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Contributors

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NOTES

ON

MALARIA

IN

CONNECTION WITH METEOROLOGICAL CONDITIONS
AT SIERRA LEONE

BY

MAJOR E. M. WILSON, C.M.G., D.S.O.
ROYAL ARMY MEDICAL CORPS

LATELY SENIOR MEDICAL OFFICER AT SIERRA LEONE

THIRD YEAR



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NOTES ON MALARIA

IN CONNECTION WITH

METEOROLOGICAL CONDITIONS AT SIERRA LEONE.

THESE tables were first undertaken with a view to ascertaining what effect, if any, was produced by the various meteorological conditions on the Malarial Fevers, endemic in this command. It was curious how much uncertainty prevailed on this subject, even among people who had the best opportunities for knowing; many "old coasters" declaring that they preferred the rainy season, and felt better in it. But, as the figures began to take shape it appeared that many other inferences might be drawn from them, perhaps not quite so obvious as the connection between the rainfall and malarial fever, and requiring a more extended series of observations, before they can be classed as facts; but still marked with considerable clearness and of sufficient importance to deserve mention. Granting at the outset that a period of seven years (eight years in the case of meteorological observations) is not sufficient to guarantee absolute certainty, the following points appear to be worthy of notice, and the inferences seem to be justified, at any rate for the present.

I. Each Battalion of the West India Regiment suffers exceptionally from fever the first year of its service on this coast; the number of admissions and deaths falling in a marked degree in the second, and still more in the third year.

II. The white troops suffer much more in proportion than the black.

III. The largest number of cases occur in the middle of the rainy season, in the period of the greatest rainfall and of highest relative humidity, and lowest temperature in the shade, *i.e.*, July and August.

IV. The smallest number of cases occur, broadly, in the period of least rainfall, least relative humidity, and greatest heat.

V. The most important factor in influencing the disease appears to be, not the rainfall itself, but the relative humidity of the atmosphere.

VI. The black troops are more affected by changes in the meteorological conditions than the white.

VII. The case mortality, or percentage of deaths to attacks, is small at all periods.

I. The first proposition will probably be contested by no one. It appears in Table I. with great clearness. In January, 1892, the 2nd W. I. R. completed their tour of service, and began to return

to the West Indies being replaced by the 1st Battalion, the transfer being completed in February. Although a detachment had been engaged on active service at the Gambia the sick rate was exceptionally small, but began to rise with the 1st West in March; and a glance at the remaining months of that year shews that they suffered severely. In 1893 and 1894, the monthly and annual ratio of admissions rapidly fell, and the Battalion was relieved in February, 1895, the 2nd West returning. The cycle at once recommences with great severity, and the fall in 1896 is considerable, in spite of the Ashanti Expedition. The Left Wing returned from Cape Coast in March, and the large number of admissions in this and subsequent months were mainly due to Malaria contracted or aggravated by exposure on active service. The invalids from this expedition were not transferred to the West Indies till January, 1897, otherwise the fall would have been more apparent.

II. The statement contained in the second proposition will also probably have been anticipated, the station having long been notorious for its unhealthiness for Europeans; but I believe the proportional relative liability of the two races, as brought out by Tables I. and II., will come as a surprise to many. Roughly speaking they shew the white troops as suffering from a sick rate twice, and a mortality seven times as great as that of the black (See totals of averages in Tables I. and II.). It is possible that a more extended series of observations may alter these conclusions, and, it must also be remembered, that the total number of white troops serving together on the coast at any time is very small, and therefore a few cases of fever, and even a single death show as large numbers when figured as proportional admissions and deaths per thousand, for comparison with the rest of the garrison, and their accuracy is necessarily somewhat diminished. On the other hand it may be said that invaliding is more easily carried out with the white troops, and therefore the totals are not swelled by repeated admissions of the same individual; and the actual deaths are very few in number.

The bulk also of the detachment R. E. does not serve continuously for twelve months on the Coast, but only in the dry (and healthy) season, when building operations can alone be carried on and when cases of fever are not expected to be so numerous or so severe.

On the whole, therefore, it appears certain that though proportions may vary, the Europeans *do* suffer exceptionally severely from the prevailing diseases.

