
INFECTIOUS HEPATITIS AND TYPHOID AND PARATYPHOID

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- 5.1 Introduction
 - 5.2 Etiological factors
 - 5.3 Infectious hepatitis
 - 5.3.1 Infectious hepatitis spread in world
 - 5.3.2 Infectious hepatitis spread in India
 - 5.4 Infectious hepatitis spread in Maharashtra
 - 5.4.1 Factors affecting infectious hepatitis in Maharashtra
 - 5.5 Districtwise spread of infectious hepatitis
 - 5.6 Citywise spread of infectious hepatitis
 - 5.7 Typhoid and paratyphoid
 - 5.7.1 Typhoid and paratyphoid spread in World
 - 5.7.2 Typhoid and paratyphoid spread in India
 - 5.8 Typhoid in Maharashtra
 - 5.8.1 Factors affecting typhoid in Maharashtra
 - 5.9 Districtwise spread of typhoid and paratyphoid in Maharashtra
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5.1 INTRODUCTION :

The infectious hepatitis (Jaundice) and Typhoid and Paratyphoid are the other notable waterborne diseases found in this state. The spatio-temporal analysis of these two diseases is undertaken here.

5.2 ETIOLOGICAL FEATURES :

The terrain of the region affects the mortality rate of any disease. The high altitude due to its low temperature and clear air conditions have very low mortality rates. While the low lying areas which are below 100 ft. in deltaic regions seems to be of high mortality rates. Surface outwash generally finds ends in river. As a result, the river becomes contaminated. The contamination rate is highest in the deltaic regions. In the river basins, water becomes sluggish and stagnant. There is also a seasonal pattern in the incidence of infectious hepatitis and typhoid and paratyphoid. The high incidence is associated with the season of rainfall - a condition which points towards water as an efficient transportor of the epidemic. It is observed that the incidence of infectious hepatitis and typhoid and paratyphoid is high in rainy and summer season.

The rate of growth of population in urban areas and the service centres do not commensurate with adequate urban amenities. Densely populated areas mainly the slums face the problems of sanitation.

5.3 INFECTIOUS HEPATITIS :

The disease occurs in sporadic and endemic form all over the world. The term 'viral hepatitis' referred by common usage to hepatitis caused by two types of viruses

i) Viral hepatitis A (Infectious) and ii) Viral hepatitis B (Serum hepatitis).

i) Viral hepatitis A :

Viral hepatitis, which was formerly known as infective hepatitis or epidemic jaundice is caused by 'A' type of virus. Man is the only known reservoir of infection. Sub-clinical cases are common and they are responsible for the spread of infection in the community. The infective agent is found in the faeces, blood and serum. It is most common among children and young adults. Both sexes are equally susceptible and cases are common throughout the year and frequently found in poor community. Overcrowding, insanitation and poor personal hygiene are the major factors behind the spread of viral hepatitis A. Large epidemics break out in towns and villages, where the source of infection is water polluted with sewage.

ii) Viral hepatitis B :

It is known as serum hepatitis and is a serious common disease. Man is the only source of infection and the virus is present in blood during the incubation period and at the acute phase of the disease. It occurs more frequently in Males than Females and in urban areas than in rural areas. ' The occurrence

of disease in cities like Glasgow and Bristol in the U.K., where sanitation standards are high, probably because the virus is not killed by ordinary chlorination,' (Mahajan B.K., 1972).

5.3.1 Infectious hepatitis spread in World :

A recent survey has shown that the prevalence of hepatitis A antibody varied from 24 percent in Switzerland to 97 percent in Yugoslavia. This survey confirmed that infectious with hepatitis A virus are widespread throughout the world. Sero-epidemiological surveys have shown that viral hepatitis 'B' has a world wide distribution, including those in remote areas and islands. The reported percentage of carriers varies widely from less than 0.1 percent to approximately 20 percent of the population. In tropical countries, the antigen is detected in individuals of all ages.

5.3.2 Infectious hepatitis spread in India :

The morbidity due to viral hepatitis A in India is not known with certainty. Hospital admissions indicate that it is an important communicable disease. In the Medical College Hospital at Jabalpur, it has accounted for 67 per 1000 hospital admissions in 1966. Epidemic of viral hepatitis type A are frequently reported in India. The largest epidemic on record was the " Delhi waterborne epidemic of 1955-56," which gave rise to over 40,000 cases in six weeks.

5.4 INFECTIOUS HEPATITIS SPREAD IN MAHARASHTRA :

It is observed that infectious hepatitis is not a major disease in Maharashtra State as the average death rate for the last two decades is declining substantially. The author has calculated the death rates of Maharashtra for rural and urban areas separately for 1965-83.

5.4.1 Factors affecting infectious hepatitis

in Maharashtra :

Physiography of the region, the drainage system, velocity and quality of water and seasonal incidence based on the duration of the precipitation are the major factors affecting the levels of epidemicity of infectious hepatitis in Maharashtra. It is found that low lying areas show the high mortality of this disease. In Central Maharashtra region or in Vidarbha, Nagpur and Khandesh regions, rivers flow in their second stage. The sluggishness of river increases with moderate to gentle terrain slope. The stagnation of water in lower reaches of these basins in the Krishna, Bhima and Wardha-Wainganga show high endemicity.

The seasonal influence of the temperature and rainfall is a major factor in the geocological analysis of infectious hepatitis in Maharashtra. This disease prevails in rainy season as well as in summer months. In the areas of low precipitation, water becomes stagnated and in summer months this stagnated insufficient water is used for many purposes, hence possibility of jaundice spread is more. The velocity of the river water and

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CAUSE SPECIFIC DEATH RATE OF
INFECTIOUS HEPATITIS

RURAL

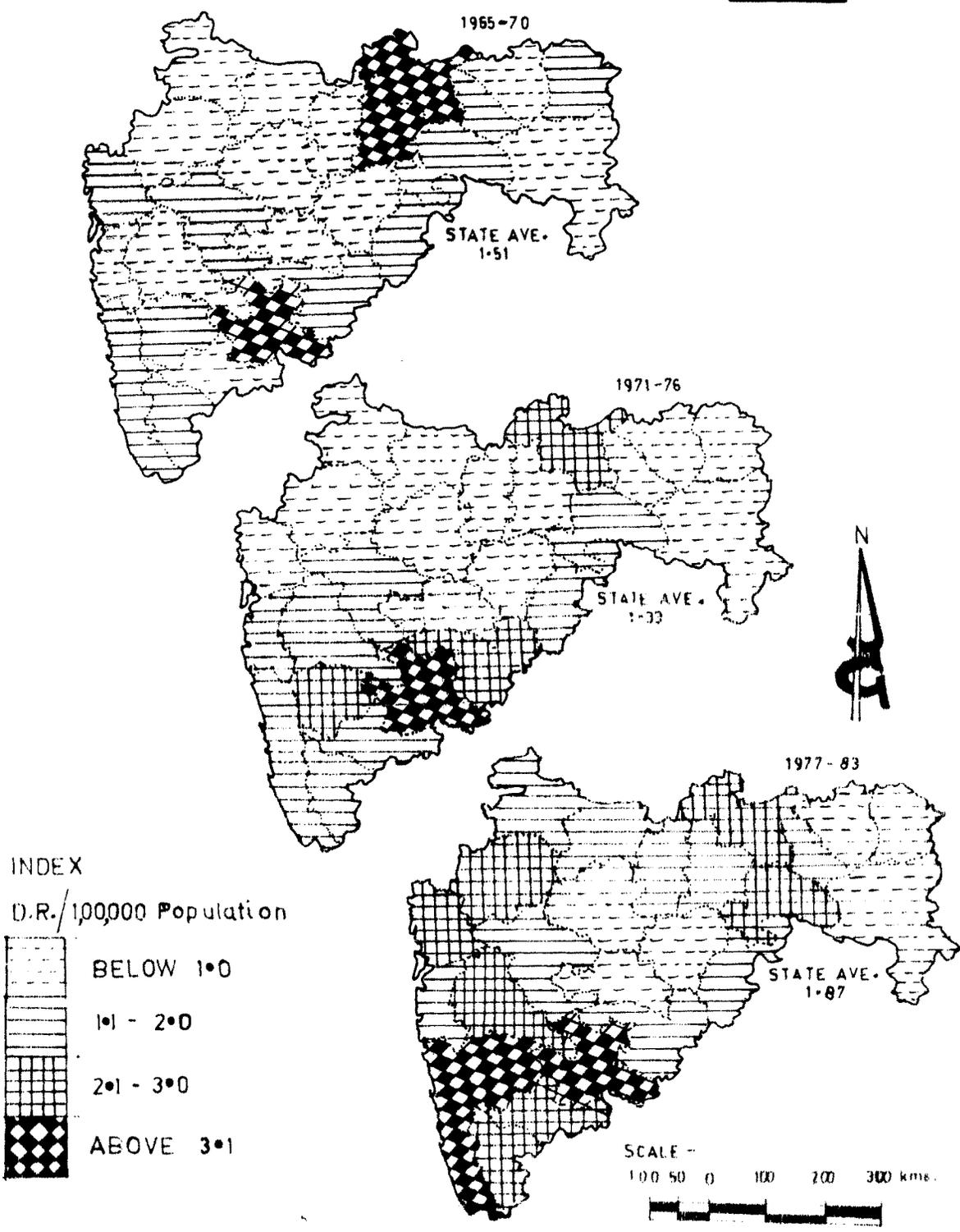


FIG. 5.1

and the quality of water supplied for the drinking purposes play a major role in the endemicity of infectious hepatitis. The spatial distribution of the disease shows that, it is mainly a rural disease, as nearly 70 percent of deaths do occur in rural areas, while the city areas have the lowest death rates. It seems that purified and filtered water of the major cities control the outbreak.

The other socio-cultural factors like, density of population, religion, social customs, pollution, population migration etc. also affect the endemicity. Defective sanitation, lack of personal hygiene, primitive methods of excreta disposal, illiteracy and poverty, overcrowding and fairs and festivals are the other social factors responsible for the widespread of this disease.

5.5 DISTRICTWISE SPREAD OF INFECTIOUS HEPATITIS :

The author has collected mortality data districtwise for the span of 19 years in this Maharashtra state from 1965 to 1983 and it has also been split up in rural and urban areas. The yearly death rates were calculated under three groups i) 1965-70 ii) 1971-76 and iii) 1977-83 to study the temporal changes. The choropleth map of rural areas (Fig.5.1) shows that during the first period i.e. (1965-70), the highest intensity of infectious hepatitis was noted in the districts of Solapur, Akola and Amraoti of Wardha-Wainganga basin. The average death rate of the state during the said period was 1.37/1,00,000 population.

