	9	...	3	...	4	...	4	...	5	1	52
...	14	...	20	...	10	...	6	...	7	...	6	...	119
...	6	...	3	...	2	...	3	...	1	...	1	...	32
...	...	...	3	...	4	...	1	...	...	...	2	...	21
...	8	...	10	...	7	...	4	...	6	...	7	1	69
...	1	...	...	...	...	...	...	...	...	...	...	1	2
...	4	...	1	...	3	...	2	...	...	...	...	...	15
...	2	...	3	...	1	...	...	...	1	...	1	2	14
...	3	...	1	...	2	...	...	...	...	...	2	...	11
...	...	...	7	...	8	...	5	...	2	...	8	...	64
...	6	...	5	...	4	...	7	...	5	...	6	...	40
1	10	...	15	...	16	1	9	...	14	...	14	10	179
...	3	...	5	...	1	...	3	...	4	...	2	...	29
...	1	...	...	...	...	...	...	...	2	...	1	...	10
3	137	1	144	0	116	1	91	0	102	0	107	34	1,397
140		145		116		92		102		107		1,431	

Table B giving the mortality in the community during the past 16 years of the epidemic.

MONTH.	1896-97.		1897-98.		1898-99.		1899-1900		1900-01.		1901-02.		1902-03.		1903-04.		1904-05.		1905-06.		1906-07.		1907-08.		1908-09.		1909-10.		1910-11.		1912.		
	Plague.	Other causes.	Plague.	Other causes.	Plague.	Other causes.	Plague.	Other causes.	Plague.	Other causes.	Plague.	Other causes.	Plague.	Other causes.	Plague.	Other causes.	Plague.	Other causes.	Plague.	Other causes.	Plague.	Other causes.	Plague.	Other causes.	Plague.	Other causes.	Plague.	Other causes.	Plague.	Other causes.			
July	125	2	119	5	100	4	130	5	146	6	105	1	145	3	113	3	113	3	93	2	127	...	119	1	110	1	96	...	...	...	...
August	...	131	3	126	4	138	13	124	10	193	12	85	9	120	6	112	5	116	3	105	...	156	...	143	2	108	2	109	...	...	...	...
September	...	111	1	106	3	103	15	115	5	129	9	78	7	111	2	102	3	93	1	84	3	126	1	125	...	104	1	94	2	97	...	...
October	...	109	...	113	5	104	16	114	3	116	10	95	3	117	6	100	3	104	...	101	2	123	...	104	1	102	1	98	1	104	...	...
November	...	5	89	...	73	4	96	13	112	2	85	9	114	7	86	...	80	5	88	...	86	1	120	...	91	...	102	1	100	...	97
December	...	65	139	6	109	26	136	15	142	8	112	12	92	6	95	4	109	3	88	...	106	...	106	...	103	...	106	1	105	...	122
January	...	162	204	122	173	34	136	24	132	19	134	30	99	33	103	13	108	30	101	6	125	2	113	...	109	...	93	1	116	..	105	1	90
February	...	82	115	171	169	40	110	31	188	71	118	39	110	57	101	44	86	50	107	26	103	23	82	8	82	2	87	2	110	5	107	1	98
March...	...	40	75	108	150	58	149	45	146	68	128	43	113	59	107	72	102	54	106	60	100	36	116	22	149	31	98	8	100	9	114	7	103
April	17	84	31	92	42	121	42	149	21	113	24	115	67	112	47	88	31	98	60	98	36	121	39	110	48	119	16	109	45	126	9	114
May	3	109	7	110	24	129	14	132	6	117	10	98	17	105	6	108	21	118	26	133	17	102	16	129	19	123	32	110	23	106	7	137
June	1	115	1	95	3	100	4	155	2	110	6	110	10	86	3	84	8	130	3	98	...	104	8	121	7	107	7	120	3	100	4	158
July	9	133	9	115	3	137
August	3	138	...	114	1	144	
September	1	86	...	116	
October	80	1	91	
November	79	...	102	
December	135	...	107	
TOTAL...	375	1,406	452	1,435	248	1,422	236	1,639	220	1,501	210	1,214	276	1,288	206	1,192	216	1,262	188	1,232	122	1,396	94	1,385	111	1,259	85	1,538	98	1,687	34	1,397	
GRAND TOTAL.	1,781	1,887	1,670	1,875	1,721	1,424	1,564	1,398	1,478	1,420	1,518	1,479	1,370	1,623	1,785	1,431																	

9

99, Hornby Road,
Bombay, 27th January 1913.

FROM

SORAB K. NARIMAN, M.D., M.R.C.S., D.P.H.,
PHYSICIAN, PARSII FEVER HOSPITAL.

TO,

SHAMSUL-ULMA DR. JEEWANJI J. MODI, B.A. PH. D.
SECRETARY, PARSII FEVER HOSPITAL COMMITTEE.

