strongly urged. Their utility at any time, except in skilled hands, is more than doubtful.

To overcome any unpleasant odour the extra flushing necessitated should be a great advantage, ensuring as it would a certain dilution.

I read that in experiments carried on in an installation in Calcutta erected on the Exeter Septic Tank system, as little as half gallon per head was found to suffice for its satisfactory working. Conditions are in a warm climate undoubtedly favourable for rapid liquefaction and subsequent nitrification, especially where an uniform and favourable degree of temperature can be maintained. A greater degree of dilution, I think, would be attended with better results, and if two to three gallons of fluid per head were obtainable, the daily output from the tank might be passed into the contact beds without diminishing their capacity to any appreciable extent.

In the present state of our knowledge, are we justified in continuing the system of trenching, now so much in vogue in India, where another and one vastly more satisfactory, from a sanitary point of view, can be successfully introduced?

Every installation, no matter how small, would be a step towards improved sanitation. It is only necessary here to mention two of the many dangers and disadvantages attending the use of trenching grounds, *viz.*, the probability of contamination of water-supplies from trenching grounds, during the rains, particularly a heavy shower of rain, either by surface drainage, or by leakage through cracks in the soil, rat and worm holes, &c. And (2) to the fact, that it can *scarcely be desirable, as is sometimes done, to build on these old trenching grounds*, even after a considerable lapse of time. Dr. Houston has found that garden soil treated with fæces, even after a lapse of six months may contain 26,780,000 micro-organisms per gramme of soil. Practically all the installations on a large scale now in England deal with, in addition to fæcal matter, refuse from breweries, soap works, and the residue from factories, &c., and in some cases, the drainage from roads the dilutions varying from 10 to 100, or, even more in rainy weather. As a result, one of the chief difficulties in disposal of sewage in England is to deal with the excess of fluid, more especially during rainy weather. Of the solids, other than the dejecta, which have to be got rid of, such articles as corks, fats, and *débris* of various kinds, offer the chief difficulty.

Now in most Indian towns and cantonments our sanitary system deals separately—

(1) With fæcal accumulation and urine.

(2) The refuse from cook-sheds, compounds and road sweepings.

Even incinerators which satisfactorily consume both the above are not all they might be, owing to the draining away of urine with some proportion of fæces, and the consequent contamination of the drainage areas in the vicinity of the latrines.

Of the other forms of sewage disposal, few, I think, can be said to be entirely satisfactory, when this is effected by the application of crude fæcal matter to the soil. In places where a constant and uniform water-supply by pipes or irrigation is *not* possible, the desirability of introducing some ready means of sewage disposal to meet various requirements should at least receive the attention of those responsible for the sanitation.

In conclusion, it may be observed that sewage effluents are exceedingly rich in nitrogenous bodies held in solution, and that the value of these as manure is very high.

In many instances an installation might be arranged so as to allow of land irrigation, and the application of a well purified effluent to the soil might safely by permitted.

The almost universal prejudice against cultivation of areas treated with raw sewage would not be so prevalent, if, as in these cases, a clear fluid possessing high manurial qualities could be offered.

MALARIA: AS SEEN IN THE ANDAMANS PENAL SETTLEMENT.

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(Continued from page 420.)

OUR hospital figures substantiate this theory. Well-cleared established stations like Aberdeen, Haddo and Phœnix Bay are less malarial than out-stations like Goplakabang, but even in the healthy stations it is the men doing hard out-door work that furnish the bulk of the malarial cases. True, it is these men that have the most inducement to come to hospital; but latterly all our malaria cases have been examined microscopically and I have yet to find a malingerer who is competent to produce pigmented crescents at will, or to arrange for a suitable increase in his large mononuclear leucocytes. It appears to me that the convict may at times derive his fever from the bite of an infected mosquito, but that he may also have a relapse from a previous attack through exposure, overwork or some cause lowering his vitality. Again, while a healthy well-nourished man may only suffer slightly from fever after an infected bite, it is obvious that a weakly, chilled, tired man whose powers of resistance are much lowered would, in all probability, suffer to a much greater or more serious extent.