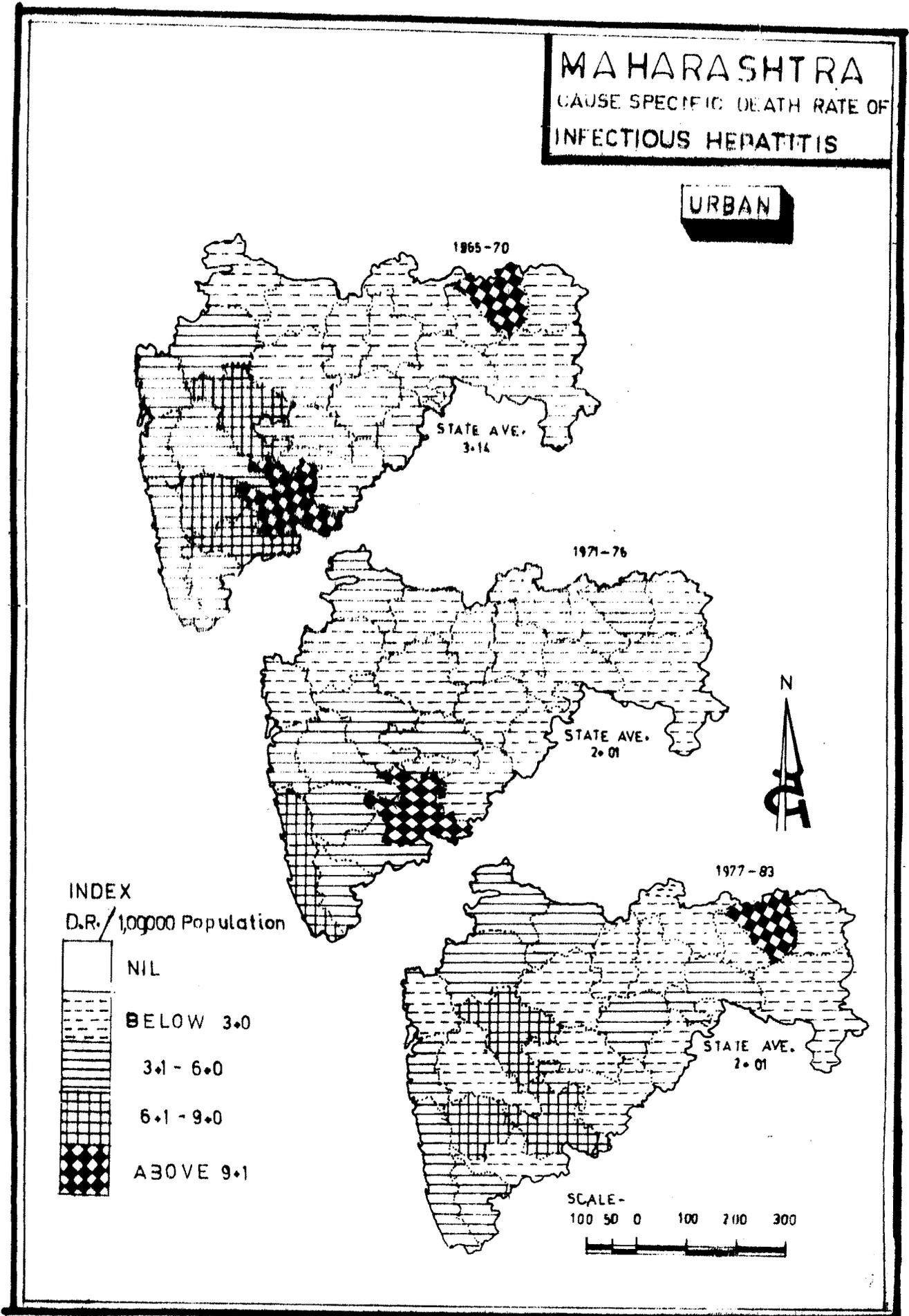


FIG. 5.2

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CAUSE SPECIFIC DEATH RATE OF
INFECTIOUS HEPATITIS

TOTAL

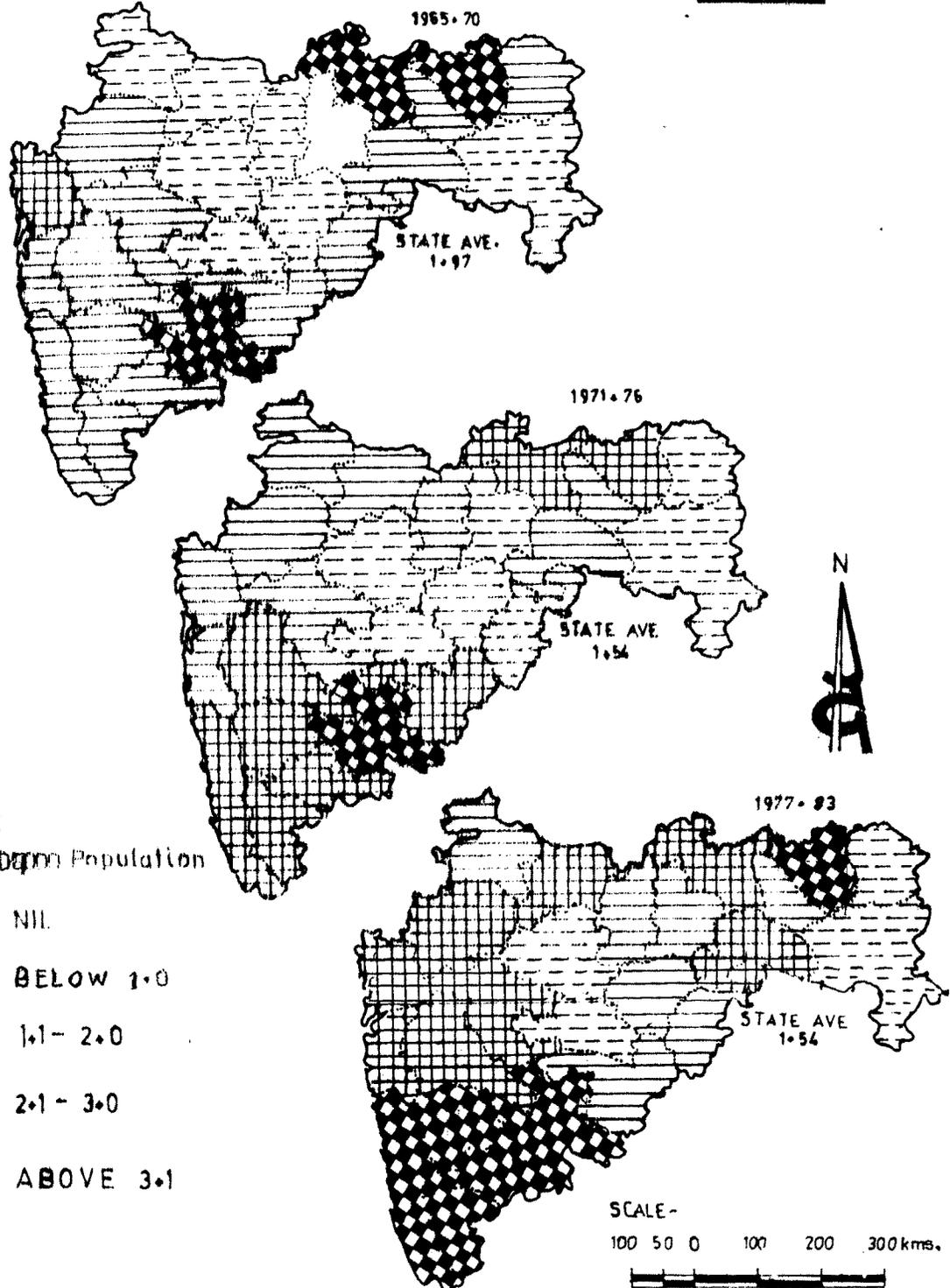


FIG. 53

The Thane, Ahmednagar, Ratnagiri, Satara, Kolhapur, Wardha, Yeotmal, Nanded and Osmanabad districts show moderate mortality rates. Remaining districts have low mortality rates. The rural mortality rates have decreased in the second period (1971-76) but comparatively rates are higher in Solapur than in other districts. In the third period (1977-83), the rates have increased than the past two periods. Satara, Sangli, Kolhapur, Ratnagiri, Ahmednagar, Thane and Jalgaon districts show higher mortality than the state average.

The choropleth map for urban areas (Fig.5.2) shows that during first period (1965-70), the cities of 11 districts were affected by infectious hepatitis. The average death rate of infectious hepatitis in urban areas was only 3.14/1,00,000 pop. The higher urban mortality was observed in the districts of Nagpur, Solapur, Satara, Sangli and Ahmednagar, while the cities of the other 19 districts' show low mortality. The rates have decreased in the second period (1971-76). The state average rate has declined upto 2.01/1,00,000 population. Only the cities of Solapur district show high mortality rates. Bombay city is completely free from this disease for the last 10 years.

The general districtwise (rural and urban) death rate of infectious hepatitis of Maharashtra state is shown in Fig.5.3. The map shows that during first period (1965-70), the highest intensity of infectious hepatitis was observed in the districts of Amraoti, Nagpur, and Solapur. These districts' mortality rates were highest than the state average (i.e. 1.97/1,00,000 pop.).

