INDIAN JOURNAL OF MALARIOLOGY

Volume 32

Number 4

December 1995

MALARIA RESEARCH CENTRE

Indian Council of Medical Research 22-Sham Nath Marg Delhi-110 054

INDIAN J. MALARIOL.

Quarterly
© Malaria Research Centre 1995
Year of Revival: 1981

SUBSCRIPTION RATE

Annual

India

Rs. 75.00*

Other countries

\$ 20.00

(including airmail postage)

*25% discount would be admissible to individual subscribers on annual basis.

Subscription may be sent by a **bank draft** or **postal order** only, payable at Delhi to the **Director**, **Malaria Research Centre**, **Delhi**.

The 'Indian Journal of Malariology' is indexed by 'BIOSIS', 'Drugs and Pharmaceuticals Current Indian Titles', 'Index Medicus', 'Indian Science Abstracts', 'Review of Applied Entomology', 'Protozoological Abstracts', 'Quarterly Bibliography of Major Tropical Diseases' and it is selectively abstracted by 'Tropical Diseases Bulletin'. This Journal is also accessible on the CAB Computer Database and MEDLINE.

INDIAN JOURNAL OF MALARIOLOGY

Chairperson Dr. G.V. Satyavati

Editor-in-Chief Dr. V.P. Sharma

Consultant Editors Dr. Rachel Reuben Mr. N.L. Kalra *Editor* Dr. Aruna Srivastava

EDITORIAL BOARD

Dr. S.S. Agarwal Director Sanjay Gandhi Postgraduate Institute of Medical Sciences Lucknow-226 001.

Dr. R.C. Mahajan
Prof. and Head
Department of Parasitology
Postgraduate Institute of Medical
Education and Research
Chandigarh-160 012.

Prof. Kamini Mendis Department of Parasitology Faculty of Medicine University of Colombo Colombo 8, Sri Lanka. Dr. V.P. Kamboj Director Central Drug Research Institute Lucknow-226 001.

Dr. K.N. Mehrotra Prof. of Eminence (Retd.) Department of Entomology Indian Agricultural Research Institute, Pusa Road New Delhi-110 012.

Dr. Ramesh Kumar Prof. and Head Department of Microbiology All India Institute of Medical Sciences New Delhi-110 029.

Production D.S. Sontiyal Arti Sharma

Assistant Editor Seema Vedantam Publication Assistant Jitender Kumar

Artist Tarun Malhotra *Type Setter* Kamini Verma

INDIAN JOURNAL OF MALARIOLOGY

CONTENTS	Volume 32 Number 4 December 1995
Anophelines of Siliguri-Naxalbari Block, Darjeeling, West Bengal	133
P. Malakar, S. Das, G.K. Saha, B. Dasgupta and A.K. Hati	
Epidemiological Observations on Malaria in Villages of Buhari PHC, Surat, Gujarat	140
H.C. Srivastava, Rajni Kant, R.M. Bhatt, S.K. Sharma and V.P. Sharma	
Bionomics of Vector Anophelines in District Naini Tal, Uttar Pradesh	153
R.P. Sukla, A.C. Pandey, V.K. Kohli, V.P. Ojha and V.P. Sharma	
Application of Simple Peptide ELISA for Stratification of Malaria Endemicity	164
Arati Roy, Shukla Biswas, Lalitha Kabilan and V.P. Sharma	
Short Note	
Drug Resistant <i>Plasmodium falciparum</i> in Mandla District, Madhya Pradesh	174
Neeru Singh, A.K. Tyagi and V.P. Sharma	

Cumulative Index

Subject Section	1 7 9
Author Section	238

Note: The editor assumes no responsibility for the statements and opinions expressed by the contributors.

Anophelines of Siliguri-Naxalbari Block, Darjeeling, West Bengal

P. MALAKAR, S. DAS, G.K. SAHA, B. DASGUPTA and A.K. HATI^a

A systematic survey has been carried out during 1993-94 to study the occurrence and distribution of anopheline mosquitoes in Siliguri-Naxalbari block of Darjeeling district. The anopheline fauna of this region consists of 13 species, namely, An. vagus, An. culicifacies, An. annularis. An. barbirostris, An. subpictus, An. maculatus, An. tessellatus, An. jamesii, An. aconitus, An. "hyrcanus" group, An. karwari, An. fluviatilis and An. jeyporiensis among which the first five species forms the major bulk (92%). All the species showed preference to cattlesheds than human-habitation for resting. The ratio between morning and evening collection was 1:0.87.

Keywords: Anopheline, Darjeeling, Habitat preference, Seasonal variation

INTRODUCTION

The malaria situation is extremely diverse in different parts of North Bengal. The foothills and its adjoining areas of Darjeeling district are considered worst affected with the problem. A gradual increase in the incidence of malaria has been noticed from areas

of Siliguri-Naxalbari block in recent years. A high number of *P. falciparum* infections were encountered (data of Deputy Director of Health Services, Malaria, Government of West Bengal).

ered worst affected with the problem. This unwelcome situation has called A gradual increase in the incidence of for an extensive entomological survey malaria has been noticed from areas in this unique ecosystem for better un-

derstanding of the underlying causes behind transmission of malaria. Since Hati¹ carried out a survey in some areas of the district, no systematic and comprehensive survey has been made so far in recent years. Malakar *et al.*², however, published a brief note on the subject. The present study was carried out to supplement the information available on the subject.

MATERIALS AND METHODS

The block shares the slope of foothills in the north and is characterised by heavy rainfall, perennial slow-running streams and rivers, forest bustees, paddy-fields and abundant tea gardens. Mosquito collections were carried out at stations namely, Prodhan Nagar, Bhangapool and Rothkhola. Prodhan Nagar is an urban colony situated at the bank of Mahananda River, while Bhangapool bustee is a rural colony at the periphery of Siliguri near river Balasan. Rothkhola is also a small village near the semi-urban Naxalbari township and the area is a part of the sub-Himalayan terrain. A large number of families of all the three study areas of the block have a practice of rearing cattle in their house-complex.

Mosquito collections were made in each station at dawn (0600-0800 hrs) and dusk (1800-2000 hrs) from cattlesheds and human habitations in April 1993 to March 1994. In each study area, three selected cattlesheds and human habitations were searched thoroughly

for adult collections. Adult collection was done twice a month spending two man-hours both in morning and evening. A total of 96 man-hours were spent in each study area during one year study period.

Mosquitoes were collected manually with the help of torches, test tubes and suction-tubes. All the specimens collected were identified following the key of Roy and Brown³ in consultation with that of Das *et al.*⁴ and kept place and habitat-wise in test tubes. The temperature and relative humidity were recorded during each collection.

RESULTS AND DISCUSSION

A total of 1371 anopheline mosquitoes were collected from April 1993 to March 1994, of which 1287 (94%) were females. The male and female ratio was 0.06:1. The anopheline fauna of this block consisted of 13 species namely, An. aconitus, An. annularis, An. barbirostris, An. culicifacies, An. fluviatilis, An. "hyrcanus" group, An. jeyporiensis, An. jamesii, An. karwari, An. maculatus, An. subpictus, An. tessellatus and An. vagus (Table 1). The most predominant species of this area was An. vagus (31.16%) followed by An. culicifacies (21.21%), An. annularis (16.24%) and An. barbirostris (14.99%). Among three collection spots surveyed the Rothkhola area harboured 12 anopheline species from October to December. A single specimen of each of An. fluviatilis (unfed) and An. jey-

Table 1. Relative abundance of different species of *Anopheles* in Siliguri-Naxalbari block (April 1993-March 1994)

Species		No. of specimen collecte	ed
	Male	Female	Total
An. vagus	53	401 (31.16)	454
An. culicifacies	22	273 (21.21)	295
An. annularis	3	209 (16.24)	212
An. barbirostris	-mad	193 (14.99)	193
An. subpictus	6	105 (8.16)	111
An. maculatus	grant'	25 (1.94)	25
An. tessellatus	Jay 7	23 (1.79)	23
An. jamesii	,marin	22 (1.71)	22
An. aconitus		16 (1.24)	16
An. hyrcanus' group		15 (1.17)	15
An. karwari	-n"	3 (0.23)	3
An. fluviatilis	na porte	1 (0.08)	1
An. jeyporiensis	Lug-	1 (0.08)	a seek
Total	84	1287	1371

Figures in parentheses are in per cent.

poriensis (fed) have been collected from cattlesheds of Rothkhola area during evening and morning hours respectively. Since *An. subpictus* was known to prefer wide range of habitations⁵, they were present uniformly in different spots of the present study area.

Several anopheline species namely, An. bengalensis, An. lindesayi, An. interruptus, An. varuna, An. theobaldi, An. ramsayi, An. culiciformis, An. balabacensis, An. annandalei, An. kochi, An. majidi, An. sintoni, An. aitkenii, An. gigas, An. leucosphyrus, An. nigerrimus, An.

minimus and An. splendidus, reported earlier from areas of Darjeeling district by several workers^{2,6-11}, were found absent during present survey. This may be attributed to the extensive spraying of DDT under National Malaria Eradication Programme¹²⁻¹⁴ as a result of high susceptibility status of some species of anophelines. Besides, massive deforestation, extension of agricultural fields especially tea gardens, unplanned urbanization and large-scale use of insecticides and synthetic fertilizers might have altered the species balance and ultimately has led to an ecological succession of biological species in this

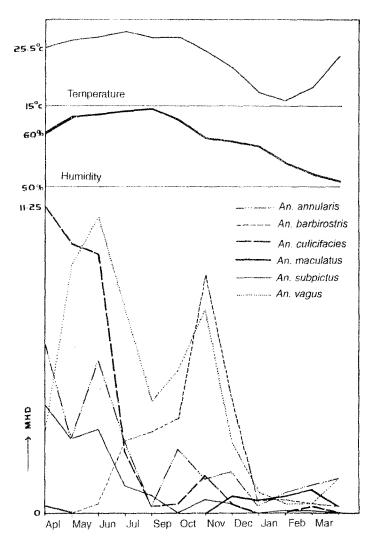


Fig. 1: Month-wise variation in the occurrence of common species of Anopheles in relation to relative humidity and temperature in the study area

Singh¹⁵ from Rajasthan.

between the morning and evening col-cies were An. vagus (36.68%), An.

area, as also suggested by Bansal and lection was found to be 1:0.87 and the ratio between the cattleshed and human habitation collection was 1:0.31. Of the total females collected, the ratio In morning collection, dominant spe-

annularis (19.5%), An. culicifacies (18%), An. barbirostris (10%) and An. subpictus (8.3%) and more than 75% specimens were collected from cattlesheds. In evening collections, 79% females were collected from cattlesheds and the notable species were An. vagus (25.17%), An. barbirostris (20.67%), An. culicifacies (20%), An. annularis (12.5%) and An. subpictus (8%). It was observed that all the 13 species of anophelines showed a marked preference to rest in cattlesheds except An. vagus that equally prefers to rest both in cattlesheds and human habitations. It is to be noted that in all collections both in cattlesheds and human habitations as well as in morning and evening, An. vagus remained the predominant species. The pattern of seasonality of An. vagus showed that the population built up with two distinct peaks (Fig.1), a high in June and another low in October, though the specimen were available throughout the year. Usually from November to March it had a comparatively lower prevalence. Likewise, bimodal peak was also found in An. annularis once in April and another in June.

The density of *An. culicifacies* remained higher (65%) in Bhangapool area reaching a peak at the end of April, while a relatively low density was attained as monsoon approached (Fig. 1). The fact may be attributed to the flushing effect in streams and rivers due to heavy rainfall during monsoon. The peak density of *An. barbirostris* attained in October and declined

sharply in December, reaching a low figure in March to May, on the onset of monsoon. As the monsoon approached, the density again increased steadily. An. maculatus were found present from October to April and were absent during monsoon as a result of heavy rainfall in this area. In case of An. subpictus the density remained high during April to June and declined steadily, as monsoon approached, with an extremely low level in September. All the specimens of An. 'hyrcanus' group were collected from cattlesheds during August, while more than 90% specimens of An. jamesii were collected from Rothkhola during August and September. The density of An. aconitus remained high in winter with a peak in November. Only three specimens (two unfed and one fed) of An. karwari were found present in the evening collection caught from the cattlesheds of Rothkhola area. Though it is an uncommon species throughout the country, it was reported for the first time from this part of India.

For better understanding of the seasonal prevalence of individual species of anophelines and to find out the relation between the temperature, humidity and mosquito density, mean man-hour density of notable species, mean temperature and mean humidity during each collection is plotted in Fig. 1. The study indicates that the density of *An. vagus* has a significant positive correlation with both the temperature (r=0.806) and humidity (r=0.794), while *An. maculatus* showed

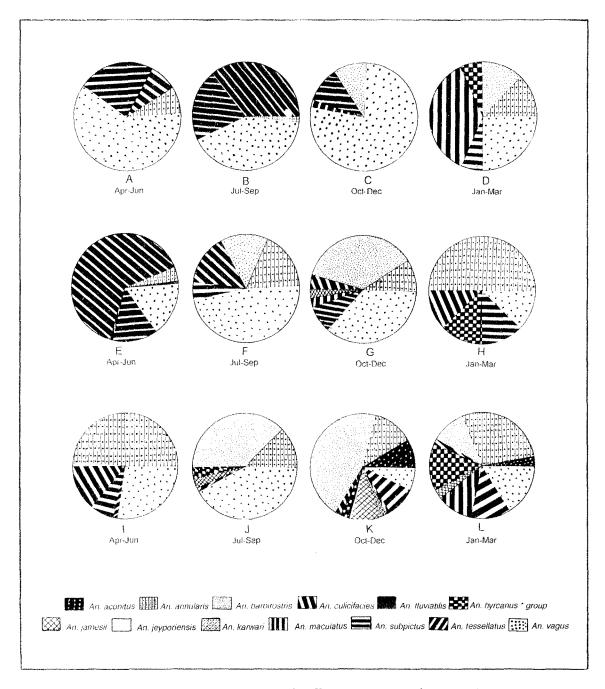


Fig. 2: Seasonal composition of different species of Anopheles in Prodhan Nagar (A,B,C and D), Bhangapool (E,F,G and H) and Rothkhola (I,J,K and L) areas during April 1993 to March 1994

a negative correlation with both of them (r=-0.698 and -0.683 respectively).

The species composition of the anopheline fauna in different seasons in three different collection spots were shown in pi-charts 'A' to 'L' (Fig. 2). Maximum number of species were found in October to December i.e. postmonsoon period, whereas less in the month of April to May.

ACKNOWLEDGEMENTS

Financial assistance provided by the Department of Science and Technology, Government of West Bengal, is gratefully acknowledged.

REFERENCES

- 1. Hati, A.K. (1986). Vector problem in malaria in West Bengal. *Indian J. Pub. Hlth.*, **30**: 203-206.
- 2. Malakar, P., S. Das, G.K. Saha and B. Dasgupta (1993). Anopheline fauna in some areas of Darjeeling district during winter season—a preliminary report. *J. Bengal Natl. Hist. Soc.*, **12**(1): 70-74.
- 3. Roy, D.N. and A.W.A. Brown (1970). *Entomology*. 3rd edn. (Bangalore Press, Bangalore).
- 4. Das, Binapani, R. Rajagopal and J. Akiyama (1990). Pictorial key to Indian Anopheline mosquitoes. *J. Pure Appl. Zool.*, **2**(3): 131-162.
- 5. Yadav, R.S., R.C. Sharma, R.M. Bhatt and V.P. Sharma (1989). Studies on the anopheline fauna of Kheda district and species-specific breeding habitats. *Indian J. Malariol.*, **26:** 65-74.
- 6. Gilroy, A.B. (1939). Health in tea gardens of the Darjeeling terai with special

- reference to malaria. *J. Mal. Inst. India*, **2:** 165-179.
- Iyenger, M.O.T. (1940). Further observation on vectors of malaria in Bengal and notes on the seasonal infectivity of Anopheles. J. Mal. Inst. Ind., 3: 115-123.
- 8. Sen, P. (1948). Records of natural infectivity of *Anopheles* in West Bengal. *Indian J. Malariol.*, **2:** 239-245.
- Verma, R.N. and B. Mahadevan (1970). Forest mosquitoes of eastern Himalayas foothills of India. *J. Med. Entomol.*, 7: 611-612.
- Rao, T.R., V. Dhanda, H.R. Bhat and S.M. Kulkarni (1973). A survey of haematophagous arthropods in western Himalayas, Sikkim and hill districts of West Bengal: A general account. *Indian J. Med. Res.*, 61: 1421-1461.
- 11. Bhat, H.R. (1975). A survey of haematophagous arthropods in western Himalayas, Sikkim and hill districts of West Bengal. Records of mosquiotes collected from Himalayan region of West Bengal and Sikkim with ecological notes. *Indian J. Med. Res.*, **63**: 232-244.
- 12. Puri, J.M. and A.K. Krishnaswami (1947). Studies on some insecticides against anopheline adults and larvae. Pt III. *Indian J. Malariol.*, 1: 159-182.
- 13. Krishnaswami, A.K. (1952). A note on the nocturnal behaviour of *An. minimus* Theobald, 1901 in DDT sprayed huts in North Bengal. *Indian. J. Malariol.*, **6**: 117.
- 14. Chakraborti, A.K. and N.N. Singh (1957). The probable causes of disappearance of *An. minimus* from the terai area of Nainital district of U.P. *Bull. Natl. Soc. Ind. Mal. Mosq. Dis.*, **5**: 82-85.
- 15. Bansal, S.K. and K.V. Singh (1993). Prevalence and seasonal distribution of anopheline fauna in district Bikaner (Rajasthan). *Indian J. Malariol.*, **30**: 119-125.

Epidemiological Observations on Malaria in Villages of Buhari PHC, Surat, Gujarat

H.C. SRIVASTAVA, RAJNI KANT, R.M. BHATT, S.K. SHARMA and V.P. SHARMA^a

Investigations were carried out in the villages of Buhari PHC, Surat district, Gujarat to determine factors responsible for high prevalence of P. falciparum. The area is well-known for sugarcane cultivation, industrialization and frequent movement of labourers. The slide positivity rate (44.24%) and P. falciparum infections (95.37%) were significantly high. The children of 5-9 yrs of age group suffered maximum from malaria. The infection in children was found associated with splenomegaly also. High falciparum infection (82.35%) was found in labourers camping near villages out of which 90% afebrile cases were reported which were silent carriers and source of transmission. Chloroquine was effective in 75% cases despite of existence of resistant falciparum strain. Among seven anopheline species encountered, An. culicifacies was predominant and found breeding in most of the breeding sites. The status of the insecticide spray and its receptivity among the community were poor. The investigation led to the conclusion that adequate measures are required to deal with migratory labourers, improper insecticide coverage, poor surveillance and mass ignorance.

Keywords: Anophelines, Malaria, Resistance, Splenomegaly

INTRODUCTION

19.6% P. falciparum (Pf) cases of the total cases in the country. Surat, one Several areas of Gujarat are endemic of the endemic district although acfor malaria. The state contributes counting for only 8.2% of Gujarat's population contributes 20.94% of all malaria cases and 33.5% *P. falciparum* cases of the state. The district is well-known for sugarcane cultivation and rapid industrialization resulting in large-scale population migration. The present investigations were carried out during November-December 1993 to identify the epidemiological and entomological factors responsible for enhanced malaria incidence in general and high *P. falciparum* in particular in some villages of Buhari PHC of district Surat.

Study area

Studies were carried out in six villages of Buhari PHC namely, Valod, Moredevi, Kumbia, Kanjod, Bhimpol and Ranveri. The first four villages are located on the banks of river Jhakaria with canal irrigation while last two villages are away from the river (Fig. 1). Ranveri, Kanjod and Bhimpol villages contain 90 to 100% backward and tribal population followed by Kumbia (76.9%) and Moredevi (50%). The proportion of tribal and backward class is low (36.6%) in Valod compared to other villages. Sugarcane and paddy are the major cash crops. The area receives good rain during June to October and the average annual rainfall and rainy days are 1383.90 mm and 42.33 respectively. The meteorological data obtained from Gujarat Agricultural University, Anand and District Panchyat Office, Surat are shown in Fig. 2.

MATERIALS AND METHODS

Mass blood surveys were conducted to obtain the quantum of malaria in local people and in migratory labourers. All blood smears were brought to the field laboratory, stained with JSB and examined. Treatment was given according to NMEP drug policy. Screening of splenomegaly was performed in children of 2-9 yrs of age group¹. Chloroquine sensitivity in Pf was investigated as per Rieckmann's method². Mosquito density was estimated through hand collection from human dwellings and cattlesheds and parity rate was determined according to Detinova³ to achieve the objectives. Larval sampling from all available breeding habitats in the villages was done using standard WHO method⁴. To assess the receptivity and quality of insecticide spray, a random survey of houses in the study villages was also carried out.

Observations on control measures by NMEP: The control activities included antiparasitic measures by instituting early detection and prompt treatment (EDPT) and anti-mostquito measures by intradomiciliary spray of conventional insecticide. Out of the seven sanctioned posts of MPHWs only three workers and one supervisor were engaged in surveillance activity in the study villages with a population of 19,900 and 39% scattered houses. Fortnightly, house-to-house visits by

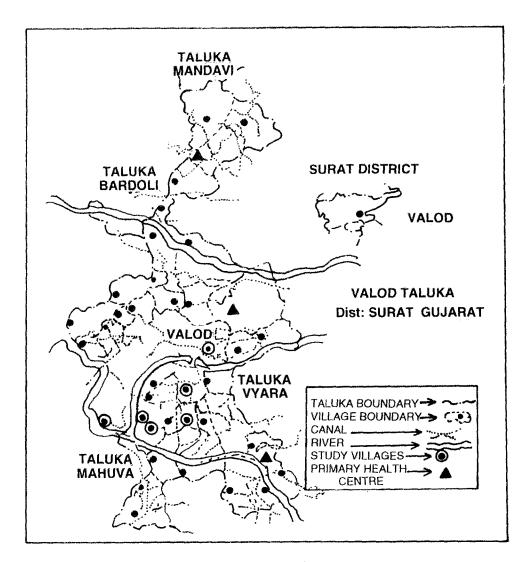


Fig. 1: Map of Valod taluka, Surat (village numbers are given against each village)

MPHWs was found irregular and some areas were untouched. However, annual blood examination rate (ABER) for the last five years has remained above 20%. Blood smears collected by ACD and PCD (1 CHC and 14 FTD) were not received by the PHC laboratory on

the same day. However, no backlog of blood smear was shown, as excess load was distributed either to District malaria Office, Surat or to nearby PHC. Mean time lag between collection and examination was 5-7 days. Surveillance of labour settlements was neglected. The presumptive and radical treatment were given according to NMEP drug policy both by the workers and supervisors. Though radical treatment was administered to 92% positive cases during 1992, incidence of Pf has shown an increase. From September 1993 onwards FRT was administered. Delayed radical treatment (7-10 days), and through third person are the indications of improper radical treatment.

Out of 21 villages under Buhari PHC, only 12 villages received insecticide spray from 1991 to 1993. During 1991, focal spray with DDT was done in three study villages. Area received single round of spray during 1991 and 1992 in September and June respectively

and two rounds in 1993 in August (1st round) and October (2nd round). Coverage of targetted population varied from 54 to 66% except in the year 1992, when it was 82%. However, spray coverage of room was less than 75% in every year. DDT (50%) in 1991 and 1993 and malathion (25%) in 1992 were used to cover targetted population.

Migrant labourer: Large-scale sugarcane cultivation throughout the year and eight sugar factories within 10 km range of study villages results in aggregation of labour. These labourers move into this area from the districts of Dang (22.10%), Panchmahal (16.14%) of Gujarat and Nasik (11.22%)

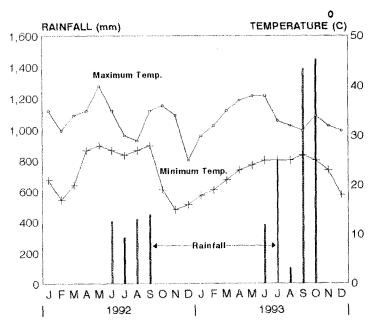


Fig. 2: Monthly means of maximum, minimum temperature and rainfall

Table 1. Epidemiological situation of Valod village, Buhari PHC and remaining PHCs (Rural)*

Year		BSE			(+) ve			API			%Pf	
	Valod	Valod Buhari PHC	Remaining Valod Buhari Remaining Valod Buhari Remaining Valod Buhari Remaining PHCs PHCs PHCs PHCs PHCs PHCs	Valod	Buhari PHC	Remaining PHCs	Valod	Buhari F PHC	Remaining PHCs	Valod	Buhari F PHC	Remaining PHCs
1989	2287	5979	2,27,279	1224 (53.51)	2375 (39.72)	37,565 1 (16,52)	107.40 26.35	26.35	19.30	35.45 34.77	34.77	35.70
1990	2762	7622	2,26,017	868 (31.42)	1555 (20.40)	24,341 (10.76)	76.19	76.19 36.16	12.51	23.04	24.82	36.14
1991	2773	6433	2,44,435	523 (18.86)	1084 (16.85)	25,032 (10.24)	45.90	25.21	12.86	27.15	27.58	47.05
1992	2655	5544	2,66,987	170 (6.40)	394 (7.10)	22,281 (8.34)	14.92	9.16	11.45	20.58 19.79	19.79	31.47
1993	4543	8609	2,75,247	624 (13.73)	1164 (13.52)	18,247 (6.63)	54.77	54.77 27.07	9.37	68.42	62.11	31.11

*Malaria cases reported from urban area have been excluded; Figures in parentheses are SPR; Population of Valod, Buhari PHC, and remaining PHCs are 11,392, 42,993 and 19,45,683 respectively. Source: District Malaria Office, Surat.

and Dhuliya (50.52%) of Maharashtra states. These districts are known for malaria endemicity. Most of these labourers visit to their native places during monsoon season (June-September) due to scarcity of work, temporary nature of their settlement and cultivation practices at their native places.

RESULTS

Epidemiological observation: Malaria incidence during last five years (1989-93) revealed there was gradual decrease in SPR and API in rural areas of District Surat, while the proportion of *Pf* has not declined significantly. In Buhari PHC, particularly in Valod village all the three parameters have sharply increased in 1993 (Table 1).

Maximum *Pf* cases were recorded during September to December in last two years which reflects the transmission season for *P. falciparum* (Fig. 3).

Results of survey in villages of Buhari PHC revealed high SPR and the contribution of P. falciparum infection was dominant over P. vivax. A low-level of mixed (Pv+Pf) infection (5.7%) was also observed. It is evident from Table 2, that former four villages situated near river were equally affected with malaria (P. falciparum), while Ranveri and Bhimpol villages had low malaria. Age and sexwise distribution of malaria given in Table 3 shows that persons of all age groups were affected. High slide positivity rate among the age group of 5-9 yrs indicate high attack rate which agree with the previous

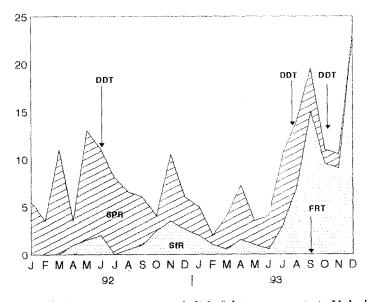


Fig. 3: Slide positivity rate and slide falciparum rate in Valod village of Buhari PHC

Table 2. Results of parasitological survey in villages of Buhari PHC, District Surat

vinage	Population	BSE	(+)ve	Pf	Mix	SPR	SIR	JA%
Valod	4252	283	117	102	6	41.34	39.22	94.87
	800	19	7	9	0	36.84	31.58	85.71
Kumbia	675	29	77	7	0	48.28	48.28	100.00
	006	50	8	29	posse	62.00	60.00	96.77
	450	4	0	0	0	00.00	00.0	0.00
	650	9	せ	च्ये'	0	66.67	29.99	100.00
-	7727	391	173	155	10	44.24	42.20	95.37

Table 3. Age and sexwise distribution of malaria cases in study villages

£ge			Male	le					Fernale	4)		
group (yrs)	BSE	(+)ve	Pf	Mix	SPR	SíR	BSE	(+)ve	Pf	Mix	SPR	SIR
-	maine	499	***		- Cardy great complements and the Cardy Ca	anda	2	and the second s	nites	***	0.00	00.00
*	ഗ	4	7	yuuq	80.00	00.09	14	1	rO	7	50.00	50.00
o,	18	12	10	2	66.70	66.70	30	22	18	2	73.33	66.70
0-14	29	19	18	houst	65.50	65.50	30	20	18		66.70	63.30
5-29	Ŋ	26	24	ŧ	50.98	47.06	51	21	20	-	41.18	41.18
30	73	16	15	ì	21.92	20.55	88	56	25	ì	29.55	28.41
otal	176	77	69	4	43.75	41.48	215	96	98	9	44.65	42.79

Table 4. Labour survey in Valod village of Surat district

				and the state of t	والمواردة والمراوع والمواودة والتناسب وويونونون والمواونة والمواونة والمواونة والمواونة والمواونة	epidan makalajak ordo cikasak sarokisskisski kasak danasi (majo jahajad d
ender i annaturante (spat) (sp. 10. 10. annaturante de la companya de la companya de la companya de la companya	BSE	(+)ve	Pf	SPR	SfR	%PJ
Fever cases	59			11.86		71.43
Non-fever cases	258	10	6	3.86	3.49	90.00
Total	317	17	1.4	5.36	4.42	82.35
o del francia como intercono como se	the annual contract and the second contract of the second contract o		and a second contract of the second contract	AND THE COLUMN ASSESSMENT OF THE PROPERTY OF T		

findings⁵. Persons above 30 yrs of age were found more safe with lowest malaria infection rate. Malaria positivity rate (57.8%) among 1-4 yrs of age group and high crescent rate (33-75%) were observed during the present survey.

Results of blood smears collected from labourers (mass blood survey), camping near the villages are shown in Table 4. Data shows that in spite of low SPR among afebrile cases, *Pf* per cent was higher compared to that among febrile cases. Spleen examination of 115 children in Valod village revealed splenomegaly in 11.3% subjects with average spleen enlargement of 1.8. Although grade 3 and 4 spleen were in low proportion (1.7%), the prevalence of falciparum and mixed infections among the children with enlarged spleen was 77.7% and 22.3% respectively.

To ascertain chloroquine sensitivity in *P. falciparum*, 48 cases with *Pf* rings were followed according to the Rieckman's method². 75% cases responded to chloroquine and rest of the cases showed varying degree (RI 16.6%; RII 2.0%; and RIII 6.25% levels) of resistance. Chloroquine resistant *Pf* strains are existing in low proportion (Table 5) with maximum occurrence in 9-20 yrs of age group. Prevalence of resistant strain has also been reported from other parts of Surat and Kheda districts^{6,7}.

Entomological observation: It revealed the presence of seven anopheline spe-

cies resting in houses. An. culicifacies was predominant constituting 88.7% of total anophelines collected followed by An. subpictus (9.6%). Other anopheline species namely, An. aconitus, An. annularis, An. barbirostris, An, stephensi, and An, tessellatus were found in small numbers (1.64%). Mean man hour density (MHD) of An. culicifacies was observed to be 59.58. Density of An. culicifacies was relatively higher in cattlesheds (MHD 136.8) than in mixed (MHD 54.0) and human dwellings (MHD 14.8) (Table 6). Results of mosquito dissections revealed that 52.63% An. culicifacies were parous, though only 7.89% were found with two dilatations.

Survey of perennial as well as temporary mosquito breeding sources in the study villages revealed the positivity of 65.38%. Out of 26 larval samples collected 43.3% were positive for mix, 19.23% for anopheline and 3.8% for Culex mosquito breeding. Density of immature stages of anophelines was maximum in river (3.9/dip). Table 7 shows irrigation drain supported the breeding of maximum number of anopheline species (6). An. culicifacies was found to breed in most of the habitats available which agree with the earlier findings of its ubiquitous breeding habit⁸.

Susceptibility test on *An. culicifacies* with different insecticides could not be conducted as the study villages were sprayed recently. However, tests carried out on *An. culicifacies* against

Table 5. Age and sexwise distribution of P. falciparum cases studied for chloroquine sensitivity

Degree of	9-2	9-20 yrs	21-	21-30 yrs	დ ^	> 31 yrs	TC	Total
resistance	Male	Fernale	Male	Female	Male	Female	Male	Female
S/RI	10 (66.7)	8 (38.1)	1 (6.7)		4 (26.7)	(38.1)	15 (41.7)	21 (58.3)
S/RI late	2 (66.7)	5 (100.0)	ı	i	1 (33.3)	i	3 (37.5)	5 (62.5)
RI early/RII	I	1 (100.0)	1	ľ	1	1	0	1 (100.0)
RIII	. 1	2 (100.0)	1 (50.0)	1	ı	ţ	1 (33.3)	2 (66.7)

Figures in parentheses are in per cent.

Table 6. Man hour density of mosquitoes in villages of Buhari PHC

Habitat		November	,		December			Total	- Мерійні пітарінні Міскі в петарапення ката по
	Total mosquito	Total anophe- lines	An. culici- facies	Total mosquito	Total anophe- lines	An. culici- facies	Total mosquito	Total anophe- lines	An. culici- facies
Human dwelling	19.20	18.40	12.00	20.33	16.66	16.00	20.00	17.17	14.80
Mixed dwelling	70.00	64.00	54.00	1	ŧ	t	70.00	64.00	54.00
Cattleshed 174.67	174.67	166.67	133.33	146.71	146.14	138.28	155.20	152.80	136.80
Mean	76.00	72.00	56.80	66.90	64.60	61.05	90.02	67.17	59.58

Table 7. Species specific mosquito breeding sources in villages of Buhari PHC

Species	River	Rocky pool	Sandy pool	Irrigation drain	Canal	Well
No. of samples	5	1	10	3	4	3
Larval density/dip						
Anophelines	3.94	2.6	2.3	2.4	0.09	No.
Culicines	JONN	-	0.5	4.8	years	19.0
% frequency of species						
Anophelines						
An. aconitus	al lingua	and the second s	***	7.6	Section 1	-
An, annularis	5.8		-	3.8	900m²	Andrew .
An. culicifacies	55.88	100.0	96.4	3.8	100.0	1965
An, nigerrimus	WALK .			15.4		
An, subpictus	38.23	_		65.4	~	Place
An, tessellatus	personal distribution of the second	-	3.6	3.8	top,	-
Culicines						
Cx. bitaeniorhynchus	•••	nage .		93.7	WAY 10	100.0
Cx. quinquefasciatus	*	viole	100.0	***************************************	****	******
Cx. vishnui group	Marks	10 Mar.	******	6.3	- Marie	Mari

DDT, HCH and malathion by State Health Department during 1992-93 in Ukhalda, Champavadi and Buhari PHCs in Surat district revealed the mortality in the range of 8.8-22%, 8.3-20% and 11.11% respectively. These results confirm the presence of DDT, HCH and malathion resistant strain of *An. culicifacies* and support the previous observations⁹.

Survey of 134 houses to assess the status of insecticide spray revealed low coverage 62.4% and the quality of spray was also poor (Fig. 4). The refusal rate by the villagers for not allowing their

dwellings to be sprayed was 21.9%, the reasons for the same were irritating smell of the insecticide enhanced nuisance of bed-bugs and fleas and inadequate impact on mosquitoes. Similar reasons have also been reported from Orissa¹⁰. Among the houses sprayed, only 38.10% were found with insecticide deposits on the eaves, wall and roof that are the preferred mosquito resting surfaces. Important reasons behind low residual deposits on the surface were traditional house cleaning and mud plastering practices before Deepawali that falls during peak transmission season.

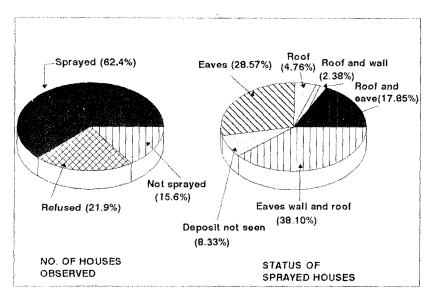


Fig. 4: Spray status of houses in Valod village, Surat

DISCUSSION

Undoubtedly, malaria has increased in Buhari PHC, especially prevalence of P. falciparum has enhanced in most of the villages surveyed. High proportion of SPR, SfR alongwith the high crescent rate observed during the present survey in this area indicate the inadequacy of surveillance and radical treatment of positive cases in containing the malaria transmission. Similar trend has been recorded from other places in past resulting in an outbreak¹¹⁻¹³. High spleen rate and dominance of P. falciparum infections in children reflect continued malaria transmission. Labour inflow with afebrile P. falciparum infection during post-monsoon months confirms possibility of parasite load enhancement that was not included in surveillance. Sharma

et al. 14 have reported continuous influx of labour for different work as an important source of malaria infection in Kheda.

Further the emergence of more RI chloroquine resistant P. falciparum strain is a great concern, which might have either been introduced by the migratory labourers camping near villages from September-October to May-June with incubating gametocytes or due to prolonged under dose treatment of malaria cases by private practitioners. High density of An. culicifacies was maintained due to favourable ecological and climatic factors as a result of unusual rainfall and vast stretch of river providing extensive breeding potential. Low level of susceptibility to insecticides and adequate longevity of An. culicifacies are suggestive of in-effectiveness of adulticide (DDT and malathion). Further, first round of DDT spray was carried out in second half of August in 1993 at the time when the transmission had already commenced. Under such situations use of some effective insecticide^{15,16} at prescribed time schedule can only interrupt malaria transmission in this area.

The present study shows that if adequate precautionary measures are not taken to deal with migratory labourers, improper insecticide coverage, inadequate surveillance and mass ignorance, malaria situation may further worsen in future in this area. Above all, people's cooperation, knowledge of disease and communication between workers and community are pre-requisite to deal with the situation.

ACKNOWLEDGEMENTS

Authors are thankful to Shri N.L. Kalra, Consultant, Malaria Research Centre, Delhi for critical review and valuable suggestions on the manuscript. Thanks are also due to Mr. S.M. Banerjee, Mrs. Bina Srivastava and staff of the parasitology team for their assistance during the entire course of investigations. Help rendered at times by Medical Officer, Buhari PHC and District Malaria Officer, Surat, is also gratefully acknowledged.

REFERENCES

1. Black, R.H. (1968). Manual of Epidemiology and Epidemiological Services in Ma-

- laria Programmes (World Health Organization, Geneva): 205.
- Rieckmann, K.H. (1990). Monitoring the response of malaria infections to treatment. Bull. WHO, 68(6): 759-760:
- 3. Detinova, T.S. (1962). Age-grouping methods in Diptera of medical importance with special reference to some vectors of malaria. WHO Monograph Ser. No. 47: 216.
- 4. WHO (1975). Manual on Practical Entomology in Malaria, Pt II: 55-69.
- Dutta, P., D.R. Bhattacharyya and L.P. Dutta (1991). Epidemiological observations on malaria in some parts of Tengakhat PHC, Dibrugarh district, Assam. *Indian J. Malariol.*, 28: 121-128.
- Sharma, R.C. and V.P. Sharma (1988). Epidemiological implications of population migration: Pt II. Evidence of chloroquine resistant *Plasmodium falciparum* malaria in Kheda district, Gujarat. *Indian J. Malariol.*, 25: 117-118.
- 7. Karmakar, P., S.C. Dutta, M.V.V.L. Narasimham and R.C. Sharma (1990). Status of *Plasmodium falciparum* resistance to chloroquine in Gujarat, Rajasthan and Maharashtra states of India. *Indian J. Malariol.*, **27**: 101-109.
- 8. Bhatt, R.M., R.C. Sharma, H.C. Srivastava, A.S. Gautam and D.K. Gupta (1993). Interspecific associations among anophelines in different breeding habitats of Kheda district Gujarat: Pt II: Non-canal area. *Indian J. Malariol.*, **30**: 91-100.
- Sharma, G.K. (1984). Review of malaria and its control in India. In Proceedings of the Indo-UK Workshop on Malaria, edited by V.P. Sharma (Malaria Research Centre, ICMR, Delhi): 13-40.
- Pinikahana, Jayaratne (1992). Socio-cultural factors associated with malaria transmission: A review. *Indian J. Malariol.*, 29: 121-126.

- 11. Malhotra, M.S., R.P. Shukla and V.P. Sharma (1985). Studies on the incidence of malaria in Gadarpur town of Terai, District Nainital, U.P. *Indian J. Malariol.*, **22**: 57-60.
- 12. Ansari, M.A., C.P. Batra and V.P. Sharma (1984). Outbreak of malaria in villages of Bareilly district, U.P. *Indian J. Malariol.*, **21**: 121-123.
- 13. Sharma, R.C. and A.S. Gautam (1990). Studies on outbreak of malaria in Muliad village of Kheda district, Gujarat. *Indian J. Malariol.*, **27**: 157-162.
- Sharma, R.C. and V.P. Sharma (1988).
 Epidemiological implications of popula-

- tion migration: Pt I. Imported malaria in Kheda district, Gujarat. *Indian J. Malariol.*, **25**: 113-116.
- Ansari, M.A., V.P. Sharma, C.P. Batra, R.K. Razdan and P.K. Mittal (1986). Village-scale trial of the impact of deltamethrin (K-othrine) spraying in areas with DDT and HCH resistant Anopheles culicifacies. Indian J. Malariol., 23: 127-131.
- 16. Ansari, M.A., V.P. Sharma, R.K. Razdan and P.K. Mittal (1990). Field evaluation of deltamethrin against resistant *An. culicifacies* in District Ghaziabad (U.P.), India. *Indian J. Malariol.*, **27:** 1-13.

Bionomics of Vector Anophelines in District Naini Tal, Uttar Pradesh

R.P. SHUKLA, A.C. PANDEYa, V.K. KOHLI, V.P. OJHA and V.P. SHARMAb

Breeding behaviour and seasonal prevalence of vector anopheline in different habitats associated with rice land agroecosystem of terai and bhabar area of District Naini Tal was studied from July 1992 to June 1994. Adult prevalence in both the areas shows two distinct An. fluviatilis peaks in the months of March and October and the breeding places for the species were pokhars in bhabar and stream and irrigation drains in terai. Prevalence of adult An. culicifacies was observed during July to August in bhabar and April and August in terai. In bhabar high immature density of An. culicifacies was noted mainly in tanks, pokhars and paddy fields (early transplantation period). In terai high immature density of An. culicifacies was noted in stream, while low in paddy fields. Higher prevalence of immatures and adult anopheline vectors coincide with peak malaria incidence in both the areas. In bhabar in the months of August and September large number of malaria cases were contributed by An. culicifacies and in November by An. fluviatilis. In terai, malaria cases in April and from June to September were contributed by An. culicifacies, whereas An. fluviatilis might be responsible for transmission in October.

Keywords: Anophelines, Malaria, Vector bionomics

INTRODUCTION

Terai area of Naini Tal was hyper-en- over as the principal vector and An. demic for malaria during the pre-DDT culicifacies a secondary vector^{4,5}. In

period and *An. minimus* was the prime vector¹⁻³, thereafter *An. fluviatilis* took over as the principal vector and *An. culicifacies* a secondary vector^{4,5}. In

Malaria Research Centre (Field Station), Bhotia Parao, Inderjeet Garden, Haldwani-263 141, India.

^aMalaria Research Centre (Field Station), BHEL Complex, Ranipur, Hardwar-249 403, India.

bMalaria Research Centre, 20-Madhuvan, Delhi-110 092, India.

1941, malaria control activity was started with application of DDT and mass administration of paludrine, resulting disappearance of An. minimus and malaria endemicity came down 6 . Reclamation of terai, clearing of forests, construction of seven water reservoirs for irrigation, colonization etc. in the DDT-era has entirely changed the ecosystem of the area. Since 1980's An. culicifacies has become a major vector followed by An. fluviatilis which was reported as primary vector in 1950's. Recently, An. culicifacies and An. fluviatilis both are incriminated as efficient vectors and evidence of their role in malaria transmission in terai is established⁷⁻¹⁰.

