CHAPTER - II

FACTORS AFFECTING THE SPREAD OF WATER-BORNE DISEASES

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2.1 INTRODUCTION :

Diseases are multiple phenomena which break out when various factors combine in time and space. It is true that environment shapes the health of the individual and that of society. Eventhough, genotypical factors which are fixed are responsible for the cause of diseases, they are not responsible for the spread of any disease in the society. It is well known that phenotypical factors are more effective in modifying the state of health of man. The phenotypical factors are variable in nature. They are changeable from time to time and from area to area. The disease producing agents are markedly influenced by the external environment. Man's physique is directly exposed to the environment and hence the relationship between environment and health of the man would be a valuable study for a medical geographer.

The task of medical geographer is to analyse all factors of physical environment (climate, soil, drainage etc.) and social environment (population growth, density of population, water supply, social customs, fairs and festivals etc.). Together, they influence the man, his health and his activities. The type and amount of our nutritional needs depend to a great extent on the productivity of soil and overall resources of region. Poor food supply means poor health and malnutrition. Certain diseases infect the people of particular sex and age group (Mulik J.D. 1987).

" The human responses of both individual and community are taken into account by means of which the people protect themselves from the dangerous influence of environment," (Tiwari A.K. 1973).

The analysis made by the researcher in this chapter is based on the physical and socio-cultural factors which are responsible for the distribution of waterborne diseases in Maharashtra State. These factors have been analysed for waterborne diseases citywise in general as main attempt of the researcher is to concentrate his attention on districtwise distribution of these diseases.

The researcher has selected some of the important aspects for his studies about which reliable and continuous data were made available. Few related factors amongst physical and socio-cultural environment have been selected and correlated with disease distribution in the cities and in districts of the state.

The following factors have been selected for the study -

i) Physical factors : a) Physiography b) Drainage c) Climate and d) Soil.

ii) Socio-cultural factors : a) Density of population b) Water supply c) Fairs and festivals d) Movement of people and e) Social customs.

2.2 EFFECT OF PHYSICAL ENVIRONMENT :

The environment is viewed individually by different scientists. To a traditional geographer, it is synonymous with natural environment, to a sociologist, it means only the social environment, and to an anthropologist, it is largely a cultural environment. In medical geography, it consists of all the physical and cultural elements which combine to form a total environment in which man and all other animal beings live together.

The major physical factors like physiography, drainage, climate and soil are influencing the man's health and ill health.

2.2.1 Physiography :

Physiography determines the distribution of diseases in the area. Certain diseases are found at certain physiographic features. There is high correlation between spread of the diseases and altitude. Physiography includes elevation, slope, rock types, soils, minerals, water content etc.

The effect of altitude on the spread of factors of diseases has certainly proved its correlation. Region of high altitude due to its low temperature and clean air conditions do not allow to survive many vector carrying diseases. High altitude accelerates respiration because of hypoxia (low oxygen content). Therefore, high altitude do not suit to the people who suffer from diseases of heart and blood vessels. While major T.B. Sanitary Clinics and health resorts are located at

high altitudes. It might be the reason why the death rate of Sahyadri ranges and that of Deccan plateau is comparatively low.

The physiographical map of Maharashtra shows four distinct divisions : Konkan low land, Sahyadri range and Deccan plateau, Wardha-Wainganga basin and Tapi basin. It shows that Tapi-Wardha-Wainganga basins have more death rate. This low lying region is comparitively of high temperature throughout the year due to which growth of disease vectors is rapid.

The region of low altitude or low lying areas are always of high temperature and high humidity content. It possesses high potential capacity of generating the disease organisms, hence more waterborne diseases are observed in low lying areas of the state. Dysentery and diarrhoea are major waterborne diseases which are mainly concentrated in these areas.

The slope of the land, determines the velocity of water. The areas of gentle slope of land are the areas where running water stagnates, thereby causing degeneration of disease vector. While steep slope checks the water stagnancy, hence waterborne disease death rate is more in river basins and less in Konkan region which is a region of moderate to high slope.

2.2.2 Drainage :

Drainage plays a vital role in distribution of infectious waterborne diseases in any region. The suspended material in drainage which are mechanically harmful cause number of diseases like cholera, dysentery and diarrhoea.

Maharashtra State cover the major part of Deccan plateau and intersecting river basins as well. The NW - SE flowing rivers have formed major river basins on the Deccan plateau. The rivers like Godavari, Krishna, Bhima, Wardha, Wainganga and Tapi have reached in their second stage of development on Maharashtra plateau. The slope of the land in this area is moderate to gentle due to which the flow of water is moderate. The water becomes sluggish and stangnant, hence there is every possibility of contamination of water by disease organisms. Hence, possibility of spread of waterborne diseases is more in river valleys and basins of Central Maharashtra.

