

only influencing the course of lesser streams but actually blocking them with silt so that they cease to exist above ground and swamps and lakes are formed behind the obstruction:

(3) That on no account should open drainage through recent alluvium be resorted to, but such areas of deterioration may perhaps be drained out by the 'backdoor method', thus defeating Nature by a stratagem:

(4) This 'backdoor' drainage is very often impracticable, as a cutting to an active stream at a suitable level would be too costly:

(5) That Man, represented in this case by tea-garden labourers, may be, though unintentionally, an important factor in altering the physical features of the surface of the land by filling in depressions for the purpose of planting paddy.

*Acknowledgments*

We are indebted to Messrs. Duncan Brothers and Company in the first instance for their kindly placing this estate at our disposal for the conduct of this sanitary experiment, and, as for the executive work, we have received a great deal of assistance from Mr. H. Aitken, the consulting engineer, who after confirming the survey levels concurred in the scheme, Mr. John Forbes, general manager of the Ali-nugger Tea Company gardens, whose influence was a great inspiration for success, Mr. Wilson, the manager of the Sancherra garden, who discovered the best line for drainage and carried out the main scheme, for which reason we would like the big cutting to be named the Wilson Cutting, and finally Mr. Johnstone, who more lately has taken out the levels again to enable us to see what changes there have been.

We would also wish to thank our assistant Dr. Paul for his careful malariological data enabling us to control the scheme.

APPENDIX

Details of executive work, and cost supplied by Mr. Wilson.

	WORK	
Total length of cutting through bank and the <i>kunji</i> on the north .. ..	690 ft.	
of which the cutting through bank may be taken to be .. ..	350 ft.	
and the outlet drain .. ..	340 ft.	
<i>Cutting</i> —		
greatest depth .. ..	15.10 ft.	
greatest width at top .. ..	15 ft.	
greatest width at bottom .. ..	3 ft.	
<i>Outlet drain</i> —		
width .. ..	3½ ft.	
depth .. ..	1½ ft.	
<i>Inlet contour-drain</i> (on west of <i>bhil</i> )—		
length .. ..	1,320 ft.	
width .. ..	1½ ft.	
depth .. ..	2 ft.	

A day's rainfall of 3.52 inches took 18 hours to drain off.

(Continued at foot of next column)

ANTI-MALARIAL WORK ON A GROUP OF TEA ESTATES IN SOUTH SYLHET

By R. A. MURPHY, L.R.C.S.I., L.R.C.P.I., L.M.  
 Medical Officer, Luskerepore Valley Medical Association,  
 South Sylhet

THE anti-malarial work here reported upon was initiated in 1926 under the auspices of Messrs. Duncan Brothers of Calcutta, the agents for three of the tea gardens in the group of which I was in medical charge. Later on, other companies decided to adopt the same measures, so that in the end the estates of the Amo, Deundi, Chandpore, Teliapara, Luskerepore, and the Imperial Tea Companies were included in the scheme of work, the results of which are reported below.

In 1926 practically no anti-malarial work had been attempted in the tea districts in India, so that the scheme—which was based mainly on the findings of Dr. C. Strickland of the Calcutta School of Tropical Medicine during an extensive malarial survey of the tea districts in 1922 and 1923 and was carried out in collaboration with him—was really an experiment in sanitation.

The results of the initial work in the gardens of Messrs. Duncan Brothers' agency have been

(Continued from previous column)

COST

The capital cost of the executive work for 1930-31 was as follows:—

	Rs.	As.	P.
1930. The big cutting cost .. ..	347	4	6
Infilling depressions .. ..	149	7	9
	<hr/>		
	496	12	3
	<hr/>		
1931. Contour-drain dug round <i>bhil</i> , big cutting deepened .. ..	60	0	0
Infilling holes .. ..	160	0	0
	<hr/>		
GRAND TOTAL 1930-31 .. ..	716	12	3

APPENDIX

Note by Mr. H. Aitken, Consulting Engineer to Messrs. Duncan Brothers and Co., on the executive work, dated 29th March, 1934:—

I inspect the *bhil* annually and can assure you the works are a complete success.

I take this opportunity of letting you know, in connection with contour seepage drains round the foot of *tillahs*, that during the past three cold weathers I have had miles of these drains cut and existing ones deepened resulting in most effective drainage in low narrow *kunjis* under tea cultivation, most profitable work.

Note by Mr. Wilson, 23rd August, 1933:—

What was previously waste *bhil* land is now excellent *khet* land while outside our boundary a greater area is being cultivated by *bustee* people.

