PLAGUE IN FURTHER INDIA.

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Further India has been affected by plague to a small extent in comparison to the Indian Empire. Some considerable interest therefore attaches to the comparatively unimportant local outbreaks which occur, from time to time, in the Malay Peninsula. It is generally very difficult to explain the reason for their limitation and to determine, with any degree of accuracy, the source of the infection. Kelantan, a small but populous and fairly healthy Native Malay State, situated in geographical position between 4° 45′ and 6° 25′ lat. N., and 101° 30′ and 102° 40′ long. E., has only been exploited by European enterprise during the last seven or eight years. The State seems hitherto to have escaped from plague. The Kelantan Malays in fact, so late as 1905, looked upon plague as a new disease and, for want of a better name, then referred to it as the "penyakit leher" or "neck sickness." Numerous deaths from this so-called "neck sickness" were reported by the natives of the interior to have occurred at some remote villages in the month of May 1905. The illness appeared from the clinical descriptions given by the Malays at the time to have been bubonic plague. It was not thought necessary however by the Kelantan Government to take any special precautions to prevent its spread, and the disease disappeared of its own accord in a few months' time.

Late in 1907, plague broke out among a gang of imported Javanese coolies who had been working throughout the year on a part of the Duff Development Concession, which is situated in the interior of Kelantan. It was at once recognised by the local Malays as the new disease, or "penyakit leher," of 1905.

In this instance, prompt preventive measures were taken by the Duff Development Company and no wide-spread epidemic occurred,

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but it is not easy to say whether the limitation was really due to the precautions taken, or to the climatic conditions of the Malay Peninsula, which seem to prevent the spread of plague in an indirect way, or to the keeping of cats—a co-operative measure which as Lieut.-Colonel Buchanan (1908) has lately pointed out—seems to have some indirect controlling influence over plague in India.

The plague in Kelantan occurred on a part of the Duff Concession, which is being opened up by the planting of a rubber estate, situated about one hundred and fifty feet above sea level and sixty miles inland, located on the left bank of the main river and some fifty miles from the capital of the State. Among many commercial possibilities in Kelantan the planting of rubber is attended with success because, speaking generally, the earth is fairly loose, and although poor in chemical composition, like the generality of soils elsewhere in Malaya, is well adapted by favourable physical and meteorological conditions to the successful growth of the trees.

In 1907, the total rainfall for the interior was 120·54 inches, with 176 rainy days; the mean average maximum temperature in the shade for the year was 85·7° F., and the average mean minimum temperature 70·9° F.; shade maximum temperature 90·5° F., and minimum 67·0° F. The climate is therefore naturally suitable for planting in being uniformly hot as well as constantly moist, a condition which appears to be unfavourable to the propagation of the fleas which are so commonly associated with man and domestic animals in the hotter, drier and more sandy parts of the tropics.

The flea (*Pulex irritans*) as a parasite of man and as distinct from the bug ("pijat," in Malay), is unknown to Malays in this part of Further India. There is no distinctive name for it, but the dog flea is well known as "kutu anjing" (lit. "dog louse"), probably because it is the most common species; the lighter coloured cat flea is not specially identified by Malays, neither is the smaller black goat flea commonly found on kids. A rat flea again is not specially recognised, although rats as well as mice are generally to be found in the bamboo huts of any Malay village community. A certain amount of paddy, or rice in the husk, is always stored either within or underneath the houses, which are almost invariably raised some feet from the ground.

The keeping of cats is a national Malay convention which is common to other Mohammedan people, but in Malaya the influence of folk-lore has an additional significance. The ancient superstitious faith of the Malays before their conversion to Mohammedanism seems to survive

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in the everyday treatment of their cats and to afford them some protection.

Among many curious ancient Malay beliefs concerning mammals, is one that an evil genius pertains to both the rat and the cat. Clothes, for instance, however costly, that have been nibbled by rats must not be worn again. A cat is always driven out of the house in the event of a death; it is most unlucky if perchance a cat should brush against a corpse, the dead may stir. It is even more unlucky to kill a cat outright, and consequently at least one or two ill-favoured cats are to be found in almost every Malay dwelling-place.

