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Malaria in the Maha Oya Basin

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Introduction

In a previous paper (Rajendram and Jayewickreme, 1951*a*) on 'Malaria in Ceylon', epidemic malaria in the combined catchments of the Maha Oya and the upper portion of the Deduru Oya was discussed. As the primary object of this paper was to show that epidemic malaria had been successfully controlled by the residual spraying of houses with DDT, it was found convenient to treat these two river catchments as a whole, as both fell within the Intermediate Zone (*vide infra*). Nowhere in Ceylon were such disastrous epidemics experienced as in these catchment areas. In this paper it is proposed to deal in considerably greater detail with various aspects of the malaria problem as it affects the Maha Oya Basin alone, leaving the Deduru Oya and other river basins to be dealt with later.

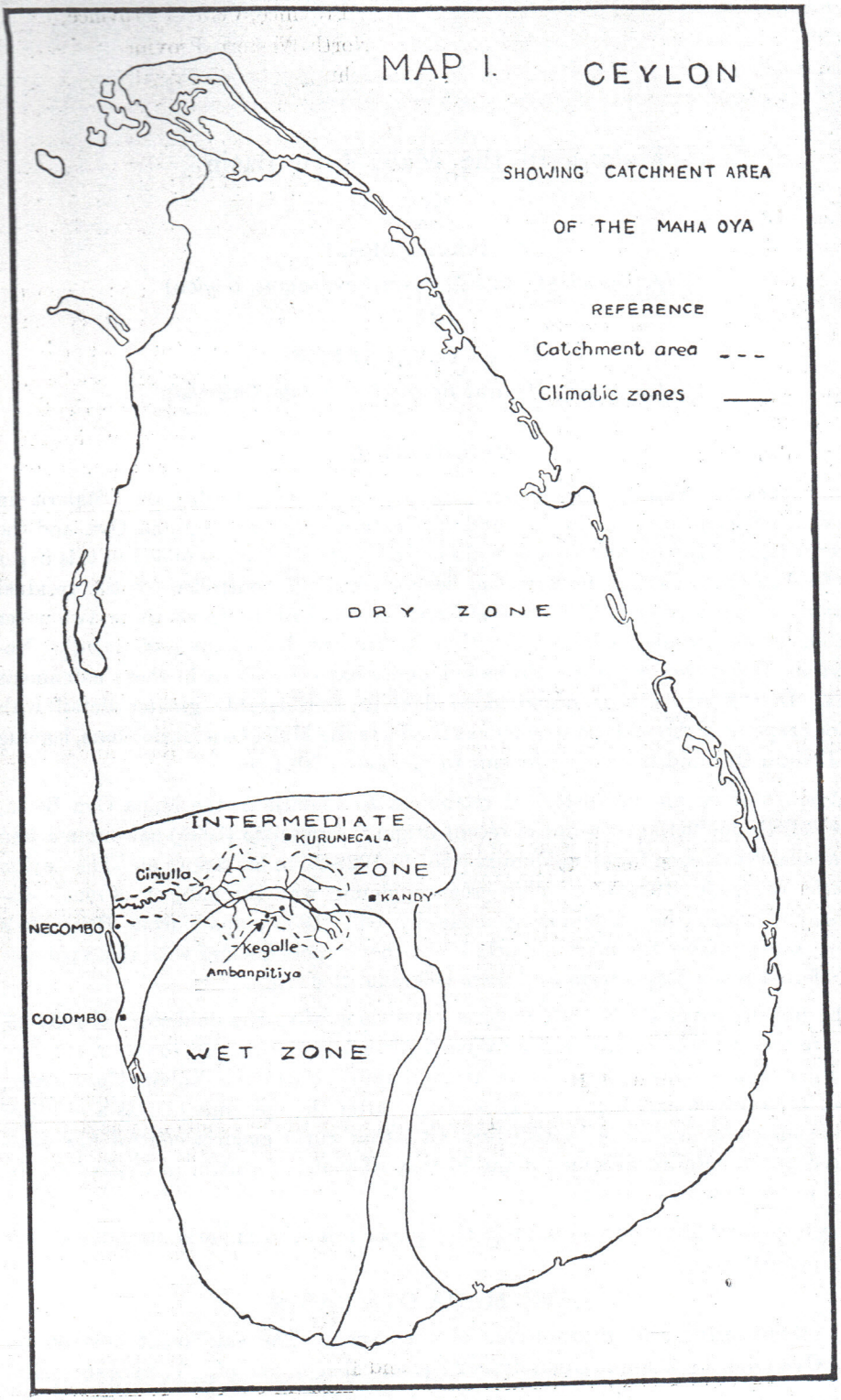
Although there are no historical references to malaria in the Maha Oya Basin, there is little doubt that it is not of recent origin. Briercliffe (1935) has summarised the available evidence for all epidemics prior to 1928-29 in his report on 'The Ceylon Malaria Epidemic, 1934-35'. This great epidemic was the subject of much discussion, of which the contribution made by Gill (1935), apart from Briercliffe's report, was probably the most important. Other papers dealing with this epidemic are referred to by Rajendram and Jayewickreme (loc. cit.).