III. The third proposition is not so simple, and an analysis of individual months gives the most puzzling coincidences. In the month of June, 1893, the rainfall was considerably below the average, yet the admission rate of the black troops was the highest for the year; and the same is true of June, 1894, with a low percentage of humidity. In May, 1895, under similar conditions, it was also excessively high. Again, January, 1896, appears to be altogether an average month as regards all meteorological phenomena, yet it is accompanied by a very high sick rate among both black and

white troops (in which the Ashanti expeditionary force is not included). To give one more instance, almost the lowest mean temperature in the shade recorded in these Tables, viz., August, 1897, is coincident with an abnormally low sick rate among both black and white troops.

But if all the averages are placed together, as is done in Table VII., excluding the deaths as too small to be any value as a guide, the general truth of the proposition appears at once, with the important exception that the month of August ought according to the theory to be more unhealthy than July which is not the case.

IV. The fourth proposition is the converse of the third, and a glance at Table VII. shews that broadly speaking it may be taken as correct.

The months of December, January, February, and March are practically rainless, the humidity is considerably less, and the average temperature in the shade distinctly higher. Compared with July and August the contrast comes out clearly. In fact it is impossible to suppose that the regular contemporaneous rise and fall of the first five columns and the reversed curve of that for temperature, can be accidental. Some of the rungs of the ascending and descending ladder are irregular, as for instance the low average humidity for April, and the fact of more cases of fever occurring in July than in August, but I believe that the statistics of future years will tend to diminish the discrepancies; and at any rate the prevalent opinions that the dry months are unhealthy, and that the beginnings and ends of the rains are worse than the middle must be dismissed as untenable.

V. This proposition is only put forward tentatively in the hope of arousing further inquiry. The subject seems to be very obscure, and it must be admitted at once that many facts appear to go against it. If it were absolutely correct, April, the month with the least relative humidity would be the healthiest, which is not the case. Individual months in different years may be quoted either way, but are not of much value. Besides this the statistics of the black troops are so much affected by the year of their tour (*see* Proposition I.) that they cannot be relied on. The gradual fall from the 1st to the 3rd year stands out so prominently that any other factors are thrown into the background. If, however, the statistics of the White troops are examined, some points in support of the theory may be observed. Varying but little in strength, and in their period of service on the Coast, in many cases being fresh men who only do one year in West Africa, they would seem to present fair material from which to draw inferences regarding climatic conditions. I admit that the period of years is too small and I hope to supplement or alter the results when the statistics of 1899 are available; but it may be noticed that the total annual number of cases *does* distinctly agree with the annual average humidity. Highest in 1892, with an average rainfall, and a high relative humidity, lowest in 1896, with the lowest relative humidity although with by far the highest rainfall.* Practically everyone appreciates the difference both mental and physical, between a day

* See Note on the year 1897, and also Note on year 1898.

or a month with heavy rain showers interspersed with bright sunshine, and the same period of dull steamy weather with rain constantly falling in small quantities. Further statistics must strengthen or correct this theory.

VI. This proposition is perhaps more recognisable by observation and experience than by figures, though figures *do* lend their support.

It is of course notorious that the coloured soldier cannot stand cold like the European, but I am of opinion that any departure from the average affects him more severely, and produces fever more rapidly than is the case with the white man.

In 1891 a small detachment of the 2nd W. I. R. was sent to garrison the Gambia, and I was struck by the disproportionate amount of fever that immediately occurred, apparently the result of increased humidity and diminished temperature. I observed the same in a marked degree in the Ashanti expedition, 1895-6, when the climate was hotter.

Comparing the years, 1895 shows a rainfall far below the average, and a less humidity; the admissions of the Black troops (first year) were 1,703 per thousand, far above the first year of the other Battalion (1892); and in 1896, although it was the second year of the tour, the admissions exceeded the first year of the 1st West. I am aware that this high number was partly due to the invalids from Ashanti arriving at Sierra Leone, but allowing for this I think the amount was excessive and to some extent due to the weather.