District Naini Tal contains three longitudinal ecogeographical areas viz. terai, bhabar and Shiwalik ranges. Near the foothills of Shiwalik is a gentle slopping area called bhabar which constitutes 10-20 km wide belt with many forests. Bhabar is a piedmont area with dry upland, low water table, sandy loam and dispersed settlements. Terai is a low-lying leveled area with abundant ground water, clay loam soil and agglomerated settlements. In rice land agroecosystem to understand the vector bionomics in terai and bhabar area of District Naini Tal, studies on prevalence of immature anophelines in different breeding grounds, vector prevalence and malaria incidence were carried out in two villages of bhabar i.e. Bhawani Singh Newar and Himmatpur Chaumwal with a population of 288 and 392 and two villages of terai, i.e. Shantipuri No. 3 and CRC, Pant Nagar with a population of 709 and 529, respectively from July 1992 to June 1994. The results of the study are communicated in this paper.

MATERIALS AND METHODS

Immature collections at fortnightly interval were carried out using standard dipper of 9.5 cm diam (300 ml capacity) from all the breeding grounds and densities of III and IV instar larvae were recorded. Regular adult collections were conducted on fortnightly interval using aspirator. Hand collections were carried out in four human dwellings and four cattlesheds of each villages and per man hour density of anophelines were recorded. Weekly active malaria surveillance from the above cited villages were made, blood smear of fever cases were prepared and presumptive treatment with 600 mg chloroquine base per adult was given. All malaria positive cases were given radical treatment.

RESULTS AND DISCUSSION

Larval density: Average anopheline immature density per dip during two years of study period in peridomestic sites was 2.3 and 1.2 in cemented tanks and *pokhars* (domestic ponds) in bhabar, and 1.0, 4.7 and 0.4 in shallow wells, stream and irrigation drains in terai areas, whereas in paddy field the immature density was 1.5 in bhabar from July to October and 1.4

cropping season) (Table 1). During the study period a total of 4317 anopheline larvae were collected and identified from all the breeding grounds.

Species prevalence: Monthwise aver-

in terai from March to October (two vectors in bhabar is given in Table 2. Seasonal prevalence of An. culicifacies and An. fluviatilis at different breeding sites in bhabar area revealed that An. culicifacies breeds predominantly in cemented tanks, throughout the year and its density per dip was recorded age density of immature anopheline highest in August (6.29), whereas, dur-

Table 1. Average immature density of mosquitoes (1992-1994)

AND THE PROPERTY OF THE PROPER		Bhabar			Тє	erai	POTENTIAL STATE ST
	Pokhar	Tank	Paddy field	Shallow well	Stream	Irrigation drain	Paddy field
Anopheline	1.2	2.3	1.5	1.0	4.7	0.4	1.4
Culicine	0.5	0.8	0.9	9.2	0.03	0.4	2.5

Table 2. Average density/dip of immature anopheline vectors in bhabar area

Months	Ta	nks	Pok	hars	Paddy	field
	An. culici- facies	An. fluvia- tilis	An. culici- facies	An. fluvia- tilis	An. culici- facies	An. fluvia- tilis
Jan	0	0	0	0.42	No cr	opping
Feb	0.15	0	0.06	0.01	No cr	opping
Маг	0.04	0	0.21	0.04	No cr	opping
Apr	1.06	0.02	1.03	0.82	No cr	opping
May	1.86	O	0.03	0.03	No cr	opping
Jun	0.57	O	0.19	0	No cr	opping
Jul	2.83	O	O	0	1.86 0	
Aug	6.29	0		ware.	0.21 0.002	
Sep	1.99	0	0.13	0	0	0
Oct	0.99	O	0	0.10	O	0
Nov	0.20	0.01	0.47	0.47	No cr	opping
Dec	0.01	0	0.12	O	No cr	opping

Table 3. Average density per dip of immature anopheline vectors in terai area

	rance of the		den sod far	table of the case account for tap of managed another managed to		•		ŝ	
Months	Shallo	Shallow wells	Irrigation drains	drains		Stream	Paddy fields	ields	
	An. culici- facies	An. fluvia- tilis	An. culici- facies	An. fluvia- A tilis	n. culici- facies	An. fluvia- tilis	An. culici- facies	An. culici- An. fluvia- facies tilis	
Jan	0	0	0.11	0	0	0	No cropping	pping	[
Feb	0	0	0.03	0.27	0.39	1.12	No cropping	pping	
Mar	0	0.05	0	0.30	0.08	0.78	9.0	0	
Apr	0	0	0	0	2.58	0	1.81	0	
May	0.98	0.16	0.63	0.11	15.92	0	0.05	0.05	
Jun	0.49	0	0.05	0	7.23	0	0	0.01	
Jul	0.13	0	0	0.2	1.0	0	0.37	0	
Aug	0	0	0.02	0	3.25	0	0.04	0.01	
Sep	0.13	0	0	0	0	0	0.02	0.01	
Oct	0	0	0	0	2.25	0	0.05	0.01	
Nov	0	0	0	0.2	0.80	0	No cropping	pping	
Dec	0	0	0	0.5	ı	1	No cropping	pping	

ing the month of November to March the density was very low (0 to 0.2). A very low density of An. fluviatilis was observed in April (0.02) and November (0.01). In pokhar, An. culicifacies density was noted in April (1.03), whereas in remaining months the density varied from 0 to 0.47. Density of An. fluviatilis was observed from January to May and October and November which varied from 0.01 to 0.82. In paddy fields, An. culicifacies immature density was observed in July (1.86) and August (0.21) and during rest of the period density remained nil. Breeding of An. fluviatilis was observed only in August (0.002), which reflected that paddy fields were not preferred by An. fluviatilis¹¹ (Table 2).

The seasonal prevalence of immature anopheline vectors in terai area is shown in Table 3. Breeding of An. culicifacies was observed in stream for the greater part of the year and its highest density was recorded in May (15.92). Prevalence of An. culicifacies was observed from May to July and September which varied from 0.13 to 0.98 in shallow wells. In irrigation drains An. culicifacies prevalence ranged from 0.02 to 0.63 in January, Feburary, May, June and August, whereas during rest of the months density remained zero in both the breeding sites. It was further noted that in May, highest density of An. culicifacies was recorded in all breeding sites except paddy fields. During dry cropping season, highest An. culicifacies prevalence was recorded in April (1.81) and low (0.02) in wet cropping season, revealing maximum breeding during early paddy transplantation period.

An. fluviatilis density recorded was very low (0-0.05) in paddy fields, while in stream, density in February and March was 1.12 and 0.78, respectively and breeding was not observed in rest of the months. In irrigation drains breeding was recorded low in February and March, May, July, October and November ranging from 0.11 to 0.30. Comparative analysis of data on average density of immature anopheline vectors revealed that stream is much preferred site for breeding of both malaria vectors.

Adult density: Average per man hour density of indoor resting vectors in bhabar and terai area are presented in Table 4. In bhabar An. culicifacies density was very low (0.05-1.3) except during July to September, when it increased sharply and reached highest in August (48.3). This abrupt increase of An. culicifacies density might be due to vast area of paddy fields which contributed to enhance its density. Overall density of An. fluviatilis was observed low as compared to An. culicifacies throughout the study, but high density of An. fluviatilis was observed in the months of October (1.7), November (2.3), December (2.0) and March (1.0) and low for rest of the months (0.05 to 0.4). In terai An. culicifacies density was recorded high as

Months	Bha	bar	Terai	
	An. culicifacies	An. fluviatilis	An. culicifacies	An. fluviatilis
Jan	0.2	0.1	1.1	1.8
Feb	0.05	0.1	1.6	4.8
Mar	0.05	1.0	4.9	9.7
Apr	0.7	0.4	18.2	5.0
May	1.2	0.3	19.9	0.6
Jun	1.3	0.05	22.9	0.3
Jul	11.3	0	22.6	0.3
Aug	48.3	0.05	12.0	0.4
Sep	6.8	0.4	5.9	2.3
Oct	1.2	1.7	4.9	10.7
Nov	0.7	2.3	8.9	5.6
Dec	0.6	1.0	5.7	2.5

Table 4. Per man hour density of indoor resting anopheline vectors

compared to bhabar throughout the year except in August. Its peak density was recorded during the month of June (22.9) and July (22.6), but low (1.6-8.9) from September to March. An. fluviatilis density was observed high in October (10.7) and March (9.7), whereas its density was observed low from late summer to mid rainy season which varied from 0.3 to 2.3. Incrimination study was not carried out during the course of investigations.

Malaria incidence: Results of malaria study conducted during the course of investigation in bhabar and terai are presented in Table 5. In terai a total of 277 blood smears from fever cases were collected and examined. Monthly fever rate varied from 1.01 to 25.5% and highest in August (25.5%). Aver-

age SPR and SfR were 7.2 and 0.7, respectively. Malaria cases per thousand population per year varied from 0 to 3.2. High incidence of malaria was observed in June (1.2), August (1.2), September (3.2) and sudden drop of cases was observed in October (0.8). Most of the malaria cases were due to *P. vivax*, whereas *P. falciparum* cases were recorded in August (SfR 1.4%) and October (SfR 5.3%).

In bhabar, a total of 283 blood smears were collected and examined. Monthly fever rate varied from 2.12 to 20.14%. Average slide positivity rate and slide falciparum rate was 5.3 and 0.3%, respectively. Malaria cases per thousand population per year varied from 0 to 4.4 during study period and more malaria cases were recorded in May (2.9), Au-

Table 5. Malaria cases in bhabar and terai area

Months		Te	rai (Pop	Terai (Popu. 1238)				m	habar	Bhabar (Popu. 680)	(089)	
	BSE	Pu	Pf	Total (+) ve	SPR	SfR	BSE	Pu	Pf	Total	SPR (+) ve	SIR
Jan	8	0	0	0	0	0	9	0	0	0	0	0
Feb	11	-	0		9.1	0	6	0	0	0	0	0
Mar	10	0	0	0	0	0	0	7	0	0	0	0
Apr	16	2	0	7	12.5	0	10	0	0	0	0	0
May	2	0	0	0	0	0	20	4	0	4	20.0	0
Jun	19	တ	0	လ	15.8	0	6	0	0	0	0	0
Jul	55		0		1.8	0	45	p==4	0	y-med.	2.2	0
Aug	70	2		တ	4.3	1.4	44	8	0	ಣ	6.8	0
Sep	47	∞	0	∞	17.0	0	22	9	0	9	10.5	0
Oct	19	4	proof.	7	10.5	5.3	45	0	0	0	0	0
Nov	1	0	0	0	0	0	15	0	proof.		6.7	6.7
Dec	13	0	0	0	0	0	16	0	0	0	0	0
Total	277	18	2	20	7.2	0.7	283	14	-	15	5.3	0.35

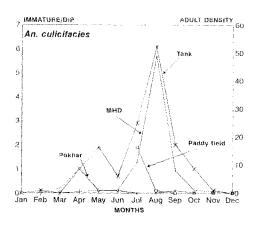
Table 6. Meteorological data of Pant Nagar (terai)

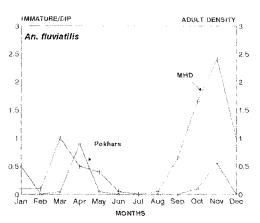
Months	S	1992			1993			1994	
	Av. temperature (0°C)	Av. relative iture humidity) (%)	Total rainfall (mm)	Av. temperature (0°C)	Av. relative humidity (%)	Total rainfall (mm)	Av. temperature (0°C)	Av. relative humidity (%)	Total rainfall (mm)
Jan	13.85	72.0	9.2	10.9	72.3	5.2	14.20	71.9	29.45
Feb	14.45	69.65	16.8	17.55	66.25	11.0	15.64	71.48	37.52
Mar	20.5	56.2	0.0	18.55	60.55	9.99	21.3	64.20	0.0
Apr	26.4	39.6	0.0	25.55	48.5	9.0	25.18	45.16	24.9
May	29.25	38.65	26.6	31.65	47.7	37.2	31.04	47.64	27.9
Jun	30,75	50.85	75.6	31.05	58.55	110.4	31.55	60.54	66.3
Jul	28.85	74.15	302.6	29.05	76.4	299.6	29.52	78.49	334.8
Aug	28.65	79.25	199.8	29.05	83.2	308.4	28.28	85.16	411.68
Sep	27.5	76.15	183.0	26.7	84.35	690.3	27.71	75.78	51.6
Oct	23.55	26.8	11.6	23.85	65.0	0.0	23.96	63.95	0.0
Nov	19.3	64.4	6.0	19.45	65.5	0.0	19.22	61.54	0.0
Dec		6.35	0.0	15.35	65.1	0.0	15.15	67.10	0.0
Total		62.7	831.2	23.2	66.2	1529.0	23.56	80.99	984.07

gust (2.2) and September (4.4). A sudden drop of malaria cases were recorded in October, whereas one case of *P. folciparum* (SfR 6.7%) was reported in November, thereafter no malaria case was observed till April (Table 5). The meteorological data for the year 1992 to 1994 collected from G.B. Pant University of Agriculture and Technology, Pant Nagar is given in Table 6. The relative humidity and temperature during July to September was favourable for transmission of malaria and the rainfall from June to September further supported the reproduction of vectors.

Prevalence trend of immature and adult anopheline vector and malaria in bhabar and terai area is shown in Figs. 1 and 2. In bhabar, an increase in malaria cases in the months of August and September indicated that cemented tanks and rice fields contribute for an abrupt increase in larval and adult An. culicifacies density. Malaria cases reported in the month of November might be due to increase in An. fluviatilis adult density which was contributed by pokhars. It was further observed that in bhabar high P. vivax malaria in August and September coincides with increase in An. culicifacies density, whereas P. falciparum malaria coincided with An. fluviatilis density in November (Fig. 1).

In terai, malaria cases observed in April, June to September is because of *An. culicifacies* density which was contributed by paddy fields and stream.





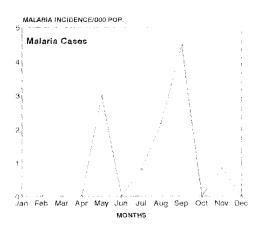
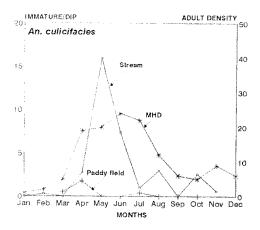
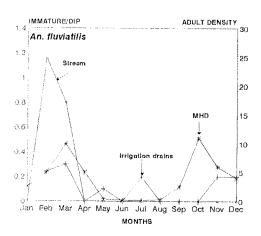


Fig. 1: Prevalence trend of immature and adult anopheline vectors and malaria in bhabar area





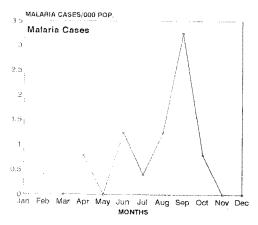


Fig. 2: Prevalence trend of immature and adult anopheline vectors and malaria in terai area

Density of An. culicifacies remained high for longer duration because of presence of stream and cultivation of crops during dry and wet cropping season and density recorded in paddy fields was low as compared to stream. Malaria cases in October might be due to high An. fluviatilis density which was contributed by stream (Fig. 2). During the study period P. vivax malaria was recorded highest in September and low from April to July followed by lowest in October. In above cited months. except in October An. culicifacies adult density was recorded high and was responsible for transmission of malaria 11,12. Peak density of An. culicifacies being the main vector of the area coincides with rice cultivation period i.e. early cropping period and more than 95% P. vivax malaria was reported during rainy season. Regarding the contribution of An. fluviatilis in transmission of malaria it was reported earlier that this species is zoophilic. Now it was found responsible in transmission of malaria from June to October suggesting prevalence of both anthropophilic and zoophilic races 5 . Presently, An. fluviatilis is considered a secondary vector due to its low anthropophilic index, resting habitats and host preference, thus its role in malaria transmission needs further investigation 13. Though, due to ecological change in the area and its flexible behaviour, possibility of malaria transmission was considered during postmonsoon period, i.e. October and November. In rice growing foothills area a high API is due to An. fluviatilis which breeds in stream¹⁴ and *pokhars* and 5. An. culicifacies in tanks, paddy fields and stream which agrees with our present findings. Presently, low malaria cases recorded from both the areas during the study period, might be due to less reservoirs and parasitic load in the community resulting in low transmission of malaria. Thus, cemented tanks, paddy fields and pokhars in bhabar and stream, paddy fields and irrigation drains in terai contributes for vectors population in malaria transmission.

ACKNOWLEDGEMENTS

Grateful acknowledgment is expressed to Shri N.L. Kalra, Consultant, Malaria Research Centre, for his keen interest in the preparation of the manuscript. The technical assistance rendered by Shri J.C. Sharma, Shri C.S. Bisht, Shri H. Gupta, Shri H.S. Negi and Shri H.C. Pandey is gratefully acknowledged.

REFERENCES

- 1. Clyde, D. (1931). Report on the control of malaria during canal construction (1920-1929). Rec. Mal. Surv. India, 2: 49-110.
- Hehir, P. (1927). Malaria in India (Oxford University Press): 16.
- 3. Das, A.N.C. (1930). Report on the Investigation of Malaria in Pant Nagar, Rudrapur, Tehsil Kichha, District Nainital (U.P. Government Publication).
- Srivastava, R.S. and A.K. Chakrabarti (1952). Malaria control measures in the terai area under the terai colonization scheme, Kichha, District Nainital (1949 to 1951). *Indian J. Malariol.*, 6: 381-394.

- Issaris, P.C., S.N. Rastogy and V. Ramkrishna (1953). Malaria transmission in the terai, Nainital district, Uttar Pradesh, India. Bull. WHO, 9: 311-333.
- Chakrabarti, A.K. (1955). Malaria control A vital element in a mass drive for food production, pt. III. Bull. Natl. Soc. Ind. Mal. Mosq. Dis., 4(2): 53-58.
- 7. Choudhury, D.S. and S.K. Ghosh (1982). Staining of sporozoites from infected mosquitoes. *Indian J. Malariol.*, **19**: 143-144.
 - Sharma, V.P., D.S. Choudhury, M.A. Ansari, M.S. Malhotra, P.K.B. Menon, R.K. Razdan and C.P. Batra (1983). Studies on the true incidence of malaria in Kharkhoda (District Sonepat, Haryana) and Kichha (District Nainital, U.P.) Primary Health Centres. *Indian J. Malariol.*, 20: 21-34.
 - 9. Choudhury, D.S., M.S. Malhotra, R.P. Shukla, S.K. Ghosh and V.P. Sharma (1983). Resurgence of malaria in Gadarpur PHC. District Nainital, Uttar Pradesh. *Indian J. Malariol.*, **20**(2): 49-58.
- Sharma, V.P., M.S. Malhotra and T.R. Mani (1984). Malaria: Entomological and epidemiological studies in terai, District Nainital, U.P. In Facets of Environmental Problems, edited by C.R. Krishnamurti (INSA Publication): 35-45.
- 11. Malhotra, M.S., R.P. Shukla and V.P. Sharma (1985). Studies on the incidence of malaria in Gadarpur town of terai, District Nainital, U.P. *Indian J. Malariol.*, **22**(2): 57-60.
- 12. Malhotra, M.S., R.P. Shukla and V.P. Sharma (1985). A three year report of the malaria clinic in Haldwani, District Nainital, U.P. *Indian J. Malariol.*, **22**(2): 123-126.
- 13. Anon. (1992). Annual Report (Malaria Research Centre, ICMR, Delhi).
- Sharma, V.P., Aruna Srivastava and B.N. Nagpal (1994). A study of the relationship of rice cultivation and annual parasitic incidence of malaria in India. Soc. Sci. Med., 38(1): 165-178.

Application of Simple Peptide ELISA for Stratification of Malaria Endemicity

ARATI ROY, SUKLA BISWAS, LALITHA KABILAN and V.P. SHARMAª

A serological investigation was conducted in north India to determine malaria endemicity based on the antibody levels against a nonapeptide RI (EENVEHDA-Cys) from the P. falciparum antigen Pf 155/RESA. P. falciparum sonicated crude antigen was also used in the study. Subjects of all age groups from various strata of malaria endemicity were included in this study. A total of 4273 finger prick blood samples from 49 villages of five districts were collected during January to March 1991 which is a non-transmission season and the antibody levels were estimated by ELISA. Although a good correlation was found between the antibody titre to the RI peptide and that to the crude antigen, the most consistent results were obtained with the RI peptide. When compared with the annual parasite index (API) values, an established method for defining malaria endemicity, mean anti-RI antibody titres obtained from several villages within a single zone correlated (r=0.94, p=0.023) with mean API value of the area. Thus, our results suggest that by using the RI peptide as antigen in seroepidemiology, it is possible to stratify malaria endemicity. We didn't distinguish between endemicity of Pv and Pf since each area experiences cycle of transmission of P. vivax followed by P. falciparum and our sera were from individuals having no fever.

Keywords: Malaria, P. falciparum, Seroepidemiology

INTRODUCTION

To determine the degree of malaria transmission in an area no simple ods are either tedious or inadequate^{2,3}.

method is available. For efficient monitoring and surveillance^I, the existing entomological and parasitological methImportance of seroepidemiology in disappearing malaria is well-recognized⁴. Crude *Pf* antigen for ELISA has been widely used^{5,6} in such studies. However, this presents a major limitation of serology, that is the lack of standardized reagents, particularly defined antigens⁷.

To overcome this limitation a standardized peptide antigen for ELISA⁸ was developed using 3' repeat sequence (EENVEHDA-Cys) of *Pf* 155/RESA antigen⁹. Its seroreactivity has been assessed in individuals from different malaria endemic situations.

Study area

The study was conducted in Srinagar, Haldwani, Shankargarh, Allahabad, Jabalpur and Mandla regions of northern India. In the study areas, an arbitrary classification was assigned, namely, low, moderate, high and nonendemic according to the annual parasite incidence (Table 1). All areas were under malaria control programme of the Malaria Research Centre, except Srinagar (Kashmir, non-endemic) and one malaria endemic (Jabalpur) area. Active malaria surveillance (weekly collection of blood smears from fever cases by door-to-door survey)¹⁰ in the study areas was well established by Malaria Research Centre. As a result of intervention, malaria incidence declined in some places that had high transmission¹¹, such as villages in Haldwani, as ascertained by a weekly active

surveillance (Table 1). Whereas, in Shankargarh, the incidence of malaria remained virtually stable probably because of new cases due to constant influx of migratory labour. In addition to the existing malariometric indices, a serological study of estimation of antimalarial antibodies against *Pf* and RI was carried out in Jabalpur (endemic/no malaria intervention measures) and Mandla (endemic/malaria control measures). These two areas were presented as control and experimental villages, respectively.

MATERIALS AND METHODS

Sample collection: Finger prick blood (50 µl) samples were collected from individuals having no fever as described earlier⁸ during January to March 1991, known as the non-transmission season.

Peptide antigen R1: The synthetic nonapeptide EENVEHDA-Cys, an immunodominant epitope of ring infected erythrocyte surface antigen (RESA) was custom made (Cambridge Research Biochemicals, England) with 80 per cent purity as assessed by HPLC.

Antigen *Pf*: Parasites from the continuous *in vitro* cultures were enriched for schizonts (95%) by centrifugation on a percoll gradient. Parasite pellet was saponin lysed, sonicated and soluble extract was used as an antigen¹².

District code no.	District	Sample size	Mean API	API range	RI	Pf
I	Srinagar (Kashmir)	66	0	0	0.15	0.25
II	Gangapar/Duaba (Allahabad)	1251	3.11	3-8.6	0.197	
111	Yamunapar (Allahabad)	430	10.6	1-17	0.193	-many
IV	Haldwani (Naini Tal)	161	22	3-64	0.321	0.24
V	Mandla (Bizadandi PHC, M	358 P)	165	80-291	0.37	0.52
VI	Shankargarh (Allahabad)	1002	218	99-431	0.834	0.83
VII	Jabalpur (MP)	1005	272	182-454	0.796	0.90

Table 1. Study of antibody response under varying endemicity

Control sera: Ten pooled serum from an endemic and non-endemic areas were taken as positive and negative sera respectively.

Enzyme linked immunosorbent assay (ELISA): Enzyme immunoassay was performed in Costar (USA) fast binding ELISA plate as described before⁸. Peptide (RI) and Pf antigen plates were coated with 50 ng/well and 10 ug/well respectively in carbonate bicarbonate buffer (0.1 M, pH 9.6) and incubated overnight at 4⁰C and then 1 h at 37°C. The plates were then washed three times with PBS T (0.05% Tween 20) and blocked with 200 µl/ well of 1% BSA in PBS for 1 h at 37°C. Later the plates were washed again as described above. 50 µl of various tive and positive sera were used as con-

sample eluant in 1 ml PBS was added to the wells at 1:40 and 1:1024 dilution as developed by checkerboard titration for R1 and Pf respectively. The plates were incubated for 1 h at 37°C, washed thrice with PBST and then 50 ul of goat anti human-HRPO conjugate (Dakopatt, Denmark) at 1:3000 dilution was added to each well. After 1 h incubation at 37°C, the plates were washed with PBST thrice, 50 µl orthophenylene diamine/H₂O₂ diluted in enzyme substrate buffer (0.1 M phosphate citrate buffer pH 5.0) was added to each well. Finally, the reaction was stopped by adding 25 µl of H₂SO₄ (8N). The OD of reaction product was recorded at 490 nm in Titretek ELISA reader. In each assay one set of negatrols to determine day-to-day variation in the tests. Seropositivity was determined using an OD value equivalent to the mean + 2 SD obtained in the control population (non-endemic) as the cut-off value.

RESULTS

Antimalarial antibodies in the finger prick blood samples to the *P. falciparum* crude antigen and to a synthetic nonapeptide derived from the blood stage antigen of *P. falciparum*, *Pf* 155/RESA, were estimated by ELISA in subjects of various age groups living in different regions. Study areas have different levels of endemicity for malaria.

Fig. 1 shows the heterogeneous distribution of antibody reactivities of donors from the different regions to the synthetic peptide RI and the Pf crude antigen. The presence of IgG type antibodies were tested in serum. In general, antibody level to the Pf crude antigen were elevated (Fig. 1). Results of individual antibody titre from non-endemic population against the Pf crude antigen showed a wider scattering in comparison to the responses directed against the RI antigen (Fig.1). There was a statistically significant positive linear correlation (r=0.86; p=0.085) between the results obtained for the two antigens from a total population of 26 villages (Fig. 2). Usually endemicity of malaria is classified based on the spleen rate and API. We also investigated whether estimation of anti-RI antibody levels can serve as an additional parameter in determining malaria endemicity. To establish how the different test-systems are related to

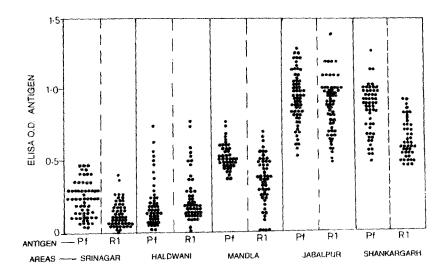


Fig. 1: Each dot presents a single individual, RI and Pf used as antigens under different endemicity

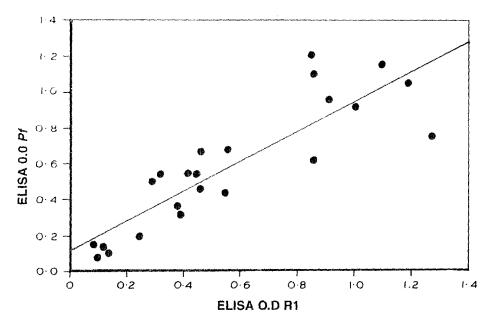


Fig. 2: Each dot presents RI, Pf values of individual village under variable malariogenic conditions

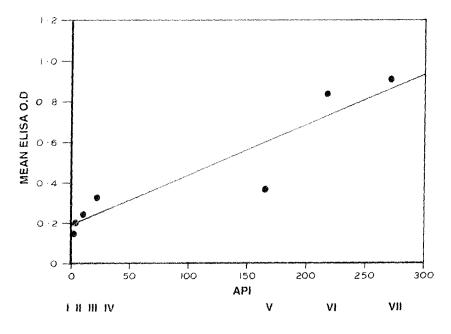


Fig. 3: Each dot presents one group comprising several villages

each other in classification of malaria To assess the significance of antibody endemicity, correlation analysis between API and antibody levels (mean ELISA OD values) from the study areas was done. The results showed a significant correlation (r=0.94; p=0.023) (Fig. 3).

responses in classification of the malaria endemicity, the study areas were arbitrarily classified into low, moderate, high and non-endemic depending on the mean ELISA OD values (Table 2). The classification was compared

Table 2. Village wise mean ELISA OD values between RI and Pf antibody with API

Area	Villages	API	RI	Pf	% population examined
Haldwani (Low)	Baira Pokhra	19	0.125 <u>+</u> 0.06	0.124 <u>+</u> 0.06	26
	Badi Mukhani	5.8	0.242 <u>±</u> 0.15	0.194 <u>+</u> 0.10	8
	Ratanpuri	35	0.099 <u>+</u> 0.04	0.071 ± 0.04	45
	Brijwalpur	64	0.380 ± 0.18	0.347 <u>+</u> 0.13	
	Kishanpur Gurdwar	15	0.455 ± 0.16	0.458±0.17	35
	Haripur Motia	13	0.547 ± 0.17	0.433 <u>+</u> 0.12	38
	Deval Chaur	4	0.385 ± 0.18	0.321 ± 0.13	10
	Manpur	3	0.138±0.08	0.127±0.07	37
	Jeetpur Negi	9	0.136 <u>+</u> 0.07	0.108 <u>+</u> 0.04	14
	Anandpur	22	0.134 ± 0.07	winds	***
	Himmatpur Baijnath	42	0.16±0.04		
	Gusaipur	31	0.134 ± 0.06		-
Mandla	Chargoan	100	0.42 ± 0.17	0.54 <u>+</u> 0.08	10
(Moderate)	Ghota	189	0.44 ± 0.22	0.53 <u>+</u> 0.13	25
	Somnopur	291	0.29 ± 0.10	0.49 <u>+</u> 0.10	29
	Vijaypur	81	0.32 <u>+</u> 0.16	0.54 <u>+</u> 0.11	18
Jabalpur	Tarwani	235	0.85 ± 0.11	1.2 ± 0.10	13.5
(High)	Dnduwa	210	0.86 ± 0.19	1.09 <u>+</u> 0.20	13.9
	Magardha	195	1.00±0.13	0.927 <u>+</u> 0.09	15.3
	Chargaonkala	293	1.19 <u>±</u> 0.05	1.045 <u>+</u> 0.23	
	Majhgaon	381	0.913 ± 0.10	0.95 <u>±</u> 0.17	
	Tikariya	231	1.27 ± 0.08	0.75 <u>+</u> 0.11	~
	Khapa	327	0.86 <u>±</u> 0.20	0.61 ± 0.17	32.8
	Dungariya	454	0.56±0.12	0.67 <u>+</u> 0.18	20.9
	Bilnagari	210	1.10 <u>+</u> 0.16	1.15 <u>+</u> 0.19	25.5
	Banjartola	182	0.46±0.16	0.66 <u>+</u> 0.19	36.7

with malaria endemicity based on the API values (Table 2.). It is apparent from the results that there was a distinct positive correlative pattern between the anti-malarial antibody titres and API values (Fig. 3). Mean OD value of RI and *Pf* antigen showed a rising trend with increased endemicity.

Sample size is 20-25% of the total that have been covered. Children of 0-5 yrs age group and adult >20 yrs have been compared in the study. Age and sexwise status did not show any impact on antibody profile. Studies of antibody response in the pre- and post-monsoon season and their relation with API values are currently in progress.

The data from our studies suggest that the RI peptide can be useful in seroepidemiological investigation in determining endemicity. This nonapeptide differs as quoted previously⁸, from that of octapeptide as reported elsewhere⁹. Whether the terminal cystine in nonamer which is absent in the octamer may enable a better binding to the plate⁸ or even undergo oligomerization during storage remains to be elucidated. However, the reproducibility, the simplicity and the specificity of the assay using RI antigen indicate the applicability of this system in seroepidemiological surveys. Moreover, the correlation seen between the levels of anti-RI antibodies and the intensity of transmission (API) also suggest that RI peptide ELISA may be useful as an additional parameter in malariometric survey. However, further work is needed to explore the potential of this antigen in malaria surveillance.

DISCUSSION

Usual malariometric surveys include parameters of host origin like spleen rate and API. Now in India, availability of anti-malarial drugs is very good. When the parasites are cleared, the spleen size reduces to normal so it is difficult to locate palpable spleen. Moreover, spleen examination requires trained personnel. This calls for inclusion of additional parameters like serology in malaria survey. In malaria surveillance, the need of a simple test that will be complementary to parasitological surveillance cannot be over emphasized¹³. Serological approach to achieve this end has been tried by many workers using crude malaria antigens¹⁴. Results obtained in different studies however, are not comparable and at times are inconsistent¹⁵. Scattering of Pf OD values of non-endemic area, not seen with R1 antigen, may suggest that the R1 antigen is relatively pure and thus may be more specific for malaria.

There are reports of cross reacting protozoal antigens¹⁶. However, it will be difficult to know whether the antibodies seen in the non-endemic population to the *Pf* crude antigen are due to multiple cross-reactivity. A good correlation was observed between the results of RI and *Pf* antigen which may

indicate that humoral responses against the RI antigen reflects the anti-Pf responses. The main limitation of these studies was the batch-to-batch variation of the crude plasmodial antigen which was used in the assays. Establishment of in vitro culture system of the parasite is necessary to procure crude antigenic material. Thus the standardization of the assay system was not feasible. Serological investigations using peptides as capturing antigens could overcome such difficulties, since results obtained with the peptides are consistent, reproducible and specific. The simplicity of the assay facilitates screening of many samples in epidemiological investigation.

In this study, we have tried to investigate whether estimation of antibody levels against a nonapeptide (RI) from Pf 155/RESA can be a complementary index in determining levels of endemicity of malaria in a particular area. Our serological data with the RI antigen revealed the distinct differences in the antibody levels in individuals living in endemic and non-endemic areas in India. Increased levels of anti-RI antibodies in endemic areas seen here reflects the continuous boosting of individuals under perennial transmission. It was shown elsewhere that antibody responses remained constant over the years in such individuals 17. It was also shown that antioctapeptide antibodies are short lived. These re-

sults showed that the categorization of endemicity correlated significantly with the rate of malaria transmission of *P. falciparum* malaria except in moderate endemic area.

In Mandla, where the anti-RI antibody level was low, a pilot malaria control programme was in practice during the period of our study and thus may attribute to the low levels of anti-RI antibodies. However, it is difficult to state now, whether the antibodies against the RI peptide are due to cross-reactivity to other malarial antigens, since P. vivax is also prevalent in the study areas. Cross-reactivities to plasmodial antigens in serum have been described by others 18. Further studies correlating antinonamer antibody with incidence of Pv and Pf are in progress to investigate this question.

ACKNOWLEDGEMENTS

Authors are thankful to Prof. Kunal B. Roy of Jawaharlal Nehru University, India, Dr. Kamini Mendis and Dr. R. Carter for their valuable suggestions. We thank Dr. M.S. Malhotra, Dr. Neeru Singh, Dr. P.K. Tyagi, Officers-in-charge of field stations, Malaria Research Centre, for providing finger prick blood samples and valuable information. We gratefully acknowledge the cooperation of the blood donors from the study areas. We also thank Dr. Aruna Srivastava for statistical analysis and staff of Immunology division for performing ELISA.

REFERENCES

- Sharma, V.P., H.C. Uprety, P.K. Srivastava and R.K. Chandrahas (1985). Studies on malaria transmission in hutments of Delhi. *Indian J. Malariol.*, 22: 77-84.
- 2. Pattanayak, S., R.G. Roy, K.G. Samnotra and M.S. Bendley (1981). Urban malaria scheme of the National Malaria Eradication Programme of India. *Indian J. Malariol.*, **18**(1): 21-27.
- 3. Choudhury, D.S., V.P. Sharma, S.C. Bhalla, S.S. Aggarwal and S.K. Das (1987). Malaria prevalence in patients attending primary health centres in ten districts of Uttar Pradesh. *Indian J. Malariol.*, **24**(1): 79-83.
- Bruce-Chwatt, L.J., C.C. Draper, D. Avramidis and Kazandozoglou (1975). Seroepidemiological surveillance of disappearing malaria in Greece. J. Trop. Med. Hyg., 78: 194-200.
- 5. Iqbal, J., A. Rab, P. Perlmann and K. Berzins (1994). Humoral immune responses to *Pf* antigens in children and adults living in a hypoendemic area of Punjab (Pakistan). *Amer. J. Trop. Med. Hyg.*, **51**(4): 444-453.
- Doi, H., Syafei and A. Ishii (1990). Detection of malaria endemicity in community villages in northern Sumatra, Indonesia by enzyme linked immunosorbent assay. Ann. Trop. Med. Parasitol., 84(4): 301-305.
- Voller, A., R. Kornille, J. Brogger, A. Storey (1980). A longitudinal study of Plasmodium falciparum malaria in the west African Savanna using the ELISA technique. Bull. WHO, 58(3): 429-453.
- 8. Roy, A., V.P. Sharma and V.S. Chuahan (1994). The use of peptide ELISA in determining malaria endemicity. *J. Immun. Methods*, **167**: 139-143.

- 9. Perlmann, H., P. Perlmann, K. Berkillns, B. Wahlin, M. Roy, M. Blomberg, I. Hagstedt, B. Anderson, E. Hogh, Petersen and A. Bjorkmann (1989). Dissection of the human antibody response to the malaria antigen *Pf*155/RESA into epitope specific components. *Immunol. Rev.*, **112**: 115-132.
- Sharma, R.C. and V.P. Sharma (1988). Epidemiological implications of population migration: Pt II. Evidence of chloroquine resistant Pf malaria in Kheda district, Gujarat. Indian J. Malariol., 25(2): 117-118.
- Sharma, V.P., R.C. Sharma and A.S. Gautam (1986). Bioenvironmental control of malaria in Nadiad, Kheda district, Gujarat. Indian J. Malariol., 23(2): 95-117.
- 12. Biswas, S., Q.B. Saxena, A. Roy and V.P. Sharma (1988). Isolation of different erythrocytic stages of *P. falciparum* and synchronization in culture. *Indian J. Malariol.*, **25**(2): 7-10.
- 13. Anon. (1992). Annual Report. Science and Technology Project on Intergrated Vector Control of Malaria, Filaria and other Vector Borne Diseases (Malaria Research Centre, Delhi).
- 14. Sanchez, E., H.A. Perez and C. Martinez (1990). Malaria in the Amazon, prevalence of *Plasmodium falciparum* antibodies in Ammerindians inhabiting the Venezuelan Amazon. *Ann. Trop. Med. Parasitol.*, **84**(4): 307.
- Huang, T.V., R. Hezi Zhang, F.X. Zhang, A.H. Jiang, D.X. Xiao, A.W. Yie, B.Y. Cherg and H. Yu (1989). Study of a seroepidemiological methods of evaluation of malaria during the advanced stage of malaria control. WHO/MAL., 89: 1053.
- Anders, R.F. (1986). Multiple cross reactivities amongest antigens of *Plas-modium falciparum* unpair the develop-

- ment of protective immunity against malaria. *Parasit. Immunol.*, **8:** 529-539.
- 17. Druilhe, P., O. Pradier, J.P. Mane, F. Miltgen, D. Mazier and G. Parent (1986) Levels of antibodies to *Plasmodium falciparum* sporozoite surface antigens re-
- flect malaria transmission rates and are persistent in the absence of reinfection. *Infect. Immun.*, **53**: 393.
- 18. Anon. (1989). Seroepidemiology of Human Malaria: A Multicentric Study (Malaria Research Centre, Delhi).

SHORT NOTE

Indian Journal of Malariology Vol. 32, December 1995, pp. 174-177.

Drug Resistant *Plasmodium falciparum* in Mandla District, Madhya Pradesh

NEERU SINGH, A.K. TYAGI and V.P. SHARMA^a

Keywords: Drug resistance, Malaria, Plasmodium falciparum

The hilly and forested tribal belt of Madhya Pradesh (M.P.) is highly malarious. Transmission is generally perennial with preponderance of *Plasmodium falciparum* in the presence of two vector species, i.e. *Anopheles culicifacies* and *An. fluviatilis*¹. Chloroquine has been a highly effective antimalarial drug in M.P., and no chloroquine resistant cases were reported till 1983². Resistant strains were first detected *in vitro*³ and also *in vivo* in Mandla⁴. Subsequently, resistance to the drug was reported from other areas of M.P.⁵ Therefore, a follow-up study was taken

up to assess changes in *P. falciparum* prevalence and its response to chloroquine after several years of drug pressure to obtain information for determining appropriate malaria treatment policy in these hard-core malarious areas.

For the purpose of this study a malaria clinic was established in PHC hospital of Bizadandi block, District Mandla during September to October 1994. After obtaining patient's consent visiting malaria clinic a simplified *in vivo* test system^{6.7} was applied to de-

Malaria Research Centre (Field Station), Medical College Building, Jabalpur-482 003, India.
^aMalaria Research Centre, 20-Madhuvan, Delhi-110 092, India.

tect chloroquine resistance. All patients were given 600 mg chloroquine phosphate orally and those below 14 years were given a dosage of 10 mg/kg body weight. Blood smears were taken before treatment and these were re-examined to determine asexual parasite density per cu mm of blood. The day of blood smear collection and drug administration was taken as Day 0. On the next day, the same dose of chloroquine was given as on Day 0. On Day 2, the patients were given 300 mg chloroquine or 5 mg/kg body weight. Follow-up blood smears were taken on Day 2 and the asexual parasite density was determined. If the level of asexual parasitaemia detected on Day 2 was more than 25% of that recorded on Day 0, the resistance to malaria parasite was considered to be at RIII level. These patients were administered a single dose of metakelfin (sulfalene 1500 mg, pyrimethamine 75 mg). The patients whose asexual parasite density on Day 2 was less than 25% of that of original smear on Day 0, follow-up blood smear were taken on Day 7, if the later was negative for malaria parasite, the degree of resistance was S/RI late. If parasites were still present, RI early/RII level of resistance was presumed and later treated with metakelfin. If the patient's blood smear were found negative for asexual parasite on Day 2, they were considered as S/RI.

A total of 1231 fever cases were screened, out of which 496 were positive for malaria (375 *Pf* and 121 *Pv*).

Only 78 patients came for follow-up of which four were pregnant women. In all 44 cases showed asexual parasites after 48 h of which three were pregnant. The individual responses observed in these patients are presented in Table 1. RIII level resistance was recorded in 35% cases and overall failure rate of chloroquine to clear *P. falciparum* was 55% as against 15-20% in 1989-90 from this area³. Perusal of malaria records of PHC hospital from the last five years revealed that prevalence of *Pf* was on increase, i.e. from 56% in 1989 to 68% in 1993.

P. falciparum had been a major problem in foot hills of M.P. and other regions of high transmission. The tribals inhabiting these regions are one of the weakest sections of society and are responsible for a sizeable number of falciparum malaria cases⁸ and deaths due to malaria. State record (NMEP)9 showed that average API of Mandla for the last five years is on increase i.e. 8,7,10,12 and 16 respectively from 1989 onwards and is third among 44 districts in M.P. This indicates that control measures carried out by NMEP in the state are not effective to contain the disease.

The spread of resistant strain to other receptive areas within the district and outside is of great concern considering the fact that there is substantial degree of human movement for various purposes. As majority of *P. falciparum* cases were found to be resistant by *in vivo* method, an immediate change in

Table 1. Chloroquine sensitivity* of *P. falciparum* by simplified in vivo test in Bizadandi PHC, District Mandla

SI. No.	Age,	/Sex		Parasitaemia/mm ³				
			Day 0	Day 2		Day 7		
1.	30	M	3494.74	1300	(37.2)	Nil		
2.	35	F	6846	2800	(41)	Nil		
3.	22	F	33654.32	10387.30	(31)	Nil		
4.	30	F	9859	3368	(34.2)	Nil		
5.	26	M	3181.74	1310.58	(41.2)	Nil		
6.	8	F	12686	2952	(23.3)	Nil		
7.	9	M	12969	12027	(93)	Nil		
8.	5	M	22807	13013	(57)	Nil		
9.	8	M	31107	7242	(23.3)	Nil		
10.	30	M	42377	11864	(28)	Nil		
11.	7	F	1927	3259	(169)	Nil		
12.	13	M	2957	1098	(37)	Nil		
13.	28	F**	1994	11284	(566)	10146***		
14.	25	F**	2443	1743	(71.4)	205		
15.	23	F**	2404	205	(8.5)	Nil		
16.	24	F**	1994	1308	(65.6)	405		

^{*}Only few cases are given here for brevity;**Pregnant women were given repeated dose of chloroquine; ***Referred to hospital for quinine. Figures in parentheses indicate the percentage parasitaemia, 100% being the level on Day 0.

drug policy is warranted. Since migration of labourers from other states to several irrigation project areas in Madhya Pradesh (29 major, 135 medium and 3000 minor irrigation projects) will continue for many years to come for development of the state, it is necessary to establish several check posts at each project site to prevent spread of drug resistant strains and deaths due to malaria.

