CHAPTER - I

INTRODUCTION

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The extraordinary challenges of basic requirements and providing a acceptable quality of life to the present and future generations in India depends on our ability to initiate sustainable integrated development at both rural and urban levels within a reasonable time frame (Rao, 1996). The health of country is related to population, education and resources available. Over population with less resources of human food and shelter weakens the health of a country.

Indian population is now more than one billion. The population control measures adopted in last two decades have resulted in the lowering of the birth rate from 35 per thousand to about 29 per thousand. However, we are still far away from reaching the desirable target of replacement fertility rate of 21 per thousand (Rao, 1996). Indian population has trebled from 361 million in 1951 to more than one billion in 2000. It is expected that India will soon take over China and will earn the dubious distinction to becoming the most populated nation in the world (Kain, 2000). Therefore, it is essential to influence the fertility behaviour of individuals for decreasing population, as over population is directly related to epidemiology. The present birth rate of India will double the population within 40 years. Population stabilisation can be possible through equalisation of number of older people dying and number of children born. According to Rao, (1996), the optimistic assumption of reaching the target of 21 per thousand for the crude birth rate by the year 2025, the population in India can only stabilise at 1.8 billion by the year 2065.

Inadequate resources of food directly affect the health of a country. The reduction of per capita availability of agricultural land to just 0.1 hector which is totally inadequate to sustain large rural population. Development of agro-based industries and value addition to agroproducts, however, are essential to increase the per capita income in rural areas, which is just about the fifth to that of urban population, in spite of agriculture contributing to almost 50% of National G.D.P. through direct and indirect means. Starvation of over 200 million people in developing nation was due to poor productivity and due to their incapability to afford the prize of food (Rao, 1996).

The urban population in India, which was barely 30 million in 1900 has already increased to over 240 million, forming almost 30% of our total population and is expected to cross more than 400 million by the year 2001. However, expected resources for sustainable health are not increased upto the satisfaction which leads to affect the health of the nation adversely.

The explosive population growth in urban areas having poor infrastructure and sanitation have turned our large metropolitan cities into mega slums. Over 25% of the urban population in our mega cities still do not have access to safe water supply, making water borne diseases such as cholera, typhoid, tuberculosis, dysentery and gastro-enteritis, the most serious health hazards affecting the urban population. Over 20% of the population in many of our major cities are suffering from hypertension, asthma and other respiratory diseases. Inadequate public transportation and poor sanitation have resulted in brown environmental degradation, converting our major cities into sources of concentrated environmental hazard instead engines of growth. The solid waste

generated each day by our mega cities like Calcutta is over 100 tons per million, adding half million ton of solid waste annually, 50% of which is not even collected, let alone recycled, making them the fertile breeding ground for a large number of communicable diseases such as cholera, plaque and malaria.

Education is the most important force for human liberation. It remains the most neglected aspect of our society. Of the global investment of about $1000 billion on education, the total share of three quarters of global population residing in 160 developing nations in the world is a mere 14%. The total investment on education including technical education and sports from both Central and State Sector in India is less than 3.5% of our G.D.P. or less than $ 25 per capita as against over $ 500 per capita in developed societies (Rao, 1996). In India, still 50% of the school catering can't have a black board, alone library and laboratory facilities. The illiteracy is around 40% of the total population with more than 60% females. The least developed countries with illiteracy rate is about 70 to 80% have only per capita annual income of less than $ 200, while low income nations group like India have a annual income ranging from $ 300 to $ 600 as against over $ 10,000 per capita income of developed nations. The illiteracy rate of India is 35 to 50% where as it is less than 5% in the developed nations. The illiteracy seriously affect the health of a country.