This year (1896) was remarkable for a very heavy rainfall and low humidity, while some of the months were very hot. These conditions did not affect the White troops, who on the contrary showed an admission rate below the average. I especially noticed the month of December when, a large number of men reported sick, the monthly admission rate much exceeding that of the White troops, which is unusual. The men themselves complained of the heat and said they could not do their duty.

VII. The case mortality, *i.e.*, the proportion of deaths to attacks is small. This is of course only relative to other diseases of a serious nature. Unfortunately as regards Malaria itself the mortality is high as compared with other stations where the disease is prevalent.

Table VIII. shows the average case mortality among White troops in eight stations compiled from A. M. D. Reports for ten years from 1886 to 1895 inclusive. Curiously enough the West Indies heads the list, not West Africa.* Perhaps extended observations may alter these figures. The death rate among West Indian troops is also higher than on the West Coast, but this is probably due to the deaths of invalids and others who contracted the disease in Africa.

As regards the mortality from other serious diseases, Table IX. shows the death rate from 10 serious varieties of disease (excluding cholera, plague, and others of an exceptional character) which are common to British troops all over the world.

* See Note, 1897.

These figures are also compiled from the A. M. D. Reports for the ten years from 1886 to 1895 inclusive, and show the average case mortality for those years for White troops for all stations, including the United Kingdom.

Malaria among the White troops in West Africa comes sixth on the list, which is a result satisfactory as far as it goes, though it may be hoped that in the future it may be still further improved.*

Finally, it will be asked, supposing all these propositions are taken as proved, and some it must be admitted are still problematical, what practical inferences can be drawn and what recommendations made for the abatement of a disease which, although the mortality is not severe, produces a non-effective list which is always large, and on active service must cause anxiety to a Commanding Officer?

As far as meteorological conditions are concerned probably but little can be effected. To attempt to diminish the total rainfall by de-forestation would appear to be a doubtful policy judging from 1895, which with the lowest rainfall, produced the highest number of admissions among the Black troops; while the heavy rainfall of 1896 was coincident with a low sick and death rate among the White; and the month of August, 1897, which was exceptionally wet, shows a low rate of admission amongst both.

To lessen the humidity seems more practical at any rate as regards the White troops and probably also the Black. The average humidity is less at Barbados and much less at Up Park Camp, Jamaica, and the average admission rate for Malaria is between 8 and 9 times less, though the case mortality is high. This, as stated above, is probably due to disease contracted on the West Coast. More extensive clearings of bush and the planting of Eucalyptus trees would probably be beneficial, and if the average temperature in the shade were slightly increased by these measures it might not be disadvantageous. The White troops do better in dry heat, as is shown by the figures for the years 1895 and 1896,* and the annual sick rate for the month of March (Table VII.). The effect on the Black troops is uncertain, but could hardly be injurious.

Passing from the meteorological conditions the most prominent fact undoubtedly is the large and constant diminution of cases of fever among the Black troops in the second and third year of their tour of service; and the necessary inference is that it would be advantageous to prolong the tour to four years.

I cannot think that even at the worst this would be injurious to their health, as at present the case mortality from all diseases, taken from the average admissions and death rates of the last ten years, is slightly lower on the West Coast than in the West Indies, viz., as 1.01 per cent. is to 1.05 per cent. of cases, and the admission rate for certain diseases is distinctly less.

It would also probably not be unpopular, as many men now exchange to stay in Africa, and the fixed Hospital Establishment who remain permanently are in my experience healthy and happy. Of course non-effective men should be invalided annually to the West Indies by steamer.

* See Note on year 1898.

As regards the Officers and European Warrant and N. C. Officers, the regulations as to leave might be extended in the third and fourth year, with but little expense, as the invaliding would be proportionately diminished.

Table II. would point to the withdrawal of as many of the White troops as possible during the rainy season; and I would suggest from my own experience the necessity of a *strict* medical examination in England in each case, before a European is permitted to return to the Coast after sick or ordinary leave. Cases have occurred in my own knowledge of men having been invalided twice and even three times at considerable expense; and great risk to the patients themselves.

