SITUATION OF MALARIA IN RELATION TO SOCIO - BEHAVIOURAL ASPECT IN DAIJEE VDC OF KANCHANPUR DISTRICT OF NEPAL

A DISSERTATION SUBMITTED

TO

CENTRAL DEPARTMENT OF ZOOLOGY

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By

YOGENDRA BAHADUR MAHATA

CENTRAL DEPARTMENT OF ZOOLOGY

TRIBHUVAN UNIVERSITY

KIRTIPUR, KATHMANDU

NEPAL

2006

RECOMMENDATION

CENTRAL DEPARTMENT OF ZOOLOGY

TRIBHUVAN UNIVERSITY

KIRTIPUR, KATHMANDU

NEPAL

This is certified that **Mr. Yogendra Bahadur Mahata** has completed his dissertation work entitled "**SITUATION OF MALARIA IN RELATION TO SOCIO-BEHAVIOURAL ASPECTS IN DAIJEE VDC OF KANCHANPUR DISTRICT OF NEPAL**" as a partial fulfillment of the Master's Degree of Science in **Zoology** with special paper **Parasitology** under my supervision. To our knowledge this work has not been submitted for any other degree.

……

Dr. RANJANA GUPTA

Associate Professor

Central Department of Zoology

Tribhuvan University, Kirtipur

Date: .....

LETTER OF APPROVAL

CENTRAL DEPARTMENT OF ZOOLOGY

TRIBHUVAN UNIVERSITY

KIRTIPUR, KATHMANDU

NEPAL

On the recommendation of supervisor **Dr. RANJANA GUPTA**, this thesis of **Mr. Yogendra Bahadur Mahata** is approved for Examination, and is submitted to the Tribhuvan University in partial fulfillment of the requirement for Master's Degree of Science in Zoology with Parasitology as a special paper.

……

Prof. Dr. TEJ KUMAR SHRESTHA

Head of Department

Central Department of Zoology

Tribhuvan University, Kirtipur

Kathmandu, Nepal.

Date: .....

APPROVAL

CENTRAL DEPARTMENT OF ZOOLOGY

TRIBHUVAN UNIVERSITY

KIRTIPUR, KATHMANDU

NEPAL

We certify that this dissertation presented by **Mr. Yogendra Bahadur Mahata** entitled "**SITUATION OF MALARIA IN RELATION TO SOCIO-BEHAVIOURAL ASPECTS IN DAIJEE VDC OF KANCHANPUR DISTRICT OF NEPAL**" is satisfactory in scope and quality as a dissertation in the partial fulfillment of Master's Degree of Science in Zoology.

Evaluation Committee

…….. ……..

Head of Department External Examiner

…….

Internal Examiner

Date: .....

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This study is dedicated to those inhabitants of Daijee VDC who took the time to participate in this research and who sincerely provided the information required. I hope this study will reflect their situation and their aspiration.

Yogendra Bahadur Mahata

Reg. No. : 5-1-61-157-98

Campus Roll No. : 02

Exam Roll No. : 552

Batch 2003 - 2005

ABSTRACT

The study was conducted in 3 different wards of Daijee VDC of Kanchanpur district. A household survey was carried to determine people's knowledge, attitudes, and practices regarding malaria by means of structured questionnaire and to determine the disease prevalence by microscopic examination in Daijee VDC which lies in terai belt of Far-western region. Altogether 260 slides were collected out of which 16 were positive cases for malaria. One was *P. falciparum* case while the rest were *P. vivax* cases. The slides were collected in the summer season from (May to September 2006). A history of fever alone was not seen as a good indicator of parasitaemia. The Slide Positivity Rate (SPR) among the studied population was 6.15%. The mix infection of *P. vivax* and *P. falciparim* was not found. The infection was prevalent among all age groups and the rate of infection was higher in males than in females. The difference in disease prevalence in three wards was insignificant ($P>0.05$). The three studied wards had no statistically difference in awareness of malaria and literacy rate ($P>0.05$), but had statistically difference in the knowledge of malaria transmission and vector, bed-net use and awareness brought by different agencies ($P<0.05$). Treatment based on people's self-diagnosis without blood result and discontinuation of medication when getting better is common. The highest positive cases were concentrated in ward 6 (9 cases) followed by ward 3 (5 cases) and ward 2 (2 cases). Only one *P. falciparum* is reported and that was from ward 6. During the last three years the *P. falciparum* malaria was reported from Daijee VDC i.e. 5, 20 and 7 cases in the years 2003, 2004 and 2005 respectively. Strengthening the lab facilities to health institutions, spraying malaria problem area as well as nearby area, providing refresher training to technicians, conducting people awareness programme and need of serology-based testing of malaria for epidemiological studies are recommended.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF PLATES

ACRONYMS

API	Annual Parasite Incidence
BBIN	Bangledesh, Bhutan, India and Nepal
CBS	Central Bureau of Statistics
CQ	Chloroquine Phosphate
DDT	Dichloro-diphenyl-trichloroethane
DPHO	District Public Health Office
DPK	District Profile Kanchanpur
EDCD	Epidemiology and Disease Control Division
EWARS	Early Warning Reporting System
GDP	Gross Domestic Product
GFATM	Global Fund to fight against AIDS, Tuberculosis and Malaria
HMIS	Health Management Information System
HP	Health Post
IgG	Immunoglobulin
INGO	International Non-Governmental Organization
IRS	Indoor Residual Spraying
KAP	Knowledge, Attitudes and Practices
MOH	Ministry of Health
MSL	Mean Sea Level
NGO	Non-Governmental Organization
PCR	Polymerase Chain Reaction
Pf	*Plasmodium falciparum*

PFR	*Plasmodium falciparum* Rate
PHC	Public Health Care
Pm	*Plasmodium malariae*
Po	*Plasmodium ovale*
Pv	*Plasmodium vivax*
PVR	*Plasmodium vivax* Rate
RBC	Red Blood Cell
RBM	Roll Back Malaria
RDT	Rapid Diagnosis Test
SEA	South East Asia
SEARO	WHO Regional Office for South East Asia
SHP	Sub-Health Post
SPR	Slide Positivity Rate
TU	Tribhuvan University
UNDP	United Nations Development Project
UNICEF	United Nations International Children Education Fund
VDC	Village Development Committee
VHW	Village Health Worker
WHO	World Health Organization

1

INTRODUCTION

Malaria is one of the most vicious disease of humans. It has played a vital role in shaping history and in the decline of civilization. It is an important tropical disease extending from 40^{o}S to 60^{o}N remaining widespread throughout the tropics, but also occurring in many temperate regions. Malaria has become a global problem. More than half of the world's population in 102 countries is exposed to malaria and is responsible for over 300 to 500 million clinical cases and more than a million death each year. Previously extremely widespread, malaria is now mainly confined to Africa, Asia and Latin America. It has a heavy toll of illness and death - especially amongst children and pregnant women. It also poses a risk to travelers and immigrants, with imported cases increasing in non-endemic area. (WHO,2000).

Malaria results from infection with protozoan parasite *Plasmodium* which are spread from human to human through the bite of infected Anopheline mosquitoes. There are four main species of *Plasmodium* namely *P. falciparum, P. vivax, P. ovale and P. malariae. Plasmodium falciparum* is associated with significant mortality (WHO and UNICEF, 2003). The infections with the four human malarias can present sufficiently similar symptoms to make species differentiation generally impossible without a laboratory investigation. The severity of the disease has been compounded by other illness e.g.- meningocoocal infection, encephalitis, typhoid fever etc. (EDCD, 2003).

The death toll from malaria remains outrageously high with more than 3000 African children dying daily. The new effective anti-malaria drugs are not yet accessible to the majority of those who need them and that only a small proportion of children at risk of malaria are protected by highly effective insecticides treated nets (WHO & UNICEF 2003).

Malaria has constituted one of the most important cause of economic misfortune engendering poverty and intellectual standards of the nation and hampering prosperity and economic progress in every way (EDCD,2003).

The problem at hands is in Asia and most of the America. It has been observed from the past that malaria burden of today is a residual of what once prevailed. It is worst in remote rural areas in situations where there is civil unrest or other conflicts. In tropical Africa, the geographical areas of malaria endemicity have remained largely unchanged for at least

the past 100 and most probably the past several thousand years. It carries by far the greatest burden today.

The situation has become more complex over the last few years with the increase in resistance to the drugs normally used to combat the parasite that causes the disease. Treatment and control have even become more difficult with the spread of insecticide-resistance strains of mosquito vectors. Nowadays malaria is spreading in a new area causing the increased number of cases each year. Health education better case management, better control tools and concerted action are needed to limit the burden of the disease. In patients suffered with malaria a prompt and accurate diagnosis is the key to effective disease management (EDCD, 2003).

The topography of the Nepal divides the country into three regions, the mountain, the hill and the terai. In 1994 the malarious area of the country were stratified into five eco-epidemiological strata based on epidemiological factors, ecological changes, socioeconomic conditions and operational feasibility. They are as -

a) **Forest related malaria:-** It's elevation 200-800m above sea level. In 2003 the population at risk of malaria was 5503549.

b) **Malaria in the plains:-** It's elevation 60-150m above sea level. In 2003 population at risk was 6767937.

c) **Highland malaria:-** It's elevation 800-1400m above sea level. In 2003 the population at risk was 4672955.

d) **Malaria in the upper river valleys:-** It's elevation 1400-2000m above sea level.

e) **Very low grade or No Transmission Area:-** Lying altitude above 2000m from mean sea level (M.S.L.). The districts on these elevations are transmission free area (EDCD, 2003).

Malaria is less seen in socio-economically developed societies and countries. Population movements from malarious area and vice versa may cause epidemic out breaks. Occupation like fishing in coastal regions, forest cutting and mining in malarious area may make the host more susceptible to malaria infection. Immunity to malaria in human is acquired only after repeated exposure overall several years and infants both of immune parents are generally protected during the first three to five months by Maternal IgG (http:// www.malariajournal.com).

During the last four decades there has been considerable fluctuation in the status of malarial situation in Nepal and during the pre-control era, malaria was hyper/mesoendemic but large parts of the country, particularly southern Nepal were prone to epidemics. Resurgence of malaria has occurred in many countries as a result of failure of eradication programs. Malaria despite the years of attempted control remains a major public health problem in Southern Nepal. Both the inner (200 to 500m high) and outer Terai (less than 200m high and near the Indian border) are densely forested and are sparsely populated in parts as a result of malaria. The malariometric indicators of Nepal 1963 to 2003 (EDCD) has shown *P. vivax* as a leading cause of malaria followed by *P. falciparum, P. vivax* is the predominant species in most of the malarious areas of Nepal by a factor of 10:1 ratio (Sherehand, 1998). However *P. malariae* and *P. ovale* has not yet been reported. *P. vivax* is more common than *P. falciparum* as a cause of malaria in many parts of the tropics outside Africa (http://www.malariaonline.com).

1.1 Significance of the study

Malaria continues to be a major health problem. In 1998 the newly elected Director General of WHO initiated the Roll Back Malaria (RBM) project, thus establishing malaria as one of WHO's highest priorities. The main objective of RBM is to reduce the global malaria and strengthening of the health sector. Nepal has adapted RBM project.

Already malaria control programme was integrated into the basic health services and included in National Health Policy, 1991. In 1995 WHO calls for the implementation of a reliable reporting system capable of early detecting and monitoring new emerging and re-emerging disease, HMIS (Health Management Information System). In 1997 an additional surveillance system EWARS (Early Warning Reporting System) was established.

The study aims to find out the situation of malaria in Daijee VDC of Kanchanpur district because the Kanchanpur is malaria hyper endemic zone and comes under stratum II of the government epidemiological classification.

The annual reports of EDCD shows that the malaria is prevalent in Kanchanpur district. During the epidemic year 2002 the total slide collected by EDCD was 32197 out of which 8100 (25.15%) were positive which is the highest among the districts. Similarly the annual reports of DPHO Kanchanpur district shows that the malaria is very much prevalent in Daijee VDC. During the epidemic year 2002 the total slide collected by DPHO from Daijee VDC was 2164 out of which 1011 (46.71%) were positive which is third highest among VDCs of Kanchanpur district. In 2003, 2004 and 2005 the total positive slide collected in Daijee VDC was 668, 82,

185 out of which 20, 5 and 7 respectively were *P. falciparum* cases. The slide positivity rate (SPR) was high (12.96) and the annual parasite incidence was also high (7.0) in Daijee VDC in 2005. In 2005 also the highest numbers of positive slides (185) were reported in Daijee VDC according to DPHO, Kanchanpur.

The reports given by different agencies (Government, NGO, INGO) showed that endemicity of malaria was high in Kanchanpur as well as in Daijee VDC. Different organizations are also working for the control strategy in that region.

Thus the present study aims to analyze the exact present situation of malaria in Daijee VDC and also to evaluate the knowledge, attitude and practice after various awareness programme run by the different agencies. The findings of the present study will bring information regarding the epidemiology and burden of the problem that should be useful for policy makers and organizations to make strategic choices in projects targeting malaria in Kanchanpur district of Far-Western Nepal.

2 OBJECTIVES

2.1 General Objectives

The general objective of the study is to determine situation of malaria in relation to socio-behaviour aspects.

2.2 Specific Objectives

- Convential microscopic examination of peripheral blood smears to diagnose the patients with suspected malaria.
- To determine the knowledge, attitude and practices in relation to malaria transmission.
- Evaluation of prevalence of malaria in different wards of Daijee VDC.
- To determine age-wise and sex-wise prevalence of malaria.
- To assess the awareness about malaria brought by different Government and Non-government agencies.

3

LITERATURE -REVIEW

3.1 Background

It is assumed that the evolutionary history of mammalian *Plasmodium* started with the adaptation of Coccidia of the intestinal epithelium to some tissue of the internal organs

and then free blood cells and that the disease originated in Africa and spread to other warmer parts of the world. Finding of fossils mosquitoes, description of malaria like fevers in the ancient religious books and the high host specificity suggest a long association between the human and four particular species of *Plasmodium*. Since pre-historic era, Hippocrates described malaria in his writing during early 400 B.C. Documents and finding from early civilizations in China, the Middle East and Egypt also show evidence that malaria was known to these culture (http://www.malariajournal.com).

Historians believe that Malaria was imported to western hemisphere by European explorer. The first recorded malaria outbreak in western hemisphere occurred in 1493 and the disease was common during the era of European exploration and settlement in Americans. From the Indus valley in Northern India, Vedic (3500 to 1900 years ago), Brahmanic (2800 to 1900 years ago), scriptures contains many references to fevers of which are said almost certainly to concern malaria. There is a description about periodic fever in Artha Veda. Hence way interfere that malaria had been imported to by around 3,000 years ago (Carter *et al.,* 2003).

In the ancient Greeks, the disease was known with it's typical symptoms of fever, chills and headache. It was treated with various herbs and even with Mantras (Black magic). Some of the herbs used for treatment were *Cinchona* bark, Chiraita, Titepati etc. *Cinchona* bark has been the most commonly used during the past 3 centuries (Rana, 2001).

The exact cause of malaria was not understood until the closing years of 19th century. In 1880, the French surgeon Charles Alphonse Laveron identified the malaria parasite in the blood of patient. In 1899 sir Ronald Ross, a British physician demonstrated that the parasite is transmitted from human to human by female anopheles mosquito. Both Laveron and Ross were awarded Nobel Prize for their contribution, physiology and Medicine.

During the 20th century much research was devoted to malaria control which was revolutionished by the discovery of insecticidal properties of DDT in 1939 by Paul Muller in Switzerland. DDT was synthesized by Zeidler in Germany in 1874. In 1944, the first field tests were carried out in Italy. In 1945, Venezuela and Guyana become the first countries where malaria control on a large scale was instituted. By 1951, WHO was actively involved in malaria control projects mainly in Asia. The initial results of malaria cases were extremely encouraging. By 1955, the numbers of cases world wide had dropped by at least a third. In momentous decision, the WHO assembly in 1955 urged the member states to take malaria eradication as international objectives. But during 1973-1978 there was resurgence of

malaria. The 31st WHO assembly in1978 reaffirmed the malaria eradication as ultimate goal and control as an immediate objective to the goal. The wheel had turned full circle from control to eradication and back again to control (Williams, 1988).

Roll Back Malaria was launched in 1998 with the declared objective of halving the global burden of malaria by 2010. Its founding partners the UNDP, UNICEF, the World Bank and WHO agreed to share their expertise and resources in a concerted effort to tackle malaria worldwide; with a particular focus on Africa. Since the launch of RBM (Roll Back Malaria) internationally spending on malaria has more than trebled to a current figure of US$ 200 million a year. Comprehensive strategic plans to tackle malaria have been developed in more than 30 endemic African countries and significant additional resources secured to implement these plans form the new GFATM (Global Fund to fight against AIDS, Tuberculosis and Malaria). The RBM has succeeded in raising global awareness of malaria, generating increased resources and achieving consensus on the tools and priority interventions required to control the disease (RBM, 2003).

3.2 Epidemiology of Malaria

At present about 102 countries or territories in the world are considered malarious. Although this number is considerably less than it was in the mid 1950s (140 countries or territories), more than 2400 million of the world's population are still at risk. The incidence of Malaria worldwide is estimated to be 300-500 million clinical cases each year, with about 90% of these occurring in Africa, south of the Sahara-mostly caused by the *P. falciparum.* Malaria is thought to kill between 1.1 and 2.7 million people worldwide each year, of which about 1 million are childrens under the age of 5 years in Asia south of Sahara. These childhood deaths, resulting mainly form cerebral malaria and anaemia, constitute nearly 25% of child mortality in Africa. Fatality rates of 10-30% have been reported among childrens referred to hospital with severer malaria, although these rates are even higher in rural and remote areas where patients have restricted access to adequate treatment. Deaths from malaria in countries outside Africa, South of the Sahara occur principally in non-immune people who become infected with *P. falciparum* in areas where diagnosis and treatment are not available (WHO 20^{th} technical report). Malaria is Africa's leading cause of under five mortality (20%) and constitutes 10% of the continents overall disease burden. It accounts for 40% of public health expenditure, 30-50% of inpatient admissions and up to 50% of outpatients visits in areas with high malaria transmission, malaria has been estimated to cost Africa more than US$ 12 billion

every year in lost GDP, even through it could be controlled for a fraction of that sum (RBM, 2003).

