

The duration of the treatment and the number of hours slept by each patient were as follows:—

Case No.	Duration of Treatment.	Duration of Sleep.
1	10 days	160 hours.
2	11 days	177 hours, 55 minutes.
3	7 days, 20 hours	130 hours, 20 minutes.

Although prolongation of this form of treatment for more than ten days is probably attended with some risk, there is no reason against employing this treatment for shorter periods. For instance, in cases of *status epilepticus*, for which this treatment has been recommended, it might suffice to keep the patient narcotised for one or two days only.

In conclusion, I hope that medical officers in other parts of India who may happen to light on this report, may be persuaded to give this treatment a trial. There is much yet to be learnt from it and about it.

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BOMBAY MILLPONDS AND ANOPHELINE CONTROL.

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IN the March 1926 number of the *Indian Medical Gazette*, Captain B. S. Chalam and one of us submitted under the above heading a preliminary communication on the use of Paris green in a millpond in Bombay; it was found that a 1 in 25 mixture of Paris green and cork-powder spread over a part of the pond in which large numbers of *Anopheles* larvæ were breeding, was effective in destroying all the larvæ, the untreated part of the tank having been automatically treated owing to the drifting action of the wind, as the drug-impregnated cork-powder was seen to have floated over the whole surface area at different times during the first twenty-four hours. The subject was pursued further with the object of arriving at some effective, convenient and cheap method of dealing with the millpond problem.

As stated in the last paper, since the introduction of electric drive in the Bombay mills, these large collections of water are no longer in use and do not get heated up as they used to when the mills were working with steam power. As the cost of filling up the tanks is considered prohibitive, and as provision has to be made for a ready supply of water for fire purposes, these tanks or ponds or mill-lodges are at present "necessary evils," and add greatly to the enormous numbers of breeding places that already exist in the island or form during the monsoon and malaria season.

A series of experiments was undertaken in different "lodges" during the present dry season; and the larvæ most commonly encountered were those of *Anopheles subpictus*, with an occasional admixture of a few *Culex* larvæ.

On the first occasion on which we used the Paris green in tank "R" as stated in the previous paper, all the larvæ disappeared in two days, and none were again found for over two weeks. This was looked upon as a very good result. On the second trial, the Paris green was diluted with 80 times its weight of cork-powder and almost the whole surface area of the tank was covered over. The cost of materials used amounted to Rs. 84. Larvæ disappeared as quickly as after the first experiment, but this time they reappeared within ten days of treatment: the action of the 1 in 25 dilution was found to last longer, probably owing to some of the drug being still available when fresh larvæ began to hatch out.

The regular use of the drug in the more effective strength was considered too expensive, and further, a certain amount of risk to persons handling it is said to be attached to the process.

Our attention was, therefore, next directed to "oiling" methods. In the middle of January of this year, tank "M," which has a surface area of 9,000 sq. feet, was found to be breeding a few *Culex* and *Anopheles* larvæ. As a trial only, one gallon of kerosene oil was first poured along one side of the tank. The larvæ did not seem to have been affected at all; three days later, four gallons of kerosene were poured along two sides of the tank. The oil was seen to evaporate rapidly, none of it could be seen the next day, and yet the larvæ had appreciably diminished in numbers. On the 25th January, when they had again increased, four gallons of a mixture of two parts kerosene and one part crude (residual) oil as used in oil-fired boilers were poured along three sides of the tank. Two days later, no larvæ could be found, and the oil was just visible as small dark patches. From the 1st to the 10th February, a few *Culex* larvæ made their appearance in the tank, but thereafter none could be found till the first week of March, though no further measures were adopted. We have seen this spontaneous disappearance of larvæ without any assignable cause on more than one occasion, and the necessity for suitable

controls should be borne in mind when any experiments to determine the efficacy of a new larvicide are in progress.

By the 2nd February, tank "R" (superficial area about 40,000 sq. feet) was found to be again breeding *Anopheles* profusely, and on that day eight gallons of a mixture of equal parts of crude oil and kerosene, cost Rs. 4, were squirted by means of tin cans along all the four sides of the tank. Within two days all the larvæ disappeared, after a week no trace of oil was visible, and the tank remained free from larvæ for twenty days, when at first a few *Culex* and later, on the 24th February, a few early *Anopheles* began to appear. It will be seen that this method is easy to apply, is much cheaper, and perhaps more lasting in its effects than Paris green.