The fact that they kill rats is the reason which is invariably given for their tolerance.

In the Malay State of Kedah there is even a special exclamation, "puspas," for driving away the cat from the primitive household dresser, but should it become too tiresome any Malay cat is banished from the village by common consent. As a last resource, it is tied, in Kelantan, by the neck to a stake, fixed on an improvised raft, and floated down stream. The unfortunate village cat again is not unfrequently drenched with water in the hope, by this means, of averting a threatened period of drought. There happened to be no cats on the Company's rubber estate: a fact which is interesting as giving negative support to Lieut.-Colonel Buchanan's hypothesis.

In 1907, for the development of the plantation, about 140 Javanese, 120 indentured Chinese coolies or "sinkhehs," and a variable number of local Malays were employed in clearing, burning and draining the jungle.

The conditions of labour necessarily involved in the development of a new territory were rough and ready, and the health of the imported coolies had in consequence not been good.

Early in November, three deaths occurred suddenly among the Javanese, followed by three others within twenty-four hours. Damp and comparatively cold wet weather, which is usual in the North East Monsoon period, had now set in, and these sudden deaths marked the commencement of a small outbreak of plague which eventually caused 13 deaths out of 31 cases as shown in the accompanying table.

The epidemic began at the time of the Malay "hari raya," an annual native festival which follows the "bulan puasa," or regular Mohammedan fasting month. The occurrence was at a particularly wet season of the year when a migration of rats to the coolie lines, owing to a scarcity of food in the field, might have been thought of, but the early

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diagnosis of plague was more than usually difficult because the early symptoms happened to be masked by those of acquired alcoholism.

The type at first was pneumonic and very fatal, followed by an evident bubonic but very mild form of plague and finally resolving into pestis minor.

The Javanese on the estate held the national holiday on the 8th, 9th and 10th days of November, and many of them, not being very strict Mohammedans, indulged in some cheap brandy in order to celebrate their merrymaking. Two boys, Kassim and Kasti, were admitted to hospital on the 10th of the month for pneumonia and pleurisy, but no special importance was attached to their cases; both however died of plague, one on the 13th and the other on the 14th of November. On the 11th, Sakimin, a male dancer, died suddenly at the estate, and his death was supposed by the Superintendent to be due to alcoholism with heart failure from over-exertion in dancing and exposure to the rain. Another male dancer, Mortostiko, died suddenly on the following day. At autopsy alcohol was found in the stomach and there was consolidation of both lungs, but no distinctive buboes being noticed, the real cause was again mistaken and the cause of death returned as pneumonia. On the evening of the same day a third dancer, Matjas, a tailor by trade, died suddenly at the plantation: the autopsy revealed recent pleurisy and dilatation of the heart with acute congestion of the lungs and kidneys. A number of enlarged, deep reddish, lymphatic glands were found in the retro-peritoneal fossae and the diagnosis of plague was made, but there were no characteristic buboes. There was an open wound on the left leg. Other deaths followed in quick succession, all with pulmonary symptoms; Kasti on the 14th, Wagio on the 15th with broncho-pneumonia and diarrhoea, Sutaruno on the 17th—the most typical and virulent example which had so far occurred—Nagadikon on the 20th with leading symptom of pleurisy, Tipostiko on the 21st with pneumonia, Kamso on the 22nd with pleurisy and pneumonia, and Matsariwi on the 23rd with pneumonia. Matsariwi was the last case of the kind, and although no alcohol had been taken, his primary symptoms much resembled those of drunkenness. The autopsy of this Javanese revealed the presence of a horseshoe example of "solitary kidney" which was bound by adhesions to the spinal column. The bad effect of alcohol in plague, other than in medicinal doses, appears to have been only relative in this small epidemic. Out of seven dancers (Kasanpaiviro, Katimin,