The crude birth rate in Kerala, where female illiteracy is less than 10% has increased to 18 per thousand as against 36 per thousand as States like Uttar Pradesh and Bihar, where female illiteracy exceed 70%. This indicates that there is immediate need to initiate massive illiteracy programme in the States. The reduction

in crude birth rate with increase illiteracy in Kerala achieved a low infant mortality rate of less than 17 per thousand as against the prevalent 80 per thousand elsewhere in the country. This clearly indicates that the female literacy, a single factor can avoid the prevalence of diseases in infants. It is therefore very much essential to have massive education at the grass root level of our society.

The trained man power invariably play important role in building the health of a country. The number of scientists in India is less than 4.5 per thousand population as against 110 in Japan or over 200 in most of the European nations. The number involved in research which is what really matters in the development of science and technology is just 0.25 per thousand population as against 5 per thousand in all scientifically advanced nations (Rao, 1996). The scientific research can crate necessary technical man power who can effectively contribute to the wealth of country and technological society of the future in India. The annual expenditure on R and D is less than $ 5 per capita as against over $ 7000 in the developed countries. Large scale tapering with selection process of both teachers and students in our educational system and Govt. employment can not create excellence.

The large percentage of illiterate females is directly attributable to increased infantile mortality rate as well as poor attention to nutrition and health care. Mortality rate of children under five, is about 130 per thousand in India as against less than 15 in the U.S. Thought the phenomenal advances achieved in medical sciences and health care, pollution of poverty, widespread illiteracy and environmental degradation in rural areas have resulted in 12 million children in the developing countries dying every year from rampant respiratory and communicative diseases in

the world. In India, over 3 million children are dying due to above reason. In 8th Plan, India contributed just about Rs. 7500 Crores on health sector which is less than 2% of our plan location.

The poor water supply and sanitation exert pressure on health of a country. In India, eighth planned expenditure on urban water supply, sanitation and other health improvement measures was a meagre, 3.5% of the total expenditure of the eighth plan.

Education, environmental management and nutritional security are the basic prerequisites required for promoting health. The development of comprehensive primary health care delivery system is essential to establish the health security in the country. The availability of just about 40 medical practitioners and about 100 beds for a lakh of population is not sufficient. Medical facilities are mostly concentrated in urban areas. Rural medical facilities are totally inadequate as the rural people constitutes 65% of our total population. About 25 thousand primary health care centres and poorly equipped 1.5 lakh of subcentres have been recognized in India, most of which do not have even a skeleton medical staff.

Through space technology, we can today conceive wide spectrum of medical services and assistance to remote areas by providing instructions to rural medics on Pediatrics, internal medicine, orthopedics, ophthalmology, gynecology, nutrition and physical therapy. Timely monitoring and management of environment and eradication of massive illiteracy, particularly female illiteracy would certainly help in solving the problems in health care of diversified society of India. Remarkable developments in medical technology now offer a great promise against several diseases with a genetic basis.

Though recent developments facilitated to cure certain diseases, still there are serious problems in health care. The extraordinary challenges now a days, are the solution for AIDS and Cancer. The AIDS epidemic is now so wide spread globally that it could help destroy foreign government and contribute to ethnic wars. The World Health Organization says that 23 million people are infected in Sub-Saharan Africa and that new cases are running at about 5,000 a day. The prevalence rate of HIV/AIDS in India is 30.02 per 1000 people surpassed only by Maharashtra and Manipur. The figure has registered an annual 5% increase since 1986 (Thakur, 2000). WHO intimates that the number of Indians with HIV is any where up to 5 million. At present Indian constitute 8 to 10% of global infection with HIV. The incidence of STDs is higher in the coastal areas which subsequently increase the risk of transmission of HIV. About 14 million people acquire STDs every year in India. Effective treatment of this large population requires the use of WHO development syndrome approach to management. Health, education, integration of reproductive and social health and development of an AIDS control programme like the one is use in Thailand could help to bring this alarming situation under control, remarked by Union Health and F.W. Minister (Thakur, 2000). The other curable diseases are also extraordinary challenge some times in rural and remote areas of India.

