natives of Barbadoes and Demarara, where it has been shown¹ that the white population is highly infected with filaria. It is, nevertheless, true that the whites in Trinidad are in no way exempt from the danger of infection, and with them the result (14.5 per cent. elephantoid disease) appears to be a very serious matter. The East Indians form the chief labourers on the sugar cane estates, and to a tendency on their part always to live by themselves in small villages away from the other classes must be attributed their slight infection with filaria.

The blood films were all collected between 8 P.M. and 11 P.M., and with one exception, in which filaria Demarquaii was found, all the infected cases proved to be filaria nocturna. The chief forms of filarial disease observed were (in the order of frequency) elephantiasis of the leg, elephantiasis of the vulva, chyluria, filarial lymphangitis, and elephantiasis of scrotum and penis. Of the 25 cases infected with filaria 3 (or 12 per cent.) were the subjects of well-marked elephantiasis, while of 475 uninfected cases 30 (or 6.3 per cent.) gave evidence of elephantoid disease.

METAMORPHOSIS OF FILARIA IN MOSQUITOS.

A number of experiments were undertaken to estimate to what extent the observations made in other tropical countries on the metamorphosis of filaria in mosquitos coincide with the conditions in Trinidad. The species of mosquitos employed were *Culex fatigans*, *Culex taeniatus*, and *Anopheles albimanus*.

Culex Fatigans.—A small brown mosquito described by Giles² as closely resembling *Culex pipiens*, and by Low³ as occurring in St. Lucia and Barbadoes, is the common house pest here during the rainy season. It breeds freely in all collections of water about the dwelling house, and bites voraciously at night. Specimens were bred out and fed on a highly-filariated patient. In about 9 per cent. of those fed, the metamorphosis of the filaria embryo took place in the muscle of the thorax in the manner described by Bancroft, James, Low, and others, working with *Culex ciliaris* and other species. About the tenth day the embryos were fully one-twentieth of an inch in length, and when teased out of the thoracic muscles exhibited active wriggling movements. The final stage of the metamorphosis was reached between the sixteenth and the nineteenth day, the fully-developed embryo appearing shortly after in the tissues of the head and proboscis. Although special attention was devoted to the point, in no case was the final stage reached earlier than the sixteenth day, in spite of the fact that the mosquitos were kept in a room, the temperature of which was never lower than 76° F., and often for the greater part of the day, was about 85° F. (August). It would appear, therefore, that a high temperature alone is not sufficient to accelerate the metamorphosis to such an extent that the final stage can be reached in seven or eight days, as Manson first announced, though a lowering of temperature may considerably retard the process. One must look to other factors for the explanation of the variability in the time taken by different species, and it will possibly be found in the fact that some species in highly filariated localities have acquired in an exceptional degree the capacity for acting as intermediary hosts. By storing the mosquitos in dry mosquito-net cages, and feeding them on ripe bananas, it was possible to keep some of them alive as long as seventy days. Many examined on the fortieth and forty-fifth days after infection with filaria still contained numerous fully-developed embryos in the proboscis and head tissues, and it is evident that Grassi's and Noë's⁴ statements that *Anopheles* rid themselves of the fully developed embryos when made to feed on fruit cannot hold good for *Culex fatigans*, for by this time most, if not all, of the embryos would have been voided.

Culex taeniatus, a smaller blackish mosquito with silvery spots on the body and striped legs, is very common all the year round, is a rapid breeder and a nocturnal and diurnal feeder. Many specimens were bred out and fed on a filariated subject, but investigation soon proved that either this species of *Culex* is not an efficient host for filaria, or that it is impossible to supply them, while in captivity, with the conditions essential to the complete metamorphosis. The metamorphosis took place more slowly than with *Culex fatigans*, and although fed on the same patient, a much smaller number

of embryos migrated from the stomach to the thorax. Of those that reached the thoracic muscle several became sessile and underwent no further change; others developed slowly up to the sixth day, after which no further changes took place, and by the eighth day disintegration and absorption began, while many specimens examined from the tenth to twelfth day showed no signs of embryos. The plan was tried of giving a second, and in some cases a third, feed of filariated blood on the third or fourth day, but the result did not appear to be affected in any way, no filaria embryos reaching the final stage.