This question is admirably worked out by Attilio Caccini of Rome, in a series of articles published in the *Journal of Tropical Medicine* for May and June 1902.

He gives specific instances (with detailed examinations of cases) where fever has re-appeared within 48 hours of exposure to damp and cold, even in patients who were taking quinine regularly at the time of exposure.

He further proves "that in patients not treated with quinine, in whom the primary malarial infection has exhausted itself, the attack recurring after a long period always comes on after the intervention of one of these recognized determining causes." In these cases, parasites rapidly re-appear in the blood.

Further: "The attack recurring after a long interval exactly resembles true first infection, that is, the paroxysms of fever may be more or less regular; attacks may or may not occur at long or short intervals and they react equally against the quinine treatment. But whereas regular systematic treatment prevents attacks recurring at short intervals, it does not prevent those recurring at long intervals, which come on after a space of time which may reach twelve months of apyrexia.

The attack always occurs upon the intervention of any of the organically debilitating causes mentioned. Thus with patients treated with quinine and divided into categories according to the method of treatment, every category shows the same percentage of attacks occurring at long intervals. In every case the attack followed upon the intervention of one of the debilitating causes above noted. Any patient guarding against debilitating accidents and observing a regular diet may remain free from attacks of fever for a long while (six to seven months), but suffers a relapse after that time upon exposure to cold, fatigue, wounds or illness."

Now these statements correspond with our experience here. We know that exceptionally hard work will send up the fever admissions among the men exposed to it, especially when proper precautions are not taken (*vide* Namunaghar figures below).

On Ross Island, in the period December to March, there is usually a strong cool wind blowing, and it is to this that the population ascribe their fever. They said beforehand that when this wind began they would get fever, and they certainly did. At the time I did not think there was an anopheles mosquito on the island; certainly one could never catch them, and even culex was very rare. The wind came direct from the North-East over some hundreds of miles of sea, so that the chances of infected mosquitoes being carried in may be dismissed.

The probability is that both these theories are true, and that direct infection from the mosquito and relapses due to exposure together and unitedly account for the malarial fevers as seen here.

The means of diminishing malaria.

Any measures that will diminish the heavy malarial sick-rate are naturally of the greatest value, and much attention has been paid to this question during the past year.

So far as our present knowledge goes three, or possibly four, methods are supposed, or are likely to be efficacious (always remembering that we are dealing with a malaria-infected population). These are:—

1. The destruction of all anopheles mosquitoes.
2. The prevention of infection of and by anopheles mosquitoes by means of nets, or combustible pastilles.
3. The dosage of the whole population with quinine to an effective extent.
4. The keeping of the population "fit," or in such a good state of general health that relapses or recrudescences are unlikely.

1. *The destruction of all anopheles mosquitoes*

This, I have no hesitation in saying, under local conditions is impossible. The large area of the Settlement, the dense vegetation, the heavy rainfall and consequent swamps all make such a task impossible of fulfilment.

It may be done over comparatively small areas, and in the older stations, but to do it over the hundred and odd square miles within the Settlement boundaries is not practicable.

But even on a small scale much good may be done, and I propose to describe in detail the results of the efforts made.

The first attempts were made on Viper, a small island accommodating about a thousand convicts, and some two hundred and fifty troops and police.

This island has no streams, its water-supply is from collected rain water, one or two wells, and from a daily ration brought from another station. The island is throughly cleared and well drained. Like all other stations the buildings are of wood, and, as a protection against fire, there are wooden fire barrels distributed round all the houses and barracks.

These fire barrels were the main sources from which the mosquitoes came, and early in the year every barrel swarmed with larvæ, and mosquito eggs could always be found. Generally these larvæ and eggs were of the culex variety, but occasionally anopheles were discovered. The work of getting rid of mosquitoes was commenced in June with a few convalescents who were instructed to keep these barrels clean and to pick up cocoanut shells, &c. The results were excellent so far as the number of mosquitoes were concerned. On every hand one got the same response to enquiries, from officials and convicts alike. The mosquitoes were much less numerous, nets were no longer a necessity, and life was rendered much more tolerable in consequence.