ACKNOWLEDGEMENTS

Help rendered by the technical staff of Malaria Research Centre, Field Station is gratefully acknowledged.

REFERENCES

1. Singh, Neeru, V.P. Sharma, M.M. Shukla and Gyan Chand (1988). Malaria outbreak in Kundam block, District Jabalpur (M.P). *Indian J. Malariol.*, **25**: 41-49.

- Houghton, P.L. (1983). Assignment Report (Plasmodium falciparum Containment Programme, Zone III (a), Madhya Pradesh, Bhopal): 33-34.
- Ghosh, S.K., D.S. Choudhury, R.K.Chandrahas, Neeru Singh, T.V. Ramanaiah and V.P. Sharma (1989). Drug-resistant P. falciparum in Madras (Tamil Nadu) and District Jabalpur (Madhya Pradesh). Indian J. Malariol., 26(2): 87-90.
- 4. Singh, Neeru, M.M. Shukla, V.P. Sharma, and B.N. Saxena (1989). A focus of high degree of chloroquine resistant *P. falciparum* in Mandla district (M.P.). *Indian J. Malariol.*, **26:** 45-51.
- 5. Singh, Neeru and M.M. Shukla (1990). Response of *Plasmodium falciparum* to

- chloroquine in a tribal area of Madhya Pradesh. Indian J. Malariol., 27: 183-186.
- 6. Reickmann, K.H. (1990). Monitoring the response of malaria infections to treatment. *Bull. WHO*, **68**(6): 759-760.
- Prasad, R.N., H. Prasad, K.J. Virk and V.P. Sharma (1990). Application of a simplified in vivo test system for determining chloroquine resistance in *Plasmodium falci*parum. Bull. WHO, 68(6): 755-758.
- 8. Sharma, G.K. (1984). Review of malaria and its control in India. In *Proceedings of the Indo-UK Workshop on Malaria*, edited by V.P. Sharma (Malaria Research Centre, Delhi): 13-40.
- 9. Anon. (1994). *Statistical Report* (National Malaria Eradication Programme, Bhopal).

INDIAN JOURNAL OF MALARIOLOGY

Editorial Acknowledgements

The Editor gratefully acknowledges the help of the following scientists who have kindly reviewed the papers for the 1995 issues of the *Indian Journal* of Malariology:

Dr. H.M. Bhatia, Seth G.S. Medical College, Bombay; Dr. V.S. Chauhan, ICGEB, National Institute of Immunology, Delhi; Prof. D.K. Choudhury, University of Burdwan, Burdwan; Dr. P.K. Das, Vector Control Research Centre, Pondicherry; Shri S.C. Das, Defence Research Laboratory, Assam; Dr. V.K. Dhanda, Vector Control Research Centre, Pondicherry; Dr. G.P. Dutta, Central Drug Research Institute, Lucknow; Shri N.L. Kaira, Malaria Research Centre, Delhi; Dr. M.S, Malhotra, Malaria Research Centre, Delhi; Dr. R.C. Mahajan, Post-graduate Institute of Medical Education and Research, Chandigarh; Dr. P.K. Mittal, Malaria Research Centre, Delhi; Dr. Indira Murali, National Institute of Health and Family Welfare, Delhi; Dr. S. Pattanayak, B-91 Swasthya Vihar, Delhi; Dr. M.K.K. Pillai, University of Delhi, Delhi; Dr. C.H. Krishna Rao, National Malaria Eradication Programme, Delhi; Dr. R. Reuben. Centre for Research in Medical Entomology, Madurai; Prof. A.B. Sen, 148 Rabindra Palli, Lucknow; Dr. P. Sen, University College of Medical Sciences, Delhi; Dr. V.N. Sehgal, A-76, Panchwati, Delhi; Dr. R.S. Sharma, National Malaria Eradication Programme, Delhi Dr. V.P. Sharma, Malaria Research Centre, Delhi; Dr. S.K. Subbarao, Malaria Research Centre, Delhi; Dr. Neena Valecha, Malaria Research Centre, Delhi; Dr. R.L. Yadava, National Malaria Eradication Programme, Delhi; Dr. R.S. Yadav, Malaria Research Centre, Delhi.

CUMULATIVE INDEX (1981-1995)

Subject Section

Animal Studies Epidemiology Parasitology
Anopheles Immunology Reviews
Chemotherapy Insecticides Taxonomy
Drug Response Malaria Vector Control

Mosquitoes

ANIMAL STUDIES

RODENT MODELS

Plasmodium berghei: Studies on host metabolism using Mastomys natalensis as experimental model — J.K. Saxena et al., 18: 80-86.

Blocking of malarial transmission by a gamete vaccine against *Plasmodium berghet*: NK-65 — N.K. Kaushik *et al.*, **19**: 13-19.

Plasmoaium berghei: Regulatory effects of spleen sonicates on the uptake of glucose in vitro by the erythrocytes of albino rat and Mastomys natalensis — **S. Khare** et al.. **19**: 39-44.

Induction of pyrimethamine resistance in a mefloquine resistant strain of *Plasmodium berghei* — **S.K. Puri** and **G.P. Dutta**, **19:** 91-96.

Glutathione metabolism of *Pladmodium berghei* parasitized erythrocytes in mice — **R.K. Seth** *et al.*, **19**: 109-114.

The effect of immunostimulants in modulating the behaviour of *P. berghet* — **Aruna Parashar** *et al.*, **19**: 109-114.

Chemotherapeutic response of *Plasmodium yoelii* nigeriensis to antimalarial drugs — **Anita Pande** and **G.P. Dutta**, **19**: 121-124.

Effect of chloroquine treatment in vivo on the cyclic AMP level of erythrocytes from normal and Plasmodium berghei infected Mastomys natalensis — **S. Khare** et al., **19**: 125-128.

Influence of dietary protein restriction on *Plasmodium berghei* infection in rats — **A. Bhatia** and **V.K. Vinayak. 20**: 107-114.

Experimental malarial infection I. *Plasmodium berghei* infection in normal and T-cell deficient mice — **V. Padmavathi** *et al.*, **20:** 115-123.

Isolation of *Plasmodium berghei* by density gradient centrifugation on histopaque — **Priti Kumar** and **Sohail Ahmed**, **20**: 125-127.

Role of cyclophosphamide in modulating behaviour of *P. berghei* infection in mice — **S. Sehgal** *et al.*, **20**: 147-152.

Suppressive action of an interferon inducer (6MFA) on blood induced rodent malaria — **J.N.S. Yadava** *et al.*, **20:** 153-156.

Experimental malarial infection II. Plasmodium berghei infection in normal and B-cell deficient mice — V. Padmavathi et al., 21: 37-44.

Experimental malarial infection III. Protective role of antibodies in *Plasmodium berghei* infection in mice — **V. Padmavathi** et al., **21**: 45-51.

Immunomodulation of experimental malaria by MDP — **N. Khullar** *et al.*, **22**: 21-27.

Effect of a specific iron chelator, desferrioxamine on the host biochemistry and parasitaemia in mice infected with *Plasmodium berghei* — **Chanan Singh** *et al.*, **22**: 35-44.

Preliminary observations on development of quinine sulphate resistance in *Plasmodium berghei*—**Mahmood Kazim** et al., **23**: 133-137.

Studies on the comparative gametocytaemia of *P. berghei* (NK 65) in male and female *Mastomys natalensis* — **M. Rastogi** et al., **24**: 39-44.

5-HT, 5-HIAA and related enzymes in P. berghei

infected rats - U. Bhattacharya et al., 24: 45-49. SIMIAN MODELS

Effect of zinc diet on xanthine oxidase activity of liver of mice infected with Plasmodium berghei -A.J. Arif et al., 24: 59-63.

Selection of Plasmodium yoelii nigeriensis resistant to triple drug combination (sulphadoxine/ pyrimethamine/mefloquine) and its response to other antimalarials - Binduja Shukla et al., **25**: 1-6.

Gametocytocidal and sporontocidal activity of some standard antimalarials on P. berghei (NK 65) infection in M. natalensis — M. Rastogi et al., 26: 9-18.

The antioxidants as protectors of host stress organ injury in mice infected with Plasmodium berghei - A.J. Arif et al., 26: 173-178.

Antimalarial effect of cyclosporin-A on murine P. berghei and Human P. falciparum - S. Biswas et al., 28: 1-8.

Dietary modulation of malaria infection in rats - A. Bhatia and V.K. Vinayak, 28: 237-242.

Histopathological studies in relation to protection induced by using MDP as an adjuvant in malaria - Neeraj Khullar and Shobha Sehgal, 28: 243-248.

Evaluation of Ayush-64 for blood schizontocidal activity against rodent and simian malaria parasites - M. Kazim et al., 28: 255-258.

Reversal of chloroquine resistance with verapamil in P. berghei in vivo - N. Valecha et al., 29: 47-53.

Role of macrophages in experimental malaria: I. Development of immunobioassay indicators — C.R. Pillai and N.N. Singh, 30: 23-28.

Screening of Coptis teeta wall for antimalarial effect: A preliminary report — S.K. Sharma et al., **30**: 179-181.

Changes in brain neurotransmitters in rodent malaria — **S. Roy** et al., **30**: 183-185.

Investigation on simian malaria in India and its potential as a source of zoonosis - D.S. Choudhury, 18: 28-34.

Hepatocystic semnopitheci in rhesus monkey populations from northern Pakistan — C.G. Haves et al., 18: 57-59.

Effect of Plasmodium cynomolgi B infection on the haematological and liver function test in rhesus monkey (Macaca mulatta) — S.K. Srivastava et al., 19: 45-48.

Proteinases of Plasmodium knowlesi - H.S. Banyal et al., 19: 73-82.

Glucose-6 phosphate dehydrogenase in Plasmodium knowlesi -- Indresh Kumar Srivastava et al., 19: 97-100.

Severity of blood induced Plasmodium cynmolgi B and Plasmodium cynomolgi cynomolgi infection in pregnant rhesus monkeys (Macaca mulatta) -K.K. Kamboj and G.P. Dutta, 20: 1-5.

Studies on malate dehydrogenase of Plasmodium knowlesi — Nalini Saxena et al., 20: 71-75.

Effect of chloroquine treatment on complement levels in Plasmodium knowlesi infected rhesus monkeys - R.N. Prasad et al., 21: 17-20.

Changes in concentration of lymphocyte subpopulations in rhesus monkey during Plasmodium knowlesi infection and in drug-cured immune monkeys - Pawan Sharma et al., 21: 31-36.

Influence of progesterone and estrogen administration on the recrudescence pattern of Plasmodium knowlesi infection in female rhesus monkeys (Macaca mulatta) following initial subcurative chloroquine therapy — G.P. Dutta and K.K. Kamboj, 21: 79-88.

Biochemical changes in cellular constituents and some enzymes in host-tissues from Plasmodium knowlesi infected rhesus monkey (Macaca mulatta) - Rahul Srivastava et al., 21: 89-97.

Progressive changes in the liver function of monkeys following Plasmodium knowlesi infection - Raka Khanna et al., 23: 43-48.

Cell-mediated immune responses in drug-suppressed simian *Plasmodium knowlesi* infection — **S. Biswas** and **Q.Z. Hussain**, **23**: 123-126.

Evaluation of Ayush-64 for blood schizonticidal activity against rodent and simian malaria parasites — **M. Kazim** *et al.*, **28**: 255-258.

Involvement of gastrointestinal tract in *Plasmodium vivax* malaria — **A.K. Hati** et al., **29**: 127-128.

ANOPHELES

Seasonal prevalence of anophelines in Kheda district, Gujarat — **R.M. Bhatt** et al., **28**: 9-18.

Matrix based approach for identification of Indian anophelines — **Aruna Srivastava** *et al.*, **29**: 185-191.

Fishes of District Sundargarh, Orissa with special reference to their potential in mosquito control — **R.S. Yadav** et al., **29**: 225-233.

Malaria and ABO blood groups — **A. Thakur** and **I.C. Verma. 29:** 241-244.

Water mite (Arrenurus sp.) parasitizing mosquitoes in District Shahjahanpur, U.P. — S.N. Sharma and R.N. Prasad, 29: 255-258.

Application of Bactoculicides (*Bacillus thuringiensis* H-14) for controlling mosquito breeding in industrial scrap at BHEL, Hardwar (U.P) — **V.K. Dua** *et al.*, **30**: 17-21.

Malaria paradigms in India and control strategy — **S. Pattanayak** et al., **31:** 141-199.

Studies on clasper movement of Anopheles species — **Kang Wamin** et al., **32**: 37-41.

An. aconitus

Matrix based approach for identification of Indian anophelines — **Aruna Srivastava** *et al.*, **29**: 185-191.

Control of mosquito breeding through Gambusia affinis in rice fields — **H. Prasad** et al., **30**: 57-65.

Breeding habitats of anopheline mosquitoes in Assam — **V. Dev. 31:** 31-34.

Incrimination of Anopheles vagus Donitz, 1902 as an epidemic malaria vector in Bangladesh — **N.P. Maheswary** et al., **31**: 35-38.

Correlation of malaria endemicity with *An. culici-facies* sibling species composition and malaria antibody profile in District Allahabad (U.P) — **S.N. Tiwari** *et al.*, **31**: 48-56.

A note on Anopheles culicifacies sibling species composition in stone quarry belt of District Allahabad (U.P.) — **S.N. Tiwari** et al., **31**: 88-91.

Distribution and relative prevalence of anophelines in District South 24-parganas, West Bengal, India — **Neelam Tandon** and **S.K. Tandon**, **31**: 115-121.

Indoor resting anophelines of North Bengal — **P. Malakar** *et al.*, **32:** 24-31.

Incrimination of *Anopheles minimus* as a vector of malaria in Karbi Anglong district of Assam — **P. Dutta** and **J. Mahanta**, **32**: 129-131.

Anophelines of Siliguri-Naxalbari block, Darjeeling, West Bengal — P. Malakar et al., 32: 133-139.

An. annularis

Salivary gland chromosomes of Anopheles annularis — Tushar K. Varma and V.P. Sharma, 18: 103-108.

Anopheles annularis as a vector of malaria in rural West Bengal — **K.K. Ghosh** et al., **22**: 65-69.

Host preference of An. annularis in different biotopes — K.K. Ghosh et al., 23: 119-121.

Susceptibility status of *Anopheles fluviatilis, An.* annularis and *An. culicifacies* to insecticides in Koraput district, Orissa — **S.S. Sahu** et al., **27**: 51-53.

Anopheline breeding in ponds of central Gujarat with reference to water hyacinth infestation — **Rajni Kant** et al., **29**: 57-61.

Malaria epidemic in Baniyani village, District Farrukhabad — R.N. Prasad et al., 29: 219-224.

Malaria in the WHO southeast Asia region — **A.V. Kondrashin, 29**: 129-160.

Control of mosquito breeding through *Gambusia* affinis in rice fields — **H. Prasad** et al., **30**: 57-65.

Interspecific associations among anophelines in different breeding habitats of Kheda district, Gujarat. Part II: Non-canal area — **R.N. Bhatt** et al., **30**: 91-100.

Preliminary observations on mosquito collections by light traps in tribal villages of Madhya Pradesh — **Neeru Singh** *et al.*, **30**: 103-107.

Prevalence and seasonal distribution of anopheline fauna in District Bikaner (Rajasihan) — **S.K. Bansal** and **Karam V. Singh, 30**: 119-125.

Seasonality of indoor resting mosquitoes in a broken-forest ecosystem of north-western Orissa — **S.K. Chand** *et al.*, **30**: 145-154.

Observations on mosquito breeding in wells and its control — **Rajni Kant** et al., **30**: 215-220.

Breeding habitats of anopheline mosquitoes in Assam — V. Dev, 31: 31-34.

Correlation of malaria endemicity with An. culicifacies sibling species composition and malaria antibody profile in District Allahabad (U.P.) — **S.N. Tiwari** et al., **31:** 48-56.

A note on *Anopheles culicifacies* sibling species composition in stone quarry belt of District Allahabad (U.P.) — **S.N. Tiwari** et al., **31**: 88-91.

Repellent action of Cymbopogan martinii martinii stapf var. sofia oil against mosquitoes — M.A. Ansari and R.K. Razdan, 31: 95-102.

Distribution and relative prevalence of anophelines in District South 24-parganas, West Bengal, India — Neelam Tandon and S.K. Tandon, 31: 115-121.

Indoor resting anophelines of North Bengal $-\mathbf{P}$. **Malakar** *et al.*, **32**: 24-31.

Anopheline fauna of Ajodhya hills, District Purulia, West Bengal — N. Tandon et al., 32: 54-58.

Relative efficacy of various oils in repelling mosquitoes — M.A. Ansari and R.K. Razdan, 32: 104-111.

Incrimination of Anopheles minimus as a vector of malaria in Karbi Anglong district of Assam — P. Dutta and J. Mahanta, 32: 129-131.

Anophelines of Siliguri-Naxalbari block, Darjeeling, West Bengal — **P. Malakar** et al., **32**: 133-139.

An. balabacensis

Incrimination of *Anopheles minimus* Theobald and *Anopheles balabacensis balabacensis* Baisas (*A. dirus*) as malaria vectors in Mizoram — **S.C. Das** and **I. Baruah**, **22**: 53-55.

A longitudinal study to monitor chloroquine-resistant *P. falciparum* malaria in Bokajan and Manja PHC areas of Karbi Anglong district, Assam — **B.N. Barkakaty** and **M.V.V.L. Narasimham**, **29**: 173-183.

An. barbirostris

Aquatic macrophytes and the associated mosquitoes in and around Madurai city (Tamil Nadu) — **T. John Victor** *et al.*, **28**: 151-155.

Anopheline breeding in ponds of central Gujarat with reference to water hyacinth infestation — **Rajni Kant** et al., **29**: 57-61.

Enhancing the efficacy of *Gambusia affinis* to control mosquito breeding in ponds — **M.S. Malhotra** and **Anil Prakash**, **29**: 65-68.

Control of mosquito breeding through Gambusia affinis in rice fields — **H. Pradad** et al., **30**: 57-65.

Interspecific association among anophelines in different breeding habitats of Kheda district, Gujarat. Part II: Non-canal area — R.N. Bhatt et al., 30: 91-100.

Priliminary observations on mosquito collections by light traps in tribal villages of Madhya Pradesh — **Neeru Singh** et al., **30**: 103-107.

Prevalence and seasonal distribution of anopheline fauna in District Bikaner (Rajasthan)—S.K. Bansal and Karam V. Singh, 30: 119-125.

Mosquitoes of Sagar Island — Mihir K. Pramanik et al., 30: 193-199.

Observations on mosquito breeding in wells and its control — **Rajni Kant** et al., **30**: 215-220.

Breeding habitats of anopheline mosquito in Assam — V. Dev, 31: 31-34.

Correlation of malaria endemicity with An. culicifacies sibling species composition and malaria antibody profile in District Allahabad (U.P.) — S.N. Tiwari et al., 31: 48-56.

A note on Anopheles culicifacies sibling species composition in stone quarry belt of District Allahabad (U.P.) — **S.N. Tiwari** et al., **31:** 88-91.

Distribution and relative prevalence of anophelines in District South 24-parganas, West Bengal, India — Neelam Tandon and S.K. Tandon, 31: 115-121.

Indoor resting anophelines of North Bengal — P. Malakar et al., 32: 24-31.

Anophelines of Siliguri-Naxalbari block, Darjeeling, West Bengal — P. Malakar et al., 32: 133-139.

An. culicifacies

Bioassay tests on the effectiveness of malathion spraying on Anopheles culicifacies resting on different wall surfaces in Aurangabad town, Maharashtra — M. Vittal and M.R. Bhate, 18: 124-125.

Impact of DDT spraying on malarla transmission in villages with resistant Anopheles culicifacies — V.P. Sharma et al., 19: 5-12.

Karyotypic variations in *Anopheles culicifacies* complex — **K. Vasantha** et al., **19:** 27-32.

Genetics of a sex-linked and two autosomal mutants in species B of the taxon *Anopheles culicifacies* Giles — **Sarala K. Subbarao** *et al.*, **19**: 83-90.

A double headed An. culicifacies — G. Raman et al., 19: 147-149.

Inheritance pattern of vermillion-eye in Anopheles culicifacies species A — T. Adak et al., 20: 59-61.

Anopheles culicifacies: Mitotic karyotype of species C — **K. Vasantha** et al., **20**: 161-162.

Incrimination of Anopheles culicifacies as vector of malaria in Orissa — B.N. Nagpal and V.P. Sharma, 23: 57-59.

Village-scale trial of the impact of deltamethrin (K-othrine) spraying in areas with DDT and HCH resistant Anopheles culicifacies — M.A. Ansari et al., 23: 127-131.

Field evaluation of deltamethrin against resistant Anopheles culicifacies in District Ghaziabad (U.P.), India — M.A. Ansari et al., 27: 1-13.

Susceptibility status of Anopheles fluviatilis, An. annularis and An. culicifacies to insecticides in Koraput district, Orissa — **S.S. Sahu** et al., **27**: 51-53.

Bionomics of *Anopheles culicifacies* Giles in riverine tract rural areas of District Shahjahanpur, Uttar Pradesh — **S.N. Sharma** and **R.N. Prasad**, **28**: 19-28.

Tralomethrin (OMS-3048), a new synthetic pyrethroid against vector mosquitoes — **D. Dominic** Amalraj et al., 28: 141-145.

Isolation and laboratory evaluation of an indigenous strain of Bacillus sphaericus (9001) — **D.K. Gupta** et al., **28**: 147-150.

Malaria related to constructions in Panaji, Goa — **Ashwani Kumar** *et al.*, **28**: 219-225.

Epidemic of malaria in Barmer district (Thar Desert) of Rajasthan during 1990 — K.K. Mathur et al., 29: 1-10.

Anopheline breeding in ponds of central Gujarat with reference to water hyacinth infestation — **Rajni Kant** et al., **29:** 57-61.

Enhancing the efficacy of Gambusia affinis to control mosquito breeding in ponds — M.S. Malhotra and Anil Prakash, 29: 65-68.

Malaria in the WHO southeast Asia region — A.V. Kondrashin, 29: 129-160.

Esbiothrin-impregnated ropes as mosquito repellent — M.A. Ansari et al., 29: 203-210.

Malaria epidemic in Baniyani village, District Farrukhabad (U.P.) — R.N. Prasad et al., 29: 219-224.

Effect of temperature on toxicity of two bioinsecticides Spherix (Bacillus sphaericus) and Bactoculicide (Bacillus thuringiensis) against larvae of four vector mosquitoes — P.K. Mittal et al., 30: 37-41.

Control of mosquito breeding through Gambusia affinis in rice fields — H. Prasad et al., 30: 57-65.

Interspecific association among anophelines in different breeding habitats of Kheda district, Gujarat. Part II: Non-canal area — R.N. Bhatt et al., 30: 91-100.

Preliminary observations on mosquito collections by light traps in tribal villages of Madhya Pradesh — **Neeru Singh** et al., **30**: 103-107.

Prevalence and seasonal distribution of anopheline fauna in District Bikaner (Rajasthan) — S.K. Bansal and Karam V. Singh, 30: 119-125.

Seasonality of indoor resting mosquitoes in a broken-forest ecosystem of north-western Orissa — **S.K. Chand** *et al.*, **30**: 145-154.

Role of An. culicifacies and An. stephensi in malaria transmission in urban Delhi — **S.N. Sharma** et al., **30**: 155-168.

Use of kerosene lamp containing synthetic pyrethroids to repel mosquitoes — **V.P. Sharma** et al., **30**: 169-176.

Observations on mosquito breeding in wells and its control — **Rajni Kant** et al., **30**: 215-220.

Breeding habitats of anopheline mosquitoes in Assam — V. Dev. 31: 31-34.

Correlation of malaria endemicity with *An. culicifacies* sibling species composition and malaria antibody profile in District Allahabad (U.P.) — **S.N. Tiwari** *et al.*, **31:** 48-56.

Field trial of esbiothrin-impregnated rope in Ramgarh village, Dadri PHC, District Ghaziabad (U.P.) — M.A. Ansari and R.K. Razdan, 31: 57-64.

Biology of malaria vectors in central Gujarat -- **R.M. Bhatt** et al., **31:** 65-76.

A note on Anopheles culicifacies sibling species composition in stone quarry belt of District Allahabad (U.P.) — **S.N. Tiwari** et al., **31**: 88-91.

Repellent action of Cymbopogan martinii martinii stapf var. sofia oil against mosquitoes — M.A. Ansari and R.K. Razdan, 31: 95-102.

Distribution and relative prevalence of anophelines in District South 24-parganas, West Bengal, India — **Neelam Tandon** and **S.K. Tandon**, **31**: 115-121.

Field evaluation of mosquito repellent action of neem oil — **Rajni Kant** and **R.M. Bhatt, 31**: 122-125.

Epidemiological study of malaria outbreak in a hotel construction site of Delhi — **T. Adak** et al., **31**: 126-131.

Feasibility study of insecticide-impregnated bednets for malaria control in forested villages of District Mandla (M.P.) — Neeru Singh et al., 31: 136-140.

Indoor resting anophelines of North Bengal — **P. Malakar** *et al.*, **32:** 24-31.

Repellent action of neem cream against mosquitoes — V.K. Dua et al., 32: 47-53.

Anopheline fauna of Ajodhya hills, District Purulia, West Bengal — N. Tandon et al., 32: 54-58

Cerebral malaria in Jabalpur, India — **M.M. Shukla** *et al.*, **32**: 70-75.

Efficacy of two flowable formulations of *Bacillus* sphaericus larvae of mosquitoes — **M.A. Ansari** et al., **32**: 76-84.

villages of Mandla district, Madhya Pradesh — A.K. Mishra et al., 32: 99-103.

Relative efficacy of various oils in repelling mosquitoes - M.A. Ansari and R.K. Razdan, 32: 104-111.

A study on insecticide resistance in Anopheles fluviatilis and Anopheles culicifacies to HCH and DDT in the Malkangiri district of Orissa — S.S. Sahu and K.P. Patra, 32: 112-118.

Investigation of malaria outbreak in Rajasthan — R.P. Shukla et al., 32: 119-128.

Anophelines of Siliguri-Naxalbari block, Darjeeling, West Bengal - P. Malakar et al., 32: 133-139.

Epidemiological observations on malaria in villages of Buhari PHC, Surat, Gujarat - H.C. Srivastava et al., 32: 140-152.

Bionomics of vector Anophelines in District Naini Tal, Uttar Pradesh — R.P. Shukia et al., 32: 153-163.

Drug resistant Plasmodium falciparum in Mandla district, Madhya Pradesh — Neeru Singh et al., 32: 174-177.

An. dirus

Incrimination of Anopheles minimus Theobald and An. balabacensis balabacensis Baisas (An. dirus) as malaria vector in Mizoram - S.C. Das and I. Baruah, 22: 53-55.

The importance of Anopheles dirus (An. balabacensis) as a vector of malaria in northeast India -P. Dutta et al., 26: 95-101.

Incrimination of Anopheles dirus as a vector of malaria in Dibrugarh district, Assam — P. Dutta et al., 26: 149-152.

An. flavirostris

Malaria in the WHO southeast Asia region -A.V. Kondrashin, 29: 129-160.

Use of neem oil as a mosquito repellent in tribal Esbiothrin-impregnated ropes as mosquito repellent — M.A. Ansari et al., 29: 203-210.

An. fluviatilis

Chromosomal translocations and semisterility in the malaria vector Anopheles fluviatilis, James -N.J. Shetty, 20: 45-48.

Susceptibility status of Anopheles fluviatilis, An. annularis and An. culicifacies to insecticides in Koraput district, Orissa — S.S. Sahu et al., 27: 51-53.

Anopheline breeding in ponds of central Gujarat with reference to water hycinth infestation -Rajni Kant et al., 29: 57-61.

Esbiothrin-impregnated ropes as mosquito repellent - M.A. Ansari et al., 29: 203-210.

Preliminary observations on mosquito collections by light traps in tribal villages of Madhya Pradesh — Neeru Singh et al., 30: 103-107.

Observations on mosquito breeding in wells and its control - Rajni Kant et al., 30: 215-220.

Biology of malaria vectors in central Gujarat -R.M. Bhatt et al., 31: 65-72.

A note on Anopheles culicifacies sibling species composition in stone quarry belt of District Allahabad (U.P.) — S.N. Tiwari et al., 31: 88-91.

Distribution and relative prevalence of anophelines in District South 24-parganas, West Bengal, India - Neelam Tandon and S.K. Tandon, **31**: 115-121.

Field evaluation of mosquito repellent action of neem oil - Rajni Kant and R.M. Bhatt, 31: 122-125.

Indoor resting anophelines of North Bengal - P. Malakar et al., 32: 24-31.

Distribution of indoor-resting Anopheles fluviatilis in human dwellings and its implication on indoor in residual spray - K. Gunasekaran et al., 32: 42-46.

Anopheline fauna of Ajodhya hills, District Purulia, West Bengal — **N. Tandon** *et al.*, **32**: 54-58.

Cerebral malaria in Jabalpur, India — M.M. Shukla et al., 32: 70-75.

A study on insecticide resistance in Anopheles fluviatilis and Anopheles culicifacies to HCH and DDT in the Malkangiri district of Orissa — **S.S. Sahu** and **K.P. Patra**, **32**: 112-118.

Investigation of malaria outbreak in Rajasthan — **R.P. Shukla** *et al.*, **32**: 119-128.

Anophelines of Siliguri-Naxalbari block, Darjeeling, West Bengal — P. Malakar et al., 32: 133-139.

Bionomics of vector Anophelines in District Naini Tal, Uttar Pradesh — **R.P. Shukla** et al., **32**: 153-163.

Drug resistant *Plasmodium falciparum* in Mandla District, Madhya Pradesh — **Neeru Singh** *et al.*, **32**: 174-177.

An. kochi

Anopheline fauna and malaria incidence in Changlang district (Arunachal Pradesh) — **P. Dutta** *et al.*, **30**: 135-143.

Breeding habitats of anophelines mosquitoes in Assam — V. Dev, 31: 31-34.

An. maculatus

Anopheline fauna and malaria incidence in Changlang district (Arunachal Pradesh) — **P. Dutta** et al., **30**: 135-143.

Breeding habitats of anophelines mosquito in Assam — V. Dev. 31: 31-34.

Anopheline fauna of Ajodhya hills, District Purulia, West Bengal — **N. Tandon** *et al.*, **32:** 54-58.

Anophelines of Siliguri-Maxalbari block, Darjeeling, West Bengal — P. Malakar et al., 32: 133-139.

An. minimus

Detection and incrimination of *Anopheles minimus* Theobald 1901 as malaria vector in the foothill areas of Nagland, India — **V.N. Bhatnagar** et al., **19:** 129-133.

Incrimination of Anopheles minimus Theobald and Anopheles balabacensis balabacensis Baisas (An. dirus) as malaria vectors in Mizoram — **S.C. Das** and **I. Baruah**, **22**: 53-55.

Incrimination of An. minimus Theobald as a vector of malaria in Arunachal Pradesh — P. Dutta and B.D. Baruah, 24: 159-162.

Malaria in the WHO southeast Asia region — A.V. Kondrashin, 29: 129-160.

A longitudinal study to monitor chloroquine-resistant *P. falciparum* malaria in Bokajan and Manja PHC areas of Karbi Anglong district, Assam — **B.N. Barkakaty** and **M.V.V.L. Narasimham**, **29**: 173-183.

Esbiothrin-impregnated ropes as mosquito repellent — M.A. Ansari et al., 29: 203-210.

Breeding habitats of anopheline mosquitoes in Assam — V. Dev. 31: 31-34.

Incrimination of Anopheles minimus as a vector of malaria in Karbi Anglong district of Assam — P. Dutta and J. Mahanta, 32: 129-131.

An. nigerrimus

Seasonality of indoor resting mosquitoes in a broken-forest ecosystem of north-western Orissa — S.K. Chand et al., 30: 145-154.

Mosquitoes of Sagar Island — Mihir K. Pramanik et al., 30: 193-199.

Observations on mosquito breeding in wells and its control — **Rajni Kant** et al., **30**: 215-220.

Breeding habitats of anophelines mosquitoes in Assam — V. Dev, 31: 31-34.

Correlation of malaria endemicity with An. culicifacies sibling species composition and malaria S.N. Tiwari et al., 31: 48-56.

A note on An. culicifacies sibling species composition in stone quarry belt of District Allahabad (U.P.) - S.N. Tiwari et al., 31: 88-91.

An. pallidus

Seasonality of indoor resting mosquitoes in a broken-forest ecosystem of north-western Orissa -S.K. Chand et al., 30: 145-154.

Breeding habitats of anophelines mosquitoes in Assam - V. Dev. 31: 31-34.

Correlation of malaria endemicity with An. culicifacies sibling species composition and malaria antibody profile in District Allahabad (U.P.) -S.N. Tiwari et al., 31: 48-56.

A note on An. culicifacies sibling species composition in stone quarry belt of District Allahabad (U.P.) — **S.N. Tiwari** et al., **31**: 88-91.

An. philippinensis

Susceptibility of Anopheles philippinensis to DDT and dieldrin in Assam - J. Dutta Choudhury and P.R. Malhotra, 19: 145-146.

A longitudinal study to monitor chloroquine-resistant P. falciparum malaria in Bokajan and Manja PHC areas of Karbi Anglong district, Assam — B.N. Barkakaty and M.V.V.L. Narasimham, 29: 173-

Anopheline fauna and malaria incidence in Changlang district (Arunachal Pradesh) - P. Dutta et al., 30: 135-143.

Incrimination of An. vagus Donitz, 1902 as an epidemic malaria vector in Bangladesh - N.P. Maheswary et al., 31: 35-38.

Incrimination of An. minimus as a vector of malaria in Karbi Anglong district of Assam - P. Dutta and J. Mahanta, 32: 129-131.

An. peditaeniatus

Aquatic macrophytes and the assoicated mosquitoes in and around Madurai city (Tamil Nadu) -T. John Victor et al., 28: 151-155.

antibody profile in District Allahabad (U.P.) - Anopheline fauna and malaria incidence in Changlang district (Arunachal Pradesh) - P. Dutta et al., 30: 135-143.

An. stephensi

Geographic variation in life table attributes of four populations of An. stephensi Liston from India -P.K.B. Menon and V.P. Sharma, 18: 91-97.

Linkage relationship between three autosomal mutants and functional relationship between two eye colour mutants in An. stephensi - Sarala K. Subbarao and T. Adak, 18: 98-102.

Effect of malathion spraying on four anopheline species and the development of resistance in An. stephensi in Mandora, Haryana - Sarala K. Subbarao et al., 21: 109-114.

An ultrastructural study on the sporogony of Plasmodium vivax in Anopheles stephensi - Nutan Nanda et al., 22: 1-15.

Comparative effectiveness of different anabolic and sex steroids on the development of Anopheles stephensi — V. Sita et al., 23: 61-63.

Daytime resting habits of Anopheles stephensi larvae in an area of Calcutta - A.K. Hati et al., 24: 85-87.

Incrimination of Anopheles stephensi Liston as malaria vector in Calcutta - S.K. Choudhury and A.K. Sen. 24: 183-185.

Vertical distribution of Anopheles stephensi larvae in Calcutta - K.K. Chatterjee et al., 25: 107-108.

Morphological variations in natural populations of Anopheles stephensi Liston 1901 collected from Kutch (Gujarat) — B.N. Nagpal, 27: 25-35.

Tralomethrin (OMS-3048), a new synthetic pyrethroid against vector mosquito - D. Dominic Amalraj et al., 28: 141-145.

Isolation and laboratory evaluation of an indigenous strain of Bacillus sphaericus (9001) - D.K. Gupta et al., 28: 147-150.

Malaria related to constructions in Panaji, Goa -Ashwani Kumar et al., 28: 217-225.

Evaluation of trebon (Ethofenprox) for insecticidal efficacy against mosquito larvae and on non-target organisms — B. Baktharatchagan and B. Vasantharaj David, 28: 249-253.

Breeding habitats and their contribution to *Anopheles stephensi* in Panaji — **Ashwani Kumar** and **D. Thayaselyam. 29**: 35-40.

Intradomestic mosquito breeding sources and their management — **D.K. Gupta** et al., **29**: 41-46.

Anopheline breeding in ponds of central Gujarat with reference to water hyacinth infestation — **Rajni Kant** *et al.*, **29**: 57-61.

Malaria in the WHO southeast Asia region - A.V. Kondrashin, 29: 129-160.

Selection of permethrin resistance in the malaria vector *An. stephensi* — **B.C. Chakravorthy** and **M. Kalyanasundaram**, **29**: 161-165.

Breeding habits of Anopheles stephensi Liston in an area of Calcutta — **D. Biswas** et al., **29**: 195-198.

Note on urban malaria vector An. stephensi (Liston) in Cochin — **T. Mariappan** et al., **29**: 247-250.

Effect of temperature on toxicity of two bioinsecticides Spherix (*Bacillus sphaericus*) and Bactoculicide (*Bacillus thruingiensis*) against larvae of four vector mosquitoes — **P.K. Mittal** et al., **30**: 37-41.

Insecticide susceptibility status of Anopheles stephensi, Culex quinquefasciatus and Aedes aegypti in Panaji Goa — **D. Thavaseivam** et al., **30**: 75-79.

Laboratory and field evaluation of Spherix a formulation of *Bacillus sphaericus* (B-101), to control breeding of *An. stephensi* and *Cx. quinque-fasciatus* — **P.K. Mittal** et al., **30**: 81-89.

Interspecific associations among anophelines in different breeding habitats of Kheda district, Gujarat. Part II: Non-canal areas — **R.N. Bhatt** et al., **30**: 91-100.

Resting sites of Anopheles stephensi Liston in Calcutta — K.K. Chatterjee et al., 30: 109-112.

Prevalence and seasonal distribution of anopheline fauna in District Bikaner (Rajasthan) — **S.K. Bansal** and **Karam V. Singh**, **30**: 119-125.

Seasonality of indoor resting mosquitoes in a broken-forest ecosystem of north-western Orissa — **S.K. Chand** *et al.*, **30**: 145-154.

Role of *An. culicifacies* and *An. stephensi* in malaria transmission in urban Delhi — **S.N. Sharma** et al.. **30**: 155-168.

Observations on mosquito breeding in wells and its control — **Rajni Kant** et al., **30**: 215-220.

Laboratory studies of pyrethroid-netting combinations to kill mosquitoes — **B.R. Janakara** *et al.*, **31:** 1-11.

Phytotoxicological evaluation of Tagetes erectes on aquatic stages of Anopheles stephensi — Manik Sharma and R.C. Saxena, 31: 21-26.

Comparative toxicity of certain mosquitocidal compounds to larvivorous fish, *Poecilia reticulata* — **P.K. Mittal** *et al.*, **31:** 43-47.

Correlation of malaria endemicity with *An. culicifacies* sibling species composition and malaria antibody profile in District Allahabad (U.P.) — **S.N. Tiwari** *et al.*, **31**: 48-56.

Biology of malaria vectors in central Gujarat — **R.M. Bhatt** et al., **31**: 65-76.

A note on *Anopheles culicifacies* sibling species composition in stone quarry belt of District Allahabad (U.P.) — **S.N. Tiwari** et al., **31**: 88-91.

Repellent action of Cymbopogan martinii martinii stapf var. sofia oil against mosquitoes — M.A. Ansari and R.K. Razdan 31: 95-102.

Distribution and relative prevalence of anophelines in District South 24-parganas, West Bengal, India — Neelam Tandon and S.K. Tandon, 31: 115-121.

Epidemiological study of malaria outbreak in a hotel construction site of Delhi — **T. Adak** et al., **31:** 126-131.

Larvicidal activity of a few plant extracts against Culex quinquefasciatus and Anopheles stephensi — E. Pushpalatha and J. Muthukrishnan, 32: 14-23.

Indoor resting Anopheles of north Bengal — P. Malakar et al., 32: 24-31.

Repellent action of neem cream against mosquitoes — V.K. Dua et al., 32: 47-53.

Anopheline fauna of Ajodhya hills, District Purulia, West Bengal — **N. Tandon** et al., **32**: 54-58.

Control of mosquito breeding using wood scrapings treated with neem oil — **B.N. Nagpal** et al., **32**: 64-69.

Cerebral malaria in Jabalpur, India — M.M. Shukla et al., 32: 70-75.

Efficacy of two flowable formulations of *Bacillus* sphaericus against larvae of mosquitoes — **M.A. Ansari** et al., **32**: 76-84.

Relative efficacy of various oil in repelling mosquitoes — M.A. Ansari and R.K. Razdan, 32: 104-111.

Investigation of malaria outbreak in Rajasthan — **R.P. Shukla** et al., **32:** 119-128.

An. subpictus

Studies on the development of *Plasmodium vivax* in *Anopheles subpictus* — **Nutan Nanda** *et al.*, **24:** 135-142.

Isolation and laboratory evaluaton of an indigenous strain of *Bacillus sphaericus* (9001) — **D.K. Gupta** *et al.*, **28**: 147-150.

Aquatic macrophytes and the associated mosquitoes in and around Madurai city (Tamil Nadu) — **T. John Victor** *et al.*, **28**: 151-155.

Gel diffusion analysis of host preference pattern of Anopheles subpictus in West Bengal, India — P.K. Banerjee et al., 28: 157-159.

Intradomestic mosquito breeding sources and their management — **D.K. Gupta** et al., **29**: 41-46.

Anopheline breeding in ponds of central Gujarat with reference to water hyacinth infestation — **Rajni Kant** et al., **29:** 57-61.

Enhancing the efficacy of Gambusia affinis to control mosquito breeding in ponds — M.S. Malhotra and Anil Prakash, 29: 65-68.

Malaria epidemic in Baniyani village, District Farrukhabad (U.P.) — **R.N. Prasad** et al., **29**: 219-224.

Control of mosquito breeding through Gambusia affinis in rice fields — H. Prasad et al., 30: 57-65.

Interspecific associations among anophelines in different breeding habitats of Kheda district, Gujarat. Part II: Non-canal area — R.N. Bhatt et al., 30: 91-100.

Preliminary observations on mosquito collections by light traps in tribal villages of Madhya Pradesh — **Neeru Singh** et al., **30**: 103-107.

Prevalence and seasonal distribution of anopheline fauna in District Bikaner (Rajasthan) — **S.K. Bansal** and **Karam V. Singh, 30**: 119-125.

Observations on mosquito breeding in wells and its control — **Rajni Kant** et al., **30**: 215-220.

Influence of soil moisture on survival and oviposition of *Romanomermis iyengari* a mermithid nematode parasite of mosquitoes — **K.P. Paily** and **K. Balaraman**, **30**: 221-225.

Correlation of malaria endemicity with *An. culicifacies* sibling species composition and malaria antibody profile in District Allahabad (U.P.) — **S.N. Tiwari** *et al.*, **31:** 48-56.

A note on *Anopheles culicifacies* sibling species composition in stone quarry belt of District Allahabad (U.P.) — **S.N. Tiwari** et al., **31:** 88-91.

Repellent action of Cymbopogan martinii martinii stapf var. sofia oil against mosquitoes — M.A. Ansari and R.K. Razdan, 31: 95-102.

Distribution and relative prevalence of anophelines in District South 24-parganas, West Ben-

gal, India — Neelam Tandon and S.K. Tandon, 31: 115-121.

