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Experimental transmission of exanthematic typhus through body lice

By C. Nicolle

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Medicine - Experimental transmission of exanthematic typhus by body louse. Note by Messrs. Charles Nicolle, C. Comte and E. Conseil, transmitted by Mr. Roux.

The study of recent epidemics of exanthematic typhus which have harried Tunisia, especially Tunis, Metlaoui and Redeyef (Phosphate mining installations at Safsao and Kerkennah islands, have led us to consider that the probable agent of transmission of the malady was an insect.

In Africa Minor (Carthage Area) typhus is a consequence of overcrowding and need; it harries the poorest populations and those which are the least careful in regards to hygiene; it is not contagious in a clean house or in a well appointed hospital. In those conditions only parasite insects of the lodgings, of the clothing and of the body, lice, fleas, bed-bugs could be suspected. The period at which typhus epidemics (spring) appeared made it unthinkable that mosquitoes, ticks or stomoxes had any role in it.

Several observed facts led us to limit our hypothesis to the louse. At the native hospital in Tunis, the incoming patients are washed and clad with clean clothes; no case of internal contagion was observed, there, notably during the epidemics of 1902 and 1906, in spite of the absence of isolation and of the presence of numerous bed-bugs in the rooms. The only contagion cases which were observed had occurred on the personnel whose duty it was to collect and disinfect the belongings of the incomers. In the Kerkennah islands, which are an endemic hotbed of typhus, the fleas are absent. Those insects swarm, on the contrary, all over the galleries of the phosphate mines; there, they attack without discrimination both the Europeans and the natives, and yet the latter alone are afflicted with typhus. Finally, we are acquainted with two observations where, after the ordinary incubation period, typhus has obviously followed the bite of a louse.

Those remarks were present in our mind when one of us succeeded in inoculating typhus to a chimp (1) and, after passing through the latter, to a Chinese macaca (*Macacus sinicus*). Thus, from the very outset of our research, we have attempted to achieve the transmission of the malady from monkey to monkey by means of a body louse.

Our experiments have been practiced: On Chinese macaca I, infected with the blood of a chimp (2), on the 16th day of the inoculation and in

(1) C. Nicolle, Experimental reproduction of exanthematic typhus in the monkey (Proceedings, 12 July 1909).

(2) Loc. cit., P. 159.

the hours which followed the appearance of the eruption, we placed 29 lice which had been collected that very morning on a person and had been kept without food for 8 hours.

On the next day and during the days which followed, we have transferred them on the Chinese macacas A and B. The monkey A was bitten for 6 consecutive days by 15, then by 12, 13, 8, 6 and 3 lice, and monkey B during 12 days by 14, then 15, 13, 9, 5, 5, 6, 5, 5, 4, 2 and 1 lice. Each day after the bite, the lice were mixed and put at a temperature of 16° to 20°. (C.)

The two monkeys A and B had previously served in experiments on Kala Azar; both were cured at the time of their inoculation and -- an important fact -- their temperature, which had been taken twice daily for the past 5 months (monkey A) and one year (monkey B) had never shown any thermic rise.

Monkey A (see curve here below). - Nothing to note until the 22nd day of the inoculation. At that date there is a rise of temperature to 39° and 39.9° (C.); then the temperature falls on the 23rd and 24th days. The temperature rose on the 25th day to reach or surpass 40° on the 26th, 27th and 29th days. Slow defervescence on the 30th to 34th days. On the 39th day, the temperature rose again; relapse of 5 days of duration with a classical thermic curve - (Maximum of 40.5° on the 41st day). Dead on 44th day in the morning.

General state rather good until the 30th day; at that date there was weakness, the animal ate less, was easier to catch. No eruption. Extreme agitation during the second fever period. Violet coloration of the lips on the last two days. Autopsy showed no lesion, except an ulceration at the caecum with an irregular surface covered with a diptheroid exudate. Spleen, 8 grams. The weight of this monkey went down from 1,500 gr. to 1,300 gr.

Monkey B (see curve below). - Nothing until the 40th day of the inoculation. On the 41st day, rise of temperature coinciding with the second fever push of monkey A. On the 44th day the temperature was 40°; defervescence starting on the 46th day and, on that same day, eruption. The only symptoms observed were a little weakness and a little less appetite; almost immediate return to health.

Passages. - With the blood of those two monkeys we inoculated several Chinese macacas. But, as we already have noted in all our past experiments, the virulence has rapidly descended.

Out of four Chinese macacas inoculated with A monkey, three (including one previously vaccinated with a virus inoculation) had an eruption; two had an aborted rise in temperature.

Two Chinese macacas inoculated with B monkey showed an aborted fever reaction, without eruption.

2-a.

Fig. 1 Lice July 1 August 1 August 13: dead at 11 a.m.

Fig. 2. ^{Lice} ~~lice~~ on July 1 August 1 Eruption

Fig. 1.

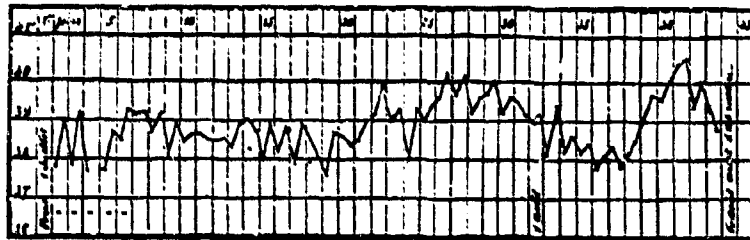
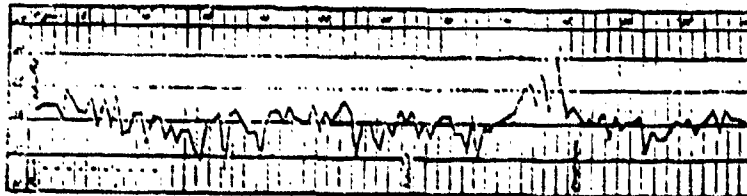


Fig. 2.



Hematological research carried out by Mr. Jaeggy have shown in two of these animals (the only ones submitted to this kind of observation) the same bloody lesions as those in monkeys afflicted with the clearest cases of typhus.

These experiments show that it is possible to transmit exanthematic typhus from a Chinese macaca who had been infected to a new Chinese macaca by means of a body louse. The application of this datum to etiology and to prophylaxy of the malady in man should be made. The measures against typhus invasions must aim at the destruction of the parasites; they will especially aim at the body, the body garments, the clothes and the bedding of the patients.

- (1) An experiment of transmission of typhus to *Macacus cynomolgus* with body lice collected on a patient afflicted with typhus had yielded a negative result, (when we tried it).