3.3 Global Trend

There were 912 reports of malaria among persons in the united-states between, January 1, 2002 and December 31, 2002. The infecting species of *Plasmodium* was identified in 753 (82.6%) of these cases, 910 (99.8%) of the 912 cases were imported 591 (64.9%) of the 912 cases were in U.S. residents (includes both civilians and military personnel) who acquired the infection outside the united states 395 (66.8%) were acquired in Africa, 63 (10.7%) in the Americans and 99 (16.8%) in Asia (Desai *et al.,* 2002).

Malaria is endemic almost everywhere in Papua New Guinea. Transmission is intense and hard to control. Before control efforts began in 1950s, parasite rates were 35% overall and 64% among childrens under 10 years of age. Malaria remains a serious health problem in coastal and island regions. It is endemic upto an altitude of around 1200-1500 meters, where it becomes epidemic. In these areas, transmission is persistently high thought the year, with *P. falciparum* causing an estimated 75% of infections. Malaria is the third leading cause of hospital admission and deaths. Only the higher mountainous areas and port Moresby are malaria free (http://www.wpro.who.int).

It is estimated that 1.2 billion people out of the 1.4 billion people of SEA (South East Asia) live in Malarious area. In 1995 malaria cases in the region were estimated to

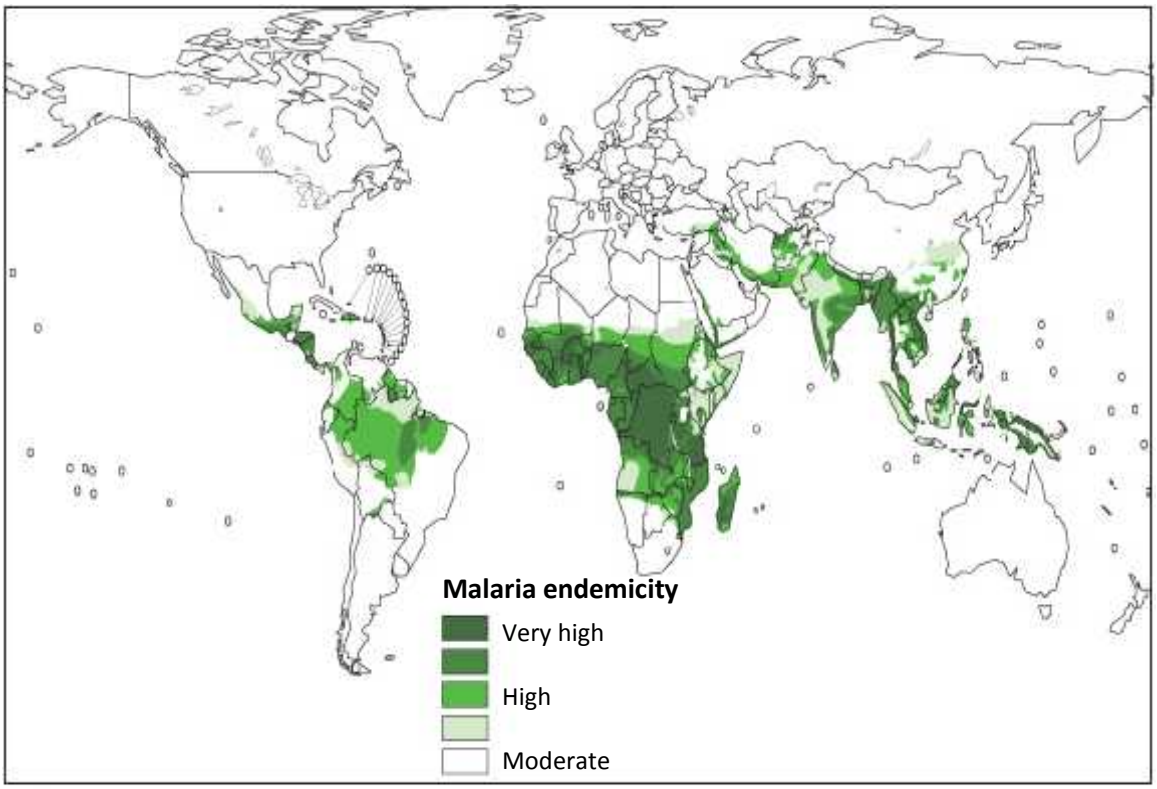


Fig. 1: Global distribution of malaria transmission risk, 2003.

(Source: WHO, 2003)

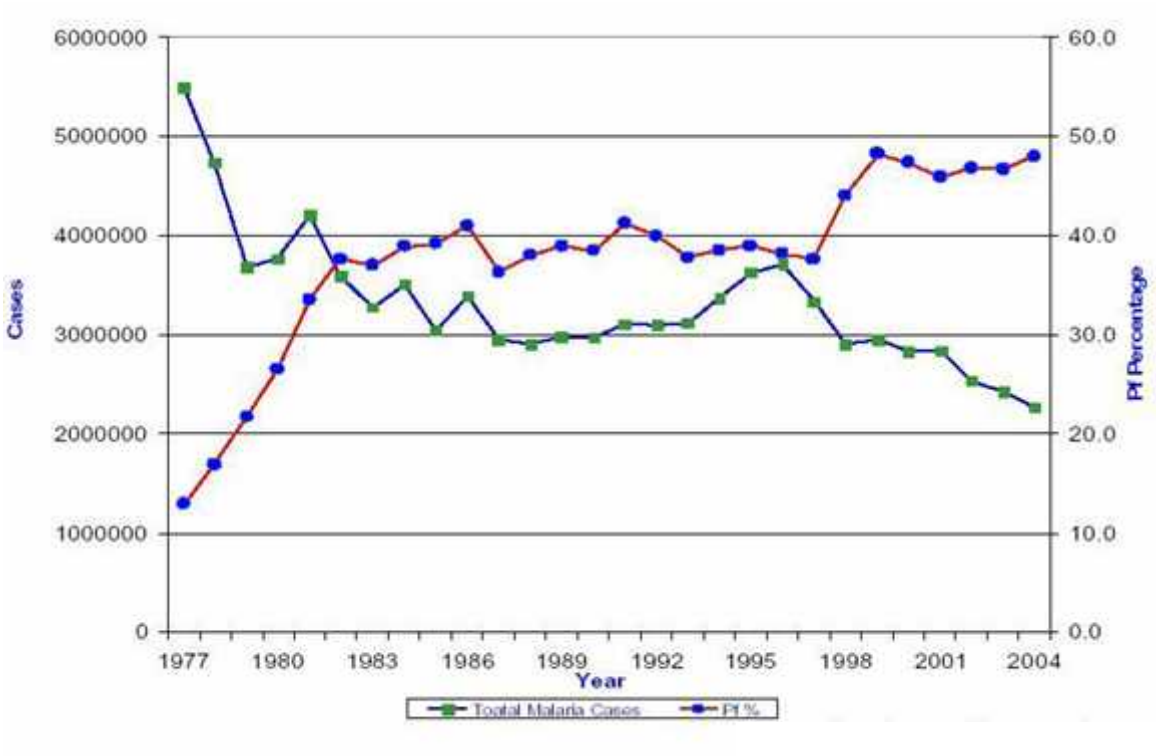


Fig. 2: Trends of malaria in SEA Region, 1977-2004.
(Source: http://www.malariajournal.com)

be 21.9 million, with almost 32,000 deaths. India accounts around 85% of the total reported cases in the region in the 1995. During 1996 also India contributed 83% of total malaria cases in SEA Region. Thus around 80% of reported cases in the region being contributed by India (Lal *et al.*, 1997).

Malaria has been also a major public health problem in Bangladesh. Approximately 88% of 128 million populations are at risk of malaria. Majority of malaria cases are reported from 13 out of 64 districts in the Bangladesh. The cases record were 68,594 in 1997, 60023 in 1998, 63723 in 1999, 55599 in 2000 and 55646 in 2001. The percentage of *P. falciparum* infections were 61.7%, 70.3%, 69.3%, 71.0% in the respective years from 1997 to 2001. The death recorded were 469, 528, 552, 484 and 470 among these respectively years (WHO; SEARO, 2002).

In Bhutan total population is 658000 in 1998, population residuing in malarious areas were 427,000. The outbreak of 1999 reported 12,237 cases of malaria with 16 death but the cases reported in 2001 were 5982 with 25 deaths (WHO; SEARO, 2002).

The population of Indonesia were 203 million in 2000, of the total population, 149.7 millions resides in malarious area. Approximately 1.5 million cases are detected annually. In

1997 the parasite incidence ranged from 0.12/1000 pupulation in Java and Bali to around 40 per 1000 population, under 10 years of age in the outer islands. In 1998 there were malaria outbreaks in the highlands of Iran, Java and resurgence in Central Java. The rate of *P. falciparum* infection was 41.9% (WHO; SEARO, 2002).

Malaria in Thailand is forest related with disease being prevalent along the international borders where as in the central plain areas, malaria transmission has been eliminated for about two decades. During the past five years (1997-2001), the numbers of reported cases fluctuated. In 2000, malaria transmission areas covered 3.87 million or 6.7% of the country's population i.e. 6789 villages or 9.85% of the total villages. A total of 149586 cases were reported of which Thai cases were 91703 (61.3%) and foreign national cases were 57883 (38.7%). In the year 2001, the number of cases decreased by 20% when compaired with the corresponding period of 2002 (WHO; SEARO, 2002).

Malaria is not a public health problem in Maldives. There is no indigenous transmission since 1984. The population of the country in 2000 was 270101 but the population residing in Malarious area was '0' zero. However 10-25 laboratories confirmed imported cases (Mostly from the neighbouring countries like Srilanka, India, and Pakistan etc.) are reported every year. Thus the Maldives has remained free of malaria for the last 19 years (since 1984) with only some imported malaria cases every year. Therefore Maldives is not engaged under RBM process (WHO; SEARO, 2002).

3.4 Malarial Situation in Nepal

Malaria in it's various forms has been the cause of mortality in Nepal throughout the age. Malaria has constituted one of the most important cause of economic misfortune engendering poverty and intellectual standards of the Nation and hamparing prosperity and economic progress in every way (EDCD, 2003).

The vast forest of the terai, stretching like a blanket across the southern belt of Nepal and the favourable environmental conditions have been known to harbour virulent forms of malaria often rapidly fatal for unwavy travelers. This fact has contributed to the isolation of Nepal from the rest of world, resulting in a slow socioeconomic development. The prevalence of malaria up to altitude of 4000 feet forced valley dwellers to migrate to the inhospitable higher regions in order to escape the ravages of the disease (Rana, 2001).

Upto the 1950s (before the malaria eradication activities was undertaken) it was estimated that approximately two million cases of malaria (40% of the total population)

occurring annually and 10-15% among those resulted in death. Though it has not been possible to accurately estimate the human and economic loss due to the disease in Nepal. There are no documented records about the prevalence of malaria in Nepal during nineteenth century except few historical descriptions. The first documented epidemiological survey dates back to 1925 by major Phillips of Indian Military service in Makawanpur and Chitwan valley. Out of 889 children examined, 712 (80%) had enlarged spleen, the average enlargement of spleen ranged from 65% to 100%. The mortality rate in children was estimated at about 43% among Pahadis (hill people) and 17% among Tharus (Tribal of the terai areas). Up to that period it was further estimated that approximately two million cases of malaria (40% of the total population) occurred annually and ten to fifteen percent among those resulted in death (EDCD, 2003).

Sherchand in his study of resurgence of malaria in the Southern Nepal in 1996 revealed that ignorance of people's beliefs regarding behaviour towards and the disease

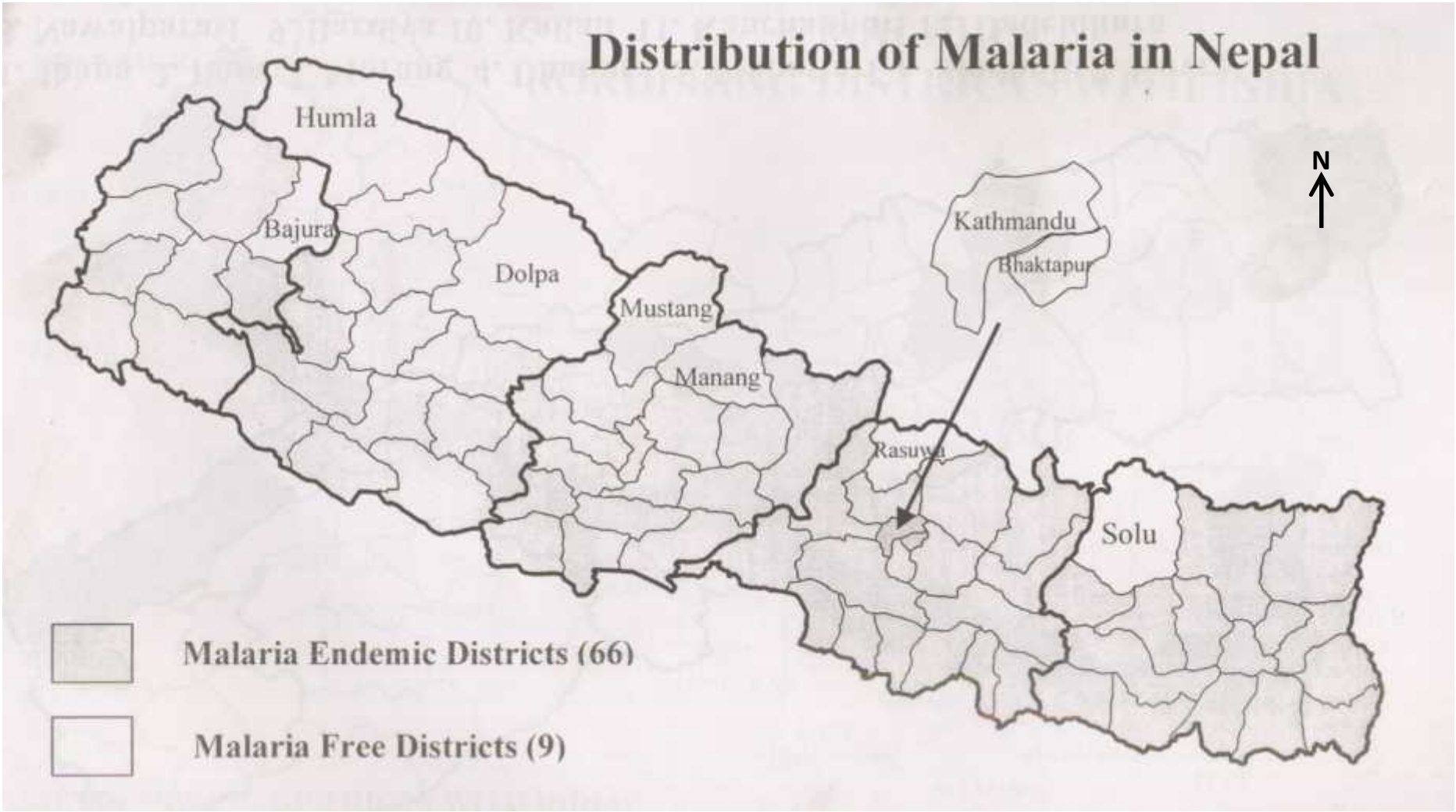


Fig. 3: Map of Nepal showing the distribution of malaria in Nepal.

(Source: EDCD, 2003)

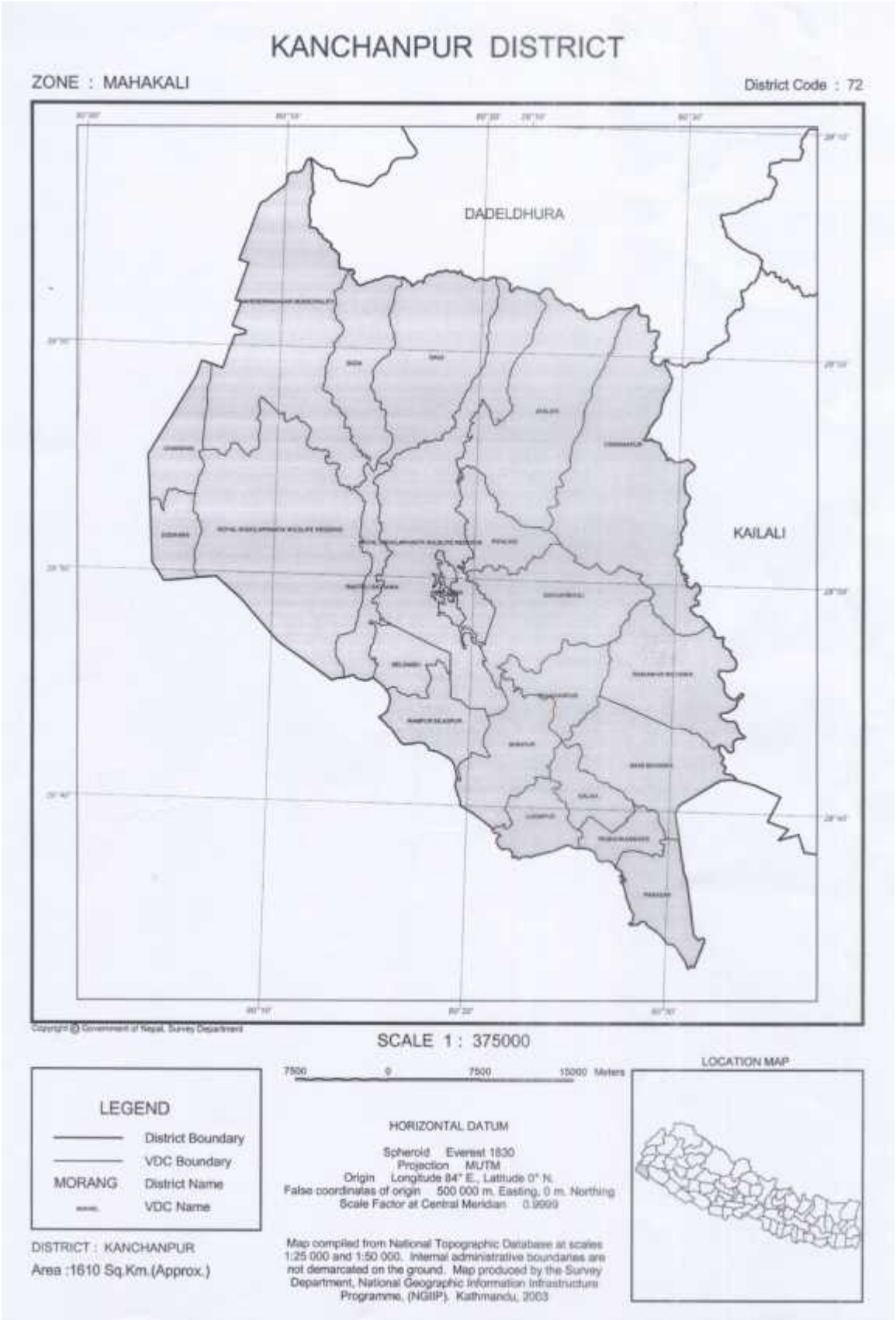


Fig. 4: Map of Kanchanpur District.