The present paper deals with malaria conditions after the epidemic of 1934-35. Prior to this malaria control had only been carried out in certain towns in the Dry and Intermediate Zones. These were Anuradhapura, Puttalam, Chilaw, Kurunegala, Maho, Trincomalee and Badulla. It was only after the epidemic and as a result of the recommendations made by Gill (loc. cit.) that rural malaria control was commenced and a detailed account of the history of malaria control in Ceylon will be found in our previous paper.

The term morbidity rate as used in this paper refers to malaria attendances per 1,000 population.

THE MAHA OYA BASIN

(*a*) **Description and Boundaries of the Area.** The catchment area of the Maha Oya (Map 1), is approximately 562 square miles in extent. It embraces parts


MAP I. CEYLON
SHOWING CATCHMENT AREA
OF THE MAHA OYA
REFERENCE
Catchment area
Climatic zones
DRY ZONE
INTERMEDIATE
ZONE
KURUNEGALA
KANDY
Ciriulla
NEGOMBO
Kegalle
Ambanpitiya
COLOMBO
WET ZONE

of four provinces (Map 2); the North-Western Province, Central Province, Sabaragamuwa and the Western Province. In the North-Western Province parts of the following revenue divisions fall within the catchment area—Pitigal Korale South, Katugampola Hatpattu, Dambadeni Hatpattu and Weudavili Hatpattu. In the Central Province small portions of Tumpane, Yati Nuwara and Udu Nuwara, and Udapalata are included. In Sabaragamuwa the whole of Kinigoda and Galboda Korales, a large portion of Beligal Korale and the eastern half and northern part of Paranakuru Korale come within the catchment. In the Western Province almost the whole of Hapitigam Korale, and the northern portions of Alutkuru Korale North A and Alutkuru Korale North B are included.

The Maha Oya is 78 miles long, and arises in the hills east of a line joining Kurunegala and Ambanpitiya at elevations of 500-1,000 feet, and where the average annual rainfall is above 100 inches a year. It eventually reaches the sea north of Kochchikade. The first part of the river, up to and slightly beyond Mawanella, is through a very rocky and relatively narrow bed. After reaching the plains the bed becomes wide, flat, sandy and shallow. In the middle reaches of the river the bed is rocky only at Rambukkana and Giriulla. In times of drought considerable pooling of the river occurs, and while the first part of the river passes through an area which is at most only moderately endemic, the middle and lower reaches of the river pass through highly endemic areas.

The Maha Oya Basin is a very well watered one as can be seen in Map 3, where only some of the principal tributaries of the river are named, and many minor ones omitted. It will be seen that the name Kuda Oya is given to a number of different tributaries.

The catchment comprises seventeen health areas or parts of health areas, each being under a Medical Officer of Health. The health areas and the revenue divisions to which they belong are given below:

1. Dankotuwa (Pitigal Korale South).
2. Pannala (Katugampola Hatpattu).
3. Narammala (Dambadeni Hatpattu).
4. Polgahawela (Dambadeni Hatpattu).
*5. Kurunegala (Weudavili Hatpattu).
*6. Galagedera (Tumpane).
*7. Kadugannawa (Yati Nuwara and Udu Nuwara).
*8. Daulagala (Yati Nuwara and Udu Nuwara).
*9. Nawalapitiya (Udapalata).
10. Aranayake (Paranakuru Korale).
11. Kegalle (Paranakuru Korale).
12. Rambukkana (Kinigoda Korale).
13. Mawanella (Galboda Korale).
14. Warakapola (Beligal Korale).
*15. Galigomuwa (Beligal Korale).
16. Yakkala (Hapitigam Korale).
17. Negombo (Alutkuru Korale North A and B).