The Konkan low land area shows less possibility of development of disease organisms, because here the land slope is steep. The rivers are short in length and water flow is speedy. The intensity of surface outwash is more and the stagnation of water is rarely found. All this might be leading to less intensity of waterborne diseases in Konkan.

Generally surface outwash ends in rivers due to which the river water may be contaminated by the disease vectors of land origin. The man made pollution of the river water is

seriously affecting the health of the man. Cholera, one of the dreadful diseases is mainly found in Lower Gangentic Valley i.e. Ganga, Brahmaputra and Meghana rivers confluence and in Caveri Delta (Pandurkar R.G., 1981).

The salinity of water has also some effect on the proliferation of bacteria. It is also known that in the deltaic parts of Bengal, there occurs a slight change from alkalinity to acidity in the reaction of river water during April and May and the reverse i.e. from acid to alkaline conditions during October and November. Increase in acidity may be due to the presence of carbon dioxide, liberated from calcium bicarbonate content in water, which is subsequently replaced by calcium nitrate. Such replacement effects the turbidity of water as well as its natural and artificial purification capacity (Bannerjee B., 1974).

Dysentery and Diarrhoea are the major diseases of the river basins than of hilly areas. The molasses and waste chemicals thrown in the rivers by many sugar and allied factories invite dysentery and diarrhoea. River water thus, contaminated spreads many waterborne diseases in cities as well as in the rural areas.

Cholera, dysentery, diarrhoea etc. are the notable waterborne diseases. Tapi and Wardha-Wainganga basins of Khandesh and Vidarbha have cholera, dysentery, and diarrhoea as the major diseases and in these basins, the highest mortality due to these diseases is noted. While the Krishna, Bhima

basins and the basins of the Konkan region have moderate rate of mortality and Godawari, Purna and Dudhana basins of Marathwada proper have low mortality rates (Pandurkar R.G. 1981).

2.2.3 Climate :

Climatic conditions have an important effect on health and is evidenced by the geographical distribution and seasonal prevalence of the disease. The elements of climate such as temperature, pressure, humidity and rainfall modify the health characteristics of the man.

In climatic condition, the components like solar radiation (heat), air movement (wind), pricipitation (rain, mist, snow, sleet, hail), moisture (humidity, fog, dew, frost) etc. are included which directly or indirectly influence the health of man (Misra R.P.,1970).

The climate influences our health directly as well as in-directly. High temperature and humidity content tend to reduce the working capacity of man. The best climates are those in which heat losses are balanced by heat production in the body without much strain. Pneumonia, paralysis, cholera, small pox and dysentery generally occur in the winter months and the cases of cholera and small pox are maximum in summer months (Misra R.P.,1970).

It can affirmatively be stated that the variations in climatic conditions have an important effect on the health and

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WATER BORNE DISEASES

RELATION BETWEEN MONTHLY RAINFALL, TEMPERATURE AND NUMBER OF DEATHS (1965-78) (DISTRICTWISE)

