SAND-FLY FEVER IN INDIA.

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Newcomers to districts where the sand-fly, *Phlebotomus papatasii*, abounds, suffer from short febrile illnesses during the summer, when the fly makes its appearance. The chief symptoms are severe frontal headache, flushed face, suffused conjunctive, half-closed eyelids, tender eyeballs, pain on moving the head, eyes, or limbs, aching and stiffness in the back and legs, furred tongue, anorexia, sometimes vomiting; constipation, though diarrhoea is not infrequent; the temperature rises suddenly to 103° or 104° F., and falls gradually about the third day. The pulse remains slow. No parasites are found in the blood, but the leucocytes are diminished in number. Recovery always ensues. Second attacks are uncommon. In Herzegovina and Malta it has been proved by experiment that the virus which causes this fever is conveyed by the *P. papatasii*. It will be shown that epidemics of a similar febrile ailment prevail every summer in many parts of India. As the *P. papatasii* is widely distributed there, it is probable that destruction of this insect would be a sanitary measure of no little importance to the health of our Indian Army.

The significant increase in the admissions recorded under the headings "Influenza," "Simple Continued Fever," and "Pyrexia of Uncertain Origin," which has occurred in India during the last decade, makes it clear that many short febrile attacks, formerly classed in the ague group, are now regarded to be non-malarial in origin. The following table shows the number of cases among the British troops, 1900-1908:

<table>
<thead>
<tr>
<th></th>
<th>1900</th>
<th>1901</th>
<th>1902</th>
<th>1903</th>
<th>1904</th>
<th>1905</th>
<th>1906</th>
<th>1907</th>
<th>1908</th>
</tr>
</thead>
<tbody>
<tr>
<td>&quot;Influenza&quot;</td>
<td>237</td>
<td>539</td>
<td>107</td>
<td>215</td>
<td>349</td>
<td>1,014</td>
<td>804</td>
<td>864</td>
<td>432</td>
</tr>
<tr>
<td>&quot;Simple continued fever&quot;</td>
<td>1,479</td>
<td>1,486</td>
<td>846</td>
<td>1,300</td>
<td>1,684</td>
<td>3,115</td>
<td>3,917</td>
<td>2,553</td>
<td>5,077</td>
</tr>
<tr>
<td>&quot;Pyrexia of uncertain origin&quot;</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Days of sickness</td>
<td>27,980</td>
<td>31,310</td>
<td>18,652</td>
<td>24,540</td>
<td>30,150</td>
<td>53,380</td>
<td>57,426</td>
<td>37,580</td>
<td>66,070</td>
</tr>
</tbody>
</table>

The disability which has arisen from these diseases has become so large that a critical study of the subject can be delayed no longer. Influenza is a short-range infection, conveyed in the
droplets of saliva and mucus scattered by the sufferers in the acts of speaking, coughing, &c.; hence, its prevalence is greatest at the season of the year when people congregate most closely together in imperfectly ventilated rooms. Therefore, nearly all the numerous pandemics of influenza have arisen in the late autumn or winter months. The summer has remained conspicuously free. Now these are the monthly aggregate admissions for "influenza," 1900-1908, among the British troops serving in India:

<table>
<thead>
<tr>
<th>Month</th>
<th>Jan</th>
<th>Feb</th>
<th>Mar</th>
<th>Apr</th>
<th>May</th>
<th>June</th>
<th>July</th>
<th>Aug</th>
<th>Sept</th>
<th>Oct</th>
<th>Nov</th>
<th>Dec</th>
<th>Total 1900-1908</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>189</td>
<td>206</td>
<td>289</td>
<td>412</td>
<td>970</td>
<td>496</td>
<td>295</td>
<td>433</td>
<td>296</td>
<td>397</td>
<td>380</td>
<td>157</td>
<td>4,562</td>
</tr>
</tbody>
</table>