Taking the 6th proposition as probable if not proved, viz., that the Native troops are more affected by changes in the meteorological conditions than the White, I would recommend that greater facilities be accorded for drying the men's clothes when wet; and that changing be insisted on as much as possible, even if extra clothing has to be issued. I am convinced that many cases of fever arise from this precaution being omitted.

In conclusion, although it has no connection with the preceding remarks, I would strongly support the recommendations made by many other Senior Medical Officers to reduce the meat and increase the vegetables in the existing rations, or if possible to put the men on ration allowance, as is done with the Haussas, and let the men provide for themselves.

Almost every case of fever among the Native soldiers that is admitted into hospital on the West Coast is complicated or aggravated by congestion of the liver, and not till this is relieved by excessive bilious vomiting, or the administration of simple remedies, is any progress made towards recovery. The men are admitted drowsy, sometimes almost comatose, jaundiced, practically poisoned by excess of nitrogenous food, and the change in 24 hours after simple medicines and very light diet is marvellous. So long as the meat is issued the men will eat the whole of it because they are entitled to it, looking on it as part of their pay. But the privilege they value most highly is to be put on ration allowance, as is the rule with the fixed Hospital Establishment, and men employed on certain duties. The fixed Hospital Establishment are undoubtedly the healthiest men in the garrison in spite of their prolonged service on the Coast, and I frequently inspected their dinners and inquired about their food. It was always largely composed of vegetables with very little meat.

Bearing on this point I would remark on the rapidly increasing number of cases of men with decayed teeth in the Regiment.

On my return to the West Coast after about four years' absence I could not fail to notice this fact, attributable largely to the excessive use of meat to which the men are unaccustomed. Certainly a far greater number of men reported sick with bad teeth in my second tour than in my first.

I cannot claim to have put forward anything remarkable or new in the foregoing observations. Most of the points have been noted before by various Senior Medical Officers, and some are merely

matters of common sense. I fancy, however, that they have not been previously collected together in one paper, or supported by similar series of Tables. I venture, therefore, to trust that they may be accepted for what they are worth, tested, corrected where wrong, and extended by future statistics, in the hope that some benefit may ultimately result to the public service, and to the troops garrisoning a station where I always received the greatest kindness, and where in spite of the much abused climate, a very pleasant portion of my service has been passed.

NOTES ON 1897.

The statistics of 1897 have now been tabulated and show the following results :—

I. The total admissions of the Black troops have sunk to 720 and there are no deaths, thus fully bearing out the remarks in Table I. regarding the health of the W. I. Regt. in the 3rd year of their service.

The S. M. O. notes in the December report that "the 1st W. I. Regt. arrived during the month and already furnish many admissions."

II. The admissions of the White troops is the lowest for the 6 years, but is partially compensated for by the increased death rate, which has raised the comparative mortality of the White troops to the Black from seven to eight times, on the average of the 6 years, the comparative admission rate of 2 to 1 remaining about the same.

III. Table III. average monthly admissions and death rate of all troops following on the two preceding, naturally shows a slightly diminished admission, and increased death rate.

IV. Bearing on the 5th proposition it may be remarked that notwithstanding the exceptionally heavy rainfall in August, the humidity is the lowest in the 6 years and so also is the number of admissions of the White troops. A comparison of the figures for the last few years certainly shows that the relative humidity has been steadily decreasing, and with it the number of admissions of White troops.

V. Table VII. has been entirely recast, and it is hoped that each additional year may give more correct averages, but it may be noted that the regular contemporaneous rise and fall of cases, rainfall and humidity and the reversed curve of temperature remains unaltered.

The average humidity of April has increased, with an abnormally high rate of admissions among the White troops, but the number of admissions is still much higher in July than in August, showing that some important factor still remains unexplained.

VI. Tables VIII. and IX. have also been re-calculated from the A. M. D. Reports for the last 10 years, without showing much alteration, except that in the case mortality for malarial fever among White troops, the West Coast now heads the list and

appears to be 6th instead of 7th in the list (Table IX.) of serious diseases among White troops at all stations, and Ceylon is exalted into the "bad eminence" of third place.

That the Malaria of West Africa is somewhat different to that of India is proved by the fact that the case mortality is more than 10 times greater.

NOTES ON 1898.