At this time, a consignment of "Larvicidal Blocks" made by a firm in England was received through their local agents for trial purposes. These were tried in both tanks "R" and "M," but their larvicidal effect was found to be negligible.

In a synopsis of the work of the Malaria Research Unit in Palestine, the addition of 0.1 per cent. castor oil to the crude-oil-kerosene mixture has been recommended as leading to better spreading of the larvicide. Accordingly this combination was next tried. On the 27th March, when *Anopheles* and *Culex* larvæ were plentiful in tank "M," it was treated with four gallons of equal parts of crude oil and kerosene plus six drachms of castor-oil, a man pouring the mixture in a thin stream as he walked along three sides of the tank. On examining the tank the next day, only *Culex* larvæ were found, the more delicate *Anopheles* larvæ having been destroyed by the comparatively small quantity of oil used. The oil was visible on the surface for two days.

Tank "M" was kept under constant observation, and by the 5th April, all larvæ were found to have automatically disappeared. On the 9th a few *Anopheles* again appeared, and were increasing rapidly when, on the 15th, steaming water was admitted into the tank for an hour owing to the mill engine having been started after some months' rest. Larvæ continued to increase and four days later hot water had to be again admitted for two hours. The number of larvæ was not at all affected by this treatment. On the 23rd April, when larvæ were in abundance and a few pupæ had also appeared, it was decided to treat the tank with oil. The mixture used on this occasion consisted of three gallons of crude oil, two gallons of kerosene oil and two ounces of castor-oil, costing in all about Rs. 2-8. As a steady breeze was blowing at the time, the whole quantity was poured along the windward side. Within half an hour all the oil had been banked up in the opposite south-west corner of the tank, covering an area of approximately 500 sq. feet; i.e., about 100 sq. feet of surface

was covered by each gallon of the oil. Two hours later, a spot was examined over which oil had been seen to be drifting during the previous hour, and active larvæ were found. During the next twenty-four hours, the wind had shifted the oil scum from one place to another over the whole area of the tank, and no larvæ whatever could be found after a thorough search. The tank remained free from larvæ till the 10th May, when the mill, which is a steam-driven mill, was re-started after some months, and at present the whole body of water in the tank daily heats up to 102°F. to 112°F. so that mosquitoes are not likely to breed in this tank.

The last experiment has proved the efficacy of the mixture used provided the scum of oil can drift over the whole area of water by wind action. Supposing that the wind were not favourable and an attempt were to be made to actually cover the whole superficial area by the mixture, it could be done at an expenditure of less than Rs. 50 and the effect of such a procedure will be more lasting. Of course, under working conditions, it is the edges of a tank only that require to be treated with larvicides. The combination is under further trial.

A series of basin experiments, mostly with *Stegomyia* larvæ, were also in progress in the mill dispensaries during this period. These were primarily started as demonstrations to the compounders, the clerks and the staff, by simply omitting to change the water in the washhand basins for about two weeks, so that the mosquitoes may lay their eggs. A point emerged during these demonstrations which may be utilised for practical purposes; if the mosquitoes in a household could be provided with a suitable receptacle such as a basin of shallow water in which to lay eggs and if the receptacle be watched so as to destroy the larvæ as soon as any in the basin "pupate," the mosquito population of the house can be appreciably diminished. This has been done in all the dispensaries for the last three months, with distinctly good results.

The above is an outline of the detailed report submitted by us to the agents, and a few generalisations and conclusions drawn from our experience may be stated:—

1. If a mill is driven by steam power, and if the water of the mill-lodge or tank is being used in the condenser, the danger of mosquito-breeding is *nil*.

2. In mills with electric drive, where the whole body of the water does not get heated, even though steaming water may occasionally be admitted into the tank, mosquito larvæ are able to breed.

3. Mosquito larvæ are susceptible to sudden meteorological and other unknown local influences which must be borne in mind in anti-mosquito work.

4. "Oiling" by a mixture of three parts of residual oil and two parts of kerosene, reinforced by 0.1 to 0.2 per cent. of castor-oil, at the rate

of about one gallon per each 100 square feet of surface may be depended on to control mosquito-breeding in millponds, and is feasible, cheap, easy to apply and efficient.

5. Such measures, however thorough, cannot by themselves reduce the incidence of malarial fevers in the mill districts unless concerted action against all breeding places in a given locality is taken.