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CAUSE SPECIFIC DEATH RATE OF INFECTIOUS HEPATITIS
(CITYWISE) (1971-83)

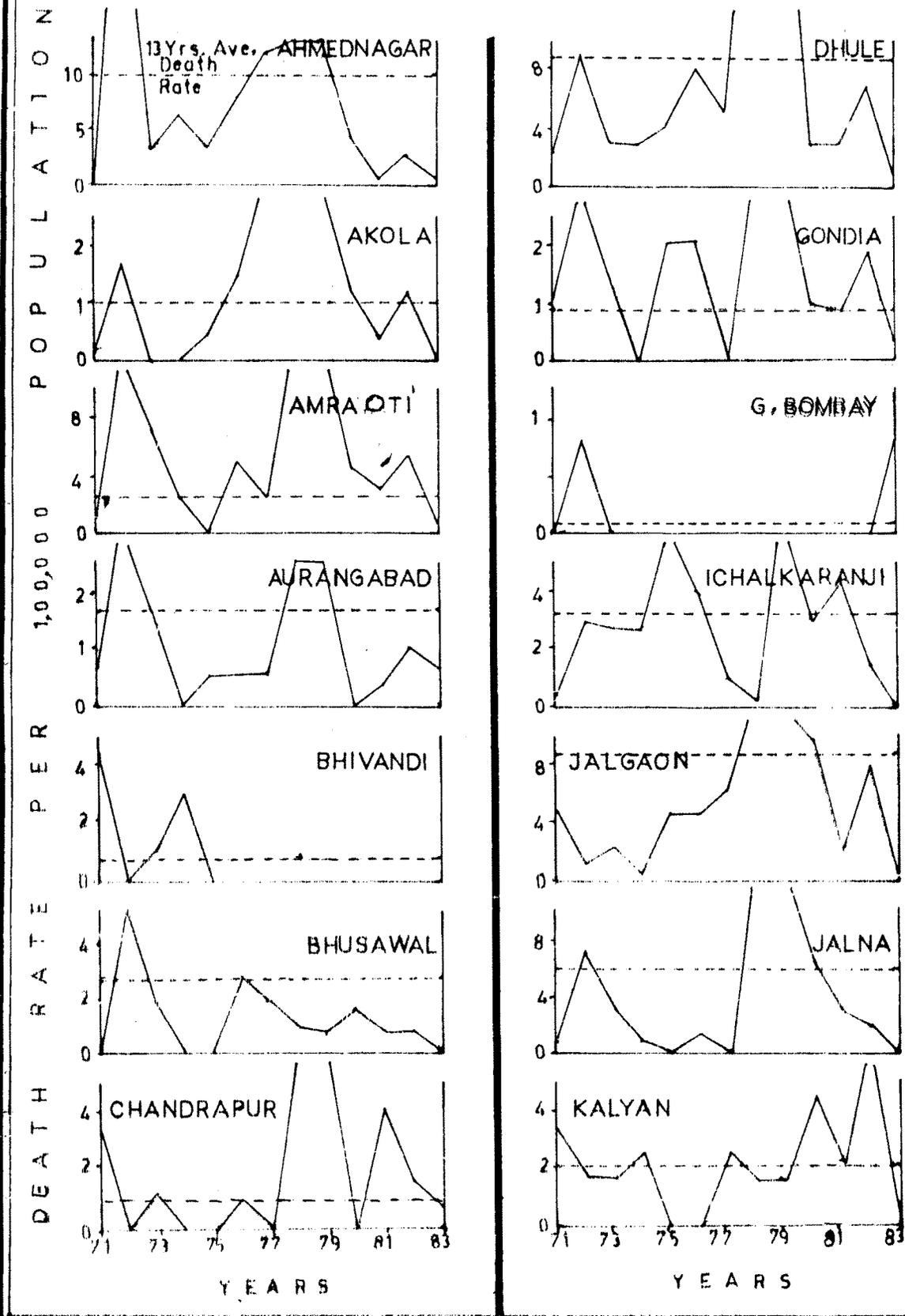


FIG. 5.4

Thane district shows moderate mortality rate and remaining districts' rates are lowest. During second period (1971-76), the overall mortality rate has decreased (state average 1.54/1,00,000 pop.) except Solapur district. In the third period (1977-83), the disease has virtually disappeared and its trace is only found in Nagpur, Solapur, Satara, Sangli, and Kolhapur districts which are the low lying areas of Krishna basin.

The stagnation of water in the lower reaches of Godawari basin of Nanded districts and middle parts of Wardha-Wainganga basin of Vidarbha (Nagpur and Amraoti) districts show high mortality, and lower parts of Krishna basin is having high mortality rates. The steep slopes of Konkan with fast flowing rivers outwashes the terrain and the heavy rainfall in these two areas have lessened the mortality.

5.6 CITYWISE SPREAD OF INFECTIOUS HEPATITIS :

The citywise data are collected for the period of 13 years (1971-83), and is shown with the help of line graphs in Figs.5.4 and 5.5. The cities selected for the study are twenty eight in number. The yearwise cause specific mortality rates per one lakh population have been calculated and the dotted lines on each graph shows the average death rate of particular disease for that city for the last 13 years (1971-83).

The graph shows the highest mortality rates of infectious hepatitis in Ahmednagar 25/1,00,000 pop. in 1972, Pune 20/1,00,000 pop. in 1976, Kolhapur 17/1,00,000 pop. in 1981, as well as in the

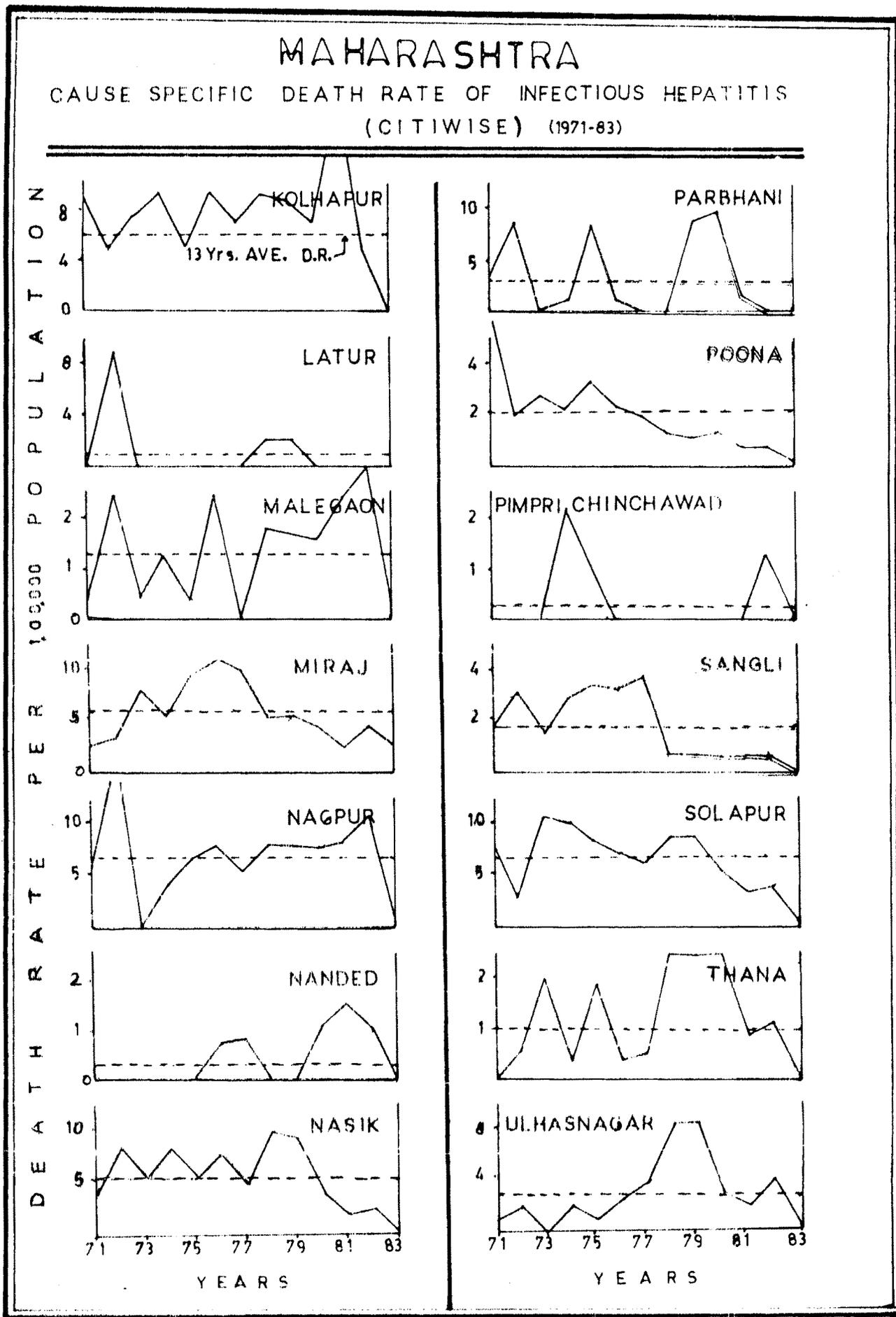


FIG. 5-5

cities like Amraoti, Jalgaon, Jalna, Latur, Miraj, Nagpur, Nasik, Solapur and Parbhani. These cities are located in low lying areas of Bhima, Godawari and Wardha-Wainganga basins. Rainfall is comparatively low and water stagnation and sluggishness have caused the spread of disease. The possibility of water pollution might be more in Bhivandi, Bhusawal, Ichalkaranji, Kalyan, Ulhasnagar as the death rate of these cities vary between 1 and 6/1,00,000 pop. In all the cities the infectious hepatitis is a continuous disease.

5.7 TYPHOID AND PARATYPHOID :

Typhoid fever is an acute communicable disease caused by *S.Typhii*. It is transmitted usually by contaminated water and food. In 1880, the germ, *Bacillus typhosus*, later *Eberthella typhosa* and now *S.Typhi*, was identified by Eberth. The isolation of the paratyphoid organisms came later; 'A' and 'B' at the turn of the century and 'C' in 1919. Typhoid and Paratyphoid salmonellas have become adapted to humans. This is particularly so in the case of *S.typhi*, *S.paratyphi*, 'B' the most common forms of the paratyphoid organism in Europe and America. It has been found in cattles, pigs and dogs. Clinically, it is characterized by prolonged fever with involvement of lymphoid tissues and considerable constitutional disturbances. The term 'Enteric Fever' includes both the typhoid and paratyphoid fevers (Park and Park, 1979).

5.7.1 Typhoid and paratyphoid spread in World :

Typhoid fever occurs in all parts of the world, but the disease has declined a good deal into western countries due to improvement in sanitation and water supply. This was the case in the canning process of corned beef which initiated the large outbreaks in Aberdeen, Scotland in 1964 (over 400 cases) and in several towns in England in 1963. Canned tongue of the beef similarly infected was responsible for an outbreak in pickering, Yorkshire in 1955. Unpasteurized milk and products such as ice-cream have been involved in many outbreaks. Dried egg is another important source, particularly for the paratyphoid organisms. These organism have also been disseminated in dessicated coconut from Ceylon and countries further east. These organisms are still widely distributed but in countries such as those of Northern Europe, in Africa, India, the far east and South Americas (Howe, G.M., 1977).

The death rate in England and Wales declined from 15.5 per 1,00,000 pop. in 1901 to 0.1 in 1954. In the U.S.A., the death rate has declined from 31.3 per 1,00,000 pop. in 1900 to 0.1 in 1950 (Park and Park, 1979).