Human health is affected by a variety of organisms which include insects, other arthropods, nematodes, protozoans, fungi, bacteria, viruses and rickettsia etc. The pathogens cause several fetal diseases to man, likely, insects also cause dreaded diseases to human being. The insects related to epidemiology include houseflies, sandflies, mosquitoes, rat flea and tse-tse fly etc. These

insects are vectors of various diseases. Among the above insect vectors, mosquitoes play an important role in epidemiology as they cause fetal diseases like malaria, filariasis, dengue, encephalitis, yellow fever, etc. They also transmit many animal diseases like fowlfox of poultry, mycomatosis of rabbits, Rift valley fever of sheep, encephalitis of horses and birds and heatworms of dogs. Mosquitoes even help in transmission of diseases of some other insects e.g. Dermatobia, a South American warblefly transports its eggs to the skin of man and animals through mosquitoes alone. On the skin they hatch and cause myiasis.

Human Malaria is transmitted exclusively by *Anopheles* spp. which include *Anopheles labranchiae* Falleroni, *An. sacharovi* Favre, *An. sargentii* (Theobald), *An. superpictus* Grassi, and *An. pharoensis* Theobald in parts of the mediterranean area; *An. funestus* Giles, *An. moucheti* Evans, *An. nili* (Theobald) and members of the gambiae Giles complex in the Ethiopian region; *An. stephensi* Liston, *An. flaviatilis* Jomes and *An. pulcherrimus* Theobald in Western Asia; *An. culicifacies* Giles in India and Ceylon; *An. maculatus* Theobald, *An. sandaicus* (Rodenwaldf) and members of the *An. barbirostris* Vander Wulp, *An. hyrcunus* (pallas) Wulp groups in Southern Asia; members of the *An. punctulatus* complex in Melanesia and *An. pseudopunctipennis* Theobald, *An. bellator* Dyar and Knab, *An. cruzii* Dyar and Knab, *An. darlingi* Roof, *An. aquasalis* Curry, *An. albimanus* Wiedemann, *An. albitarsis* Lynch Arribalzaga and *An. nuneztovavi* Gobaldon in Central and South America.

In India, following species of *Anopheles* are most prevalent which transmit malaria. *An. annularis, An. sundaicus, An. stephensi, An. maculatus, An. philippinensis, An. leucosphyrus, An.*

fluviatilis, An. culicifacies, An. varuna, An. minimus, and *An. sundaicus.* The prominent species of Culex includes *Culex pipiens* Fatigas, *C. pipiens, C. vishnui, C. pseudovishnui, C. triaeniorhynchus, C. bitaeniorhynchus, C. sinensis, C. gelidus, C. sitiens* and of the Genus *Aedes* are *Aedes aegypti, A. albopictus, A. vittalis* and *A. variegatus* (Rao, 1984).

Malaria disease is caused by mostly four species of Plasmodium and still is an important disease of man throughout the world and its control is formidable global problem.

In India, malaria killed 8,00,000 people in 1953, out of 75 million infected people. There after the cases decline to 60,000 with no death in 1962 but during 1969 the malarial resurgence took place. During 1975, 1976 and 1977 about 5.1, 6.4 and 4.7 million people suffered from malaria respectively. However, death due to malaria were 3, 99, 59 and 55 in the year 1974, 1975, 1976 and 1977 respectively. The picture of Maharashtra with respect to incidence of malaria is not encouraging.

Malarial incidence have been studied during the year, 1992-2000 by Girhe and Sathe (2001) with respect to malarial infection cases in human population in Kolhapur district, Maharashtra. It was observed that the incidence of malaria during the years 1992-1996 was in increasing order. Maximum, 700 infection cases have been reported during the year 1996. However, the incidence of malaria declined from the years 1997-2000, showing only 60 infection cases during the year 2000. The reasons for decline in malaria incidence were the proper strategies of mosquito control

adopted by the Health Department and low rainfall in the region (Girhe and Sathe, 2001).

