MALARIAL AND FILARIAL DISEASES IN
BARBADOES, WEST INDIES.¹By GEORGE C. LOW, M.A., M.B., C.M. EDIN.,
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THE analogy between malaria and filariasis is in many ways a close and interesting one, both as far as the tropics are concerned, being very often found coexisting in the same districts, and both being spread from man to man by their own special species of mosquitos. It is, therefore, interesting to be able to point to a tropical island, namely, Barbadoes, in which the former is non-existent, while the latter is extremely prevalent amongst all classes of the community.

The reason for the presence of the one and the absence of the other is supplied by the fact that *Anopheles* mosquitos, the definitive host of the malarial parasite, are not found in the island, whereas *Culex fatigans*, one of the suitable intermediate hosts of *filaria nocturna*,² abounds.

Before considering certain local features of these two infections, a brief description of the physical characters of the island may be given with advantage.

DESCRIPTION OF THE ISLAND OF BARBADOES.

Barbadoes, the most easterly of the Carribean Islands, lies well out in the ocean by itself in latitude 13° 4' north, and longitude 59° 37' west, about 100 miles distant from St. Lucia and St. Vincent. It measures 21 miles long by 11 miles broad, and comprises an area of 166 square miles, six-sevenths of which consists of a formation of coral limestone, the remaining one-seventh being formed of different geological strata, namely, the Scotland series, consisting of sandstones and dark clays; and the oceanic series, consisting of white earths and chalks.³ The surface is more or less flat, the land rising gradually towards the centre of the island into two ridges, one of which running east and west attains a height of 400 feet above sea-level, while the other to the north of this is about 1,000 feet high.

The population of the island numbers 200,000, 30,000 living in Bridgetown, the chief town, and 1,500 in Speightstown, the second town, while the remainder are scattered about in separate huts and hamlets or in small villages.

With the exception of one or two springs, which bubble up and find their way into the sea within a few hundred yards of their origin, there are no rivers, the water supply for the town being obtained by boring into the large subterranean reservoirs of water which exist underneath the coral.

Several ponds and larger collections of water are found at different parts of the island, two such existing at Speightstown and Holietown respectively; three miles south of Bridgetown there is a permanent swamp.

In addition to these there is a creek communication with the harbour, which runs inland for some distance in the centre of the town, and another swamp at the south of the island. The water in the latter disappears during the dry season. After heavy rains, and during the wet season, various collections of water are found in hollows and other situations, chiefly along the coast. The whole island is practically under cultivation, sugar-cane being the staple product. Two seasons may be distinguished—a wet and a dry; the former in summer and autumn, the latter in winter and spring. The average rainfall is about 60 to 70 in. a year.

Malarial Fever.

On arriving in Barbadoes, and talking with the medical men practising in the town and island, all were unanimous in the statement that indigenous malarial fever does not exist in the island. Cases are frequently met with in the General Hospital; all of these come from some of the neighbouring islands where malaria is very common. No one could point to a case which had originated in the island itself.

The interesting question now arises, are any mosquitos of the genus *Anopheles* to be found in Barbadoes or not? As may be gathered from what has been already stated, the features of the island do not lend themselves very readily for the production of suitable breeding places for these insects, with the exception of the swamp at Worthing, three miles south of Bridgetown. This swamp is situated at the foot of some elevated ground quite close to the sea, with which it com-

municates by a canal, the exit, however, being very often blocked up with sand thrown up by the surf. It covers a considerable area of ground and is divided up into canals and ponds with roads and paths running through it in various directions. The water, especially in the part near the outlet, is slightly brackish, and in parts it is very stagnant, smelling strongly of sulphuretted hydrogen resulting from the decomposition of vegetable material. It is probably fed by springs of water, rain, and other collections which percolate from the neighbouring high ground. The surface of the water at many places is covered with algae of various sorts and other sorts of aquatic vegetation. On looking at it, it certainly appears to be a spot favourable for the development of *Anopheles* larvae, but although larvae of a species of *Culex* and those of dragon-flies and other aquatic insects were always found in abundance, no *Anopheles* larvae could be discovered. Confirmatory evidence of this was found in the fact that people living in the vicinity never suffered from fever, but enjoyed remarkably good health. It is probable from the close similarity of this place to *Anopheles*-infested swamps in the other and neighbouring islands, that such larvae could live here perfectly well; whether they have ever been here and have died out, or whether they have never existed, is a matter of speculation.