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Mongin, Mortostiko, Matjas, Sakimin, and Samirah), four had regaled themselves with brandy, and of these only two died, one of them (Katimin), in whose sputa *B. pestis* was found, recovered and the other escaped infection. Of the remaining three, who all drank syrup and water, only Matjas the tailor died suddenly and the other two remained in good health. One of the two that escaped, Samirah, is a woman and it is remarkable that the epidemic, with the one exception of Parsem, a girl coolie and a prostitute, was confined to the male coolies. The children, about fifteen in number, all escaped except one; they lived with the women at the further end of the coolie lines. One little boy, Kader, having no mother, lived with his father in the Javanese male quarters; he fell ill but recovered in hospital from an attack of broncho-pneumonia complicated with large cervical buboes. It was not difficult to demonstrate the presence of *B. pestis* in the sputa of these cases, but no very profuse sanious expectoration was observed in any of them.

Although plague never occurs in equatorial regions in a bad epidemic form, the gravity of individual cases is maintained. This was exemplified in the case of Sutaruno, a strong man who was brought from the estate as suffering from mumps. *B. pestis* was found in the secretion of the parotid buboes, and hyperpyrexia very rapidly ran into delirium followed by coma and death within twenty-four hours of his admission to hospital. Shortly before his death large numbers of small, superficial, subcutaneous haemorrhages occurred, depicting, in livid colours, the malignant nature of the case. Four days afterwards, Hamat bin Janka, an in-patient under treatment for rheumatism, who had volunteered to nurse this case, developed cervical buboes followed by inguinal buboes but ended in recovery. In the first week there were eight Javanese deaths out of fourteen cases; and of these fourteen cases all except five were characterised by pulmonary symptoms and nearly all were under the age of thirty. A typical example of the sudden collapse which may occur in plague was afforded by Kamso, a young Javanese who left the estate in a quarantine boat for admission to hospital, apparently in no very precarious condition. He died suddenly on landing through being allowed to walk up the river bank which is rather steep. No evident bubonic swellings could be seen or felt after death, but dissection disclosed a mass of deep glands in the right femoral region; both lungs bound down by thick yellow adhesions; the pericardium very much thickened and containing an excess of fluid, the heart dilated; both lungs oedematous and hyperaemic with

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haemorrhagic infarcts in the lower lobes, the liver enlarged and both kidneys congested.

The earliest cases of a simple bubonic nature were noticed among the Javanese between the 15th of November and the 8th of December; there were eight altogether and with the exception of one (Kromorjo), they all recovered; four had inguinal buboes, three femoral and one an axillary bubo.

The virulence of the epidemic appears to have been exhausted by the end of November, shortly after recommendations for the prevention of the spread of plague had been very strictly put into force. Up till now the Chinese "sinkhehs," who lived in separate quarters but quite close to the Javanese males, had all escaped; they as well as the Malays employed on the estate were all males, but the Malays dwelt at the further end of the lines near the female quarters about two hundred yards from the other coolies. There was consequently very little intercourse between the Malays and the male Javanese.

Pestis minor was diagnosed mostly among the Chinese "sinkhehs" who began to sicken with it in December, and of those coming within the incubation period (six to seven days) and isolated as "suspects," four developed buboes which could not be accounted for otherwise; these comprised two inguinal, one femoral and one axillary bubo. About the same time, some Chinese employed at the headquarters of the Company, nearly three miles from the estate, fell ill and four other cases were found, three with femoral and one with cervical buboes, but none of these men suffered much inconvenience; all recovered and several on admission might, by casual clinical examination, have been easily mistaken as suffering from malaria. Four of the total number were treated for double femoral buboes.

The actual channel through which the infection was imported to the estate was not determined. Popular suspicion rested upon some clothes brought in by Matjas the tailor, who went to Kota Bharu the capital, fifty miles away, to purchase goods for the coming "hari raya" festival. Kota Bharu was known to be free from plague by the Siamese medical officer and the resident English officers representing the Government of Kelantan, and he returned from there on October 25th, sixteen days before the first case. His purchases consisted of a few pounds of some pleasant tasting seeds (basil), some syrup, sugar and a variety of clothes among which were three pairs of elastic braces. The clothing was not however unpacked until the first week in November, it was then put up for sale at the estate, and Samirah, the dancer, bought and wore some of it with no ill effects; Parsem wore some and

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was very ill, but the latter being a prostitute it is probable that she may have acquired infection in some other way. The braces, said to have been imported from Bombay *viâ* Singapore, were bought by two of the men who died suddenly and the odd pair was given to a little boy (Jonet), a nephew of the deceased tailor.