Malaria is caused by four species of protozoa namely, *Plasmodium vivax*, *Plasmodium falciparum* (malignant tertian, subtertian aestivoautumnal malaria, falciparum malaria); *Plasmodium malariae* (quarten malaria) and *Plasmodium ovale* (ovale malaria). In case of *P. vivax* and *P. falciparum* there are races and strains distinguished through the clinical picture, geographical distribution and immunological responses. In India, *P. vivax* is responsible for causing 65-90% malaria where as *P. falcipanum* cause 25-30% of total malaria. The *P. malariae* represent only 1% of the cause where as *P. ovale* is distributed sporadically. The protozoa invade the paranchyma cells of the liver and after passing through developmental stage attach and reside inside R.B.Cs. Female mosquito inject saliva and sporozoites during the act of biting and feeding. Other means of malarial transmission can be either through blood transfusion or congenital transmission or even by the use of a syringe from an infected person.

For completion of life cycle of malarial parasite two different host are required. Asexual reproduction take place in man and sexual in insect vector.

Filariasis is caused by mosquitoes belongs to genera *Culex* and *Mansonia*. Filariasis is a morbid condition caused in man by two nematodes namely, *Wuchereria bancrofti* and *Brugia malayi*. The diseases yellow fever and dengue fever are transmitted by the mosquitoes of Genus *Aedes*, specially Aedes *aegypti* and some other species. Yellow fever is viral fever of short duration varying in

severity like toxic jaundice, albuminuria and haemorrhages etc. According to Atwal (1986) India and South Asia is luckily free from yellow fever virus, however still the possibility of its introduction can not be ruled out.

The disease dengue fever is widely distributed in tropical and subtropical areas. The dengue fever is aquite febile illness clinically characterized by haemorrhagic phenomena and tendency to develop a shock syndrome which may be fetal. The Mansonia mosquito belongs to genus Monsonia causes viral encephalitis in man. Japanese encephalitis (J.E.) is an arboviral (B) infection. Recently in India Japanese encephalitis incidence was reported from New Delhi, the disease is transmitted by *Culex* species.

Several workers (Mitzmain, 1917; Korke, 1928, 1932; Williams, 1937; Ross *et al.*, 1943; Puri, 1947, 1948, 1960; Bate, 1949; Sabin, 1952; Horsefall, 1955; Basu, 1958; Soper, 1958; Christophers, 1960; Reid & Knight, 1961, 1966; Mattingly 1962; Reid & Weitz, 1966; Subbarao & Sharma, 1988; etc.) contributed on mosquito borne diseases of man.

The mosquitoes are characterized by small size 3.00 to 6.00 mm body length (or more), delicate and slender bodied, covered with hairs and scales. They are black or brown, often spotted white and have piercing and sucking type of mouth parts for sucking the blood of animals or cell sap of plants. The larvae of mosquitoes are elongate wrigglers and aquatic in habitat. The pupae are also aquatic and capable of swimming by paddle like movements of the abdomen. The larvae breed in all kinds of fresh water and in the brackish water. The larvae feed mostly on minute algae and other organic matter floating in the water.

Mosquitoes are diversified taxonomical group of insects. Biodiversity of mosquitoes is an important aspect of medical science. Biodiversity was the concept confined to the text books and among the biologist for long years. Now, it is figuring as an important item in national and international agenda. We now have a convention on conservation of biodiversity with 159 countries. Biodiversity is variety of living organisms, including their genetic diversity and assemblages they form. In other words, biodiversity entails the interlinked web of life forms ranging from man to microbes. It is the base for continuing evolution which is a phenomenon that has enriched our lives. Biodiversity encompeses the totality of gene species and ecosystems in a region more specially.