To the garden coolies every acre under cultivation means anything from Rs. 100 to 175 *per annum*, and this for a capital cost to the garden of about Rs. 100 an acre, plus a little for necessary upkeep.....

(Sd.) D WILSON.



lately reported upon by Dr. Strickland and myself (1932).

The operations were particularly difficult because of the nature of the terrain; this is dominated by alluvial deposits obstructive to drainage on the estates, which lie on the low hills bordering the flood plains. However, various means have been adopted to overcome the difficulty, and two new methods in anti-malarial work have been evolved, one 'bhil-silting', the other 'backdoor drainage'.\*

In the earlier work the problem was to deal with the extensive anopheles-breeding marshes or *bhils*. These *bhils* on the gardens originally joining the scheme have for the most part been rendered innocuous by *bhil*-silting, but the numerous highly-dangerous drains remain to be treated. Thick shading of drains is essential, and it is unfortunately more difficult to start and maintain this growth of vegetation than to make the drains, as it requires more supervision and generally has to be done at a more inconvenient season of the year. Cattle do much damage to drains, but even more to the growth of shading, and the only satisfactory solution is to fence them off.

Further progress now depends almost entirely on this drain shading, and this will have to be undertaken intensively.

The mosquito catchers visit each garden approximately once a month, and the assistant, Dr. Chakravarty, after examination of the captures, sends to the manager a report regarding the dangerous species and where they have been found. This enables the managers to know exactly what place requires attention, and they are now aware of what steps to take to right matters, unless the conditions are exceptional.

Tanks were oiled periodically.

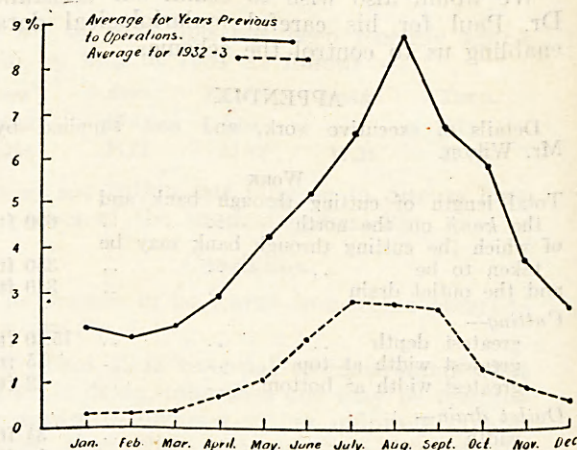
The maintenance of drains requires constant supervision, and where there is a tea-house assistant it is a good arrangement to put him in charge of them. It is work that he is not tied down to do at a definite time, and that can be done as opportunity offers. It interests him, being a change from factory routine, and allows of fresh air and exercise.

*The effect of the anti-malarial measures on the health of the labour forces.*—On the whole the results to health have been very satisfactory. The case of garden B, where the August sickness rate has dropped from 19.6 per cent to 2.5 per cent, may be claimed as fairly typical of the results obtained, but apart from such figures the managers affirm that the working capacity of the coolies has enormously improved.

\* This is described in another article in this issue.—  
EDITOR, I. M. G.

The population on any one tea estate, or even group of estates, is too small to enable definite conclusions to be drawn from vital statistics covering only short periods, except in the case of gross variations or exceptional circumstances. A favourable infant death rate in any year, for instance, may be spoilt by the unavoidable deaths of a pair of premature twins. All diseases fluctuate naturally in their incidence over varying periods. In this report therefore the figures for several years have been grouped together, so that a truer perspective may be obtained. The tables and graph show the figures for malarial incidence and infant deaths before and after the scheme was instituted. The graph illustrates the drop in malaria cases better than does the table, as the latter takes no account of the increase in population, which has risen from 14,398 in 1929 to 17,656 in 1933, so that the drop in cases from 6,596 to 2,101 is more significant than at first it appears to be. Further this additional labour has been largely recruited from Tipperah gardens and from the local *bastis* and the disease thus imported tends to lower the general health, also, as is well known, immigrants may intensify malaria.

Infant-mortality rates are given, as, although a non-malarial garden may from one or other cause have a high rate, a badly malarious garden will never have a low one. Most of the infant death rates are very good and prove the control of malaria. The garden with the highest rate has only recently joined the scheme, and already there is an improvement, which as work progresses is certain to continue. The coolie infant enjoys the advantages of natural feeding and sunlight, and, were malaria to be eliminated, the death rate here should be very low.