The statistics of 1898 have now been added and show the following results.

I. The admission and death rates of the non-European troops have risen considerably, this being the first year of the tour (compare 1892, which was the first year of the same battalion in its former tour). The S. M. O. writes that "the W. I. Regt. furnished many admissions to Hospital in its first year." The numbers would probably have been still larger but for prompt invaliding, 171 cases having been transferred to the West Indies and 50 to St. Helena.

II. The admission rate of the European troops is a little below the average, though higher than the three preceding years, when the heat was greater, but the death rate is the lowest of the series.

III. Table III. of former years, which showed the average monthly admission and death rate of all troops combined, has been omitted, as the mixed statistics of European and non-European troops seemed to be of little practical value.

IV. The rainfall for the year is low, and the shade temperature is the lowest in the series of years, but the humidity is higher than in the three preceding years 1895-6-7, and so is the admission rate of European troops (see Proposition V.).

V. Table VII., comparison of averages, has been re-calculated with the new figures, and it may be remarked that apparently something approaching accuracy has been obtained, as, notwithstanding some wide individual deviations, the figures remain almost unaltered, and the statistics of 1898 lend weight to the propositions formulated in 1896.

VI. Table VIII. has been made out from the A. M. D. Reports, the average of the last ten years 1887-96 being taken. The mortality from malarial fever has decreased at all stations with the exception of the Straits Settlements, where it has increased considerably; but West Africa still comes a very *bad* first, and the mortality is still ten times greater than that from the same cause in India.

VII. Table IX. has also been re-calculated from the last A. M. D. Report (average of 10 years) and the important class of Nervous diseases, apart from Mental, introduced, thus putting Malarial Fever on the West Coast into the 7th place among serious diseases which claim their percentage from the British Soldier.

April, 1899.

TABLE I.—NON-EUROPEAN TROOPS.
Ratio per 1000 of Admissions and Deaths from Malarial Fevers in West African Command.

Month.	1892.		1893.		1894.		1895.		1896.		1897.		1898.		TOTAL.		AVERAGE.	
	Admissions.	Deaths.	Admissions.	Deaths.	Admissions.	Deaths.	Admissions.	Deaths.	Admissions.	Deaths.	Admissions.	Deaths.	Admissions.	Deaths.	Admissions.	Deaths.	Admissions.	Deaths.
January .	28	—	100	—	13	—	16	—	91	2	80	—	35	—	363	2	52	.3
February .	8	—	74	—	51	—	37	—	83	—	30	—	47	2	330	2	47	.3
March .	36	1	68	—	31	—	53	1	135	1	35	—	83	1	441	4	63	.6
April .	146	4	53	—	15	—	70	—	120	3	58	—	140	—	602	7	86	1.0
May .	119	1	35	—	30	—	229	3	124	—	72	—	87	1	696	5	99	.7
June .	146	1	97	—	99	—	213	1	178	—	72	—	91	1	896	3	128	.4
July .	212	3	95	—	79	—	280	—	212	—	122	—	200	—	1200	3	171	.4
August .	79	3	91	—	56	1	291	—	118	—	72	—	102	—	809	4	116	.6
September	117	1	69	—	72	1	202	—	52	—	52	—	70	.5	634	2.5	91	.4
October .	109	1	50	—	55	2	110	—	63	—	48	—	35	—	470	3	67	.4
November	125	1	22	—	37	—	134	—	53	—	36	—	95	2	502	3	72	.4
December	108	2	14	—	28	—	68	—	67	—	43	—	121	.5	449	2.5	64	.4
TOTAL	1233	18	768	Nil	566	4	1703	5	1296	6	720	Nil	1106	8	7392	41	1056	5.9 =
Average—Monthly	103	1.5	64	Nil	47	.33	142	.42	108	.5	60	Nil	92	.7			The average annual admission and death rate for the 7 years.	

TABLE II.—EUROPEAN TROOPS.
Ratio per 1000 of Admissions and Deaths from Malarial Fevers in West African Command.