Biodiversity is destined to emerge as a new significant and integral aspect of human life. This prodigious diversity is facing a lot of threats and it is a known fact that there are serious losses in terms of both material and knowledge. The global warming, disruption of ozone layer, air, water and soil pollution, acid soils, acid rains, degradation of ground water quality, erosion, pressure on energy, deforestation and depletion of natural resources are the most dangerous ones for concern. Of these, the later two have distinct and direct bearing on the biodiversity (Ramamurty and Ghai, 1993). Man is continuously manupulating 70% of the natural ecosystem for harvesting 90% of his needs (Vitousek *et al.*, 1986). We have already lost about one million species of plants and animals. The extinction rate is a whopping 150 species per day or 50,000 species per year (Reid and Miller, 1989). At this rate, the loss will be 1 in 100 species per year or 0.7% annually. It is thus feared that more than two million species will be lost in the next decade of which 50% will be arthropods. It would mean that we will

lose material along with associated valuable knowledge on ecological and biological issues. However, diversity of fetal mosquito species and diseases are found increasing. Indian species of harmful mosquito needs special attention since biodiversity helps in understanding useful and harmful species and different ecosystsms and their sustainable use for well being of man kind and nature.

India is considered to be one of the richest centres of biodiversity in the world, particularly because of the large number of diverse ecosystems which nurture an extremely large number of animal and plant species. More than 3 million varieties of plants, animals and microorganism have been estimated from the world (Rajamani, 1993). Out of the above estimated species, 500,000 have yet been given a scientific name and detailed information is available on about one in hundred only. In India, more than 45,000 species of plants and 75,000 species of animals have been recorded from various parts (Ananthakrishnan, 1993). The insect comprises more than 67,000 species (Nair and Mathew, 1993).

Among the insects, mosquitoes are most important since they are related to health and survival of man. Mosquito biodiversity have been studied by several workers note worthy among them are Christophers (1933), Barraud (1934), Foote and Cook (1959), William and Maurice (1961), Smith (1973), Busvine (1980), Sathe and Girhe (2001) etc.

There are about 2400 described species of mosquitoes in the world (Stone *et al.*, 1959; Ward, 1984, 1992). These ubiquitoes insects occur at elevations of 14,000 feet in Kashmir and as low as 3760 feet below sea level in gold mines of South India (Russell *et*

al., 1943). Larval and adult characters of mosquito are described, keyed and figured (Carpenter and Lacasse, 1955). Biodiversity is not merely the description of different forms and habits. It is study with respect to animal morphology, taxonomy, anatomy, physiology, biochemistry, molecular biology, genetics and genetic engineering, distribution, occurrence etc. In the present study, mosquito biodiversity have been studied with respect to taxonomy, distribution and occurrence.

Some workers (Christophers, 1933; Barraud, 1934; James and Liston, 1911; Foote and Cook, 1959; Rao, 1984; Nagpal & Sharma, 1987,1995; Das & Akiyama, 1990; etc.) have contributed on the mosquitoes of India with respect to taxonomy, distribution and seasonal abundance. However, very little attention is paid on mosquitoes of the Maharashtra.

Geographically and climatically Maharashtra (Fig. 1) is divided into three regions namely, Konkan, Western Ghat and Maharashtra plateau regions. Hence, it would be very interesting to study biodiversity of mosquitoes in these regions and study will be helpful in understanding the epidemiological aspects of the region.

Kolhapur district (Fig. 2) is included in Western Maharashtra and is characterized by hilly regions, Western Ghats and several kinds of water bodies. The river Panchganga and Panchganga river system is special attribute of Kolhapur district. It has rainfall ranging from 1500-2700 mm. The above conditions favour mosquitoes for breeding in the area which ultimately leads to infectious diseases like dengue, malaria etc. in human population. Hence, biodiversitical work on mosquitoes of Kolhapur district will add great relevance in health care of the region.