At the same time experiments were made with combustible pastilles, so evil-smelling as to be calculated to drive out the mosquitoes from any building in which they were burnt. These

were made of sulphur, charcoal and saltpetre, but were not satisfactory.

They were expensive (the cost to burn them twice weekly throughout the Settlement at the scale of one per thousand cubic feet would have been about 10,000 rupees), and they were only temporarily effectual. The general opinion was that so long as they were burning, neither man nor mosquito could exist within their range, but that as soon as they had burnt out sufficiently to permit the inhabitants to return, the mosquitoes returned also.

Following the small Viper experiment and other small experiments elsewhere, a more thorough trial was decided on. In November the Chief Commissioner issued orders forming mosquito brigades in every station, and these commenced operations on December 15th, information and literature, including Ross's book, had previously been widely circulated, and the Petty Officers in charge of the gangs were instructed in their duties. The men of the brigades, numbering in all nearly two hundred, were equipped with carts, tools and dippers for searching purposes. Careful arrangements were made to check the exact sleeping places and occupations of all men reporting sick, and the blood of every fever case was examined microscopically, often more than once.

In some respects the results of these special gangs have been excellent. Mosquitoes everywhere have enormously decreased; in fact in many places a mosquito is quite a rarity and as such is immediately noticed. The exact prevalence in bungalows appears to depend on the interest and enthusiasm of the occupant. Many residents have assured me that they can now sleep without nets or punkahs, and the convicts all tell me that mosquitoes have much diminished.

Besides this the general sanitation of the Settlement has much improved. Drains have been cleared, puddles filled, rubbish removed and undergrowth cut back to a considerable distance.

The improvement in the general cleanliness is most marked, and in this respect alone the mosquito gangs have done much good. But when we examine the effect of these measures on the malarial admissions we do not obtain such encouraging or consistent results.

The results from the principal stations and districts are as follows for the three months the brigades have been working:—

ROSS ISLAND.

Year.	Approximate Strength.	Fever admissions, December, January and February.
1899-00	660	43
1900-01	698	82
1901-02	735	48
1902-03	718	203

Of this season's admissions, mullahs furnished 67 and sweepers 25; 49 admissions came from No. 1 barrack and 29 from each of the others.

Government House, the Senior Medical Officer's bungalow, and the Mess which are close to one another, each had 10 fever admissions, whilst Mr. Hilton's and Mr. Galvin's bungalows, which are side by side, gave 13 and 12 admissions respectively. No other house had anything approaching this number.

These cases are very difficult to explain on the purely mosquito theory. In the patients (boatmen) from the Senior Medical Officer's bungalow distinct parasites were found and in two cases crescents; at that time of the year it was impossible to discover an anopheles on Ross Island.

The patients generally, and many of the residents too, ascribed their fever to the onset of the North-East monsoon which they say chilled them and gave them fever. On the other hand both the areas above named are thickly covered, with vegetation which gives good mosquito cover.

FEMALE JAIL.

Year.	Strength.	Fever admission for 3 months.
1899-00	359	140
1900-01	369	109
1901-02	406	80
1902-03	401	168

Here, too, the results are similarly disappointing. It is easy to explain why the female jail should be malarious, but it is not easy to explain why it should have been more malarious this year than usual, when stringent sanitary precautions were exercised, and when half the inhabitants were taking 20 grains of quinine twice daily.

Blood examination.—At Ross Hospital the blood of every patient coming to hospital was examined for malaria parasites, whatever his disease may have been.

In all 527* patients were examined, and parasites were found in 136 cases.

These analysed show:

Intra-cellular hyaline	49	times.
„ pigmented	36	„
Extra-cellular forms	20	„
Crescent „	31	„

besides combinations of these varieties.

In many cases crescents were found in enormous numbers, as many as 180 being counted in a single slide. In other cases crescents abounded in the blood of men feeling perfectly well, having normal temperatures and who were anxious to get out of hospital.

ABERDEEN.

Period: Dec. to March.	Malaria admissions.
1899-00	312
1900-01	234
1901-02	70
1902-03	215

* These figures include sick from Aberdeen.

Here, too, careful blood examinations were made, but the results are included with those of Haddo Hospital.