Epidemiological study of malaria outbreak in a hotel construction site of Delhi — **T. Adak** et al., **31**: 126-131.

Efficacy of two flowable formulations of *Bacillus* sphaericus against larvae of mosquitoes — **M.A. Ansari** et al., **32:** 76-84.

Anophelines of Siliguri-Naxalbari block, Darjeeling, West Bengal — P. Malakar et al., 32: 133-139.

An. sundaicus

Variations in ornamentation of palpi of Anopheles sundaicus Rodenwaldt (1925) collected from Andaman Islands, India — B.N. Nagpal and V.P. Sharma, 20: 85-87.

Malaria in the WHO southeast Asia region — **A.V. Kondrashin**, **29**: 129-160.

Feeding preferences of *An. sundaicus* in Car Nicobar Island — **Roop Kumari** et al., **30:** 201-206.

Resting and biting habits of *An. sundaicus* in Car Nicobar Island — **Roop Kumari** and **V.P. Sharma**, **31**: 103-114.

Distribution and relative prevalence of anophelines in District South 24-parganas, West Bengal, India — Neelam Tandon and S.K. Tandon, 31: 115-121.

An. vagus

Morphological variations in a natural population of Anopheles vagus Donitz (1902) collected from Andaman Islands — B.N. Nagpal and V.P. Sharma, 20: 35-44.

Aquatic macrophytes and the associated mosquitoes in and around Madurai city (Tamil Nadu) — **T. John Victor** et al., **28**: 151-155.

Enhancing the efficacy of *Gambusia affinis* to control mosquito breeding in ponds — M.S. Malhotra and Anil Prakash, 29: 65-68.

Preliminary observations on mosquito collections by light traps in tribal villages of Madhya Pradesh — **Neeru Singh** et al., **30**: 103-107.

Seasonality of indoor resting mosquitoes in a broken-forest ecosystem of north-western Orissa — **S.K. Chand** *et al.*, **30**: 145-154.

Mosquitoes of Sagar Island — Mihir K. Pramanik et al., 30: 193-199.

Breeding habitats of anopheline mosquitoes in Assam — V. Dev. 31: 31-34.

Incrimination of Anopheles vagus Donitz, 1902 as an epidemic malaria vector in Bangladesh — **N.P. Maheswary** et al., **31**: 35-38.

Correlation of malaria endemicity with *An. culicifacies* sibling species composition and malaria antibody profile in District Allahabad (U.P.) — **S.N. Tiwari** *et al.*, **31:** 48-56.

A note on *An. culicifacies* sibling species composition in stone quarry belt of District Allahabad (U.P.) — **S.N. Tiwari** et al., **31**: 88-91.

Distribution and relative prevalence of anophelines in District South 24-parganas, West Bengal, India — Neelam Tandon and S.K. Tandon, 31: 115-121.

Indoor resting anophelines of North Bengal — P. Malakar *et al.*, **32**: 24-31.

Anopheline fauna of Ajodhya hills, District Purulia, West Bengal — **N. Tandon** *et al.*, **32**: 54-58.

Anophelines of Siliguri-Naxalbari block, Darjeeling, West Bengal — P. Malakar et al., 32: 133-139.

An. varuna

Distribution and relative prevalence of anophelines in District South 24-parganas, West Bengal, India — **Neelam Tandon** and **S.K. Tandon**, **31**: 115-121.

Indoor resting anophelines of north Bengal — **P. Malakar** *et al.*, **32**: 24-31.

CHEMOTHERAPY

Problems in malaria research — T. Ramachandra Rao, 18: 4-11.

The interaction of drugs and immunity in malaria — **W. Peters**, **20**: 93-106.

Role of cyclophosphamide in modulating behaviour of *P. berghei* infection in mice — **Ś. Sehgal** *et al.*, **20**: 147-152.

Suppressive action of an interferon inducer (6MFA) on blood induced rodent malaria — J.N.S. Yadava et al., 20: 153-156.

Chemotherapy of malaria and the host-parasite interaction — Wallace Peters. 21: 7-16.

Immunomodulation of experimental malaria by MDP — N. Khullar et al., 22: 21-27.

Effect of a specific iron chelator, desferrioxamine on the host biochemistry and parasitaemia in mice infected with *Plasmodium berghei*—**Chanan Singh** et al., **22**: 35-44.

The antioxidants as protectors of host stress organ injury in mice infected with *Plasmodium berghei* — **A.J. Arif** *et al.*, **26**: 173-178.

Problem of antimalarial drug resistance in *Plasmodium falciparum* in Mizoram — **B.N. Barkakaty** and **M.V.V.L. Narasimham**. **29:** 89-93.

Malaria in the WHO southeast Asia region — **A.V. Kondrashin**, **29**: 129-160.

A longitudinal study to monitor chloroquine-resistant *P. falciparum* malaria in Bokajan and Manja PHC areas of Karbi Anglong district, Assam — **B.N. Barkakaty** and **M.V.V.L. Narasimham**, **29**: 173-183

In vivo and in vitro sensitivity of Plasmodium falciparum to chloroquine at Indian Oil Corporation, Mathura (U.P.) — **Virendra K. Dua** et al., **30**: 29-35.

Effects of malaria infection on pregnancy — Latika S. Nair and A.S. Nair, 30: 207-214.

In vitro chloroquine resistance of *P. falciparum* in Veilore, Tamil Nadu — **E.A. Venkatesan** et al., **31**: 39-41.

Epidemiological study of malaria outbreak in a hotel construction site of Delhi — **T. Adak** et al., **31**: 126-131.

Drug resistant *Plasmodium falciparum* in Mandla district, Madhya Pradesh — **Neeru Singh** *et al.*, **32**: 174-177.

ANTIMALARIALS

Detection

A comparison of lignin test and filter paper spot test for the screening of the long acting sulfon-amides in urine — R.G. Roy and S. Balakrishnan, 21: 105-108.

High performance liquid chromatographic determination of chloroquine in finger tip blood dried on filter paper: Sample handling problems — V.K. Dua et al., 23: 151-154.

Antimalarial effect of cyclosporin-A on murine *P. berghei* and human *P. falciparum* — **S. Biswas** et al., **28**: 1-8.

Microscopic diagnosis of malaria in Kheda district of Gujarat — A.S. Gautam et al., 29: 83-87.

New antimalarials

New antimalarials: Synthesis and study of 4, 6-Diamino-1, 2-dihydro-1-(haloalkoxyphenyl)-2, 2-dialkyl (or aryl)-s-triazines as possible antimalarial agents-I—P.P. Gudadhe et al., 18: 73-79.

New antimalarials: Synthesis and activity of 4, 6-Diamino-1, 2-dihydro-1-(p-(4'-(2', 5'-di-substitued) thiazolyl) phenylene)-2, 2-dimethyl-s-triazines-II — P.P. Gudadhe et al., 19: 49-53.

Antiparasitic agents. Part 7: Antimalarial activity of alkyl 5(6)-(4-Aminophenyl) sulphonobenzimidazole-2-carbamates — **Subhash Chandra** *et al.*, **24:** 17-19.

In vitro chloroquine resistant Plasmodium falciparum in Calcutta and its sensitivity to Qinghaosu (Artemisitene) — **S. Sinha** et al., **24**: 107-109.

In vitro antimalarial activity of neem (Azadirachta indica A. Juss) leaf and seed extracts — Lalita Badam et al., 24: 111-117.

Synthesis and evaluation of 4,6-Diamino-1,2-Dihydro-2, 2-Dialkyl or Aryl-1-(substituted)-s-triazines as antimalarial agents — **Zarine Khety** et al., **25**: 119-124.

Antimalarial activity of some 4-alkylamino 2/3 methoxy-4-aminodiphenyl sulphones — **Subash Chandra** *et al.*, **27**: 163-166.

Evaluation of Ayush-64 for blood schizontocidal activity against rodent and simian malaria parasites — M. Kazim et al., 28: 255-258.

In vitro activity of fluoroquinolones against chloroquine-sensitive and chloroquine-resistant Plasmodium falciparum — K.D. Tripathi et al., 30: 67-73.

Screening of *Coptis teeta* wall for antimalarial effect: A preliminary report — **S.K. Sharma** et al., **30**: 179-181.

Halofantrine in the treatment of falciparum malaria — K.H. Patel et al., 32: 1-5.

Screening

Plasmodium berghei: in vitro microtechnique for preliminary screening of antimalarials — **S. Sinha** et al., **19**: 1-4.

In vitro activity of fluoroquinolones against chloroquine-sensitive and chloroquine-resistant Plasmodium falciparum — K.D. Tripathi et al., 30: 67-73

Screening of *Coptis teeta* wall for antimalarial effect: A preliminary report — **S.K. Sharma** et al., **30:** 179-181.

DRUG COMBINATION

Pyrimethamine in combination with sulfadoxine or sulfalene in vivax malaria in India — K.C. Rastogi et al., 18: 63-66.

Pyrimethamine in combination with sulfadoxine or sulfalene in *P. falciapurm* infected cases in India — **Silpi Das** et al., **18**: 109-116.

Selection of *Plasmodium yoelii nigeriensis* resistant to triple drug combination (sulphadoxine/pyrimethamine/mefloquine) and its response to other antimalarials — **Binduja Shukla** et al., **25:** 1-6.

Clinical trial of fansimef in Indian patients of *P. falciparum* malaria — **Omkar P. Asthana** et al., **25**: 89-96.

Reversal of chloroquine resistance with verapamil in P. berghei in vivo — N. Valecha et al., 29: 47-53.

TREATMENT

Results of 3-day radical treatment of *Plasmodium* vivax in north Arcot and south Arcot districts of Tamil Nadu — N.C. Appavoo et al., 21: 21-24.

Efficacy of single dose quinine as presumptive treatment in *P. falciparum* malaria — **G.K. Sharma** et al., **22**: 29-34.

Efficacy of 5-day radical treatment of primaquine in *Plasmodium vivax* cases at the BHEL industrial complex, Hardwar (U.P.) — **S. Sinha** et al., **26**: 83-86.

Radical treatment of vivax malaria in Madhya Pradesh, India — Neeru Singh et al., 27: 55-56.

Three case reports of behavioural problems in malaria treatment — **R.N. Prasad** et al., **27**: 195-196.

A study of current practices in the treatment of malaria in industrial complexes in India — V.K. Dua et al., 28: 199-200.

Histopathological studies in relation to protection induced by using MDP as an adjuvant in malaria — Neeraj Khuliar and Shobha Sehgal, 28: 243-248.

Observations on malaria patients seeking treatment in hospitals in a rural and urban area of Sri Lanka — R. Ramasamy et al., 29: 29-34.

Management of admitted malaria cases in four major hospitals of Delhi: A case study — G.P. Singh et al., 29: 95-102.

Biochemical alterations in *Plasmodium vivax*-infected malarial patients before and after radical treatment — **R. Selvam** and **Suresh T. Mathews**, **29**: 103-111.

Report of three cases of *P. falciparum* showing moderately high parasitaemia — **Neeru Singh** et al., **29**: 199-201.

Sensitivity status of *Plasmodium falciparum* to chloroquine, amodiaquine, quinine, mefloquine and sulfadoxine/pyrimethamine in a tribal population of District Sundergarh, Orissa — **S.K. Ghosh** et al., **29:** 211-218.

Complication of intramuscular quinine injection: Three case reports — **R. Satpathy** *et al.*, **30**: 45-49.

Oxidative stress and antioxidant defence mechanism in *Plasmodium vivax* malaria before and after chloroquine treatment — **Kumud Sarin** *et al.*, **30:** 127-133.

Response of *P. falciparum* to chloroquine in Car Nicobar Island — **A. Giri** and **M.K. Das, 31**: 27-30.

High level chloroquine resistance of *Plasmodium* falciparum in Madras, Tamil Nadu — **E.A. Venkatesan** et al., **31**: 92-93.

Malaria paradigms in India and control strategy — S. Pattanayak *et al.*, 31: 141-199.

Halofantrine in the treatment of falciparum malaria — K.H. Patel et al., 32: 1-5.

Cerebral malaria in Jabalpur, India — **M.M. Shukla** *et al.*, **32:** 70-75.

Status of chloroquine resistance in Plasmodium falciparum in Tripura — R.K. Dasgupta et al., 32: 89-92.

DRUG RESPONSE

Chemotherapeutic response of *Plasmodium yoelii* nigeriensis to antimalarial drugs — **Anita Pande** and **G.P. Dutta**, **19**: 121-124.

Dynamics of *P. falciparum* ratio – An indication of malaria resistance or a result of control measures? — **A.V. Kondrashin** et al., **24**: 89-94.

Selection of *Plasmodium yoelii nigeriensis* resistant to triple drug combination (sulphadoxine/pyrimethamine/mefloquine) and its response to other antimalarials — **Binduja Shukla** *et al.*, **25**: 1-6.

Evaluation of Ayush-64 for blood schizontocidal activity against rodent and simian malaria parasites — **K. Kazim** *et al.*, **28**: 255-258.

Observations on malaria patients seeking treatment in hospitals in a rural and an urban area of Sri Lanka — R. Ramasamy et al., 29: 29-34.

Sensitivity status of *Plasmodium falciparum* to chloroquine, amodiaquine, quinine, mefloquine and sulfadoxine/pyrimethamine in a tribal population of District Sundargarh, Orissa — **S.K. Ghosh** *et al.*, **29**: 211-218.

Malaria paradigms in India and control strategy — **S. Pattanayak** *et al.*, **31**: 141-199.

Halofantrine in the treatment of falciparum malaria — **K.H. Patel** et al., **32**: 1-5.

CHLOROQUINE

Response of *P. falciparum* to chloroquine in Andaman Nicobar Islands, India — **S. Das** *et al.*, **18**: 47-50.

Sensitivity status of *P. falciparum* to chloroquine in some parts of Andhra Pradesh and Madhya Pradesh, India — **R.B. Ghosh** et al., **18**: 119-123.

Further studies on chloroquine resistance in *P. falciparum* in Karnataka state, India — **G. Raman** *et al.*, **18:** 126-128.

Effect of chloroquine treatment in vivo on the cyclic AMP level of erythrocytes from normal and Plasmodium berghei infected Mastomys natalensis—S. Khare et al., 19: 125-128.

Response of *Plasmodium falciparum* to chloroquine in Delhi, Sonepat district of Haryana and terai region of Uttar Pradesh — **D.S. Choudhury** *et al.*, **20**: 63-70.

Effect of chloroquine treatment on complement levels in *Plasmodium knowlesi* infected rhesus monkeys — **R.N. Prasad** et al., **21**: 17-20.

Chloroquine resistance of *Plasmodium falciparum* in Sonapur PHC area (Assam) detected by micro *in vitro* and *in vivo* tests — **A.N. Raichowdhuri** et al., **21**: 25-30.

Chloroquine-resistant *P. falciparum* malaria in Assam and Meghalaya — **B.N. Barkakaty** *et al.*, **21**: 55-56.

Instability of resistance of *Plasmodium falciparum* to chloroquine and pyrimethamine in vitro — **S. Sinha** *et al.*, **22**: 49-51.

Biochemical method for the detection of chloroquine resistance in *P. falciparum* — **L.N. Grinberg** et al., **23**: 49-53.

In vitro susceptibility of chloroquine resistant *Plasmodium falciparum* to mefloquine in Delhi — **A. Gajanana** *et al.*, **23**: 91-94.

Report of a case of *P. falciparum* malaria resistance to chloroquine and combination of sulfalene and pyrimethamine in Delhi — **D.S. Choudhury** *et al.*, **24**: 95-96.

In vitro chloroquine resistant Plasmodium falciparum in Calcutta and its sensitivity to Qinghaosu (Artemisitene) — **S. Sinha** et al., **24**: 107-109.

Chloroquine resistant *Plasmodium falciparum* malaria in Calcutta: A case report — **M.S. Das** *et al.*, **25**: 99-101.

Epidemiological implications of population migration. Part II. Evidence of chloroquine resistant *Plasmodium falciparum* malaria in Kheda district, Gujarat — R.C. Sharma and V.P. Sharma, 25: 117-118.

Chloroquine sensitivity of *P. Jalciparum* in Koraput district, Orissa — **S.S.S. Mohapatra** *et al.*, **26:** 33-39.

A focus of high degree chloroquine resistant P. falciparum in Mandla district (M.P.) — **Neeru Singh** et al., **26**: 45-51.

Drug resistant *P. falciparum* in Madras (Tamil Nadu) and District Jabalpur (Madhya Pradesh) — **S.K. Ghosh** *et al.*, **26:** 87-90.

Chloroquine resistant imported *Plasmodium falci-* parum in an industrial complex at Hardwar (U.P.) — **S. Sinha** et al., **26**: 123-125.

Ultrastructural comparison of erythrocytic stages of experimentally selected drug resistant strains of rodent malaria parasite *P. berghei* with its susceptible strain — **Ragini Saxena** et al., **26**: 199-207.

Micro in vitro assessment of Plasmodium falciparum sensitivity to chloroquine and messoquine in Gujarat — P. Karmakar et al., 27: 37-42.

Chloroquine sensitivity of *Plasmodium falci*parum in Shankargarh block of Allahabad district (U.P.) — **P.K. Tyagi** and **S.N. Tiwari, 27:** 79-83.

Status of *Plasmodium falciparum* resistance to chloroquine in Gujarat, Rajasthan and Maharashtra states of India — **P. Karmakar** et al., **27**: 101-109.

Response of *P. falciparum* to chloroquine in a tribal area of Madhya Pradesh — **Neeru Singh** and **M.M. Shukla**, **27**: 183-186.

In vivo test for sensitivity of P. falciparum to chloroquine in Faridabad complex of Haryana (India) — Usha Arora et al., 27: 205-208.

P. falciparum — Chloroquine in vivo test in northeast India: Reclassification and extended follow-up till Day 14 — A.P. Pandya et al., 27: 223-229.

Resistant falciparum malaria in an endemic area of Allahabad (U.P.) — **A.K. Rastogi** et al., **28**: 215-217.

Problem of antimalarial drug resistance in *P. falciparum* in Mizoram — **B.N. Barkakaty** and **M.V.V.L. Narasimham**, **29**: 89-93.

Biochemical alterations in *Plasmodium vivax*-infected malarial patients before and after radical treatment — **R. Selvam** and **Suresh T. Mathews**, **29**: 103-111.

A longitudinal study to monitor chloroquine-resistant *P. falciparum* malaria in Bokajan and Manja PHC areas of Karbi Anglong district, Assam — **B.N. Barkakaty** and **M.V.V.L. Narasimham, 29:** 173-183.

Report of three cases of *P. falciparum* showing moderately high parasitaemia — **Neeru Singh** et al., **29**: 199-201.

Sensitivity status of *P. falciparum* to chloroquine, amodiaquine, quinine, mefloquine and sulfadoxine/pyrimethamine in a tribal population of District Sundargarh, Orissa — **S.K. Ghosh** *et al.*. **29**: 211-218.

In vivo and in vitro sensitivity of P. falciparum to chloroquine at Indian Oil Corporation, Mathura (U.P.) — V.K. Dua et al., 30: 29-35.

Oxidative stress and antioxidant defence mechanism in *Plasmodium vivax* malaria before and after chloroquine treatment — **Kumud Sarin** et al., **30**: 127-133.

Response of *P. falciparum* to chloroquine in Car Nicobar Island — **A. Giri** and **M.K. Das**, **31**: 27-30.

In vitro chloroquine resistance of P. falciparum in Vellore, Tamil Nadu — E.A. Venkatesan et al., 31: 39-41.

High level chloroquine resistance of *Plasmodium* falciparum in Madras, Tamil Nadu — **E.A. Venkatesan** et al., **31**: 92-93.

Cerebral malaria in Jabalpur, India — M.M. Shukla et al., 32: 70-75.

Status of chloroquine resistance in *Plasmodium* falciparum in Tripura — **R.K. Dasgupta** et al., **32**: 89-92.

Drug resistant *Plasmodium falciparum* in Mandla District, Madhya Pradesh — **Neeru Singh** *et al.*, **32:** 174-177.

MEFLOQUINE

Induction of pyrimethamine resistance in a mefloquine resistant strain of *Plasmodium berghei* — **S.K. Puri** and **G.P. Dutta**, **19**: 91-96.

Drug resistant *P. falciparum* in Madras (Tamil Nadu) and District Jabalpur (Madhya Pradesh) — **S.K. Ghosh** *et al.*, **26:** 87-90:

Micro in vitro assessment of Plasmodium falciparum sensitivity to chloroquine and mefloquine in Gujarat — P. Karmakar et al., 27: 37-42.

Sensitivity status of *Plasmodium falciparum* to chloroquine, amodiaquine, quinine, mefloquine and sulfadoxine/pyrimethamine in a tribal population of District Sundargarh. Orissa — **S.K. Ghosh** *et al.*, **29**: 211-218.

PYRIMETHAMINE

Induction of pyrimethamine resistance in a mefloquine resistant strain of *Plasmodium berghei* — **S.K. Puri** and **G.P. Dutta**, **19**: 91-96.

Instability of resistance of *Plasmodium falciparum* to chloroquine and pyrimethamine in vitro — **S. Sinha** *et al.*, **22:** 49-51.

Report of a case of *P. falciparum* malaria resistance to chloroquine and combination of sulfalene and pyrimethamine in Delhi — **D.S. Choudhury** *et al.*, **24**: 95-96.

Selection of *Plasmodium yoelii nigeriensis* resistant to triple drug combination (sulphadoxine/pyrimethamine/mefloquine) and its response to other antimalarials — **Binduja Shukla** et al., **25**: 1-6.

Ultrastructural comparison of erythrocytic stages of experimentally selected drug resistant strains of rodent malaria parasite *P. berghei* with its susceptible strain — **Ragini Saxena** *et al.*, **26**: 199-207.

Problem of antimalarial drug resistance in *Plasmodium falciparum* in Mizoram — **B.N. Barkakaty** and **M.V.V.L. Narasimham**, **29**: 89-93.

Sensitivity status of *Plasmodium falciparum* to chloroquine, amodiaquine, quinine, mefloquine and sulfadoxine/pyrimethamine in a tribal population of District Sundargarh, Orissa — **S.K. Ghosh** *et al.*, **29**: 211-218.

QUININE SULPHATE

Efficacy of single dose quinine as presumptive

treatment in *P. falciparum* malaria — **G.K. Sharma** et al., **22**: 29-34.

Preliminary observations on development of quinine sulphate resistance in *Plasmodium berghei*—**Mahmood Kazim**, et al., **23**: 133-137.

Problem of antimalarial drug resistance in *Plasmodium falciparum* in Mizoram — **B.N. Barkakaty** and **M.V.V.L. Narasimham**, **29:** 89-93.

Sensitivity status of *Plasmodium falciparum* to chloroquine, amodiaquine, quinine, mefloquine and sulfadoxine/pyrimethamine in a tribal population of District Sundargarh, Orissa — **S.K. Ghosh** *et al.*, **29**: 211-218.

Complication of intramuscular quinine injection: Three case reports — **R. Satpathy** et al., **30:** 45-49.

RESISTANCE

Biochemical method for the detection of chloroquine resistance in *P. falciparum* — **L.N. Grinberg** *et al.*, **23**: 49-53.

Dynamics of *P. falciparum* ratio: An indication of malaria resistance or a result of control measures? — **A.V. Kondrashin** et al., **24**: 89-94.

Micro in vitro assessment of Plasmodium falciparum sensitivity to chloroquine and mefloquine in Gujarat — P. Karmakar et al., 27: 37-42.

Resistant falciparum malaria in an endemic area of Allahabad (U.P.) — **A.K. Rastogi** et al., **28**: 215-217.

Reversal of chloroquine resistance with verapamil in *P. berghei in vivo* — **N. Valecha** *et al.*, **29**: 47-53.

Problem of antimalarial drug resistance in *Plasmodium falciparum* in Mizoram — **B.N. Barkakaty** and **M.V.V.L. Narasimham**, **29**: 89-93.

Malaria in the WHO southeast Asia region — **A.V. Kondrashin**, **29**: 129-160.

A longitudinal study to monitor chloroquine resistant *P. falciparum* malaria in Bokajan and Manja PHC areas of Karbi Anglong district, Assam — **B.N. Barkakaty** and **M.V.V.L. Narasimham**, **29**: 173-183.

Sensitivity status of *Plasmodium falciparum* to chloroquine, amodiaquine, quinine, mefloquine and sulfadoxine/pyrimethamine in a tribal population of District Sundargarh, Orissa — **S.K. Ghosh** *et al.*, **29**: 211-218.

In vitro chloroquine resistance of P. falciparum in Vellore, Tamil Nadu — E.A. Venkatesan et al., 31: 39-41.

High level chloroquine resistance of *Plasmodium* falciparum in Madras, Tamil Nadu — **E.A. Venkatesan** et al., **31**: 92-93.

Cerebral malaria in Jabalpur, India. — M.M. Shukla et al., 32: 70-75.

Status of chloroquine resistance in *Plasmodium* falciparum in Tripura — **R.K. Dasgupta** et al., **32**: 89-92.

Drug resistant *Plasmodium falciparum* in Mandla District, Madhya Pradesh — **Neeru Singh** *et al.*, **32**: 174-177.

GEOGRAPHICAL DISTRIBUTION

A focus of chloroquine resistance in *Plasmodium* falciparum in Shaktinagar area of Mirzapur district, Uttar Pradesh — **S.R. Dwivedi** et al., **18**: 35-40

Response of *P. falciparum* to chloroquine in Andaman Nicobar Islands, India — **S. Das** *et al.*, **18**: 47-50.

Sensitivity status of *P. falciparum* to chloroquine in some parts of Andhra Pradesh and Madhya Pradesh, India — **R.B. Ghosh** *et al.*, **18**: 119-123.

Further studies on chloroquine resistance in *P. falciparum* in Karnataka state, India — **G. Raman** et al., **18**: 126-128.

Response of *Plasmodium falciparum* to chloroquine in Delhi, Sonepat district of Haryana and terai region of Uttar Pradesh — **D.S. Choudhury** et al., **20**: 63-70.

,Chloroquine resistance of *Plasmodium falciparum* in Sonapur PHC area (Assam) detected by micro in vitro and in vivo tests — **A.N. Raichowdhuri** et al., **21**: 25-30.

Chloroquine resistant *P. falciparum* malaria in Assam and Meghalaya — **B.N. Barkakaty** *et al.*, **21**: 55-56.

In vitro susceptibility of chloroquine resistant Plasmodium falciparum to mefloquine in Delhi — A. Gajanana et al., 23: 91-94.

Dynamics of *P. falciparum* ratio — An indication of malaria resistance or a result of control measures? — **A.V. Kondrashin** *et al.*, **24**: 89-94.

Chloroquine resistant *Plasmodium falciparum* malaria in Calcutta: A case report — **M.S. Das** *et al.*, **25**: 99-101.

Epidemiological implications of population migration: Part II. Evidence of chloroquine resistant *Plasmodium falciparum* malaria in Kheda district, Gujarat — R.C. Sharma and V.P. Sharma, 25: 117-118.

Chloroquine sensitivity of *P. falciparum* in Koraput district, Orissa — **S.S.S. Mohapatra** *et al.*, **26**: 33-39.

A focus of high degree chloroquine resistant *P. falcipaurm* in Mandla district (M.P.) — **Neeru Singh** *et al.*, **26:** 45-51.

Drug resistant imported *Plasmodium falciparum* in Madras (Tamil Nadu) and District Jabalpur (Madhya Pradesh) — **S.K. Ghosh** et al., **26**: 87-90.

Chloroquine resistant imported *Plasmodium* falciparum in an industrial complex at Hardwar (U.P.) — **S. Sinha** et al., **26**: 123-125.

Micro in vitro assessment of *Plasmodium falci*parum sensitivity to chloroquine and mefloquine in Gujarat — **P. Karmakar** et al., **27**: 37-42.

Chloroquine sensitivity of *Plasmodium falcipa*rum in Shankargarh block of Allahabad district (U.P.) — **P.K. Tyagi** and **S.N. Tiwari**, **27**: 79-83.

Status of Plasmodium falciparum resistance to chloroquine in Gujarat, Rajasthan and Maharashtra states of India — P. Karmakar et al., 27: 101-109.

Response of *Plasmodium falciparum* to chloroquine in a tribal area of Madhya Pradesh — **Neeru Singh** and **M.M. Shukla**, **27**: 183-186.

Problem of antimalarial drug resistance in *Plasmodium falciparum* in Mizoram — **B.N. Barkakaty** and **M.V.V.L. Narasimham**, **29:** 89-93.

A longitudinal study to monitor chloroquine-resistant *Plasmodium falciparum* malaria in Bokajan and Manja PHC areas of Karbi Anglong district, Assam — **B.N. Barkakaty** and **M.V.V.L. Narasimham**, **29**: 173-183.

Response of *P. falciparum* to chloroquine in Car Nicobar Island — **A. Giri** and **M.K. Das, 31**: 27-30.

In vitro chloroquine resistance of P. falciparum in Vellore, Tamil Nadu — E.A. Venkatesan et al., 31: 39-41.

High level chloroquine resistance of *Plasmodium* falciparum in Madras, Tamil Nadu — **E.A. Venkatesan** et al., **31**: 92-93.

Malaria paradigms in India and control strategy — **S. Pattanayak** *et al.*, **31**: 141-199.

Drug resistant *Plasmodium falciparum* in Mandla district, Madhya Pradesh — **Neeru Singh** et al., **32:** 174-177.

Treatment

Pyrimethamine in combination with sulfadoxine or sulfalene in *P. falciparum* infected cases in India — **Silpi Das** *et al.*, **18**: 109-116.

Efficacy of single dose quinine as presumptive treatment in *P. falciparum* malaria — **G.K. Sharma** *et al.*, **22:** 29-34.

Instability of resistance of *Plasmodium falciparum* to chloroquine and pyrimethamine in vitro — \mathbf{S} . **Sinha** et al., $\mathbf{22}$: 49-51.

In vitro susceptibility of chloroquine resistant Plasmodium falciparum to mefloquine in Delhi — A. Gajanana et al., 23: 91-94.

In vitro chloroquine resistant Plasmodium falciparum in Calcutta and its sensitivity to Qinghaosu (Artemisitene) — **S. Sinha** et al., **24**: 107-109.

Clinical trial of fansime in Indian patients of *P. falciparum* malaria — **Omkar P. Asthana** et al., **25**: 89-96.

A study of current practices in the treatment of malaria in industrial complexes in India — **V.K. Dua** *et al.*, **28**: 199-200.

Histopathological studies in relation to protection induced by using MDP as an adjuvant in malaria — Neeraj Khullar and Shobha Sehgal, 28: 243-248.

Reversal of chloroquine resistance with verapamil in *P. berghei in vivo* — **N. Valecha** *et al.*, **29**: 47-53.

Management of admitted malaria cases in four major hospitals of Delhi: A case study — G.P. Singh et al., 29: 95-102.

In vitro activity of fluoroquinolones against chloroquine-sensitive and chloroquine-resistant *P. falciparum* — **K.D. Tripathi** et al., **30**: 67-73.

Screening of *Coptis teeta* wall for antimalarial effect: A preliminary report — **S.K. Sharma** *et al.*, **30**: 179-181.

EPIDEMIOLOGY

Problems in malaria research — T. Ramachandra Rao, 18: 4-11.

Urban malaria scheine of the National Malaria Eradication Programme of India — **S. Pattanayak** *et al.*, **18:** 21-27.

Observations on the incidence of malaria in India — V.P. Sharma, 19: 57-58.

Modified plan of operation and its impact on malaria — H.C. Uprety et al., 19: 137-138.

Studies on the true incidence of malaria in Kharkhoda (District Sonepat, Haryana) and Kichha (District Nainital, U.P.) Primary Health Centre — V.P. Sharma et al., 20: 21-34.

Studies on the true incidence of malaria in Gadarpur town of terai, District Nainital, U.P. — **M.S. Malhotra** *et al.*, **22**: 57-60.

Studies on malaria transmission in hutments of Delhi — V.P. Sharma et al., 22: 77-84.

Studies on the detection of malaria at Primary Health Centres. Part I. Reliability of parasitologi-

cal diagnosis by decentralized laboratories — **A.E. Beliaev** *et al.*, **22**: 85-103.

Follow-up studies of malaria epidemic in villages of Shahjahanpur district, U.P. — **V.P. Sharma** et al., **22**: 119-121.

A three year report of the malaria clinic in Haldwani, District Nainital, U.P. — M.S. Malhotra et al., 22: 123-126.

Splenomegaly in malaria — H.A.H. Mashaal, 23: 1-18.

Studies on the detection of malaria at Primary Health Centres. Part II. Age and sex composition of patients subjected to blood examination in passive case detection — **A.E. Beljaev** et al., **23**: 19-25.

Malaria situtation in Meerut district villages (U.P.) — M.A. Ansari et al., 23: 147-150.

Malaria prevalence in patients attending Primary Health Centres in ten districts of Uttar Pradesh — **D.S. Choudhury** et al., **24:** 79-83.

Dynamies of *P. falciparum* ratio: An indication of malaria resistance or a result of control measures? — **A.V. Kondrashin** *et al.*, **24**: 89-94.

Studies on the detection of malaria at Primary Health Centres. Part III. Parasitological profile of population surveyed for malaria through passive case detection — A.E. Beljaev et al., 24: 97-106.

Epidemiological implications of population migration: Part I. Imported malaria in Kheda district, Gujarat — R.C. Sharma and V.P. Sharma, 25: 113-116.

Epidemiological implications of population migration: Part II. Evidence of chloroquine resistant Plasmodium falciparum malaria in Kheda district, Gujarat — R.C. Sharma and V.P. Sharma, 25: 117-118.

Persistent malaria transmission in Kundam block, District Jabalpur (M.P.) — **Neeru Singh** and **V.P. Sharma**, **26**: 1-7.

A preliminary malaria survey in Bisra PHC, District Sundargarh, Orissa — **S.K. Ghosh** et al., **26**: 167-170.

Laboratory diagnosis of malaria infection and its natural history in an urban pocket of Hyderabad city — M.M.A. Khan et al., 26: 215-218.

Role of splenomegaly in diagnosis and epidemiology of malaria — M.K. De et al., 27: 45-46.

Radical treatment of vivax malaria in Madhya Pradesh, India — Neeru Singh et al., 27: 55-56.

Quartan malaria: An investigation on the incidence of *Plasmodium malariae* in Bisra PHC, District Sundargarh, Orissa—**R.S. Yadav** et al., **27**: 85-94.

Active malaria transmission in south Mizoram — **S.C. Das** *et al.*, **27**: 111-117.

The natural occurrence of circulating antibodies in populations of endemic malarious areas — **S. Biswas** *et al.*, **27**: 139-148.

Living conditions and occurrence of malaria in a rural community—**S. Subramanian** et al., **28**:29-38.

Infection rate and vectorial capacity of malaria vectors in Jeypore hill tract — **S.K. Parida** et al., **28**: 207-213.

Some observations on *Plasmodium falciparum* gametocytaemia in natural infections in an endemic area of Koraput district, Orissa — **S.S.S. Mohapatra** *et al.*, **29**: 69-72.

A longitudinal study to monitor chloroquine-resistant *P. falciparum* malaria in Bokajan and Manja PHC areas of Karbi Anglong district, Assam—B.N. Barkakaty and M.V.V.L. Narasimham, 29: 173-183.

Malaria and ABO blood groups — **A. Thakur** and **I.C. Verma**, **29**: 241-244.

Three genetic markers and malaria in upper caste Hindus of Kheda district of Gujarat state — C.S. Pant et al., 30: 229-233.

Resting and biting habits of *Anopheles sundaicus* in Car Nicobar Island — **Roop Kumari** and **V.P. Sharma**, **31**: 103-114.

Epidemiological study of malaria outbreak in a hotel construction site of Delhi — **T. Adak** et al., **31**: 126-131.

Man biting rate of culicine mosquitoes in Cochin city — Alex Eapen and R.K. Chandrahas, 31: 132-135.

Malaria paradigms in India and control strategy — **S. Pattanayak** *et al.*, **31:** 141-199.

ABO blood groups among malaria cases from District Mandla, Madhya Pradesh — Neeru Singh et al., 32: 59-63.

Role of health education in schoolchildren with particular reference to malaria — **P.G. Bhati** et al., **32**: 93-98.

Investigation of malaria outbreak in Rajasthan — **R.P. Shukia** *et al.*, **32:** 119-128.

Epidemiological observations on malaria in villages of Buhari PHC, Surat, Gujarat — **H.C.** Srivastava et al., 32: 140-152.

Bionomics of vector Anophelines in District Naini Tal, Uttar Pradesh — **R.P. Shukla** et al., **32**: 153-163.

CLINICAL STUDIES

Studies on the detection of malaria at Primary Health Centres. Part I. Reliability of parasitological diagnosis by decentralized laboratories — **A.E. Beljaev** *et al.*, **22**: 85-103.

A three year report of the Malaria Clinic in Haldwani, District Nainital, U.P. — M.S. Malhotra et al., 22: 123-126.

Splenomegaly in malaria — **H.A.H. Mashaal**, **23**: 1-18.

Studies on the detection of malaria at Primary Health Centres. Part II. Age and sex composition of patients subjected to blood examination in passive case detection — **A.E. Beljaev** et al., **23**: 19-25.

Genetic markers in malaria patients in Delhi — **Hema Joshi** et al., **24**: 33-38.

Report of a case of *P. falciparum* malaria resistance to chloroquine and combination of sulfalene and pyrimethamine in Delhi — **D.S. Choudhury** *et al.*, **24**: 95-96.

Studies on the detection of malaria at Primary Health Centres. Part III. Parasitological profile of population surveyed for malaria through passive case detection — **A.E. Beljaev** et al., **24**: 97-106.

Clinical trial of fancimef in Indian patients of *P. falciparum* malaria — **Omkar P. Asthana** *et al.*, **25**: 89-96.

Chloroquine resistant *Plasmodium falciparum* malaria in Calcutta: A Case report — **M.S. Das** *et al.*, **25**: 99-101.

Transfusion malaria amongst operated neuro-surgical patients: A prospective study of 22 cases — A.K. Mahapatra and A.K. Banerji, 26: 91-94.

Laboratory diagnosis of malaria infection and its natural history in an urban pocket of Hyderabad city — M.M.A. Khan et al., 26: 215-218.

Role of splenomegaly in diagnosis and epidemiology of malaria — M.K. De et al., 27: 45-46.

Three case reports of behavioural problems in malaria treatment — **R.N. Prasad** *et al.*, **27**: 195-196.

Transfusion malaria in operated neurosurgical cases: A report of two cases — A.K. Mahapatra and D.N. Rao, 27: 243-245.

Common clinical symptoms of *P. falciparum* infection and its utility in malaria diagnosis in field conditions — **P. Govardhini** *et al.*, **28:** 55-63.

Impact of monitoring malaria control activities of PHC workers — **R.C. Sharma** and **A.S. Gautam**, **28**: 69-71.

Importance of clinical diagnosis of malaria in National Malaria Control Programme — A.S. Gautam et al., 28: 183-187.

Gujarat model of health management information system with reference to malaria — **R.C. Sharma** *et al.*, **29**: 11-32.

Antigenic diversity amongst ten geographic isolates of *Plasmodium falciparum* defined by merozoite invasion inhibition assay — **A. Bhatia** and **A. Vernes**, **29**: 23-28.

Microscopic diagnosis of malaria in Kheda district of Gujarat — A.S. Gautam et al., 29: 83-87.

Management of admitted malaria cases in four major hospitals of Delhi: A case study — G.P. Singh et al., 29: 95-102.

Biochemical alterations in *Plasmodium vivax*-infected malarial patients before and after radical treatment — **R. Selvam** and **Suresh T. Mathews**, **29**: 103-111.

Socio-cultural factors associated with malaria transmission: A review — **Jayaratne Pinikahana**, **29**: 121-126.

Malaria in the WHO southeast Asia region — **A.V. Kondrashin**, **29**: 129-160.

Hepatic changes in P. falciparum malaria — S.K. Mishra et al., 29: 167-171.

Frequency of ABO blood groups, sickle-cell hacmoglobin, G-6-PD deficiency and their relation with malaria in scheduled castes and schedule tribes of Kheda district, Gujarat — C.S. Pant et al., 29: 235-239.

JSB versus Giemsa stain : An evaluation — **A.S. Gautam** et al., **29:** 251-253.

Malaria in Shankargarh PHC, Allahabad district (U.P.): A clinical report — **R.N. Yadav** et al., **30**: 9-16.

Complication of intramuscular quinine injection: Three case reports — **R. Satpathy** et al., **30**: 45-49

Trends in malaria morbidity and mortality in Sri Lanka — Jayaratne Pinikahana and Robert A. Dixon, 30: 51-55.

Effects of malaria infection on pregnancy — Latika S. Nair and A.S. Nair, 30: 207-214.

Prevalence of malaria among pregnant and nonpregnant women of District Jabalpur, Madhya Pradesh — **Neeru Singh** et al., **32**: 6-13.

Status of chloroquine resistance in *Plasmodium* falciparum in Tripura — **R.K. Dasgupta** et al., **32:** 89-92.

DISEASE INCIDENCE

Malaria epidemic in Shahjahanpur (U.P.) — R.K. Chandrahas and V.P. Sharma, 20: 163-166.

Outbreak of malaria in villages of Bareilly district, U.P. — M.A. Ansari et al., 21: 121-123.

Studies on the incidence of malaria in Gadarpur town of terai, District Nainital, U.P. — M.S. Maihotra et al., 22: 57-60.

Studies on malaria transmission in hutments of Delhi — **V.P. Sharma** *et al.*, **22**: 77-84.

Follow-up studies of malaria epidemic in villages of Shahjahanpur district, U.P. — **V.P. Sharma** et al., **22**: 119-121.

Malaria situation in Meerut district villages (U.P.) — M.A. Ansari et al., 23: 147-150.

Malaria prevalence in patients attending Primary Helath Centres in ten districts of Uttar Pradesh — **D.S. Choudhury** *et al.*, **24**: 79-83.

Malaria outbreak in Kundam block, District Jabalpur (M.P.) — Neeru Singh et al., 25: 41-49.

Persistent malaria transmission in Kundam block, District Jabalpur (M.P.) — **Neeru Singh** and **V.P. Sharma**, **26:** 1-7.

Outbreak of malaria in Banda PHC of District Shahjahanpur (U.P.) — **R.N. Prasad** and **S.N. Sharma**, **27**: 47-50.

Quartan malaria: An investigation on the incidence of Plasmodium malariae in Bisra PHC, District Sundargarh, Orissa—**R.S. Yadav** et al., **27**: 85-94.

Studies on outbreak of malaria in Muliad village of Kheda district, Gujarat — R.C. Sharma and A.S. Gautam, 27: 157-162.

Epidemic of malaria in Barmer district (Thar Desert) of Rajasthan during 1990 — K.K. Mathur et al., 29: 1-10.

Malaria morbidity survey in schoolchildren in age group 5-15 years in an urban area — M.M.A. Khan and M.A. Kareem, 29: 63-64.

Malaria epidemic in Baniyani village, District Farrukhabad (U.P.) — **R.N. Prasad** et al., **29**: 219-224.

Three genetic markers and malaria in upper caste Hindus of Kheda district of Gujarat state — **C.S. Pant** *et al.*, **30**: 229-233.

Epidemiological study of malaria outbreak in a hotel construction site of Delhi — **T. Adak** et al., **31**: 126-131.

Naturally acquired concomitant infections of *Bancroftian filariasis* and human plasmodia in Orissa — **S.K. Ghosh** and **R.S. Yadav**, **32**: 32-36.

SOCIOGEOGRAPHICAL FACTORS

Economics

Cost effectiveness of the bioenvironmental control of malaria in Kheda district, Gujarat — V.P. Sharma and R.C. Sharma, 23: 141-145.

Comparative cost of mosquito control with larvicidal bacilli and insecticides — **K. Balaraman** and **S.L. Hoti, 24:** 131-134.

Economic loss due to malaria in Kheda district, Guiarat — R.C. Sharma et al., 27: 149-155.