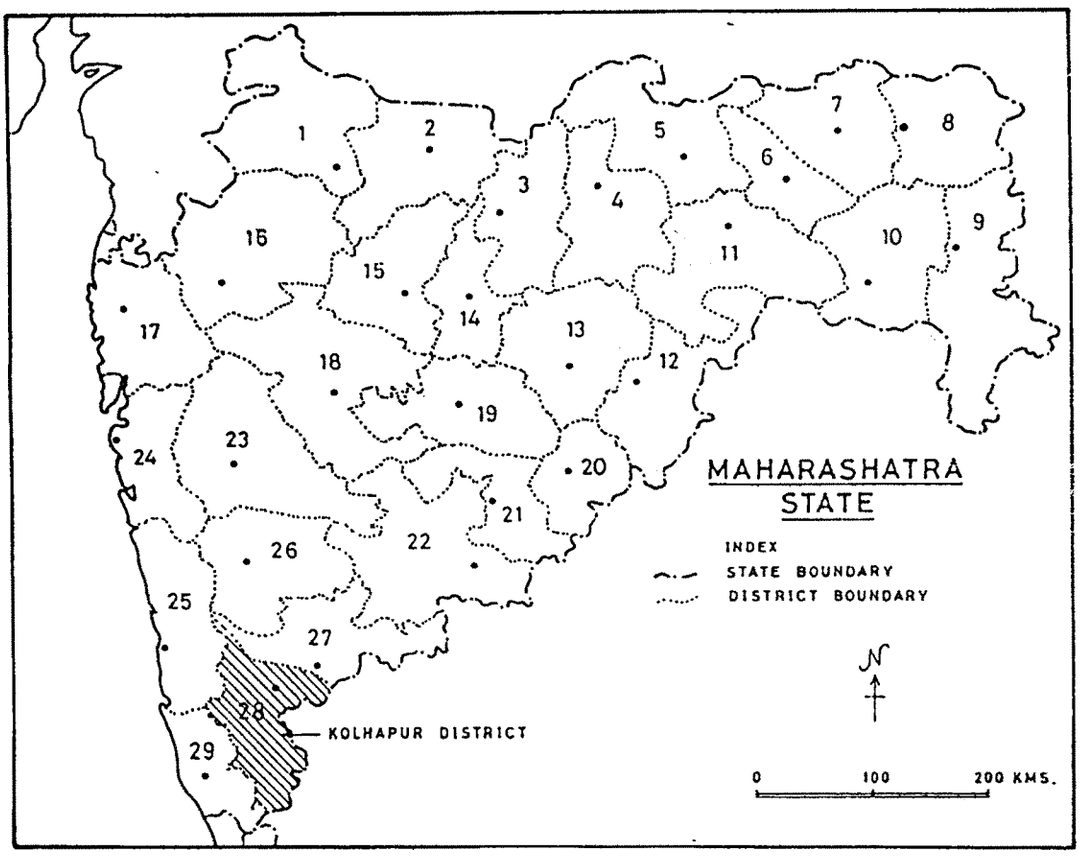

Fig. 1: MAP OF MAHARASHTRA STATE

1.	Dhule	11.	Yawatmal	21.	Osmanabad
2.	Jalgaon	12.	Nanded	22.	Solapur
3.	Buldhana	13.	Parbhani	23.	Pune
4.	Akola	14.	Jalna	24.	Alibag
5.	Amaravati	15.	Aurangabad	25.	Ratnagiri
6.	Wardha	16.	Nasik	26.	Satara
7.	Nagpur	17.	Thane	27.	Sangli
8.	Bhandara	18.	Ahmednagar	28.	Kolhapur
9.	Gadchiroli	19.	Bhid		
10.	Chandrapur	20.	Latur		