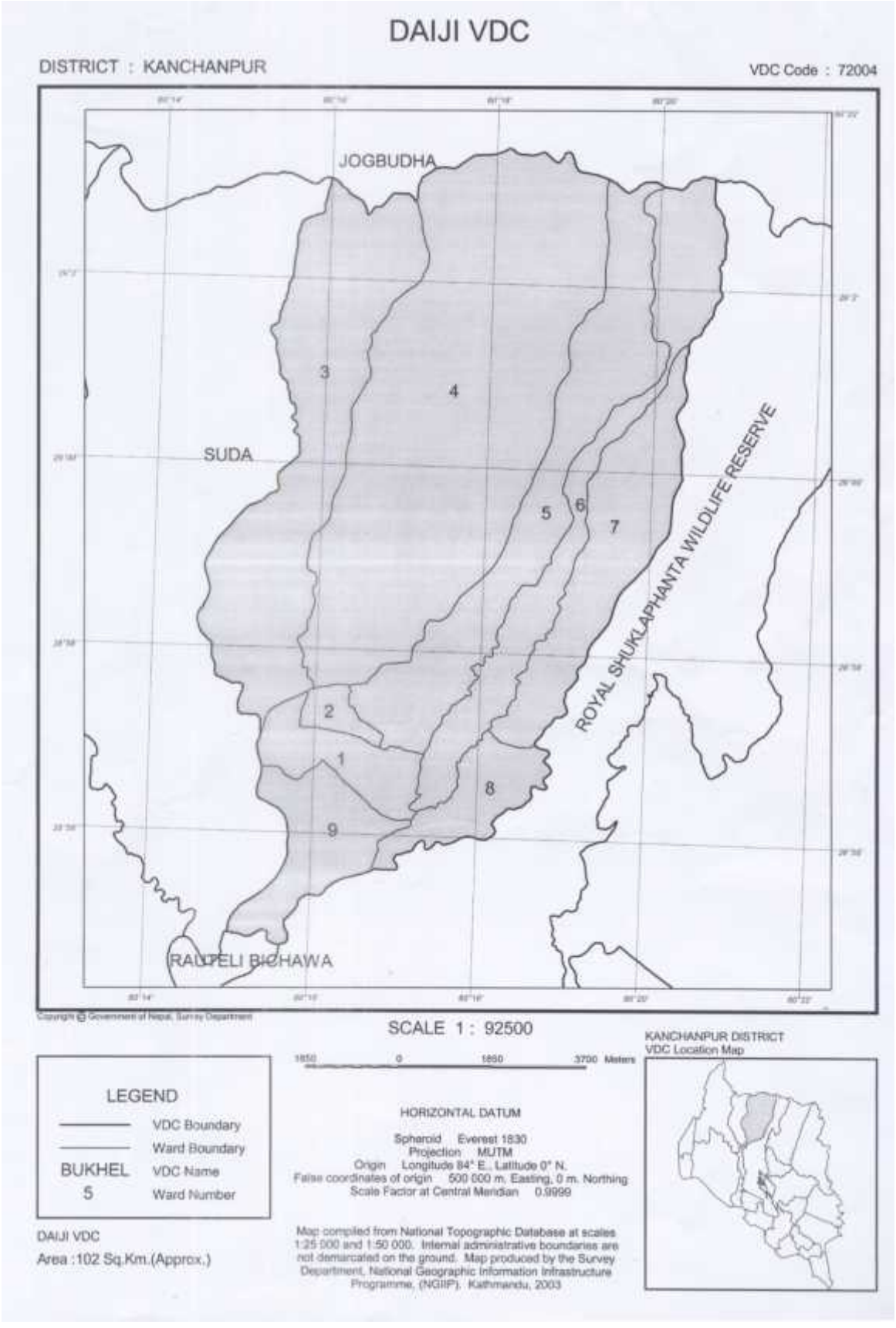

DAIJI VDC
DISTRICT : KANCHANPUR
VDC Code : 72004
JOGBUDHA
SUDA
RAUTELI BICHAWA
ROYAL SHUKLAPHANTA WILDLIFE RESERVE
1
2
3
4
5
6
7
8
9
Copyright © Government of Nepal, Survey Department
SCALE 1 : 92500
1850 0 1850 3700 Meters
LEGEND
VDC Boundary
Ward Boundary
BUKHEL VDC Name
5 Ward Number
DAIJI VDC
Area :102 Sq.Km.(Approx.)
HORIZONTAL DATUM
Spheroid Everest 1830
Projection MUTM
Origin Longitude 84° E., Latitude 0° N.
False coordinates of origin 500 000 m. Easting, 0 m. Northing
Scale Factor at Central Meridian 0.9999
Map compiled from National Topographic Database at scales 1:25 000 and 1:50 000. Internal administrative boundaries are not demarcated on the ground. Map produced by the Survey Department, National Geographic Information Infrastructure Programme, (NGIIP), Kathmandu, 2003
KANCHANPUR DISTRICT
VDC Location Map

Fig. 5: Map of Daijee VDC of Kanchanpur District.

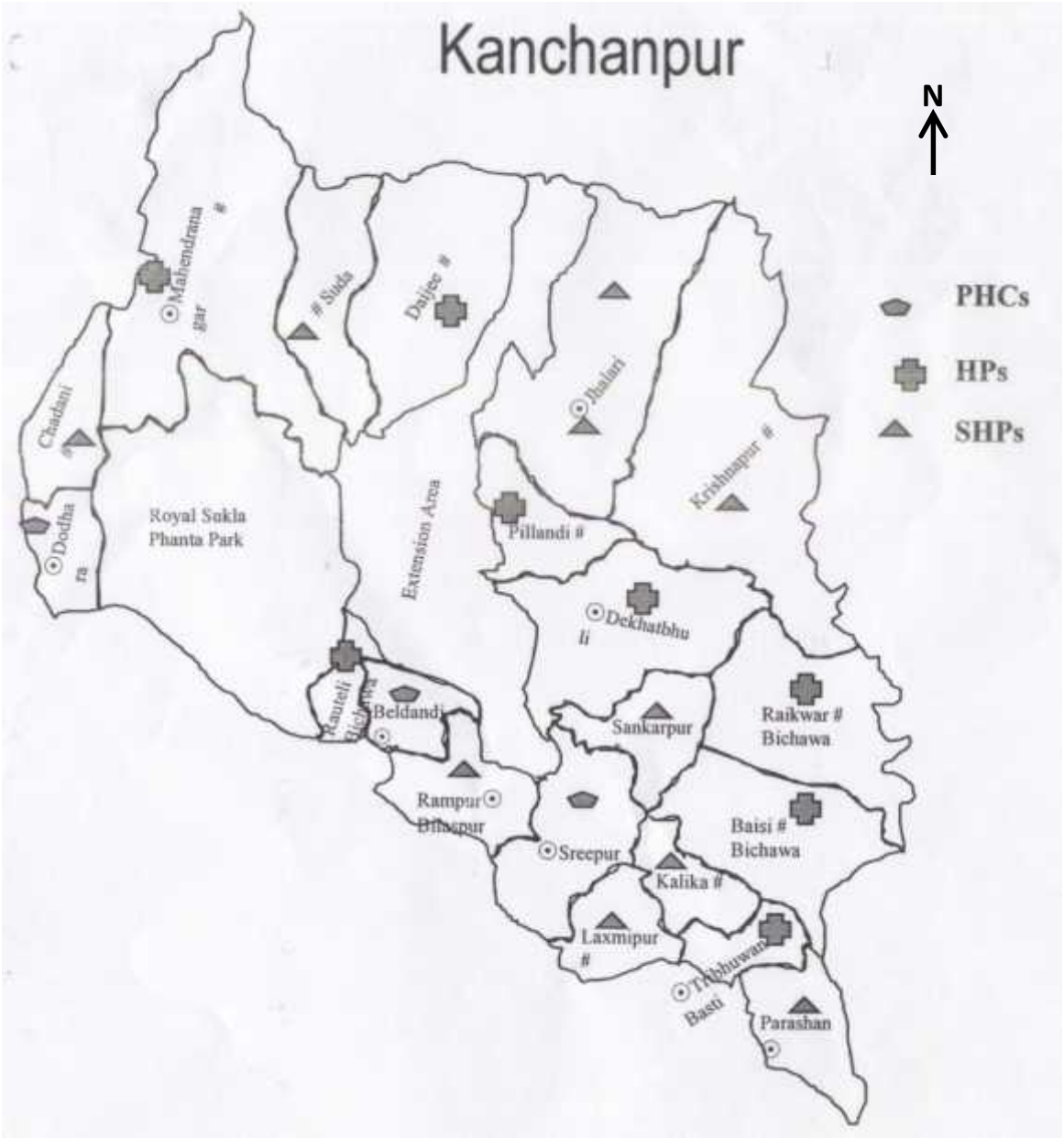


Fig. 6: Map of Kanchanpur District showing Health Infrastructure.
(Source: DPHO, Kanchanpur)

result in the development of inappropriate control programs that are not designed according to local conditions and needs.

The extensions of urban areas lead to epidemics in the peripheries of the growing cities. Mass migration of non-immune population into endemic areas for political reasons further complicate matters. It has been predicated that climate changes might cause some modifications to the present global distributions of malaria to it's present boundaries (Hay *et al.,* 2002).

In the decade of (1960) sixty had high proportion of *P. falciparum* at the beginning (more than 35%) and was down to around 8% by 1970. The major events in 1960's was the incrimination of *A. minimus* and *A. fluviatilis* responsible for transmission of malaria in terai belt and *A. willmori* as a vector responsible for transmission of malaria at an altitude of 6500 ft. in Mugu district of Mid-western region. During early seventies there was massive outbreaks in Kapilvastu, Nawalparasi and Rupandehi of Western Region and Parsa district of Central Region. The number of cases increased to 9375 in 1973 and to 14647 in 1974. The resurgence was due to resistance of *A. annularis* against DDT. The effort directed to change the insectide from DDT to Malathion, Ficam and larviciding with abate controlled the epidemic in Western Region and the cases were reduced to 10123 by 1976. By the time the epidemics were controlled the cases started increasing almost all over the country and by 1980 increases again to 14148. However, during the first half of the decade the percentage of *P. falciparum* increased with the increase of case but in the later half the same percentage of *P. falciparum* decreased in spite of gradual increase in case (EDCD, 2002).

The decade of 1980s had massive epidemics in Far-Western Region with smaller epidemics in Central Region in 1985 to 1988. In all the years the case were well above 15,000 annually escalating to as high as 42231 in 1985. Proportion of *P. falciparum* was also very high (18 to 19% in 1984 and 1985). By the end of the decade the cases reduced to 22000. The decade of 90s also experienced periodic epidemic resulting into 29000 cases in 1991 in

Central and Far Western Region. Again, efforts like regular IRS (Indoor Residual Spraying) in epidemic prone areas reduce the cases to 9700 in 1995 (EDCD, 2001).

The additional malaria report was due to Bhutanese refugees in the Eastern part of Nepal. The cases remained below 10,000 annually from 1996 onwards. Proportion of *P. falciparum* in 1996 and 1997 was high because of the outbreak in Kanchanpur in 1996 and in Nawalparasi in 1997. There were 7981 cases in 2000. The major burden of malaria during the time was found in refugee camp. As compaired to 6,396 cases of 2001 the epidemic of 2002 reported 12,750 cases. In the epidemic of 2002, the highest numbers of malaria cases were reported from Far West (8856) and least from Western region (177). Similarly *P. falciparum* cases were highly concentrated in Far-Western (1721) and least in Western Region (21) (Bista *et al.,* 2002).

Table 1: Malaria situation of Nepal from 1963-2003

Year	Population	Blood slide examined	Positive detected	*P. f* cases	*P. f*%	API
1963	1174324	67761	159	65	40.88	0.14
1964	2169309	378502	2359	937	39.72	1.09
1965	3325641	454448	4616	1304	28.25	1.39
1966	3580855	554973	8583	1859	21.66	2.40
1967	4393519	678401	6041	983	16.27	1.38
1968	5660000	774934	2357	175	7.42	0.42
1969	6118500	882604	3894	522	13.39	0.64
1970	5882000	1007057	2926	255	7.69	0.50
1971	5932000	1138803	2787	197	7.07	0.47
1972	6200000	1172260	4066	674	15.10	0.66
1973	6259000	1506248	9375	1540	16.43	1.50
1974	6410000	1656329	14647	2805	19.15	2.28
1975	6776000	1482327	12372	2980	24.09	1.83
1976	7340000	1455615	10123	2230	22.03	1.38
1977	7638000	1505836	11615	1680	14.46	1.52
1978	7796000	1579392	14212	1434	10.09	1.82
1979	8100000	1432633	14014	1467	11.18	1.73
1980	8159000	1323861	14148	1001	7.08	1.73
1981	8682000	1290579	16087	716	4.45	1.85
1982	9050000	1497998	16902	1068	6.32	1.78
1983	9273000	1504544	16719	1885	11.27	1.80
1984	9465000	1502099	29388	5535	18.83	3.10
1985	10758000	1539300	42321	7581	17.91	3.93
1986	10981000	1451044	36351	3557	9.87	3.31
1987	10605651	1453250	26866	3890	14.48	2.53
1988	10954451	1294234	24973	3525	14.12	2.28
1989	11300223	1069099	22366	2384	10.61	1.98
1990	11643741	847491	22856	1853	8.11	1.96
1991	11871917	781543	29135	5068	17.39	2.45
1992	12030945	725068	23234	2954	12.71	1.93
1993	12355314	596689	16380	1689	10.31	1.33
1994	12750286	430801	9884	1200	12.04	0.81
1995	12298141	338189	9718	844	8.68	0.77
1996	15225411	204355	9020	951	10.40	0.60

1997	15619053	160293	8957	1150	12.84	0.57
1998	16344287	175879	8498	520	6.12	0.52
1999	15961979	132044	8959	642	6.94	0.56
2000	15295571	156370	7981	836	10.47	0.32
2001	13215972	126962	6393	428	6.70	0.50
2002	16147782	183519	12750	2165	17.00	0.80
2003	17004435	194901	9394	1192	12.69	0.55

(Source: EDCD, 2003)

Table 2: Malaria situation in Kanchanpur District from 1995-2005

Year	Approximately population at risk	Total examined	Positive	*P.v*	*P.f*	Pf%
1995	230671	6369	344	343	1	0.29
1996	263282	8412	1155	510	642	55.58
1997	259764	8523	605	473	132	21.81
1998	330304	5905	395	382	13	3.29
1999	342185	7216	389	356	42	10.79
2000	354495	7833	260	242	18	6.92
2001	367249	15058	2670	2597	73	2.73
2002	380459	32197	8100	6628	1472	18.17
2003	405449	26157	4341	4118	223	5.13
2004	409465	15429	1126	1085	81	6.94
2005	429070	13604	1141	1113	28	2.45

(Source: DPHO, Kanchanpur 2005)

Table 3: Age group and Sex-wise malaria in Kanchanpur 2005

Type of malaria	Age group and Sex												
	Total	0-1yr		1-4 yr		5-9 yr		10-14 yr		14+		Total	
		M	F	M	F	M	F	M	F	M	F	M	F
P.v	1113	0	0	2	1	17	13	76	52	556	396	651	462
P.f	28	0	0	0	0	0	0	3	2	14	9	17	11

(Source: DPHO, Kanchanpur 2005)

In 2003, the distribution of malaria cases by regions showed highest in Far West (4987). However the highest numbers of *P. falciparum* were concentrated in Jhapa (734) in the eastern region. The number of *P. falciparum* dropped to 267 in Far Western (Bista *et al.,* 2002). In the year 2002 highest parasite incidence was reported among nine successive years. Before 2000, malaria parasite incidence was reported