Industrial

Efficacy of 5-day radical treatment of primaquine in *Plasmodium vivax* cases at the BHEL industrial complex, Hardwar (U.P.) — **S. Sinha** *et al.*, **26**: 83-86.

Chloroquine resistant imported *Plasmodium falci-* parum in an industrial complex at Hardwar (U.P.) — **S. Sinha** et al., **26**: 123-125.

A study of current practices in the treatment of malaria in industrial complexes in India — **V.K. Dua** *et al.*, **28**: 199-200.

Bioenvironmental control of malaria at the Indian Drugs and Pharmaceuticals Ltd., Rishikesh (U.P.) — V.K. Dua et al., 28: 227-235.

Migration

Importation of malaria cases from Sri Lanka to

Rameswaram Island (Tamil Nadu) — A. Ramalingeswara Rao et al., 24: 181-182.

Epidemiological implications of population migration: Part I. Imported malaria in Kheda district, Gujarat — R.C. Sharma and V.P. Sharma, 25: 113-116.

Epidemiological implications of population migration: Part II. Evidence of chloroquine resistant *Plasmodium falciparum* malaria in Kheda district, Gujarat — R.C. Sharma and V.P. Sharma, 25: 117-118.

Chloroquine resistant imported *Plasmodium falciparum* in an industrial complex at Hardwar (U.P.) — **S. Sinha** et al., **26**: 123-125.

Malaria in stone quarry area of Faridabad complex (Haryana) — S.N. Sharma, 30: 113-117.

Role of *An. culicifacies* and *An. stephensi* in malaria transmission in urban Delhi — **S.N. Sharma** et al., **30**: 155-168.

Epidemiological observations on malaria in village of Buhari PHC, Surat Gujarat — **H.C.** Srivastava et al., 32: 140-152.

Relapse

Relapse pattern of *Plasmodium vivax* in Kheda district, Gujarat — **R.C. Sharma** et al., **27**: 95-99.

Maiaria morbidity survey in schoolchildren in age group 5-15 years in an urban area — M.M.A. Khan and M.A. Kareem, 29: 63-64.

Urban

Urban malaria scheme of the National Malaria Eradication Programme of India — **S. Pattanayak** et al., **18**: 21-27.

Studies of malaria transmission in hutments of Delhi — V.P. Sharma et al., 22: 77-84.

Laboratory diagnosis of malaria infection and its natural history in an urban pocket of Hyderabad city — M.M.A. Khan et al., 26: 215-218.

Malaria related to construction in Panaji, Goa -- Ashwani Kumar et al., 28: 219-225.

Breeding habitats and their contribution to *Anopheles stephensi* in Panaji — **Ashwani Kumar** and **D. Thavaselvam**, **29:** 35-40.

Intradomestic mosquito breeding sources and their management — **D.K. Gupta** *et al.*, **29:** 41-46.

Breeding habits of Anopheles stephensi Liston in an area of Calcutta — **D. Biswas** et al., **29**: 195-198.

Note on urban malaria vector *Anopheles stephensi* (Liston) in Cochin — **T. Mariappan** et al., **29**: 247-249.

SEROEPIDEMIOLOGY

Seroepidemiology of human malaria: Indirect haemagglutination test using the *Plasmodium knowlesi* antigen — **S.S. Agarwal** et al., **19**: 21-25.

Evaluation of *Plasmodium cynomolgi* B antigen in enzyme linked immunosorbent assay (ELISA) test for human malaria — **G.P. Dutta** et al., **21**: 71-78.

An evaluation of *Plasmodium cynomolgi bastia-nellii* and *Plasmodium knowlesi* antigens in the seroepidemiology of human malaria using indirect haemagglutination test — **Amar Nath** et al., **21**: 99-104.

Evaluation of micro-sampling of blood by filter paper strips for malaria seroepidemiology — **H. Srinivasa** and **P. Bhat, 21**: 127-129.

Feasibility of IHA and ELISA in seroepidemiology of malaria — Ramesh Kumar et al., 23: 75-80.

Immunofluorescence test in the seroepidemiology of malaria around Delhi — Ramesh Kumar et al., 24: 119-124.

Specific IgM and IgG antimalarial antibody responses in paired samples from malaria patients — Krishan Gopal et al., 24: 125-129.

Stabilization of *Plasmodium knowlesi* antigen for seroepidemiology of malaria — **S.K. Saxena** and **G.P. Dutta**, **25**: 27-32.

Fractionation of *Plasmodium knowlesi* antigen for seroepidemiology of human malaria by IHA test — S.K. Saxena et al., 25: 33-39.

Reliability of the fluorescent antibody test in the measurement of malaria in the community — Ramesh Kumar et al., 25: 73-76.

Indirect fluorescent antibody (IFA) test for malaria in pregnant and non-pregnant women — **S.L. Sholapurkar** *et al.*, **26**: 61-63.

Seroepidemiological study of malaria in a rural population of Chandigarh — M.L. Dubey et al., 26: 187-190.

Donor screening for malaria by antibody and antigen detection in endemic area — **Nabajyoti Choudhury** *et al.*, **28:** 179-182.

Correlation of malaria endemicity with An. culicifacies sibling species composition and malaria antibody profile in District Allahabad (U.P.) — **S.N. Tiwari** *et al.*, **31:** 48-56.

Application of simple peptide ELISA for stratification of malaria endemicity — **Arati Roy** *et al.*, **32**: 164-173.

IMMUNOLOGY

Immunological studies in benign tertian (*P. vivax*) malaria — **S. Kohli** *et al.*, **18**: 41-46.

The interaction of drugs and immunity in malaria — W. Peters, 20: 93-106.

Effect of chloroquine treatment on complement levels in *Plasmodium knowlest* infected rhesus monkeys — **R.N. Prasad** *et al.*, **21**: 17-20.

Changes in concentration of lymphocyte subpopulations in rhesus monkey during *Plasmodium knowlesi* infection and drug-cured immune monkeys — **Pawan Sharma** *et al.*, **21**: 31-36.

Importance of clinical diagnosis of malaria in National Malaria Control Programme — **A.S. Gautam** *et al.*, **28:** 183-187.

Dietary modulation of malaria infection in rats — A. Bhatia and V.K. Vinayak, 28: 237-242.

Histopathological studies in relation to protection induced by using MDP as an adjuvant in malaria — Neeraj Khullar and Shobha Sehgal, 28: 243-248.

Observations on malaria patients seeking treatment in hospitals in a rural and an urban area of Sri Lanka — R. Ramasamy et al., 29: 29-34.

Reversal of chloroquine resistance with verapamil in *P. berghei in vivo*—**N. Valecha** *et al.*, **29:** 47-53.

Some observations on *Plasmodium falciparum* gametocytaemia in natural infections in an endemic area of Koraput district, Orissa — **S.S. Mahapatra** *et al.*, **29**: 69-72.

Effect of tissue culture media on multiplication of *Plasmodium falciparum in vitro* — **N.K. Sutar** *et al.*, **29:** 73-82.

A longitudinal study to monitor chloroquine resistant *P. falciparum* malaria in Bokajan and Manja PHC areas of Karbi Anglong district, Assam — **B.N. Barkakaty** and **M.V.V.L. Narasimham, 29**: 173-183.

Role of macrophages in experimental malaria: I. Development of immunobioassay indicators — **C.R. Pillai** and **N.N. Singh, 30:** 23-28.

Oxidative stress and antioxidant defence mechanism in *Plasmodium vivax* malaria before and after chloroquine treatment — **Kumud Sarin** et al., **30**: 127-133.

Oxidative stress and malaria-infected erythrocyte — **Neerad C. Mishra** *et al.*, **31**: 77-87.

ANTIGEN

Evaluation of *Plasmodium cynomologi* B antigen in enzyme linked immunosorbent assay (ELISA) test for human malaria — **G.P. Dutta** *et al.*, **21**: 71-78.

An evaluation of Plasmodium cynomologi bastianellii and Plasmodium knowlesi antigens in the seroepidemiology of human malaria using indirect haemagglutination test — Amar Nath et al., 21: 99-104.

Stabilization of *Plasmodium knowlesi* antigens for seroepidemiology of malaria — **S.K. Saxena** and **G.P. Dutta, 25**: 27-32.

Fractionation of *Plasmodium knowlei* antigen for seroepidemiology of human malaria by IHA test — **S.K. Saxena** et al., **25**: 33-39.

Donor screening for malaria by antibody and antigen detection in endemic area — **Nabajyoti Chowdhury** *et al.*, **28**: 179-182.

Histopathological studies in relation to protection induced by using MDP as an adjuvant in malaria — Neeraj Khullar and Shobha Sehgal, 28: 243-248.

Antigenic diversity amongst ten geographic isolates of *Plasmodium falciparum* defined by merozoite invasion assay — **A. Bhatia** and **A. Vernes**, **29**: 23-28.

The host immune responses to *Plasmodium falci*parum: Part II. T-cell regulation of human immune responses to *Pf*155/RESA, a well-defined blood-stage antigen of *Plasmodium falciparum*: A review — **Lalitha Kabilan** et al., **31**: 12-20.

Application of simple peptide ELISA for stratification of malaria endemicity — **Arati Roy** *et al.*, **32**: 164-173.

IMMUNITY

Cellular

The interaction of drugs and immunity in malaria — W. Peters, 20: 93-106.

Experimental malaria infection I: *Plasmodium berghei* infection in normal and T-cell deficient mice — **V. Padmavathi** et al., **20**: 115-123.

Suppressive action of an interferon inducer (6-MFA) on blood induced rodent malaria — **J.N.S. Yadava** *et al.*, **20:** 153-156.

Changes in concentration of lymphocyte subpopulations in rhesus monkey during *Plasmodium knowlesi* infection and in drug-cured immune monkey — **Pawan Sharma** et al., **21**: 31-36.

Experimental malaria infection II: *Plasmodium* berghei infection in normal and B-cell deficient mice — V. Padmavathi et al., 21: 37-44.

Experimental malaria infection III: Protective role of antibodies in *Plasmodium berghei* infection in mice — **V. Padmavathi** *et al.*, **21**: 45-51.

Cell-mediated immune responses in drug-suppressed simian *Plasmodium knowlesi* infection — **S. Biswas** and **Q.Z. Hussain, 23:** 123-126.

Status of natural killer activity in the peripheral blood of *P. vivax* and *P. falciparum* malaria patients — **Q.B. Saxena** et al., **25**: 11-15.

Role of macrophages in experimental malaria: I Development of immunobioassay indicators — C.R. Pillai and N.N. Singh, 30: 23-28.

The host immune responses to Plasmodium falciparum: Part II. T-cell regulation of human immune responses to Pf155/RESA, a well-defined blood-stage antigen of Plasmodium falciparum: A review — Lalitha Kabilan et al., 31: 12-20.

Correlation of malaria endemicity with *An. culicifacies* sibling species composition and malaria antibody profile in District Allahabad (U.P.) — **S.N. Tiwari** *et al.*, **31**: 48-56.

Application of simple peptide ELISA for stratification of malaria endemicity — **Arati Roy** et al., **32:** 164-173.

Humoral

Experimental malaria infection III- Protective role of antibodies in *Plasmodium berghei* infection in mice — **V. Padmavathi** et al., **21**: 45-54.

Some components of kinin system in human malaria — **S. Roy** *et al.*, **25:** 51-58.

The natural occurrence of circulating antibodies in populations of endemic malarious areas — **S. Biswas** *et al.*, **27**: 139-148.

IMMUNOGLOBULINS

Serum immunoglobulin levels in malaria — **Satish Gupte** *et al.*, **19**: 71.

Serum proteins and immunoglobulin changes in human malaria — **Pawan Sharma** et al., **20:** 15-19

Experimental malaria infection III- Protective role of antibodies in *Plasmodium berghei* infection in mice — **V. Padmavathi** *et al.*, **21:** 45-51.

Specific IgM and IgG antimalarial antibody responses in paired samples from malaria patients — **Krishan Gopal** et al., **24:** 125-129.

The natural occurrence of circulating antibodies in populations of endemic malarious areas — **S. Biswas** *et al.*, **27**: 139-148.

TECHNIQUES

Indirect haemagglutination and indirect fluorescent antibody tests for human malaria using *Plasmodium knowlesi* antigen — **S.S. Agarwal** *et al.*, **18**: 67-72.

Seroepidemiology of human malaria: Indirect haemagglutination test using the *Plasmodium knowlesi* antigen — **S.S. Agarwal** et al., **19**: 21-25.

Enzyme-linked immunosorbent assay test in the diagnosis of human malaria — **G.P. Dutta** *et al.*, **19**: 33-37.

Evaluation of *Plasmodium cynomologi* B antigen in enzyme linked immunosorbent assay (ELISA) test for human malaria — **G.P. Dutta** *et al.*, **21**: 71-78.

An evaluation of *Plasmodium cynomologi basti*anellii and *Plasmodium knowlesi* antigens in the seroepidemiology of human malaria using indirect haemagglutination test — **Amar Nath** et al., **21**: 99-104.

Feasibility of IHA and ELISA in seroepidemiology of malaria — Ramesh Kumar et al., 23: 75-80.

An adaptation of the gel diffusion technique for identifying the source of mosquito blood meals — **R.T. Collins** *et al.*, **23**: 81-89.

Microdot ELISA: Development of a sensitive and rapid test to identify the source of mosquito blood meals — **Arati Roy** and **V.P. Sharma, 24:** 51-58.

Detection of *Plasmodium vivax* in human blood using synthetic DNA probe — **Kunal B. Roy** et al., **24:** 65-69.

Immunofluorescence test in the seroepidemiology of malaria around Delhi — Ramesh Kumar et al.. **24**: 119-124.

Fractionation of *Plasmodium knowlesi* antigen for seroepidemiology of human malaria by IHA test — **S.K. Saxena** et al., **25**: 33-39.

Reliability of fluorescent antibody test in the measurement of malaria in the community — **Ramesh Kumar** *et al.*, **25**: 73-76.

Indirect fluorescent antibody (IFA) test for malaria in pregnant and non-pregnant women — **S.L. Sholapurkar** *et al.*, **26**: 61-63.

Gel diffusion analysis of host preference pattern of *Anopheles subpictus* in West Bengal, India — **P.K. Banerjee** et al., **28**: 157-159.

Microscopic diagnosis of malaria in Kheda district of Gujarat — A.S. Gautam et al., 29: 83-87.

VACCINE

Blocking of malaria transmission by a gamete vaccine against *Plasmodium berghei* NK-65 — **N.K. Kaushik** *et al.*, **19**: 13-19.

Progress towards a malaria vaccine — **Ranjan** Ramasamy, 24: 1-7.

Progress towards a molecular vaccine against malaria — Ranjan Ramasamy and Manthri S. Ramasamy. 26: 127-148.

Host immune response to *Plasmodium* — **Lalitha S. Kabilan**, **28**: 189-196.

The host immune responses to *Plasmodium falci*parum: Part II. T-cell regulation of human immune responses to *Pf*-155/RESA, a well-defined blood-stage antigen of *Plasmodium falciparum*: A review — **Lalitha Kabilan** et al., **31**: 12-20.

IMMUNOMODULATION

Suppressive action of an interferon inducer (6-MFA) on blood induced rodent malaria — **J.N.S. Yadava** *et al.*, **20**: 153-156.

Immunomodulation of experimental malaria by MDP — N. Khullar et al., 22: 21-28.

Antimalarial effect of cyclosporin-A on murine *P. berghei* and human *P. falciparum* — **S. Biswas** et al., **28**: 1-8.

INSECTICIDES

Experiments to test Paris green emulsion to control mosquito breeding — M. Vittal and L.B. Deshpande, 18: 117-118.

The value of spraying cattlesheds in a control programme — **M.A. Ansari** et al., **25**: 17-22.

Insecticide impregnated ropes as mosquito repellent — **V.P. Sharma** et al., **26:** 179-185.

Susceptibility status of Anopheles fluviatilis, An. annularis and An. culicifacies to insecticide in Koraput district, Orissa — **S.S. Sahu** et al., **27**: 51-53.

Insecticide susceptibility of mosquito vectors in Sundargarh district, Orissa — S.K. Chand and R.S. Yadav, 28: 65-68.

Tralomethrin (OMS-3048), a new synthetic pyrethroid against vector mosquitoes — **D. Dominic** Amalraj et al., 28: 141-145.

Acute toxicity of certain organochlorine, organophosphorous, synthetic pyrethroid and microbial insecticides to mosquito fish *Gambusia affinis* (Baird & Girard) — **P.K. Mittal** et al., **28**: 167-170

Insecticide susceptibility of Anopheles flavirostris in the Philippines — **Murari L. Das** et al., **28**: 261-263.

Epidemic of malaria in Barmer district (Thar Desert) of Rajasthan during 1990 — **K.K. Mathur** *et al.*, **29:** 1-10.

Malaria in the WHO southeast Asia region — **A.V. Kondrashin, 29**: 129-160.

Malaria paradigms in India and control strategy — S. Pattanayak et al., 31: 141-199.

A study on insecticide resistance in Anopheles fluviatilis and Anopheles culicifacies to HCH and DDT in the Malkangiri district of Orissa — **S.S. Sahu** and **K.P. Patra, 32**: 112-118.

Epidemiological observations on malaria in villages of Buhari PHC, Surat, Gujarat — **H.C.** Srivastava *et al.*, **32**: 140-152.

BIOCIDES

Evaluation of the formulations of the mosquito larvicidal agent BIOCID-S from *Bacillus sphaericus* 1593 M — **P.K. Mittal** *et al.*, **22**: 71-75.

Comparative cost of mosquito control with larvicidal bacilli and insecticides — **K. Balaraman** and **S.L. Hoti, 24**: 131-134.

Evaluation of *Bacillus sphaericus* to control breeding of malaria vectors — **M.A. Ansari** et al., **26**: 25-31.

Isolation and laboratory evaluation of an indigenous strain of *Bacillus sphaericus* (9001) — **D.K. Gupta** *et al.*, **28**: 147-150.

Acute toxicity of certain organochlorine, organophosphorous, synthetic pyrethroid and microbial insecticides to mosquito fish *Gambusia affinis* (Baird & Girard) — **P.K. Mittal** et al., **28**: 167-170.

Application of Bactoculicide (Bacillus thuringiensis H-14) for controlling mosquito breeding in industrial scrap at BHEL, Hardwar (U.P.) — V.K. Dua et al., 30: 17-21.

Effect of temperature on toxicity of two bioinsecticides Spherix (*Bacillus sphaericus*) and Bactoculicide (*Bacillus thuringiensis*) against larvae of four vector mosquitoes — **P.K. Mittal** et al., **30**: 37-41.

Comparative toxicity of certain mosquitocidal compounds to larvivorous fish, *Poecilia reticulata* — **P.K. Mittal** *et al.*, **31**: 43-47.

Efficacy of two flowable formulations of *Bacillus* sphaericus against larvae of mosquitoes — **M.A. Ansari** et al., **32**: 76-84.

DDT

Succeptibility of Anopheles philippinensis to DDT and dieldrin in Assam — J. Dutta Choudhury and P.R. Malhotra, 19: 145-146.

Impact of DDT and HCH spraying on malaria transmission in villages with DDT and HCH resistant Anopheles culicifacies — **V.P. Sharma** et al., **23**: 27-38.

Selection of permethrin resistance in the malaria vector *Anopheles stephensi* — **B.C. Chakravorthy** and **M. Kalyanasundaram**, **29**: 161-165.

Malaria epidemic in Baniyani village, District Farrukhabad (U.P.) — **R.N. Prasad** et al., **29:** 219-224.

Trends in malaria morbidity and mortality in Sri Lanka — Jayaratne Pinikahana and Robert A. Dixon, 30: 51-55.

Insecticide susceptibility status of Anopheles stephensi, Culex quiquefasciatus and Aedes aegypti in Panaji, Goa — D. Thavaselvam et al., 30: 75-79.

Incrimination of Anopheles vagus Donitz, 1902 as an epidemic malaria vector in Bangladesh — **N.P. Maheswary** et al., **31**: 35-38.

A study on insecticide resistance in *Anopheles fluviatilis* and *Anopheles culicifacies* to HCH and DDT in the Malkangiri district of Orissa — **S.S. Sahu** and **K.P. Patra, 32**: 112-118.

Investigation of malaria outbreak in Rajasthan — **R.P. Shukia**, **32**: 119-128.

Incrimination of *Anopheles minimus* as vector of malaria in Karbi Anglong district of Assam — **P. Dutta** and **J. Mahanta, 32:** 129-131.

DELTAMETHRIN

Village scale trial of the impact of deltamethrin (K-othrine) spraying in areas with DDT and HCH resistant *Anopheles culicifacies* — **M.A. Ansari** et al., **23**: 127-131.

Insecticide impregnated ropes as mosquito repellent — **V.P. Sharma** *et al.*, **26:** 179-185.

Field evaluation of deltamethrin against resistant *Anopheles culcifacies* in District Ghaziabad (U.P.), India — **M.A. Ansari** et al., **27**: 1-13.

Laboratory studies of pyrethroid netting combinations to kill mosquitoes — **B.R. Jana Kara** *et al.*, **31**: 1-11.

Comparitive toxicity of certain mosquitocidal compounds to larvivorous fish, *Poecilia reticulata* — **P.K. Mittal** *et al.*, **31:** 43-47.

Feasibility study of insecticide-impregnated bednets for malaria control in forested villages of District Mandla (M.P.) — **Neeru Singh** *et al.*, **31**: 136-140.

A study on insecticide resistance in Anopheles fluviatilis and Anopheles culicifacies to HCH and DDT in the Malkangiri district of Orissa — **S.S. Sahu** and **K.P. Patra, 32**: 112-118.

HCH

Impact of DDT and HCH spraying on malaria transmission in villages with DDT and HCH resistant *Anopheles culicifacies* — **V.P. Sharma** et al., **23:** 27-38.

Malaria epidemic in Baniyani village, District Farrukhabad (U.P.) — **R.N. Prasad** et al., **29**: 219-224.

A study on insecticide resistance in Anopheles fluviatilis and Anopheles culicifacies to HCH and DDT in the Malkangiri district of Orissa — **S.S. Sahu** and **K.P. Patra**, **32**: 112-118.

LARVICIDES

Experiments to test Paris green emulsion to control mosquito breeding — M. Vittal and L.B. Deshpande, 18: 117-118.

Evaluation of the formulations of the mosquito larvicidal agent BIOCID-S from *Bacillus sphaericus* 1593 M — **P.K. Mittal** *et al.*, **22**: 71-75.

Comparitive cost of mosquito control with larvicidal bacilli and insecticides — **K. Balaraman** and **S.L. Hoti, 24**: 131-134.

Evaluation of four Azadirachtin rich fractions from neem *Azadirachta indica* A. Juss (Family: Meliaceae), as mosquito larvicides — **D. Raghunatha Rao** et al., **25**: 67-72.

Evaluation of *Bacillus sphaericus* to control breeding of malaria vectors — **M.A. Ansari** *et al.*, **26**: 25-31.

Evaluation of Juvenile harmone analogue JHM/S-31183 against immature stages of mosquitoes in natural habitats — M.A. Ansari et al., 28: 39-43.

Evaluation of Trebon (Ethofenprox) for insecticidal efficacy against mosquito larvae and on nontarget organisms — **B. Baktharatchagan** and **B. Vasantharaj David, 28**: 249-253.

Laboratory and field evaluation of Spherix, a formulation of *Bacillus sphaericus* (B-101) to control breeding of *Anopheles stephensi* and *Culex quinquefasciatus* — **P.K. Mittal** et al., **30**: 81-89.

Phytotoxicological evaluation of *Tagets erectes* on aquatic stages of *Anopheles stephensi* — **Manik Sharma** and **R.C. Saxena**, **31**: 21-26.

Control of mosquito breeding using wood scraping treated with neem oil — **B.N. Nagpal** et al., **32**: 64-69.

MALATHION

Bioassay tests on the effectiveness of malathion spraying on *Anopheles culicifacies* resting on different wall surfaces in Aurangabad town, Maharashtra — **M. Vittal** and **M.R. Bhate, 18**: 124-125.

Effect of malathion spraying on four anopheline species and the development of resistance in *An. stephensi* in Mandora, Haryana — **Sarala K. Subbarao** *et al.*, **21**: 109-114.

Impact of malathion thermal fogging on mosquito populations in Delhi and its place in malaria control — **V.P. Sharma** *et al.*, **23:** 65-67.

Ultra low volume (ULV) malathion application as a supplementary malaria control measure in two villages of south Arcot district, Tamil Nadu — **G. Narayanasamy** *et al.*, **26:** 19-24.

Insecticide susceptibility status of Anopheles stephensi, Culex quiquefasciatus and Aedes aegypti in Panaji, Goa — **D. Thavaselvam** et al., **30:** 75-79.

REPELLENTS

Insecticide impregnated ropes as mosquito repellent — **V.P. Sharma** *et al.*, **26**: 179-185.

Evaluation of certain mosquito repellents marketed in India — **M.A. Ansari** et al., **27**: 57-64.

Repellent action of Cymbopogan martinii martinii stapf var. sofia oil against mosquitoes — M.A. Ansari and R.K. Razdan, 31: 95-102.

Field evaluation of mosquito repellent action of neem oil — **Rajni Kant** and **R.M. Bhatt, 31**: 122-125.

Repellent action of neem cream against mosquitoes — V.K. Dua et al., 32: 47-53.

Use of neem oil as a mosquito repellent in tribal villages of Mandla district, Madhya Pradesh — **A.K. Mishra** et al., **32**: 99-103.

Relative efficacy of various oils in repelling mosquitoes — M.A. Ansari and R.K. Tazdan, 32: 104-111.

PERMETHRIN

Selection of permethrin resistance in the malaria vector *Anopheles stephensi* — **B.C. Chakravorthy** and **M. Kalyanasundaram, 29:** 161-165.

ESBIOTHRIN

Esbiothrin-impregnated ropes as mosquito repellent — **M.A. Ansari** *et al.*, **29**: 203-210.

Use of kerosene lamp containing synthetic pyrethroids to repel mosquitoes — **V.P. Sharma** *et al.*, **30**: 169-176.

Field trial of esbiothrin-impregnated rope in Ramgarh village, Dadri PHC, District Ghaziabad (U.P.) — M.A. Ansari and R.K. Razdan, 31: 57-64.

DIELDRIN

Insecticide susceptibility status of Anopheles stephensi, Culex quiquefasciatus and Aedes aegypti in Panaji, Goa — **D. Thavaselvam** et al., **30**: 75-79.

FENITROTHION

Insecticide susceptibility status of Anopheles stephensi, Culex quiquefasciatus and Aedes aegypti in Panaji, Goa — D. Thavaselvam et al., 30: 75-79.

TEMEPHOS

Insecticide susceptibility status of Anopheles stephensi, Culex quiquefasciatus and Aedes aegypti in Panaji, Goa—D. Thavaselvam et al., 36: 75-79.

LAMBDACYHALOTHRIN

Laboratory studies of pyrethroid netting combinations to kill mosquitoes — **B.R. Jana Kara** et al., **31**: 1-11.

Feasibility study of insecticide-impregnated bednets for malaria control in forested villages of District Mandla (M.P.) — **Neeru Singh** *et al.*, **31**: 136-140.

ORGANOPHOSPHOROUS

Comparitive toxicity of certain mosquitocidal compounds to larvivorous fish, *Poecilia reticulata* — **P.K. Mittal** *et al.*, **31**: 43-47.

MALARIA

Problems in malaria research — T. Ramachandra Rao, 18: 4-11.

Some aspects of the socio-economic impact of malaria and its control — **A.P. Ray, 18:** 12-20.

Urban malaria scheme of the National Malaria Eradication Programme of India — S. Pattanayak, 18: 21-27.

Observations on the incidence of malaria in India — V.P. Sharma, 19: 57-58.

Modified plan of operation and its impact on malaria — **H.C. Uprety** *et al.*, **19**: 137-138.

Preliminary studies on irrigation malaria — **V.P. Sharma** and **H.C. Uprety**, **19**: 139-142.

Studies on the true incidence of malaria in Kharkhoda (District Sonepat, Haryana) and Kichha (District Nainital, U.P.) Primary Health Centres — **V.P. Sharma** *et al.*, **20**: 21-34.

Resurgence of malaria in Gadarpur PHC, District Nainital, Uttar Pradesh — **D.S. Choudhury** et al., **20**: 49-58.

The interaction of drugs and immunity in malaria — W. Peters, 20: 93-106.

Malaria epidemic in Shahjahanpur (U.P.) — R.K. Chandrahas and V.P. Sharma, 20: 163-166.

Chemotherapy of malaria and the host-parasite interaction — **Wallace Peters**, 21: 7-16.

Outbreak of malaria in villages of Bareilly district, U.P. — M.A. Ansari et al., 21: 121-123.

Studies on the incidence of malaria in Gadarpur town of terai, District Nainital, U.P. — M.S. Malhotra et al., 22: 57-60.

Follow-up studies of malaria epidemic in villages of Shahjahanpur district, U.P. — **V.P. Sharma** et al., **22**: 119-121.

A three year report of the malaria clinic in Haldwani, District Nainital, U.P. — M.S. Malhotra et al., 22: 123-126.

Malaria situation in Meerut district villages (U.P.) — M.A. Ansari et al., 23: 147-150.

Malaria prevalence in patients attending Primary Health Centres in ten districts of Uttar Pradesh — **D.S. Choudhury** et al., **24:** 79-83.

Dynamics of *P. falciparum* ratio — An indication of malaria resistance or a result of control measures? — **A.V. Kondrashin** *et al.*, **24:** 89-94.

Importation of malaria cases from Sri Lanka to Rameswaram Island (Tamil Nadu) — A. Ramalingeswara Rao et al., 24: 181-182.

Malaria outbreak in Kundam block, District Jabalpur (M.P.) — **Neeru Singh** et al., **25**: 41-49.

Epidemiological implications of population migration: Part I. Imported malaria in Kheda district, Gujarat — R.C. Sharma and V.P. Sharma, 25: 113-116.

Epidemiological implications of population migration: Part II. Evidence of chloroquine resistant Plasmodium falciparum malaria in Kheda district, Gujarat — R.C. Sharma and V.P. Sharma, 25: 117-118.

Persistent malaria transmission in Kundam block, District Jabalpur (M.P.) — **Neeru Singh** and **V.P. Sharma, 26:** 1-7.

Efficacy of 5-day radical treatment of primaquine in *Plasmodium vivax* cases at the BHEL industrial complex, Hardwar (U.P.) — **S. Sinha** *et al.*, **26**: 83-86.

A preliminary malaria survey in Bisra PHC, District Sundargarh, Orissa — **S.K. Ghosh** et al., **26**: 167-170.

Mosquito breeding in rice fields and its role in malaria transmission in Mandla district, M.P. — **Neeru Singh** *et al.*, **26:** 191-198.

Laboratory diagnosis of malaria infection and its natural history in an urban pocket of Hyderabad city — M.M.A. Khan et al., 26: 215-218.

Outbreak of malaria in Banda PHC of District Shahjahanpur (U.P.) — **R.N. Prasad** and **S.N. Sharma, 27:** 47-50.

Radical treatment of vivax malaria in Madhya Pradesh, India — Neeru Singh et al., 27: 55-56.

Quartan malaria – An investigation on the incidence of *Plasmodium malariae* in Bisra PHC, District Sundargarh, Orissa — **R.S. Yadav** *et al.*, **27**: 85-94.

Relapse pattern of *Plasmodium vivax* in Kheda district, Gujarat — R.C. Sharma et al., 27: 95-99.

Active malaria transmission in south Mizoram — **S.C. Das** *et al.*, **27**: 111-117.

Economic loss due to malaria in Kheda district, Gujarat — R.C. Sharma et al., 27: 149-155.

Studies on outbreak of malaria in Muliad village of Kheda district, Gujarat — R.C. Sharma and A.S. Gautam, 27: 157-162.

Living conditions and occurrence of malaria in a rural community — **S. Subramanian** et al., **28**: 29-37.

Impact of monitoring malaria control activities of PHC workers — R.C. Sharma and A.S. Gautam, 28: 69-71.

Repeat regions of malaria parasite proteins: A review of structure and possible role in the biology of the parasite — **Ranjan Ramasamy**, **28**: 73-81.

Aquatic macrophytes and the associated mosquitoes in and around Maduari city (Tamil Nadu) — **T. John Victor** *et al.*, **28**: 151-155.

Host immune response to Plasmodium — **Lalitha S. Kabilan, 28**: 189-196.

A study of current practices in the treatment of malaria in industrial complexes in India — **V.K. Dua** *et al.*, **28:** 199-200.

Culture of Gambusia affinis with food fishes — **S. Haq** et al., **28**: 201-206.

Infection rate and vectorial capacity of malaria vectors in Jeypore hill tract — **S.K. Parida** et al., **28**: 207-213.

Resistant falciparum malaria in an endemic area of Allahabad (U.P.) — **A.K. Rastogi** et al., **28**: 215-217.

Bioenvironmental control of malaria at the Indian Drugs and Pharmaceuticals Ltd., Rishikesh (U.P.) — V.K. Dua et al., 28: 227-235.

Evaluation of Trebon (Ethofenprox) for insecticidal efficacy against mosquito larvae and on nontarget organisms — B. Baktharatchagan and B. Vasantharaj David, 28: 249-253.

Epidemic of malaria in Barmer district (Thar Desert) of Rajasthan during 1990 — **K.K. Mathur** *et al.*, **29:** 1-10.

Gujarat model of health management information system with reference to malaria — R.C. Sharma et al., 29: 11-22.

Observations on malaria patients seeking treatment in hospitals in a rural and an urban area of Sri Lanka — **R. Ramasamy** *et al.*, **29**: 29-34.

Reversal of chloroquine resistance with verapamil in P. berghei in vivo — N. Valecha et al., 29: 47-53.

Malaria morbidity survey in schoolchildren in age group 5-15 yeras in an urban area — M.M.A. Khan and M.A. Kareem, 29: 63-64.

Enhancing the efficacy of *Gambusia affinis* to control mosquito breeding in ponds — **M.S. Malhotra** and **Anil Prakash**, **29**: 65-68.

Some observations on *Plasmodium falciparum* gametocytaemia in natural infections in an endemic area of Koraput district, Orissa — **S.S.S. Mohapatra** *et al.*, **29**: 69-72.

Problem of antimalarial drug resistance in *Plasmodium falciparum* in Mizoram — **B.N. Barkakaty** and **M.V.V.L. Narasimham**, **29**: 89-93.

Management of admitted malaria cases in four major hospitals of Delhi: A case study — **G.P. Singh** *et al.*, **29**: 95-102.

Socio-culture factors associated with malaria transmission: A review — **Jayaratne Pinikahana**, **29**: 121-126.

Malaria in the WHO southeast Asia region — **A.V. Kondrashin, 29**: 129-160.

A longitudinal study to monitor chloroquine resistant *P. falciparum* malaria in Bokajan and Manja PHC areas of Karbi Anglong district, Assam — **B.N. Barkakaty** and **M.V.V.L. Narasimham, 29:** 173-183.

Breeding habits of *Anopheles stephensi* Liston in an area of Calcutta — **D. Biswas** *et al.*, **29**: 195-198.

Malaria epidemic in Baniyani village, District Farrukhabad (U.P.) — **R.N. Prasad** et al., **29**: 219-224.

Frequency of ABO blood groups, sickle-cell haemoglobin, G-6-PD deficiency and their relation with malaria in scheduled castes and schedule tribes of Kheda district, Gujarat — C.S. Pant et al., 29: 235-239.

Note on urban malaria vector *Anopheles stephensi* (Liston) in Cochin — **T. Mariappan** et al., **29**: 247-249.

JSB versus Giemsa stain: An evaluation — **A.S. Gautam** et al., **29**: 251-253.

Availability and utility of local fishes of Shahjahanpur for mosquito control — **S. Haq** et al., **30**: 1-8. Trends in malaria morbidity and mortality in Sri Lanka — **Jayratne Pinikahana** and **Robert A. Dixon, 30:** 51-55.

Preliminary observations on mosquito collections by light traps in tribal villages of Madhya Pradesh — **Neeru Singh** et al., **30**: 103-107.

Malaria in stone quarry area of Faridabad complex (Haryana) — **S.N. Sharma, 30**: 113-117

Prevalence and seasonal distribution of anopheline fauna in District Bikaner (Rajasthan) — **S.K. Bansal** and **Karam V. Singh, 30**: 119-125

Anopheline fauna and malaria incidence in Changlang district (Arunachal Pradesh) — P. Dutta et al., 30: 135-143.

Role of *An. culicifacies* and *An. stephensi* in malaria transmission in urban Delhi — **S.N. Sharma** *et al.*, **30:** 155-168.

Screening of *Coptis teeta* wall for antimalarial effect: A preliminary report — **S.K. Sharma** *et al.*, **30**: 179-181.

Biocontrol efficacy of Gerris (A) spinolae, Laccotrephes griseus and Gambusia affinis on larval mosquitoes — T. Ambrose et al., 30: 187-192.

Feeding preferences of *Anopheles sundaicus* in Car Nicobar Island — **Roop Kumari** et al., **30**: 201-206.

Effect of malaria infection on pregnancy — Latika S. Nair and A.S. Nair, 30: 207-214.

Laboratory studies of pyrethroid-netting combinations to kill mosquitoes — **B.R. Jana Kara** *et al.*, **31:** 1-11.

Incrimination of *Anopheles vagus* Donitz, 1902 as an epidemic malaria vector in Bangladesh — **N.P. Maheswary** *et al.*, **31**: 35-38.

Biology of malaria vectors in central Gujarat—**R.M. Bhatt** *et al.*, **31**: 65-76.

Resting and biting habits of *Anopheles sundaicus* in Car Nicobar Island — **Roop Kumari** and **V.P. Sharma, 31:** 103-114.

neem oil - Rajni Kant and R.M. Bhatt, 31: R.P. Shukla et al., 32: 119-128. 122-125.

Feasibility study of insecticide-impregnated bednets for malaria control in forested villages of District Mandla (M.P.) - Neeru Singh et al., 31: 136-140

Malaria paradigms in India and control strategy -S. Pattanayak et al., 31: 141-199.

Halofantrine in the treatment of falciparum malaria - K.H. Patel et al., 32: 1-5.

Larvicidal activity of a few plant extracts against Culex guinquefasciatus and Anopheles stephensi— E. Pushpalatha and J. Muthukrishnan, 32: 14-

Naturally acquired concomitant infections of Bancroftian filarisis and human plasmodia in Orissa — S.K. Ghosh and R.S. Yadav, 32: 32-36.

Distribution of indoor-resting Anopheles fluviatilis in human dwellings and its implication on indoor residual spray - K. Gunasekaran et al., **32**: 42-46.

Repellent action of neem cream against mosquitoes — Virendra K. Dua et al., 32: 47-53.

Control of mosquito breeding using wood scrapings treated with neem oil - B.N. Nagpal et al., **32:** 64-69.

Role of health education in schoolchildren with particular reference to malaria - P.G. Bhati et al., 32: 93-98.

Use of neem oil as a mosquito repellent in tribal villages of Mandla district, Madhya Pradesh -A.K. Mishra et al., 32: 99-103.

Relative efficacy of various oils in repelling mosquitoes - M.A. Ansari and R.K Razdan, 32: 104-111.

A study on insecticide resistance in Anopheles fluviatilis and Anopheles culicifacies to HCH and DDT in the Malkangiri district of Orissa — S.S. Sahu and K.P. Patra, 32: 112-118.

Field evaluation of mosquito repellent action of Investigation of malaria outbreak in Rajasthan —

Incrimination of Anopheles minimus as a vector of malaria in Karbi Anglong district of Assam --P. Dutta and J. Mahanta, 32: 129-131.

Epidemiological observations on malaria in villages of Buhari PHC, Surat, Gujarat — H.C. Srivastava et al., 32: 140-152.

Bionomics of vector Anophelines in District Naini Tal, Uttar Pradesh - R.P. Shukla et al., 32: 153-

Drug resistant Plasmodium falciparum in Mandla district, Madhya Pradesh — Neeru Singh et al., 32: 174-177.

DIAGNOSIS

Studies on the detection of malaria at Primary Health Centres, Part I. Reliability of parasitological diagnosis by decentralized laboratories - A.E. Beljaev et al., 22: 85-103.

Splenomegaly in malaria — H.A.H. Mashaal, 23: 1-18.

Studies on the detection of malaria at Primary Health Centres, Part II. Age and sex composition of patients subjected to blood examination in passive case detection - A.E. Beljaev et al., 23: 19-25.

Studies on the detection of malaria at Primary Health Centre, Part III. Parasitological profile of population surveyed for malaria through passive case detection - A.E. Beliaev et al., 24: 97-106.

Transfusion malaria amongst operated neurosurgical patients: A prospective study of 22 cases -- A.K. Mahapatra and A.K. Banerji, 26: 91-94.

Laboratory diagnosis of malaria infection and its natural history in an urban pocket of Hyderabad city — M.M.A. Khan et al., 26: 215-218.

Transfusion malaria in operated neurosurgical cases: A report of two cases - A.K. Mahapatra and D.N. Rao, 27: 243-245.

Role of splenomegaly in diagnosis and epidemiology of malaria — M.K. De et al., 27: 45-46.

Symptomatic diagnosis of *Plasmodium falciparum* malaria in field conditions — **P. Govardhini** *et al.*, **28**: 52-62.

Donor screening for malaria by antibody and antigen detection in endemic area — **Nabajyoti Choudhury** *et al.*. **28**: 179-182.

Importance of clinical diagnosis of malaria in National Malaria Control Programme — A.S. Gautam et al., 28: 183-187.

Biochemical alterations in *Plasmodium vivax*-infected malarial patients before and after radical treatment — **R. Selvam** and **Suresh T. Mathews**, **29**: 103-111.

Report of three cases of *P. falciparum* showing moderately high parasitaemia — **Neeru Singh** et al., **29**: 199-201.

Malaria and ABO blood groups — **A. Thakur** and **I.C. Verma, 29**: 241-244.

JSB versus Giemsa stain: An evaluation — **A.S. Gautam** et al., **29**: 251-253.

Malaria in Shankargarh PHC, Allahabad district (U.P.): A clinical report — **R.N. Yadav** et al., **30**: 9-16.

Role of macrophages in experimental malaria: I. Development of immunobioassay indicators — C.R. Pillai and N.N. Singh, 30: 23-28.

In vivo and in vitro sensitivity of Plasmodium falciparum to chloroquine at Indian Oil Corporation, Mathura (U.P.) — Virendra K. Dua et al., 30: 29-35.

Complication of intramuscular quinine injection: Three case reports — **R. Satpathy** *et al.*, **30**: 45-49.

In-vitro activity of fluoroquinolones against chloroquine-sensitive and chloroquine-resistant Plasmodium falciparum — K.D. Tripathi et al., 30: 67-73.

Correlation of malaria endemicity with An. culicifacies sibling species composition and malaria an-

tibody profile in District Allahabad (U.P.) — **S.N. Tiwari** *et al.*, **31**: 48-56.

Epidemiological study of malaria outbreak in a hotel construction site of Delhi — **T. Adak** et al., **31**: 126-131.

Prevalence of malaria among pregnant and nonpregnant women of District Jabalpur, Madhya Pradesh — **Neeru Singh** et al., **32**: 6-13.

Cerebral malaria in Jabalpur, India — **M.M. Shukia** et al., **32**: 70-75.

Status of chloroquine resistance in *Plasmodium* falciparum in Tripura — **R.K. Dasgupta** et al., **32:** 89-92.

Application of simple peptide ELISA for stratification of malaria endemicity — **Arati Roy** *et al.*, **32**: 164-173.

GENETICS

Human

Three new electrophoretic allelomorphs of glucose-6-phosphate dehydrogenase — **Hema Joshi** *et al.*, **24:** 29-31.

Genetic markers in malaria patients in Delhi— Hema Joshi et al., 24: 33-38.

Studies on genetic polymorphism in relation to malaria in tea gardens of Dibrugarh district, Assam — R.S. Balgir and L.P. Dutta, 27: 237-241.

Genetic markers in refrectory and susceptible malaria patients in village Bhanera, District Ghaziabad, U.P. — **Hema Joshi** et al., **28**: 161-165.

