Malaria Outbreak in District Korea, Chhattisgarh

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Abstract

Malaria is a major public health problem in India. Recently malaria, particularly that caused by *Plasmodium falciparum* has increased in Madhya Pradesh and Chhattisgarh. A focal outbreak was recorded in villages of Khadgawa Community Health Centre (CHC), district Korea (Chhattisgarh) in December 2003. Investigation was undertaken in 21 villages of this CHC after reports of high fever and deaths in the month of March 2004. During rapid fever surveys by the team of National Institute of Malaria Research (NIMR), Field Unit Jabalpur in the months of March, June and August 2004, the SPR, SFR and Pf% were found to be 20.5, 11.9 and 58.1 respectively. Entomological surveillance revealed that *Anopheles culicifacies* was the dominant species followed by *An.subpictus* and *An. fluviatilis. An. culicifacies* was resistant to DDT and susceptible to synthetic pyrethroids (SP).

Introduction

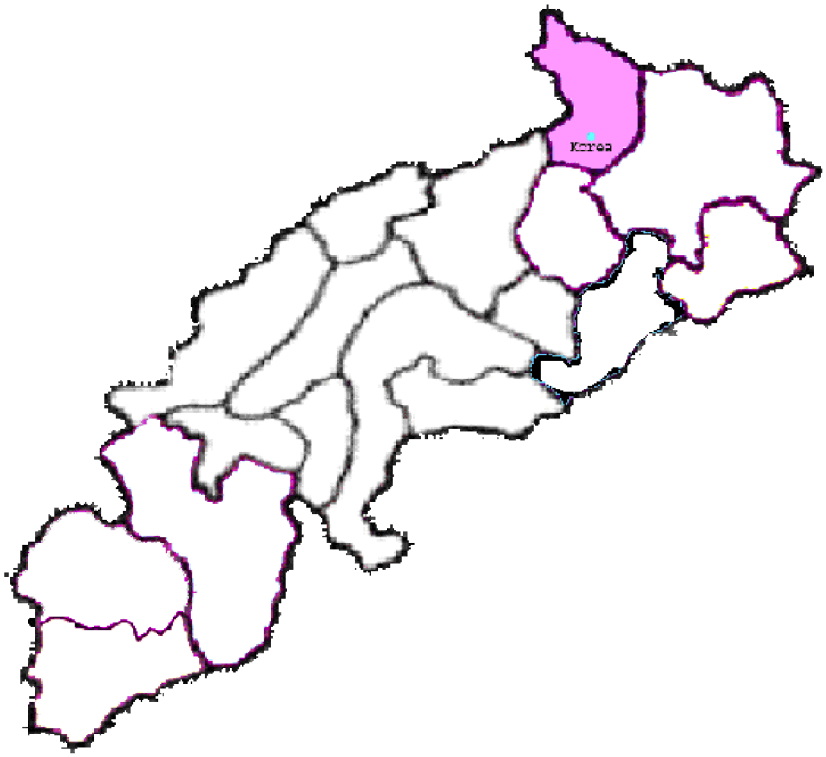
Malaria remains one of the major public health problems in Central India despite 50 years of malaria control efforts. The dynamics of this disease vary from place to place (Pattanayak et al. 1994). Control of malaria in the tribal belts is made particularly difficult by the terrain, poor communication and the prejudices and superstitions of the tribal people. The gravity of the problem can be assessed by the fact that Chhattisgarh state accounts for 2% of the total population of the country but contributes >16% of the total malaria cases, 23% of *Plasmodium falciparum* cases and 7% of deaths due to malaria in the country (Singh et al. 2004). Further, it is the number two malarious state in India after Orissa (Anon. 2002).

An outbreak of malaria was reported in the month of December 2003 along with 4 deaths in Khadgawa Community Health Centre (CHC), District Korea. There after a team of National Institute of Malaria Research (NIMR), Field Station Jabalpur visited the area to assess the situation.

Material and Methods

1. Study Area : District Korea is a tribal forested district of Chhattisgarh state (Fig 1) having >80% ethnic tribe i.e. Gond. The District lies between 22°56' and 23°48' North and 81°56' and 82°47' East. It is bounded on the north by Sidhi district of Madhya Pradesh, on the south by Bilaspur district, on the east by Surguja district, and on the west by Shahdol district of Madhya Pradesh. The area of the district is 5977 km², of which 59.9% is forest area. According to the 2001 census, the total population of the district was 600767. The district is rich in mineral resources, especially coal.