All the clothing was sold, along with the other purchases, at a small native shop kept on the estate, at that time, by the Javanese headman. The shop was in a very insanitary condition, more especially in regard to ventilation, but although rice and other native food stuffs, such as cakes, sweetmeats, biscuits and the like, were stored, it never appears to have been over-run with rats. No mice were seen. A possible hiding place for fleas existed in some bullock hides which were stored among the rafters of the house.

In 1905, most of the deaths occurred inland on the opposite bank of the river, but a few Malays died from "penyakit leher" in a village near the site afterwards chosen for the dwelling houses on the plantation. This suggests that the former epidemic may have subsided owing to the heat of the South West Monsoon period of 1905 and, the infection remaining latent in 1906, may have revived during the coolest part of the year 1907.

Presupposing that a number of rats existed in the field, the hypothesis is not so improbable as it may seem at first sight. The infection, for instance, may have remained latent in the form of chronic rat plague. In 1907, the last burning of felled timber and brushwood on the plantation took place in the forenoon, late in October. It would certainly have driven any field rats from their burrows and may have caused them to seek shelter in the coolie lines which happened to be near at hand. Fleas imported by traders from without and introduced among the clothing brought in to the estate by Matjas the tailor may then have been infected.

The Company's hospital being situated up stream, a system of inspection in conjunction with a quarantine boat service was at once established; the patients were isolated and a crusade commenced against the rats found in the houses on the estate. This was done by means of traps and by killing them with sticks by hand. It disclosed some features of interest, as there were apparently very few rats, either in the shop or in the adjacent Javanese male quarters. No attempt was made to destroy rats in the field. The wet weather was unfavourable for the practice of suffocating them in their tunnels by means of carbon bisulphide. This method, which is used for the extermination of rats in the rice fields of the Federated Malay States, was recently introduced by the Director of Agriculture and would, in other circum-

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stances, be also of material benefit in checking the spread of plague. Out of a total of about fifty rats eventually killed on the estate, the majority came from the female quarters when the epidemic was practically over. They were nearly all young rats about the age of commencing sexual maturity and all of them were small black rats (*? Mus rattus*). A much larger brown rat, which is found in the native town of Kota Bharu, was not seen on the estate. It was of interest to find that most of the few rats that were caught in December were young ones because it has been shown in Egypt that the maximum pregnancy of the rat, in that country, corresponded with the maximum of plague and the literature of plague abounds with examples of epidemics in which a scarcity or disappearance of rats has been noted. No naked eye appearances of disease were recognised in four adult rats that were dissected or in five others that were examined; *Loemopsylla cheopis*, the flea of the black rat, escaped recognition although a sharp look-out was kept for its capture. For the destruction of these insects all the coolie lines were disinfected bi-weekly with a solution of Jeyes' fluid, about 1 in 40 in strength.

The hides were disposed of; all clothing which in any way appeared likely to convey infection was burnt, the shop pulled down and a number of minor precautions of local importance insisted upon. Quarantine regulations were dispensed with one month after the diagnosis of the last case, but still a good deal of anxiety was felt for the Malays on the estate who suffered from an ill-defined form of fever in the middle of December. They disbanded, returning to their homes to be nursed by their women folk as is their custom. Kelantan peasants are very conservative in their customs and in their belief of ancient superstitions, such, for example, as breathing or blowing over a cadaver in order to drive out a supposed evil familiar spirit; this and similar procedures, employed under exceptional circumstances, would render the scientific practice of plague prevention very difficult in Further India in the event of a serious epidemic of plague occurring among the Malay residents. Out of about forty Kelantan Malays however who might have been exposed to infection at the estate, happily only one death from "penyakit leher" was announced from the neighbouring villages and there has been no recurrence of the disease.