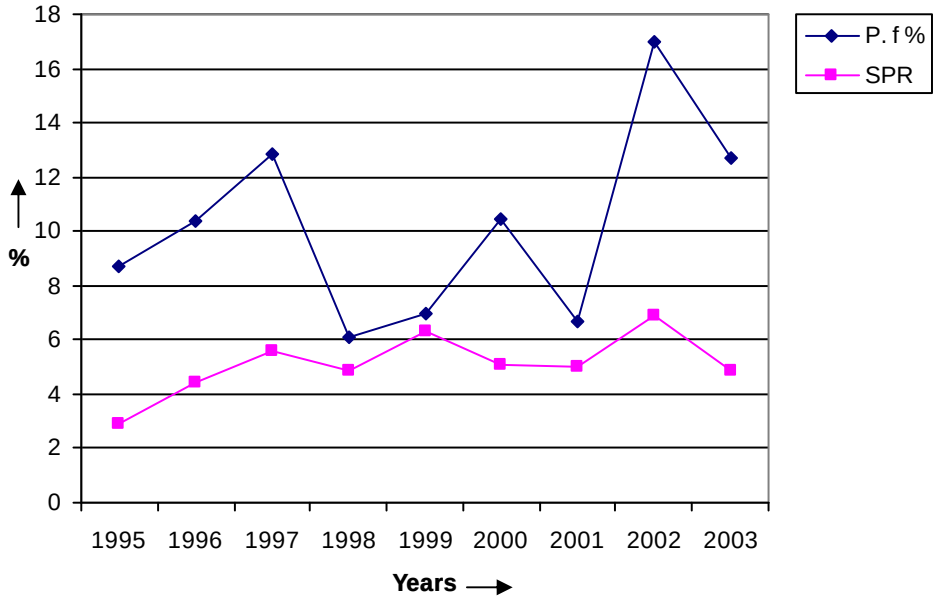


Fig. 7: Malaria surveillances parameters in Nepal (1995-2003)

(Source: EDCD, 2003)

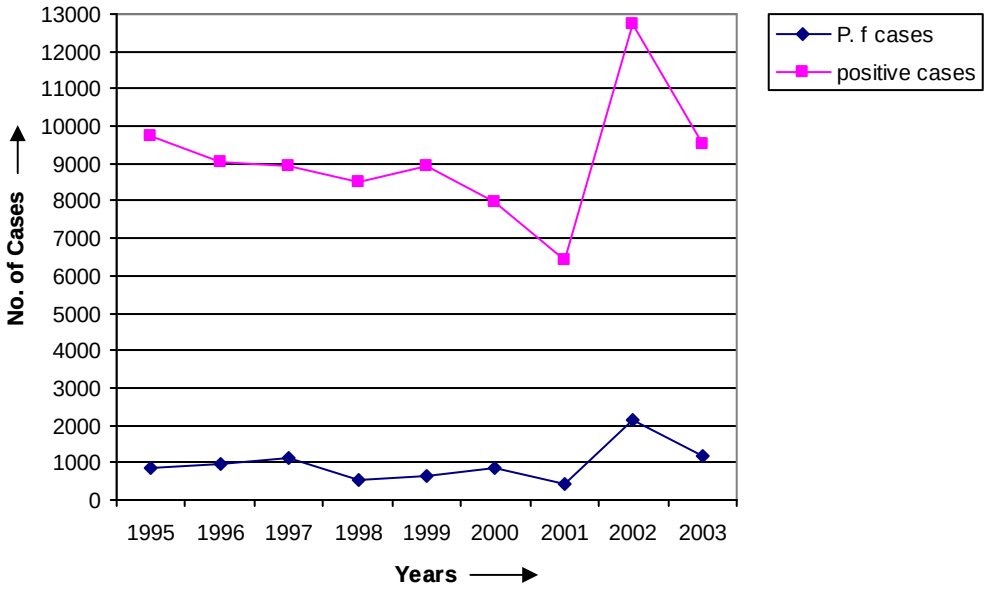


Fig. 8: Malaria positivity and prevalence of *P. falciparum* in Nepal (1995-2003)
(Source: EDCD, 2003)

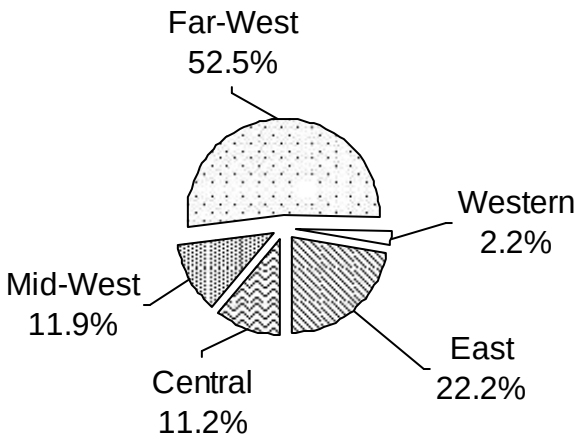


Fig. 9: Region-wise distribution of Malaria 2003

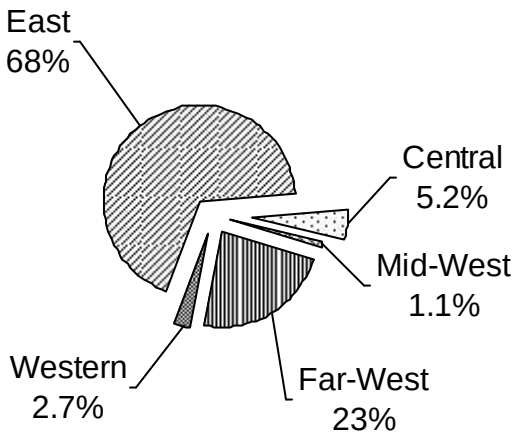
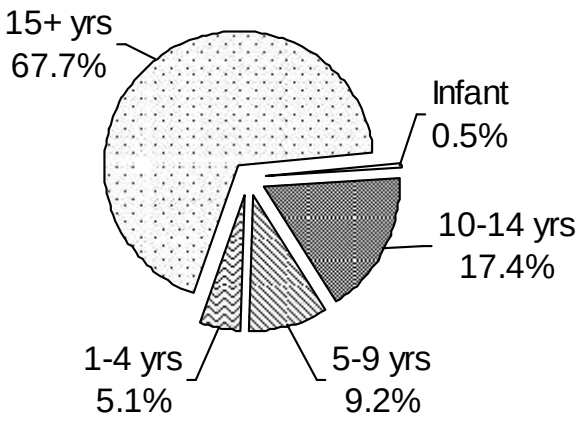


Fig. 10: Region-wise distribution of *P. falciparum* 2003

(Source: EDCD, 2003)

Total Malarial Case



P. falciparum Cases

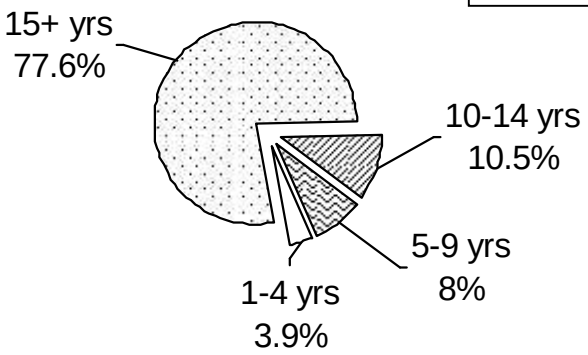


Fig. 11: Age group-wise Distribution of Malaria cases 2003

(Source: EDCD, 2003)

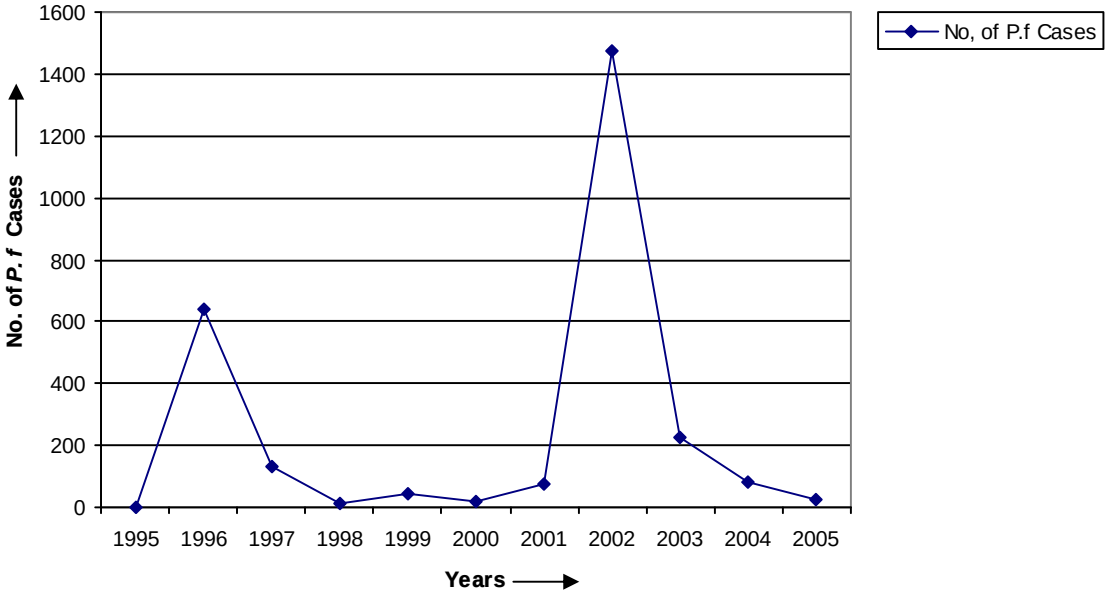


Fig. 12: Distribution of *P. falciparum* in Kanchanpur district (1995-2005)

(Source: DPHO, Kanchanpur)

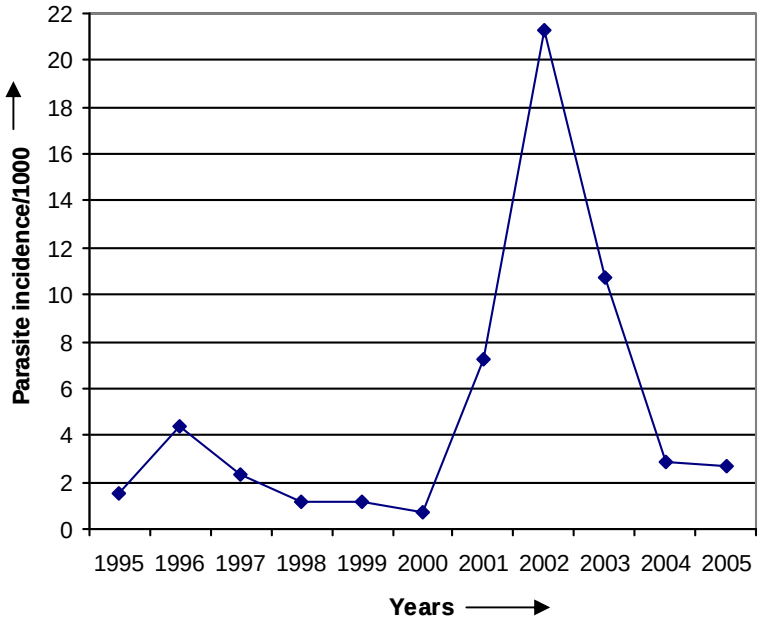


Fig. 13: Annual Parasite Incidence/1000 in Kanchanpur district (1995-2005)

(Source: DPHO, Kanchanpur)

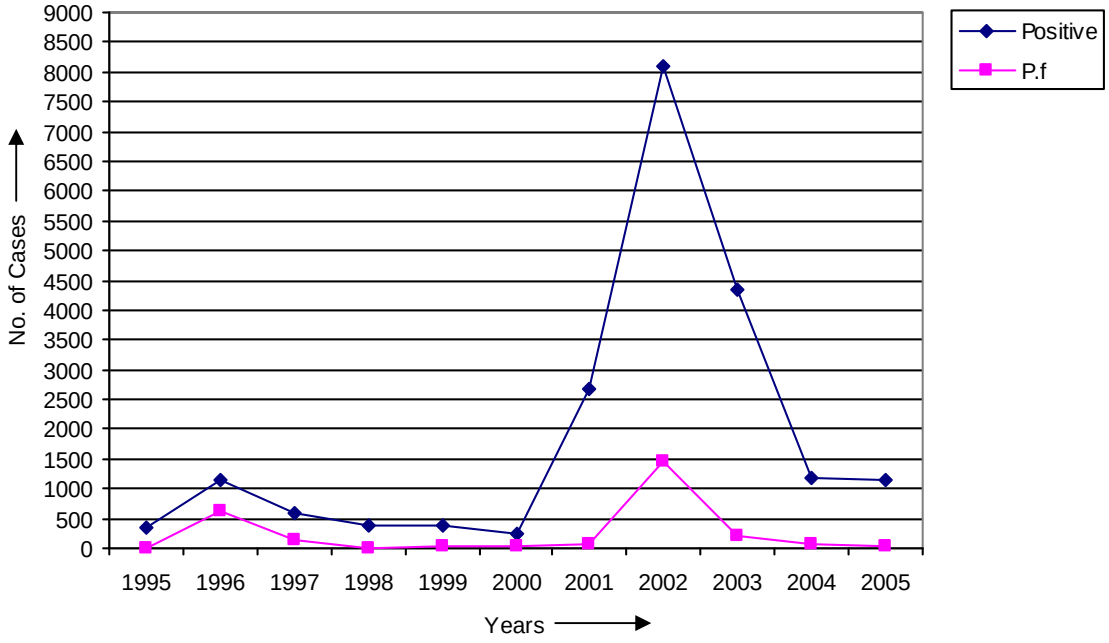


Fig. 14: Malaria situation in Kanchanpur district (1995-2005)

(Source: DPHO, Kanchanpur)

very low with comparison to the last three successive years (i.e. 2001, 2002 & 2003) (Table 1). A rise was observed in 1996 with comparison to previous year and after which it starts to decline up to 2000, where it was below 1/1000. But unexpected increase was reported in 2001 and 2002 during which parasite incidence was 7.27 and 21.29 respectively. In 2003 it was reported low with comparison to previous year although it was more than 10/1000. In 2004 and 2005 the parasite incidence was reduced to less than 10/1000. The successive

decline from 2003 to 2005, it is because the outbreak of malaria in 2001 and 2002 in Far Western region more priority is given due to which it helps to control the malarial outbreak.

In 2005 the VDCs record of Kanchanpur district showed that the highest parasite incidence was noted in Jhalari VDC(20.04) followed by Parasan (8.53) and Tribhuwan Basti (8.02). Shankarpur, Raikwar Bichwa, Baise Bichwa, Rampur Bilashpur and Rauteli Bichwa reported parasite incidence zero followed by Dekhatbhuli (0.051). The highest slide positively rate was noted in Kishnapur VDC (44.98) followed by Kalika, Laxmipur, Daijee and Jimuwa. Shankarpur, Raikwqar Bichawa, Baise Bichawa, Rampur Bilashpur and Rauteli Bichwa reported zero positivity. The highest number of *P. falciparum* were reported from Shreepur VDC (23.08) followed by Chandani (14.29) and Suda (8.33).

Eleven VDCs reported zero percentage of *P. falciparum* . Krishanpur reported low *P. falciparum* percentage (0.68) followed by Parasan (0.76). Table No. 2 shows the distribution of *P. falciparum* in Kanchanpur district from 1995 to 2005. There was a single case of *P. falciparum* detected in 1995 which after epidemic outbreak reached to 642 in 1996. The reduction in the number of cases in 1997 result into 132 *P. falciparum*. There were stagnant *P. falciparum* cases during 1998, 1999, 2000 and 2001 during which the case reported were 1472. The total positive detected were 8100 which covered 91% of the region and 63.4% of the country. The reduction of cases in 2003, 2004 and 2005 reported 223, 81 and 28 *P. falciparum* respectively (DPHO Kanchanpur,2005).

3.5 Malarial Situation in Refugees Camp

More than hundred thousand displaced persons from Bhutan had been settled within six different camps of Jhapa district. The problems like waste disposal, water supply drainage system, overcrowding and other socials problems are faced by the refugees (Sivakoti *et al.,* 2004). During the decades of 90s the country had to suffer from additional malaria due to influx of refugees from Bhutan during (1993) which added 812 (51%) *P. falciparum* malaria in 1994 and 629 (43%) *P. falciparum* cases in 1995 (EDCD, 2002). There were 504 and 372 *P. falciparum* cases in 1996 and 1997. In 1998, 1999 and 2000 the total *P. falciparum* positive from the local people and refugees were 256,466 and 210 (Bista *et al.,* 2002).

3.6 Malaria in Border Districts

With the free open border between two countries, local cross-border mobility is very much common. There are certain entry/exist point (Kakarvitta, Bhadrapur and Jogbani

in Eastern, Birgung in the Central, Sunuli in the Western, Rupandehi in the Mid-Western and Gauri Phanta and Banbasa in the Far-Western regions), which have movement of population not only from bordering districts but also from the Northern parts of the country (Rana,1998). Nepal's problem of cross border disease is compounded by the fact that there is easy access and free movement of population among the BBIN (Bangladesh, Bhutan, India and Nepal) countries, making transmission of diseases very easy. It should be noted that the border area that are more succceptible to infectious diseases. Around 94 millions people that live in the border area of BBIN countries are vulnerable to the emerging cross-border nature of public health (Punduka, 2002).

About 71.26 percent of the border population on malarious risk prone areas of bordering district 53.96%, 84.08% and 91.12% of positive cases were detected from border districts in 2000, 2001 and 2002 (Bista *et al.,* 2002)

4

MATERIALS AND METHODS

4.1 Study Area

Kanchanpur district of Nepal lies in the Far-Western development region. It is one of the terai district, situated between 28°33'-28°08' N latitude and 80°03'-80°34' E longitude. It is approximately 710 kilometer far from the capital Kathmandu. It's neighboring districts are Dadeldhura district in the North, Kailali district in the East, India in the South and again India in the west. Mahakali river flows in the west side of the Kanchanpur district. The district covers an area of 1610 square kilometer. Politically Kanchanpur district has 19 VDCs (Village Development Committees) and one municipality, 11 ilakas and 3 electoral constituencies.