An examination of the other swamp at the south end of the island was not very hopeful, as at the time of my visit it had only filled up with water after some very heavy rain, and contained practically no algae or other vegetation; no *Anopheles* larvae were found in it, the only result of my search being a species of *Culex* in small numbers. The creek in the centre of the town is very dirty and muddy, and is really an arm of the sea fed at its upper end by rain and other waters. Several examinations produced no larvae of any sort, the water being probably too dirty for anything to live in. All the various ponds, springs, and other collections of water, though often containing plenty of suitable vegetation, gave similar results; in some, larvae of *Culex* were found, in others nothing.

These observations coincide with the researches of Mr. Lefroy, Entomologist to the Imperial Department of Agriculture, who has also made a systematic search for *Anopheles* larvae with negative result.

The conclusions reached, therefore, bear out that suggested by the epidemiological fact that there is no malarial fever in the island, and once more go to prove that without mosquitos of the genus *Anopheles* no malarial fever can exist.

Filarial Diseases.

In marked contrast to the absence of malaria is the large amount of filarial disease in Barbadoes. This is not to be wondered at when one considers the extraordinary abundance of the common domestic mosquito of those parts, *Culex fatigans*, which acts as an efficient host for the spread of the disease. It is an interesting fact that out of more than 600 blood examinations of people from all parts of the island, only *filaria nocturna* was found, *filaria Demarquaii*, which exists in St. Vincent and St. Lucia, and which I lately found in Dominica, never being met with. Although Bridgetown has now a very good water supply, brought in pipes from the centre of the island, where it is pumped up from the subterranean collections of water, yet many tanks exist in the gardens of the large houses for watering purposes, and around the neighbouring huts barrels and tubs of water are kept and left standing for considerable times. In these situations myriads of *Culex fatigans* breed and multiply and eventually may act as propagators of the disease. An examination of the night blood of 600 cases (taken irrespectively of the patients suffering from disease or not) from the General Hospital, Central Almshouse, and from private sources, will show to what extent filariasis prevails in Barbadoes.

The proportion of 14 infected whites out of 39 is manifestly much too high to be regarded as representing the degree of infection in the white population as a whole. Many of these whites for one reason or another were collected in the almshouse at the time of examination, others being more or less selected private cases. The table indicates probably correctly the proportion of the coloured population affected.

The figures referring to white people make clear a point on which sufficient evidence has not been laid before, namely,

that the white person is quite susceptible to filarial disease. This is specially so as regards Barbadoes, where persons, whether resident in the island all their lives, or only visiting it temporarily, often contract the disease; the rich and poor are alike in this respect.

Race.	Number Infected.	Non-Infected.	Infected.
Negroes	401	357	44
Mulattos	160	142	18
Whites	39	25	14
Total	600	524	76

Equal to 12.66 per cent.

In analysing the table, 27 or 4.5 per cent. of the total number examined, or 35.5 per cent. of the filarial cases, had definite pathological changes indicative of filarial disease such as elephantiasis, chyluria, filarial lymphangitis, etc.; whereas 49 of the filarial cases, or 8.1 per cent. of the total examined, had no symptoms whatever, the diagnosis being come to by the discovery of embryos in the blood. This latter class is a dangerous one as regards the spread of the disease, for it is manifest that unless sleeping under mosquito nets, which if they are negroes they never do, they nightly infect many mosquitos, which in turn infect other people and so spread the disease.

To get some idea of the number of infected mosquitos about, a series of dissections of 100 mosquitos, of the species *Culex fatigans* taken from the wards and corridors of the General Hospital, in which there were cases with embryo circulating in their blood was carried out. Of this number, 23 per cent. were found to be infected with filaria nocturna at various stages of development, and in one mature forms were found in the proboscis, thus showing the danger of being near infected people.