Three genetic markers and malaria in upper caste Hindus of Kheda district of Gujarat state — **C.S. Pant** *et al.*, **30**: 229-233.

ABO blood groups among malaria cases from District Mandla, Madhya Pradesh — **Neeru Singh** et al., **32**: 59-63.

Vector

Linkage relationship between three autosomal mutants and functional relationship between two eye colour mutants in Anopheles stephensi — Sarala K. Subbarao and T. Adak, 18: 98-102.

Salivary gland chromosomes of Anopheles annularis — Tushar K. Varma and V.P. Sharma, 18: 103-108.

Karyotypic variation in Anopheles culicifacies complex — K. Vasantha et al., 19: 33-37.

Genetics of a sex linked and two autosomal mutants in species B of the taxon Anopheles culicifacies Giles — Sarala K. Subbarao et al., 19:83-90.

Chromosomal translocations and semisterlity in the malaria vector *Anopheles fluviatilis* James — **N.J. Shetty, 20**: 45-48.

Inheritance pattern of vermilion-eye in Anopheles culicifacies species A — T. Adak et al., 20: 59-61.

Karyotypic studies on Anopheles fluviatilis—**Tushar K. Varma** and **V.P. Sharma**, **20**: 137-139.

Anopheles culicifacies — Mitotic karyotype of species C — K. Vasantha et al., 20: 161-162.

Insecticide susceptibility of mosquito vectors in Sundargarh district, Orissa — S.K. Chand and R.S. Yadav, 28: 65-68.

Tralomethrin (OMS-3048), a new synthetic pyrethroid against vector mosquitoes — **D. Dominic** Amalraj et al., **28**: 141-145.

Insecticide susceptibility of *Anopheles flavirostris* in the Philippines — **Murari L. Das** et al., **28**: 261-263.

Selection of permethrin resistance in the malaria vector Anopheles stephensi — B.C. Chakravorthy and M. Kalyanasundaram, 29: 161-165.

Matrix based approach for identification of Indian anophelines — **Aruna Srivastava** *et al.*, **29**: 185-191.

METABOLISM

Plasmodium berghei: Studies on host metabolism using Mastomys natalensis as experimental Model — J.K. Saxena et al., 18: 80-86.

Plasmodium berghei: Regulatory effects of spleen sonicates on the uptake of glucose in vitro by the

erythrocytes of albino rat and Mastomys natalensis — S. Khare et al., 19: 39-44.

Effect of *Plasmodium cynomolgi* B infection on the haematological and liver function tests in rhesus monkey (*Macaca mulatta*) — **S.K. Srivastava** *et al.*, **19:** 45-48.

Proteinases of Plasmodium knowlesi — H.S. Banyal et al., 19: 73-82.

Glucose-6 phosphate dehydrogenase in Plasmodium knowlesi — Indresh Kumar Srivastava et al., 19: 97-100.

Glutathione metabolism of *Plasmodium berghei* parasitized erythrocytes in mice — **R.K. Seth** *et al.*, **19:** 109-114.

Effect of chloroquine treatment *in vivo* on the cyclic AMP level of erythrocytes from normal and *Plasmodium berghei* infected *Mastomys natalensis*—**S. Khare** *et al.*, **19**: 125-128.

Studies on malate dehydrogenase of *Plasmodium knowlesi* — **Nalini Saxena** et al., **20:** 71-75.

Influence of dietary protein restriction on *Plasmodium berghei* infection in rats — **A. Bhatia** and **V.K. Vinayak**, **20**: 107-114.

Role of cyclophosphamide in modulating behaviour of *P. berghei* infection in mice — **S. Sehgal** *et al.*, **20:** 147-152.

Biochemical changes in cellular constituents and some enzymes in host-tissues from *Plasmodium knowlesi* infected rhesus monkey (*Macaca mulatta*) — **Rahul Srivastava** et al., 21: 89-97.

Effect of a specific iron chelator, desferrioxamine on the host biochemistry and parasitaemia in mice infected with *Plasmodium berghei* — **Chanan Singh** *et al.*, **22**: 35-44.

Progressive changes in the liver function of monkeys following *Plasmodium knowlesi* infection — **Raka Khanna** et al., **23**: 43-48.

5-HT, 5-HIAA and related enzymes in *P. berghei* infected rats — **U. Bhattacharya** *et al.*, **24:** 45-49.

Effect of zinc diet on xanthine oxidase activity of liver of mice infected with Plasmodium berghei — **A.J. Arif** et al., **24**: 59-63.

The antioxidants as protectors of host stress organ injury in mice infected with *Plasmodium* berghei — A.J. Arif et al., 26: 173-178.

Gel diffusion analysis of host preference pattern of Anopheles subpictus in West Bengal, India — P.K. Banerjee et al., 28: 157-159.

Dietary modulation of malaria infection in rats — A. Bhatia and V.K. Vinayak, 28: 237-242.

Histopathological studies in relation to protection induced by using MDP as an adjuvant in malaria — Neeraj Khullar and Shobha Sehgal, 28: 243-248.

Involvement of gastrointestinal tract in *Plasmodium vivax* malaria — **A.K. Hati** et al., **29**: 127-128.

Hepatic changes in *P. falciparum* malaria — **S.K. Mishra** *et al.*, **29:** 167-171.

Changes in brain neurotransmitters in rodent malaria — **S. Roy** et al., **30**: 183-185.

Oxidative stress and malaria-infected erythrocytes — Neeraj C. Mishra et al., 31: 77-87.

MOSQUITOES

Water mites (*Arrenurus* sp.) parasitising mosquitoes in Uttar Pradesh terai, District Nainital — **V.K. Saxena** and **V.P. Sharma**, **18**: 51-52.

Experiments to test Paris green emulsion to control mosquito breeding — M. Vittal and L.B. Deshpande, 18: 117-118.

A note on the feeding behaviour of mosquitoes in Maharashtra villages — M. Vittal and R.R. Deo, 19: 63-68.

Ecology of anophelines in Basantpur village situated on the bank of Jumna — **M.A. Ansari** et al., **19:** 65-68.

Mosquitoes of Andaman Islands — B.N. Nagpal and V.P. Sharma, 20: 7-13.

Mosquito breeding survey in urban Delhi — **H.C. Uprety** *et al.*, **20**: 79-82.

Mosquitoes of Nainital terai (U.P.) — B.N. Nagpal et al., 20: 129-135.

Laboratory experiments on the effectiveness of expanded polystyrene (EPS) beads in mosquito control — V.P. Sharma, 21: 115-118.

Mosquitoes of Mizoram — P.R. Malhotra et al., 21: 125-126.

Mosquitoes of coastal Orissa — B.N. Nagpal and V.P. Sharma, 21: 141-145.

Mosquitoes of Kutch, Gujarat — Neeru Singh et al., 22: 17-20.

Mosquito breeding in water meter chambers — E. Narayanan and V. Maruthanayagam, 22: 47-48.

Field trials on the application of expanded polystyrene (EPS) beads in mosquito control — **R.C. Sharma** *et al.*, **22**: 107-109.

Mosquitoes of Mandla district, M.P. — Neeru Singh and B.N. Nagpal, 22: 111-113.

Treehole breeding and resting of mosquitoes in Orissa — B.N. Nagpal and V.P. Sharma, 22: 115-117.

Mosquitoes of Goa — S.M. Kulkarni et al., 23: 39-42.

Impact of malathion thermal fogging on mosquito populations in Delhi and its place in malaria control — **V.P. Sharma** *et al.*, **23**: 65-67.

Some ecological observations on anophelines collected from Manipur — **K.B. Rajput** and **T.K. Singh, 23**: 155-158.

Survey of the anopheline fauna of the western ghats in Tamil Nadu, India — **S.C. Tewari** *et al.*, **24**: 21-28.

Studies on the role of indigenous fishes in the control of mosquito breeding — **R.C. Sharma** *et al.*, **24:** 73-77.

Comparative cost of mosquito control with larvicidal bacilli and insecticides — **K. Balaraman** and **S.L. Hoti, 24**: 131-134.

Survey of mosquito fauna of north-eastern region of India — B.N. Nagpal and V.P. Sharma, 24: 143-149.

Mosquito survey in Tirap and Subansiri districts of Arunachal Pradesh — P.R. Malhotra et al., 24: 151-158.

Feeding behaviour of anopheline mosquitoes in an area endemic for malaria in Bastar district, Madhya Pradesh — **S.M. Kulkarni**, **24**: 163-171.

Small-scale field trials with polystyrene beads for the control of mosquito breeding — R.K. Chandrahas and V.P. Sharma, 24: 175-180.

Mosquitoes of Daman — J.S. Khamre and M.B. Kaliwal, 25: 109-111.

Studies on the anopheline fauna of Kheda district and species specific breeding habitats — **R.S. Yadav** *et al.*, **26:** 65-74.

Resting of mosquitoes in outdoor pit shelters in Kheda district, Gujarat—**R.M. Bhatt** et al., **26**: 75-81.

Studies on malaria and filariasis vectors in Kamorta and Great Nicobar Islands — **S.C. Das** *et al.*, **26**: 153-157.

Treehole breeding of mosquitoes in Nadiad, Kheda district (Gujarat) — H.C. Srivastava, 26: 161-165.

Mosquito breeding in rice fields and its role in malaria transmission in Mandla district, M.P. — **Neeru Singh** et al., **26**: 191-198.

Control of mosquito breeding in wells by the application of expanded polystyrene (EPS) beads — S.N. Tiwari and P.K. Tyagi, 26: 211-214.

Seasonal incidence of water mites (*Arrenurus* sp.) parasitising mosquito vectors at Tezpur, Assam, India — **P.K. Sarkar** et al., **27**: 121-126.

Morphological variations in some Indian anophelines from Koraput district, Orissa, India — K. Gunasekaran et al., 27: 127-138.

Interspecific associations among anophelines in different breeding habitats of Kheda district, Gujarat. Part I: Canal irrigated area — R.M. Bhatt et al., 27: 167-172.

Seasonal prevalence and resting behaviour of malaria vectors in Koraput district, Orissa — **P.K. Das** *et al.*, **27:** 173-181.

Density patterns of anophelines and their relation to malaria in Bastar district, Madhya Pradesh — **S.M. Kulkarni**, **27**: 187-194.

Living conditions and occurrence of malaria in a rural community — **S. Subramanian, 28**: 29-30.

Evaluation of Juvenile harmone analogues JHM/S-31183 against immature of stages of mosquitoes in natural habitats — M.A. Ansari et al., 28: 39-43.

Role of Azolla in controlling mosquito breeding in Ghaziabad district villages (U.P.) — M.A. Ansari and V.P. Sharma, 28: 51-54.

Tralomethrin (OMS - 3048), a new synthetic pyrethroid against vector mosquitoes — **D. Dominic Amalraj** et al., **28**: 141-145.

Isolation and laboratory evaluation of an indigenous strain of *Bacillus sphaericus* (9001) — **D.K. Gupta** et al., **28**: 147-150.

Evaluation of mosquito fish (Gambusia affinis) in the control of mosquito breeding in rice fields — M.K. Das and R.N. Prasad, 28: 171-177.

Bioenvironmental control of malaria at the Indian Drugs and Pharmaceuticals Ltd., Rishikesh (U.P) — V.K. Dua et al., 28: 227-235.

Evaluation of Trebon (Ethofenprox) for insecticidal efficacy against mosquito larvae and on nontarget organisms — **K. Baktharatchagan** and **B. Vasantharaj David**, **28**: 249-253.

Epidemic of malaria in Barmer district (Thar Desert) of Rajasthan during 1990 — **K.K. Mathur** *et al.*, **29**: 1-10.

Anopheline breeding in ponds of central Gujarat with reference to hycinth infestation — **Rajni Kant** et al., **29**: 57-61.

Fishes of District Sundargarh, Orissa with special reference to their potential in mosquito control—**R.S. Yadav** *et al.*, **29:** 225-233.

Water mites (*Arrenurus* sp.) parasitizing mosquitoes in District Shahjahanpur, U.P. — **S.N. Sharma** and **R.N. Prasad, 29**: 255-258.

Availability and utility of local fishes of Shahjahanpur for mosquito control — **S. Haq** et al., **30**: 1-8.

Application of Bactoculicide (*Bacillus thuringiensis* H-14) for controlling mosquito breeding in industrial scrap at BHEL, Hardwar (U.P.) — **Virendra K. Dua** *et al.*, **30**: 17-21.

Effect of temperature on toxicity of two bioinsecticides Spherix (Bacillus sphaericus) and Bactoculicide (Bacillus thuringiensis) against larvae of four vector mosquitoes — P.K. Mittal et al., 30: 37-41.

Control of mosquito breeding through Gambusia affinis in rice fields — H. Prasad et al., 30: 57-65.

Laboratory and field evaluation of Spherix, a formulation of Bacillus sphaericus (B-101), to control breeding of Anopheles stephensi and Culex quinquefasciatus — P.K. Mittal et al., 30: 81-89.

Preliminary observations on mosquito collections by light traps in tribal villages of Madhya Pradesh — **Neeru Singh** *et al.*, **30**: 103-107.

Biocontrol efficacy of Gerris (A) spinolae, Laccotrephes griseus and Gambusia affinis on larval mosquitoes — T. Ambrose et al., 30: 187-192.

Laboratory studies of pyrethroid-netting combinations to kill mosquitoes — **B.R. Jana Kara** *et al.*, **31**: 1-11.

Correlation of malaria endemicity with *An. culici-facies* sibling species composition and malaria antibody profile in District Allahabad (U.P.) — **S.N. Tiwari** et al., **31:** 48-56.

Field trial of esbiothrin-impregnated rope in Ramgarh village, Dadri PHC, District Ghaziabad (U.P.) — M.A. Ansari and R.K. Razdan, 31: 57-64.

A note on *Anopheles culicifacies* sibling species composition in stone quarry belt of District Allahabad (U.P.) — **S.N. Tiwari** et al., **31:** 88-91.

Repellent action of Cymbopogan martinii martinii stapf var. sofia oil against mosquitoes — M.A. Ansari and R.K. Razdan, 31: 95-102.

Man biting rate of culicine mosquitoes in Cochin city — Alex Eapen and R.K. Chandrahas, 31: 132-135.

Feasibility study of insecticide-impregnated bednets for malaria control in forested villages of District Mandla (M.P.) — **Neeru Singh** et al., **31**: 136-140.

Malaria paradigms in India and control strategy — **S. Pattanayak** *et al.*, **31:** 141-199.

Larvicidal activity of a few plant extracts against Culex quinquefasciatus and Anopheles stephensi—E. Pushpalatha and J. Muthukrishnan, 32: 14-23.

Studies on clasper movement of Anopheles species — Kang Wamin et al., 32: 37-41.

Distribution of indoor-resting Anopheles fluviatilis in human dwellings and its implication on indoor residual spray — **K. Gunasekaran** et al., **32**: 42-46.

Repellent action of neem cream against mosquitoes — V.K. Dua et al., 32: 47-53.

Control of mosquito breeding using wood scrapings treated with neem oil — **B.N. Nagpal** et al., **32:** 64-69.

Cerebral malaria in Jabalpur, India — M.M. Shukla et al., 32: 70-75.

Role of health education in schoolchildren with particular reference to malaria — **P.G. Bhati** *et al.*, **32**: 93-98.

Use of neem oil as a mosquito repellent in tribal villages of Mandla district, Madhya Pradesh — **A.K. Mishra** et al., **32**: 99-103.

Relative efficacy of various oils in repelling mosquitoes — M.A. Ansari and R.K. Razdan, 32: 104-111.

Investigation of malaria outbreak in Rajasthan — **R.P. Shukla** *et al.*, **32**: 119-128.

Anophelines of Siliguri-Naxalbari block, Darjeeling, West Bengal — P. Malakar et al., 32: 133-139.

BEHAVIOUR

Host preference of Anopheles annularis in different biotopes — K.K. Ghosh et al., 23: 119-121.

Daytime resting habits of Anopheles stephensi in an area of Calcutta — A.K. Hati et al., 24: 85-87.

Feeding behaviour of anopheline mosquitoes in an area endemic for malaria in Bastar district, Madhya Pradesh — **S.M. Kulkarni**, **24**: 163-171.

Resting of mosquitoes in outdoor pit shelters in Kheda district, Gujarat — **R.M. Bhatt** *et al.*, **26**: 75-81.

Treehole breeding of mosquitoes in Nadiad, Kheda district, Gujarat — H.C. Srivastava et al., 26: 161-165.

Mosquito breeding in rice fields and its role in malaria transmission in Mandla district, M.P. — **Neeru Singh** et al., **26**: 191-198.

Control of mosquito breeding in wells by the application of expanded polystyrene (EPS) beads — **S.N. Tiwari** and **P.K. Tyagi**, **26**: 211-214.

Seasonal prevalence and resting behaviour of malaria vectors in Koraput district, Orissa — **P.K. Das** *et al.*, **27**: 173-181.

Seasonal prevalence of anophelines in Kheda district, Gujarat — **R.M. Bhatt** et al., **28**: 9-18.

Bionomics of Anopheles culicifacies Giles in riverine tract rural areas of District Shahjahanpur, Uttar Pradesh — S.N. Sharma and R.N. Prasad, 28: 19-28.

Insecticide susceptibility of mosquito vectors in Sundargarh district, Orissa — S.K. Chand and R.S. Yadav, 28: 65-68.

Observations on the breeding of anophelines in rice fields of Shahjahanpur district, Uttar Pradesh — **S.N. Sharma** and **R.N. Prasad**, **28**: 83-89.

Insecticide susceptibility of Anopheles flavirostris in the Philippines — Murari L. Das et al., 28: 261-263.

Breeding habits of An. stephensi Liston in an area of Calcutta — D. Biswas et al., 29: 195-198.

Phytotoxicological evaluation of *Tagetes erectes* on aquatic stages of *Anopheles stephensi* — **Manik Sharma** and **R.C. Saxena**, **30**: 21-26.

Insecticide susceptibility status of Anopheles stephensi, Culex quinquefasciatus and Aedes aegypti in Panaji, Goa — D. Thavaselvam et al., 30: 75-79.

Prevalence and seasonal distribution of anopheline fauna in District Bikaner (Rajasthan) — S.K. Bansal and Karam V. Singh, 30: 119-125.

Anopheline fauna and malaria incidence in Changlong district (Arunachal Pradesh) — **P. Dutta** et al., **30**: 135-143.

Seasonality of indoor resting mosquitoes in a broken-forest ecosystem of north western Orissa — **S.K. Chand** *et al.*, **30**: 145-154.

Role of An. culicifacies and An. stephensi in malaria transmission in urban Delhi — **S.N. Sharma** et al., **30**: 155-168.

Feeding preferences of Anopheles sundaicus in Car Nicobar Island — **Roop Kumari** et al., **30**: 201-206.

Biology of malaria vectors in central Gujarat — **R.M. Bhatt** et al., **31**: 65-76.

Resting and biting habits of Anopheles sundaicus in Car Nicobar Island — Roop Kumari and V.P. Sharma. 31: 103-114.

Field evaluation of mosquito repellent action of neem oil — **Rajni Kant** and **R.M. Bhatt, 31**: 122-125.

Man biting rate of culicine mosquitoes in Cochin city — **Elex Eapen** and **R.K. Chandrahas**, **31**: 132-135.

A study on the mosquito emergence from the underground sewerage system in some areas of Delhi — C.P. Batra et al., 32: 85-88.

A study on insecticide resistance in Anopheles fluviatilis and Anopheles culicifacies to HCH and

DDT in the Malkangiri district of Orissa — S.S. Sahu and K.P. Patra, 32: 112-118.

Bionomics of vector anophelines in District Naini Tal, Uttar Pradesh — **R.P. Shukla** et al., **32**: 153-163.

BLOOD MEAL IDENTIFICATION

An adaption of the gel diffusion technique for identifying the source of mosquito blood meals—**R.T. Collins** et al., **23**: 81-89.

Microdot ELISA: Development of a sensitive and rapid test to identify the source of mosquito blood meals — **Arati Roy** and **V.P. Sharma, 24:** 51-58.

Gel diffusion analysis of host preference pattern of Anopheles subpictus in West Bengal, India — P.K. Banerjee et al., 28: 157-159.

DISTRIBUTION

Mosquitoes of Andaman Islands — B.N. Nagpal and V.P. Sharma, 20: 7-13.

Mosquitoes of Naini Tal terai (U.P.) — **B.N. Nagpal** et al., **20**: 129-135.

Mosquitoes of Mizoram — P.R. Malhotra et al., 21: 125-126.

Mosquitoes of Kutch, Gujarat — Neeru Singh et al., 22: 17-20.

Anopheles annularis as a vector of malaria in rural West Bengal — **K.K. Ghosh** et al., **22**: 65-69.

Mosquitoes of Mandla district, M.P. — Neeru Singh and B.N. Nagpal, 22: 111-113.

Treehole breeding and resting of mosquitoes in Orissa— B.N. Nagpal and V.P. Sharma, 22: 115-117.

Mosquitoes of Goa — S.M. Kulkarni et al., 23: 39-42.

Survey of the anopheline fauna of the western ghats in Tamil Nadu, India — **S.C. Tewari** et al., **24**: 21-28.

Survey of mosquito fauna of north-eastern region of India — B.N. Nagpal and V.P. Sharma, 24: 143-149.

Mosquito survey in Tirap and Subansiri districts of Arunachal Pradesh — P.R. Malhotra et al., 24: 151-158.

A note on *Anopheles dirus* Peyton and Harrison, 1979 [*An. balabacensis* (Sensu lato) Baisas, 1936] in India — **H.R. Bhat, 25**: 103-105.

Vertical distribution of Anopheles stephensi larvae in Calcutta — **K.K. Chatterjee** et al., **25**:107-108.

Mosquitoes of Daman — J.S. Khamre and M.B. Kaliwal, 25: 109-111.

Breeding habitats of mosquitoes in Goa — **S.M. Kulkarni** and **Prashant S. Naik**, **26**: 41-44.

Studies on the anopheline fauna of Kheda district and species specific breeding habitats — **R.S. Yadav** *et al.*, **26**: 65-74.

The importance of *Anopheles dirus* (*An. balabacensis*) as a vector of malaria in northeast India — **P. Dutta** *et al.*, **26**: 95-101.

Studies on malaria and filariasis vectors in Kamorta and Great Nicobar Islands — **S.C. Das** *et al.*, **26**: 153-157.

Treehole breeding of mosquitoes in Nadiad, Kheda district (Gujarat) — **H.C. Srivastava**, **26**: 161-165.

Mosquito breeding in rice fields and its role in malaria transmission in Mandla district, M.P. — **Neeru Singh** et al., **26**: 191-198.

Control of mosquito breeding in wells by the application of expanded polystyrene (EPS) beads — **S.N. Tiwari** and **P.K. Tyagi**, **26:** 211-214.

Active malaria transmission in south Mizoram — **S.C. Das** *et al.*, **27**: 111-117.

Seasonal prevalence and resting behaviour of malaria vectors in Koraput district, Orissa — **P.K. Das** *et al.*, **27:** 173-181.

Density patterns of anophelines and their relation to malaria in Bastar district, Madhya Pradesh — **S.M. Kulkarni, 27**: 187-194.

Mosquito fauna of medical importance in Kumbakkarai: A tourist spot near Madurai (Tamil Nadu) — T. John Victor et al., 27: 233-236.

Mosquito fauna of certain areas of deltaic west Bengal: A preliminary report — Mita S. Mahapatra et al., 28: 45-50.

Malaria in the WHO southeast Asia region — **A.V. Kondrashin, 29**: 129-160.

Note on urban malaria vector Anopheles stephensi (Liston) in Cochin — **T. Mariappan** et al., **29**: 247-249.

Anopheline fauna and malaria incidence in Changlang district (Arunachal Pradesh) — P. Dutta et al., 30: 135-143.

Seasonality of indoor resting mosquitoes in a broken-forest ecosystem of north-western Orissa — **S.K. Chand** *et al.*, **30**: 145-154.

Role of An. culicifacies and An. stephensi in malaria transmission in urban Delhi — **S.N. Sharma** et al., **30**: 155-168.

Mosquitoes of Sagar Island — Mihir K. Pramanik et al., 30: 193-199.

Biology of malaria vectors in central Gujarat — **R.M. Bhatt** et al., **31**: 65-76.

Distribution and relative prevalence of anopheline in District South 24-parganas, West Bengal, India — **Neelam Tandon** and **S.K. Tandon**, **31**: 115-121.

Indoor resting anophelines of north Bengal — P. Malakar et al., 32: 24-31.

Anopheline fauna of Ajodhya hills, District Purulia, West Bengal — N. Tandon et al., 32: 54-58.

Anophelines of Siliguri-Naxalbari block, Darjeeling, West Bengal — P. Malakar et al., 32: 133-139.

ECOLOGY

Geographic variation in life table attributes of four

populations of Anopheles stephensi Liston from India — P.K.B. Menon and V.P. Sharma, 18: 91-97.

A note on the feeding behaviour of mosquitoes in Maharashtra villages — M. Vittal and R.R. Deo, 19: 63-64.

Ecology of anophelines in Basantpur village situated on the bank of Jumna — **M.A. Ansari** et al., **19:** 65-68.

Preliminary studies on irrigation malaria — V.P. Sharma and H.C. Uprety, 19: 139-141.

Mosquito breeding survey in urban Delhi — **H.C. Uprety** *et al.*, **20**: 79-82.

Mosquito breeding in water meter chambers — E. Narayanan and V. Maruthanayagam, 22: 47-48.

Treehole breeding and resting of mosquitoes in Orissa — B.N. Nagpal and V.P. Sharma, 22: 115-117

Some ecological observations on anophelines collected from Manipur — **K.B. Rajput** and **T.K. Singh, 23:** 155-158.

Seasonal prevalence of sibling species A and B of the taxon *Anopheles culicifacies* in villages around Delhi — **Sarala K. Subbarao** et al., **24:** 9-16.

Daytime resting habits of *Anopheles stephensi* in an area of Calcutta — **A.K. Hati** et al., **24**: 85-87.

Breeding habitats of mosquitoes in Goa — S.M. Kulkarni and Prasant S. Naik, 26: 41-44.

Studies on the anopheline fauna of Kheda district and species specific breeding habitats — **R.S. Yadav** *et al.*, **26**: 65-74.

Treehole breeding of mosquitoes in Nadiad, Kheda district (Gujarat) — H.C. Srivastava, 26: 161-165

Mosquito breeding in rice fields and its role in malaria transmission in Mandla district, M.P. — **Neeru Singh** *et al.*, **26**: 191-198.

Interspecific associations among anophelines in different breeding habitats of Kheda district, Gujarat. Pt I: Canal irrigated area — R.M. Bhatt et al., 27: 167-172.

Seasonal prevalence and resting behaviour of malaria vectors in Koraput district, Orissa — P.K. Das et al., 27: 173-181.

Breeding habitats of malaria vectors: An. fluviatilis, An. annularis and An. culicifacies in Koraput district, Orissa — **S.S. Sahu** et al., **27**: 209-216.

Seasonal prevalence of anophelines in Kheda district, Gujarat — **R.M. Bhatt** *et al.*, **28**: 9-18.

Aquatic macrophytes and the associated mosquitoes in and around Madurai city (Tamil Nadu) — **T. John Victor** *et al.*, **28**: 151-155.

Evaluation of mosquito fish Gambusia affinis in the control of mosquito breeding in rice fields — M.K. Das and R.N. Prasad, 28: 171-177.

Breeding habitats and their contribution to Anopheles stephensi in Panaji — Ashwani Kumar and D. Thavaselvam, 29: 35-40.

Intradomestic mosquito breeding sources and their management — **D.K. Gupta** et al., **29**: 41-46.

Malaria epidemic in Baniyani village, District Farrukhabad (U.P.) — R.N. Prasad et al., 29: 219-224.

Malaria in the WHO southeast Asia region — **A.V. Kondrashin, 29**: 129-160.

Note on urban malaria vector *Anopheles stephensi* (Liston) in Cochin — **T. Mariappan** *et al.*, **29**: 247-249.

Control of mosquito breeding through Gambusia affinis in rice fields — **H. Prasad** et al., **30**: 57-65.

Interspecific associations among anophelines in different breeding habitats of Kheda district Gujarat. Pt II. Non-canal area — **R.M Bhatt** *et al.*, **30**: 91-100.

Resting sites of An. stephensi Liston in Calcutta — **K.K.** Chatterjee et al., **30**: 109-112.

Prevalence and seasonal distribution of anopheline fauna in District Bikaner (Rajasthan) — S.K. Bansal and Karam V. Singh, 30: 119-125.

Anopheline fanua and malaria incidence in Changlang district (Arunachal Pradesh) — **P. Dutta** et al., **30**: 135-143.

Seasonality of indoor resting mosquitoes in a broken-forest ecosystem of north-western Orissa — **S.K. Chand** *et al.*, **30**: 145-154.

Observations on mosquito breeding in wells and its control — **Rajni Kant** et al., **30**: 215-220.

Breeding habitats of anopheline mosquitoes in Assam — V. Dev. 31: 31-34.

Biology of malaria vectors in central Gujarat — **R.M. Bhatt** et al., **31**: 65-76.

Distribution and relative prevalence of anophelines in District South 24-parganas, West Bengal, India — Neelam Tandon and S.K. Tandon, 31: 115-121.

Anopheline fauna of Ajodhya hills, District Purulia, West Bengal — N. Tandon et al., 32: 54-58.

A study on the mosquito emergence from the underground sewerage system in some areas of Delhi:— C.P. Batra et al., 32: 85-88.

Bionomics of vector anophelines in District Naini Tal, Uttar Pradesh — R.P. Shukla et al., 32: 153-163.

GENETICS

Linkage relationship between three autosomal mutants and functional relationship between two eye colour mutants in *Anopheles stephensi*—**Sarala K. Subbarao** and **T. Adak, 18**: 98-102.

Salivary gland chromosomes of Anopheles annularis — Tushar K. Varma and V.P. Sharma, 18: 103-108.

Karyotypic variations in *Anopheles culicifacies* complex —**K. Vasantha** et al., **19:** 27-32.

Genetics of a sex linked and two autosomal mutants in species B of the taxon Anopheles culicifacies Giles — Sarala K. Subbarao et al., 19: 83-90.

Chromosomal translocation and semisterlity in the malaria vector *Anopheles fluviatilis* James — **N.J. Shetty, 20:** 45-48.

Inheritance pattern of vermillion-eye in Anopheles culicifacies species A-T. Adak et al., 20: 59-61.

Anopheles culicifacies mitotic karyotype of species C — K. Vasantha et al., 20: 161-162.

Selection of permethrin resistance in the malaria vector Anopheles stephensi—B.C. Chakravorthy and M. Kalyanasundaram, 29: 161-165.

Correlation of malaria endemicity with *An. culicifacies* sibling species composition and malaria antibody profile in District Allahabad (U.P.) — **S.N. Tiwari** et al., **31**: 48-56.

MORPHOLOGY

A double headed An. culicifacies — G. Raman et al., 19: 147-150.

Morphological variations in a natural population of *Anopheles vagus* Donitz (1902) collected from Andaman Islands — **B.N. Nagpal** and **V.P. Sharma**, **20**: 35-44.

Variations in ornamentation of palpi of Anopheles sundaicus Rodenwaldt (1925) collected from Andaman Islands, India — B.N. Nagpal and V.P. Sharma, 20: 85-87.

Morphological variations in natural populations of *An. stephensi* Liston 1901 collected from Kutch (Gujarat) — **B.N. Nagpal, 27:** 25-35.

Morphological variations in some Indian anophelines from Koraput district, Orissa, India — **K. Gunasekaran** *et al.*, **27**: 127-138.

Matrix based approach for identification of Indian anophelines — **Aruna Srivastava** et al., **29**: 185-191.

PARASITES

Water mites (Arrenurus sp.) parasitising mosquitoes in Uttar Pradesh terai, District Nainital — V.K. Saxena and V.P. Sharma, 18: 51-52.

Natural parasitic infections in anopheline larvae of Mandya district, Karnataka state — C. Achuthan, 25: 59-62.

Seasonal incidence of water mites (*Arrenurus* sp.) parasitising mosquito vectors at Tezpur, Assam, India — **P.K. Sarkar** et al., **27**: 121-126.

Water mite (*Arrenurus* sp.) parasitizing mosquitoes in District Shahjahanpur, U.P. — **S.N. Sharma** and **R.N. Prasad, 29:** 255-258.

Influence of soil moisture on survival and oviposition of *Romanomermis iyengari* a mermithid nematode parasite of mosquitoes — **K.P. Paily** and **K. Balaraman, 30:** 221-225.

VECTOR INCRIMINATION

Detection and incrimination of *Anopheles minimus* Theobald 1901 as malaria vector in the foothill areas of Nagaland, India— **V.N. Bhatnagar** *et al.*, **19:** 129-133.

Detection of sporozoites in *Anopheles subpictus* in Bastar district, Madhya Pradesh — **S.M. Kulkarni**, **20**: 159-160.

Incrimination of Anopheles minimus Theobald and Anopheles balabacensis balabacensis Baisas (An. dirus) as malaria vectors in Mizoram — S.C. Das and I. Baruah, 22: 53-55.

Anopheles annularis as a vector of malaria in rural West Bengal — K.K. Ghosh et al., 22: 65-69.

Incrimination of *Anopheles culicifacies* as vector of malaria in Orissa — **B.N. Nagpal** and **V.P. Sharma**, **23**: 57-59.

Incrimination of Anopheles minimus Theobald a vector of malaria in Arunachal Pradesh — P. Dutta and B.D. Baruah, 24: 159-162.

Incrimination of Anopheles stephensi Liston as malaria vector in Calcutta — **S.K. Choudhuri** and **A.K. Sen, 24**: 183-185.

The importance of Anopheles dirus (An. balabacensis) as a vector of malaria in northeast India — **P. Dutta** et al., **26**: 95-101.

Incrimination of *Anopheles dirus* as a vector of malaria in Dibrugarh district, Assam — **P. Dutta** et al., **26**: 149-152.

Kondrashin, 20: 129-160.

A longitudinal study to monitor chloroquine-resistant P. falciparum malaria in Bokajan and Manja PHC areas of Karbi Anglong district, Assam -B.N. Barkakaty and M.V.V.L. Narasimham, 29: 173-183.

Incrimination of An. vagus Donitz 1902 as an epidemic malaria vector in Bangladesh - N.P. Maheswary et al., 30: 35-38.

Incrimination of An. minimus as vector of malaria in Karbi Anglong district of Assam - P. Dutta and J. Mahanta, 32: 129-131.

PARASITOLOGY

PLASMODIA

Multiple invasion of erythrocytes by Plasmodium vivax - A report of 56 cases - D.S. Choudhury et al., 19: 101-108.

Chemotherapeutic response of Plasmodium yoelii nigeriensis to antimalarial drugs - Anita Pande and G.P. Dutta, 19: 121-124.

Repeat regions of malaria parasite proteins: A review of structure and possible role in the biology of the parasite - Ranjan Ramasamy, 28: 73-81.

Host immune response to Plasmodium - Lalitha S. Kabilan, 28: 189-196.

JSB verses Giemsa stain: An evaluation - A.S. Gautam et al., 29: 251-253.

P. berghei

Plasmodium berghei studies on host metabolism using Mastomys natalensis as experimental model - J.K. Saxena et al., 18: 80-86.

Plasmodium berghei in vitro microtechnique for preliminary screening of antimalarials - S. Sinha et al., 19: 1-4.

Blocking of malaria transmission by a gamete vaccine against Plasmodium berghei NK-65 - N.K. Kaushik et al., 19: 13-19.

Malaria in the WHO southeast Asia region — A.V. Plasmodium berghei: Regulatory effects of spleen sonicates on the uptake of glucose in vitro by the erythrocytes of Albino rat and Mastomys natalensis — S. Khare et al., 19: 39-44.

> Induction of pyrimethamine resistance in a mefloquine resistant strain of Plasmodium berghei -S.K. Puri and G.P. Dutta, 19: 91-96.

> Glutathione metabolism of Plasmodium berghei parasitized erythrocytes in mice - R.K. Seth et al., 19: 109-114.

> The effect of immunostimulants in modulating the behaviour of P. berghei - Aruna Parashar et al., 19: 115-120.

> Effect of chloroquine treatment in vivo on the cyclic AMP level of erythrocytes from normal and Plasmodium berghei infected Mastomys natalensis - S. Khare et al., 19: 125-128.

> Influence of dietary protein restriction on Plasmodium berghei infection in rats - A. Bhatia and V.K. Vinayak, 20: 107-114.

> Experimental malarial infection I. Plasmodium berghei infection in normal and T-cell deficient mice — V. Padmavathi et al., 20: 115-123.

> Isolation of Plasmodium berghei by density gradient centrifugation on histopaque - Priti Kumar and Sohail Ahmad, 20: 125-127.

> Role of cyclophosphamide in modulating behaviour of P. berghet infection in mice — S. Sehgal et al., 20: 147-152.

Suppressive action of an interferon inducer (6-MFA) on blood induced rodent malaria — J.N.S.Yadava et al., 20: 153-156.

Experimental malarial infection II - Plasmodium berghei infection in normal and B-cell deficient mice - V. Pandmavathi et al., 21: 37-44.

Experimental malarial infection III - Protective role of antibodies in Plasmodium berghei infection in mice — V. Padmavathi et al., 21: 45-51.

Effect of a specific iron chelator, desferrioxamine on the host biochemistry and parasitaemia in

mice infected with Plasmodium berghei — **Chanan Singh** et al., **22**: 35-44.

Preliminary observations on development of quinine sulphate resistance in *Plasmodium berghei* — **Mahmood Kazim** et al., **23**: 133-137.

Studies on the comparative gametocytaemia of *P. berghei* (NK 65) in male and female *Mastomys* natalensis — **M. Rastogi** et al., **24**: 39-44.

5-HT, 5-HIAA and related enzymes in P. berghei infected rats — U. Bhattacharya et al., 24: 45-49.

Effect of zinc diet on xanthine oxidase activity of liver of mice infected with *Plasmodium berghei* — **A.J. Arif** et al., **24**: 59-63.

Sporogonic stages of *P. berghei* (NK 65): An ultrastructural study — M. Rastogi et al., 25: 77-82.

Ultrastructural studies on morphogenesis of rhoptries in sporozoites of *Plasmodium berghet* (NK 65) in *Anopheles stephensi* — **M. Rastogi** et al., **25**: 83-87.

Gametocytocidal and sporontocidal activity of some standard antimalarials on *P. berghei* (NK 65) infection in *M. natalensis* — **M. Rastogi** et al., **26**: 9-18.

The antioxidants as protectors of host stress organ injury in mice infected with *Plasmodium* berghei — **A.J. Arif** et al., **26**: 173-178.

Ultrastructural comparison of erythrocytic stages of experimentally selected drug resistant strains of rodent malaria parasite *P. berghei* with its susceptible strain — **Ragini Saxena** et al., **26**: 199-207

Antimalarial effect of cyclosporin-A on murine *P. berghei* and human *P. falciparum* — **S. Biswas** et al., **28**: 1-8.

Dietary modulation of malaria infection in rats — A. Bhatia and V.K. Vinayak, 28: 237-242.

Histopathological studies in relation to protection induced by using MDP as an adjuvant in malaria — Neeraj Khullar and Shobha Sehgal, 28: 243-248.

Evaluation of Ayush-64 for blood schizontocidal activity against rodent and simian malaria parasites — M. Kazim et al., 28: 255-258.

Reversal of chloroquine resistance with verapamil in *P. berghei in vivo* — **N. Valecha** *et al.*, **29**: 47-53.

Role of macrophages in experimental malaria: I. Development of immunobioassay indicators — C.R. Pillai and N.N. Singh, 30: 23-28.

Screening of *Coptis teeta* wall for antimalarial effect: A preliminary report — **S.K. Sharma** et al., **30**: 179-181.

Changes in brain neurotransmitters in rodent malaria — **S. Roy** et al., **30**: 183-185.

P. cynomolgi

Effect of *Plasmodium cynomolgi* B infection on the haematological and liver function tests in rhesus monkey (*Macaca mulatta*) — **S.K. Srivastava** *et al.*, **19:** 45-48.

Severity of blood induced Plasmodium cynomolgi B and Plasmodium cynomolgi cynomolgi infection in pregnant rhesus monkeys (Macaca mulatta) — K.K. Kamboj and G.P. Dutta, 20: 1-5.

Evaluation of *Plasmodium cynomolgi* B antigen in enzyme linked immunosorbent assay (ELISA) test for human malaria — **G.P. Dutta** *et al.*, **21**: 71-78.

An evaluation of *Plasmodium cynomolgi bastianellii* and *Plasmodium knowlesi* antigens in the seroepidemiology of human malaria using indirect haemagglutination test — **Amar Nath** et al., **21**: 99-104.

Evaluation of Ayush-64 for blood schizontocidal activity against rodent and simian malaria parasites — M. Kazim et al., 28: 255-258.

P. falciparum

A focus of chloroquine resistance in *Plasmodium* falciparum in Shaktinagar area of Mirzapur district, Uttar Pradesh — **S.R. Dwivedi** et al., **18**: 35-40.

Response of *P. falciparum* to chloroquine in Andaman-Nicobar Islands, India — **S. Das** *et al.*, **18**: 47-50.

Isolation of *P. falciparum* in vitro continuous culture from a patient treated with chloroquine 24 hour before — **C.A. Sivaraman** et al., **18**: 87-90.

Pyrimethamine in combination with sulfadoxine or sulfalene in *P. falciparum* infected cases in India — **Silpi Das** et al., **18**: 109-116.

Sensitivity status of *P. falciparum* to chloroquine in some parts of Andhra Pradesh and Madhya Pradesh, India — **R.B. Ghosh** et al., **18**: 119-123.

Further studies on chloroquine resistance in *P. falciparum* in Karnataka state, India — **G. Raman** et al., **18**: 126-128.

Plasmodium falciparum malaria in Haryana villages and a case report of aphasia — D.S. Choudhury and S.K. Ghosh, 19: 69-70.

Response of *Plasmodium falciparum* to chloroquine in Delhi, Sonepat district of Haryana and terai region of Uttar Pradesh — **D.S. Choudhury** et al., **20**: 63-70.

Chloroquine resistance of *Plasmodium falciparum* in Sonapur PHC area (Assam) detected by micro in *vitro* and *in vivo* tests — **A.N. Raichoudhuri** et al., **21**: 25-30.

Chloroquine resistant *P. falciparum* malaria in Assam and Meghalaya — **B.N. Barkakaty** *et al.*, **21**: 55-56.

Efficacy of single dose quinine as presumptive treatment in *P. falciparum* malaria — **G.K. Sharma** et al.. **22**: 29-34.

Instability of resistance of Plasmodium falciparum to chloroquine and pyrimethamine in vitro — \mathbf{S} . Sinha et al., $\mathbf{22}$: 49-51.

Biochemical method for the detection of chloroquine resistance in *P. falciparum* — **L.N. Grinberg** et al., **23**: 49-53.

In vitro susceptibility of chloroquine resistant *Plasmodium falciparum* to mefloquine in Delhi — **A. Gajanana** *et al.*, **23**: 91-94.

Dynamics of *P. falciparum* ratio—An indication of malaria resistance or a result of control measures? — **A.V. Kondrashin** et al., **24:** 89-94.

Report of a case of *P. falciparum* malaria resistance to chloroquine and combination of sulfalene and pyrimethamine in Delhi — **D.S. Choudhury** *et al.*, **24**: 95-96.

In vitro chloroquine resistant Plasmodium falciparum in Calcutta and its sensitivity to Qinghaosu (Artemisitene) — **S. Sinha** et al., **24:** 107-109.

Status of natural killer activity in the peripheral blood of *P. vivax* and *P. falciparum* malaria patients — **Q.B. Saxena** et al., **25**: 11-15.

Cryopreserved human erythrocytes for *in vitro* cultivation of *Plasmodium falciparum* — **H. Srinivasa** *et al.*, **25**: 23-25.

Clinical trial of fansimef in Indian patients of *P. falciparum* malaria — **Omkar P. Asthana** *et al.*, **25**: 89-96.

Chloroquine resistant *Plasmodium falciparum* malaria in Calcutta – A case report — **M.S. Das** *et al.*, **25**: 99-101.