At the Female Jail the malaria admissions for the three months were:—

January	...	... 66
February	...	... 49
March	...	... 33

Miscroscopic examination of the blood gave the following results:—

Cases examined	... 212	(all admissions).
Parasites found	... 125	

Varieties :—

Hyaline intra-cellular	... 47
Intra-cellular pigmented	... 36
Extra-cellular ,,	... 23
Crescents ...	... 10

HADDO.

Fever admissions :—

Period.	Haddo.	Chatham.	Phœnix Bay.
1899-1900	152	154	186
1900-1901	69	54	92
1901-1902	78	33	58
1902-1903	49	28	49

In these three stations the results are favourable; everywhere there were fewer cases, although in 1902 the population tended to steadily increase. Possibly the inhabitants of these stations are less exposed in the cold season to changes of temperature than most other men, and consequently are more likely to benefit from anti-mosquito efforts.

As in other cases, careful blood examinations were always made, with the following results:—

Fever cases examined	...	... 194
Parasites found in	...	... 172

Varieties of parasites :—

Intra-cellular Hyaline	...	... 101
,, Pigmented	...	... 23
,, Ring forms	...	... 21
Extra-cellular pigmented	...	... 10
Crescents ...	...	... 10
Segmenting forms	...	... 6
Flagellæ ...	...	... 2

This blood examination was carried out by Dr. Sanyal who ascribes the high parasite rate to the fact that:

1. Only "fever" cases are included.
2. There was no prophylactic issue of quinine going on.
3. No quinine was given to the patients until the blood examination had been made and the diagnosis checked.

SOUTHERN DISTRICT.

It is in an unhealthy area such as this that the mosquito brigade work is of special interest. Attention was specially directed to Viper, Namunaghar, Dundas Point and Minnie Bay.

Averages are for three years:—

Period.	Viper.		Namunaghar.		Dundas Point.		Minnie Bay.	
	Average.	1902-03.	Average.	1902-03.	Average.	1902-03.	Average.	1902-03.
December ...	35	76	101	61	49	26	5	9
January ...	40	53	75	41	33	35	23	
February ...	52	64	59	27	43	34	43	19

Of the 129 admissions from Namunaghar in the three months, 83 came from one barrack—the temporary one,—but the firewood cutters (who are always unhealthy) lived in this barrack.

Altogether the blood of 592 fever cases were examined. In 289 of these malarial parasites were discovered.

WIMBERLEY GANJ SUB-DIVISION.

Period.	Admissions.	Strength.
1899-00 ...	520	1,480
1900-01 ...	916	1,944
1901-02 ...	811	2,161
1902-03 ...	603	2,352

Here, too, there is a decline in the admission rate as compared with previous years, and that although the population of the Sub-Division has has increased.

The results of blood examinations were:

Examinations (October to February)	...	1,062
Parasites found ...	...	... 892
arieties :		
Intra-cellular hyaline	...	... 851
Extra-cellular ...	...	... 19
Crescents ...	...	... 22

The above tables are of course merely a summary of all the information which has been collected on this subject, but which want of space prevents me from inserting.

This account does not exhaust what has been done in the direction of mosquito brigades.

In the villages, both ticket-of-leave and free, the system has also been inaugurated and men told off to attend to puddles, sanitation and general cleanliness. The effect of this action is bound to be most marked.

I am indebted to Mr. Lowis, the Sub-Divisional Officer, Ross, for much assistance in connection with the mosquito brigades and for the following information as to local varieties of the insect.

The commonest variety of mosquito in Port Blair is Culex Fatigans. It is a house mosquito, breeding in any convenient collection of water and biting at all hours, but especially at night.

The only other known variety of culex locally found is C. Concolor, a larger insect than C. Fatigans and possessing larvæ of cannabalistic habits.

There is one other small culex found, but it has not yet been identified.

Of the sub-family Stegomya (Theobald) two species are found, namely, S. Fasciata and S. Scutellaris. Both are very common here, but they do not affect houses as much as the true culex.

(To be continued.)

THE HEALTH OF THE DISTRICT OF JESSORE, AND HOW TO IMPROVE IT.

By H. SEN, M.B.,

Offg. Civil Surgeon, Jessore.

