

## THE CARRIAGE OF PLAGUE

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PETRIE (1929) states that in his opinion, "experiments should be repeated on a large scale, because there is a sharp difference of opinion among plague workers on the mode of dispersal of infection over considerable distances", and Otten (1923) regards "human traffic, in the widest sense, as the only medium for the dissemination of plague to near and far distances".

It has been found extremely difficult to frame and carry out experiments on the carriage of plague under natural conditions, and meanwhile the following notes are offered on observations made on the carriage of the disease by human agency and maize.

Towards the end of 1935 a sharp recrudescence of plague took place in the Mount Kenya endemic area. A native from this district arrived at a mission station about 40 miles distant and died of pneumonic plague within 24 hours of his arrival. The orderly attending him also died of the pneumonic type within 48 hours of the death of the other. A missionary attending the orderly also contracted the same form, was removed to a nearby farmhouse amongst other Europeans, then taken from there in an open ambulance to Nairobi and died shortly after. No further cases resulted in this series.

About the same time a dead native was found in some bushes close to the European residential area of Nairobi, and post-mortem examination revealed that he had died of septicaemic plague. He was found to be a recent immigrant from the Fort Hall area. A further solitary case of plague was found dead about a month later close to the Indian residential quarter.

Two months later, in March 1936, a sick native was picked up on the roadside and found to be suffering from septicaemic plague.

Although these are isolated cases of plague, they do prove that Nairobi is open to and does receive infection by human agency, but the township has remained free from indigenous cases since 1932, and no infection has been established from such immigrants.

### CARRIAGE OF RATS AND FLEAS IN MAIZE

During February 1936, when large quantities of the Kenya maize crop were being exported, a survey of the rat and flea fauna of loaded maize trucks was carried out at Mombasa, the seaport of Kenya. Maize being the main foodstuff of many African populations in Kenya it would naturally be suspected as a most likely vehicle for rats and fleas.

The survey was carried out on similar lines to those adopted for cotton seed (Roberts, 1935). During the afternoons, the trucks were placed in sidings, and traps baited with sweet potatoes or tomatoes were set inside among the maize. The traps were removed in the early morning and tame white rats were then released to wander over the bags or loose maize until off-loading operations were commenced. During the first day it was found that the white rats were prostrated by the heat in the trucks if left longer than 3 hours inside. After that they were only left in the trucks for about an hour and were then replaced by fresh rats, as it was essential that the white rats should wander about.

During off-loading, careful watch was kept in case any rats escaped. None were seen, neither was damage to bags observed nor excreta found.

No rats were trapped inside maize trucks. Fleas were obtained from the white rats as recorded in Table I.

Table I

Station at which maize was loaded	No. of trucks	No. of maize bags	No. of open trucks	Fleas
Kitale	25	2652	14	1 ♂ <i>X. cheopis</i> 1 ♂, 1 ♀ <i>D. lypusus</i>
Nakuru	2	—	2	2 ♀ <i>X. cheopis</i> 1 ♀ <i>Ct. cabirus</i>
Butere	2	224	—	—
Chemelil	8	684	4	—
Hoey's Bridge	10	2693	—	—
Rongai	3	844	—	—
Fort Ternan	1	—	1	—
Sabatia	3	883	—	—
Lugazi	3	930	—	—
Njoro	1	275	—	—
Broderick Falls	1	280	—	1 ♂ <i>X. cheopis</i>
Yala	1	288	—	(Maize and Sinsim)
Koru	2	80	1	—
Soy	1	308	—	—
?	3	—	3	—

Total number of trucks examined = 66

Number of bags of maize = 10,141

Number of open trucks = 25

Fleas obtained = 2 ♂, 2 ♀ *X. cheopis*; 1 ♂, 1 ♀ *D. lypusus*; 1 ♀ *Ct. cabirus*

At the same time traps were set in the dock sheds into which the maize was off-loaded, with the following results:

Shed 3. 5 ♂, 9 ♀ <i>Rattus rattus</i> .	18 ♂, 18 ♀ <i>X. cheopis</i> . 1 ♂ <i>X. brasiliensis</i> .
Shed 4. 3 ♂, 5 ♀ <i>Rattus rattus</i> .	9 ♂, 10 ♀ <i>X. cheopis</i> . 2 ♂, 1 ♀ <i>X. brasiliensis</i> .

As rat runs were observed on the ground behind the sheds these were also trapped, yielding the following species of rats; no fleas were taken.

1 ♀ *Mastomys coucha*.

1 ♂, 3 ♀ *Arvicanthis abyssinicus*.

This survey showed that sixty-six maize-laden trucks contained only seven fleas and no rats. *D. lypusus* and *C. cabirus* can be ignored, since they do not carry plague in nature, and only four specimens of *Xenopsylla cheopis*, an

established vector of plague, were taken. Similar work carried out by George and Webster (1934) on the transport of rats and fleas in grain from their endemic centres agrees with these results. They only captured three field mice and field rats and their total catch of fleas was one *Ctenocephalus felis*. Their conclusion was that "Although it is not denied that plague infection could have been, and in all probability was, conveyed to Travancore by this route, the evidence so far as could be obtained was negative."

Mombasa, being the port to which enormous quantities of cotton seed and maize are sent from highly endemic areas inland, appears to be the ideal place for the transference of plague to shipping, either by merchandise, rats, fleas or human agency. The port itself has, however, remained free from plague for the last five years and not a ship has been reported to have become infected there, in spite of the heavy incidence inland and facilities offered for rapid transference of infected material.

Cotton seed and maize carry infinitesimal numbers of rats and fleas, and there is little likelihood of their being responsible for the carriage of plague.

#### SUMMARY

1. Nairobi township and other areas about the Mount Kenya endemic centre have frequently been penetrated by persons suffering from plague, but, at least during the last few years, plague has failed to become established in this way.

2. A survey of rats and fleas, conducted at Mombasa upon 66 truckloads of maize in transit, resulted in no rats being seen or captured, whilst only seven fleas (2 ♂ and 2 ♀ *X. cheopis*, 1 ♂ and 1 ♀ *D. lycopus* and 1 ♀ *Ct. cabirus*) were collected from clean white rats after they had been allowed to run about in the maize.

3. Although maize continues to be repeatedly unloaded and handled at Mombasa, this town has remained free from plague.

4. We have failed to obtain any evidence that the transport of maize from endemic centres by railway is a factor in the dissemination of plague.

#### REFERENCES

- GEORGE, P. V. & WEBSTER, W. J. (1934). Plague inquiry in the Cumbum Valley, South India. *Ind. J. Med. Res.* **22**, No. 1.
- OTTEN, L. (1923). *Rep. Dutch-Indian Med. Civ. Service*, p. 278. Java.
- PETRIE, G. F. (1929). *A System of Bacteriology*, **3**, Chap. 8.
- ROBERTS, J. I. (1935). The relationship of the cotton crop to plague, and its rôle as a vehicle for rats and fleas in East Africa. *J. Hygiene*, **35**, No. 3.

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