Anopheles albimanus, a large black insect with snow-white rings on legs, occurs in the highly malarious districts and in swampy localities outside of the city of Port of Spain. In these localities it sometimes greatly outnumbered the commoner species of *Culex*, and as it proved to be an efficient host for filaria it probably forms an important factor in the spread of filariasis in these districts. Great difficulty was experienced in getting them to breed in captivity and it was found impossible to keep them alive more than fourteen days. The specimens bred out and fed on a filariated subject showed the metamorphosis taking place more rapidly than in *Culex fatigans*, the stage reached by the tenth day corresponding to that of the twelfth day with *Culex*. As none lived beyond the twelfth day after feeding it is not possible to say definitely when the final stage is reached, but judging from the size of the embryo and its active movements it is likely that the fully metamorphosed filaria reaches the proboscis shortly after the twelfth day. A second feed of filariated blood did not seem to improve the condition of the *Anopheles*, those receiving it dying about the same time as the others.

PROPHYLAXIS.

That filariasis is transmitted through mosquito bites admits of little doubt, whatever may be the other means by which infection may be carried, and protection from infection practically means protection from mosquitos. It may be possible to rid a locality of *Anopheles*, which require special conditions for breeding, but this is not so easy a matter in the case of the *Culices*, which breed readily in any collection of water. Much may be done even in the case of *Culex* by protecting all stored water and frequently emptying all collections of water so as not to allow sufficient time for the larvae to mature.

Meanwhile the only safeguard is to be found in the habitual use of mosquito nets, especially when in the neighbourhood of known filariated individuals. If a malarial subject is a source of danger to those around him, a filariated individual is doubly so, for in his case the carriers of infection are drawn from the ranks of a very common species of mosquito, as well as from the rarer species to which we owe malaria.

REFERENCES.

¹ *Journal of Tropical Medicine*, August, 1898. ² *Handbook of the Gnats or Mosquitos*. ³ *BRITISH MEDICAL JOURNAL*, June 1st, 1901. ⁴ *Ibid.*, November 3rd, 1900.

ON THE CAUSAL RELATIONSHIP BETWEEN "GROUND-ITCH," OR "PANI-GHAO," AND THE PRESENCE OF THE LARVAE OF THE ANKYLOSTOMA DUODENALE IN THE SOIL.

By CHARLES A. BENTLEY, M.B., C.M. EDIN.,
Medical Officer to the Empire of India and Ceylon Tea Company, Limited,
Borjulia, Tezpur, Assam.

In the *Journal of Tropical Medicine* for March 1st, 1901, an article appeared under the heading "Water-itch; or Sore feet of Coolies," describing a disease with which all tea garden medical officers in Assam, Cachar and Sylhet, are familiar. Apparently a similar affection is very prevalent on the sugar plantations of the West Indies; for in the annual report, by the Surgeon-General of Trinidad, for the year 1900, it is mentioned that "ground-itch is very prevalent during the rainy season on the sugar plantations, amongst the East Indian labourers." It is further remarked in this report, that although the disease is not a serious one, it is a matter of great

importance to the planters, on account of the number of labourers it incapacitates from work.

The disease has been defined by Dr. Dalgetty (Sylhet), one of the writers referred to, as: "A superficial vesicular dermatitis, which occurs epidemically among the coolies working on tea gardens during the wet months of the year, which solely attacks the feet, and which has a considerable resemblance to ordinary scabies." In place of this definition, I substitute one which I think is perhaps more suited to the condition.

DEFINITIONS.