There are 10 Health posts(HPs), 8 Public Health Centres (PHCs) and 1 Zonal Hospital. The total population of the district is 377899 (CBS, 2058 B. S.), Population growth rate is 3.91% and population density is 235/ square kilometer (DPK, 2060 B.S.).

The region has different ethnic groups comprising Brahmin, Chhetry, Damai, Kami, Sharki, Majhi, Newar, Magar, Tharus, Thakuri, Tamang, Gurung, Sanaysi, Sunwar, Kayastha, Rajput, Dholi, Muslim and some Christians. Tharus are the ethnical races of southern terai. Tharus include Chaudhary and Ranas. The total population of Tharus is 88120 (CBS, 2001). The major occupations are paddy cultivation, cattle farming, poultry farming, pig farming, pisciculture, handloms, collection of forest products and other daily wage jobs. The houses have two to three rooms often with adjacent cattle sheds made up of bamboos with thatched roof. The annual rainfall ranges from 1000-1575mm and the relative humidity is very high which ranges from 65-83 %. The temperature ranges from 6.96^{o} - 43^{o}C. The district is located 176 feet (Parasan) to 1528 feet (Jhalari) high from the sea level.

The present study area Daijee VDC lies within Daijee healthpost region. There is only one HP in the Daijee VDC. It is surrounded by Suda VDC in the west, Jhalari VDC in the east, Royal Suklaphanta Wildlife Reserve area in the South and the Churia hill range in the North. The Daijee VDC comprises of 9 wards with total population 22681 (11578 male and 11103 female). Daijee Health Post is located on 3-4 hours walk from the district headquarter Mahendranagar. The Mahendra Rajmarg runs from the Southern border of the Daijee VDC.

Investigation was carried out in three wards representing three villages of different castes and economic conditions. Ward No. 2 (Santipur village) was located in the south west of the VDC. Ward No. 3 (Polkhari village) located in the west side of the VDC and Ward No. 6 (Gadepani village) located in the East side of the VDC.

Ward No. 2 has 944 population (M = 468, F = 476) with 150 household. Ward No. 3 has 2801 population (M=1445, F=1356) with 490 household. Ward No. 6 has 3814 population (M=1992, F=1822) with 642 household (District Profile Kanchanpur 2060 B. S.)

4.2 Preliminary Field Survey

A preliminary field survey was carried out in April, 2006 to know the malarial situation in Kanchanpur and to choose a study area. DPHO of Kanchanpur informed that Daijee and Jhalari are risky areas. After discussions with village health worker (VHW) and VDC Chairman, Daijee VDC was chosen as the study areas.

4.3 Materials Required

(i) Clean Slides.

(ii) Sterile lancets.

(iii) 3% Giemsa Solution (pH. 7.2).

(iv) Microscope.

(v) Methylated sprit.

(vi) Cotton.

(vii) Slide box.

(viii) Distilled water.

(ix) Measuring cylinder.

(x) Lead pencil.

(xi) Record from and Register.

(xii) Ball point pen.

4.4 Data Collecting Techniques

4.4.1 Primary data

The study population are the inhabitants of all ages and both sexes of the selected wards of Daijee VDC. Probability sampling with a household as sampling unit was chosen. The study was conducted in the months of May 2006 to September 2006.

The households in the area were visited and enquired (a) weather there was a fever case in the house (b) weather there had been a fever case in the house before up to two weeks. If the answer to either of these two question was yes, a blood film was made and questionnaire was administrated either to him/her or his/her guardian. Date of collection, name of patients, place, age, sex and result of examination were noted in a register. All together 260 blood slides were collected from the study area. People's knowledge attitude and practices about malaria were accessed by interviewing structured questions (Annex-1).

Prior to the study permission was granted from the EDCD (Epidemiology and Disease Control Division) as well as from DPHO (District Public Health Office) Kanchanpur and Zonal hospital. The collected slides were checked in the Zonal hospital and laboratory of Central Development of Zoology T. U., Kirtipur.

4.4.2 Secondary data

Slides collected in Daijee H. P. and their results were noted down. Related data of Daijee VDC was also taken from DPHO Kanchanpur.

4.5 Microscopic Diagnosis

4.5.1 Preparation of thick and thin blood film on the same slide

Holding the patient left hand the third finger from the thumb was selected (the big toe can be used with infants). The finger was cleaned with a piece of cotton soaked in alcohol. Now the ball of finger was punctured with a sterile lancet. Working quickly a single small drop of blood was collected on the middle for the thin film and three drops on slide about 1 cm from the intended for the thick film. Using a second clean slide as a spreader, with the slide the blood resting on surface, touching the small drop with the spreader blood we allowed to run along its edge. Keeping the spreader at an angle of 45^{o} the spreader was firmly pushed along the slide. Using the corner of the spreader the drops of blood was quickly joined and circular thick film was made by spreading the blood. Finally the dry film was labeled with lead pencil.

Plate 1: Collecting the blood sample of the patients

Plate 2: Arranging the stained slides in the drying rack to drain and dry.

Plate 3: Microscopic examination of the Giemsa stained blood films for malarial parasites.

Plate 4: Stagnant water near the houses which is favourable breeding site for mosquitoes.

4.5.2 Staining blood film

The thin films were fixed by dabbing it into 200 ml container containing methanol making sure that the alcohol does not touch the thick film. The slide were placed in staining rack ensuring that thick films are placed at one end of rack. 3% Giemsa Solution (stain) was poured in the slides until slides were totally covered. The slides were leaved in the stain for 30-40 minutes. The stain was gently washed under tap water. The slides were removed one by one and were arranged them with film downwards in a drying rack to drain and dry.

4.5.3 Microscopic examination of blood film

The thin film consists of a single layer of RBC and is always used as label to identify the patient. It is used to assist in the identification of the malaria species or other morphological characters of the parasite. The thick film is made up of large numbers of dehaemoglobinized RBC. Any parasite present are concentrated in a smaller area than in the thin film and so are more quickly seen under the microscope. For routine examination, thick film was followed by thin film if necessary. A drop of immersion oil or anisol was kept in the film and examined under the 100X objective lens.

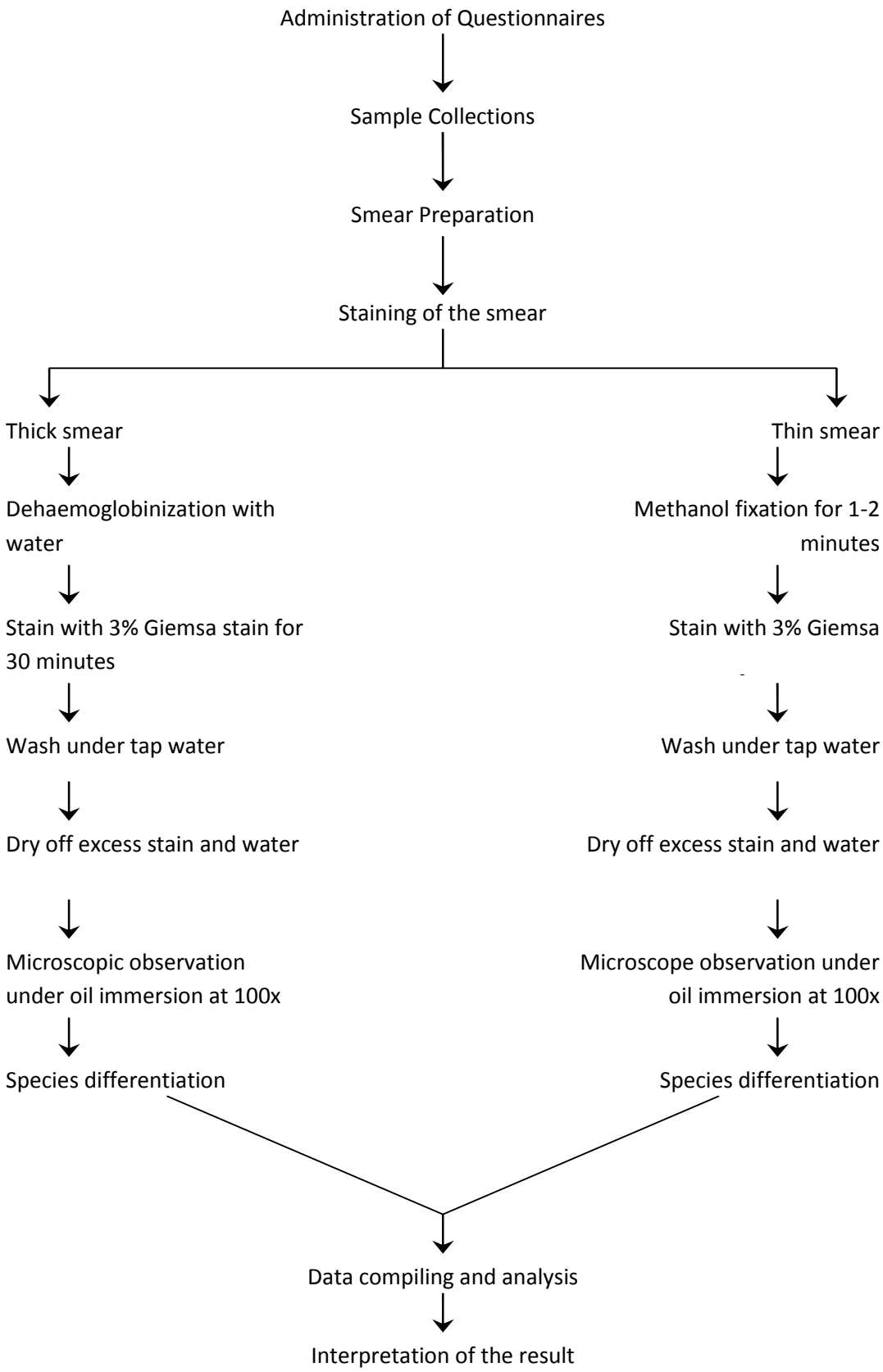
4.6 Data Analysis

Collected data was qualitative. They were presented and analyzed with appropriate statistical methods. Chi-square test was applied to find associate relationship between variables identified.

4.7 Ethnical Consideration

The study was started after information to EDCD, Teku and written permission was taken from DPHO Kanchanpur. Feedback was given to related agencies after checking the slides.

Research Design


Administration of Questionnaires
Sample Collections
Smear Preparation
Staining of the smear
Thick smear
Thin smear
Dehaemoglobinization with water
Methanol fixation for 1-2 minutes
Stain with 3% Giemsa stain for 30 minutes
Stain with 3% Giemsa
Wash under tap water
Wash under tap water
Dry off excess stain and water
Dry off excess stain and water
Microscopic observation under oil immersion at 100x
Microscope observation under oil immersion at 100x
Species differentiation
Species differentiation
Data compiling and analysis
Interpretation of the result

5
RESULTS

The present study includes two parts (i) Questionnaire Survey and (ii) Parasitological examination by forming blood smears. For this the households in the area were visited and enquired (a) weather there was a fever case in the house (b) weather there had been a fever case in the house previously up to two weeks. If the answer to either of these two questions was yes, a blood film from the concerned individual was made and questionnaire was administrated either to him/her or his/her guardian. Those having fever were included in study and were considered as clinically suspected malaria. Questionnaires were administrated to altogether 120 respondents from the 120 households, 260 blood slides were collected from the same 120 households.

5.1 Demographic, Economic and Educational Status

The study area consisted of 3 different wards of Daijee VDC. The total population under study represents 105 (40.38%) from ward 6; 95 (36.53%) from ward 3 and 60 (23.07%) from ward 2. Of the total blood slide collected 140 (53.84%) slides were of males and 120 (46.15%) slides were of females (Fig.15).

Ward number 2 has 944 population (F=476, 50.42%, M=468, 49.57%) with 151 house holds; Ward number 3 has 2801 population (F=1356, 48.41%, M=1445, 51.58%) with 495 house holds; Ward number 6 has 3814 population (F=1822, 47.77%, M=1992, 52.22%) with 642 house holds (Fig.16).

Interviews were conducted in a total of 120 households: 20, 45 and 55 with the coverage of 13.24%, 9.09% and 8.56% of the respective population of wards 2, 3 and 6 respectively. Of the respondents 13 (65%) were males and 7 (35%) were females in ward number 2, in ward number 3, 31 (68.88%) were males and 14 (31.11%) were females and in ward number 6, 38 (69.09%) were males and 17 (30.90%) were females.

Of the respondents 12 (60 %); 29 (64.44%) and 41 (74.54%) have no formal educational i.e. illiterate in ward 2, 3 and 6 respectively. Statistically the difference of literacy in three wards was found to be insignificant $(\chi^2 = 1.932, \mathrm{P} > 0.05, \mathrm{d.f.} = 2)$.

Economic activities in the area were focused in farming (rice, wheat, maize cultivation). 85%, 93.3% and 90.90% of the respondents in ward 2, 3 and 6 were farmers respectively.

The study population represents 5 different ethnic groups. Chettris were dominating in number 99 (38.07%), Brahmins were second to Chettris 74 (28.46%), Dalit were 47 (18.07%). Tharus were 28 (10.76%) and 12 (4.61%) were other caste in the study (Fig.17).

5.2 Awareness of malaria, Malaria transmission, Preventive methods and Practices

The people's awareness regarding malaria appeared relatively high: 18 (90%), 40 (88.88%) and 51 (92.72%) of the respondents in wards 2, 3 and 6 respectively were aware of malaria. This assessment was made if they considered there was risk of infection and if they knew intermittent fever with shivering (kamjworo) as primary symptoms of malaria. Statistically the difference of awareness of malaria in three wards was found to be insignificant $(\chi^2 = 0.4574, \mathrm{P} > 0.05, \mathrm{d.f.} = 2)$.

Regarding malaria transmission 6 (30%), 30 (66.66%) and 31 (56.36%) of wards 2, 3 and 6 respectively said that malaria was acquired by mosquito bites. Statistically the difference of awareness of malaria vector in three wards was found to be significant $(\chi^2 = 7.559, \mathrm{P} < 0.05, \mathrm{d.f.} = 2)$. A few of them also knew that mosquitoes breed in water. All of them said they were bitten by mosquitoes during night. People's view regarding malaria preventive methods is shown in Table 4.

Table 4: People's view regarding preventive methods

Category	No. (%) of respondents			
	Ward 2 (n=20)	Ward 3 (n=45)	Ward 6 (n=55)	Total (n=120)
Medicine	4(20%)	16(35.55%)	20(36.36%)	40(33.33%)
Spray	4(20%)	12(26.66%)	08(14.54%)	24(20.00%)
Clean environment	3(15%)	05(11.11%)	16(29.09%)	24(20.00%)
Bed-net	2(10%)	08(17.77%)	10(18.18%)	20(16.66%)
Unknown	3(15%)	04(08.80%)	05(09.09%)	12(10.00%)

Regarding the bed-net use, 4 (20%), 33 (73.33%) and 16 (29.09%) respondents in wards 2, 3 and 6 respectively said that they used bed-nets while sleeping. Statistically the difference of bed-net users in three wards was found to be significant $(\chi^2 = 25.341, \mathrm{P} < 0.05, \mathrm{d.f.} = 2)$.

Regarding the sleeping habits most people said that they used to sleep both indoor as well as outdoor during the hot season is shown in Table 5.

Table 5: People's sleeping habits during hot season

	No. of respondents			
	Outdoor	Indoor	Both	Total (n)
Ward 2	1	12	7	20
Ward 3	0	37	8	45
Ward 6	2	48	5	55
Total	3	97	20	120

People consideration about age group most affected by malaria is shown in Table 6.

Table 6: People's view about age-group most effected by malaria

Category	No. (%) of respondents			
	Ward 2 (n=20)	Ward 3 (n=45)	Ward 6 (n=55)	Total (n=120)
All age group	9(45%)	25(55.55%)	29(52.72%)	63(52.50%)
Old	7(35%)	13(28.88%)	21(38.18%)	41(34.16%)
Children	2(10%)	05(11.11%)	07(12.72%)	14(11.66%)
Infant	0	01(02.22%)	01(01.81%)	02(01.66%)

All the respondents considered that it is necessary to give blood for diagnosis. Regarding the treatment done in case of malarial infection, most of the respondents said that they primarily relied upon the Health Post in case of malarial attack because it is cheaper than others (Table 7).

Table 7: Treatment seeking attitudes in case of malaria attack

Category	No. (%) of respondents			
	Ward 2 (n=20)	Ward 3 (n=45)	Ward 6 (n=55)	Total (n=120)
Health Post	16(80%)	39(86.66%)	45(81.81%)	100(83.33%)
Private centre	4(20%)	04(08.80%)	09(16.36%)	017(14.16%)
Ayurvedic (Herbal)	0	02(04.44%)	01(01.81%)	003(02.50%)

When studied comparatively the awareness about malaria brought by different agencies such as Government, NGO, INGO, most of the respondents said that Government provide better awareness programme than others (Table 8).

Table 8: People's view about awareness brought by different agencies

Wards	No. of respondents				
	Government	NGO	INGO	Others	Total (n=120)
2	8	6	5	1	20
3	30	11	4	0	45
6	50	3	1	1	55
Total	88	20	10	2	120

(Note: Others mean Radio, T.V., Newspaper etc.)

Statistically the difference of awareness brought by different agencies in three wards was found to be significant $(\chi^2 = 25.182, P < 0.05, d.f. = 6)$.

5.3 Parasitological Results

5.3.1 General prevalence of malaria

Altogether 260 slides were collected: 60, 95 and 105 from wards 2, 3 and 6 respectively. Of them 29 and 31, 42 and 53 and 49 and 56 were females and males respectively in wards 2, 3 and 6 (Fig.18). Out of the 260 slides collected, 16 were positive for malaria parasite while 244 (93.84%) slides were diagnosed negative. Similarly 15 (5.77%) and 1 (0.38%) slides were of *P. vivax* and *P. falciparum* respectively (Fig.19). The SPR (Slide Positivity Rate) was 6.15%. Of the total positive record, 15 were of *P. vivax* and 1 was of *P. falciparum*. The multiple infections were not found. The *P. vivax* Rate (PVR) was 93.75% and *P. falciparum* Rate (PFR) was 6.25%. There were 2 (3.33%), 5 (5.26%) and 9 (8.57%) positive slides collected respectively in wards 2, 3 and 6 (Fig.20). The only one case of *P. falciparum* was reported from ward 6.