Fig 1: Map of Chhattisgarh state showing the location of district Korea



The epidemiological and entomological investigations were carried out in 21 malaria affected villages of Khadgawa CHC, District Korea in the months of March, June and August 2004. All the villages are located near a perennial stream. Most of the villages are unapproachable during rains for 2-5 months

The reported annual incidence of malaria in the year 2001, 02 and 03 was 13.8, 13.0 and 14.6 respectively in district Korea and 17, 14 and 21.6 in Khadgawa CHC (Table 1) as per record of National Vector Borne Disease Control Programme (NVBDCP). The district was under DDT spray. In July 2004, nine villages affected with malaria were sprayed with Etofenfrox 20% wp synthetic pyrethroid (SP).

Table 1: Epidemiological data of Korea district, Khadgawa CHC (NVBDCP)

District/ CHC	Year	Population	BSE	+ve	Pf	ABER	API	SPR	Pf%	Death
District Korea	2001	600767	94765	8295	6662	15.7	13.8	8.7	80.3	Nil
	2002	614284	83375	8042	6401	13.5	13.0	9.6	79.5	Nil
	2003	628412	104013	9161	6032	16.5	14.6	8.8	65.8	6
CHC Khadgawa	2001	186528	22266	3167	3042	11.9	16.9	14.2	96.0	Nil
	2002	190745	17474	2703	2503	9.1	14.1	15.4	92.6	Nil
	2003	195112	29783	4213	2761	15.3	21.6	14.1	65.5	4

BSE-Blood slides examined, +ve- Malaria positive cases, Pf- *Plasmodium falciparum*, ABER-Annual blood examination rate, API- Annual parasite incidence, SPR- Slide positivity rate

2. Parasitologic and entomologic monitoring : Blood smears were collected door to door from all fever cases, stained with JSB stain (Singh and Bhattacharji 1944) and examined microscopically. Treatment was given to all the positive cases as per NVBDCP drug schedule. Mosquito collections were made in 13 villages. Anophelines resting inside four houses located in different parts of the villages (two human dwellings and two cattle sheds)) were collected with flash lights and mouth aspirators during early morning hours for 15 minutes in each place as per standard WHO techniques (World Health Organization 1975). Mosquitoes were also collected by CDC light traps in four villages from in door and out door sites from dusk to dawn. Collected mosquitoes were identified as per Christophers' keys. Bioassay tests were conducted in 6 SP sprayed and 4 DDT sprayed villages to observe the efficacy of the insecticides.

Results

1. Rapid fever survey: Results of rapid fever surveys in the months of March, June and August 2004 revealed a total of 62 malaria positive cases (26 Pv and 36 Pf) out of 303 blood smears examined (Table 2). In the month of August (after SP spray), only 3(1 Pv & 2 Pf) smears were positive out of 32 smears in SP sprayed 7 villages whereas in the 9 DDT sprayed villages, 23 smears (8Pv & 15 Pf) were positive out of 68.

Table 2: Results of rapid fever surveys in malaria affected villages of Khadgawa CHC

Months	Villages	BSE	+ve	Pv	Pf	SPR	SfR	Pf%
March2004	21	72	16	9	7	22.2	13.5	43.8
June2004	18	131	20	8	12	15.3	9.2	60.0
August2004	16	100	26	9	17	26.0	17.0	65.4
Total	-	303	62	26	36	20.5	11.9	58.1

2. Hand catch: During indoor resting collections, the average per man hour density (MHD) of anophelines recorded in 13 villages was 45.5 of which *Anopheles culicifacies* was the dominant species (25.2) followed by *An.subpictus* (17.5) and *An.fluviatilis* (1.3, Table 3). After SP spray, the MHD of total anophelines in SP sprayed 7 villages was 42.7 where as in DDT sprayed 6 villages it was 86.6.