Epidemiological implications of population migration: Part II. Evidence of chloroquine resistant Plasmodium falciparum malaria in Kheda district, Gujarat — R.C. Sharma and V.P. Sharma, 25: 117-118.

Chloroquine sensitivity of *P. falciparum* in Koraput district, Orissa — **S.S.S. Mohapatra** *et al.*, **26**: 33-39.

A focus of high degree chloroquine resistant P. falciparum in Mandla district (M.P.) — Neeru Singh et al., 26: 45-51.

Drug resistant *P. falciparum* in Madras (Tamil Nadu) and District Jabalpur (Madhya Pradesh) — **S.K. Ghosh** et al., **26:** 87-90.

Chloroquine resistant imported Plasmodium falciparum in an industrial complex at Hardwar (U.P.) — **S. Sinha** et al., **26**: 123-125.

Micro in vitro assessment of Plasmodium falciparum in sensitivity to chloroquine and mefloquine in Gujarat — P. Karmakar et al., 27: 37-42.

Chloroquine sensitivity of *Plasmodium falciparum* in Shankargarh block of Allahabad district (U.P.) — **P.K. Tyagi** and **S.N. Tiwari, 27**: 79-83.

Status of *Plasmodium falciparum* resistance to chloroquine in Gujarat, Rajasthan and Maharashtra states of India — **P. Karmakar** et al., **27**: 101-109.

Response of *Plasmodium falciparum* to chloroquine in a tribal area of Madhya Pradesh — **Neeru Singh** and **M.M. Shukla, 27:** 183-186.

In vivo test for sensitivity of *Plasmodium falciparum* to chloroquine in Faridabad complex of Haryana (India) — **Usha Arora** et al., **27**: 205-208.

Influence of some growth promoting substances on multiplication of *Plasmodium falciparum* in vitro — N.K. Sutar and D.M. Renapurkar, 27: 217-222.

Plasmodium falciparum- Chloroquine in vivo test in northeast India: Reclassification and extended follow-up till day 14 — A.P. Pandya et al., 27: 223-229.

Antimalarial effect of cyclosporin-A on murine *P. berghei* and human *P. falciparum* — **S. Biswas** et al., **28**: 1-8.

Common clinical symptoms of *Plasmodium* falciparum infection and its utility in malaria diagnosis in field conditions — **P. Goverdhini** et al., **28**: 55-63.

A study of current practices in the treatment of malaria in industrial complexes in India — **V.K. Dua** *et al.*, **28**: 199-200.

Infection rate and vectorial capacity of malaria vectors in Jeypore hill tract — **S.K. Parida** *et al.*, **28**: 207-213.

Resistant falciparum malaria in an endemic area of Allahabad (U.P.) — A.K. Rastogi et al., 28: 215-217.

Epidemic of malaria in Barmer district (Thar Desert) of Rajasthan during 1990 — **K.K. Mathur** *et al.*. **29:** 1-10.

Antigenic diversity amongst ten geographic isolates of *Plasmodium falciparum* defined by merozoite invasion inhibition assay — **A. Bhatia** and **A. Vernes, 29:** 23-28.

Observations on malaria patients seeking treatment in hospitals in a rural and an urban area of Sri Lanka — R. Ramasamy et al., 29: 29-34.

Enhancing the efficacy of Gambusia affinis to control mosquito breeding in ponds — M.S. Malhotra and Anil Prakash, 29: 65-68.

Some observations on *Plasmodium falciparum* gametocytaemia in natural infections in an endemic area of Koraput district, Orissa — **S.S.S. Mohapatra** *et al.*, **29**: 69-72.

Effect of tissue culture media on multiplication of *Plasmodium falciparum* in vitro — **N.K. Sutar** et al., **29:** 73-82.

Problem of antimalarial drug resistance in *Plasmodium falciparum* in Mizoram — **B.N. Barkakaty** and **M.V.V.L. Narasimham, 29:** 89-93.

Management of admitted malaria cases in four major hospitals of Delhi: A case study — **G.P. Singh** *et al.*, **29**: 95-102.

Biochemical alterations in *Plasmodium vivax* infected malarial patients before and after radical treatment — **R. Selvam** and **Suresh T. Mathews**, **29**: 103-111.

Involvement of gastrointestinal tract in Plasmodium vivax malaria — A.K. Hati et al., 29: 127-128.

Malaria in the WHO southeast Asia region — **A.V. Kondrashin, 29**: 129-160.

Hepatic changes in *P. falciparum* malaria — **S.K. Mishra** *et al.*, **29**: 167-171.

A longitudinal study to monitor chloroquine-resistant P. falciparum malaria in Bokajan and Manja PHC areas of Karbi Anglong district, Assam — B.N. Barkakaty and M.V.V.L. Narasimham, 29: 173-183.

Report of three cases of *P. falciparum* showing moderately high parasitaemia — **Neeru Singh** *et al.*, **29**: 199-201.

Sensitivity status of *Plasmodium falciparum* to chloroquine, amodiaquine, quinine, mefloquine and sulfadoxine/pyrimethamine in a tribal population of District Sundargarh, Orissa — **S.K. Ghosh** et al., **29:** 211-218.

Malaria epidemic in Baniyani village, District Farrukhabad (U.P.) — R.N. Prasad et al., 29: 219-224.

Note on urban malaria vector Anopheles stephensi (Liston) in Cochin — **T. Mariappan** et al., **29**: 247-249.

Malaria in Shankargarh PHC, Allahabad district (U.P.): A clinical report — R.N. Yadav et al., 30: 9-16.

In vivo and in vitro sensitivity of Plasmodium falciparum to chloroquine at Indian Oil Corporation, Mathura (U.P.) — Virendra K. Dua et al., 30: 29-35.

Complication of intra muscular quinine injection: Three case reports — **R. Satpathy** et al., **30**: 45-49.

In-vitro activity of fluoroquinolones against chloroquine-sensitive and chloroquine-resistant Plasmodium falciparum — K.D. Tripathi et al., 30: 67-73.

Preliminary observations on mosquito collection by light traps in tribal villages of Madhya Pradesh — **Neeru Singh** *et al.*, **30**: 103-107.

Anopheline fauna and malaria incidence in Changlang district (Arunachal Pradesh) — P. Dutta et al., 30: 135-143.

Role of *An. culicifacies* and *An. stephensi* in malaria transmission in urban Delhi — **S.N. Sharma** et al., **30**: 155-168.

Screening of *Coptis teeta* wall for antimalarial effect: A preliminary report — **S.K. Sharma** *et al.*, **30**: 179-181.

Changes in brain neurotransmitters in rodent malaria — **S. Roy** et al., **30**: 183-185.

Three genetic markers and malaria in upper caste Hindus of Kheda district of Gujarat state — C.S. Pant et al., 30: 229-233.

The host immune responses to *Plasmodium* falciparum Part II. T-cell regulation of human immune responses to *Pf*155/RESA, a well defined blood-stage antigen of *Plasmodium* falciparum: A review — **Lalitha Kabilan**, **31**: 12-20.

Response of *P. falciparum* to chloroquine in Car Nicobar Island — **A. Giri** and **M.K. Das. 31:** 27-30.

In-vitro chloroquine resistance of *P. falciparum* in Vellore, Tamil Nadu — **E.A. Venkatesan** et al., **31**: 39-41.

Correlation of malaria endemicity with *An. culici-facies* sibling species composition and malaria antibody profile in District Allahabad (U.P.) — **S.N. Tiwari** *et al.*, **31:** 48-56.

Oxidative stress and malaria-infected erythrocytes — Neeraj C. Mishra et al., 31: 77-87.

High level chloroquine resistance of *Plasmodium* falciparum in Madras, Tamil Nadu — **E.A. Venkatesan** et al., **31:** 92-93.

Epidemiological study of malaria outbreak in a hotel construction site of Delhi — **T. Adak** *et al.*, **31:** 126-131.

Malaria paradigms in India and control strategy — **S. Pattanayak** *et al.*, **31**: 141-199.

Halofantrine in the treatment of falciparum malaria — K.H. Patel et al., 32: 1-5.

Prevalence of malaria among pregnant and non-pregnant women of District Jabalpur, Madhya Pradesh — Neeru Singh et al., 32: 6-13.

Naturally acquired concomitant infections of Bancroftian filariasis and human plasmodia in Orissa — S.K. Ghosh and R.S. Yadav, 32: 32-36.

ABO blood groups among malaria cases from district Mandla, Madhya Pradesh — **Neeru Singh** et al., **32**: 59-63.

Cerebral malaria in Jabalpur, India — M.M. Shukla et al., 32: 70-75.

Status of chloroquine resistance *Plasmodium falciparum* in Tripura — **R.K. Dasgupta** et al., **32**: 89-92.

Investigation of malaria outbreak in Rajasthan — **R.P. Shukla**, **32**: 119-128.

Incrimination of *Anopheles minimus* as a vector of malaria in Karbi Anglong district of Assam — **P. Dutta** and **J. Mahanta**, **32**: 129-131.

Epidemiological observations on malaria in villages of Buhari PHC, Surat, Gujarat — **H.C. Srivastava** *et al.*, **32**: 140-152.

Bionomics of vector Anophelines in District Naini Tal, Uttar Pradesh — **R.P. Shukla** et al., **32**: 153-163.

Application of simple peptide ELISA for stratification of malaria endemicity — **Arati Roy** *et al.*, **32**: 164-173.

Drug resistant *Plasmodium falciparum* in Mandla district, Madhya Pradesh — **Neeru Singh** *et al.*, **32**: 174-177.

P. knowlesi

Indirect haemagglutination and indirect fluorescent antibody tests for human malaria using *Plasmodium knowlesi* antigen — **S.S. Agarwal** *et al.*, **18**: 67-72.

Seroepidemiology of human malaria: Indirect haemagglutination test using the *Plasmodium knowlesi* antigen — **S.S. Agarwal** et al., **19**: 21-25.

Proteinases of Plasmodium knowlesi — H.S. Banyal et al., 19: 73-82.

Glucose-6 phosphate dehydrogenase in *Plasmodium knowlesi* — **Indresh Kumar Srivastava** et al., **19**: 97-100.

Studies on malate dehydrogenase of *Plasmodium* knowlesi — **Nalini Saxena** et al., **20:** 71-75.

Effect of chloroquine treatment on complement levels in *Plasmodium knowlesi* infected rhesus monkeys — **R.N. Prasad** *et al.*, **21**: 17-20.

Changes in concentration of lymphocyte subpopulations in rhesus monkey during *Plasmodium knowlesi* infection and in drug-cured immune monkeys — **Pawan Sharma** et al., **21**: 31-36.

Influence of progesterone and estrogen administration on the recrudescence patterns of *Plasmodium knowlesi* infection in female rhesus monkeys (*Macaca mulatta*) following initial subcurative chloroquine therapy — **G.P. Dutta** and **K.K. Kamboj. 21:** 79-88.

Biochemical changes in cellular constituents and some enzymes in host-tissues from *Plasmodium knowlesi* infected rhesus monkey (*Macaca mulatta*) — **Rahul Srivastava** et al., **21**: 89-97.

An evaluation of *Plasmodium cynomolgi bastianellii* and *Plasmodium knowlesi* antigens in the sero-epidemiology of human malaria using indirect haemagglutination test — **Amar Nath** et al., **21**: 99-104.

Progressive changes in the liver function of monkeys following *Plasmodium knowlesi* infection — **Raka Khanna** et al., **23**: 43-48.

Cell-mediated immune responses in drug-suppressed simian *Plasmodium knowlesi* infection — **S. Biswas** and **Q.Z. Hussain**, **23**: 123-126.

Stabilization of *Plasmodium knowlesi* antigen for seroepidemiology of malaria — **S.K. Saxena** and **G.P. Dutta, 25:** 27-32.

Fractionation of *Plasmodium knowlesi* antigen for seroepidemiology of human malaria by IHA test — **S.K. Saxena** *et al.*, **25**: 33-39.

Evaluation of Ayush-64 for blood schizontocidal activity against rodent and simian malaria parasites — M. Kazim et al., 28: 255-258.

P. malariae

Quartan malaria – An investigation on the incidence of *Plasmodium malariae* in Bisra PHC, District Sundargarh (Orissa) — **R.S. Yadav** *et al.*, **27:** 85-94.

Infection rate and vectorial capacity of malaria vectors in Jeypore hill tract — **S.K. Parida** *et al.*, **28**: 207-213.

Naturally acquired concomitant infections of Bancroftian filariasis and human *Plasmodium* in Orissa — **S.K. Ghosh** and **R.S. Yaday**, **32**: 32-36.

P. yoelii

Chemotherapeutic response of *Plasmodium yoelii* nigeriensis to antimalarial drugs — **Anita Pande** and **G.P. Dutta**, **19**: 121-124.

Selection of *Plasmodium yoelii nigeriensis* resistant to triple drug combination (sulphadoxine/pyrimethamine/mefloquine) and its response to other antimalarials — **Binduja Shukla** *et al.*, **25**: 1-6.

Evaluation of Ayush-64 for blood schizontocidal activity against rodent and simian malaria parasites — M. Kazim et al., 28: 255-258.

Oxidative stress and malaria-infected erythrocytes — **Neerad C. Mishra** *et al.*, **31:** 77-87.

P. vivax

Immunological studies in benign tertian (*P. vivax*) malaria — **S. Kohli** et al., **18**: 41-46.

Multiple invasion of erythrocytes by *Plasmodium* vivax — A report of 56 cases — **D.S. Choudhury** et al., **19:** 101-108.

Results of 3-day radical treatment of *Plasmodium vivax* in north Arcot and south Arcot districts of Tamil Nadu — **N.C. Appavoo** *et al.*, **21**: 21-24.

An ultrastructural study on the sporogony of Plasmodium vivax in Anopheles stephensi — **Nutan Nanda** et al., **22**: 1-15.

Detection of *Plasmodium vivax* in human blood using synthetic DNA probe — **Kunal B. Roy** et al., **24**: 65-69.

Studies on the development of *Plasmodium vivax* in *Anopheles subpictus* — **Nutan Nanda** et al., **24**: 135-142.

Status of natural killer activity in the peripheral blood of *P. vivax* and *P. falciparum* malaria patients — **Q.B. Saxena** et al., **25**: 11-15.

Efficacy of 5-day radical treatment of primaquine in *Plasmodium vivax* cases at the BHEL industrial complex, Hardwar (U.P.) — **S. Sinha** *et al.*, **26:** 83-86.

Ultrastructural study on the erythrocytic schizogony of Plasmodium vivax — Nutan Nanda, 27: 15-23.

Radical treatment of vivax malaria in Madhya Pradesh, India — Neeru Singh et al., 27: 55-56.

Fine structure of the erythrocytic stages of *Plasmodium vivax* and the host cell alteration — **Nutan Nanda**, **27**: 65-78.

Relapse pattern of *Plasmodium vivax* in Kheda district, Gujarat — **R.C. Sharma** et al., **27**: 95-99.

Infection rat and vectorial capacity of malaria vectors in Jeypore hill tract — **S.K. Parida** *et al.*, **28**: 207-213.

Epidemic of malaria in Barmer district (Thar Desert) of Rajasthan during 1990 — **K.K. Mathur** et al., **29**: 1-10.

Enhancing the efficacy of *Gambusia affinis* to control mosquito breeding in ponds — **M.S. Malhotra** and **Anil Prakash**, **29**: 65-68.

Management of admitted malaria cases in four major hospitals of Delhi: A case study — **G.P. Singh** *et al.*, **29**: 95-103.

Biochemical alterations in *Plasmodium vivax* infected malarial patients before and after radical treatment — **R. Selvam** and **Suresh T. Mathews**, **29**: 103-111.

Involvement of gastrointestinal tract in *Plasmodium vivax* malaria — **A.K. Hati** et al., **29**: 127-128.

Malaria epidemic in Baniyani village, District Farrukhabad (U.P.) — **R.N. Prasad** et al., **29**: 219-224.

Note on urban malaria vector Anopheles stephensi (Liston) in Cochin — T. Mariappan et al., 29: 247-249.

Malaria in Shankargarh PHC, Allahabad district (U.P.): A clinical report — R.N. Yadav et al., 30: 9-16.

Trends in malaria morbidity and mortality in Sri Lanka — Jayaratne Pinikahana and Robert A. Dixon, 30: 51-55.

Oxidative stress and antioxidant defence mechanism in *Plasmodium vivax* malaria before and after chloroquine treatment — **Kumud Sarin** *et al.*, **30**: 127-133.

Role of *An. culicifacies* and *An. stephensi* in malaria transmission in urban Delhi — **S.N. Sharma** et al., **30:** 155-168.

Three genetic markers and malaria in upper caste Hindus of Kheda district of Gujarat state — **C.S. Pant** *et al.*, **30**: 229-233.

Incrimination of *Anopheles vagus* Donitz 1902 as an epidemic malaria vector in Bangladesh — **N.P. Maheswary** *et al.*, **31**: 35-38.

Correlation of malaria endemicity with An. culicifacies sibling species composition and malaria antibody profile in District Allahabad (U.P.) — **S.N. Tiwari** et al., **31**: 48-56.

Oxidative stress and malaria-infected erythrocytes — Neerad C. Mishra et al., 31: 77-87.

Epidemiological study of malaria outbreak in a hotel construction site of Delhi — **T. Adak** et al., **31**: 126-131.

Malaria paradigms in India and control strategy—**S. Pattanayak** *et al.*, **31**: 141-199.

Naturally acquired concomitant infections of Bancroftian filariasis and human plasmodia in Orissa — S.K. Ghosh and R.S. Yadav, 32: 32-36.

ABO blood groups among malaria cases from district Mandla, Madhya Pradesh — **Neeru Singh** et al., **32**: 59-63.

Investigation of malaria outbreak in Rajasthan — **R.P. Shukla, 32:** 119-128.

Incrimination of *Anopheles minimus* as a vector of malaria in Karbi Anglong district of Assam — **P. Dutta** and **J. Mahanta**, **32**: 129-131.

Epidemiological observations on malaria in villages of Buhari PHC, Surat, Gujarat — **H.C. Srivastava** *et al.*, **32**: 140-152.

Bionomics of vector Anophelines in District Naini Tal, Uttar Pradesh — **R.P. Shukla** *et al.*, **32:** 153-163.

Application of simple peptide ELISA for stratification of malaria endemicity — **Arati Roy** *et al.*, **32**: 164-173.

PARASITE BIOLOGY

An ultrastructural study on the sporogony of *Plasmodium vivax* in *Anopheles stephensi* — **Nutan Nanda** et al., **22:** 1-15.

Studies on the development of *Plasmodium vivax* in *Anopheles subpictus* — **Nutan Nanda** et al., **24**: 135-142.

Sporogonic stages of *P. berghei* (NK 65): An ultrastructural study — **M. Rastogi** *et al.*, **25**: 77-82.

Ultrastructural studies on morphogenesis of rhoptries in sporozoites of *Plasmodium berghei* (NK 65) in *Anopheles stephensi* — **M. Rastogi** *et al.*, **25:** 83-87.

Ultrastructural comparison of erythrocytic stages of experimentally selected drug resistant strains of rodent malaria parasite *P. berghei* with its susceptible strain — **Ragini Saxena** *et al.*, **26**: 199-207.

Ultrastructural study on the erythrocytic schizogony of *Plasmodium vivax* — **Nutan Nanda, 27**: 15-23.

Fine structure of the erythrocytic stages of *Plasmodium vivax* and the host cell alterations — **Nutan Nanda. 27:** 65-78.

TECHNIQUES

Culture

Isolation of *P. falciparum* in *in vitro* continuous culture from a patient treated with chloroquine 24 hour before — **C.A. Sivaraman** *et al.*, **18:** 87-90.

Isolation of *Plasmodium berghei* by density gradient centrifugation on histopaque — **Priti Kumar** and **Sohail Ahmad, 20**: 125-127.

Isolation of different erythrocytic stages of *Plasmodium falciparum* and synchronization in culture — **S. Biswas** *et al.*, **25:** 7-10.

Cryopreserved human erythrocytes for *in vitro* cultivation of *Plasmodium falciparum* — **H. Srinivasa** *et al.*, **25**: 23-25.

Influence of some growth promoting substances of multiplication of *Plasmodium falciparum in vitro* — N.K. Sutar and D.M. Renapurkar, 27: 217-222.

Parasite isolation

Isolation of different erythrocytic stages of *Plasmodium falciparum* and synchronization in culture — **S. Biswas** *et al.*, **25**: 7-10.

Staining

A technique of preparing thick blood films on soft slides — **A.E. Beljaev, 18**: 60-62.

Staining of sporozoites from infected mosquitoes—**D.S. Choudhury** and **S.K. Ghosh, 19:** 143-144.

Vital staining of the malaria parasites — V.P. Sharma, 20: 83-84.

JSB versus Giemsa stain: An evaluation — **A.S. Gautam** *et al.*, **24**: 251-253.

Ultrastructure

An ultrastructural study on the sporogony of *Plasmodium vivax* in *Anopheles stephensi* — **Nutan Nanda** *et al.*, **22:** 1-15.

Sporogonic stages of *P. berghei* (NK 65): An ultrastructural study — **M. Rastogi** *et al.*, **25:** 77-82

Ultrastructural studies on morphogenesis of rhoptries in sporozoites of *Plasmodium berghei* (NK 65) in *Anopheles stephensi* — **M. Rastogi** et al., **25:** 83-87.

Ultrastructural comparison of erythrocytic stages of experimentally selected drug resistant strains of rodent malaria parasite *P. berghei* with its susceptible strain — **Ragini Saxena** et al., **26**: 199-207.

Ultrastructural study on the erythrocytic schizogony of *Plasmodium vivax* — **Nutan Nanda**, **27**: 15-23.

Fine structure of the erythrocytic stages of *Plasmodium vivax* and the host cell alterations — **Nutan Nanda. 27:** 65-78.

REVIEWS

Problems in malaria research — T. Ramachandra Rao, 18: 4-11.

Some aspects of the socio-economic impact of malaria and its control — **A.P. Ray**, **18**: 12-20.

The interaction of drugs and immunity in malaria — W. Peters, 20: 93-106.

Chemotherapy of malaria and the host-parasite interaction — **W. Peters**, **21**: 7-16.

Splenomegaly in malaria — **H.A.H. Mashaal, 23**: 1-18.

Progress towards a malaria vaccine — **Ranjan Ramasamy**, **24**: 1-7.

Progress towards a molecular vaccine against malaria — Ranjan Ramasamy and Manthri S. Ramasamy, 26: 127-148.

Indian Journals on Malariology — B.K. Sen et al., 27: 197-204.

Repeat regions of malaria parasite proteins: A review of structure and possible role in the biology of the parasite — **Ranjan Ramasamy**, 28: 73-81.

Host immune response to *Plasmodium* — **Lalitha S. Kabilan**, **28**: 189-196.

Socio-cultural factors associated with malaria transmission: A review — **Jayaratne Pinikahana**, **29**: 121-126.

Malaria in the WHO southeast Asia region — **A.V. Kondrashin**, **29**: 129-160.

The host immune responses to *Plasmodium falciparum*: Part II — T-cell regulation of human immune responses to *Pf*155/RESA, a well-defined blood stage antigen of *Plasmodium falciparum*: A review — **Lalitha Kabilan. 30**: 12-20.

Oxidative stress and malaria-infected erythrocytes — **Neerad C. Mishra** *et al.*, **31:** 77-87.

TAXONOMY

FAUNASTIC SURVEYS

Detection and incrimination of *Anopheles minimus* Theobald 1901 as malaria vector in the foothill areas of Nagaland, India — **V.N. Bhatnagar** *et al.*, **19**: 129-133.

Mosquitoes of Andaman Islands — B.N. Nagpal and V.P. Sharma, 20: 7-13.

Mosquitoes of Mizoram — P.R. Malhotra et al., 21: 125-126.

Mosquitoes of Kutch, Gujarat — Neeru Singh et al., 22: 17-20.

Mosquitoes of Mandla district, M.P. — Neeru Singh and B.N. Nagpal, 22: 111-113.

Mosquitoes of Goa — S.M. Kulkarni et al., 23: 39-42.

Survey of the anopheline fauna of the western ghats in Tamil Nadu, India — **S.C. Tiwari** et al., **24**: 21-28.

Survey of mosquito fauna of northeastern region of India — B.N. Nagpal and V.P. Sharma, 24: 143-149.

Mosquito survey in Tirap and Subansiri districts of Arunachal Pradesh — P.R. Malhotra et al., 24: 151-158.

A note on Anopheles dirus Peyton and Harrison, 1979 [An. balabacensis (Sensu lato) Baisas, 1936] in India — H.R. Bhat, 25: 103-105.

Mosquitoes of Daman — J.S. Kamre and M.B. Kaliwal, 25: 109-111.

Studies on the anopheline fauna of Kheda district and species specific breeding habitats — **R.S. Yadav** *et al.*, **26**: 65-74.

Studies on malaria and filariasis vectors in Kamorta and Great Nicobar Island — **S.C. Das** *et al.*, **26:** 153-157.

Seasonal prevalence of anopheline in Kheda district, Gujarat — R.M. Bhatt et al., 28: 9-18.

Bionomics of Anopheles culicifacies Giles in riverine tract rural areas of District Shahjahanpur, Uttar Pradesh — **S.N. Sharma** et al., **28**: 19-28.

Mosquito fauna of certain areas of deltaic West Bengal-Apreliminary report—**Mita S. Mahapatra** et al., **28**: 45-50.

Matrix based approach for identification of Indian anophelines — **Aruna Srivastava** et al., **29**: 185-191.

Anopheline fauna and malaria incidence in Chanlang district (Arunachal Pradesh) — P. Dutta et al., 30: 135-143.

Seasonality of indoor resting mosquitoes in a broken-forest ecosystem of north-western Orissa — **S.K. Chand** *et al.*, **30**: 145-154.

Mosquitoes of Sagar Island — Mihir K. Pramanik et al., 30: 193-199.

Biology of malaria vectors in central Gujarat — **R.M. Bhatt** *et al.*, **31**: 65-76.

A note on *Anopheles culicifacies* sibling species composition in stone quarry belt of District Allahabad (U.P.) — **S.N. Tiwari** et al., **31**: 88-91.

Distribution and relative prevalence of anophelines in District south 24-parganas, West Bengal, India — Neelam Tandon and S.K. Tandon, 31: 115-121.

Indoor resting anophelines of north Bengal — P. Malakar et al., 32: 24-31.

Distribution of indoor-resting Anopheles fluviatilis in human dwellings and its implication on indoor residual spray—K. Gunasekaran et al., 32: 42-46.

Anopheline fauna of Ajodhya hills, District Purulia, West Bengal — N. **Tandon** *et al.*, **32:** 54-58.

SIBLING SPECIES

Seasonal prevalence of sibling species A and B of the taxon *Anopheles culicifacies* in villages around Delhi — Sarala K. Subbarao et al., 24: 9-16.

A note on *Anopheles culicifacies* sibling species composition in stone quarry belt of District Allahabad (U.P.) — **S.N. Tiwari** et al., **31:** 88-91.

VARIATIONS

Geographic variation in life table attributes of four populations of *Anopheles stephensi* Liston from India — P.K.B. Menon and V.P. Sharma, 18: 91-97.

A double headed An. culicifacies — G. Raman et al., 19: 147-149.

Morphological variations in a natural population of *Anopheles vagus* Donitz (1902) collected from Andaman Islands — **B.N. Nagpal** and **V.P. Sharma, 20:** 35-44.

Variations in ornamentation of palpi of *Anopheles* sundaicus Rodenwaldt (1925) collected from Andaman Islands, India — **B.N. Nagpal** and **V.P. Sharma**, **20**: 85-87.

Morphological variations in natural populations of *Anopheles stephensi* Liston 1901 collected from Kutch (Gujarat) — **B.N. Nagpal, 27**: 25-35.

Morphological variations in some Indian anophelines from Koraput district, Orissa, India — **K. Gunasekaran** *et al.*, **27**: 127-138.

Matrix based approach for identification of Indian anophelines — **Aruna Srivastava** *et al.*, **29**: 185-191.

ZOONOSIS

Investigation on simian malaria in India, and its potential as a source of zoonosis—**D.S. Choudhury**, **18**: 28-34.

VECTOR CONTROL

Urban málaria scheme of the National Malaria Eradication Programme of India — **S. Pattanayak** *et al.*, **18**: 21-27.

Experiments to test Paris green emulsion to control mosquito breeding — M. Vittal and L.B. Deshpande, 18: 117-118.

Modified plan of operation and its impact on malaria — H.C. Uprety et al., 19: 137-138.

Mosquito breeding survey in urban Delhi — **H.C. Uprety** *et al.*, **20**: 79-82.

Laboratory experiments on the effectiveness of expanded polystyrene (EPS) beads in mosquito control — **V.P. Sharma**, **21**: 115-118.

Mosquito breeding in water meter chambers — E. Narayanan and V. Maruthanayagam, 22: 47-48.

Field trials on the application of expanded polystyrene (EPS) beads in mosquito control — **R.C. Sharma** *et al.*, **22**: 107-109.

Comparative effectiveness of different anabolic and sex steroids on the development of *Anopheles stephensi* — **V. Sita** *et al.*, **23**: 61-63.

Impact of malathion thermal fogging on mosquito populations in Delhi and its place in malaria control — **V.P. Sharma** *et al.*, **23**: 65-67.

Small-scale field trials with polystyrene beads for the control of mosquito breeding — **R.K. Chandrahas** and **V.P. Sharma**, **24**: 175-180.

The value of spraying cattlesheds in a control programme — **M.A. Ansari** *et al.*, **25**: 17-22.

Evaluation of four Azadirachtin rich fractions from neem, *Azadirachta indica* A. Juss (Family: Meliaceae), as mosquito larvicides — **D. Raghunatha Rao** *et al.*, **25:** 67-72.

Insecticide impregnated ropes as mosquito repellent — **V.P. Sharma** *et al.*, **26**: 179-185.

Control of mosquito breeding in wells by the application of expanded polystyrene (EPS) beads — **S.N. Tewari** and **P.K. Tyagi**, **26**: 211-214.

Evaluation of certain mosquito repellents marketed in India — **M.A. Ansari** et al., **27**: 57-64.

Aquatic macrophytes and the associated mosquito in and around Madurai city (Tamil Nadu) — **T. John Victor** *et al.*, **28**: 151-155.

Malaria related to constructions in Panaji, Goa — **Ashwani Kumar** *et al.*, **28:** 219-225.

Malaria in WHO southeast Asia region — **A.V. Kondrashin**, **29**: 129-160.

Selection of permethrin resistance in the malaria vector Anopheles stephensi — B.C. Charkravorthy and M. Kalyanasundaram, 29: 161-165.

Trends in malaria morbidity and mortality in Sri Lanka — Jayaratne Pinikahana and Robert A. Dixon, 30: 51-55.

Preliminary observations on mosquito collections by light traps in tribal villages of Madhya Pradesh — **Neeru Singh** et al., **30**: 103-107.

Repellent action of Cymbopogan martinii martinii stapf var. sofia oil against mosquitoes — M.A. Ansari and R.K. Razdan, 31: 95-102.

Epidemiological study of malaria outbreak in a hotel construction site of Delhi — **T. Adak** et al., **31**: 126-131.

Feasibility study of insecticide-impregnated bednets for malaria control in forested villages of District Mandla (M.P.) — **Neeru Singh** *et al.*, **31**: 136-140.

Malaria paradigms in India and control strategy — **S. Pattanayak** *et al.*, **31:** 141-199.

Repellent action of neem cream against mosquitoes — V.K. Dua et al., 32: 47-53.

A study on the mosquito emergence from the underground sewerage system in some areas of Delhi — **C.P. Batra** *et al.*, **32**: 85-88.

Use of neem oil as a mosquito repellent in tribal villages of Mandla district, Madhya Pradesh — **A.K. Mishra** et al., **32**: 99-103.

Relative efficacy of various oils in repelling mosquitoes — M.A. Ansari and R.K. Razdan, 32: 104-111.

BIOCIDES

Evaluation of the formulations of the mosquito larvicidal agent BIOCID-S from *Bacillus sphaericus* 1593 M — **P.K. Mittal** *et al.*, **22**: 71-75.

Comparative cost of mosquito control with larvicidal bacilli and insecticides — **K. Balaraman** and **S.L. Hoti, 24**: 131-134.

Evaluation of *Bacillus sphaericus* to control breeding of malaria vectors — **M.A. Ansari** et al., **26**: 25-31.

Isolation and laboratory evaluation of an indigenous strain of *Bacillus sphaericus* (9001) — **D.K. Gupta** *et al.*, **28**: 147-150.

Acute toxicity of certain organochlorine, organophosphorus, synthetic pyrethroid and microbial insecticides to the mosquito fish *Gambusia affinis* (Baird and Girard) — **P.K. Mittal** *et al.*, **28**: 167-170.

Application of Bactoculicide (*Bacillus thuringiensis* H-14) for controlling mosquito breeding in industrial scrap at BHEL Hardwar (U.P.) — **Virendra K. Dua** *et al.*, **30**: 17-21.

Effect of temperature on toxicity of two bioinsecticide Spherix (*Bacillus sphaericus*) and Bactoculicide (*Bacillus thuringiensis*) against larvae of four vector mosquitoes — **P.K. Mittal** et al., **30**: 37-41.

Laboratory and field evaluation of Spherix, a formulation of *Bacillus sphaericus* (B-101), to control breeding of *An. stephensi* and *Culex quinque-fasciatus* — **P.K. Mittal** et al., **30:** 81-89.

Efficacy of two flowable formulations of *Bacillus* sphaericus against larvae of mosquitoes — **M.A. Ansari** et al., **32:** 76-84.

BIOLOGICAL CONTROL

Water mites (Arrenurus sp.) parasitising mosquitoes in Uttar Pradesh terai, District Naini Tal — V.K. Saxena and V.P. Sharma, 18: 51-52.

Studies on the role of indigenous fishes in the control of mosquito breeding — **R.C. Sharma** *et al.*, **24**: 73-77.

Bioenvironmental control of malaria linked with edible fish production in Gujarat — **D.K. Gupta** *et al.*, **26**: 55-59.

Seasonal incidence of water mites (*Arrenurus* sp.) parasitising mosquito vectors at Tezpur, Assam, India — **P.K. Sarkar** et al., **27**: 121-126.

Acute toxicity of certain organochlorine, organophosphorus, synthetic pyrethroid and microbial insecticides to the mosquito fish Gambusia affinis (Baird and Girard) — P.K. Mittal et al., 28: 167-170.

Evaluation of mosquito fish Gambusia affinis in the control of mosquito breeding in rice field — M.K. Das and R.N. Prasad, 28: 171-177.

Culture of Gambusia affinis with food fishes — **S.** Haq et al., **28**: 201-206.

Enhancing the efficacy of Gambusia affinis to control mosquito breeding in ponds — M.S. Malhotra and Anil Prakash, 29: 65-68.

Gambusia affinis: Dispersal due to floods and its failure to colonize new water bodies in Shahjahanpur district (U.P.) — **S. Haq** et al., **29**: 113-118.

Fishes of District Sundargarh, Orissa with special reference to their potential in mosquito control—**R.S. Yadav** et al., **29**: 225-233.

Water mites (*Arrenurus* sp.) parasitizing mosquitoes in District Shahjahanpur, U.P. — **S.N. Sharma** and **R.N. Prasad**, **29**: 255-258.

Availability and utility of local fishes of Shah-jahanpur for mosquito control — **S. Haq** *et al.*, **30**: 1-8.

Control of mosquito breeding through Gambusia affinis in rice fields — H. Prasad et al., 30: 57-65.

Biocontrol efficacy of Gerris (A) spinolae, Laccotrephes griseus and Gambusia affinis on larval mosquitoes — T. Ambrose et al., 30: 187-192.

Observations on mosquito breeding in wells and its control — **Rajni Kant** et al., **30**: 215-220.

Influence of soil moisture on survival and oviposition of *Romanomermis iyengari* a mermithid nematode parasite of mosquitoes — **K.P. Paily** and **K. Balaraman**, **30**: 221-225.

Comparative toxicity of certain mosquitocidal compounds to larvivorous fish, *Poecilia reticulata* — **P.K. Mittal** *et al.*, **31**: 43-47.

INSECTICIDES

Experiments to test Paris green emulsion to control mosquito breeding — M. Vittal and L.B. Deshpande, 18: 117-118.

Bioassay tests on the effectiveness of malathion spraying on *An. culicifacies* resting on different wall surfaces in Aurangabad town, Maharashtra — **M. Vittal** and **M.R. Bhate, 18**: 124-125.

Impact of DDT spraying on malaria transmission in villages with resistant *An. culicifacies* — **V.P. Sharma** *et al.*, **19:** 5-12.

Insecticide susceptibility status of malaria vectors in Maharashtra — **M. Vittal** et al., **19:** 59-61.

Susceptibility of Anopheles philippinensis to DDT and dieldrin in Assam — J. Dutta Choudhury and P.R. Maihotra, 19: 145-146.

Effect of malathion spraying on four anopheline species and the development of resistance in *An. stephensi* in Mandora, Haryana — **Sarala K. Subbarao** et al., **21**: 109-114.

Impact of DDT and HCH spraying on malaria transmission in villages with DDT and HCH resistant *An. culicifacies* — **V.P. Sharma** *et al.*, **23**: 27-38.

Impact of malathion thermal fogging on mosquito populations in Delhi and its place in malaria control — **V.P. Sharma** *et al.*, **23**: 65-67.

Village scale trial of the impact of deltamethrin (K-othrine) spraying in areas with DDT and HCH resistant Anopheles culicifacies — M.A. Ansari et al., 23: 127-131.

Comparative cost of mosquito control with larvicidal bacilli and insecticides — **K. Balaraman** and **S.L. Hoti, 24:** 131-134.

The value of spraying cattlesheds in a control programme — M.A. Ansari et al., 25: 17-22.

Ultra low volume (ULV) malathion application as a supplementary malaria control measure in two villages of south Arcot district, Tamil Nadu — **G.** Narayanasamy *et al.*, **26**: 19-24.

Insecticide impregnated ropes as mosquito repellent — **V.P. Sharma** *et al.*, **26:** 179-185.

Field evaluation of deltamethrin against resistant Anopheles culicifacies in District Ghaziabad (U.P.), India — M.A. Ansari et al. 27: 1-13.

Susceptibility status of Anopheles fluviatilis, An. annularis and An. culicifacies to insecticides in Koraput district, Orissa — **S.S. Sahu** et al., **27**: 51-53.

Role of Azolla in controlling mosquito breeding in Ghaziabad district villages (U.P.) — **M.A. Ansari** and **V.P. Sharma**. **28:** 51-54.

Insecticide susceptibility of mosquito vectors in Sundargarh district, Orissa — **S.K. Chand** and **R.S. Yadav, 28**: 65-68.

Tralomethrin (OMS-3048), a new synthetic pyrethroid against vector mosquitoes — **D. Dominic** Amalraj et al., 28: 141-145.

Acute toxicity of certain organochlorine, organophosphorus, synthetic pyrethroid and microbial insecticides to the mosquito fish *Gambusia affinis* (Baird and Girard) — **P.K. Mittal** *et al.*, **28**: 167-170.

Evaluation of Trebon (Ethofenprox) for insecticidal efficacy against mosquito larvae and on nontarget organisms — B. Baktharatchagan and B. Vasantharaj David, 28: 249-253.

Insecticide susceptibility of *An. flavirostris* in the Philippines — **Murari L. Das** *et al.*, **28**: 261-263.

Esbiothrin-impregnated ropes as mosquito repellent — M.A. Ansari et al., 29: 203-210.

Insecticide susceptibility status of An. stephensi, Cx. quinquefasciatus and Aedes aegypti in Panaji, Goa — **D. Thavaselvam** et al., **30:** 75-79.

Use of kerosene lamp containing synthetic pyrethroids to repel mosquitoes — **V.P. Sharma** et al., **30**: 169-176.

Laboratory studies of pyrethroid-netting combinations to kill mosquitoes — **B.R. Jana Kara** *et al.*, **31**: 1-11.

Phytotoxicological evaluation of Tagetes erectes on aquatic stages of An. stephensi — Manik Sharma and R.C. Saxena, 31: 21-26.

Field trial of esbiothrin-impregnated rope in Ramgarh village, Dadri PHC, District Ghaziabad (U.P.) — M.A. Ansari and R.K. Razdan, 31: 57-64.

Field evaluation of mosquito repellent action of neem oil — **Rajni Kant** and **R.M. Bhatt, 31**: 122-125.

Feasibility study of insecticide-impregnated bednets for malaria control in forested villages of District Mandla (M.P.) — **Neeru Singh** et al., **31**: 136-140.

Larvicidal activity of a few plant extracts against Cx. quinquefasciatus and An. stephensi — E. Pushpalatha and J. Muthukrishnan, 32: 14-23.

Distribution of indoor-resting An. fluviatilis in human dwellings and its implication on indoor residual spray — K. Gunasekaran et al., 32: 42-46.

Repellent action of neem cream against mosquitoes — V.K. Dua et al., 32: 47-53.

A study on insecticide resistance in *An. fluviatilis* and *An. culicifacies* to HCH and DDT in the Malkangiri district of Orissa — **S.S. Sahu** and **K.P. Patra.**, **32**: 112-118.

Epidemiological observations on malaria in villages of Buhari PHC, Surat, Gujarat — **H.C.** Srivastava *et al.*, **32**: 140-152.

INTEGRATED CONTROL

Laboratory experiments on the effectiveness of expanded polystyrene (EPS) beads in mosquito control — **V.P. Sharma**, **21**: 115-118.

Field trials on the application of expanded polystyrene (EPS) beads in mosquito control — **R.C.** Sharma et al., 22: 107-109.

Bioenvironmental control of malaria in Nadiad, Kheda district, Gujarat — V.P. Sharma et al., 23: 95-117.

Cost effectiveness of the bioenvironmental control of malaria in Kheda district, Gujarat — V.P. Sharma and R.C. Sharma, 23: 141-145.

Small-scale field trials with polystyrene beads for the control of mosquito breeding — R.K. Chandrahas and V.P. Sharma, 24: 175-180.

Bioenvironmental control of malaria linked with edible fish production in Gujarat — **D.K. Gupta** et al., **26**: 55-59.

Bioenvironmental control of malaria in a tribal area of Mandla district, Madhya Pradesh, India—Neeru Singh et al., 26: 103-120.

Malaria among bednet users and non-users — P. **Dutta** *et al.*, **26**: 171-172.

Insecticide impregnated ropes as mosquito repellent — **V.P. Sharma** et al., **26**: 179-185.

Control of mosquito breeding in wells by the application of expanded polystyrene (EPS) beads—**S.N. Tiwari** and **P.K. Tyagi**, **26**: 211-214.

Evaluation of certain mosquito repellents marketed in India — M.A. Ansari et al., 27: 57-64.

Acute toxicity of certain organochlorine, organophosphorus, synthetic pyrethroid and microbial insecticides to the mosquito fish *Gambusia affinis* (Baird and Girard) — **P.K. Mittal** et al., **28**: 167-170.

Bioenvironmental control of malarta at the Indian Drugs and Pharmaceuticals Ltd., Rishikesh (U.P.) — V.K. Dua et al., 28: 227-235.

Fishes of District Sundargarh, Orissa with special reference to their potential in mosquito control — **R.S. Yadav** et al., **29**: 225-233.

Availability and utility of local fishes of Shah-jahanpur for mosquito control — **S. Haq** et al., **30**: 1-8.

Observations on mosquito breeding in wells and its control — **Rajni Kant** *et al.*, **30**: 215-220.

Laboratory studies of pyrethroid-netting combinations to kill mosquitoes — B.R. Jana Kara et

al., 31: 1-11.

Resting and biting habits of *An.* sundiacus in Car Nicobar Island — **Roop Kumari** and **V.P. Sharma**, **31**: 103-114.

Repellent action of neem cream against mosquitoes — V.K. Dua et al., 32: 47-53.

Relative efficacy of various oils in repelling mosquitoes — M.A. Ansari and R.K. Razdan, 32: 104-111.