Ground-itch (synonyms: pani-ghao, water-itch, water-pox, water-sores, sore feet of coolies) is an affection of the skin confined entirely to the lower extremities, and probably always associated with the presence of the larvae of the ankylostoma duodenale in the soil of the affected areas; endemic in Assam and the West Indies, and possibly present in other parts of the tropics; characterised by its periodical epidemic appearance in the infected areas, coincident with the onset of the rainy season; with typical lesion consisting in a primary erythema, followed by a vesicular eruption which frequently becomes pustular, and in severe cases may result in obstinate ulceration or even in gangrene.

PREVALENCE.

In Assam the disease is almost universally known by the name "pani-ghao" (literally, water-sore), a term which has been applied to it probably because it only occurs during the seasonal rains when the earth is saturated with moisture. On tea gardens, where the disease has once appeared, it becomes a yearly recurring epidemic. Sporadic cases may occur as early as May, but the general outbreak does not usually appear until a month or six weeks later, and does not disappear until about the end of October, when the ground has become comparatively dry again. People of all classes are liable to contract the disease, although it is rare for a European to be attacked.

The disease may generally be said to attack the different individuals in a community with a frequency directly proportionate to their exposure to the source of infection. All observations point to the earth as being the infecting medium, and faecal contamination of the soil as being the most active agency in the propagation of the disease, which in over 90 per cent. of cases is contracted in the immediate neighbourhood of the coolie lines, as the collection of coolie houses is termed.

It is a well-known fact that the Indian coolie is not very particular in regard to the disposal of human refuse. He will not adopt any proper conservancy system, and latrines, if erected on tea gardens, are never used by the labour force. The coolie walks but a few yards from his dwelling in order to relieve himself. In this way the cultivated areas for some distance round the lines in most tea gardens is constantly being contaminated with faecal matter. The coolies themselves recognise that this accumulation of filth is the cause of the disease, and as far as possible they try to avoid exposure to infection by shirking work in the parts of the garden in close proximity to the lines. When obliged to walk over the infected soil they almost invariably protect their feet by wearing "kurrums," a kind of wooden sandal.

In this part of Assam the disease appears chiefly among the labourers who are engaged in hoeing; it affects the strong and healthy quite as frequently as the weakly and anaemic. Cases occurring among hoeing people almost always show the eruption on the instep and ankle. This is no doubt due to the nature of their work, which necessitates their remaining near the same spot for a considerable time, and ensures that their feet are in contact with the soil, while a constant shower of moist earth falls from the hoe upon their feet and ankles. Of the total cases 75 per cent. occur among men. This is explained by the fact that during the time when the disease is prevalent, the strong men are engaged in hoeing while the more weakly men, the women, and children are at work plucking.

Among pluckers, the disease is very much more frequently seen on weakly individuals and those whose caste customs forbid a high standard of personal cleanliness. Among this class of coolie the lesion is almost always confined to the underside of the foot or to the clefts between the toes, and

can generally be traced to neglect to wear kurrums, or to want of sufficient care in cleansing the feet after return from work. Want of cleanliness may certainly be regarded as a strongly predisposing cause of infection, and this fact rather than any inherent susceptibility must be looked upon as the reason why anaemic and debilitated coolies so frequently suffer from the disease. The reason that so few robust plucking people are subject to the affection is no doubt to be sought in the almost universal adoption of kurrums by the better coolies, combined with careful washing of the feet immediately on leaving work. The weakly coolie is always dirty and negligent in matters of this kind. He often eats his food without washing his hands, and it is probably quite exceptional for him to wash his feet at night.

SYMPTOMS.

The first symptom is an intense itching and burning at the spot where afterwards the eruption appears. This is sometimes so distressing as to cause the sufferer to rub his feet on the ground or some other hard rough surface in order to obtain relief. A faint papular eruption may be distinguished at this time, although sometimes a slight erythema is all that can be detected. This may occur within a few hours of infection, or may be deferred for twenty-four hours.

Later, usually about the second day, a distinctly vesicular eruption appears, which may be confined to the skin between the toes, or be found under the arch of the foot, or as in a large number of cases be chiefly seen in isolated patches over the dorsum of the foot, reaching sometimes several inches above the ankle. Apparently the affection is confined entirely to the lower extremities, no cases having been reported as occurring on any other part of the body, except as the result of experiment.