The so-called "influenza" has its maximum incidence in May, and its minimum in December, January, and February. This fact alone should render us cautious in accepting the diagnosis of influenza as being correct in every instance. Our suspicions are not allayed when we refer to the remarks on the infection in the Annual Reports of the Sanitary Commissioner for India. There is no record of the discovery of the influenza bacillus in any of these thousands of cases. Since there is no difficulty in finding it in abundance in the sputum of the early stages of influenza if films are stained with carbol-thionine blue, this negative evidence is suggestive. Again, the terms "influenza" and "simple continued fever" often appear to be interchangeable. In the year 1900 the summer epidemic of seventy-seven cases was named "influenza" at Barrackpore, and "simple continued fever" at Cawnpore, where 103 attacks were returned. In the following summer there were simultaneous outbreaks of influenza and simple continued fever at the latter station. At Rangoon in 1901, the April to June epidemic of sixty-two cases was shown as "influenza." There was no "simple continued fever." For four years the summer febricula was classed under both headings. While in 1907, 208 attacks of "simple continued fever" occurred during the period April to September, the "influenza" admissions had become reduced to three. The statistics of Fort William are similar. In the hot weather of 1904 there were forty-seven cases of "influenza" and forty-seven of "simple continued fever." There was no "influenza." In the summer epidemic of 1905, 423 of the hot-weather short pyrexial illnesses were called "influenza,"
and 213 “simple continued fever.” In 1906 the “influenza” incidence had swollen to 313 attacks, and the “simple continued fever” had fallen to twenty-one. In 1907 the summer outbreak of 262 cases consisted entirely of “influenza.” “Simple continued fever” had undergone extinction. Sometimes, while “influenza” has been raging among the native troops during the heat of the year, the British have been prostrated with “simple continued fever,” and vice versa. For example, at Quetta, from June to October, 1907, there occurred 197 attacks of “simple continued fever,” and four of “influenza” among the British soldiers. Among the native troops at this station during this period there were 265 admissions for “influenza” and only forty-four for “simple continued fever.” Conversely, while “influenza” was laying low 313 of the British troops at Peshawar during May to October, 1906, “simple continued fever” was thinning the ranks of the native regiments by causing 197 admissions to hospital. There was an outbreak of 82 cases of “influenza” among the British troops at Sialkot in 1908. Sixty-six of the attacks occurred during July, August, and September. The native troops, meanwhile were being incapacitated with “pyrexia of uncertain origin.” The Report for the year 1905 contains remarks on the Peshawar outbreak of “influenza.” There were 317 attacks among the British soldiers in May, and 108 in June. The symptoms were fever, headache, pains in the back and limbs, and prostration. Nausea, vomiting, and diarrhoea occurred in some cases. Ague was excluded by microscopical examination of the blood. This description harmonises with that of phlebotomus fever of the Mediterranean. Moreover, we have the weighty negative experimental evidence of McCarrison, who failed to induce the disease by inoculating the throats of healthy men with pharyngeal mucus derived from these “summer influenza” patients. He noted also that the outbreak ceased when the infected body of men was moved to a station at a higher altitude where the conditions were more favourable for the spread of true influenza. Doubtless, influenza has occasionally invaded India. L. Rogers states that instances of the disease occur for the most part in January, February, and March. The infection disappears in the hot weather. Inflammatory signs in the lungs and throat were nearly constant in the Calcutta epidemic of 1892. Therefore, the conclusion seems warranted that the “summer influenza” of India is phlebotomus or “sand-fly” fever.

The seasonal prevalence of “simple continued fever” and “pyrexia of uncertain origin” among the British troops 1900 to 1908 is here given.
It is seen that July is the month of maximum prevalence and December to March the period of minimum. The highest point on the ague seasonal prevalence curve is attained in October or November. On epidemiological grounds alone, therefore, it must be allowed that a large proportion of these seizures are non-malarial in origin. Also, it is repeatedly stated that the soldiers who have recently arrived in India are more prone to be attacked by "simple continued fever" than others. Nevertheless, many cases of ague are probably included in these figures, for we read in the Annual Reports that at some stations the diagnosis of ague has not been made unless the parasite has been discovered. Though painstaking and experienced observers, working under favourable conditions will find the haemamoeba in wellnigh 100 per cent. of cases of untreated malaria, those less expert, or hampered by climatic difficulties, will not attain this ratio of success, even when quinine has not been administered. A diagnosis of ague subject to such limitations would exclude many instances of the infection. On the other hand, Captain S. P. James, I.M.S., says in his report of the anti-malarial operations, Mian Mir, 1901-1902 (Report to the Malarial Committee of the Royal Society, 8th series, p. 32), that Christophers found parasites in only 40 per cent. of cases which were diagnosed "ague" in October, 1901. James detected the haemamoeba in but 45 per cent. of the admissions recorded "ague" in September, 1902, though no quinine had been given and repeated examinations were made. Doubtless, many non-malarial illnesses are returned under the heading of "Ague" where facilities for microscopic diagnosis do not exist.