5.7.2 Typhoid and Paratyphoid spread in India :

Typhoid fever is not a notifiable disease throughout India and as such a complete picture of the incidence of the disease is lacking. Survey conducted in the community development area by the Central Ministry of Health in recent years

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CAUSE SPECIFIC DEATH RATE
OF TYPHOID AND
PARATYPHOID

RURAL

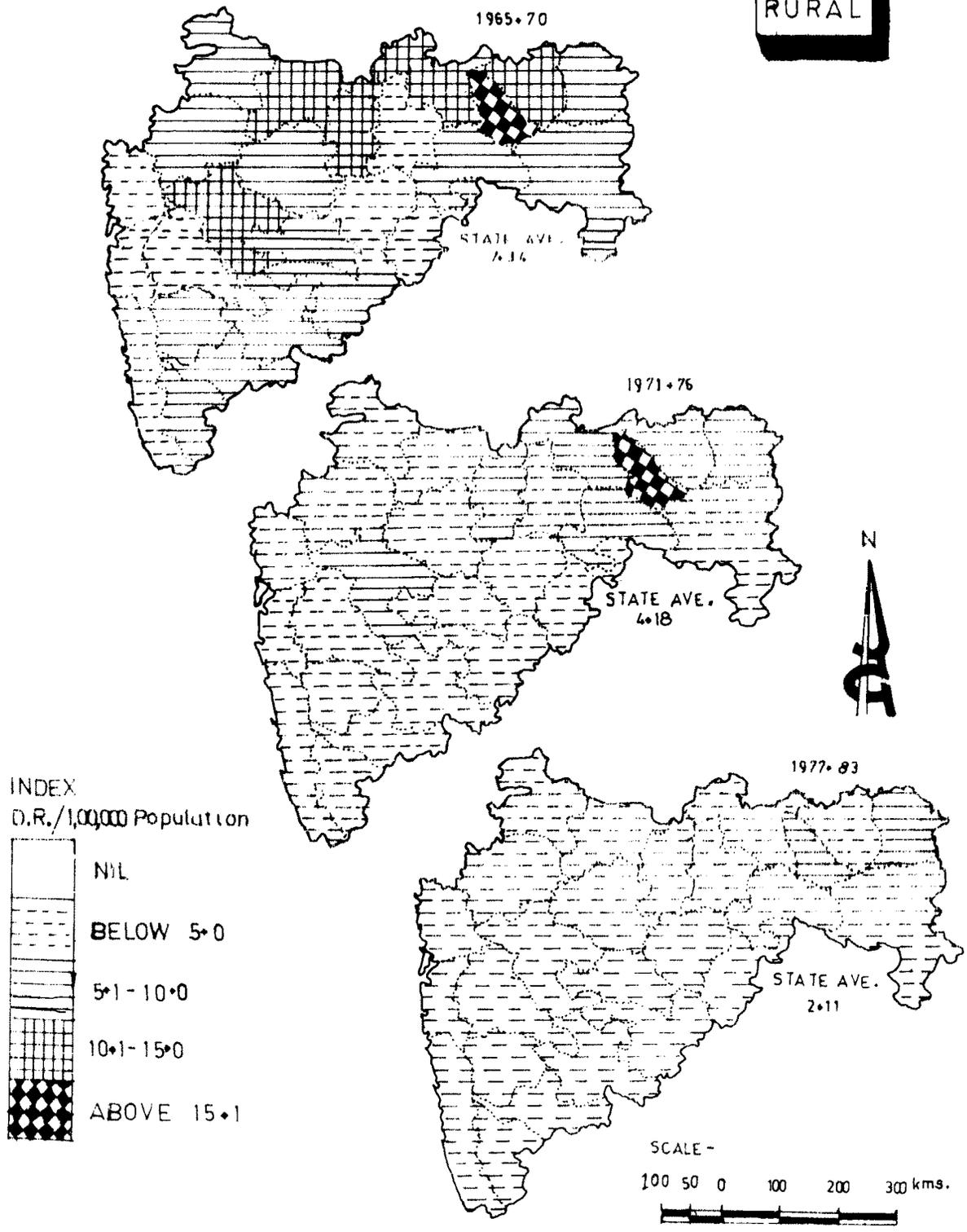


FIG. 5-6

indicate that the morbidity rate varies from 102.2 to 219 per 1,00,000 population in different parts of the country. Patnaik (1967) reported an incidence of 110 amongst males and 75 amongst females per 1,00,000 population in Delhi. The reported number of cases treated in medical institutions in India during 1976 were 2,29,354 with 745 deaths. In India, Patnaik (1967) reported a death rate 7.09 per 1,00,000 pop. in Delhi (Park and Park, 1979).

5.8 TYPHOID AND PARATYPHOID SPREAD IN MAHARASHTRA :

It is observed that typhoid and paratyphoid is a major disease in Maharashtra State eventhough the average death rate for the last two decades is declining sharply. The author has calculated the death rate of Maharashtra for rural and urban areas separately for 1965-83. It also shows that the death rate is more in urban areas than in rural areas.

5.8.1 Factors affecting typhoid and paratyphoid in Maharashtra :

The seasonal influence of the temperature and rainfall are the major factors in the geocological analysis of typhoid and paratyphoid epidemics in Maharashtra. Disease breaks after the first onset of monsoon and reaches it's peak in the month of August and September. The type of water supply available to the population in various parts of the region, the velocity of the rivers and the quality of water supplied for the drinking purposes play a major role in the endemicity of typhoid and paratyphoid.

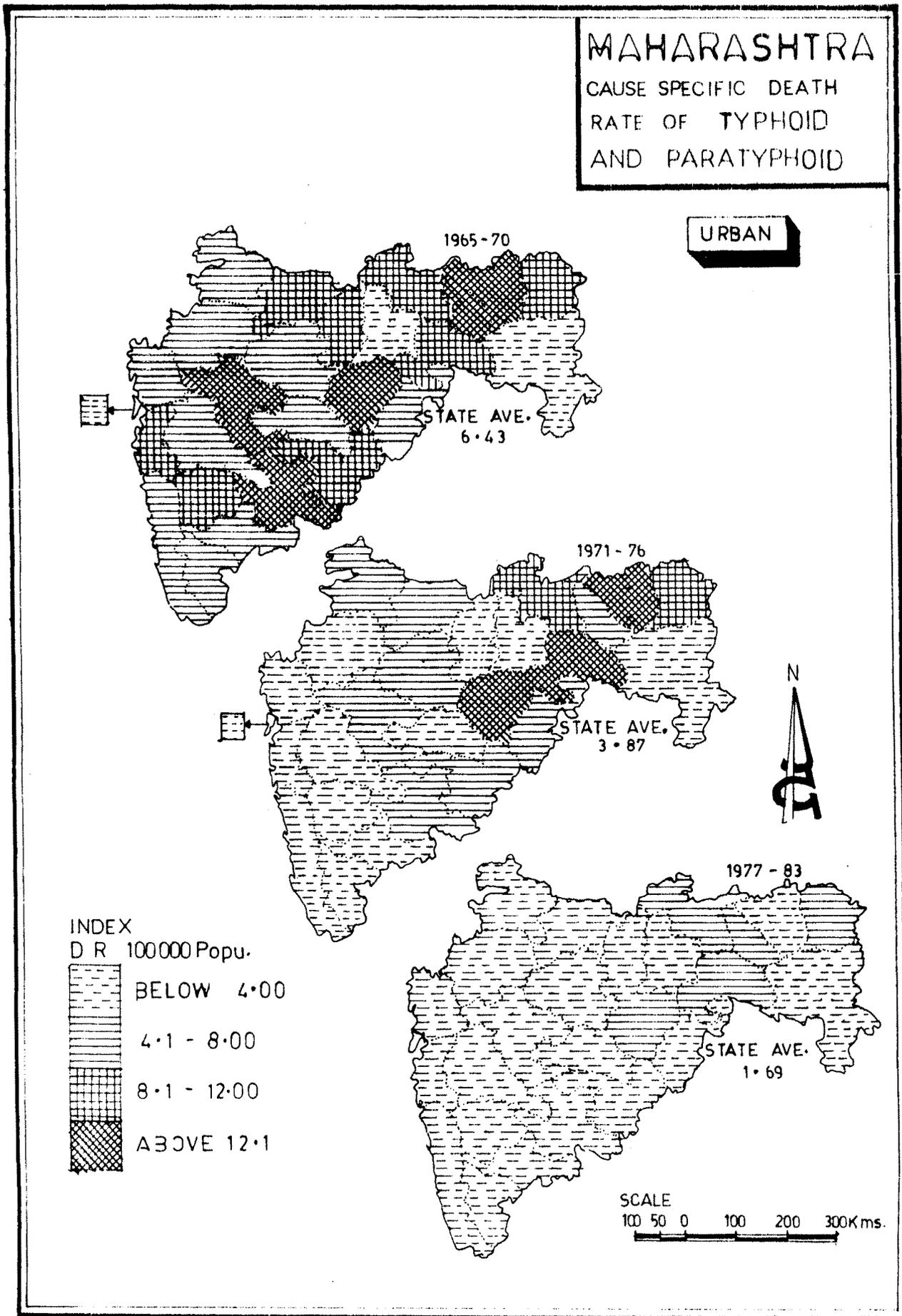


FIG. 5.7

The socio-cultural factors like, density of population, religion, pollution, population migration, fairs and festivals, personal hygiene, defective sanitation are some other factors responsible for the widespread of this disease.

5.9 DISTRICTWISE SPREAD OF TYPHOID AND PARATYPHOID IN MAHARASHTRA :

The choropleth map of rural area (Fig.5.6) shows that during 1965-70, the highest intensity of typhoid and paratyphoid was noted in the district of Wardha of Wardha-Wainganga Basin of Vidarbha division. The average death rate of the said period was 7.34/1,00,000 pop. Nagpur, Amraoti, Buldhana, Jalgaon and Ahmednagar districts were of moderate intensity and in remaining districts the rates were low. The rural mortality rates have decreased in the second period (1971-76) but comparatively rates are higher in Wardha district than other districts of Maharashtra State. In third period (1977-83), the rates have gone substantially down in all district with state average as 2.11/1,00,000 population.

