

LEAGUE OF NATIONS.

C.H./MALARIA/231(a).

Geneva, June 24th, 1936.

HEALTH ORGANISATION.

Malaria Commission.

The Secretary of the Malaria Commission has the honour to communicate herewith a letter received from Dr. R. SENIOR WHITE (Malariologist, Bengal-Nagpur Railway, Calcutta) in reply to the note by Professor C. SCHILLING concerning the study of the malaria epidemiology of Ceylon. (C.H./Malaria/231).

CALCUTTA, May 13th, 1936.

With reference to your circular of March 27th, 1936 quoting letter from Prof. C. Schilling on the subject of the recent Ceylon Malaria Epidemic, and suggesting an extended enquiry into malaria conditions in that Island, I would comment as follows:-

Ceylon has been the subject of very intensive malaria investigations for many years. The principal published papers, omitting systematic entomological and clinical studies, are:-

- (a) James & Gunasekera - "Report on Malaria at the Port of Talaimannar" Ceylon Govt. Sessional Paper xxxiv of 1913.
- (b) Gunasekera "Report on the Anti-malaria campaign at Kurunegalla" Ceylon Govt. Sessional Paper xxxii of 1913.
- (c) James "Summary of a year's mosquito work in Colombo" Ind. Jo. Med. Res. II, 227 - 267 (1914).
- (d) Senior White "A survey of the Culicidae of a Rubber Estate" Ind. Jo. Med. Res. VIII, 304 - 325 (1920).
- (e) Carter "Report on Malaria and Anopheline Mosquitos in Ceylon" Ceylon Govt. Sessional Paper vii of 1927.
- (f) Carter & Jacocks "Observations on the Transmission of Malaria by Anopheline Mosquitos in Ceylon" Ceylon Jo. Sci. (Med. Sec) II, 67 - 86, (1929).
- (g) Clemesha, "Brief Account of the Natural History of Malaria in Ceylon" Ceylon Jo. Sci. (Med. Sec.) 157 - 172, (1934).
- (h) Briercliffe - "The Ceylon Malaria Epidemic, 1934--35" Ceylon Govt. Sessional Paper xii of 1935 (2 vol).
- (i) Gill - "Report on the Malaria Epidemic in Ceylon in 1934-35" Ceylon Govt. Sessional Paper xxiii of 1935.

- (j) Gill - "Some Points in the Epidemiology of Malaria arising out of the Study of the malaria epidemic in Ceylon in 1934-35" Trans. R.S. Trop. Med. Hyg., xxix, 427 - 480, (1936).

In spite of the mass of information contained in these papers, there are to my mind several lacunae that require further investigation.

(a) Spleen Rate: Taken throughout the Island by Carter in 1922-24, (e p.17) but not thereafter kept up to date by annual re-examinations. The lack of these figures was obviously felt by Gill (i, p.17). I consider it very necessary that records be obtained over a full 10 year-cycle covering the next epidemic of 1939 or 1940.

(b) The carrier Anopheline: Prior to the epidemic, it is extraordinary how little knowledge, based on actual dissections, was available. I can only trace in the literature (James & Gunasekera, a.p.13, Carter, e.p.31, Carter & Jacocks, f) the following dissections:

<u>A. Barbirostris</u>	108
<u>A. hyrcanus</u>	225
<u>A. subpictus</u>	525
<u>A. culicifacies</u>	2008
<u>A. varuna*</u>	100
<u>A. maculatus</u>	22
<u>A. tessellatus</u>	1
<u>A. annularis</u>	47
<u>A. jamesi</u>	72

Of these 82 culicifacies have been found infected, either for gut or glands, i.e. 4.1% of those dissected. The other species have been consistently negative, but the numbers dissected, especially of varuna and maculatus, suspected carriers, is very small.

During the epidemic (Briercliffe, h.p. 23), much more dissection was done, Analysing these figures we find the total catch consisted of:

<u>A. subpictus</u>	440
<u>A. Culicifacies</u>	4481
<u>All other spp.</u>	142

* Referred to in earlier Ceylon papers as A.funestus, v.listoni and A.listoni. The name given is that used by Briercliffe, (h.p.10), and is presumably based on re-examination of his material by Carter.

Details are given of the dissection of 3847 culcifacies from the epidemic area, showing an infection rate of 6.6%, which is low, in view of the 4.1% rate found in normal times, and considering what has been found in other epidemics in a number of countries. Again the number of varuna and maculatus dissected must have been very small, as five species are mentioned as making up the total of 142 specimens of other species.