If early treatment is adopted the disease may be aborted, the vesicles drying up, and the patient becoming fit for work again in two or three days; more frequently the vesicles become pustules, or they burst, discharging a watery fluid, and then becoming open sores. If pustules have formed, unless they are speedily opened, the process may extend, the pus appearing to burrow under the surrounding healthy skin, and so forming large bullae. In this way an area of several square inches may be denuded of skin.

In a large number of cases very severe inflammation occurs associated with acute pain and great swelling, preventing the sufferer from walking; sometimes also extensive ulceration or even sloughing or gangrene takes place.

ETIOLOGY.

As previous observers have pointed out, this disease is one of great importance to the employer of coolie labour; for during the seasonal epidemic more than 5 per cent. of a labour force may be temporarily invalidated by its attacks.

Until recently nothing was known as to the cause of the affection, although various suggestions have been made from time to time. Dr. Seheult (Trinidad) has stated that the condition is probably due to some chemical irritant present in the soil, either natural or due to manure used in cultivation. Dr. Dalgetty (South Sylhet), led astray by the superficial resemblance which the lesions of the disease bear to ordinary scabies, has described an acarus as the cause. His article in the *Journal of Tropical Medicine* was mainly devoted to an account of the anatomical characters and life-history of this mite, which certainly occurs as an accidental infection of neglected water-sores, and may almost constantly be found in the scab or crust round the edges of any untreated ulcer in this part of India.

I have been familiar with this disease in its clinical aspects for the past three years, have frequently met with it in tea-garden practice both in Cachar and Assam; but until this present season I have had no opportunities for investigating the nature of the condition.

I had been engaged in investigatory work for some two months before my attention was called to Dr. Dalgetty's article. After reading it, I felt greatly surprised that my observations appeared to be entirely at variance with those recorded by him. As a result, I repeated my experiments and observations, in order to satisfy myself as to their accuracy.

A few simple experiments served to show conclusively that the condition, although possessing a superficial resemblanc

to scabies, is in no sense an analogous disease. Dr. Dalgetty's methods of investigation are open to sources of grave error; thus he says: "If care be taken to evacuate the pustule completely, and to remove at the same time any crust that may happen to surround the spot, then in a certain percentage of cases the ova of an acarus may be seen." He adds that he has frequently found living acari in this way, which is hardly surprising, seeing that they may be found by the score on any dry dead animal matter which is exposed to the air. If, however, he does not find the mite in this way, "he lays the pus or crust aside for a day or two, covered up and moistened with sterilised water, but not covered with a cover slip."

It naturally follows that very soon some mite in search of food finds its way to the specimen put aside for future inspection. I first found the acarus on the scab taken from an old water-sore, but on the same day I was fortunate to come across a colony of the same acari feasting upon the body of an *Anopheles* mosquito that I had put aside on a slide about a week before. Since then I have found the mite on all sorts of decaying animal matter, such as dry faecal matter, dead flies, etc., and recently I bred about a hundred of them for experimental purposes upon the dead body of an ankylostoma.

It may here be remarked that the acarus described by Dr. Dalgetty seems to prefer dry to moist surroundings, and certainly it appears to breed very much more readily in the former.

In order to prove, however, whether or not the mite could produce the lesions of the disease, the following experiments were tried:

Experiment No. 1.—A small quantity of soil was taken from a known infected area near to some coolie lines, and after being moistened was applied to the arm, where it was kept in contact with the skin for a period of six hours, with the result that typical water-sores followed. The soil that had thus been utilised, as well as the unused portion, was then carefully examined with the microscope, but no sign of any acari could be found.

This experiment showed that the cause of the disease must be sought for in the soil from areas near the coolie lines. This soil, as has already been mentioned, is contaminated with faecal matter in a very marked degree. Careful microscopic examination of samples of the soil from different areas was undertaken. The following list of living objects which were found present in these samples were noted down for future reference:

(a) Rhabditiform larvæ of the *ankylostoma duodenale* (recognised by comparison with special cultures of larvæ) were present in great numbers.