P. vivax and *P. falciparum* were the only two *Plasmodium species* encountered. No case of *P. ovale* and *P. malariae* were identified. It was found that the rate of infection was higher in males, 10 (7.14%), than in females, 6 (5%). Out of 16 positive slides it was found that 8 slides were between the age group 20-30 years, while 5 slides were of below age 20 years and 3 slides were of over age 30 years. Ward wise positivity of slides is shown in Table 9.

Table 9: Ward wise malaria positive cases

	Total slide examined	Positive	*P. v*	*P. f*
Ward 2	60	2	2	0
Ward 3	95	5	5	0
Ward 6	105	9	8	1

Statistically the difference of malaria positive cases in three wards was found to be insignificant $(\chi^2 = 2.016, \mathrm{P} > 0.05\,\mathrm{p.f.} = 2)$.

5.3.2 Comparison of the present data with the previous data of the same wards

In year 2005, the total of 610 slides were collected from the three wards (2, 3 and 6) of Daijee VDC. Out of which 36 slides were positive for malarial parasite. The ward no. 2 reported 6 positive slides all of *P. vivax.* Ward no. 3 reported 10 positive slides all of *P. vivax* and ward 6 reported 20 positive slides of which 1 was of *P. falciparum* (DHPO, 2005).

It was found that the SPR (slide positivity rate) of the present study was slightly higher (6.15) than secondary data, (5.90) respectively for three studied wards.

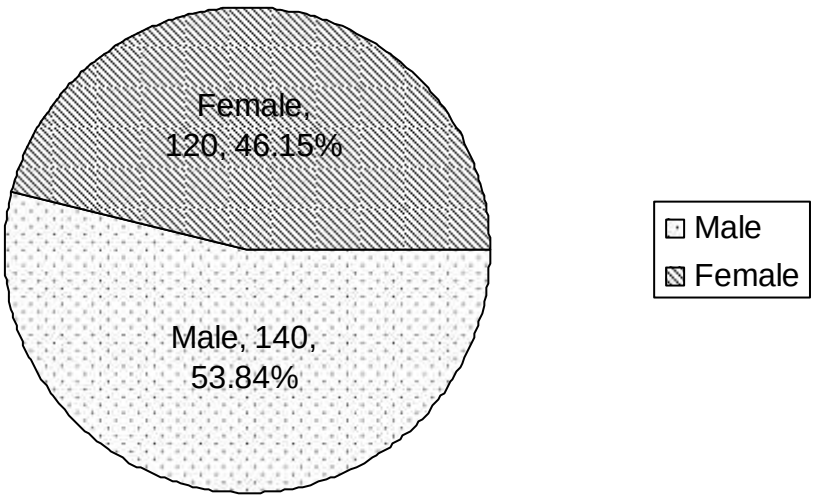

Female, 120, 46.15%
Male, 140, 53.84%
Male
Female

Fig. 15: Gender wise distribution of study population

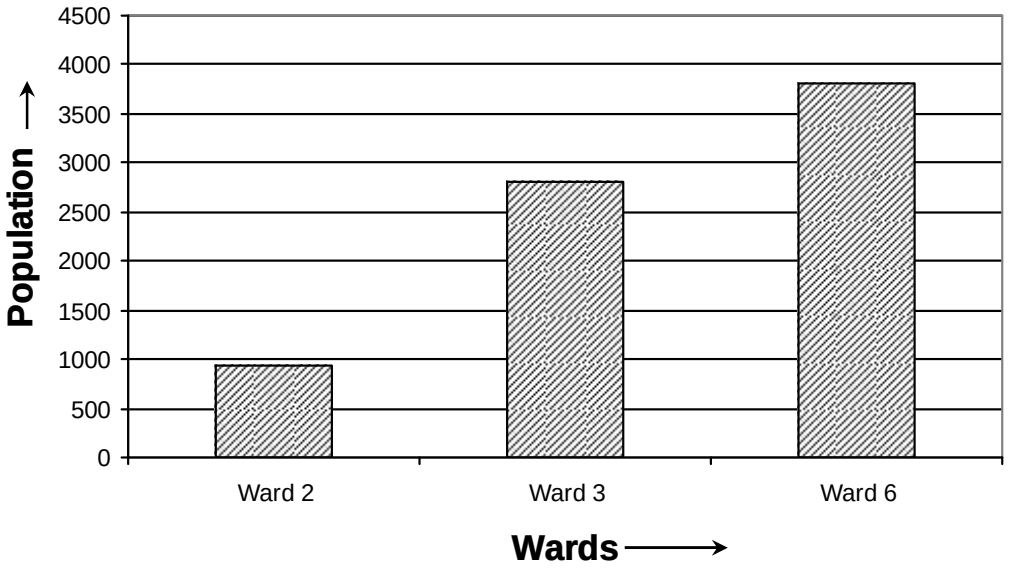


Fig. 16: Total population of the study area

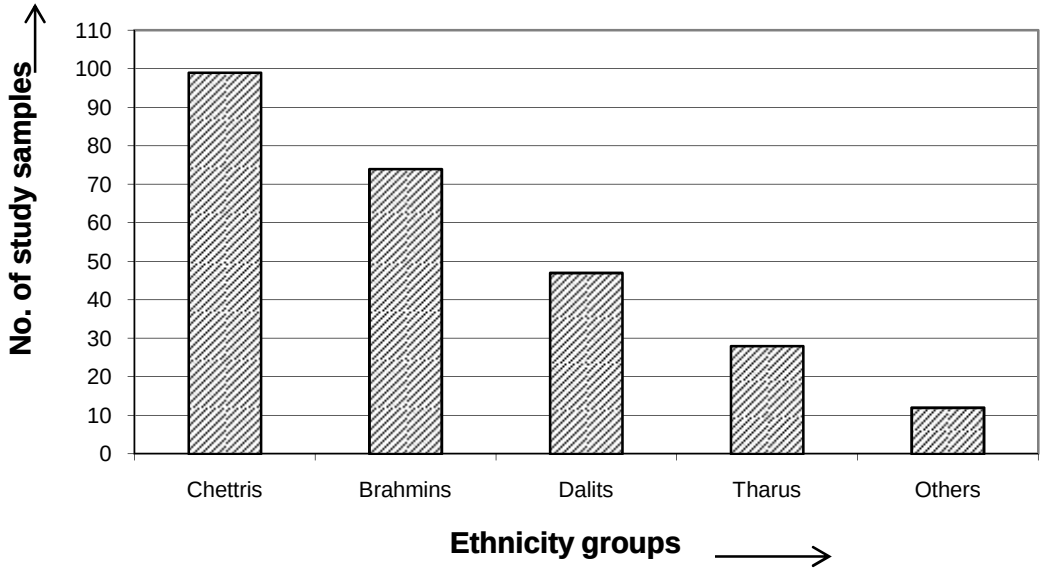


Fig. 17: Representation of the study population by ethnicity

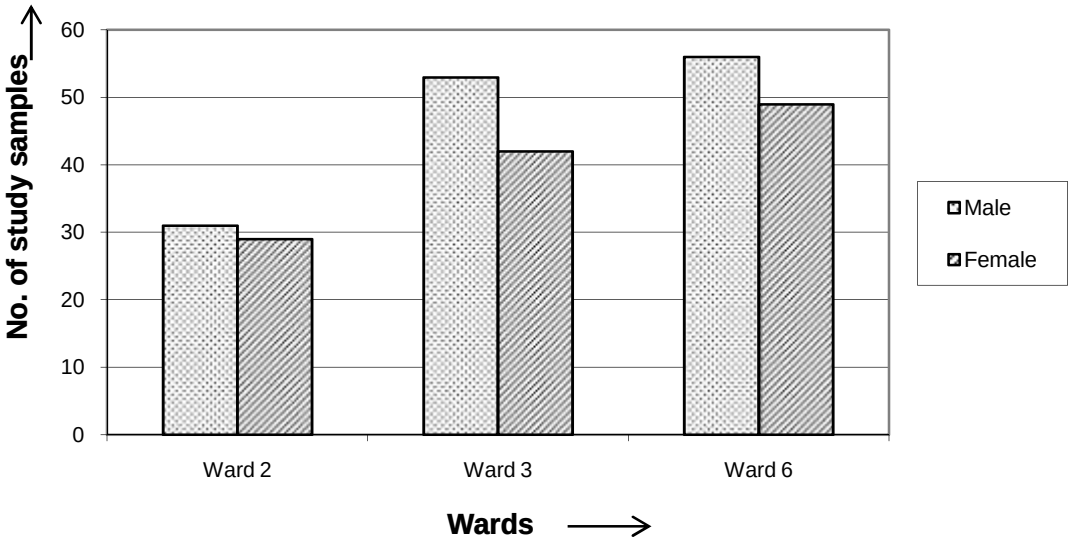


Fig. 18: Sex-wise study population from different wards

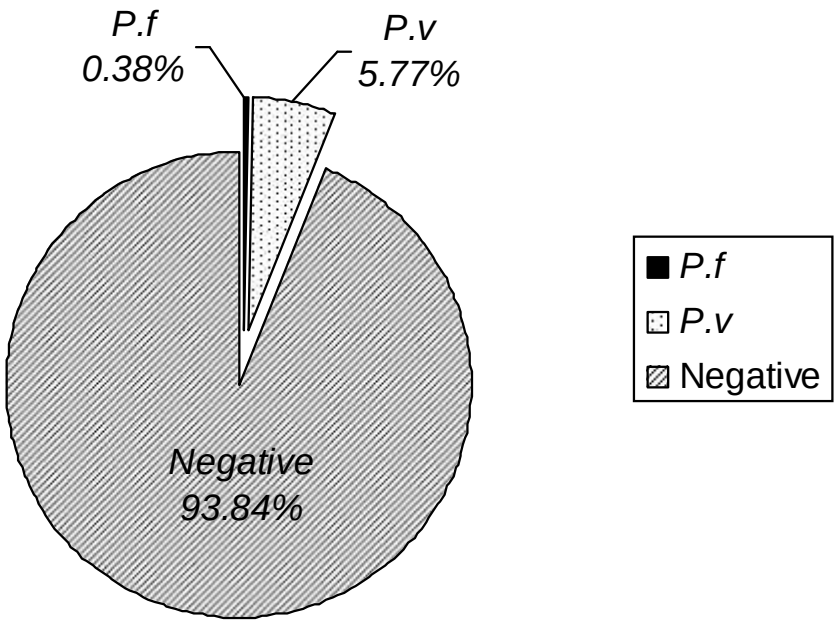


Fig. 19: Distribution of malaria cases

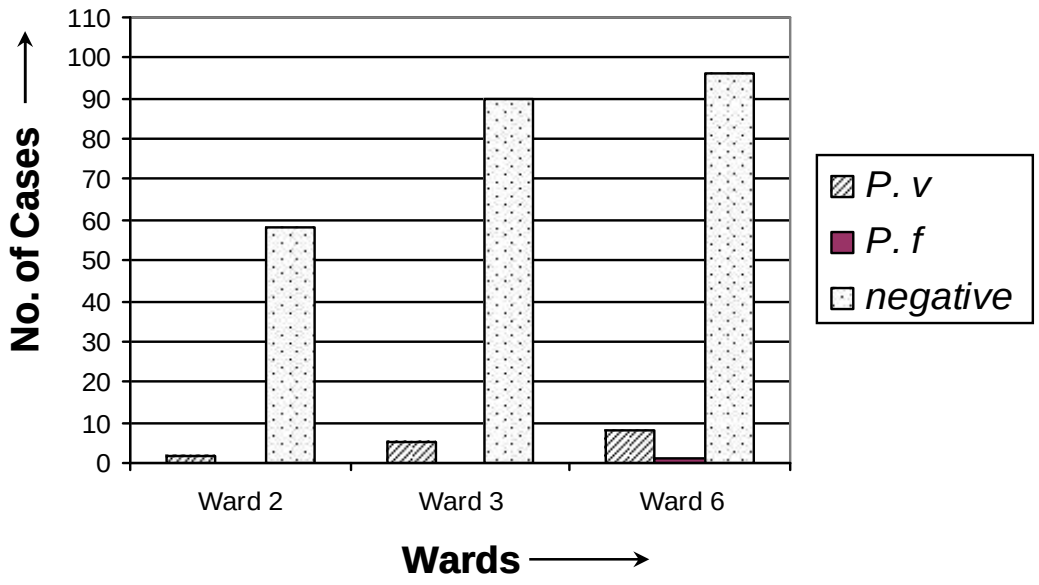


Fig. 20: Distribution of malaria in three wards of Daijee VDC.

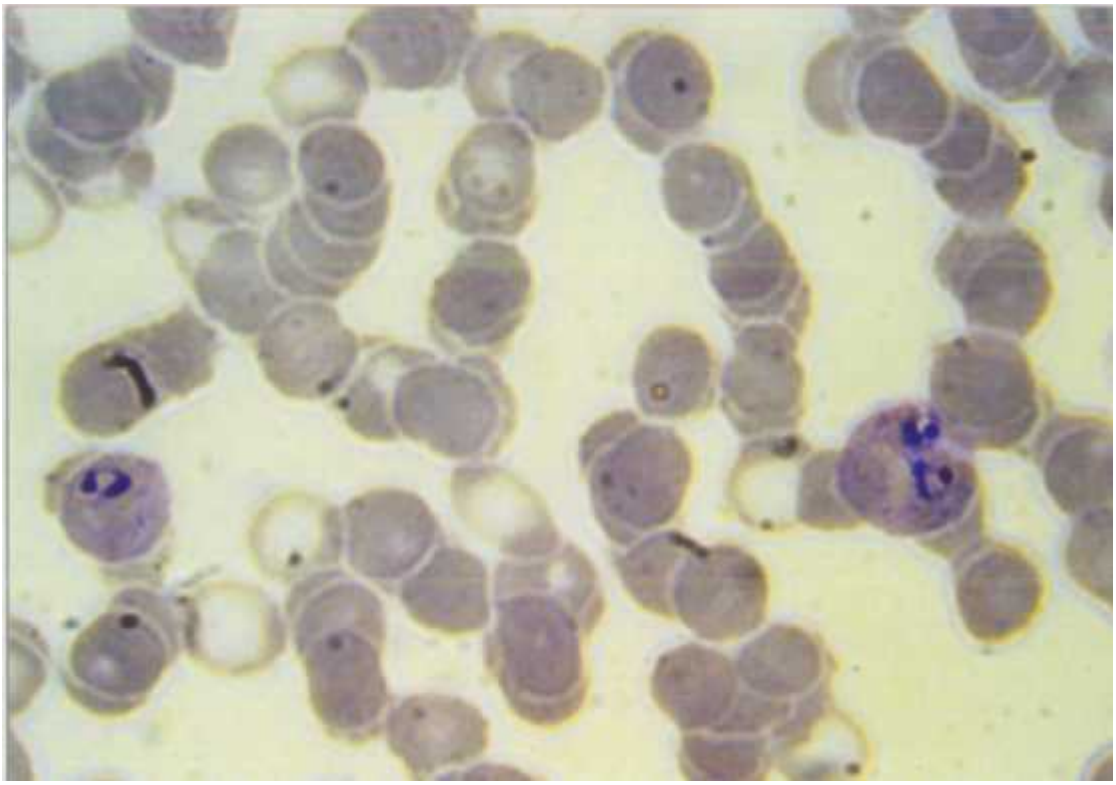


Plate 5: Tropozoites of *P. vivax* in thick film (10 x 100)

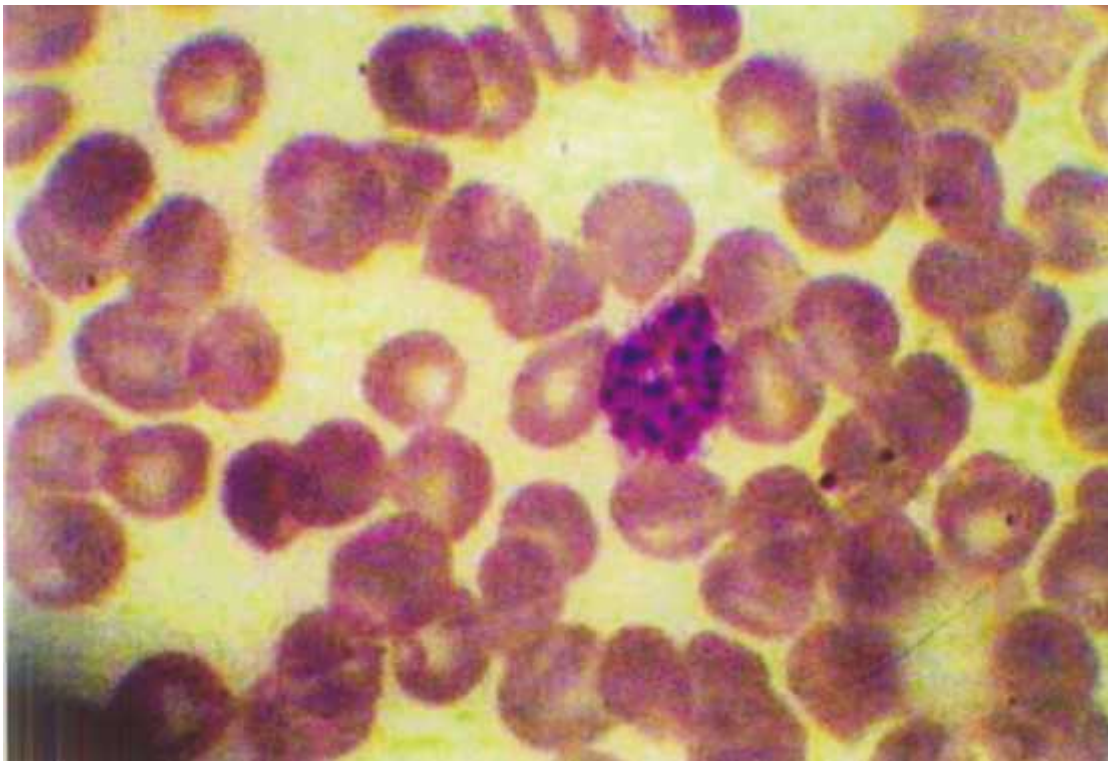


Plate 6: Schizont of *P. vivax* in thick film (10 x 100)