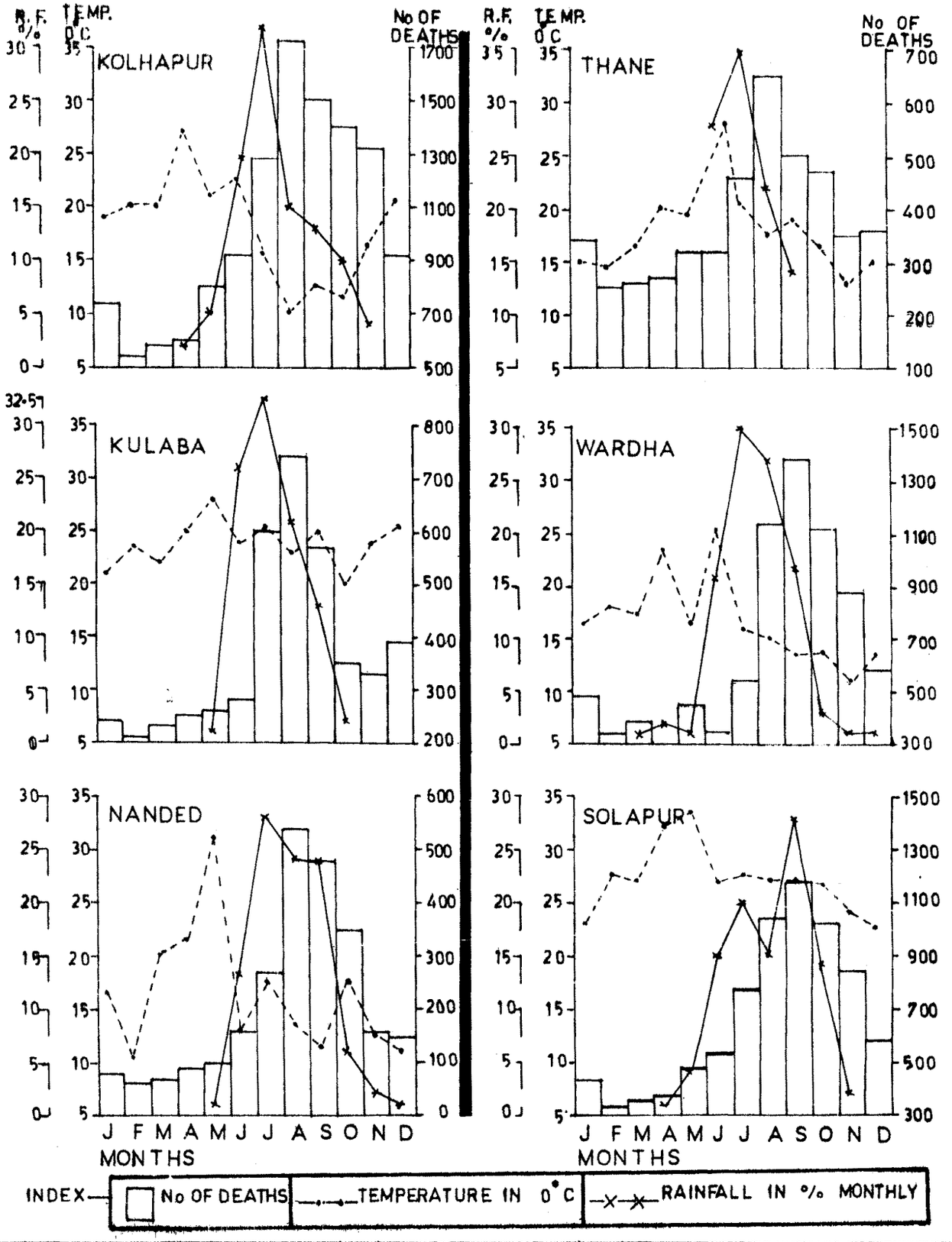

FIG. 2.1

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WATER BORNE DISEASES

RELATION BETWEEN MONTHLY RAINFALL, TEMPERATURE AND NUMBER OF DEATHS (1965–78) (DISTRICTWISE)