As only small portions of the health areas of *Kurunegala, *Kadugannawa, *Daulagala, *Nawalapitiya and *Galigomuwa fall within this catchment, the malaria statistics for these areas will be discussed in future papers in connection with the main river basins to which they belong. The statistics for Galagedera are being excluded from this paper as the boundaries of this health area were considerably revised in 1944, as a result of which nearly a third of its population was transferred to Harispattu. The figures for the health areas of Kegalle and Aranayake are given together in Appendix III, as these areas have only recently been separated.

(*b*) **Temperature and Humidity.** Climatic conditions over Ceylon as a whole have been discussed in an earlier paper (Rajendram and Jayewickreme, loc. cit.), and there is little to add here as no main climatological station is located in the Maha Oya Basin. No data are therefore available for any discussion of temperature and humidity in this area.

(*c*) **Rainfall.** There are fourteen meteorological stations in the catchment. They are Hunumulla, Giriulla, Ambepussa, Poramadela, Kempitikande, Alagalla, Meddegoda, Aranayake, Ambanpitiya, Kegalle, Etnawela, Diwela, Polgahawela and Mawanella. In Table 1, is given the monthly rainfall calculated as an average for all these stations for the years 1935-50, together with the average rainfall calculated for the period 1911-46.

The Maha Oya Basin receives rainfall from both south-west and north-east monsoons. The south-west monsoon blows from May to September, and the north-east monsoon from November to March. At each monsoon after heavy rain in the first two months or so the monsoons begin to weaken. August and early September are relatively dry periods with only occasional rain, and similarly, during the north-east monsoon period a dry spell ensues from about the middle of January till the middle of March. In these dry periods *A. culicifacies* breeds heavily in rock pools and sand pools which are formed in the river beds, while the seasonal rises of malaria follow shortly after the first heavy rains that end these periods of drought. These rains are experienced in April and October, both months of thunderstorm activity. Approximately the same amount of rain is received during each monsoon, but the south-west monsoon is spread over a longer period. The dry period which ends the north-east monsoon, is relatively longer as it often begins late in December. Unfortunately, both monsoons tend to fail, and when this happens conditions for the breeding of the vector become very favourable owing to the pooling of rivers. Conversely, even when there is little rain over that part of the basin which lies in the plains, heavy rain in the hills particularly in the Kegalle and Aranayake areas tends to flush the river and its tributaries and obliterate the pools. But like most Ceylon rivers, the raging torrent of today may be reduced to a narrow channel of flowing water in a few days, with pooling taking place in the bed on both sides of it.

(*d*) **Climatic Zones.** Ceylon is divided into a Dry and Wet Zone by meteorologists ; but for malaria studies it has been found convenient to recognise a third or Intermediate Zone. The three zones (Map 1), are readily demarcated on the amount of rainfall received during the south-west monsoon. Thus the Wet Zone receives 40 inches of rain and upwards, the Intermediate Zone between 20-40 inches and the Dry Zone less than 20 inches of rain. The Dry Zone actually receives only one monsoon, the north-east monsoon.

TABLE I

Monthly rainfall in inches for the years 1935-1950 *calculated as an average for all Meteorological Stations situated in the Maha Oya Basin.*