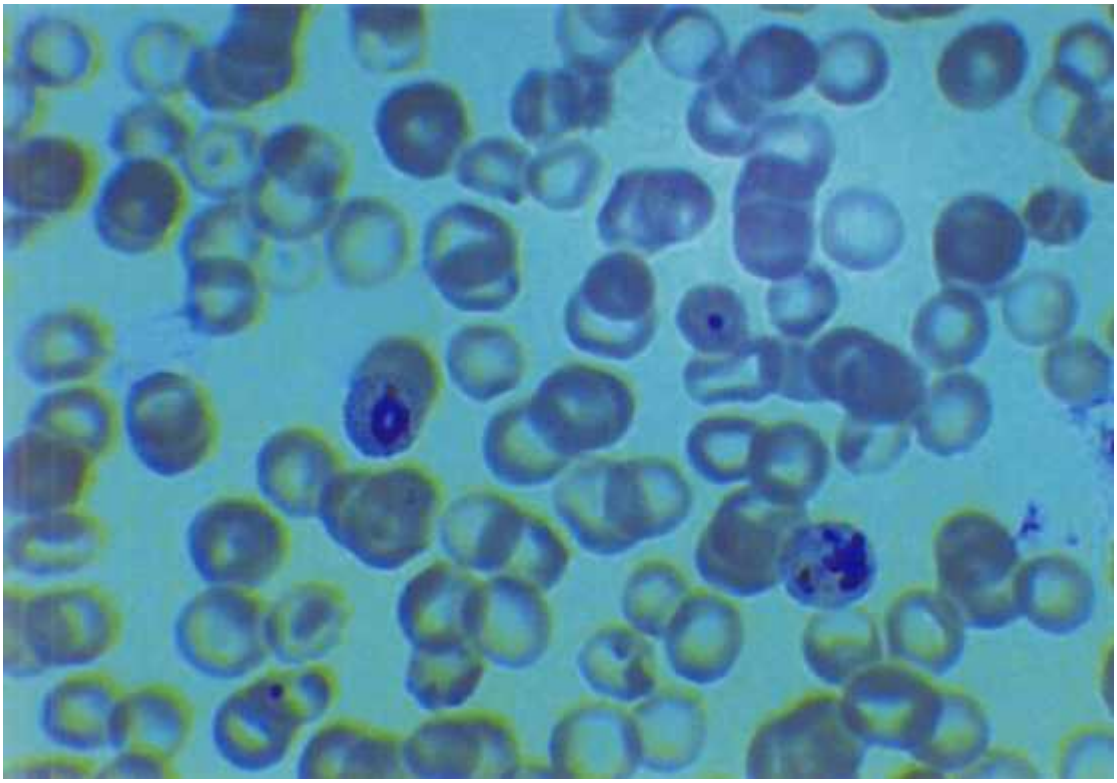


Plate 7: Tropozoite of *P. falciparum* in thick film (10 x 100)

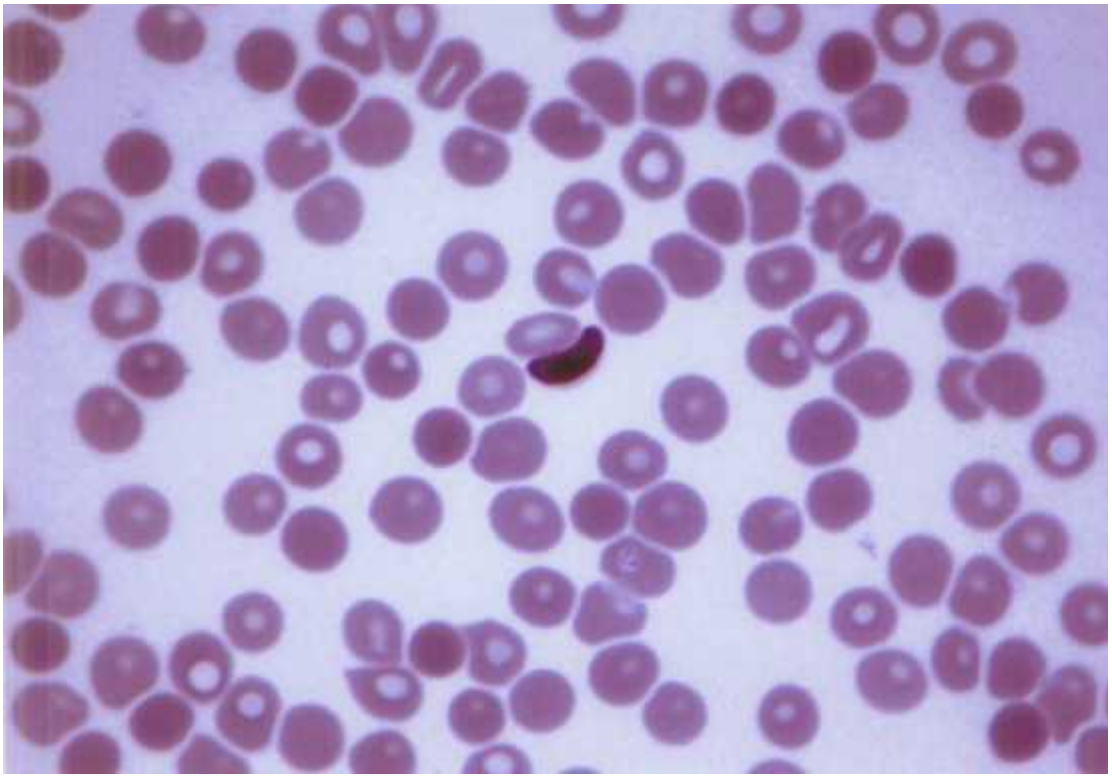


Plate 8: Gametocyte of *P. falciparum* in thick film (10 x 100)

6

DISCUSSION

Kanchanpur district has been notorious as malarious area for years. It is malaria hyperendemic zone and comes under stratum II of the government epidemiological classification. The estimated population of Kanchanpur district in 2005 is 429070 (DPHO Kanchanpur, 2005). This accounts for 19.65% of population of Far-western region and 2.52% of the total population residuing in malarious areas of Nepal. All together 1141 positive cases were recorded in 2005 out of which 28 (2.45%) were *P. falciparum* cases (DPHO Kanchanpur, 2005). The risk of malaria being reintroduced to an area can be calculated by determining it's malariogenic potential, which is influenced by 3 factors: receptivity, infectivity and vulnerability. Receptivity takes into account the presence, density and biological characteristics of the vectors; infectivity is the degree of susceptibility of mosquitoes to different *Plasmodium species,* and vulnerability is the number of gametocyte carriers present in the area (Banerjee *et al.,* 2000).

The receptivity wise data from 1997 onwards shows that maximum number of cases in moderate receptivity areas followed by low terai receptivity and least in low hill area (EDCD, 2003). Kanchanpur district experienced two major outbreaks within a period of 10 years. The death toll during the outbreak on Parasan Health Post of Kanchanpur district during 1996 reached 15. However in the epidemics of 2002, the total positive reached 8100 which covers 63.52% of the country's national figure and 91.46 percent of the region. During this period the *P. falcifarum* coverage was 68% of the country's total. In 2001, 1 death case was reported and in 2002, 3 death cases were reported (Annual report of EDCD, 2003). In 2004, 1 death was reported and in 2005 no death cases were reported (DPHO Kanchanpur, 2005).

The use of DDT and Chloroquine initially reduced the number of cases to 2357 in 1968 but the resistance of the vectors towards DDT in mid seventies caused outbreaks reporting 14647 in 1974. Synthetic pyrethroid compound lamdacyhalothrin (Icon) was introduced in 1988 and since 1992 Lamdacyhalothrin has been extensively used for both the malaria and kala-azar vector control and it has been found effective both for malaria and

kala-azar. Synthetic pyrethroid compounds have been found effective against both the malaria and kala-azar vectors (Bista, 1998).

Traditional diagnosis of malaria using thick blood film examination is most widely used routine in Nepal (Sherchand, 1998). In the present study thick blood film examination has been used. The common practice form of treatment in the area is Chloroquine and Primaquine tablets. Chloroquine resistant *P. falciparum* in Nepal is common and current first line drug is Sulfadoxine / Pyrimethamine (Banerjee and Bista, 2000). Malaria workers are trained to recognize as clinical malaria by symptoms characteristics of *vivax* malaria which is most common in Nepal and there is need to give refresher training so as to detect as well as treat *falciparum* malaria (Sherchand *et al.,* 1996).

In the present surveillance a total of 16 positive cases with 1 *P. falciparum* case were detected out of 260 slides examined. The SPR (Slide Positivity Rate) was 3.33%, 5.26% and 8.57% for ward 2, 3 and 6 respectively. The national figure of SPR is 5.10%, 5.0%, 6.93%, 4.85% in 2000, 2001, 2002 and 2003 respectively (EDCD, 2003). For Kanchanjpur district the SPR were 3.31%, 17.73%, 25.15%, 16.59%, 7.55% and 8.38% in the years 2000, 2001, 2002, 2003, 2004 and 2005 respectively. The SPR for Daijee VDC were 46.71%, 36.89%, 6.21% and12.14% in the years 2002, 2003, 2004 and 2005 respectively. In 2005, 7 *P. falciparum* cases were reported out of 185 total positive slides. The total slide collected was 1524 and the API rate was 6.91% for Daijee VDC (DPHO Kanchanpur, 2005).

In an active surveillance of this kind, the SPR is certainly influenced by samples which were random based on fever or history of fever and by time. The low positivity indicated that a history of fever alone was not a good indicator of parasitaemia.

Out of 260 slide collected in the study, 140 (53.84%) were of males and 120 946.15%) were of females. It was found that the rate of infection was higher in males 10 (7.14%) than in females 6 (5%). It is because males works outside the homes such as in paddy fields, nurseries, forest and fishery, so there is high risk of malarial infection. Most of the positive slide collected 8 (50%) were between the age-group 20-30 years. People's view about age group most effected 63 (52.5%) of respondents said all age-groups are effected by malarial infection.

People recognized malaria as a significant disease. Three wards have no significant difference in literacy, awareness of malaria and slide positivity ($P>0.05$). But the awareness of malaria vector, bed-net use and awareness brought by different agencies in the present study were found to be significantly different in 3 wards ($P<0.05$). The study population

represents 5 different ethnic group among which Chettris were dominating in number 99 (38.07%).

The survey showed that people considered it is necessary to give blood for diagnosis of malarial parasite, but they go to Health Post for malarial tablets rather than being diagnosed. Similarly the health personnel give antimalarial drug based on people's self diagnosis without blood result. A few of the respondents also knew that mosquito breed in water but nearby their houses stagnant water was seen in ditches.

Regarding the sleeping habits most of people used both outdoor and indoor sleeping during hot season. Most of the respondent 40 (33.33%) said that the malaria is cured or prevented by the use of medicines. Similarly the people's view about awareness brought by different agencies, most of the respondents (88) said that Government provide better awareness programme than others. DPHO of Kanchanpur play vital role in the awareness programme as well as the spraying medicines and distribution of impregnated mosquito nets. Environmental methods might be difficult since the villages at that land are surrounded by paddy field, pond reservoir and forest. Further majority of people keep cattle in the same house where they sleep. This significantly increases mosquito density. The study findings are significant with the government finding as the study shows the leading numbers of cases concentrated in different wards of Daijee VDC.

In Kanchanpur district there are 10 Health Posts, 8 Public Health Centres, 1 zonal hospital and 10 Sub-health Posts. In Daijee VDC there is only one HP. There is no SHP in Daijee VDC. So there is much pressure on HP, where only one technician is to examine all the cases.

Control of malaria in this region was based on two powerful tools, use of DDT and treatment with Chloroquine Phosphate (CQ). Their use is now very problematic. It is difficult to quantify the effect of a single factor or its importance in control of malaria. The problem is compounded by the presence of a moderate level of resistance. The risk of DDT on human health and the environment have resulted in a reduction in spraying with DDT and an increase in the use of Chemotherapy, thus changing the strategy from the vector control to malaria control. Nevertheless resistance to CQ is also increasing.

Although there are limitations in the interpretation of the result, it is possible that these results may not represent all population of Kanchanpur district because of the small sample size. Thus it was not possible to reach statistically valid conclusions. However, these results provide information that may be relevant to future studies.

7

CONCLUSIONS

- Malaria is a significant health problem in Kanchanpur district as well as Daijee VDC. The study concluded showing it's prevalence among all the ages of people. Despite the

massive outbreak in 2002, though the cases have reduced in number but the magnitude of problem is severe.

- The API/1000 population of Daijee VDC was 24.44, 7.27 in 2003 and 2004, while in 2005 it was 6.91. For Kanchanpur district the API was 10.70, 2.79 and 2.65 in 2003, 2004 and 2005 respectively (DPHO, 2005). Similarly the API for whole country in 2002 was 0.80 and 0.50 in 2003 (EDCD 2003). Decreased API indicates better implementations of malaria control activity.
- The ward wise data of Daijee VDC reported that API/1000 population of ward 2, 3 and 6 were 5.39, 3.02 and 4.44 respectively. The highest API was found in ward 1 i.e. 8.36. The VDC wise data of Kanchanpur district reported that API/1000 of Daijee VDC is 6.91 while the highest API was recorded from Jhalari VDC in 2005 (DPHO, 2005).
- The crucial determinants for the difference in disease prevalence in three wards were bed-net use, an awareness of malaria vector and awareness brought by different agencies.
- Health personnel are constrained to give antimalarial drugs based on people's self diagnosis without blood result. So some suspected cases might have received antimalarial drugs without having malaria. Other cases with disease might not have received full course of treatment because of not having the knowledge of full course of antimalarial dosage.
- Human dwelling cattle keeping field and low socio-economic conditions have been posing challenging obstacles for control.

8

RECOMMENDATIONS

On the basis of the findings of the study following recommendation are put forward.

- Taking the consideration of endemicity of Daijee VDC, diagnosis facilities should be strengthen to Health Post as much as possible.
- Health staff should be motivated to keep accurate data and records, to take blood before giving antimalarial drugs and feed back to the slide taken should be given.
- Malaria problem area as well as adjacent area should be sprayed.
- The reliability of malaria lab technicians should be evaluated and refresher training in relation to changing pattern of malaria should be provided.
- Different diagnostic test should be performed alternatively. Test like RDTs can provide quick result and hence prompt treatment can be accessed. The PCR though require technical expertise seems valuable for molecular epidemiological studies.
- The study had a very few participation of infants and pregnant women, a highly vulnerable group. Therefore the study seeks for future studies targeting this group that can have exploratory findings.
- People awareness programme about malarial infection and preventive methods should be conducted.
- Research on *Anopheles* species identification, vector behaviour, drug resistance pattern and serology based diagnosis of malaria should be conducted.

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Annex-1

HOUSEHOLD SURVEY BY A SET OF QUESTIONNAIRE RELATING TO (KAP) KNOWLEDGE, ATTITIDES AND PRACTICES

Name : _____ Age : _____

Sex : _____ Address : _____

Occupation : _____ Literacy : _____

1. What are the symptoms of malaria?
   (i) Fever with shivering (ii) Headache (iii) Sweating
   (iv) Nausea (v) Others: _____
2. Is there risk of malaria infection? Yes [ ] No [ ]
3. Do you know how malaria is acquired?
   (i) By mosquito bite (ii) Others: _____
4. Which age group is most affected?
   (i) Infant (ii) Children (iii) Old (iv) All
5. Do you think it is necessary to give blood for malaria diagnosis? Yes [ ] No [ ]
6. Are you satisfied with care provided by the health post? Yes [ ] No [ ]

7. When and where do you go for treatment if you have malaria?

   _____

8. Had anybody in your family have malaria attack recently? Yes [ ] No [ ]

   Whom: _____ When: _____

9. Where do you sleep?

   (i) Indoor [ ] (ii) Outdoor [ ] (iii) both [ ]

10. Do you use mosquito net? Yes [ ] No [ ]
11. Do you think the malaria transmission is prevented? Yes [ ] No [ ]
12. What are the preventive measures?

    (i) Spray (ii) Medicines (iii) Clean environment (iv) Unknown

13. Do you know about breeding place?

    (i) Water (ii) Soil (iii) Others

14. Which agencies provide better awareness programme about malaria?

    (i) Government (ii) NGO(iii) INGO (iv) Others

Annex-2

PREPARATION OF GIEMSA SOLUTION

Preparation 500ml Giemsa stock

Requirements

Giemsa powder---------- 3.8 grams

Glycerol (Glycerine) ---------- 250 ml

Methanol (Methyl alcohol) --------- 250ml

1. 3.8 grams of ready made Giemsa powder was weighed and transferred to dry brown bottle.
2. It was mixed with 250ml of methanol and 250ml of glycerol.

3. After mixing the above contents, the bottle was placed in hot water bath at 50-60^0 C for up to 2 hours to dissolve the stain. It was shaken regularly for obtaining homogenous mixture.
4. The bottle was marked and stored at room temperature in the dark. The Giemsa stock is prepared and storing properly it can be used for several months.