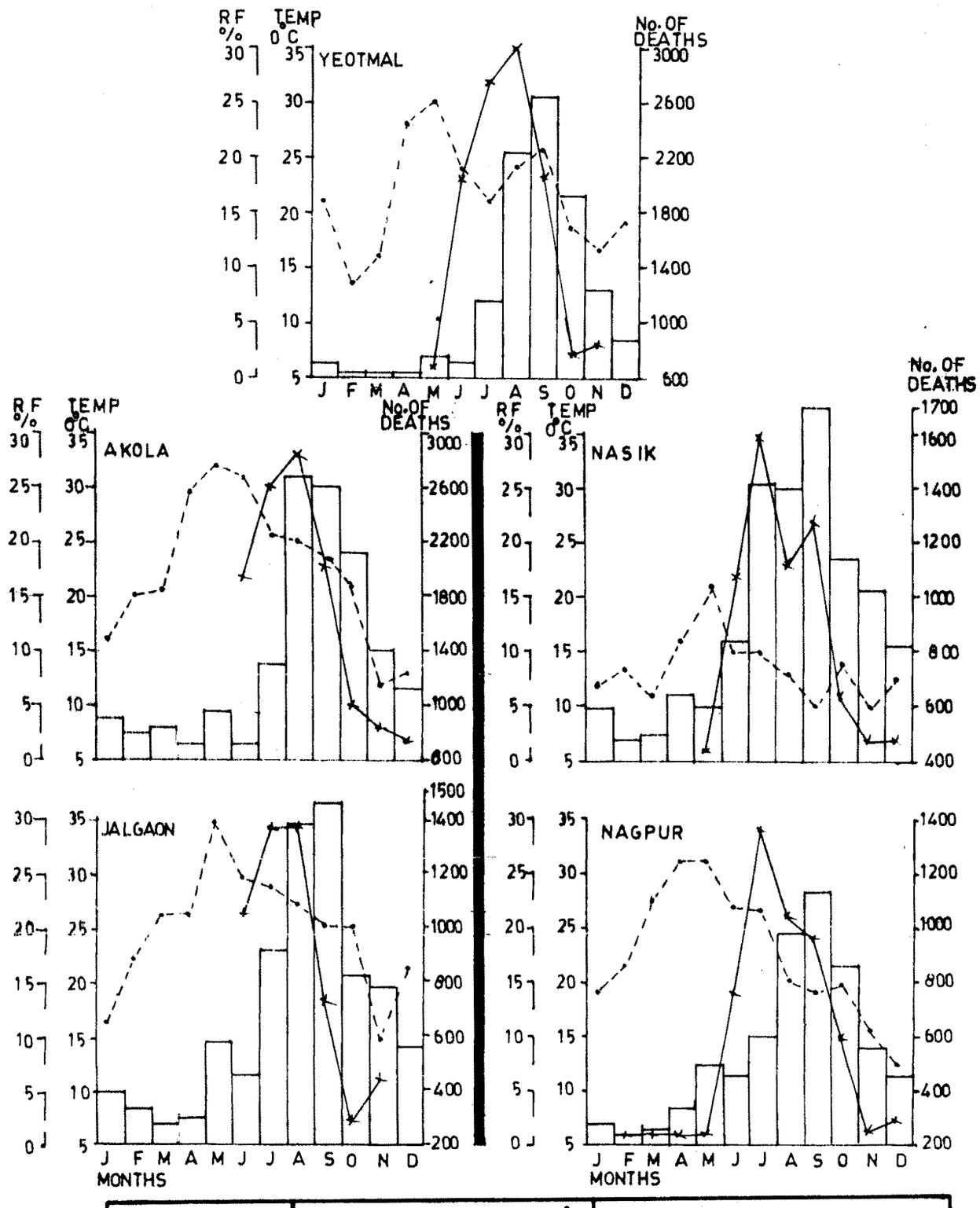

FIG. 7.7

hence climatic factors show seasonal variation in prevalence of different types of diseases. Amongst the chief elements of climate, rainfall and temperature can modify the health of man and society. The monthly variation in amount of rainfall and temperature may affect the seasonal distribution of waterborne diseases in any region. With considering this presumption; the author has correlated the monthly distribution of rainfall, temperature and number of monthly deaths for some eleven districts of Maharashtra State (1965-1978) (Fig.2.1 and 2.2). The monsoon begins in the month of June and more than 80% of annual rainfall occur in four months viz. June, July, August and September. While in the early winter months, amount of rainfall decreases sharply. It is also observed that the monthly temperature in four districts vary only between 10 and 20°C. The number of deaths starts increasing by the onset of monscon and they decreases when amount of rainfall starts declining.

The researcher has selected eleven districts correlating monthly deaths with rainfall and temperature factors. The maps show that the highest number of deaths do occur in the months of August and September, when the average monthly temperature varies between 1C°C and 22°C and monthly percentage of annual rainfall show 21 to 37%. The waterborne diseases like dysentery and diarrhoea start increasing by onset of monsoon. Eventhough, deaths are occuring throughout all months of year, the percentage of deaths occuring during rainy season is comparatively more than in nonrainy season of the year.

2.2.4 Soil :

There is a positive correlationship between the type of soil and cholera spread in any region. Pattenkoffer ϕs of opinion that when the ejects of the cholera patients came into contact with soil, fermentation and toxin formation take place. Macnamara has observed that, when the relative amount of carbonic acid in soil is lowest, the epidemic reaches its peak. The bacteria favour alkaline conditions and the chance of their proliferation is minimized in acidic soil. It may be said that the infection of cholera largely depends on the amount of hydrochloric acid in the stomach.

When the soil temperature is higher than atmospheric temperature, the incidence of the disease is said to be low. But it is difficult to find out any direct correlation with soil temperature and cholera mortality. The temperature and soil moisture is also an important factor.

The gray brown forest soil, red earth and yellow sandy soil do not encourage the growth and proliferation of V.cholerae but sandy loam soil records high concentration of this disease. The red loam soil record moderate concentration of this disease (Banerjee B.,1974).