The choropleth map for urban area (Fig.5.7) shows that during first period (1965-70), the cities of 23 districts were affected by typhoid and paratyphoid. The average death rate of typhoid and paratyphoid in urban areas was 6.43/1,00,000 pop. The higher urban mortality was observed in the districts of Wardha, Nagpur, Solapur, and Ahmednagar while the Bhandara, Yeotmal, Raigad, Amraoti, Osmanabad and Satara show moderate mortality rates. Remaining districts show low mortality rates. The mortality rate has

MAHARASHTRA

CAUSE SPECIFIC DEATH RATE
OF TYPHOID AND
PARA TYPHOID

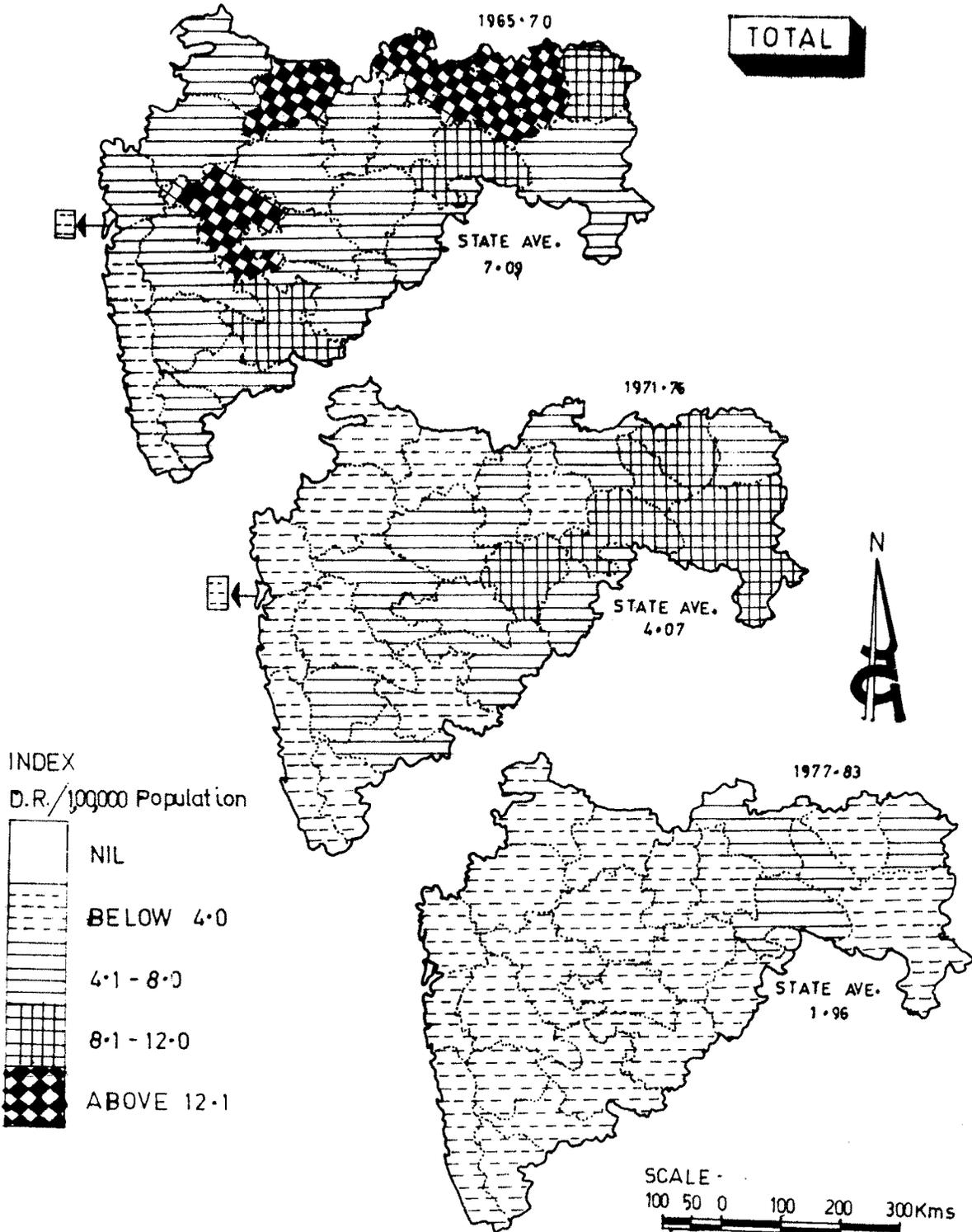


FIG. 5.8

decreased in the second period (1971-76), as the state average has declined upto 3.87/1,00,000 pop. Only the Parbhani, Yeotmal and Nagpur districts show high mortality rates. In third period rates have decreased in all the districts of Maharashtra State.

The general districtwise (rural + urban) death rates of typhoid and paratyphoid of Maharashtra State is shown in Fig.5.8. This map shows that during first period (1965-70), the highest intensity of typhoid and paratyphoid was observed in the districts of Jalgaon, Ahmednagar, Amraoti, Wardha, and Nagpur. These districts death rates are highest than the state average (i.e. 7.09/1,00,000 pop.). The districts like Bhandara, Yeotmal and Solapur show moderate mortality rate of typhoid and paratyphoid and remaining districts' rates are low. During second period (1971-76), the overall mortality rate has decreased (state average 4.07/1,00,000 pop.). But districts of Vidarbha division i.e. Wardha, Nagpur, Chandrapur, Yeotmal, and Parbhani show still the higher mortality rates. It means that districts of Vidarbha division are the areas of it's endemicity. In third period (1977-83), the disease has virtually disappeared and it's trace is found only in the districts of Vidarbha division.

5.10 CITYWISE SPREAD OF TYPHOID AND PARATYPHOID :

The author has collected the data about mortality of typhoid and paratyphoid occuring in different cities throughout the Maharashtra State. The data so collected for the period of 13 years (1971-83) are studied citywise, and is shown with the help of line graphs in Figs.5.9 and 5.10.

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CAUSE SPECIFIC DEATH RATE OF TYPHOID AND PARATYPHOID (CITYWISE) (1971-83)