6. Incidentally, a simple method of keeping down the mosquito population of a household has been described.

Finally, we have to thank Captain Chalam for his interest in the work, and Messrs. E. D. Sassoon & Co. for affording us facilities and sanctioning the expenditure involved.

THE TREATMENT OF PLAGUE; A NEW SUGGESTION.

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(A paper read at the Kodaikanal Conference of the Medical Missionary Association of India on the 27th May, 1926.)

IN spite of the presence of plague amidst us for the past 30 years, and the loss of over 10 million lives from it during the period, the treatment of the disease after the infection has occurred, it will be admitted, is still unsatisfactory, and although numerous remedies have been suggested and tried, they have not so far proved successful.

The advice given by Osler in the treatment of plague is as follows:—"In a disease the mortality of which may reach as high as 80 or 90 per cent., the question of treatment resolves itself into making the patient as comfortable as possible, and following out certain general principles, such as guide us in the case of fever patients."

Now, as plague is caused by *B. pestis*, one would expect that the most successful method of combating the infection would be by the use of its specific anti-serum. The serum commonly used for this purpose is Yersin's; Dr. Choksey, who has tried it extensively, recommends that it should be administered in large doses, 50 to 100 c.c. or even more on the first day according to the condition of the patient, and repeated as necessary. In his series of 400 consecutive cases conducted at the Maratha Plague Hospital in Bombay (moribund and convalescent patients being excluded), and treated alternately with Yersin's serum, the mortality was as follows:—

200 cases treated with serum, mortality 63.5 per cent.

200 controls treated without serum, mortality 74.0 per cent.

Difference in favour of serum—10.5 per cent.

The Plague Research Commission also tried this serum in 444 cases of plague. They examined each case bacteriologically by planting out on agar slopes $\frac{1}{4}$ c.c. of blood from every patient, and according to the number of colonies of

plague bacilli which developed on that medium, they divided all their cases into the following four groups of septicæmias:—

(1) Blood sterile in $\frac{1}{4}$ c.c. of blood = septicæmia 0

(2) 1 to 10 colonies in $\frac{1}{4}$ c.c. of blood = septicæmia +

(3) 11 to 100 colonies in $\frac{1}{4}$ c.c. of blood = septicæmia ++

(4) Above 100 colonies in $\frac{1}{4}$ c.c. of blood = septicæmia +++

Alternate cases received the serum treatment, the moribunds and convalescents being excluded.

The results were as follows:—

Septicæmia.	CASES TREATED WITH SERUM.		CONTROL CASES.	
	Cases.	Mortality.	Cases.	Mortality.
0	85	26.0%	70	34.0%
+	47	74.5%	47	74.5%
++	15	100.0%	24	100.0%
+++	75	100.0%	81	100.0%
TOTAL	222		222	

It will be seen from the above table that in the higher grades of septicæmia the mortality was 100 per cent. in spite of the serum. In slight septicæmia, the mortality was the same (74.5 per cent.) in those treated with the serum, as well as in the controls. In sterile cases, however, there was an advantage in favour of the serum by 8 cases in 100. But the Plague Commission were of opinion that this difference was not large enough in such a small number of cases to indicate any definite influence of the serum, and did not satisfy the statistical test for error due to "random sampling."

Tincture of iodine has also been recommended for the treatment of plague, and an experiment with it was conducted by the Director of the Bombay Bacteriological Laboratory—now the Haffkine Institute—on sixty cases of plague in the Maratha Plague Hospital. Twenty of these cases received the ordinary treatment, as adopted by Dr. Choksey, the Medical Officer in charge. Twenty were treated with 5 drops of tincture of iodine administered every three hours by the mouth. Twenty others were treated by intravenous injections of seven minims of the tincture every twenty-four hours.

The table given below shows the result of this treatment in each group, the cases being classified according to the degree of septicæmia present:—

Treatment.	DEGREE OF SEPTICÆMIA.								Total treated.	
	0		+		++		+++		R	D
	R	D	R	D	R	D	R	D		
Ordinary (controls)	3	4	1	1	10	3	0	8	14	16
Iodine by mouth	6	3	2	1	0	1	0	7	8	12
Iodine intravenously	3	4	0	3	10	13	0	7	3	17
TOTAL	12	11	3	5	10	7	0	22	15	37