The correlation is positive between the pH values of soil and cholera mortality. A map of Maharashtra has accordingly been drawn showing the pH values in different areas of the state (Fig.2.3). The map shows that areas with neutral pH values

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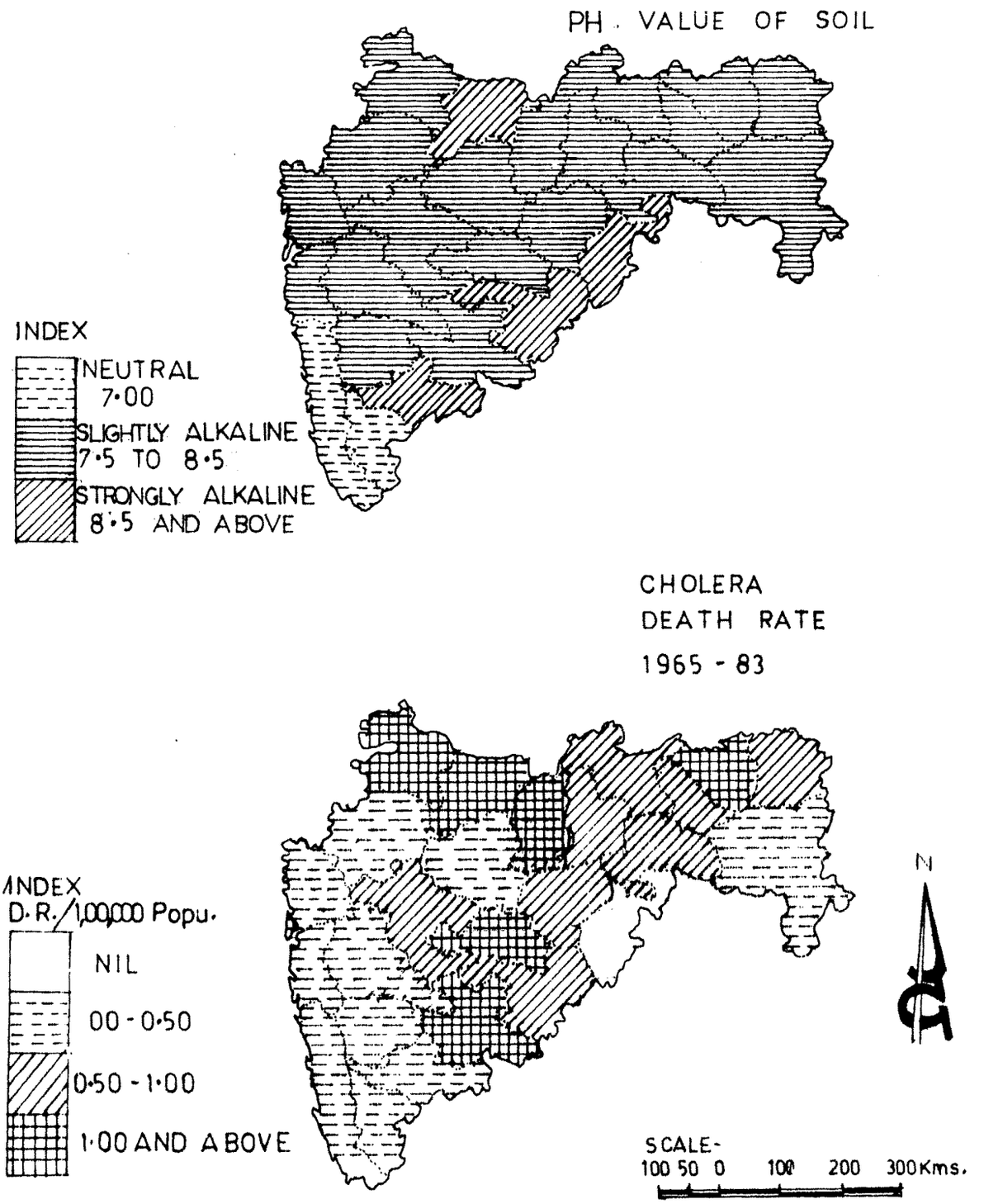


FIG. 2·3

(7) generally record less cholera deaths. It is mainly observed in Ratnagiri and Kolhapur districts where soil is neutral. The regions with strongly alkaline soil whose pH values are above 8.5, record a high incidence of the disease and the districts are Jalgaon, Sangli, Osmanabad and Nanded. Thus the pH value of the soil determines the organism development in the soil and the type of soil controls the disease spread.

2.3 SOCIO-CULTURAL ENVIRONMENT :

The physical and socio-cultural factors taken together, influence the health pattern of a community. In the earlier section, the effect of physical environment on health has been discussed. Here, the effect of socio-cultural factors is attempted in detail. Cultural environment can well be conditioned by man to draw benefits for the society. But some times maladjustments do occur when man fails to accommodate his physical environments with cultural traits. Cultural landscape of an area includes the religion, social attitude, demographic character and human adaptability to techno-economic changes along with his social, political and economic conditions. The rate of change varies from place to place, depending on the level of education and technology (Bannerjee B.,1974).