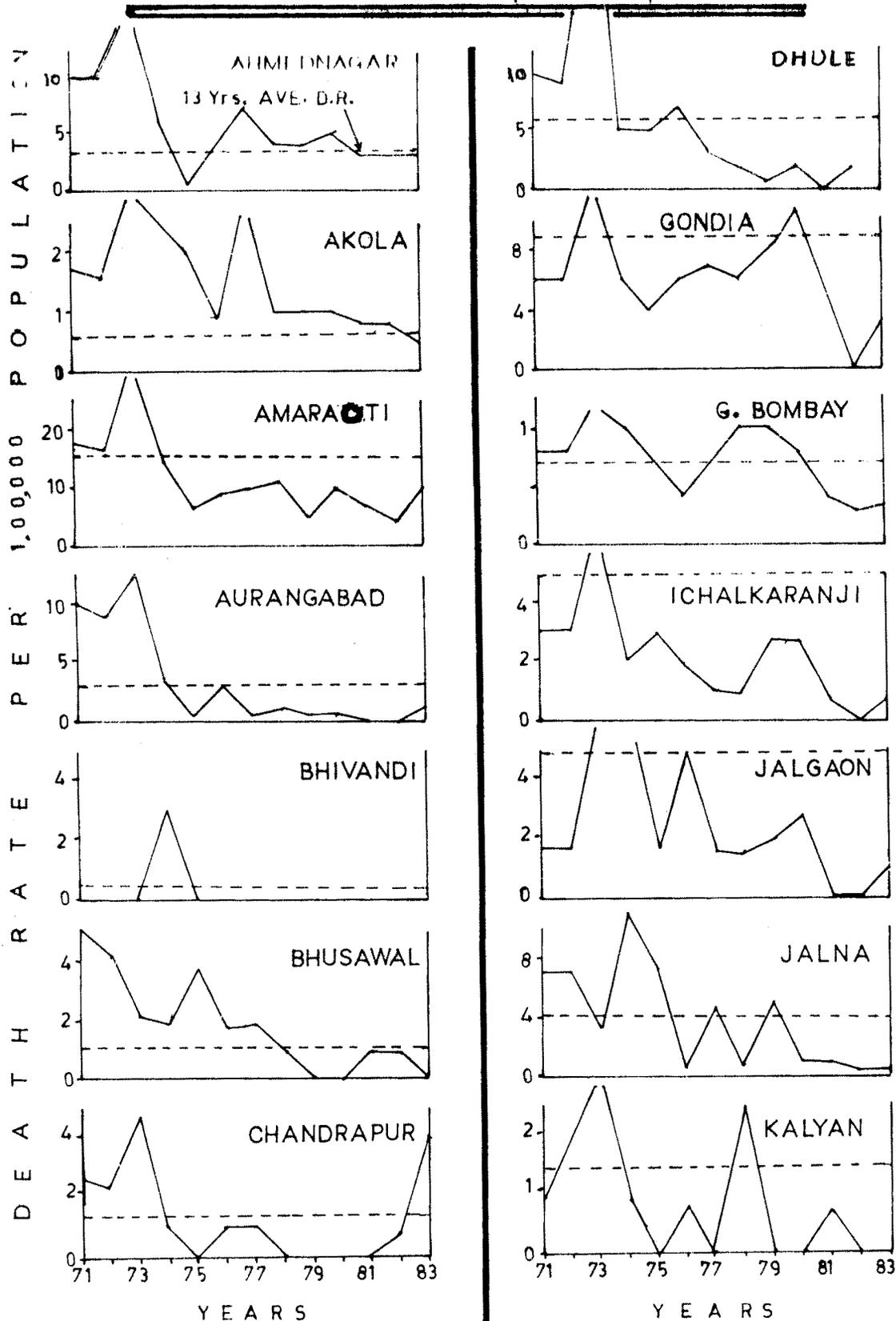


FIG. 5.9

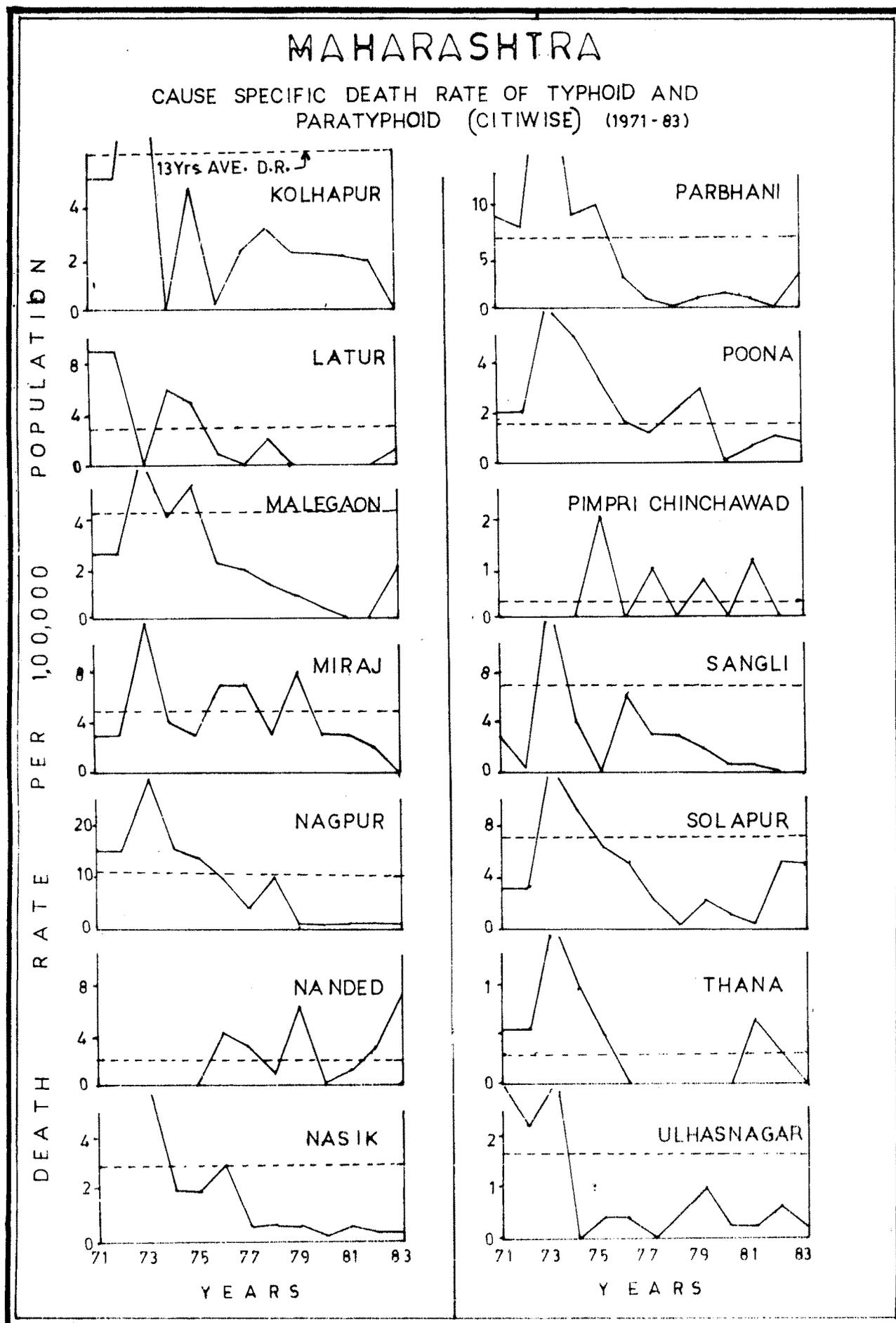


FIG. 5-10

The graph shows that the moderate mortality rates of typhoid and paratyphoid are observed in Ahmednagar, Dhule, Aurangabad, Nanded, Miraj, Sangli and in Solapur (8 to 10/1,00,000 pop.), while the cities like Parbhani, Nagpur and Amraoti of Vidarbha division show highest mortality rates as compared to other cities of Maharashtra State. These cities' death rates vary between 10 and 20/1,00,000 pop. These cities are located in low lying areas of Wardha-Wainganga river basin where rainfall is comparatively low and water stagnation and sluggishness have caused the spread of disease. The possibility of water pollution might be more and spread of disease germs might be through polluted drinking water.

5.11 MAHARASHTRA'S WATERBORNE DISEASES :

5.11.1 Introduction and Methodology :

Water is very important aspects for human life. Without water, there would not have been life. For this reason, in early times habitation were used to be near rivers, well, lakes and springs. Human body consist nearly two-third of water. Water is great cleaning agent both external and internal. It is the main constituent of body cells and fluids. All types of food contains water. It acts as a diluent and solvent of food chemicals and gases and carries them to different parts of body. It regulates body temperature, replaces the water that is lost by respiration, urination, sweating etc.

Much of the ill health in the underdeveloped countries is largely due to lack of safe drinking water. There can be no state

of positive community health and well being without safe water supply. Water is composed of dissolved gases (hydrogen sulphide, carbon dioxide, Ammonia, Nitrogen etc.) dissolved mineral (salts of calcium, magnesium, sodium); suspended impurities (clay, silt, sand and mud) and microscopic plants and animals residues.

Water pollution is mainly caused by human activities. Urbanization and industrialization lead to water pollution. Sewage, industrial and trade waste, agricultural pollutants and physical pollutants are different sources of water pollution. Man's health may be affected by the contaminated water either directly or indirectly.

The various waterborne diseases may be listed as follows which are caused by different organisms :-

- a) Viral - Viral hepatitis, Poliomyelitis,
- b) Bacterial - Cholera, Typhoid and Paratyphoid, Bacillary dysentery, Gastroenteritis, Diarrhoea,
- c) Protozoal - Amoebiasis, Giardiasis,
- d) Helminthic - Round worm, Whip worm,
- e) Leptospiral - Weils disease,
- f) Cyclops - Guinea worm and
- g) Snail - Schistosomiasis.

The upper listed waterborne diseases are found to be distributed in different parts of Maharashtra in different intensities but due to lack of data only few have analysed earlier. The type of water pollution depends upon the water

Sources channelled defectively by man and by his different activities. The man made environmental factors are mainly responsible to pollute the water, hence systematic spatio-temporal study of waterborne diseases may be of much use to the health planning in any community.

5.11.2 Ranking of waterborne diseases :

The study of disease intensity and ranking may be very useful in understanding the disease distribution in the districts of Maharashtra State. This study may provide an idea of relative dominance of different diseases in order of importance. The ranking techniques used here are based on mortality rates calculated for particular disease in particular year and for particular district.

The author has calculated upto Vth rank the diseases whose data were available. The maps (Figs.5.11 and 5.12) show the following ranking order of these diseases.

- 1) The diarrhoea is observed to be a disease of Ist rank in all 26 districts.
- 2) Typhoid and paratyphoid rank in mortality rate in their IInd order. These diseases are found to be of IInd rank in 22 districts of Maharashtra. In Bombay, Kulaba, Ratnagiri and Solapur districts these diseases are not found.
- 3) At IIIrd rank infectious hepatitis is found in 17 districts of Maharashtra. These districts are Thane, Raigad, Ratnagiri, Pune, Satara, Kolhapur, Sangli, Nasik, Ahmednagar, Aurangabad, Nanded, Parbhani, Akola, Yeotmal, Nagpur and Osmanabad.

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RANKING OF WATERBORNE DISEASES

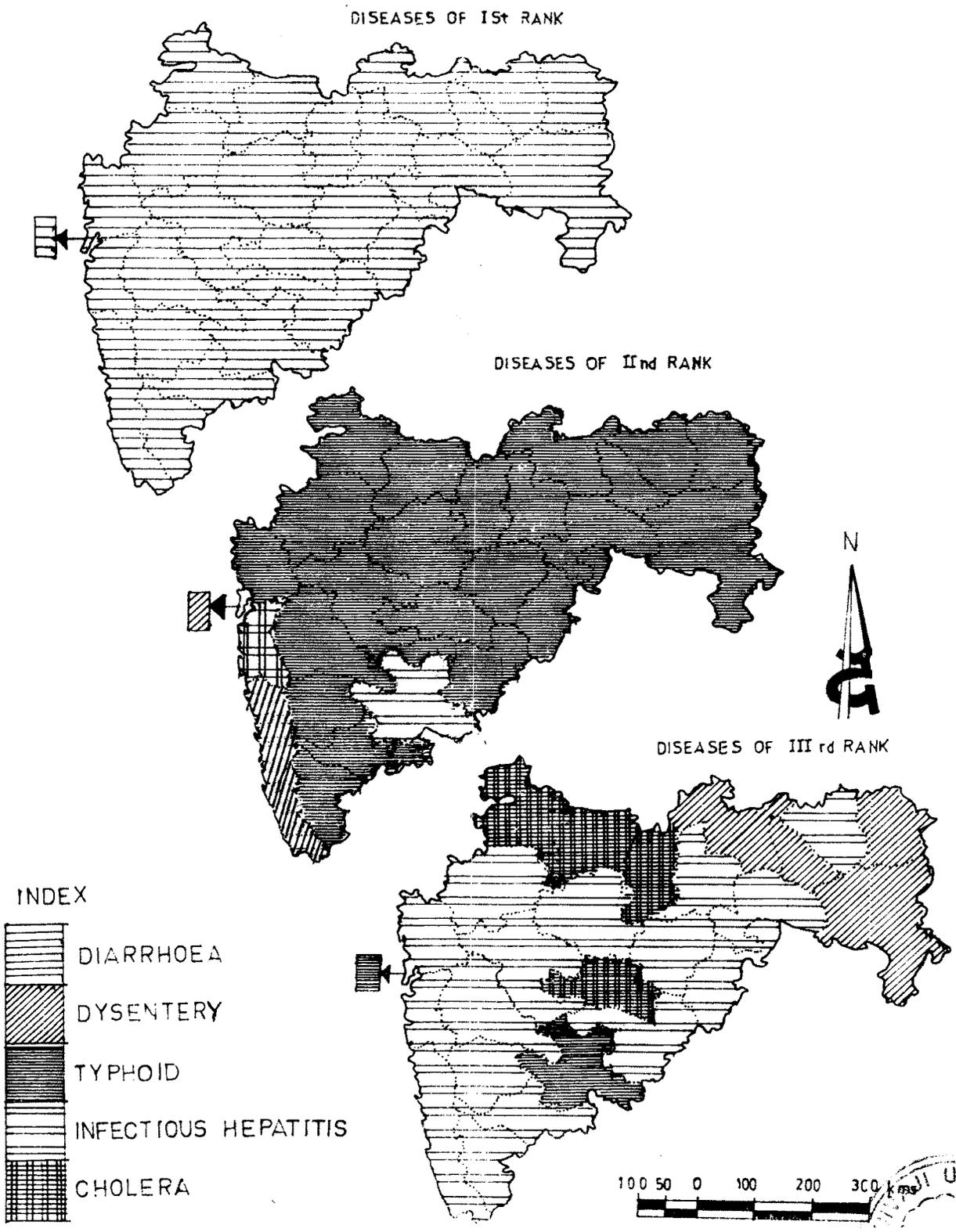


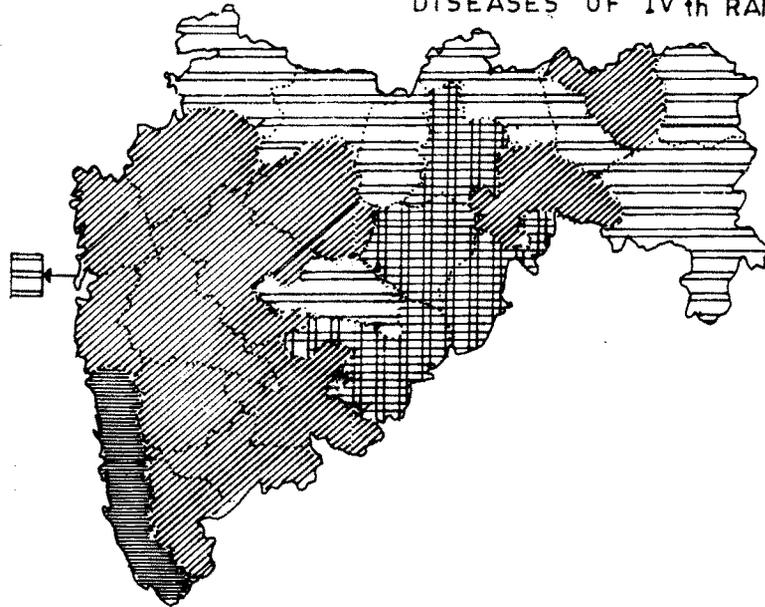
FIG. 5.11



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RANKING OF WATERBORNE
DISEASES