"Simple continued fever" prevails in explosive outbreaks. Kamptee was visited by an epidemic in 1900; 220 attacks were registered, of which sixty-seven occurred in October. At Deesa, in 1901, 153 admissions were caused by it, half of which happened in September. The incidence in the Lucknow Division has risen from 810 attacks in 1905, when 667 admissions were registered during the period June to September, to 1,233 in 1908, of which 803 occurred during those months. Quetta has annual epidemics, with
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the maximum in September; 379, 398, 197 are the figures for the years 1905, 1906, 1907. Immunity is afforded by a previous attack. On the arrival of a susceptible body of men at a station where the fever prevails, many will be infected during their first hot weather in it. In the following summer the incidence will be much less. Thus, the Report for the year 1903 shows that 187 cases of "simple continued fever" occurred in the British troops in Multan, September being the month of maximum prevalence. In the following year Multan was almost exempt, seventeen admissions only being recorded. The native regiments suffered severely at Abbottabad in the year 1906; 1,220 admissions were registered "simple continued fever." The epidemic began in May and reached its acme in September when 556 cases occurred. In November the number had fallen to thirty-five. Next year there were fifty-five attacks only, although the strength of the body of men was the same. At Aden, in the year 1908, 215 admissions of British troops were recorded under "pyrexia of uncertain origin"; 160 of the cases occurred in June, July, and August. Here, as elsewhere, the hot weather febricula is sometimes called "influenza." The writer's own experience of the Aden "three-day fever" enables him to state that it resembles sand-fly fever of the Mediterranean. He failed to detect malarial parasites in the blood.

Since the occupation of Chitral in 1895 there have prevailed yearly epidemics of febricula during the months April to July. The Chitralis themselves recognise that this ailment differs from ague, which is also prevalent, though later in the year. Captain R. McCarrison, T.M.S., has made a special investigation in these outbreaks at Chitral and Kila Drosh. He has published such a valuable report in the Indian Medical Gazette, January, 1906, that no excuse is needed for here reproducing much of it:

"The fever is characterised by sudden onset, though occasionally vague pains, feelings of discomfort and disinclination for exertion precede the attack. There may be chilliness or a slight rigor, never the shivering and chattering of the teeth typical of the onset of the ague fit. Severe frontal headache, giddiness, pain in the eyeballs, aggravated by turning the eyes or moving the head, pains in the back limbs and knees, are complained of. The conjunctivae are suffused and the face is flushed. The skin is usually hot and dry, though occasional perspirations may be noted. No rash is observed. The temperature rises rapidly and attains a height of 103° to 104° F. in twenty-four hours. The pulse remains slow. With a degree of fever from 103° to 104° F. the rate is 80 or
90 only. Meanwhile, the patient is racked with pains in his body, head, and limbs, which any change of position, in order to get ease, aggravates. The patient resents being disturbed in any way. His tongue is coated with a white fur except at the tip and edges. Constipation is the rule, but vomiting and diarrhoea are not infrequent. There is total loss of appetite. Tenderness on pressure of various parts of the body is common; sometimes sharp, shooting pains are experienced along the nerves. Malarial parasites are not found in blood films. Leucopenia is marked; the average count is about 5,000 leucocytes per c.mm. The polynuclear leucocytes are diminished, while the mononuclears are increased. The incubation period is four or five days; new arrivals are predisposed. The temperature declines gradually to normal limits in two or three days. Epidemics vary; in some abdominal symptoms may be more marked than in others. Abortive attacks are frequent. Convalescence is protracted for a week or fortnight by a feeling of apathy and lassitude which prevents the sufferer from following his usual pursuits.