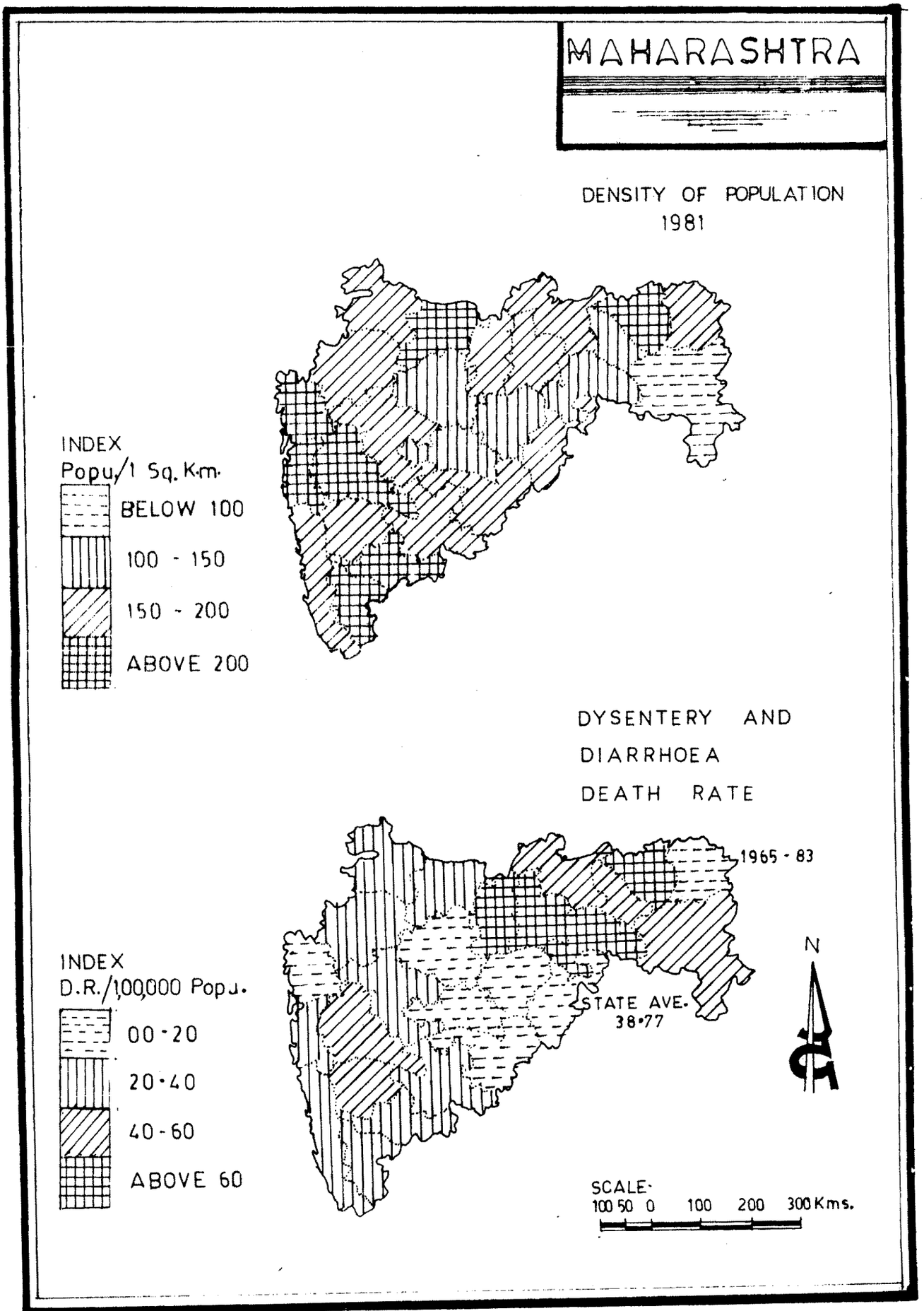
The relationship between cultural factors and health has been recognised very recently. Many social and cultural factors

have a close relation with the natural conditions in which people live. These factors can vary from place to place and can be modified with systematic efforts for the sake of positive health of man. There are many socio-cultural factors like density of population, water supply, fairs and festivals, movement of people, social customs etc., the study of which is imperative in the branch of medical geography.

2.3.1 Density of population :

Density of population may also be an indicator of the healthy status of society. More population on less land, exerts it's pressure due to which resources, if they are insufficient naturally affect the health of people. Densely populated areas face the problems of sanitation, easy availability of medical aid, good and balanced diet etc. Generally, the crowded areas face the problem of under and malnutrition (Pandurkar R.G.,1981).

