SUSCEPTIBILITY OF *PLASMODIUM FALCIPARUM* TO CHLOROQUINE IN TEA GARDEN TRIBES OF ASSAM, INDIA

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Abstract. *P. falciparum* was the predominant parasite (> 80%) species in malaria ridden tea estates of Assam. A simplified 3 day *in vivo* test to determine chloroquine sensitivity in tea garden tribes revealed that the majority of the cases (85%) were S/RI, 7% were RI, and 3% were RII and 5% were RIII, respectively. Early case detection and treatment were deemed necessary to reduce morbidity and mortality due to *P. falciparum* in these tea estates.

INTRODUCTION

Resistance to chloroquine in *Plasmodium falciparum* infections is a wide spread phenomenon in Southeast Asia (Kondrashin, 1992); in India it was first documented in Assam in 1973 (Sehgal *et al*, 1973). With its resurgence, there have been a number of similar reports from various endemic areas (Sharma, 1983; Sharma and Mehrotra, 1986). Recently, there has been a sudden spurt of malaria cases in some of the tea estates, particularly those located along the forest fringe, causing a notable degree of morbidity and mortality (Gogoi *et al*, 1994). Consequently, chloroquine sensitivity studies were conducted in malaria ridden tea estates wherein tea garden populations (tribes of various ethinic origin) are confined and represent a closed community, thus providing an ideal set up for follow-up studies.

MATERIALS AND METHODS

To determine chloroquine sensitivity status, *in vivo* follow up studies were conducted in Tarajulie Tea Estate (District Sonitpur), and Paneery Tea Estate (District Darrang) of Assam during the peak transmission period, *ie* May to September 1992, using a simplified 3 day (D0, D4, D7) test (Prasad *et al*, 1990). Malaria positives were detected in the outdoor patient clinic of respective tea estates, and the patients selected for the follow up study were admitted in the garden hospital to ensure intake of chloroquine.

The follow up cases were given 25 mg/kg chloroquine base orally, divided over 3 days; blood smears were taken on D0, D4 and D7 for asexual parasite counts. Patients with clearance of parasitemia within 7 days and those with recrudescence on D7 were categorized as S/RI and RI, respectively. Follow up cases with marked reduction of asexual parasitemia but no clearance were taken as RII, and those with no marked reduction were classified as RIII.

RESULTS AND DISCUSSION

In the Tarajulie Tea Estate, of the 1,071 blood smears collected from fever patients, 374 were malaria positive, of which 298 (80%) were *P. falciparum* cases. Malaria positives were recorded in all age groups including infants, indicating active transmission during the study period (Table 1). In total, 40 patients were selected for follow up study

Table 1

Passive case detection in Tea Estates of Assam (India)[a]

Age group	Tarajulie Tea Estate			Paneery Tea Estate		
(yrs)	BSC/E	+ve	Pf	BSC/E	+ve	Pf
0-1	99	22	18	111	50	38
1-5	310	76	69	493	275	231
5-15	221	88	72	688	417	351
> 15	441	188	139	1,661	915	798
Total	1,071	374	298	2,953	1,657	1,418

[a] Study period : May 1992 to September 1992.

Table 2

Results of a simplified *in vivo* 3 day test for chloroquine sensitivity in *P. falciparum* in Tarajulie Tea Estates, Assam.

S No.	Age (Yrs)/Sex	Asexual parasite count/mm³ blood in different days interval			Degree of resistance
		Day 0	Day 4	Day 7	
1	43/F	15,600	13,280	14,800	R III
2	5/M	8,960	Neg	Neg	S/RI
3	50/F	35,200	Neg	Neg	S/RI
4	30/M	3,360	Neg	Neg	S/RI
5	12/F	848	Neg	Pfg	S/RI
6	24/M	14,080	Pfg	Pfg	S/RI
7	56/M	15,600	Neg	Neg	S/RI
8	25/F	23,200	Neg	Neg	S/RI
9	10/F	6,400	Neg	Neg	S/RI
10	2/F	14,200	Pfg	Pfg	S/RI
11	35/M	5,600	Neg	Neg	S/RI
12	50/F	4,400	Pfg	Pfg	S/RI
13	15/M	50,000	Neg	Pfg	S/RI
14	10/M	6,800	Pfg	Neg	S/RI
15	15/F	1,824	Neg	Neg	S/RI
16	4/M	20,000	Pfg	Pfg	S/RI
17	3/M	5,640	Neg	21,600	RI
18	13/M	113,600	Neg	Pfg	S/RI
19	45/M	24,400	Neg	Neg	S/RI
20	70/F	8,800	Pfg	Pfg	S/RI
21	50/M	5,600	Neg	Neg	S/RI
22	15/F	60,000	Neg	Neg	S/RI
23	24/F	10,240	Neg	6,400	RI
24	22/M	31,600	Neg	Neg	S/RI
25	34/M	145,600	Pfg	Pfg	S/RI
26	12/M	10,560	Neg	Neg	S/RI
27	10/F	6,640	Neg	Pfg	S/RI
28	4/M	15,200	Neg	Pfg	S/RI
29	3/F	480,000	Neg	Pfg	S/RI
30	5/F	320,000	Neg	Neg	S/RI
31	30/M	4,800	Neg	Neg	S/RI
32	3/F	11,840	5,760	8,640	RIII
33	30/M	80,000	11,200	28,800	RII
34	52/F	10,400	Neg	5,600	RI
35	4/M	55,200	Pfg	Neg	S/RI
36	7/M	4,000	Neg	1,120	RI
37	30/M	10,240	55,600	Terminated	RIII
38	4/M	42,400	Neg	Pfg	S/RI
39	75/M	35,600	Pfg	Neg	S/RI
40	2/F	120,800	Neg	Neg	S/RI

comprising both sexes of all age groups excluding infants (Table 2). Of these, 32 (80%) patients were negative for malaria parasites on D4 and D7, thus were categorized as S/RI. Four patients (10%) were parasite negative on D4 but had recrudescence on D7, thus showing RI level of resistance. Only a single patient had marked reduction on d4 and had a rise in parasitemia on d7, thus was RII. The remaining 3 (7.50%) patients had no marked reduction in parasitemia, thus were RIII; one of these developed cerebral symptoms, and was treated with quinine.

Similarly, Paneery Tea Estate was also equally affected by the malaria upsurge, and *P. falciparum* (85%) was the predominant parasite species (Table 1). In this tea estate, 63 patients selected for follow up study showed varying degrees of sensitivity to chloroquine but apparently very similar to that observed in Tarajulie Tea Estate (Table 3). The majority of the cases (89%) were S/RI; 7%, 5% and

Table 3

Proportions of degree of Pf response to chloroquine in Tea garden tribes of Assam, India.

S No.	Tea Estate	Degree of Pf response*				Total
		S/RI	RI	RII	RIII	
1	Tarajulie	32 (80)	4 (10)	1 (2.5)	3 (7.5)	40
2	Paneery	56 (89)	3 (5)	2 (3)	2 (3)	63
	Total	88 (85)	7 (7)	3 (3)	5 (5)	103

*Figures in parntheses indicate percentages

3% were RI, RII and RIII, respectively. There did not appear to be any age specificity, and resistance at RI level and above, though minimal, was recorded equally in all age groups. It is interesting to note that while resistance has been recorded in other tribes of Assam (Barkakaty and Narasimham, 1992), infections of tea garden tribes were by and large sensitive to chloroquine. Thus, early case detection and treatment are most important to reduce morbidity and mortality due to falciparum malaria transmitted by *An. minimus*, the vector in Assam (Dev *et al*, 1994).

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