This account of "simple continued fever" given by McCarrison corresponds closely with "Pappatacifieber," the sand-fly fever of Bosnia and Herzegovina. This ailment differs from the kindred infection which occurs in Malta and Crete by the langour attending convalescence, hence the popular name for it of "Hundskrankheit." The Chitral fever therefore bears the closest resemblance to the Austrian infection investigated by Doerr. An abstract of Doerr, Franz, and Taussig's work on "Pappatacifieber" in which is included a description of the sand-fly, P. papatasii, and of its habits, appears in Lieutenant-Colonel Aldridge's useful "Note on Pappataci Fever," 1909, which has been circulated throughout India. McCarrison observed that it was the locality and not the individual which was infectious. He noted that a stay of a few hours in an infected spot was sufficient to originate the fever. Though he thought that the disease was possibly conveyed by dust, he remarked that the period of the outbreak corresponded in a striking manner with the appearance of sand-flies. The malady did not occur where these were absent. He experimented unsuccessfully with these insects. He could not overcome the great difficulty of keeping them alive in captivity. It was still more unfortunate that his attempts to induce the fever by inoculating seven healthy men with the blood of patients ended in failure. It is probable that he abstracted blood after the first twenty-four hours of the pyrexia. In phlebotomus fever the blood is virulent during the first day only,
All the subjects of his experiments were natives from the plains, who are relatively immune. None of them were attacked at a later period.

McCarrison was just on the verge of the discovery achieved by R. Doerr in 1908, who proved that the fever is caused by an invisible virus conveyed by the *P. papatasii*.

L. Rogers states in his "Fevers in the Tropics" that he has recognised the frequent occurrence of cases similar to McCarrison's "Chitral" fever in the hot weather in the Punjab and United Provinces which gave a temperature curve differing from malaria. James has inserted charts of the short non-malarial fevers of Mian Mir in the paper referred to previously. They are identical with those of phlebotomus fever of the Mediterranean. Lieutenant-Colonel G. Wilson, R.A.M.C. (JOURNAL OF THE ROYAL ARMY MEDICAL CORPS, June, 1909, p. 615), has made a careful study of the fevers of Ferozepore. He gives a table showing the seasonal prevalence of 2,064 cases of "simple continued fever," 1887-1906. It is a hot-weather—April to September—infection. July is the month of greatest incidence. The onset of the fever is seldom marked by a rigor. Headache is the chief symptom. Malarial parasites are absent. The temperature gradually falls to normal in three days or thereabouts. Lieutenant-Colonel J. J. Gerrard, R.A.M.C., recognises that the phlebotomus fever of Malta is identical in its clinical aspects with the short pyrexial illnesses which are common among the troops in the Punjab. Other officers who have had opportunities of observing these ailments in both localities agree that they are of the same nature. Therefore it is clear that before the admissions for the summer febricula are classed under "pyrexia of uncertain origin" a search for the phlebotomus should be made. The patient may bear the marks of its bites in the form of pimples, which are more irritable than those of mosquito bites. Sometimes, however, an urticarial spot arises which disappears in an hour or two, and every indication of the sting will have vanished next day. It is quite useless to accept the patient's statement that he has not been attacked by these flies. They are so minute that in an imperfectly lighted barrack-room they escape observation during the night. Search must be made for them in the daylight on the walls, behind clothes and accoutrements, doors, or shutters, in shady corners or crevices. A whiff of tobacco smoke often serves to dislodge them from their hiding-places. F. M. Howlett says that at least two species of phlebotomus are found almost all over India, and form the bulk of the pest known as "sand-flies."
Over North-east India the flies are most abundant at the end of September and beginning of October, the period when the short non-malarial fever is most prevalent at Fort William and Barrackpore. They appear in Bombay in March and April, according to A. Powell.

Since it has been shown that sudden outbreaks of a short fever, unlike ague, but similar to the phlebotomus fever of the Mediterranean, prevail every summer in various parts of India, and that the *P. papatasii* is widely distributed, it is suggested that many of the short febrile ailments, hitherto attributed to “influenza,” “ague,” “sun,” “confinement to the house,” “heat,” “chill,” “intemperance,” “water drinking,” “over-eating,” “lack of food,” “constipation,” “diarrhoea,” “excessive exertion,” “want of exercise,” “upsetting of the thermostatic centre,” “auto-intoxication,” “climate,” are caused by the invisible virus carried by the “sand-fly.” It is probable that out of the 26,000 cases of “influenza,” “simple continued fever,” and “pyrexia of uncertain origin,” which appear in the returns of the British Army in India, 1900-1908, 13,000 were instances of sand-fly fever.