Density of population and disease mortality are closely related to each other. In slums of urban sector, density of population is always high as compaired to other areas. This population do not enjoy clear air, ventilation, clean water for drinking and due to proximate contacts, people are easily victimised by infectious and contagious diseases. In slum areas, there is no proper disposal of sewage, waste water stagnates near the house and rapid growth of the disease organism in this stagnated waste water is obvious. This condition leads to increase in morbidity and mortality rate in slums.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DENSITY OF POPULATION
1981
INDEX
Popu/1 Sq. K.m.
BELOW 100
100 - 150
150 - 200
ABOVE 200
DYSENTERY AND
DIARRHOEA
DEATH RATE
1965 - 83
INDEX
D.R./1,00,000 Popu.
00-20
20-40
40-60
ABOVE 60
STATE AVE.
38·77
N
SCALE-
100 50 0 100 200 300 Kms.

FIG. 2·4

Due to the supply of unchlorined contaminated water, the spread of cholera, dysentery and diarrhoea is possible. High density of population results in less availability of water per capita and intensity of pollution of water increases in the densly populated areas.

The researcher has tried to compare the districtwise death rate of dysentery and diarrhoea of 20 years with average density of population (Fig.2.4). In the Vidarbha division, the districts with high density of population seem to be of high death rate by dysentery and diarrhoea. This fact is true in case of Nagpur, Akola and Amraoti. While in Marathwada division, the districts are of low density and the death rate is also low to moderate as compared to Vidarbha division.

While in Bombay, Thana, Poona, Raigad, Jalgaon, Kolhapur and Sangli, the density of population is high but the death rate is comparatively low to medium. It might be due to availability of good medical services in the major cities of these districts.

2.3.2 Water supply :

The water for drinking purpose and for domestic use also influence the health of the individual and of community. The quality, quantity and continuity of water is responsible for the cause of many diseases. In many cities of Maharashtra, drinking water is supplied through pipelines and these pipelines run parallel and close to the sewage lines. There is a danger of contamination of water through seepage if both lines are rusted,

In Gr.Bombay, some of the water pipelines run close to the sewage and danger of contamination is more when sewage pipeline is broken.

People belive that running water is purified itself when it flows, hence it is not polluted. There is some truth in this belief but it happens only after a long distance from the place of pollution. Diseases like cholera, desentery, diarrhoea etc. are mainly spreaded by water contamination. The people in rural areas are mainly dependent on well and river water for drinking purposes. River and even well water is contaminated by adding human wastes and by peoples' unhyginic habits like drinking, bathing, washing clothes and animals in the same water. The various waterborne organisms survive safely and many are transmitted through the contaminated water.

In Maharashtra, many cities have vital problem of water contamination. In slum areas, because of high density of population and scarcity of safe water, people seek to find out other sources of water and there is every possibility of that water being largely contaminated by disease vectors.

Many a times, through industries namely chemical factories, sugarcane industries etc. waste materials are thrown in the river, thereby causing the contamination of water.

Diseases like cholera, typhoid, gastroenterities, various types of dysentery, different forms of diarrhoea etc. result from the use of unsafe water. Due to high concentration of fluorides

in water, incidence of endemic fluorosis is possible. Providing drinking water to villagers with fluoride content of less than one part per million is the way to prevent fluorosis, because water in wells in many parts of our country have fluoride content ranging from 3 to 10 parts per million (Pandurkar R.G.,1981).

Fluoride also affects the health of the teeth. Deficiency of iodine in water, result in high endemicity of goitre occurance. It is estimated that nearly 30% of deaths and 60% of the morbidity in India is due to the waterborne diseases. In Maharashtra, 16% of the inhabited villages do not provide safe water facility and this percentage is highest in Kolhapur district i.e. 22.38%.

2.3.3 Fairs and festivals :

During fairs and festivals, large number of people from different parts of the country assemble together. Adequate arrangement of sanitation, drinking water and food for such a congregation of people are hardly possible and as a result, such fairs and festivals turn into epidemics of diseases.

These fairs and festivals attract pilgrims from all over the country and in case of an outbreak of cholera, dysentery, diarrhoea, typhoid, jaundice and such other diseases generally spread over wide spread area. Some local fairs attract people from the neighbouring areas. These fairs are mainly arranged in the months of April and May of summer season, when water scarcity is more and people use this limited water for many purposes and

as such the communicable diseases as well as waterborne diseases are transmitted from one region to another very easily.