DISEASES OF IVth RANK



DISEASES OF Vth RANK

- INDEX
- DIARRHOEA
 - DYSENTERY
 - TYPHOID
 - INFECTIOUS HEPATITIS
 - CHOLERA

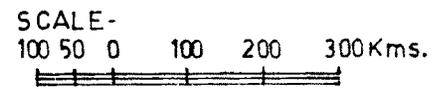
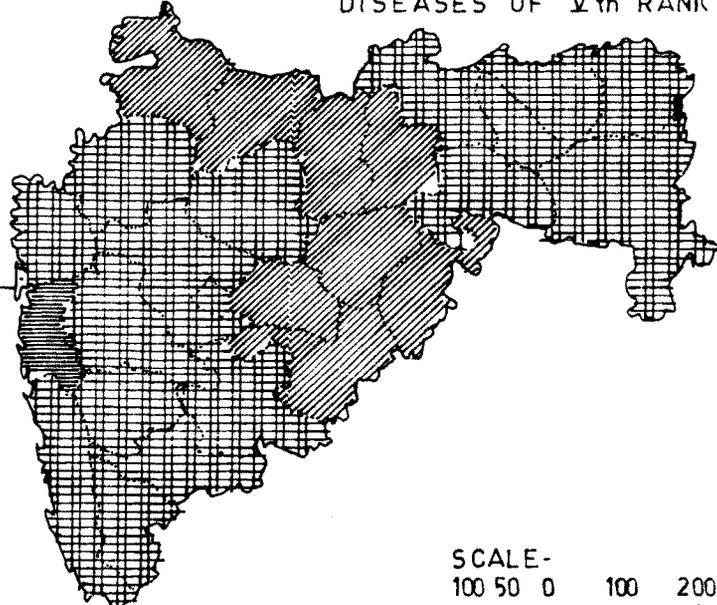


FIG. 5-12

- 4) Dysentery shows it's IVth rank in Maharashtra. This disease of IVth rank is found in 12 districts. These districts are Thane, Nasik, Ahmednagar, Aurangabad, Pune, Satara, Sangli, Solapur, Kolhapur and Yeotmal.
- 5) Cholera stands at Vth rank in Maharashtra state in 17 districts namely Nasik, Thane, Ahmednagar, Aurangabad, Pune, Satara, Sangli, Kolhapur, Solapur, Amraoti, Wardha, Nagpur, Yeotmal, Bhandara and Chandrapur.

In general, in terms of ranking Diarrhoea takes Ist rank, followed by typhoid and paratyphoid, infectious hepatitis, Dysentery and cholera at Vth rank. It means Diarrhoea is the major waterborne disease on whose eradication major control programmes should be launched by the government.

5.12 SPREAD OF WATERBORNE DISEASES IN MAHARASHTRA :

The average death rate of waterborne diseases discussed earliest has calculated combinally for rural and urban areas and rates were calculated periodwise.

5.12.1 Areawise spread of waterborne diseases :

The mortality data were collected areawise for the span of 19 years in this Maharashtra State from 1965 to 1983. The choropleth map of average death rate by waterborne diseases (Fig.5.13) shows that in rural areas the highest intensity of waterborne diseases is found in the areas of Buldhana, Akola, Amraoti and Yeotmal districts of Wardha-Wainganga basin. The

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AVERAGE DEATH RATE BY
WATERBORNE DISEASES (AREAWISE)