Table 3: Indoor resting collection in villages of Khadgawa CHC

S.No.	Species	Months		
		March	June	August
1	*An.culicifacies*	5.5	43.4	26.8
2	*An.subpictus*	2.0	17.0	33.4
3	*An.annularis*	0.0	1.4	2.5
4	*An.fluviatilis*	1.5	0.5	0.2
5	*An.vagus*	0.0	0.5	0.0
5	*An.maculatus*	0.5	0.0	0.0
6	*An. splendidus*	1.0	0.0	0.0
	Total *Anopheles*	10.5	63.0	62.9

3. Light trap catches: Light trap catches carried out in 4 villages revealed that average per trap- per night catch was low in June but in August the per trap catch was 20.2 in indoors and 80.0 in outdoors. *An.culicifacies* was the dominant species followed by *An.subpictus* and *An.fluviatilis* (Table 4). Of these per trap catch was 38.5 in indoors and 102.0 in outdoors in two DDT sprayed villages whereas in two SP sprayed villages the per trap catch was 2.0 in indoors and 58.0 in outdoors.

Table 4: Light Trap catches in villages of Khadgawa CHC

Species	June		August	
	Indoor	Outdoor	Indoor	Outdoor
An.culicifacies	0.3	11.7	10.0	40.0
An. subpictus	0.7	4.3	9.5	34.0
An.annularis	0.0	4.0	0.7	4.0
An.fluviatilis	0.0	1.0	0.0	0.5
An.splendidus	0.0	0.0	0.0	0.5
An.theobaldi	0.0	0.0	0.0	0.5
An.varuna	0.0	0.0	0.0	0.5
Total *Anopheles*	1.0	21.0	20.2	80.0

4. Bioassay tests: During the survey, bioassay tests were conducted in six SP sprayed and 4 DDT sprayed villages to observe the efficacy of these insecticides. 63.8% mortality of *An.culicifacies* mosquitoes was observed in 30 minutes of exposure after 6 weeks of SP spray (Table 5). In one village Khadgawa 100 % mortality was observed after 1 week of SP spray. In DDT sprayed villages, 25.0% mortality of *An.culicifacies* was observed in 2 villages where DDT was sprayed one week prior to bioassay test whereas in those 2 villages where DDT was sprayed 3 weeks prior to bioassay test, only 13% mortality was observed.

Table 5: Bioassay tests carried out in Khadgawa CHC

Period of test	*An.culicifacies* tested/Replicates	Knockdown			No.dead/mortality in 24 hr.
		10min	20min	30min	
After 1 week of DDT spray	60/6	0	0	0	15/25.0%
After 3 weeks of DDT spray	60/6	0	0	0	8/13.3%
After 6 weeks of SP spray	180/18	0	0	6	115/63.8%
After 1 week of SP spray	30/3	5	15	30	30/100%

Discussion

We present the results of entomological and parasitological surveys carried out on a recent out break of malaria in district Korea, Chhattisgarh. There was a focal outbreak of malaria in Dec 2003 in Khadgawa CHC. Both *Plasmodium vivax* and *P.falciparum* were present. The percentage of *P.falciparum* gradually increased from summer to rainy season.

In earlier studies in Madhya Pradesh, the neighboring state, *An.culicifacies* was the only vector species found in all seasons and in all villages. *An.culicifacies* was incriminated as vector. This species was reported to be responsible for 60% of the total malaria transmission in India (Raghvendra and Subbarao 2002 and Singh et al. 2006). However, *An fluviatilis* has a limited role. It has been reported that this species maintains unstable malaria with epidemic potential in most areas (Gunasekaran et al. 2005). *An.culicifacies* borne malaria is always very difficult to control without specific intensive control measures (Singh et al. 2004). *Plasmodium .falciparum* is the predominant species causing considerable morbidity and mortality. Malaria transmission in forest villages is intense because of Pf resistance to anti-malarials (Singh et al. 1995), difficult terrain, innumerable breeding sites, particularly after post monsoon season, low socioeconomic status and ecological conditions favouring vector longevity and rapid multiplication (Houghton 1983). The other factors that are responsible for intense malaria transmission are migration of people, presence of asymptomatic carriers, high man vector contact and probably under doses of antemalarials (Das et al. 2003). Furthermore these villages were under DDT spray and the vector species are resistant to this insecticide. To avoid malaria outbreak in future, entomological surveillance is essential. Data should be used to implement situation specific malaria vector control strategies in conjunction with parasitological surveillance.

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