In 1933 the percentage of cases as a whole showed little change from the previous year. A substantial decrease would have been shown had there not been an unusually large number of

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A FORM OF GENERALIZED OEDEMA ATTENDED WITH MALNUTRITION WHICH IS BECOMING INCREASINGLY COMMON IN RANGOON

By M. L. KUNDU, M.B. (Cal.), F.R.F.P.S. (Glas.), L.M. (Dub.)

General Hospital, Rangoon

DURING the last two and a half years that I have been posted in Rangoon, a peculiar disease,

(Continued from previous page)

cases in the latter half of October and November, a time when malaria here is usually becoming quiescent. This, it may be surmised, was due to exceptional climatic conditions, but owing to lack of facilities, it is not possible to define these. The meteorological records available are of little value for scientific purposes as temperatures taken with thermometers hung on bungalow walls are subject to many errors.

Gardens	MEAN ANNUAL MALARIA CASE INCIDENCE		INFANT DEATHS PER 1,000 BIRTHS	
	‡ Years previous to operations	For 1931-32-33	Average 1924-27	Average 1928-33
A	1,376	505	101	67
B	1,284	172	148	82
C	768	159	295	125
D	409	222	98	53
E	663	108	212	65
F	603	202	98	43
G	484	193	78	75
H	254	238	101	95
I	755	302*	175 †	136*
	6,596	2,101		

Population, 1929	..	..	..	14,398
" 1933	..	..	..	17,656

\* 1932-33, since joining the scheme.

† 1924-31.

‡ From 3 and 6 years, as records were available.

In spite of the scheme having been handicapped by the financial stringency, and in some cases by difficulties in supervision due to attenuated staffs, considerable success has been attained, and if further work is now carried on energetically the loss due to malaria should after a few more years be trivial.

My thanks are due to Dr. Strickland of the Calcutta School of Tropical Medicine for his collaboration in the initiation of the scheme and for his continued interest and advice during its development.

REFERENCE

Strickland, C., and Murphy, R. A. (1932). River-sand Silting and other Anti-malarial Measures in South Sylhet, Assam. *Records Malaria Survey India*, Vol. III, p. 125.

apparently of the deficiency group, characterized by a rapidly progressive general anasarca, moderate anæmia, normal or increased urinary output, and malnutrition, has come under my observation more frequently than when I was in this city fourteen years ago. The disease differs from the type of beri-beri which is prevalent in Burma, and also from epidemic dropsy, which occurs almost exclusively amongst the Bengalee residents of the city and which is clinically a different entity from beri-beri, though many authorities presume that it is only another manifestation of this disease. It may be similar to cases of famine dropsy or war œdema, described by Sir John Megaw (1930), as, undoubtedly, on account of the increasing trade depression in this city, there are large numbers of the labouring class people who are unemployed and who have to subsist on a diet verging on starvation. However, the price of rice being very favourable, a sufficient quantity of food can easily be made up for a few pice with white rice and leafy vegetables; it is the quality of the food of all the patients that came under my observation that was at fault; it was ascertained by questioning them that their diets were particularly poor in fat, and articles rich in vitamin B.

The cases suggest chronic glomerulo-tubular nephritis, but it soon becomes apparent that there is hardly any cardiovascular change; the blood pressure is low or normal, and the urine is not scanty, and contains neither albumen nor casts. They have none of the symptoms of either beri-beri or epidemic dropsy, and with rest, a diet of milk, eggs, germinating pulses and red rice or good bread, and with only a little iron and aperients by way of medicine, they improve fairly rapidly, except in cases where the œdema is of long standing and the skin has become hardened with continued waterlogging; in these cases hypodermic injections of strychnine seem to be of great value.

The following cases are typical of the disease; and a brief description of their condition and result of clinical investigation will give a better idea of this ailment :

Case 1.—N., Hindu male, aged 40, gardener by occupation, was admitted in Rangoon General Hospital on 31st January, 1933, for treatment of anæmia and general anasarca of 10 months' duration. He had been mostly out of employment and often had to subsist on charity. Two months ago he was admitted into hospital once and was treated for ancylostomiasis and discharged relieved. He had to return very soon as he quickly deteriorated for want of proper nourishment.

Examination of blood on 2nd February:—Total white blood cells—5,400 per cubic millimetre; total red blood cells—3,930,000 per cubic millimetre; hæmoglobin—55 per cent.

Urine—nothing abnormal; stools—no ova, no protozoa, no cellular exudate.

Blood pressure—120/75; Wassermann reaction—negative.

Chloride content of tissue fluids:—On 7th, 8th and 10th February these were respectively 622, 613 and 613 milligrammes NaCl per 100 cubic centimetres.