The question arises, What can be done for the prevention of filarial disease? Much has now been done and tried for the destruction of *Anopheles*, the malaria-bearing mosquito. Similar or modified methods should be carried out for all domestic mosquitos. Considering that their breeding places are confined to houses and their vicinity, this should not prove a task at all approaching in magnitude to the draining of large swamps or to treating them in other ways.

Taking Barbadoes as an example, as has already been stated, there is now a perfect water supply, and people can get their water fresh from the standpipes at their doors. Such being the case, old wells ought to be filled up; no water barrels or tubs should be allowed, or if kept they should be emptied every week or so. Tanks and collections of water in gardens should all be periodically treated with kerosene or be furnished with closely-fitting covers to prevent mosquitos getting in.

These methods are simple and inexpensive, and each householder should see that they are applied in his garden and grounds. The difficulty begins when one has to take into account the inability of the negro to grasp anything of a hygienic nature. The only way to get over this would be a system of sanitary inspection by a few competent men. For individual prophylaxis mosquito nets ought always to be used, but many, even educated, people still persist in sleeping without them; of course nothing in this line can be expected of the native population.

If such means were adopted for Barbadoes, the prevalence of filarial disease, which is at present quite alarming, could easily, with little trouble and expense, be greatly diminished, and thus save much suffering, as well as loss of time, hideous deformity, and, doubtless, in not a few instances, loss of life.

NOTE AND REFERENCES.

¹ This paper, forwarded by the Honorary Secretary of the Barbadoes Branch of the British Medical Association in reply to a request for the consideration of the resolutions re filariasis in Barbadoes passed in the Section of Tropical Diseases at the annual meeting at Cheltenham, is published by order of the Council. ² BRITISH MEDICAL JOURNAL, June 28, 1901. ³ *The Geology of Barbados*, Harrison and Jukes Brown, 1890.

NOTE ON MEDIA FOR DISTINGUISHING B. COLI, B. TYPHOSUS AND RELATED SPECIES.

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IN this brief note we take cognizance only of some recently described media and dyes of which we have made and tested several combinations.

During last summer one of us (A. S. G.) made some attempts to improve on the well-known MacConkey's medium (taurocholate-lactose-agar), which is still *facile princeps* of media for this kind of work. The addition of neutral red¹ to the solid medium was tried, and it was found that *B. coli* could then be easily distinguished by the crimson colour of its colonies. From the time when Rothberger introduced this dye it has been used by several observers in different combinations, but not, so far as we are aware, in lactose-containing media. We see no advantage in the addition of neutral red to glucose media. Lactose, from the fact that *B. coli* and its congeners are the only members of the group which decompose it with the formation of gas bubbles, we consider to be an essential ingredient of these differential media.

The other of us (E. H. H.) has recently been working with v. Drigalski and Conradi's medium with satisfactory results, but it seemed worth while to try various other combinations.

We may say at once that for ordinary working purposes MacConkey's medium with neutral red seems to give the best results, but for demonstration purposes a medium containing both neutral red and "Krystall-violett"² gives very striking and instructive pictures. The medium recommended has the following composition:

Agar	2 gram.
Pentone	2 "
Water	100 c.cm.

made alkaline to the extent of 0.4 c.cm. normal NaOH beyond the neutral (litmus) point.

To this when filtered and sterilized is added:

Sod. taurocholate (from ox bile)	0.5 gram.
Lactose	1.0 "
Half per cent. neutral red solution	1 c.cm.

and the whole heated in the Koch's sterilizer for fifteen minutes. This avoids decomposition of the lactose; and is, nevertheless, sufficient for sterilization.

Petri dish inoculated with bacillus coli (dark colonies) and bacillus typhosus (light colonies); observe darkening of medium around the colon colonies and the lightening of the same around the typhoid colonies.

The superficial inoculation of poured plates gives very good results, but the plates should not be poured until the day on which they are required. Only *B. coli* and other lactose fermenters (including *B. pyogenes fetidus*) grow as red colonies, colour the surrounding medium red and produce a