MONTH.	1892.		1893.		1894.		1895.		1896.		1897.		1898.		TOTAL.		AVERAGE.	
	Admis- sions.	Deaths.	Admis- sions.	Deaths.	Admis- sions.	Deaths.	Admis- sions.	Deaths.	Admis- sions.	Deaths.	Admis- sions.	Deaths.	Admis- sions.	Deaths.	Admis- sions.	Deaths.	Admis- sions.	Deaths.
January .	119	—	24	—	64	21	70	—	228	—	38	—	109	—	652	21	93	3
February .	43	21	179	26	43	—	200	—	98	—	73	—	57	—	693	47	99	6.7
March .	42	—	23	—	67	—	63	—	82	20	73	—	62	—	412	20	59	2.9
April .	130	—	93	—	73	—	63	—	143	—	186	—	54	—	742	—	106	—
May .	233	—	163	—	94	—	276	21	400	—	244	—	168	—	1578	21	225	3
June .	472	—	258	—	475	—	200	—	250	—	415	—	361	10	2431	10	347	1.4
July .	667	—	406	—	474	—	333	—	333	—	222	28	454	—	2889	28	413	4
August .	385	38	406	—	486	29	314	—	77	—	103	—	197	—	1968	67	281	9.6
September	286	—	241	—	323	—	88	—	24	—	74	—	175	—	1211	—	173	—
October .	193	—	97	—	64	—	177	29	71	—	104	—	143	—	849	29	121	4.1
November	216	—	79	—	132	—	42	—	119	—	143	36	141	—	872	36	125	5.1
December	122	22	89	—	73	—	100	—	49	—	71	—	143	—	647	22	92	3.1
TOTAL	2908	81	2058	26	2368	50	1926	50	1874	20	1746	64	2064	10	14944	301	2134	42.9 =
Average— Monthly	242	6.7	171	2.2	197	4.2	161	4.2	156	1.7	146	5.3	172	.8			The average annual ad- mission and death rate for 7 years	

TABLE IV.

Average Monthly and Annual Rainfall from 1891-1898 inclusive.

Month.	1891	1892	1893	1894	1895	1896	1897	1898	Total.	Average.
January	—	—	4'15	0.33	1'94	—	—	—	6'42	.80
February	1'14	—	—	—	'26	—	4'21	1'28	6'89	.86
March	—	3'83	3'41	0'18	1'61	'74	'10	'04	9'91	1'24
April	9'32	1'98	5'23	3'32	2'78	3'50	6'76	2'03	34'92	4'36
May	12'72	18'81	16'43	15'06	5'29	19'26	15'68	9'39	112'64	14'08
June	24'98	10'87	13'28	22'80	17'57	25'56	12'63	21'27	148'96	18'62
July	32'07	24'34	35'06	34'10	34'76	46'23	28'26	31'89	266'71	33'34
August	31'62	30'37	42'22	34'91	26'76	46'96	55'35	43'51	311'70	38'96
September	40'20	48'05	21'73	26'73	24'64	31'64	24'64	21'14	238'77	29'85
October	11'75	20'91	25'00	12'84	5'40	24'28	10'53	6'29	117'00	14'63
November	9'22	5'47	2'00	4'31	3'78	5'15	5'41	7'90	43'24	5'41
December	2'43	1'40	3'90	1'42	—	'23	'74	—	10'12	1'26
TOTALS	175'45	166'03	172'41	156'00	124'79	203'55	164'31	144'74	1307'28	163'41

TABLE V.

Average Monthly Relative Mean Humidity per cent., 1891-1898 inclusive.

Month.	1891	1892	1893	1894	1895	1896	1897	1898	Total	Average.
January	78	71	74	66	68	71	65	69	562	70'2
February	74	73	63	68	69	63	67	69	546	68'2
March	76	73	67	68	66	62	65	65	542	67'7
April	66	73	67	66	68	63	68	67	538	67'3
May	80	77	73	74	71	70	70	71	586	73'3
June	79	76	78	75	77	79	75	78	617	77'1
July	87	89	83	81	79	82	81	82	664	83'0
August	85	88	83	84	80	81	86	85	672	84'0
September	84	87	82	80	80	81	81	83	658	82'2
October	79	83	89	77	74	78	74	79	633	79'1
November	79	81	74	74	72	76	71	73	600	75'0
December	76	81	73	71	70	66	68	70	575	71'9
Total	943	952	906	884	874	872	871	891	7193	899
Average	78'6	79'3	75'5	73'7	72'8	72'7	72'6	74'2	899*	75*

* Average annual and monthly for 8 years.