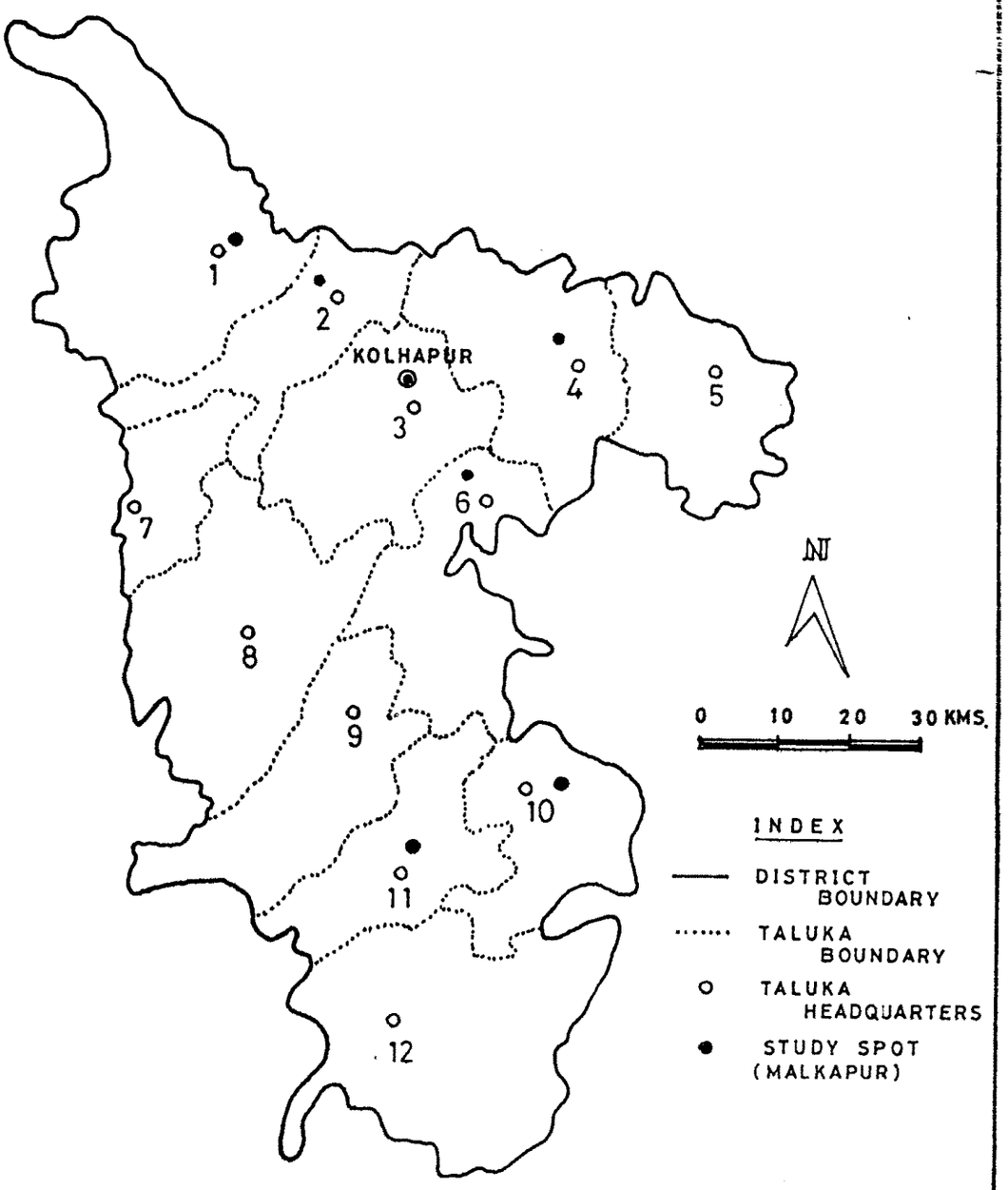

Fig. 2: MAP OF KOLHAPUR DISTRICT

Study Area (2, 4, 6, 10, 11)

1.	Shahuwadi	5.	Shirol	9.	Gargoti
2.	Panhala	6.	Kagal	10.	Gadhinglaj
3.	Karveer	7.	Gaganbavda	11.	Ajra
4.	Hatkanangale	8.	Radhanagari	12.	Chandgad