Though A. culcifacies has alone been found infected in Ceylon, it is to my mind imperative that the position of the two other carriers, A. varuna and A. maculatus, suspected of playing a part in the epidemiology of malaria in the Island be cleared up. Regarding A. maculatus the writer (Senior White d.) and Carter & Jacocks, (f.p.82) have suspected it around the 1000 ft. level. That in the malaria of the rubber estate surveyed by the writer A. culcifacies played no part is obvious from my table I. The year of my survey was an epidemic year, (Gill i. p.12), and that this affected the estate in question is perfectly clear from table II of the present writer's short paper on results of malaria control work on this estate in Ind. Jo. Med. Res., xii, 545-551, (1925). This table also covers 1914 and 1923, epidemic years. In 1923 it is seen that due to control the estate was not affected by the epidemic. Yet, of the breeding places controlled, table I of my paper (d) shows that even in the previous epidemic year, these produced very few culcifacies, but, with few exception, almost entirely maculatus. The difficulty of catching A. maculatus adults has been stressed by many writers, but it is to be borne in mind that workers in Indo-China succeeded in incriminating this species by special catching methods, and these should be tried in Ceylon. With regard to the vectorial capacity of this species, attention should be paid to the relationship between the housing of cattle and man, on account of the known deviation to cattle of this species. Fig. 1 of Senior White (d) shows that on the estate I investigated cattle were all housed away from the coolie lines, a measure of general sanitation that may very possibly have adverse effects in places where this species is prevalent.

Turning to A. varuna, table 23 of Carter (e) shows the high place, by larval counts, this insect occupies in the area of moderate to high endemicity. Yet Carter and Jacocks (f) (and the second of those authors in subsequent conversations with me), have emphasised the extreme difficulty of finding adults, even when heavy breeding places are known to exist close by. This would suggest that this species has very different day-time resting places in Ceylon to those it has in South India, for in the Jeypore Hills, 800' - 1400', A. varuna, (Sens. strict, excluding fluviatilis and minimus) has, in the course of some uncompleted work, in 8 months formed 5.6% of 3456 Anophelines dissected, with an infection rate of 11.4%. I think that in Ceylon search should be directed for day-time resting places of the type found for minimus flavirostris in the Philippines by Russell.

(c) Rice Fields: Clemesha, (g.p.104) makes the definite statement that A. culcifacies never breeds in paddy - Carter, (e. p.28 - 30, & Charts 14 - 17) gives far more detailed observations showing that this is not the case, but that only

in rain-fed paddy is there any considerable breeding of this species. The relationship of paddy breeding to malaria can be extracted from Carter's article as under:

Spleen Rate	culicifacies %		varuna %		maculatus %	
	Field	Channels.	Field.	Channel	Field	Channel.
0-5	0.33	0	0.64	0.56	0.13	0
1-20	0.08	0.01	1.58	3.46	0.79	1.42
10-40	1.88	-	2.26	-	-	-
33-55	0.11	0.25	4.88	6.50	0.20	0.03
50	0.37	0.58	3.69	4.62	-	0

On these figures increasing prevalence of malaria appears to be more closely correlated with increased varuna breeding than with that of culicifacies. The relationship of rice cultivation to malaria is of such vast importance to the whole of the Eastern Tropics that further investigations into this point seem well merited.

(d) Oiling: Briercliffe (h.p.63) states that, in oiling rivers, 15 galls. per mile were required. In my own experience this is a quite inadequate figure. One of my malaria protections includes a length of a river which forcibly reminds all those who have seen both, of the Deduru Oya in Ceylon. This river takes 20 galls. per mile to oil weekly, and even then the treated length is not sterile, though breeding is reduced from 23.5 larvae per dip above the limit to 0.2 larvae per dip within it. Such figures are almost prohibitive. Paris green would seem an infinitely cheaper solution, but, with its use I cannot, on the river in question, obtain the measure of reduction with it that I can with oil. On the other hand, on the Sperchios river in Greece I saw Paris green perfectly effective as a method of control. Whether the reason for this lies in different current speeds, or in the difference in feeding habits of the Anophelines concerned, is unknown. The matter seems to me to be worth investigating.

(e) The initiation of an epidemic: (Gill (j.p.450) has advanced the entirely new hypothesis that the start of the Ceylon epidemic was mainly due 'to an "epidemic of relapses" among apparently healthy human carriers'. On the facts as recorded by Gill this hypothesis seems extremely tenable. Unfortunately there are no data of blood examinations over the area affected by this epidemic, prior to its onset. If an extended investigation be carried out in Ceylon this subject would doubtless be in the forefront of points for investigation. Gill's further hypothesis (j.p.454) that there is a direct relationship between such an epidemic of relapses and atmospheric humidity is, apart from extended field observations, capable of experimental proof either with human or monkey malaria if a sufficiently large air-conditioned cabinet or room (of the type that exists at the Calcutta

School of Tropical Medicine, though the one at that Institute is not large enough), were available. The matter is of such paramount importance that it is greatly to be hoped that it will be investigated.

(f) Gill (i.p.24) states that if anti-malarial operations are continued in inter-epidemic periods, an actual epidemic can be avoided. I have proved this myself at a certain large railway junction in Orissa. I think it would be well worth repeating, as a demonstration, at some selected place in Ceylon.

I am in complete agreement with Prof. Schilling that the Health Committee of the League could most profitably take up the various investigations outlined above, and doubtless numerous other points for research into the epidemiology of malaria in Ceylon will occur to other Members of the Commission.