LARVICIDES

Experiments to test Paris green emulsion to control mosquito breeding — M. Vittal and L.B. Deshpande, 18: 117-118.

Laboratory experiments on the effectiveness of expanded polystyrne (EPS) beads in mosquito control — **V.P. Sharma**, **21**: 115-118.

Field trials on the application of expanded polystyrene (EPS) beads in mosquito control — **R.C. Sharma** *et al.*, **22**: 107-109.

Comparative cost of mosquito control with larvicidal bacilli and insecticides — **K. Balaraman** and **S.L. Hoti, 24:** 131-134.

Small-scale field trials with polystyrene beads for the control of mosquito breeding — **R.K. Chandrahas** and **V.P. Sharma**. **24**: 175-180.

Evaluation of four Azadirachtin rich fractions from neem, Azadirachta indica A. Juss (Family: Meliaceae), as mosquito larvicides — D. Raghunatha Rao et al., 25: 67-72.

Control of mosquito breeding in wells by the application of expanded polystyrene (EPS) beads — **S.N. Tiwari** and **P.K. Tyagi**, **26**: 211-214.

Evaluation of Juvenile harmone analogue JHM/S-31183 against immature stages of mosquitoes in natural habitats — **M.A. Ansari** et al., **28**: 39-43.

Evaluation of mosquito fish Gambusia affinis in the control of mosquito breeding in rice field — M.K. Das and R.N. Prasad, 28: 171-177.

CUMULATIVE INDEX (1981-1995)

Author Section

Abuzar, Syed **24**: 17 Achary, P.M.R. **30**: 193

Achuthan, C. 18: 63, 126; 25: 59

Adak, T. **18**: 98; **19**: 27, 83; **20**: 59, 161; **21**: 109; **24**: 9, 135: **28**: 167; **30**: 37, 81; **31**: 1, 43, 126; **32**: 85

Agarwal, S.S. **18**: 67; **19**: 21, 33; **20**: 15; **21**: 71, 99; **24**: 79, 125

Agarwala, R.S. **23**: 81 Aggarwal, S.K. **19**: 109 Agnihotri, S.K. **28**: 179

Ahmad, Sohail 20: 125; 23: 43; 28: 99

Aikat, B.K. **19**: 115; **20**: 147 Amalraj D. Dominic **28**: 141

Ambrose, T. 30: 187

Ansari, M.A. **19**: 65; **20**: 21; **21**: 121; **23**: 27, 65, 75, 127, 147; **24**: 119, **25**: 17, 73; **26**: 25, 179; **27**: 1, 57; **28**: 39, 51, 161; **29**: 203; **30**: 169; **31**: 57, 95; **32**: 76, 104

Appavoo, N.C. **21**: 21; **26**: 19 Arif, A.J. **22**: 35; **24**: 59, **26**: 173

Arora, Usha **27**: 205 Arunachalam, N. **29**: 247 Arva, Abha **25**: 77

Asthana, Omkar P. 25: 89

Badam, Lalita **24**: 111 Bagar, S. **18**: 57 Baishya, K.K. **21**: 25 Bajpai, Renu **25**: 1

Baktharatchagan, R. **28**: 249 Balakrishnan, S. **21**: 105 Balaraman, K. **24**: 131; **30**: 221

Balgir, R.S. **27**: 237 Banerjee, B.P. **18**: 119 Banerjee, P.K. **28**: 157 Banerji, A.K. **26**: 91 Bansal, S.K. **30**: 119 Banyal, H.S. **19**: 73

Barkakaty, B.N. 18: 47, 109; 21: 55; 22: 29; 27: 223; 29: 89, 173

Baruah, B.D. 24: 159

Baruah, I. **21**: 125; **22**: 53; **26**: 153; **27**: 111; **28**: 129

Basak, B. **32**: 54 Basil, A. **22**: 71

Batra, C.P. **20**: 21; **21**: 121; **23**: 27, 65, 127, 147; **25**: 17, 73; **26**: 25; **28**: 161; **30**: 81; **31**: 126; **32**: 85

Beljaev, A.E. 18: 60; 22: 85; 23: 19; 24: 97

Bendley, M.S. 18: 21

Bhalla, S.C. 18: 35; 23: 27: 24: 79

Bhambhani, S. 29: 47

Bharadwaj, Y. 24: 119; 25: 73

Bhat, H.R. **25**: 103 Bhat, P. **21**: 127 Bhate, M.R. **18**: 124 Bhati, P.G. **27**: 149; **32**: 93

Bhatia, A. 20: 107; 28: 237; 29: 23

Bhatnagar, V.N. 19: 129

Bhatt, R.M. **26**: 65, 75; **27**: 167; **28**: 9, 91, 147; **29**: 11, 41, 57, 83, 251, 235; **30**: 91, 215, 229; **31**: 65, 122

Bhattacharya, M. **28**: 215 Bhattacharya, S. **22**: 65; **23**: 119 Bhattacharya, U. **24**: 45; **25**: 51 Bhattacharyya, Amrita **25**: 107

Bhattacharyya, D.R. **26**: 95, 149, 171; **28**: 121; **30**:

Bhuyan, M. 21: 125; 26: 153; 27: 111; 28: 129

Bhuyan, M.K. 22: 29 Das. N.G. 24: 151; 26: 153 Bhuyya, 21: 25; Das, P.K. 24: 17: 27: 51, 173, 209; 28: 29, 55; 32: Biswas, D. 24: 85; 25: 107; 29: 195; 30: 109 Das, S. 18: 47, 109; 21: 55; 23: 119; 25: 99; 32: Biswas, S. 23: 123; 25: 7, 11; 27: 139; 28: 1; 29: 24.54 47: 30: 67 Das, S.C. 22: 53; 26: 153; 27: 111; 28: 129 Bose, T.K. 29: 167 Das, S.K. 24: 79, 125 Brohult, J.A. 22: 85; 23: 19, 151; 24: 97 Das, Sukumar, 28: 45 Dasgupta, B. 32: 24, 89 Cardona, Eulogio V. 28: 261 Dasgupta, R.K. 27: 205 Chakraborty, S. 22: 65; 23: 119 Dash, B.K. 23: 81 Chakravorthy, B.C. 29: 161 Dass, C.M.S. 22: 1; 24: 135 Chand, Gyan 25: 41 David, B. Vasantharaj 28: 249 Chand, S.K. 26: 167; 28: 65, 105; 30: 145 De, M.K. 27: 45; 29: 127 Chandra, G. 25: 107; 27: 45 Deo, R.R. 19: 59, 63 Chandra, S. 19: 39, 125; 22: 35; 24; 17, 59; 26: 173; 27: 163 Deobhankar, R.B. 19: 59 Chandrahas, R.K. 20: 163; 22: 77, 119; 23: 27; 24: Deolankar, R.P. 24: 111 175; **26**: 87; **31**: 132 Deshpande, L.B. 18: 117; 19: 59 Chatteriee, K.K. 24: 85: 25: 107: 27: 45; 29: 195: Dev. Vas 30: 135; 31: 31 **30**: 109 Dewan, S. 29: 47 Chatterjee, P.S. 29: 127 Dhal, K.B. 23:81 Chatterjee, R.N. 28: 157 Dhanpal, J. 23: 39 Chattopadhyay, R.N. 30: 183 Dixon, Robart A. 30: 51 Chaudhari, D.T. 18: 73; 19: 49 Dua, V.K. 23: 151; 26: 83, 123; 28: 199, 227; 30: Chelleng, P.K. 28: 137 17, 29; 32: 47 Choudhuri, A.R. 31: 35 Dubey, M.L. 26: 187; 28: 179 Choudhuri, D.K. 30: 109 Dutt, S.C. 27: 37, 101 Choudhuri, S.K. 24: 183 Dutta, Choudhury J. 19: 145 Choudhury, D.S. 18: 28; 19: 69, 101, 143, 20: 21, Dutta, G.D.P. 24: 17; 29: 219 49, 63; **23**: 49; **24**: 79, 95 107; **26**: 87, 167: **30**: Dutta, G.P. 18: 67: 19: 21, 33, 45, 73, 91, 121; 20: 155 1, 15, 71, 153; **21**: 31, 71, 79, 89, 99; **23**: 133; Choudhury, Nabajyoti 28: 179 **24**: 17, 125; **25**: 1, 27, 33; **26**: 199; **28**: 255 Chugh, T.D. 19: 71 Dutta, L.P. 26: 95, 149, 171; 27: 237; 28: 121, 137; Collins, R.T. 23: 81 **30**: 179 Curtis, C.F. 31: 1 Dutta, P. 24: 159; 26: 95, 149, 171; 24: 159; 28: 121, 137, **30**: 135; **32**: 129 Dutta, R.N. 29: 195 Damian, Loreto V. 28: 261 Das, B.S. 29: 167; 30: 45 Dwivedi, S. 28: 215 Dwivedi, S.R. 18: 35, 63, 109, 119; 19: 21, 33, 129 Das, D.B. 30: 45 Das. D.C. 29: 127 Das. L.K. 26: 33 Eapen, Alex 31: 132 Das, M. 19: 129 Ericsson, O. 23: 151 Das, M.K. 28: 171: 31: 27 Das, M.L. 28: 261 Faruque, M.S. 31: 35

Fernando, N.K. 29: 29

Das, M.S. 25: 99

Jambulingam, P. 27: 51, 127, 173, 209; 28: 29, 55, Gajanana, A. 18: 87; 19: 1; 21: 25; 22: 49; 23: 91 207; 29: 69; 32: 42 Ganesh, A. 31: 39 Jana Kara, B.R. 31: 1 Ganguly, N.K. 21: 17; 26: 187; 28: 179 Jayaraman, Kunthala 22: 71 Garg, S.K. 21: 17 John, T. Jacob 31: 39, 92 Garnham, P.C.C. 18: 57 John, V.M. 24: 151 Gautam, A.S. 23: 95; 27: 95, 157; 28: 9, 69, 91, Jolly, J.G. 28: 179 147, 183; **29**: 11, 41, 57, 83, 235, 251; **30**: 91, 215, 229Joshi, Hema 24: 29, 33; 28: 161; 20: 201; 31: 48 Ghatak, S. 18: 80: 19: 39, 125 Joshi, P.L. 28: 215 Ghosh, K.K. 22: 65; 23: 119 Kabilan, Lalitha S. 28: 189: 31: 12, 77 Ghosh, K.N. 28: 157 Ghosh, R.B. 18: 119 Kalita, P.C. 21: 55; 22: 29 Kaliwal, M.B. 25: 109 Ghosh, S.K. 19: 69, 101, 143; 20: 49, 63; 24: 95, 107; **26**: 87, 167; **27**: 85; **28**: 105; **29**: 195, 211; Kalra, N.L. 29: 1, 95; 31: 141 **32**: 32 Kalvanasundaram, M. 29: 161 Giri, A. 30: 201; 31: 27 Kamath, Vijayalaxmi 25: 119 Gitanjali, Y. **25**: 67 Kamboj, K.K. 20: 1; 21: 79 Gopal, Krishan 24: 125 Kant, Rajni 29: 41, 57; 30: 215; 31: 122; 32: 93-Gopalan, P. 19: 147 Kapali, V. 21: 21; 26: 19 Govardhini, P. 28: 29, 55; 29: 69 Kar, P.K. 24: 45; 25: 51; 30: 28 Grinberg, L.N. 23: 49 Karanjai, Aruna 27: 197 Gudadhe, P.P. 18: 73; 19: 49 Kareem, M.A. 26: 215; 29: 63 Guha, A.K. 18: 109 Karmakar, P. 27: 37,101 Kaushik, N.K. 19: 13 Gunasekaran, K. 27: 51, 127, 173, 209; 28: 207; **32**: 42 Kazim, Mahmood 23: 133; 26: 199; 28: 255 Gupta, A.N. 26: 61 Khadse, B.G. 25: 119 Gupta, C.M. 22: 21 Khamre, J.S. 25: 109 Gupta, D.K. 24: 73; 26: 55; 28: 9, 91, 147; 29: 11, Khan, Haris M. 23: 43; 28: 99 41, 57, 83, 235, 257; **30**: 91, 215, 229 Khan, M.M.A. 26: 215: 29: 63 Gupta, V.K. 19: 5, 137 Khan, M.T. 31: 136 Gupte, Satish 19: 71 Khanna, Raka 23: 43: 28: 99 Khare, S. 19: 39, 125 Haq, S. 27: 195; 28: 201; 29: 113; 30: 1, 57 Khety, Zarine 25: 119 Haque, M.A. 22: 85; 23: 19 Khullar, N. 22: 21; 28: 243 Harpalani, G. 29: 1 Kohli, S. 18:41 Hati, A.K. 22: 65; 23: 119; 24: 85; 25: 107; 27: 45; Kohli, V.K. 27: 167; 28: 91 **29**: 127, 195; **30**: 109, **32**: 24 Kondrashin, A.V. 24: 89; 29: 129 Hayes, C.G. 18: 57 Kudesia, Madhur 24: 125 Hazarika, S. 24: 151 Kulkarni, M.M. 24: 111 Hiriyan, J. 24: 21 Kulkarni, S.M. 20; 159; 23; 39; 24; 163; 26; 41; 27: 187 Hoti, S.L. 24: 131 Kulshrestha, A.K. 30: 9; 31: 88 Huailu, Chen 32: 37 Kumar, A. 26: 167; 27: 85; 28: 105, 219; 29: 35; Husain, Mujtaba 21:31 30: 75 Hussain, Q.Z. 23: 123 Kumar, Ajay 30: 127 Kumar, Hemant 28: 99 Jaiswal, A. 31: 136 Kumar, L. Cyril Arun 30: 187 Jaleel, N. 24: 181

Kumar, Priti 20: 125 Misra, B.G. 19: 129 Kumar, Ramesh 18: 41; 20: 115; 21: 37, 45; 23: Misra, S.P. 29: 95; 32: 89 75: **24**: 119; **25**: 73 Mittal, P.K. 22: 71; 23: 65, 127; 25: 17; 26: 25, 179; Kumar, Suresh 30: 29 **27**: 1, 57; **28**: 39, 167; **30**: 37, 81; **31**: 43, 126; **32**: 76, 85 Kumar, Yogendra 20: 129 Mohanty, D. 29: 167 Kumaresan, P.R. 28: 115 Mohanty, S. 29: 167 Kumari, Roop 30: 201: 31: 103 Mohapatra, L.N. 20: 115; 21: 37, 45 Mohaparta, S.S.S. 26: 33; 28: 29, 55; 29: 69 Lahiri, S.C. 24: 45; 25: 51 Montanari, R.M. 31: 35 Ligat, Boeni S. 28: 261 Mukherjee, A. 25: 99 Mukherjee, H. 28: 127; 30: 109 Mahajan, R.C. 21: 17; 26: 61, 187; 28: 179 Munshi, Usha Mujoo 27: 197 Mahanta, J. 32: 129 Murthy, G.G.K. 29: 1 Mahapatra, A.K. 26: 91; 27: 223, 243 Mustafa, S.M. 19: 59 Mahapatra, Mita S. 28: 45 Muthukrishnan, J. 32: 14 Mahapatra, P.K. 27: 223 Mahdi, Abbas Ali 28: 99 Nagaraj, C. 19: 147 Maheswary, N.P. 31: 35 Nagpal, B.N. 20: 7, 35, 79, 85, 129, 141; 22: 17, Maitra, S.C. 25: 77 83; 26: 199 111, 115, 119; **23**: 27, 57; **24**: 143; **27**: 25; **29**: Maitra, S.K. 30: 183 185; 32: 47, 64 Maity, C.R. 29: 127 Nagsampgi, B.A. 24: 111 Majumdar, S. 31: 35 Naik, Prashant S. 26: 41 Malakar, P. 32: 24 Naik, V.M. 23: 39 Malaviya, A.N. 18: 41; 20: 115; 21: 37, 45 Nair, A.S. 30: 207 Malhotra, M.S. 20: 21, 49, 63; 22: 57, 123, 29: 65 Nair, Latika S. 30: 207 Malhotra, P.R. 19: 145; 21: 125; 24: 151; 27: 121 Nanda, N.C. 30: 45 Malviya, V.S. 27: 149; 32: 93 Nanda, Nutan 19: 5; 22: 1; 24: 135; 27: 15, 65 Mani, T. 30: 187 Nandi, J. 32: 89 Mant, T.R. 19: 65 Narasimham, M.V.V.L. 27: 37, 101, 205, 223: 28: Manoharan, A. 28: 29, 55 255; 29: 1, 89, 95, 173 Mariappan, T. 247 Narayanan, E. 22: 47 Marimuthu, S. 28: 151 Narayanasamy, G. 26: 19 Maruthanayagam, V. 22: 47 Nath, Amar 18: 67: 19: 21,33; 20: 15: 21: 99 Mashaal, H.A.H. 23: 1 Nath, D.R. 26: 153; 27: 121 Mathai, Dilip 31: 39, 92 Nath, L.M. 18: 41 Mathai, E. 31: 39, 92 Nityanand, Swarn 25: 89 Mathews, Suresh T. 29: 103 Nooshtaev, D.A. 23: 49 Mathews, T. Thresia 30: 187 Mathur, A. 32: 119 Orlov, V. 27: 95: 31: 141 Mathur, K.K. 29: 1 Mathur, P.D. 22: 35: 24: 59 Padhan, K. 29: 225 Padmavathi, V. 20: 115; 21: 37, 45 Menon, P.K.B. 18: 91; 20: 21 Mishra, A.K. 26: 103; 27: 55; 30: 103; 31: 136 Paily, K.P. 30: 221

Pal, N.L. 24: 39; 26: 9

Palit, A. 22: 65

Mishra, Neerad C. 31: 77

Mishra, S.K. 29: 167; 30: 45

Pande, Anita 19: 121 Rao, A. Ramalingeswara 24: 181 Pandey, A.C. 32: 119 Rao, B. Kishen 23: 61 Pandey, K.C. 30: 155 Rao, C.V.R. Mohan 18: 119 Pandey, V.C. 19: 73, 97; 20: 71; 21: 89; 25: 33 Rao, D.N. 27: 243 Rao, D. Raghunatha 23: 61; 25: 67 Pandya, A.P. 27: 223 Pani, S.P. 26: 33; 29: 69 Rao, G.K. 26: 215 Rao, S.N. 23: 75 Panicker, K.N. 29: 247 Pant, C.S. 22: 71; 29: 235; 30: 229 Rao, T. Ramachandra 18: 4 Rastogi, A.K. 28: 215 Parashar, Aruna 19: 115; 20: 147 Rastogi, K.C. 18: 35, 63, 109, 119 Parida, S.K. 19: 5; 27: 127, 209; 28: 207 Rastogi, M. 24: 39; 25: 77, 83; 26: 9 Parikh, P.J. 32: 1 Ray, A.P. 18: 12 Passey, M.N. 24: 125 Razdan, R.K. 19: 65; 20: 21; 23: 27, 65, 75, 127, Patel, H.R. 32: 1 147; **24**: 119; **25**: 17, 73; **26**: 25, 179 **27**: 1, 57; Patel, K.H. 32: 1 **28**: 39, 161; **29**: 203; **30**: 169; **31**: 57, 95; **32**: 76, Patel, R.Z. 32: 1 Pathak, K.J. 32: 1 Regis, M.L. 18: 87 Patnaik, J.K. 29: 167; 30: 45 Renapurkar, D.M. 18:73; 19:49; 25:119; 27:217; Patra, K.P. 27: 127: 28: 207: 32: 112 29:73 Pattanayak, S. 18: 21, 35, 47, 63, 109, 119, 126; Reuben, R. 24: 21; 25: 67; 26: 19 31: 141 Rooney, W. 24: 89 Peters, W. 20: 93; 21: 7 Roy, A. 24: 51, 65; 25: 7; 27: 139; 31: 48 Pillai, C.R. 30: 23 Rov. J.R. 18: 109 Pinikahana, Jayaratne 29: 121; 30: 51 Roy, Kunal B. 24: 65. Prakash, Anil 29: 65; 30: 9, 127; 31: 48, 88 Roy, R.G. 18: 21, 35, 47, 63, 109, 119, 126; 21: 21, Pramanik, Mihir K. 30: 193 105 Prasad, H. 27: 195; 28: 201; 29: 113; 30: 1, 57 Roy, S. 24: 45; 25: 51; 30: 183 Prasad, H.B. 18: 63, 126 Prasad, R.N. 21: 17; 26: 61; 27: 47, 195; 28: 19, 83, Sabharwal, Uma 19:71 171, 201; **29**: 113, 219, 255; **30**: 1, 57 Sadanand, A.V. 24: 181 Pujara, P.K. 31: 65; 32: 93 Sadanandane, C. 27: 127, 173, 209; 28: 207 Puri, Anju **20**: 153 Saha, G.K. 32: 24 Puri, S.K. 19: 45, 91; 28: 255 Sahu, H. 18: 63 Pushpalatha, E. 32: 14 Sahu, S. 28: 29 Sahu, S.S. 27: 51, 127, 173, 209; 28: 207; 32: 112 Raghvendra, K. 23: 27; 24: 29, 33; 28: 161 Saini, A.S. 19: 109 Rai, Jagdish 18: 67 Samantaray, K.C. 22: 85; 24: 97 Raichowdhuri, A.N. 18: 87; 19: 1; 21: 25 Samnotra, K.G. 18: 21 Raina, Rita 27: 163 Samuel, Sam Jayanth 25: 23 Raina, V.K. 19: 5 Sarin, Kumud **30**: 127 Raj, B. 28: 215 Sarkar, P.K. 24: 151; 27: 121 Rajput, K.B. 23: 155 Sarkar, Sagartirtha 30: 193 Raman, G. 18: 63, 126; 19: 147 Satpathy, R. 30: 45 Ramanaiah, T.V. 26: 87 Satpathy, S.K. 29: 167 Ramasamy, Manthri S. 26: 127; 29: 29

Ramasamy, Ranjan 24: 1; 26: 127, 28: 73; 29: 29

Satvanarayana, S. 28: 137; 30: 179

Saxena, A.K. 27: 163 **28**: 39, 51, 167, 183, 199, 219, 227; **29**: 113, 185, 203, 211, 225; **30**; 17, 29, 37, 81, 145, 169, Saxena, B.N. 26: 45 201; 31: 1, 43, 48, 103, 126, 141; 32: 6, 47, 59, Saxena, J.K. 18: 80 64, 70, 76, 99 Saxena, Mridula 27: 163 Shastri, H. 32: 1 Saxena, Nalini 19: 97; 20: 71; 21: 89 Shetty, N.J. 20: 45 Saxena, Q.B. 25: 7, 11: 27: 139; 28: 1 Sholapurkar, S.L. 26: 61 Saxena, R.C. 31: 21 Shukla, Binduja 25: 1 Saxena, Ragini 23: 133; 26: 199 Shukla, M.M. 25: 41; 26: 45; 27: 183; 29: 199; 32: Saxena, Rekha 29: 185 6, 59, 70 Saxena, S.K. 25: 27, 33 Shukla, R.P. 20: 49; 22: 57, 123; 29: 113; 32: 119 Saxena, V.K. 18: 51 Sitaram, U. 31: 39, 93 Sebastian, M.J. 25: 23 Singh, Chanan 22: 35; 24: 59; 26: 173 Sehgal, S. 19: 13, 115; 20: 147; 22: 21; 28: 243 Singh, G. 28: 215 Selvam, R. 28: 115; 29: 103 Singh, G.P. 29: 95 Sen. A.B. 18: 80: 19: 39, 125; 22: 35; 24: 39, 59: Singh, Gurcharan 27: 205 **25**: 77, 83; **26**: 9; **27**: 163 Singh, Karam V. 30: 119 Sen. A.K. 24: 183 Singh, M.P. 32: 70 Sen, B.K. 27: 197 Singh, Neeru 22: 17, 111; 25: 41; 26: 1, 45, 87, Sengupta, S.R. 29: 73 103, 191; **27**: 55, 183; **29**: 199; **30**: 103; **31**: Seth, R.K. 19: 109 136; **32**: 6, 59, 70, 99 Sharma, A.K. 30: 67 Singh, Nihal 24: 89 Sharma, Arun 30: 127; 31: 77 Singh, N.N. 30: 23 Sharma, C.K. 26: 95 Singh, O.P. 26: 103, 191; 30: 103; 31: 136 Sharma, G.K. 22: 29, 85; 23: 19, 27, 65; 24: 97; 28: Singh, T.K. 23: 155 183 Singh, Vijay Kumar 19: 1 Sharma, Manik 31: 21 Sinha, Ragini 21: 99; 24: 125 Sharma, Pawan 18: 67; 19: 21, 33: 20: 15: 21: 31, Sinha, S. 19: 1; 21: 25; 22: 49; 23: 91; 24: 95, 107; 71; 22: 29 **26**: 83, 123 Sharma, R.C. 22: 107; 23: 95, 141; 24: 73; 25: 113, Sita, V. 23: 61 117; **26**: 55, 65, **7**5; **27**: 37, 95, 101, 149, 157, Sitaram, U. 30: 39; 31: 92 167; **28**: 9, 69, 91, 147, 183; **29**: 11, 41, 57, 83, Sivaramakrishnan, K.G. 27: 233; 28: 151 235, 251; **30**: 91, 215, 229 Sivaraman, C.A. 18: 87; 22: 49 Sharma, R.S. 27: 205: 31: 141 Soan, V. 26: 191 Sharma, S.K. 26: 187; 28: 137, 199, 227; 30: 17. Soprunov, F.F. 23: 49 Srimannarayana, G. 25: 67 Sharma, S.N. 27: 47; 28: 19, 83; 29: 255; 30: 155 Sharma*, S.N. 30: 113 Srinivasa, H. 21: 127; 25: 23 Sharma, Satyavan 24: 17: 26: 187 Srivastava, A. 23: 75; 29: 185; 32: 64 Sharma, T. 29: 219: 30: 1 Srivastava, D.K. 32: 70 Sharma, Usha 20: 129 Srivastava, H.C. 26: 161: 30: 91, 215; 31: 65: 32: Sharma, V.P. 18: 51, 91, 103; 19: 5, 27, 57, 65, 83, 137, 139; **20**: 7, 21, 35, 49, 59, 79, 83, 85, 129, Srivastava, I.K. 18: 67; 19: 21, 33, 97; 20: 15; 21: 137, 141, 161, 163; **21**: 109, 115, 121; **22**: 1, 17, 71, 99; 24: 125 57, 71, 77, 107, 115, 119, 123; **23**: 27, 49, 57, Srivastava, P.K. 20: 79; 22: 77, 119; 23: 27 65, 75, 95, 127, 141, 147, 151; **24**: 9, 29, 33, 51, Srivastava, R. 32: 6 65, 73, 79, 95, 107, 119, 135, 143, 175; **25**: 7, Srivastava, Rahul 21:89 11, 17, 41, 73, 113, 117; 26: 1, 25, 45, 55, 65, Srivastava, S.K. 19: 45 75, 83, 87, 103, 123, 179; **27**: 1, 55, 57, 85, 95;

Srivastava, V.M.L. 19: 125

Subbarao, Sarala K. 18: 98; 19: 27, 83; 20: 59.

161; **21**: 109; **24**: 9, 29, 33, 135; **28**: 161; **30**:

155; 31: 48

Subonesan, N. 29: 29

Subrahmanyam, D. 19: 13

Subramaniam, S. 28: 29, 55

Sudarsanam, A. **31**: 39, 92

Sumodan, P.K. **30**: 75

Sutar, N.K. 27: 217; 29: 73

Talukdar, A.C. 21: 55

Talukdar, P.K. 26: 153; 27: 121: 28: 129

Tandon, Neelam 22: 65; 28: 45; 31: 115; 32: 54

Tandon, S.K. 31: 115

Tangri, A.N. 25: 89

Tejwani, B.M. 32: 70

Tewari, S.C. 24: 21

Thaker, H.M. 29: 11

Thakur, A. 29: 241

Thakur, S.S. 23: 61

Thavaselvam, D. 28: 219; 29: 35; 30: 75

Thomas, Molly 31: 39, 92

Tiwari, S.N. 26: 211: 27: 79; 30: 9; 31: 48, 88

Tripathi, K.D. 30: 67

Tyagi, P.K. 26: 211; 27: 79; 30: 9

Uniyal, V.P. 32: 59

Upender, M. 28: 1

Uprety, H.C. 19: 5, 137, 139; 20: 79; 22: 77

Usha Devi, C. 19: 101; 20: 63; 23: 49; 24: 95, 107

Valecha, N. 29: 47, 199; 30: 67

Varma, Tushar K. 18: 103; 20: 137

Vasantha, K. 19: 27, 83; 20: 161; 21: 109:

24:9

Vasisth, S. 23: 91

Vasuki, V. 28: 141

Velayudhan, R. 28: 141

Venkataraman, K. 27: 233

Venkatesan, E.A. 30: 39; 31: 92

Verma, I.C. 29: 241

Vernes, A. 29: 23

Victor, T. John 27: 233; 28: 151

Vijayakumar, K.N. 29: 247

Vinayak, V.K. 20: 107; 28: 237

Vincent, S. 30: 187

Virk, J. 29: 219

Vittal, M. 18: 117, 124; 19: 59, 63

Wanmin, Kang 32: 37

Wagh, U.V. 24: 11

Wijesundere, A. 29: 29

Yadav, R.N. 30: 9

Yadav, R.N.S. 28: 137; 30: 179

Yadav, R.S. 22: 107; 26: 65, 75; 27: 85; 28: 65,

105; **29**: 211, 225; **30**: 145; **32**: 32

Yadava, J.N.S. 20: 153

Yadava, R.L. 18: 35; 19: 21

Yajnik, V. 24: 65

Yunhua, Xi 32: 37

^{*}Directorate of NMEP, Delhi.

INDIAN JOURNAL OF MALARIOLOGY

Instructions to Authors

Editorial Policy

The 'Indian Journal of Malariology' is devoted to the publication of original research papers which contribute significantly to any field of malariology. Papers of routine and repetitive nature dealing with gross observations may not be included. Articles will be published at the Editor's discretion in the order accepted. Date of acceptance will be the date on which copy is accepted in final form for publication. The authors should also submit names of three experts in the field of research on which the paper has been submitted. If there is no expert in India, experts from outside the country may be suggested. Manuscripts in triplicate along with the undertaking form duly filled by author(s) should be submitted to:

The Editor Indian Journal of Malariology 20-Madhuvan Delhi-110 092, India.

Classes of Items Published

In addition to full papers the Journal publishes short note. Review articles are also invited. Book reviews may also be published at the end of the journal.

Format

The matter should be arranged in the following order: Title, Name(s) of the author(s) with address of the Institute/

University (as footnotes and indicated serially in superscript), Abstract, Introduction, Materials and Methods, Results, Discussion, Acknowledgements and References. Authors should provide keywords and a short title to be used as running title, of not more than five words.

Preparation of Copy

Manuscript should be typewritten in English on one side of the paper leaving $1^1/_2$ inch left-hand margin. The entire matter should be typed double space including references, tables and captions. Abstract, tables, references and legends for illustrations should be typed on separate sheets of paper. Pages are to be numbered consecutively.

Tables should be placed singly on sheets of paper, along with relevant headings and footnotes. Table width should not be more than 80 characters including column space and should be self-explanatory and referred to in the text. Tables should be numbered in arabic numerals (e.g. 1, 2); avoid roman numerals (e.g. I, II). Do not use any horizontal or vertical lines in the body of the table.

Footnotes to the text should be avoided as far as possible parenthetical insertions are preferable.

Illustrations should be sent in triplicate. All illustrations including figures, pho-

We accept manuscript on $3^{1}/_{2}$ and $5^{1}/_{4}$ floppies in MS word.

tographs, graphs and maps should be numbered consecutively in the order in which they appear in the text. Captions and legends should be typed separately and must not appear on the face of illustrations. Authors should identify each illustration on the reverse side with author's name, fig. no. and abbreviated captions. Line drawings should be clear, and letters and numerals should be planned for legibility after reduction. Labelling should be neat and accurate. Photographs should be sharp, glossy, black and white prints, preferably mounted and covered with a transparent overlay for protection. Photographs should have allowance for reduction to 1/3 size. The approximate sizes of art work should be: 24 x 21 cm for quarter page, 45 x 24 cm for half page and 57 x 45 for full page.

Data for tables, graphs, etc. should be carefully verified. All statistics, percentages and other calculations should be checked thoroughly before submission of a paper. Once a paper is accepted for publication, data in it would be treated as final.

Nomenclature. Authors of scientific names of insects should be omitted in abstract and title, but should be included at first instance in the body of the text.

Numbers less than one should have a zero set before the decimal point, e.g. 0.1.

Measurements should follow the International System (SI) of units. Kindly see WHO publication *The SI for the Health*

Professional, WHO, Geneva, 1977. Use of the 24-hour time system (e.g. 0830 hrs, not 8:30 A.M.) is preferable.

References should include only published references and papers in press. References to literature cited should be numbered consecutively and placed at the end of the manuscript. In the text they should be indicated above the line as a superscript number. As far as possible mentioning names of author(s) under references should be avoided in the text. For references to a paper accepted for publication, the words 'in press' should appear after the title of the periodical. Citations of unpublished work should be incorporated in the text itself (e.g. R.G. Roy, unpublished data; or S. Pattanayak, personal communication). If the references is to an article published without any authorship in a periodical, in place of author's name the word "Anonymous" (Anon.) should be used. Titles of periodicals cited in the references are to be abbreviated as in the World List of Scientific Periodicals. The following style is accepted for this journal:

Research Paper

Sharma, V.P. (1976). Elimination of aziridine residues from chemosterilised mosquitoes. *Nature*, **261**: 135.

Book/Monograph

Rao, T. Ramachandra (1981). The Anophelines of India (WQ, Judge Press, Bangalore).

Landau, I. and Y. Boulard (1978). In *Rodent Malaria*, edited by R. Killick-Kendrick and W. Peters (Academic Press Inc., London): 53-84.

Paper presented at Symposium/Conference

Subbarao, S.K. (1981). Cytoplasmic incompatibility in mosquitoes. Paper presented at the International symposium on recent developments in the genetics of insect disease vectors. Bellagio, Italy, 20-24 April.

Authors are requested to verify spelling, punctuation, titles and dates of all references. The address of the publisher should be given for books. References are attributable to authors, not to editors in the case of compilations or contributory texts e.g.:

Killick-Kendrick, R. and W. Peters (1978). Ed. *Rodent Malaria*. (Academic Press Inc., London): 406. (Incorrect).

Landau, I. and Y. Boulard (1978). In *Rodent Malaria*, edited by R. Killick-Kendrick and W. Peters (Academic Press Inc., London): 53-84. (Correct).

Providing correct and complete references is the sole responsibility of the author.

Short notes should be prepared in a manner similar to the research papers and should contain Title, Name(s) of author(s) with Address of Institute/University as footnotes, Acknowledgements and References.

Proofs

Page proofs of the articles will be sent to the authors for correction. Corrected proofs must be returned promptly to the editor or else the article may not be printed in the stated issue, or may be printed as it stands. Only minimal changes, i.e. those that do not substantially alter the page make-up, are permissible at the proof stage and only in exceptional cases. Alterations which are disallowed by the Editor shall be deleted or charged to author.

From 1994 onwards reprint service has been discontinued. All senior authors (first) will be provided with a copy of the Journal free of cost containing their paper.

Check-list

- 1. Manuscript to be checked as per the format of IJM.
- 2. Three copies of the manuscript in double space with a covering letter.
- 3. Short title of the research paper (max. 5 words).
- 4. Keywords.
- 5. Undertaking by the author(s).
- 6. Names of at least three experts on the subject of paper submitted for publication.
- 7. Set of figures with legends and captions in triplicate on a separate sheet.

Announcement

We prefer submission of manuscripts on electronic media.

- Acceptable medium is $3^1/2^n$ or $5^1/4^n$ disk in MSDOS compatible format with file name, software/hardware used.
- The contents on the disk should exactly match with the manuscript and should be submitted with the hard copy (printed copý). The disk would be sent back in case of revision; the same should be returned to editor along with the revised copy of the manuscript. The file on the disk and printout should be identical. 'R' should be marked with red ink with the file name for revised manuscript.
- Package used for graphs should be mentioned.
- Floppies will be sent back to the authors after a final decision on the manuscript only on request.

- Editors

OTHER PUBLICATIONS OF MALARIA RESEARCH CENTRE

- (1) Proceedings of the ICMR/WHO Workshop on Community Participation for Disease Vector Control (1986) pp. 256 Edited by **V.P. Sharma**
- (2) Seroepidemiology of Human Malaria A multicentric study (1989), pp. 206 Edited by **V.P. Sharma**
- (3) Indigenous Larvivorous Fishes of India (1991), pp. 66
 A.G.K. Menon
- (4) Proceedings of an Informal Consultative meeting WHO/MRC on Forest Malaria in Southeast Asia (1991), pp. 206 Editors V.P. Sharma and A.V. Kondrashin
- (5) Malaria Patrika quaterly (Hindi) 1993 onwards.
- (6) Community Participation in Malaria Control (1993), pp. 295 Edited by **V.P. Sharma**
- (7) Larvivorous Fishes of Inland Ecosystem: Proceedings of the MRC-CICFRI Workshop (1994), pp. 224

 Editors V.P. Sharma and Apurba Ghosh

VIDEO FILMS PRODUCED BY MALARIA RESEARCH CENTRE

DOCUMENTARIES

Fighting Malaria (English)

Master Tape No. 2001

Malaria Control in Shahjahanpur

(English)

Master Tape No. 6003

Malaria Control in Shahjahanpur

(Hindi)

Master Tape No. 6001

Defeating the Invincible - Hardwar

(English)

Master Tape No. 6004

A Seven Point Action Programme for Malaria Control in Madras (English)

Master Tape No. 2010

Tackling Malaria in Orissa (English)

Master Tape No. 2011

Insecticide Impregnated Bednets for

Malaria Control (Assamese)

Master Tape No. 2008

Insecticide Impregnated Bednets for

Malaria Control (English)

Master Tape No. 2006

Man Made Malaria (English)

Master Tape No. 2002

Sirf Ek Muskan (Hindi)

Master Tape No. 2078

Ek Anootha Prayog (Hindi)

Master Tape No. 2003

Insecticide Impregnated Bednets for

Malaria Control (Hindi)

Master Tape No. 2061

Malaria Control in Madras (English)

Master Tape No. 2153

Man, Mines and Malaria (English)

Master Tape No. 2018

Mosquito Menace (English)

Master Tape No. 6049

A Seven Point Action Programme for Malaria Control in Madras (Tamil)

Master Tape No. 2208

SCIENTIFIC DISCUSSION

Synthetic Malaria Vaccine: A Hope

for Future (English)

Master Tape No. 2121

Malaria Vaccine: A Perspective

(English)

Master Tape No. 2204

Malaria Vaccine: A State of Art

(English)

Master Tape No. 2122

Malaria Vaccine: Status and Future

Prospect (English)

Master Tape No. 2211

M-10, A New Environment Friendly Insecticide for Disease Vector Control (English)

Master Tape No. 2212

Global Malaria Control – An Approach Plan (English)

Master Tape No. 2275

Chelating Agent in Severe Malaria

Master Tape No. 2140

TEACHING PROGRAMMES

Life Cycle of Malaria Parasite

(English)

Master Tape No. 2247

The Microscope (English)

Master Tape No. 2240

How to Make a Blood Smear and Stain

for Malaria Parasite (English)

Master Tape No. 6052

How to Treat Uncomplicated Malaria

(English)

Master Tape No. 6045

Cerebral Malaria (English)

Master Tape No. 2200

Malaria in Pregnancy (English)

Master Tape No. 6060

Laboratory Diagnosis of Malaria

(English)

Master Tape No. 6066

HEALTH EDUCATION

Malaria - Bednets a TV Spot (Hindi)

Master Tape No. 2013

Malaria - Bednets a TV Spot (English)

Master Tape No. 2072

Malaria - Spread the Knowledge

(English)

Master Tape No. 2071

Malaria - Mukti Pavoo (Hindi)

Master Tape No. 2236

Malaria - Arivay Parappivoo (Tamil)

Master Tape No. 2214

Malaria – Gnanava Haradona

(Kannada) Master Tape No. 2261

Malaria - Overhead Tanks & Malaria

Control - A TV Spot (Tamil)

Master Tape No. 2282

Cost of each cassette is Rs. 100.00 + postal charges for 2 cassettes Rs 18.00; 3-4 Rs. 24.00 and for 5 Rs. 30/-.

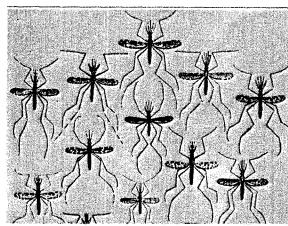
These cassettes could be obtained by sending crossed Demand Draft, drawn in favour of "Assistant Director, A.V.P. Unit", and send to the Assistant Director, A.V.P. Unit, Malaria Research Centre, 2, Nanak Enclave, Delhi-110 009.

INDIAN ANOPHELINES

by

B.N. NAGPAL . V.P. SHARMA

INDIAN ANOPHELINES



B.N. Nagpal • V.P. Sharma

ISBN81-204-0929-9
Size: Crown 4TO
Price: Rs. 750/pp. viii, 416 (Hardbound)
1995

Indian Anophelines is the first book of its kind on the fauna of anopheline mosquitoes from India. The book assumes special importance because of the deteriorating malaria situation in India, complicated by vector resistance to insecticides, ecological succession of mosquitoes, invasion of mosquitoes to new areas, as also their disappearance from certain areas. As a result mosquito fauna has undergone major changes and this precise knowledge at the local level in endemic regions is invariably lacking. Often the identification is made difficult due to variations in many appendages. For each anopheline species the book provides names, derivatives, type form availability, resting habits, breeding ecology, biting time, flight range, susceptibility to insecticides, relation to disease, reported distribution in India and the world, and results of vector incrimination studies.

© OXFORD & IBH PUBLISHING CO PVT. LTD. 66, Janpath, New Delhi-110 001.

INDIAN JOURNAL OF MALARIOLOGY MALARIA RESEARCH CENTRE (ICMR)

UNDERTAKING BY AUTHORS

subi	mitted for publication in the Indian Journal	of Malariology :	
1*.	Ethical committee has approved the research as presented in this research paper/this piece or research does not require ethical committee clearance.		
2.	The article mentioned above has not been submitted for publication in any form to any othe journal.		
3.	We also agree to the authorship of the article in the following sequence:—		
	Authors' names (in sequence)	Signature of Authors	
1.			
2.			
3.			
4.			
<i>5</i> .			
6. 7.			
8.			
IMI	PORTANT		
1.	All authors are required to sign independent photocopy of this form may also be used.	ntly in the form and in the sequence given above. A	
2.	No addition/deletion/ or any change in the sequence of the authorship will be permissible at a later stage, without valid reasons. If change is valid, then all the authors involved should attest to the change. The decision however, rests with the Editor.		
3.	If the authorship is contested at any stage, the article will be either returned or will not be processed for publication till the dispute is dissolved.		

MALARIA RESEARCH CENTRE

PRICED PUBLICATIONS

Indian Journal of Malariology			
Volume 18 Nos. 1-2 (1981)* Volume 19 Nos. 1-2 (1982)* Volume 20 Nos. 1-2 (1983)* Volume 21 Nos. 1-2 (1984)* Volume 22 Nos. 1-2 (1985)* Volume 23 Nos. 1-2 (1986)* Volume 24 Nos. 1-2 (1987) Volume 25 Nos. 1-2 (1988) Volume 26 Nos. 1-4 (1989) Volume 27 Nos. 1-4 (1990) Volume 28 Nos. 1-4 (1991) Volume 29 Nos. 1-4 (1992) Volume 30 Nos. 1-4 (1993) Volume 31 Nos. 1-4 (1994) Volume 32 Nos. 1-4 (1995)	Annual Subscription { India Rs. 75.00 ⁺ Foreign US \$ 20.00 +25% discount for individuals		
*Back issues are available at old rates, i.e. Rs. 30.00 or \$ 10.00			
The Editor Indian Journal of Malariology Malaria Research Centre 20-Madhuvan Delhi-110 092 (India)			
Sir,			
I enclose herewith a bank draft/postal order(s) No.(s)			

