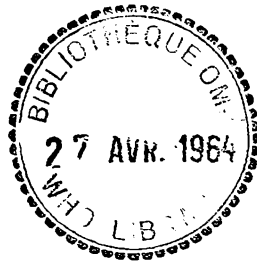


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THE INFECTION OF ANOPHELES GAMBIAE WITH PLASMODIUM FALCIPARUM  
IN THE LABORATORY

by

R. S. Bray<sup>1</sup> and R. W. W. Burgess<sup>2</sup>  
The Liberian Institute of the American Foundation  
for Tropical Medicine, Harbel, Liberia

The accompanying tables set out our experiences in the laboratory of feeding A. gambiae on selected local (Liberian) carriers of the gametocytes of P. falciparum.

All the mosquitos used were taken from a laboratory colony first initiated in 1957 from two wild-caught females. No mosquito was fed on blood prior to the infective blood meal. All mosquitos were maintained at room temperature and humidity (23.2°C--30.9°C; R.H. 57.4%-98.5%) and were fed only on sugar solution prior to the infection.

Patients were selected largely for the higher gametocytaemias as we required sporozoites for experimental procedures. The range of gametocyte counts tabulated (Tables 1 and 2) here does not therefore represent a cross-section of gametocytaemias usually found in the Liberian population.

Gametocytaemia was estimated at the time of feeding by taking a white cell count, counting gametocytes against 1000 white cells and converting the count to  $\text{mm}^3$ .

We feel that two conclusions may be drawn from the data presented.

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<sup>1</sup> Present address: Department of Parasitology, London School of Hygiene and Tropical Medicine, Keppel Street, London, W.C.1., England

<sup>2</sup> Present address: c/o The American Foundation for Tropical Medicine, 551 Fifth Avenue, New York 17, N.Y., United States of America

1. That in Tropical Africa gametocytaemias of less than 100 gametocytes/mm<sup>3</sup> may be of great importance to the transmission of malaria and that there is no gametocytaemia which is not a potential danger. We believe it would be most unwise to discount low gametocytaemias in any consideration of the epidemiology of A. gambiae-borne falciparum-malaria and especially when they occur in residual foci. It will be seen that with gametocyte counts above 30 gametocytes/mm<sup>3</sup> only one failure to infect A. gambiae is recorded. (Tables 1 and 2)

2. We find that the majority of gametocytaemias found in Liberia are in the range of 5-50 gametocytes/mm<sup>3</sup>. Muirhead-Thomson (1957) has shown previously that adults are important contributors to the infection of anopheles and in our experience gametocytaemias in adults are almost always below 100 gametocytes/mm<sup>3</sup>. This point has been also stressed recently by Bruce-Chwatt (1963).

It is our conclusion that highly endemic malaria in Liberia, where sporozoite rates in A. gambiae are around 5%, is largely maintained by gametocytaemias of less than 100 gametocytes/mm<sup>3</sup>. This conclusion is reinforced by the finding of an average of less than five oocysts per gut in wild-caught Anopheles gambiae in Liberia for nine months of the year. Furthermore it is our experience that heavy sporozoite infections of salivary glands occur in mosquito batches where the average oocyst count has been of the order of one to five oocysts per infected gut. It is our opinion that the percentage of sporozoites of P. falciparum reaching the salivary glands from the gut wall of A. gambiae is exceptionally high.

#### REFERENCES

- Bruce-Chwatt, L. J. (1963) W. Afr. med. J., 12, 141 and 199  
Muirhead-Thomson, R. C. (1957) Amer. J. trop. Med. Hyg., 6, 971

TABLE 1. RELATIONSHIP BETWEEN THE GAMETOCYTE COUNT OF  
P. FALCIPARUM IN ADULTS (OVER 12 YEARS) AND THE INFECTION OF A. GAMBIAE

Group of gametocyte count	Gameto-cytes/mm <sup>3</sup> of blood	Percentage <u>A. gambiae</u> positive (gut and glands)	Average number of oocysts/infected gut	Estimated number of oocysts in 100 mosquitos
Over 1000/mm <sup>3</sup>	2 310	90	32	2 880
501-1000/mm <sup>3</sup>	708	88	106	9 328
251-500/mm <sup>3</sup>	489	93	95	8 835
101-250/mm <sup>3</sup>	235	78	13	1 014
	233	96	14	1 344
	193	80	-	-
	179	89	40	3 560
	123	13	13	169
	102	44	2	88
	Average	178	67	16
51-100/mm <sup>3</sup>	95	26	2	52
	70	67	-	-
	69	98	14	1 372
	54	33	2	66
	54	52	2	104
	Average	68	55	5
11-50/mm <sup>3</sup>	35	33	2	66
	26	0	0	0
	16	23	3	69
	16	5	1	5
	14	0	0	0
	11	0	0	0
	Average	20	10	1