The question of the health of a district is always of vital interest to its people. It has become specially so in this. According to the last census the district has lost a large percentage of its population. I find the number of deaths has been exceeding the number of births almost every year. I noticed this especially in the Sub-Division of Narail which is supposed to be the healthiest part of the district. I have inspected all the important places of the district, and I found that malaria of a very virulent type has taken a firm hold of it. A deltaic tract once intersected by innumerable streams, many of which in course of time have run out their existence or are fast running it out, throwing their beds high up above the general level; a tract of country naturally of monotonous level and of pure alluvial formation with extensive swamps and dense jungles, having a sub-soil water always at a high level, a rainfall about 63 inches in the year and a mean temperature of 77°F.; it has, as might be expected, become a veritable hot-bed of the scourge of the country. Every year malarial fever carries off 57,924 people on the average. The number thus carried away is but a minute fraction of those who are affected by it. And these look more dead than alive. They walk the earth like so many ghosts in the valley of death, the victims of a slowly grinding disease. If I may style Bengal as the "Valley of Death" which it actually is, situated as it is at the mouth of the two largest drainage systems in India, hemmed in by stupendous ranges of mountains on three sides, I may justly call Jessore the bottom of the Valley of Death. All the places in it are not, however, equally bad. I found Kesabpur, Maheshpur, Jhenidah and Magurah to be the unhealthiest places. At Kesabpur 72·3 per cent. of the boys and 70·3 per cent. of the adults were affected with enlarged spleen. Marshes, jungles, densely shaded and unclean orchards, ditches, ponds and hollows all shaded over by leafy trees, and a dying river close by are the characteristic feature of the place. At Maheshpur I found 78·94 per cent. of the boys had spleen. The town looked a most pitiable sight with its tumbled-down, deserted, jungle-covered, pucca buildings, once the abode of a healthy and a happy people but now the haunts of wild animals and reptiles. When I saw the place I could give only one advice to the people and that was to fly from it. At Jhenidah I found cent. per cent. of the children had spleen. The town stands on the bank of a dead river, it is encumbered with dark and dense jungles, cut up in every possible way with ditches and pits all over, every elevation having a corresponding depression, badly built, badly drained, thickly shaded and completely obstructed; it seems to me that both nature and man have conspired together to bring death and destruction on the ill-fated town. What an amount of suffering the people there must be undergoing, but they have got to thank themselves for much of it. At Narail I found 45 per cent. of the children had spleen. The Mahomedans were the worst sufferers, as is the case all over the district. On comparing the deaths with the births here I found that the former exceeded the latter every year since 1899, from which I start. The figures are given below:—

	Deaths	Births.
1899	5,194	4,235
1900	4,168	4, 96
1901	5,380	3,568
1902	5 286	3,804
1903 (up to 9th June) ...	1,978	1,149

Narail is reckoned to be the healthiest place in the district. These figures, however, speak otherwise. If Narail be the healthiest part of the district, how very unhealthy then the district must be. At Sreedharpur I found 33·33 per cent. of the boys had spleen. The place is is not so unhealthy as other parts of the district. There is no dead river close to it. At Raigram 36 per cent. of the boys had spleen. Again a better figure, for the place is situated on a river not yet dead.

At Magurah I found 74·62 per cent. of the ordinary children belonging to the cultivating class, and 18·8 and 27·27 per cent. of the school boys, classified according to their ages, had enlarged spleens. The school boys suffer less than the boys belonging to the cultivating class for evident reasons, the former belonging to the well-to-do-families and having a less exposed life. This part of the district seems to be much more open, and at any rate is blessed with a river on one side which is still alive, but there is a dead one also on the other side.

At Bongaon I found 25 per cent, of the total examined, adult and children, had enlarged spleens. The percentage among the adults was 34·28, and that among the children 21·73. Bongaon would appear to possess a fairly good health.

At Kotechandpur, where I examined 408 children, I found 104 had enlarged spleens, or, 23·63 per cent. It would appear to be, when compared with the others, a very fairly healthy place. In the Jessore town I could examine only the boys of the Government School, and found that 27·12 per cent. of them had enlarged spleens. The percentage among the Hindu