Year	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total
1935	1·69	1·19	11·85	10·66	4·54	8·15	3·35	6·97	2·83	18·47	12·50	7·48	89·68
1936	2·48	1·58	10·35	1·98	20·07	6·29	7·63	3·62	11·09	10·17	9·97	9·86	95·09
1937	5·39	4·23	7·37	7·82	16·95	5·11	8·69	7·45	8·38	11·83	17·20	3·64	104·06
1938	1·83	10·56	12·96	12·59	4·84	4·58	6·45	5·52	8·58	5·69	6·57	4·71	84·88
1939	5·88	0·29	3·03	13·51	10·96	11·21	8·35	13·12	6·62	12·17	13·82	4·76	103·72
1940	0·01	0·85	2·14	15·15	21·64	16·18	5·46	7·28	7·10	18·18	23·42	6·87	124·28
1941	1·61	2·90	4·51	7·52	14·60	11·42	4·37	9·84	9·68	19·07	20·53	6·38	112·43
1942	1·15	1·63	9·23	11·73	7·78	13·10	9·25	9·26	5·00	13·51	5·51	14·19	101·34
1943	4·04	1·95	3·20	8·57	21·66	11·61	5·08	5·73	3·92	21·09	21·39	8·72	116·96
1944	2·72	7·28	10·57	9·86	9·26	8·63	3·04	4·03	11·95	15·21	21·24	7·87	111·66
1945	0·44	0·41	4·62	5·38	1·06	8·76	4·14	3·55	2·84	19·27	11·10	10·29	71·86
1946	1·41	1·27	9·10	9·73	5·53	8·11	4·56	9·25	7·03	12·13	20·15	21·52	109·79
1947	7·69	1·81	10·18	2·30	3·69	9·46	7·22	19·68	8·18	15·17	2·40	5·21	92·99
1948	2·37	1·10	11·69	6·33	5·07	11·41	7·71	5·62	2·92	12·77	8·88	7·33	83·20
1949	2·20	1·17	4·14	7·84	12·20	12·92	15·20	14·98	4·71	10·43	8·64	4·93	99·36
1950	1·05	6·51	5·95	7·57	7·40	9·66	8·55	5·09	9·11	14·80	7·38	2·52	85·59
Average 1911-1946	4·75	2·49	7·08	9·70	10·90	11·49	7·60	6·18	7·71	15·95	13·85	6·57	104·27

The major portion of the Maha Oya Basin, particularly that part which is highly endemic, falls within the Intermediate Zone. The Kegalle and Mawanella areas, which are also severely affected in epidemic years, lie in the Wet Zone. The upper reaches of the river around Aranayake, also lie in the Wet Zone, and are relatively healthy or only moderately endemic.

MALARIA PREVALENCE AND RAINFALL

There are five hospitals, seven rural hospitals and eight dispensaries in the Maha Oya Basin, and their location is indicated in Map 3. They are as follows:

1. Hataraliyadde—Dispensary (Tumpane).
2. Kegalle—Hospital (Paranakuru Korale).
3. Aranayake—Hospital (Paranakuru Korale).
4. Hemmategama—Rural Hospital (Paranakuru Korale).
5. Mawanella—Rural Hospital (Galboda Korale).
6. Rambukkana—Rural Hospital (Kinigoda Korale).
7. Warakapola—Rural Hospital (Beligal Korale).
8. Nelundeniya—Dispensary (Beligal Korale).
9. Niyandurupola—Dispensary (Beligal Korale).
10. Giriulla—Hospital (Dambadeni Hatpattu).
11. Narammala—Rural Hospital (Dambadeni Hatpattu).
12. Alawwa—Rural Hospital (Dambadeni Hatpattu).
13. Polgahawela—Dispensary (Dambadeni Hatpattu).
14. Makandura—Dispensary (Katugampola Hatpattu).
15. Dankotuwa—Rural Hospital (Pitigal Korale South).
16. Negombo—Hospital (Alutkuru Korale North A).
17. Kochchikade—Dispensary (Alutkuru Korale North A).
18. Halpe—Dispensary (Alutkuru Korale North A).
19. Mirigama—Hospital (Hapitigam Korale).
20. Ambepussa—Dispensary (Hapitigam Korale).

At all three types of institution malaria cases are clinically diagnosed and the error in diagnosis at dispensaries, manned by Apothecaries, would tend to be higher, particularly in non-epidemic times. It is a fact that almost any fever case in malarial districts tends to be diagnosed as ' malaria '. But during epidemics this error would be at its lowest. In Table 2, is summarised the monthly malaria attendance and the morbidity rate per 1,000 population at all these hospitals and dispensaries for the period 1937-50. These figures include first and subsequent visits of patients, as it is not possible to separate them satisfactorily. Patients often forget to bring their check tickets on subsequent visits and are then regarded as coming for treatment for the first time. The population figures have been calculated on the basis of the 1921 and 1946 census figures according to revenue divisions. But only that fraction of a revenue division which falls within the Maha Oya Basin has been taken into account. Thus for Pitigal Korale South only 25 per cent. of the total population for the revenue division has been included in the general population figure of the basin, as this is approximately the area which comes within it. The population