TABLE 1. RELATIONSHIP BETWEEN THE GAMETOCYTE COUNT OF P. FALCIPARUM IN ADULTS (OVER 12 YEARS) AND THE INFECTION OF A. GAMBIAE (continued)

Group of gametocyte count	Gameto-cytes/mm <sup>3</sup> of blood	Percentage <u>A. gambiae</u> positive (gut and glands)	Average number of oocysts/infected gut	Estimated number of oocysts in 100 mosquitos
0-10/mm <sup>3</sup>	6	45	4	180
	5	0	0	0
	4	83	-	-
	2	2	1	2
	0	17	1	17
	0	0	0	0
	0	0	0	0
	0	3	2	6
	0	2	1	2
Average	2	17	1	26

TABLE 2. RELATIONSHIP BETWEEN THE GAMETOCYTE COUNT OF P. FALCIPARUM IN CHILDREN (UNDER 12 YEARS) AND THE INFECTION OF A. GAMBIAE

Group of gametocyte count	Age (yrs)	Gameto-cytes/mm <sup>3</sup> of blood	Percentage <u>A. gambiae</u> positive (gut and glands)	Average number of oocysts/infected gut	Estimated number of oocysts in 100 mosquitos
Over 1000/mm <sup>3</sup>	2½	6 294	71	62	4402
	6	3 895	9	10	90
	1	1 596	79	135	10 665
	4	1 431	35	39	1 365
	4	1 406	52	163	1 476
	5	1 290	100	154	15 400
	3	1 166	69	41	2 329
	Average	4	2 455	59	86
501-1000/mm <sup>3</sup>	2½	772	100	85	8 500
	1½	763	71	88	6 248
	4	751	19	3	57
	2	700	77	29	2 233

TABLE 2. RELATIONSHIP BETWEEN THE GAMETOCYTE COUNT OF P. FALCIPARUM IN CHILDREN (UNDER 12 YEARS) AND THE INFECTION OF A. GAMBIAE (continued)

Group of gametocyte count	Age (yrs)	Gameto-cytes/mm <sup>3</sup> of blood	Percentage <u>A. gambiae</u> positive (gut and glands)	Average number of oocysts/infected gut	Estimated number of oocysts in 100 mosquitos
500-1000/ mm <sup>3</sup> (continued)	5	696	100	31	3 100
	7	636	83	161	13 363
	2	631	100	-	-
	3/4	578	84	74	6 216
	6	516	56	42	2 352
	Average	3	671	77	64
251-500/ mm <sup>3</sup>	7	482	97	100	9 700
	10	454	80	66	5 280
	3	448	40	7	280
	4	437	82	105	8 610
	1	364	92	31	2 852
	4	308*	0	0	0
	1½	295	75	3	225
	4	257	86	40	3 440
	4	256	78	-	-
	3	253	100	100	10 000
Average	4	355	73	50	4 488
101-250/ mm <sup>3</sup>	4	189	75	45	3 375
	4½	185	96	32	3 072
	6	181	89	70	6 230
	9	180	76	-	-
	9	162	90	26	2 340
	7	161	80	54	4 320
	5	140	94	15	1 410
	2	140	71	86	6 106
	7	133	58	2.4	139
	5	120	87	6	522
	4	104	49	2	98
	Average	6	154	79	34

\* Gametocytes distorted and possibly immature.

TABLE 2. RELATIONSHIP BETWEEN THE GAMETOCYTE COUNT OF P. FALCIPARUM IN CHILDREN (UNDER 12 YEARS) AND THE INFECTION OF A. GAMBIAE (continued)

Group of gametocyte count	Age (yrs)	Gameto-cytes/mm <sup>3</sup> of blood	Percentage <u>A. gambiae</u> positive (gut and glands)	Average number of oocysts/infected gut	Estimated number of oocysts in 100 mosquitos
51-100/mm <sup>3</sup>	9	90	81	8	648
0-10/mm <sup>3</sup>	6	4	0	0	0
	4	3	53	-	-
	7	3	55	5	275
Average	6	3	36	2.5	138

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