(b) Minute leeches.

(c) Minute earth worms recognised by their setae.

(d) Several species of rotiferae.

(e) Several different species of infusoriae, both amoeboid and ciliated.

(f) The spores and hyphae of several microscopic fungi.

(g) Bacteria, rod shaped, curved, spiral (?) and micrococci.

While making these observations several further experiments were performed in order to show whether or not some chemical irritant in the soil might be regarded as the cause of the condition under consideration.

Experiment No. 2.—A small portion of the same earth that was obtained for previous experiments, and had been proved to contain the cause of the disease, was sterilized by being baked for a considerable time. Some of it was then moistened and applied to the arm, as described previously. It failed, however, to produce any irritation, and thus completely negated the idea that a chemical irritant in the soil was the cause of the disease.

Microscopic examination of the soil in parts of the garden where the disease was never contracted showed that earth worms and minute leeches were present in greater number there than in the faecal-infected places. Infusoria were to be found in pretty nearly as great numbers where decaying vegetable matter was present, and certainly could not be looked upon as a likely cause of the disease. Of the probable causes, some bacterium, some species of fungus, or the rhabdoid larvæ of the *ankylostoma*, had to be considered.

Meanwhile a large number of cases of water-sore had been carefully examined. In the earliest stage, when only a slight erythema showed where the vesicular eruption would shortly appear, blood films were prepared from the part affected. Nothing definite was derived from this procedure, although a few micrococci were seen once or twice. Scraping a patch of erythema showed on several occasions objects which at first were taken to be fibres of cotton or the shrivelled hyphae of fungi, but when at last an intact and easily recognisable specimen of an *ankylostoma* larva was found, these objects

were more carefully examined under a higher power, when they proved in a number of cases to be undoubtedly the empty sheaths of similar larvæ. In the vesicular stage bacteria of certain kinds, lymph cells, a few blood cells, and once or twice a small amoeboid organism were discovered. The pustular form of the disease showed staphylococci and streptococci, together with a few rod-shaped bacilli. Not having a microtome or other apparatus necessary for preparing sections, it was impossible to make this part of the investigation as complete as could have been wished.

Failing to find any definite cause for the disease by microscopic preparations for the lesions themselves, I once more turned my attention to the search for the cause in external Nature, and to this end the following experiments were undertaken:

(a) Some ordinary soil was sterilised by heat, and after being moistened with sterilised water was infected with a small quantity of faecal matter, containing numerous ova of the *ankylostoma duodenale*.

(b) A similar preparation of soil was infected with a small quantity of faeces, which on examination were found to be free from ankylostomal infection.

These two preparations were incubated at the ordinary temperature of the air for about a week. At the end of this time sample "a" was swarming with larval *ankylostoma* and various forms of bacteria and fungi, and sample "b," but for the absence of the dochmii, presented a similar appearance. Of "a" and "b" respectively two small quantities were taken, the first portions of which were kept moist, while the second were gently dried at the temperature of the air for a period of eight hours. Previous experiments with cultivations of the larvæ of the *ankylostoma* had shown that gentle drying at ordinary temperatures for a period of six hours was sufficient to kill the larvæ. The four preparations were then applied (after remoistening the two desiccated samples with sterilized water) to the wrists of the subjects of experiment, who retained them in a position for a period of about eight to nine hours. At the expiration of that time the bandages were removed. Fifteen hours after the first application of the earth, however, considerable erythema with a minute papular eruption appeared over the spot to which the earth containing embryo *ankylostoma* had been applied. Within twenty-four hours a distinctly vesicular eruption had developed, followed by pustules exactly resembling those found in the lesions of ground-itch. In the other cases a faint reddening of the skin was produced, which shortly afterwards entirely disappeared.