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A return showing the number of cases of Plague in Kelantan—1907.

No.	Name	Sex	Nationality	Occupation	Date of attack	Result	Clinical Remarks
1	Kassim	M	Javanese	Estate Coolie	10. XI. 07	Died 13. XI. 07	Leading symptom, pneumonia.
2	Kasti	M	,,	,,	10. XI. 07	Died 14. XI. 07	Leading symptom, pleuro-pneumonia.
3	Sakimin	M	,,	,,	11. XI. 07	Died 11. XI. 07	Died suddenly, leading symptom, alcoholism.
4	Katimin	M	,,	Mandore	12. XI. 07	Recovered	Leading symptom, pneumonia; *B. pestis* in sputa.
5	Mortostiko	M	,,	Estate Coolie	12. XI. 07	Died 12. XI. 07	Leading symptom, alcoholism, p.m. exam.
6	Matjas	M	,,	Tailor	13. XI. 07	Died 14. XI. 07	Died suddenly at the Estate, p.m. exam.
7	Wagio	M	,,	Estate Coolie	14. XI. 07	Died 15. XI. 07	Leading symptom, broncho-pneumonia.
8	Kader	M	,,	Child	15. XI. 07	Recovered	Pneumonia and cervical buboes.
9	Wongsolaksomo	M	,,	Estate Coolie	15. XI. 07	,,	Indolent femoral buboes.
10	Sutaruno	M	,,	,,	16. XI. 07	Died 17. XI. 07	Septicaemia, large cervical buboes, p.m. exam.
11	Matsariwi	M	,,	,,	17. XI. 07	Died 23. XI. 07	Pneumonia with deep glands, p.m. exam.
12	Kasanpaiviro	M	,,	,,	17. XI. 07	Recovered	Indolent inguinal buboes.
13	Madicom	M	,,	,,	17. XI. 07	Died 20. XI. 07	Acute pleurisy with deep glands, p.m. exam.
14	Kromorjo	M	,,	,,	17. XI. 07	Died 3. I. 08	Indolent inguinal buboes, asthenia.
15	Tipostiko	M	,,	,,	19. XI. 07	Died 21. XI. 07	Leading symptom, pneumonia.
16	Matajoh	M	,,	,,	19. XI. 07	Recovered	Bubo, right axilla, *B. pestis* found.
17	Mamat bin Janka	M	,,	,,	20. XI. 07	,,	Contracted in hospital from case No. 10; cervical and femoral buboes.
18	Kamso	M	,,	,,	22. XI. 07	Died 22. XI. 07	Died suddenly; p.m. exam., pleuro-pneumonia.
19	Parsem	F	,,	,,	22. XI. 07	Recovered	Indolent cervical and inguinal buboes.
20	Hamat Estart	M	,,	,,	23. XI. 07	,,	Indolent inguinal buboes.
21	Slamat	M	,,	,,	26. XI. 07	,,	Indolent inguinal buboes.
22	Kasanmuradi	M	,,	,,	27. XI. 07	,,	Indolent femoral buboes.
23	Talio	M	,,	,,	4. XII. 07	,,	Femoral buboes; *B. pestis* found.
24	Liang Ho	M	Chinese	Sinkheh	8. XII. 07	,,	Inguinal buboes; subsequently died of Beri beri.
25	Wong Kong	M	,,	Prisoner	8. XII. 07	,,	Indolent femoral buboes.
26	Lee Ah Choi	M	,,	Barber	10. XII. 07	,,	Indolent femoral buboes.
27	Tan Kit	M	,,	Sinkheh	15. XII. 07	,,	Bubo, left axilla; subsequently died of Beri beri.
28	Ang Niu Seng	M	,,	,,	15. XII. 07	,,	Indolent bubo, left groin; died of Beri beri.
29	Hai Tiam	M	,,	Station Coolie	15. XII. 07	,,	Bubo, left groin.
30	Chan Yow	M	,,	Sinkheh	17. XII. 07	,,	Indolent inguinal buboes.
31	Chin Heng	M	,,	Station Coolie	23. XII. 07	,,	Cervical buboes.

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