Preparations of Buffer Water, pH 7.1-7.2 required for dilution of Giemsa stain.

This is best prepared from the stock phosphate buffer solutions A and B as follows: Two types of salts are required.

a) **<u>Stock phosphate solution A</u>**

Monobasic Sodium phosphate, 1 hydrate ($NaH_2PO_4.H_2O$)

Requirements

$NaH_2PO_4.H_2O$---------- 27.6 grams

Distilled water ---------- to 1 litre

b) **<u>Stock phosphate solution B</u>**

Dibasic sodium phosphate (Na_2HPO_4)

Requirements

Na_2HPO_4---------- 28.39 grams

Distilled water---------- to 1 litre

Preparation of 1 litre buffered water.pH 7.2

Requirements

Stock Phosphate solution A---------- 140ml

Stock phosphate solution B---------- 360ml

Distilled water---------- 500ml

1. Above phosphate solutions were properly measured, transferred to leak free bottle and mixed well. The pH was measured using pH papers or pH meter.
2. The bottle was labeled and stored at room temperature. Under proper condition of storage the buffer remains stable for several months.

Precautions

1. Giemsa stain will be spoilt if water enters the stock solution during its preparation or storage.
2. Methanol is toxic and highly flammable, therefore it should be handled with care and its use should be restricted to an open flame.

Annex-3

GUIDELINES FOR THE USE OF ANTIMALARIALS AS PER THE NATIONAL DRUG POLICY

Type of malaria	**Drugs doses, and routes of admission**
Clinical	Choloroquine total 1500 mg over 3 days orally
P. vivax	Chloroquine total 1500 mg over 3 days orally + Primaquine total 75 mg over 5 days
P. falciparum	Sulfadoxine 1500 mg + Pyrimethamine 75 mg + Primaquine 45 mg in a single dose orally.
Suspected treatment failure of clinical malaria	Sulfadoxine 1500 mg + Pyrimethamine 75 mg + Primaquine 45 mg in a single dose orally.
Severe and complicated malaria	Quinine dihydrochloride/sulphate with an initial loading dose of 20 m/kg body weight in 500 ml isotonic saline or 5% dextrose infused IV at a constant rate over 4 hours and then continued with10 mg/kg body weight at the same infusion rate 8 hourly. However, parenteral quinine dihydrochloride/sulphate is replaced by oral quinine tablets 10 mg salt/kg body weight 8 hourly for 7 days as soon as the patient becomes conscious and is able to swallow the tablets.
Malaria in pregnancy *P. vivax* *P. falciparum*	Chloroquine total 1500 mg over 3 days orally Sulfadoxine 1500 mg + Pyrimethamine 75 mg.
Malaria in infants and children below 2 years	Chloroquine total 25 mg/kg body weight over 3 days.

(Source: National Workshop on Prevention and control of Vector Borne diseases in Nepal, 2002.)

Annex-4

SPECIES IDENTIFICATION OF MALARIA PARASITE IN GIEMSA-STAINED THICK BLOOD FILMS

Species		Stage of parasite in peripheral blood		
		Trophozoite	Schizont	Gametocyte
P. faciparum	Young, growing trophozoites and/or mature gametocyles usually seen.	**Size:** small to medium; **number:** often numerous; **shape:** ring and comma forms common; **chromatin:** often two dots; **cytoplasm:** regular, fine to fleshy; **mature forms:** sometimes present in severe malaria, compact with pigment as few coarse grains or a mass.	Usually associated with many young ring forms. **Size:** small, compact; **number:** few, uncommon, usually in severe malaria; **mature forms:** 12-30 or more merozoites in compact cluster; **pigment:** single dark mass.	Immature pointed-end forms uncommon. **Mature forms:** banana-shaped or rounded; **chromatin:** single, well defined; **pigment:** scattered, course, rice-grain like; pink extrusion body sometimes present. Eroded forms with only chromatin and pigment often seen.
P. vivax	All stages seen; Schuffner's stippling in 'ghost' of host red cells, especially at film edge.	**Size:** small to large; **number:** few to moderate; **shape:** broken ring to irregular forms common; **chromatin:** single, occa-sionally two; **cytoplasm:** irregular or fragmented; **mature forms:** compact, dense; **pigment:** scattered, fine.	**Size:** large, **number:** few to moderate; **mature forms:** 12-24 merozoites, usually 16, in irregular cluster; **pigment:** loose mass.	Immature forms difficult to distinguish from mature trophozoites. **Mature forms:** round, large; **chromatin:** single, well defined; **pigment:** scattered, fine. Eroded forms with scanty or no cytoplasm and only chromatin and pigment present.

P. ovale	All stages seen; prominent Schüffner's stippling in 'ghost' of host red cells, especially at film edge.	**Size:** may be smaller than *P. vivax*; **number:** usually few; **shape:** ring to rounded, compact forms; **chromatin:** single, prominent; **cytoplasm:** fairly regular, fleshy; **pigment:** scattered, coarse.	**Size:** rather like *P. malariae*; **number:** few; **mature forms:** 4-12 merozoites, usually 8, in loose cluster; **pigment:** concentrated mass.	Immature forms difficult to distinguish from mature trophozoites. **Mature forms:** round, may be smaller than *P. vivax*; **chromatin:** single, well defined; **pigment:** scattered, coarse. Eroded forms with only chromatin and pigment present.
P. malariae		**Size:** small; **number:** usually few; **shape:** ring to rounded, compact forms; **chromatin:** single, large; **cytoplasm:** regular, dense; **pigment:** scattered, abundant, with yellow tinge in older forms.	**Size:** small, compact; **number:** usually few; **mature forms:** 6-12 merozoites, usually 8, in loose cluster; some apparently without cytoplasm; **pigment:** concentrated.	Immature and certain forms difficult to distinguish from mature trophozoites. **Mature forms:** round, compact; **chromatin:** single, well defined; **pigment:** scattered, coarse, may be peripherally distributed. Eroded forms with only chromatin and pigment present.

(Source: Basic Laboratory Methods in Medical Parasitology; WHO, 1991)

Annex-5

LIFE CYCLE OF MALARIAL PARASITE

The malarial parasite passes its life cycle in two different hosts.

i. Human cycle

The parasite residing inside the liver cell and the red blood corpuscle reproduces by asexual method (schizogony). Hence, man represents the *intermediate host* of the malarial parasite. In nature, the disease is contracted by inoculation of the saliva of an infected female *Anopheles* mosquito with the malarial parasite in the form of sporozoites. Sporozoites circulate in the blood for about half an hour and then enter the liver cells where they develop and multiply for about 6-10 days and become multinucleate schizonts. Development of the parasite in the liver cells constitutes the pre-erythrocytic phase. The fully mature schizonts burst and liberate many merozoites, which enter the Red blood Cells (RBC) to start the erythrocytic cycle.

Some of the sporozoites in the liver cells do not mature quickly and remain dormant as hypnozoites in the liver tissue to produce relapses as in the case of *P. vivax*. The merozoites in the Red blood Cells successively develop into trophozoites and schizonts, which multiply asexually and liberate many merozoites into fresh Red Blood Cells in the blood circulation. Each such erythrocytic cycle is repeated every 48-72 hours, depending on the species of the parasite, e.g. *P. vivax* and *P. falciparum* -48 hours, *P. ovale* -50 hours and *P. malariae* -72 hours. The infected person develops fever and chills with the release of first batches of merozoites.

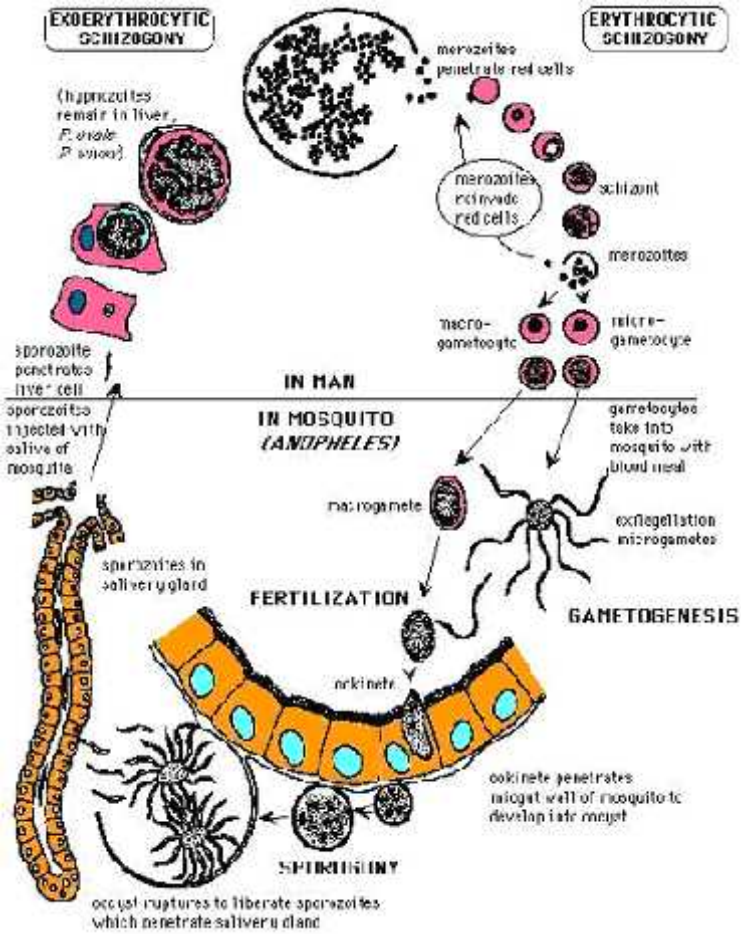
In all species, some of the erythrocytic merozoites that invade the blood cells do not divide but differentiate into male and female gametocytes, which are the sexual stages of the parasite in the host. The sexual cycle starts in the intermediate host (man) but it is completed in the definite host i.e. female anopheline mosquito (Rana, 2001).

ii. Mosquito cycle

This phase starts when a female anopheline mosquito sucks infected human blood. All the blood elements and the asexual stages of the malarial parasites (merozoites, trophozoites, etc.) are digested in the gut of the mosquito, but the sexual stages of the male and female malarial parasite (gametocytes) are left intact and start maturing. On account of this sexual method of reproduction, mosquito represents the definite host of the malarial parasite.

The male and female gametocytes give to the male and female gametes, respectively, which unite to form a zygote. The zygote forms a worm like ookinete that penetrates the wall of the stomach of the mosquito and develops into an oocyst. The nucleus of the oocyst multiplies to form many sporozoites, which are liberated in the body fluid of the mosquito by the bursting of the oocyst.

In the final stage, these sporozoites penetrate the salivary glands of the mosquito and remain there, ready to enter a flesh host when the infected mosquito bites another healthy person. The phase of development of the malarial parasite in the mosquito of called "sporogony" or the "extrinsic phase" and takes about 7-55 days, depending upon the species of the malarial parasite and the ambient temperature (Rana, 2001).



The Life Cycle of *Plasmodium species* in man and mosquito.

(After Vickerman and Cox,1967)

(Source: http://www-micro.msb.le.ac.uk/index.html)

Annex-6

REASONS FOR THE RESURGENCE OF MALARIA

Man made reasons	Complacency and laxity in anti malarial campaigns; conflicts and wars; migrations; deteriorating health systems; poverty.
Parasite	Drug Resistance.
Vector	Insecticide Resistance.

Environment	Global Warming - increased breeding and life span of the insect vector.
Jet Age	Shrinking world - spread of malaria from endemic areas to all other parts of the world.

(Source: http://www.malaria.farch.net)

Annex-7

OUTBREAK OF CEREBRAL MALARIA IN BANKE DISTRICT, 2006

Treatment still eludes malaria patients

• One more patient dies, taking toll to 40 • Rapti river making affected area virtually inaccessible

Himalayan News Service

Banke, November 3

Patients suffering from cerebral malaria patients across the Rapti river complained today that treatment was still beyond their reach.

Meanwhile, 45-year-old Shantidevi Yadav of Holiya-1 died today for want of treatment, a local, Sohanlal Yadav, said over phone. Patients are awaiting treatment, he said. With Yadav's death, the malaria toll in the last two weeks has climbed to 40. Though physicians had referred 12 patients to the Bheri Zonal Hospital on Wednesday, saying the patients were at high risk, just one patient was brought to the hospital in a vehicle yesterday. The District Public Health Office (DPHO) Banke does not even know where they are.

The DPHO said the patients could not be brought to the hospital as the affected areas were virtually inaccessible.

Chief of the DPHO Banke, Jaya Bahadur Karki, said the vehicle has been arranged for bringing the patients to the hospital. "Several people will be needed to bring the patients up to the Rapti. "No one is cooperating with us to ferry the patients."

Karki said a tractor will head for the Rapti tomorrow to ferry the patients. He said a patient was rushed to the Bheri Zonal Hospital in a vehicle yesterday.

Karki, however, said: "A team of physicians from the Nepalgunj Medical College arrived in the malaria-affected areas today. All the physicians are busy treating patients, he added.

(Left) A worker spraying pesticide to kill mosquitoes in cerebral malaria-affected Sonbarsha-3, Banke, on Friday. A mother holding her child who is suffering from cerebral malaria in Piprahawa-4, Banke, on Friday.

After floods, malaria wreaking lives of Banke folk

Rupesh Acharya

Banke, November 3

Floods ruined the lives of people of Pipmahawa and other villages across the Rapti river in August. Now, cerebral malaria is killing them.

Cerebral malaria is spreading in Gangapur, Fatehpur, Pipralawa, Narainapur and Holiya villages across the river. The epidemic has killed 40 people in the area so far.

Blood samples of 521 persons were tested and 47 per cent of them were found to be infected with severe types of malaria P falciparum and 43 per cent with PV type.

The floods had devastated almost everything in these affected areas, Imran Ali Sheikh, who came to a health camp as his three children continuously suffered from fever, said: "The area around my house was waterlogged during flooding."

Another local Basir Ali, who, together with five of his family members, has taken ill, said insecticide had not yet been spread in the affected areas.

"I had warned of epidemic during floods and appealed for medicines, but no one listened to me. Relief packages included only a few kilogrammes of beaten rice and rice."

He also complained that his call for distribution of mosquito nets had gone unheard.

Twelve people of a ward in Piprahawa village are among those who have died of malaria. Hedurum Dhobi, a farmer, said he is suffering from fever for the past 20 days. I went to India for medical check-up.

Adviser to the Health Ministry, Dr Mahesh Maskay, who is conducting a health camp in the affected area, said the epidemic spread because precautionary measures were not taken. Children may be infected with pneumonia during winter if the flood victims are not resettled, he said.

The Himalayan Times (Vol. V No. 344 Kathmandu. Saturday, November 4)

12 malaria patients await rescue

Himalayan News Service

Banke, November 2

Lack of transport facility has threatened the lives of cerebral malaria patients in remote villages of Banke.

Teams of medical experts reached the villages yesterday and have started conducting tests and treatment. However, 12 patients whom they had referred for special treatment in Nepalgunj have not been able to go there due to lack of transport facility.

Head of the District Public Health Office, Banke, Jay Bahadur Karki, said medical teams had referred the malaria patients to Nepalgunj yesterday.

The teams, however, could not be sure which villages those 12 patients were from.

Advisor to the Health Ministry, Dr Mahesh Maskey, said they were working to bring the serious patients to Nepalgunj on a helicopter.

"We are trying to ferry the patients to Nepalgunj but there is no helicopter in Nepalgunj at the moment," Dr Maskey said.

"I have talked to the Prime Minister on this regard but nothing has happened as yet," he said.

Meanwhile, Dr Usha Shah, chief of the Bheri zonal hospital told a press conference here that they would provide free treatment to malaria patients.

Director General of the Department of Health, Dr Mahendrakeshari Chhetri, expressed hope that they would be able to control the disease soon.

"We have dispatched enough equipment and medicines for the villages," he said, adding that the remoteness of the villages and the Rapti river has affected the treatment process.

Malaria was detected in 82 of the 255 blood samples. Of them 39 were found to have P Falsiperam and 43 were infected with P Vives malaria.

An experts' team headed by Dr Suman Thapa has set up health camps in Fattehpur, Nainanapur and Holiya VDCs.

The Himalayan Times (Vol. V No. 343 Kathmandu, Friday, November 3)

Mystery disease diagnosed as 'cerebral malaria'

Himalayan News Service

Banke, November 1

The mystery disease that has spread in four VDCs of Banke across the Rapti river for the past two weeks was diagnosed as cerebral malaria (a severe type of malaria) today.

A team of medical professionals led by Dr Suman Thapa, which arrived here from Kathmandu, diagnosed the disease.

Talking to this daily, advisor to the Health Ministry Dr Mahesh Maskey said the team reached the affected VDCs with essential equipment and medicines today. "The disease was diagnosed as cerebral malaria after examining blood samples of some patients." Maskey said: "Blood samples of 21 patients were tested today. Among them 16 were found infected with malaria."

"Cerebral malaria transmits due to the bite of female mosquito of 'anopheles' species. This kind of malaria directly affects the mind so a person infected with this malaria dies within some days," Dr Maskey said. Doctors are treating patients by setting up health camps in Fattepur, Gangapur, Narainapur and Holiya VDCs. "We have made arrangements for the treatment of patients," said Jay Bahadur Karki, chief of the Banke District Public Health Office (DPHO). The death toll from the disease has reached 39 with the death of three more persons in the past two days. Over 500 villagers have been affected.

Five-year-old Jogi Yadav of Fattepur died today, while Baur Kha, 40, of Narainapur and Sattan Baskar, 4, died yesterday, Banke DPHO said.

Meanwhile, a report from Bara said blood tests of 25 persons in Bara's Kabahi Goth showed one person was infected with malaria. malaria (plasmodium vibex) was detected in 28-year-old Shambhu Mahato of Santagunj in Kabahi Goth-8.

The Himalayan Times (Vol. V No. 342 Kathmandu, Thursday, November 2)