The small portions of soil which had been applied to the skin were then re-examined under the microscope. The sample which had been known to be swarming with the active embryos was found to contain no living larvæ, one or two dead specimens being all that could be detected. The sample that had contained dead embryos was seen to be full of their shrivelled bodies. Apparently, therefore, the living larvæ had entered the skin, and their entry had been followed by lesions similar in every particular to those found associated with the condition known as water-sore.

It now remains to review the fact which various observers have recorded with reference to the clinical nature of the disease, and see whether or not they appear to agree with the theory deduced from the results of the experiments and microscopical investigation described above. The disease only occurs when the atmospheric temperature is fairly high and the earth is saturated with moisture; moreover it only occurs in areas in which, as has been already shown, there is constantly increasing faecal infection of the soil. Where the disease is prevalent ankylostomal infection is extremely common. Giles, Dobson, Rogers, and others, have shown that upwards of 75 per cent. of tea garden coolies are the subjects of ankylostomal infection, and my own observations point to an even more general infection in certain districts. Thus recently among some three hundred coolies, in all conditions as regards health, whose stools I examined microscopically, only one individual showed freedom from ankylostomal infection. It may thus be readily imagined what an enormous number of larvæ of this parasite may be set free in the soil when the conditions are favourable to their development.

As I have previously shown desiccation at comparatively low temperatures is sufficient to kill the larval *ankylostoma*,

this is a simple explanation of the fact that water-sores are never seen during the dry season. At this time the ground is hard, and on tea gardens, owing to pruning and other processes of cultivation, is also denuded of the vegetation which affords protection from the rays of the sun during the rains.

The result is that the embryo ankylostoma—which hatches out from the ova within the first two or three days after they have been expelled from the host, in the faeces—perishes almost immediately.

The very rare occurrence of the disease among the rural population is explained by the different methods adopted in the bushes for the disposal of human filth. It appears probable that the acuteness of the inflammation attending an attack of ground-itch is largely governed by the nature of the organisms which accompany or follow the larval ankylostoma in its passage through the skin. That this entry through the epidermis can and does occur has been recently demonstrated by Dr. Looss and Professor Sandwith, of Cairo; but I believe that I am the first to identify this entry of the parasite as the cause of the distinct and well-known skin affection so prevalent in this and other parts of the world.

TREATMENT AND PROPHYLAXIS.

In the papular and early vesicular stage of the disease, the application of a strong solution of salicylic acid in colodion or methylated spirit will cause the eruption to dry up, and so cut short the attack of the disease to one or two days. If, however, pus has formed, the only treatment of any service is the opening up and disinfection of the pustules with pure carbolic acid, silver nitrate, or nitric acid, and the after-treatment of the sore as an ordinary ulcer. In cases attended with great swelling, inflammation, and a tendency towards the formation of sloughs, free skin incisions and the use of hot antiseptic foot baths are indicated.

The adoption of a proper conservancy system would probably entirely prevent the occurrence of the disease, but to anyone familiar with the habits and prejudices of the Indian coolie this solution of the question appears beyond the bounds of possibility.

The wearing of shoes or some kind of protection to the feet is known to be an almost certain preventive of the disease, and the frequent application of tar to the feet of those engaged in working in infected areas is a procedure of proved value. It is probable that the application of sulphur, or some strong disinfecting agent, to the soil in the neighbourhood of the lines may prove to be of use in destroying the parasite and so preventing the disease.

I have to thank Dr. P. K. Mitra, my assistant, for considerable help in carrying out the various experiments described.

MALARIAL FEVER IN ST. LUCIA, W.I.

BY ST. GEORGE GRAY, and GEORGE C. LOW,
B.A., M.B., B.Ch. Univ. Dubl., M.A., M.B., C.M. Edin.,
Colonial Assistant Surgeon, Craggs Scholar, London School
St. Lucia. of Tropical Medicine; St. Lucia.