The phenomenon has often been ascribed to religious fairs and festivals connected with the Ardha Kumbha and Kumbha Melas which usually take place at an interval of 6 and 12 years respectively. The mortality rate during these fairs has now been reduced due to better arrangements of the public health undertakings. Improved measures of sanitation and chlorination of surface water by the fair authorities and the state governments have checked the mortality rates. The approach routes to the festival centres, along which the pilgrims have to travel, become susceptible to disease infection as no elaborate sanitary arrangements are made during the fairs to cover those areas.

2.3.4 Movement of people :

Since the middle of the 19th century, industrial or urban civilization are progressively being superimposed over rural areas. Overpopulation in the villages has produced a marked tendency towards rural-urban migration. Unplanned growth of urban areas has created problems such as growth of slums, water supply, sewage, dimination of open land, fresh air and light. The incidences of various diseases, like those connected with respiratory troubles, water pollution and virus infection have recorded a remarkable rise (Bannerjee B.,1974).

Temporary migration of labourers from urban to rural areas or vice-versa might also help in the spread of diseases. The casual migrants become the carriers of the diseases. The seasonal movement of people i.e. sugarcane industries' labourers and Gur industries labourers is also responsible for the spread of diseases from one region to another.

In Maharashtra, the casual, seasonal and temporary migration cause certain problems of health. The seasonal rural urban migration causes the spread of urban oriented diseases in the rural areas such as tuberculosis, Pneumonia etc. The labour population working in different sugar factories in Maharashtra are also the carriers of certain waterborne diseases like cholera, dysentery, diarrhoea etc.

2.3.5 Social customs :

Some social, cultural and traditional practices and customs are directly or indirectly responsible in developing a disease organisms in the body. Totems and taboos or interdictions sometimes overrule the scientific treatment of the diseases. Small pox or the leprosy incidences are due to the divine curse and have no remedy is the belief amongst the vast rural population.

Certain social, cultural and traditional customs, directly or indirectly, may help in the propogation of a disease. Very often the average people do not follow the general guidelines of personal cleanliness, thus creating

conditions favourable for the proliferation of the diseases. The neglect to follow the general rules of personal hygine is not entirely due to ignorance, but also due to the traditional habits and customs of the people. Due to scarcity of filtered water in summer, people have to use unfiltered water for domestic purposes. The common practice of washing hands with mud after toilet and washing face, mouth, feet etc. with the same water may also help in the spread of diseases.

The holy water bath and hymen is performed for the case of snake bite. All these and many other social and traditional customs are still observed in the rural parts of Maharashtra or even in the educated families, which results in the incidence of death or the severe epidemic.

In the rural area of Maharashtra, many of the patients are first treated by people who are belived to have super natural powers. According to Dube, 'Most of common diseases are interpreted as a fault in the physical system and are treated with herbal medicines or modern drugs obtained from the dispensary. Common cold, scabies, headache, fever etc. are attributed supernatural powers and small pox, cholera and the plague are always attributed to the wrath of various Goddesses. For these diseases, only worship is regarded as the remedy and no medicines are administrated to the patients' (Misra R.P.,1970).

Social hierarchy in a society also affect the health of the people. In rural parts, women are not treated with same

social status as that of men. Girl is not cared with the same attention as a boy in a family. In a joint family, the position of the bride is not very independent and hence she does not get the same attention that she would got in her parent's home.

Thus, many elements of the socio-cultural environment do create influence on the health of man.

2.4 CONCLUSION :

While studying the physical and social environment and its effect on distribution of waterborne disease in Maharashtra State, it is found that low death rate is remarkably observed in Konkan areas e.g. in Raigad and Ratnagiri districts, while on the Deccan plateau, in river basins high incidence of these diseases is observed. It is also found out that temperature and rainfall play the major role in the distribution of diseases seasonwise. The number of deaths starts increasing at the onset of monsoon when the occurance of waterborne diseases is more. The number of death are more in rainy season than in non-rainy season.

The pH value of the soil determines the organism development and the strongly alkaline soil whose pH value is above 8.5 record the high incidence of the diseases specially in Jalgaon, Sangli, Osmanabad and Nanded districts of the state. Density of population and disease mortality are closely related to each other. Contamination of water and scarcity of water lead to spread many waterborne diseases like cholera,

dysentery, diarrhoea etc. in different parts of the state. The places of fairs and festivals in Maharashtra have become the regions of seasonal spread of waterborne diseases. It is mainly proved by 'Aashadhi Ekadashi' festival at Pandharpur. Even the approach routes to the festival centres become susceptible to disease infection. The casual, seasonal and temporary migration of the labourers of Maharashtra has created the number of health problems and diffusion of many waterborne diseases from the centre of their origin and the social customs and beliefs have stronghold on the people of the state which too affect the health of the individual and that of community.

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