TABLE VI.

Average Mean Monthly Temperature in the Shade, 1891-1898 inclusive.

Month.	1891	1892	1893	1894	1895	1896	1897	1898	Total	Average.
January	82.5	82.2	79.0	80.5	81.8	80.9	81.3	78.2	646.4	80.8
February	82.8	81.3	80.0	81.4	81.5	82.0	81.5	77.7	648.2	81.0
March	88.4	80.6	79.9	80.4	82.0	82.0	81.5	78.7	653.5	81.7
April	81.1	82.1	79.4	82.4	82.4	84.0	82.3	79.1	652.8	81.6
May	80.2	80.0	77.4	81.3	82.1	82.3	80.1	78.8	642.2	80.3
June	80.3	78.4	79.6	79.6	80.0	80.3	78.7	76.9	633.8	79.2
July	79.0	79.2	79.6	79.1	78.4	79.1	76.2	76.1	626.7	78.3
August	78.4	80.1	78.1	77.6	78.4	78.0	76.0	74.8	621.4	77.7
September	79.3	80.5	79.1	79.0	79.7	79.1	76.9	76.4	630.0	78.8
October	81.5	78.7	79.3	79.9	80.7	80.1	78.0	77.4	635.6	79.4
November	82.5	80.2	81.1	80.8	80.9	82.2	78.3	79.1	645.1	80.6
December	81.6	80.1	80.2	80.9	81.9	82.3	78.7	79.9	645.6	80.7
Total	977.6	963.4	952.7	962.9	969.8	972.3	949.5	933.1	7681.3	960.1
Average	81.5	80.3	79.4	80.2	80.8	81.0	79.1	77.8	960.1*	80.0*

* Average annual and monthly for 8 years.

TABLE VII.

Comparison of Averages—Sick Rate per 1,000, Non-European and European; Rainfall, Humidity, and Temperature.

Month.	Average Sick Rate per 1000.		Average Rainfall in inches.	Average Humidity.	Average Temperature in the shade.
	Non-European.	European.			
January	52	93	.80	70.2	80.8
February	47	99	.86	68.2	81.0
March	63	59	1.24	67.7	81.7
April	86	106	4.36	67.3	81.6
May	99	225	14.08	75.3	80.3
June	128	347	18.62	77.1	79.2
July	171	413	33.34	83.0	78.3
August	116	281	38.96	84.0	77.7
September	91	173	29.85	82.2	78.8
October	67	121	14.63	79.1	79.4
November	72	125	5.41	75.0	80.5
December	64	92	1.26	71.9	80.7

TABLE VIII.

Average Case Mortality or proportion of Deaths to Cases of Malarial Fever among EUROPEAN TROOPS at various stations where Malaria is prevalent. Average of 10 years.

West Coast of Africa . . .	2'01	per cent.—average of 7 years.		
West Indies	1'30	"	"	10 years from 1887-1896.
Ceylon	'94	"	"	"
Straits Settlements . . .	'74	"	"	"
China	'49	"	"	"
Mauritius	'48	"	"	"
India	'20	"	"	"
Egypt and Cyprus . . .	'02	"	"	"

TABLE IX.

Case Mortality or proportion of Deaths to Cases of serious diseases among EUROPEAN TROOPS in all stations compared with that from Malarial Fever in the West Coast of Africa.

	Mortality per cent. of cases.	
Tubercular Diseases	24'0	average of 10 years.
Enteric Fever	22'7	" "
Circulatory System	5'7	" "
Urinary System	5'4	" "
Nervous System, apart from Mental . . .	4'8	" "
Dysentery	3'2	" "
Malaria, West Coast	2'01	average of 7 years.
Respiratory System	1'89	average of 10 years.
Eruptive Fevers, apart from Small Pox . .	'80	" "
Digestive System	'74	" "
Continued Fevers, apart from Enteric . .	'40	" "