Sir,

I beg to submit this short account of the working of the Parsi Fever Hospital during the plague-epidemic of 1912.

The Hospital was opened on 15th April 1912 for the reception and treatment of Parsi plague patients, and was closed on 20th June 1912. During this period only nine patients were admitted, two in April, six in May, and one in June.

All the nine cases treated in the Hospital were plague cases; of these six died and three recovered. The hospital mortality was therefore 66.6 per cent, which is considerably higher than the average of previous years. Plague mortality

Of the 9 patients, 6 were females of whom 4 died and 2 recovered, and 3 were males, of whom 2 died and 1 recovered.

Two patients were admitted from Fort, both of whom died; five were brought from Khetwadi, of whom two recovered; one came from Chira-Bazar who recovered, and one from Fanaswadi, who died. Plague localities.

Four patients were admitted from one house in Ardesir Dady Street Khetwadi, two of whom recovered. Most infected house.

None of the patients were previously inoculated with Haffkine's plague prophylactic. Haffkinism

The type of the plague was of ordinary kind. The higher mortality is due to cases being brought at a later stage of the disease. Five patients were brought on the third or fourth day of the disease, that is from 50 to 76 hours after the first commencement of the disease; of these five cases four died. Virulence.

The total admissions in 1912 were considerably fewer than in any of the previous years since the establishment of the hospital in 1896-1897. Plague-subsideuce.

The following table shows the plague admissions, deaths, recoveries, and the plague-mortality rate in the Parsi Fever Hospital since 1900, and also total recorded plague-deaths in the Parsi community.

Year	Plague admissions	Plague deaths	Plague recoveries	Plague-deaths per cent	Plague-deaths in the community.
1900	141	90	51	63.8	193
1901	117	59	58	50.4	245
1902	59	34	25	57.6	185
1903	122	70	52	57.3	264
1904	121	65	56	53.7	207
1905	121	64	57	52.9	201
1906	127	62	65	48.8	189
1907	89	49	40	55	115
1908	44	26	18	59	97
1909	70	35	35	50	114
1910	23	9	14	39.1	81
1911	51	30	21	58.8	95
1912	9	6	3	66.6	34
TOTAL...	1,094	599	495	54.7	2,020

The substantial decrease in the plague-deaths in 1912 gives us hopes that plague will gradually disappear, and the Parsees of Bombay will in a few years recoup the great loss in their number caused by plague. If the gradual fall in the total mortality, and the small rise in the birth-rate noticed for the past few years be maintained, the community will soon return to its normal healthy conditions of pre-plague years, viz, a death-rate of under 24 per 1000 (from 1100 to 1150 deaths in a year), and a birth-rate of over 25 per 1000 (from 1200 to 1300 births in a year).

Presents

Besides a few rupees collected from the Hospital-box, the following presents were received for the use of the Hospital which were accepted with thanks to the donors :—

- (1) Mr. Piroshaw Dinshawji Bode sent 1 cwt. of sugar, 1 doz. jam-tins 6 bottles of essence of coffee, 6 bottles of Vibrona-wine and 4 bottles of brandy.

- (2) Mrs. Jerbai Nowroji Wadia sent 40 yds. of sheeting-cloth.
- (3) Lady Clarke Works-Guild sent through Mrs. Dhunbai Dinshawji Parakh 24 bed-sheets.
- (4) Messrs. Edulji Brothers sent some medicines for the Hospital.
- (5) A Parsi gentleman sent through Ervad Rustomji B. Ranji 2 dozs. napkins and 10 yds. of M'Kintosb.

For the continuous help to the Hospital our thanks are due to (a) Messrs. S. B. Fraser & Sons for supplying ice, (b) Messrs. Hormusji Adarji for supplying tea and coffee, (c) Messrs. Edalji Nusserwanji for keeping in order the Hospital ambulance, (d) Messrs. Jamsetji Muncherji & Co. for keeping in good order the Kitson-lights, and (e) Messrs. Rashid Namdar Irani for supplying biscuits.

Dr. Jamshedji Nusserwanji Bhada, L.M. & S. and Mr. Ruttonji Ardesir Contractor performed the duties of Resident Medical Officers to my entire satisfaction. They also looked after the general management of the Hospital, and arranged for the feeding of patients. Ervad Rustomji Bejonji Ranji and Mr. Ruttonji Cowasji Mistry of the Doongarwadi Staff rendered me help as required. The nursing work was satisfactorily performed by two Parsi nurses who had done work in the Hospital in previous years.

I tender my best thanks to all the members of the Hospital Committee, especially the Trustees of the Parsee Panchayet Funds, for their cordial support in all matters connected with the Hospital. Mr. Muncherji P. Khareghat, and Dr. Jeewanji J. Modi visited the Hospital on several occasions and made kind inquiries about the welfare of the patients.

I beg to remain.

Sir,

Your most obedient servant,
SORAB K. NARIMAN, M. D.