DURING the months of January, February, and March, malarial fevers are more prevalent in St. Lucia than at other times of the year. To see to what extent such infections might exist, the blood of as many native patients as possible visiting the Castries and district dispensaries for treatment, during a period extending from January 14th, to April 4th, 1901, was examined. In that time 1,065 persons suffering from various diseases presented themselves. As it was impossible to examine the whole of this number in the limited time at our disposal, a special selection was made, namely, cases complaining of fever, those with febrile symptoms, and as many children as possible. All the films were examined wet, immediately after pricking the finger, and out of 230 cases the large number of 137 were found to be infected with one form or other of malarial parasites. None of these patients had been treated with quinine. Keeping in view the observations of Koch in New Guinea, and Stevens and Christophers in West Africa, as to the high percentage of children infected, and as to the immunity gained by the adult native of those parts, these points were specially investigated. The result of our observations, which are seen in the subjoined table, show

that as far as the natives of this island are concerned, there is a considerable difference as regards the conditions in the aboriginals of New Guinea and West Africa.

Although children under 2 years of age are very susceptible, yet in the blood of many no parasites were found, and in all infected with malarial parasites there were very definite clinical symptoms of malarial fever, the mothers in nearly every instance bringing the children to the dispensary to be treated for those symptoms.

On the other hand, where such signs were absent or where there was no previous history of fever no parasites could be found. Dr. Nicholls has noted that this same condition exists in the native children of Dominica.

As age advances the percentage of infections still remains high, and there does not seem to be any very marked immunity attained. Between the ages of 2 and 9 more than half the cases are found to be infected, and a similar condition exists in cases between 10 and 20 years. Adults are also susceptible to the disease, and generally suffer very severely, many of the cases developing pernicious symptoms with great rapidity. In 50 people over 21 years of age, more than half were found to have parasites in their blood.

This point is interesting because it shows that the West Indian negro differs from his African ancestors in his susceptibility to malarial fever. Why this is so is difficult, perhaps, to explain. It is a well-known fact that natives, when brought to a new part of the tropics from their original home, suffer severely from the fever of the district; but then the West Indian is not a recent importation; he has lived now for a considerable time in those islands, and has become thoroughly acclimatised to the climate and customs of his new home.

One must remember, however, that he is no longer a savage; he is semi-civilised, wears clothes, and more or less lives the same life as the white residents. Further, in the West Indian the question of a mixed race must always be considered. In St. Lucia there is a very large coloured population, varying greatly in degree, the result of interbreeding between white and black; many of the cases treated at the dispensaries were of this mixed class.

The following table shows the results of the blood examinations (a) according to the age of the subjects and (b) according to the nature of the parasites found:

	Children under 2 years.	Children 2-9 years.	10-20 years.	21 years and over.	Total.
Number of cases seen at dispensary ...	87	174	260	544	1,065
Number of cases examined ...	49	71	60	50	230
Number of cases infected ...	22	46	38	31	137
Malignant parasites alone ...	14	32	24	19	89
" " with crescents ...	2	5	7	6	20
Benign tertian parasites ...	3	1	5	3	12
Quartan parasites ...	—	1	1	—	2
Double infections ...	2	3	—	1	6*
Pigmented leucocytes alone ...	1	4	1	2	8
Not infected ...	27	25	22	19	93

* Malignant and benign tertian.

From this table it will be seen that the very large majority of the cases of malarial fever in St. Lucia are of the malignant type, the aestivo-autumnal fever of the Italians. Many of the cases showed large numbers of parasites in the peripheral blood, while others had very few. The usual type of the fever was quotidian, and the non-pigmented and pigmented quotidian parasites described by Italian pathologists were both found. Some cases exhibited the tertian type; the parasites in those were non-pigmented and were apparently similar to the quotidian ones.

Crescents are by no means so rare as appears to be the case in Africa; out of the 109 cases in which malignant parasites were found they were seen in 20 instances, generally associated with the small ring-shaped parasites and with many pigmented leucocytes. The parasites of benign tertian fever were found 12 times, most of these cases were double, with two generations of parasites, and many gametes were present.

Quartan fever appears to be very rare, only 2 cases having been met with. Double infections were met with 6 times, the