1965 - 83

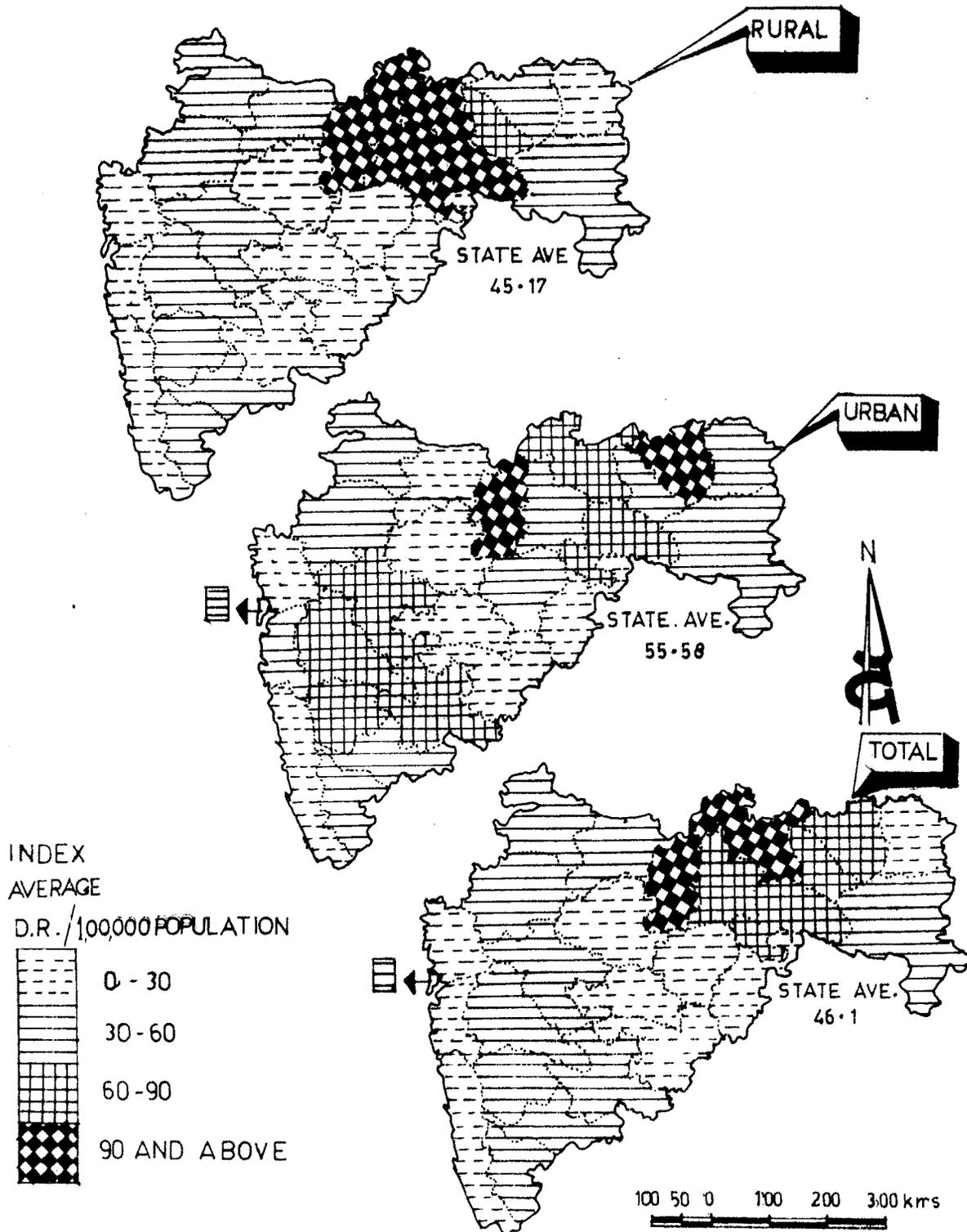


FIG. 5-13

MAHARASHTRA

WATERBORNE DISEASES CAUSE SPECIFIC DEATH RATE

RURAL

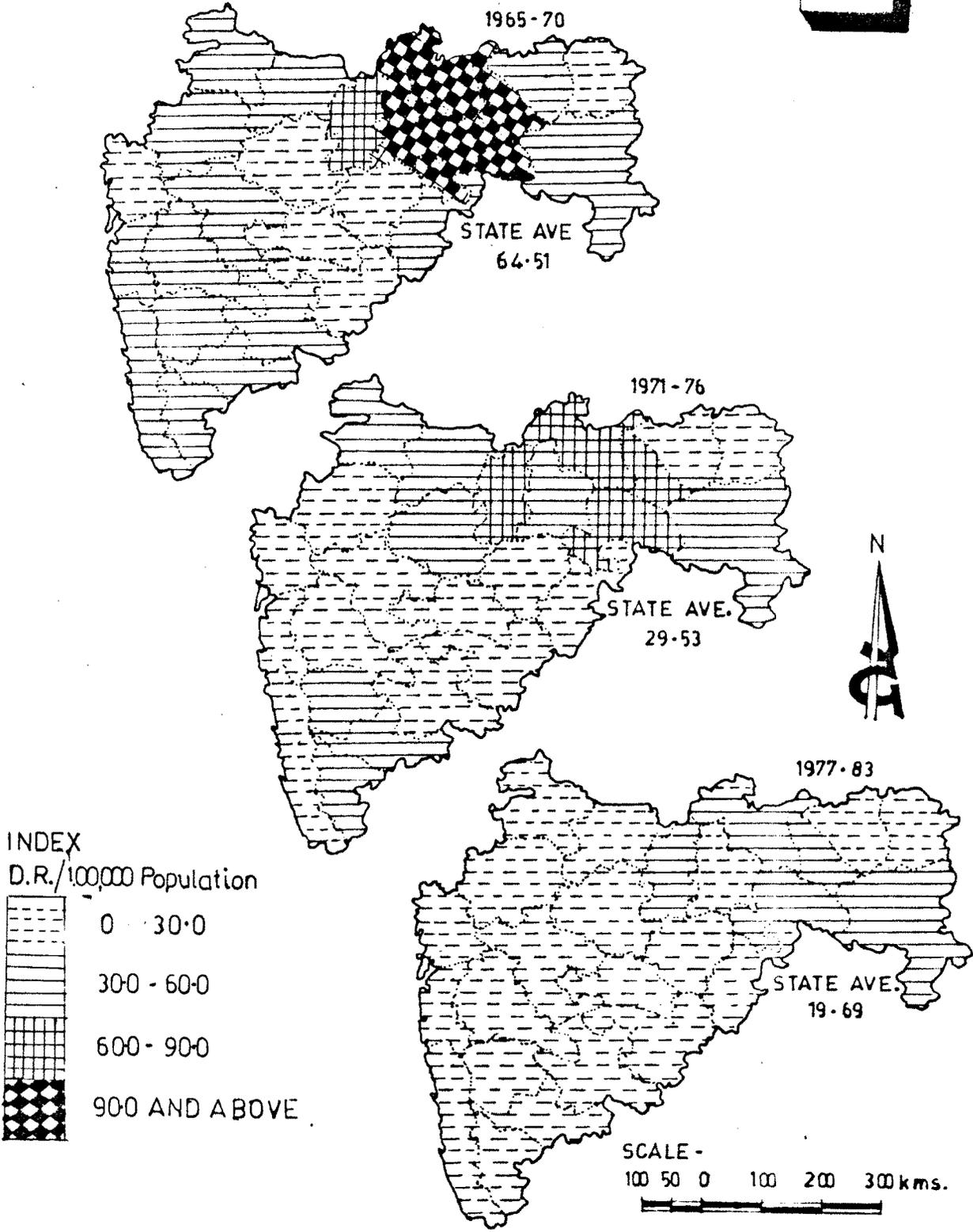


FIG. 5.14

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WATERBORNE DISEASES
CAUSE SPECIFIC DEATH RATE

URBAN

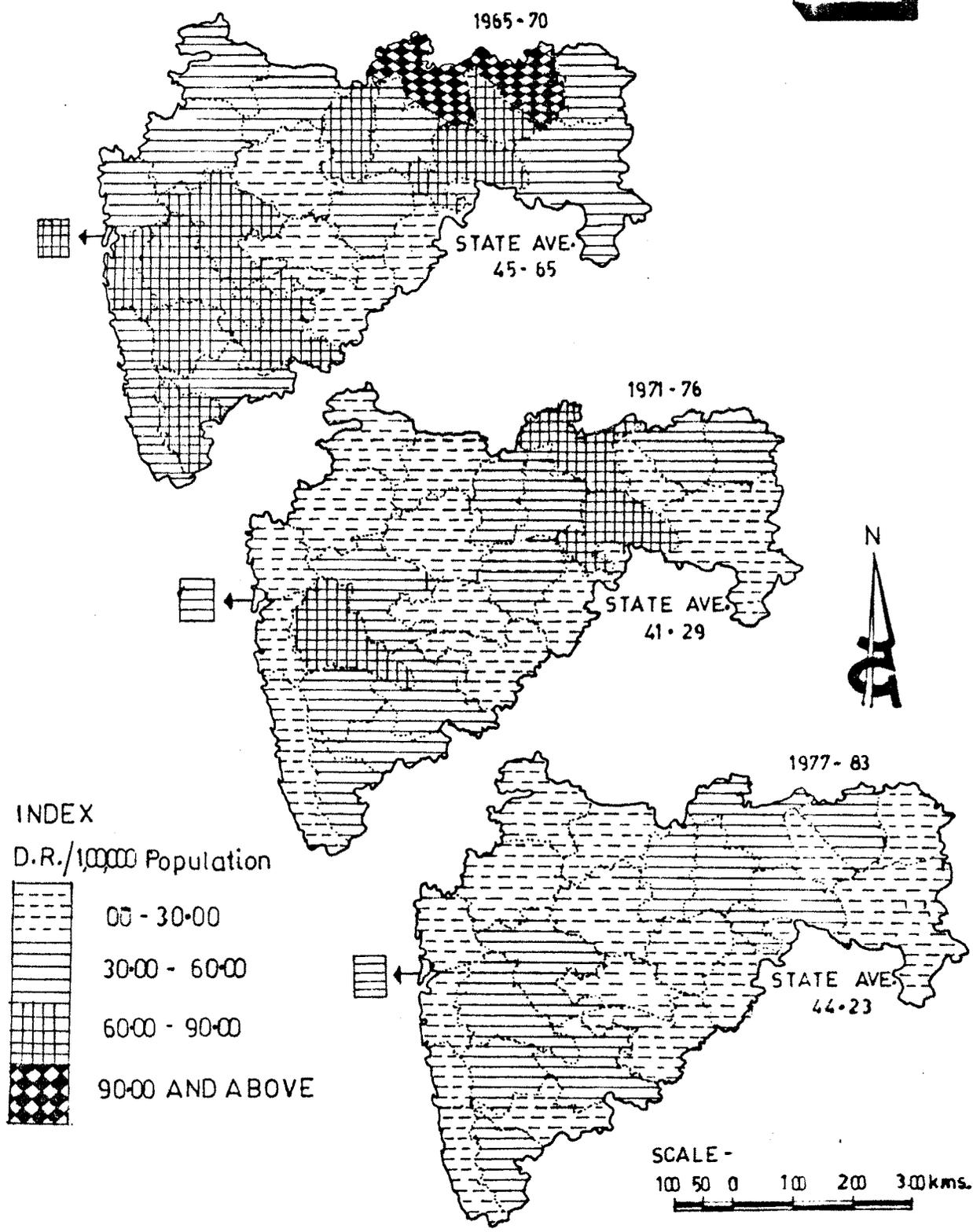


FIG. 5.15

MAHARASHTRA

WATERBORNE DISEASES
CAUSE SPECIFIC DEATH RATE

TOTAL

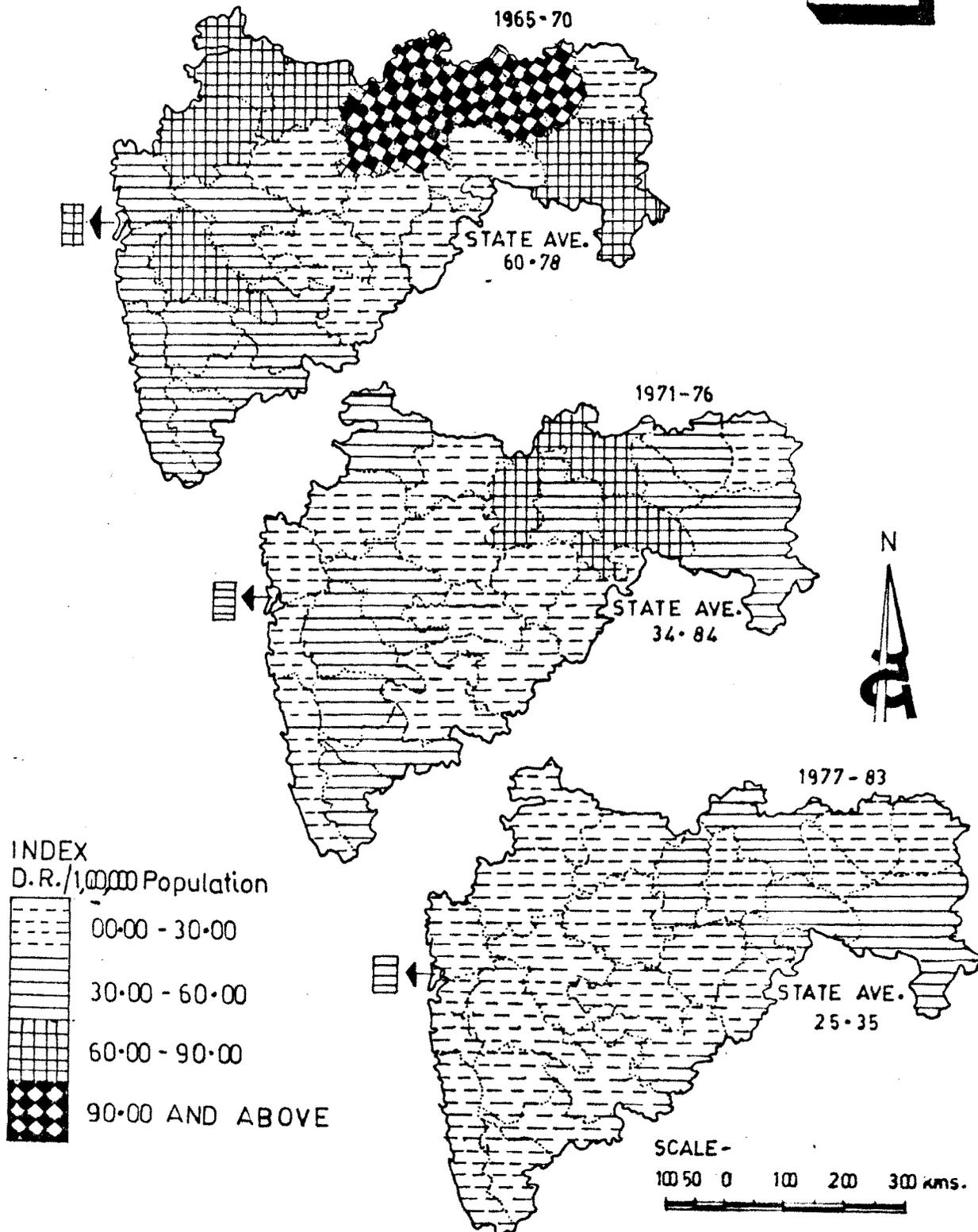


FIG. 5.16

average death rate of a state during the said period was 45.17/1,00,000 pop. The Dhule, Jalgaon, Nasik, Ahmednagar, Pune, Satara and Sangli districts were of moderate death rate and the Konkan divisional districts and middle parts of Maharashtra state show low rates.

In urban areas the high death rates are observed in the cities of Buldhana and Nagpur districts, while the cities of Bombay, Ahmednagar, Poona, Satara, Solapur, Amraoti, Yeotmal, district have moderate death rate of waterborne diseases. The cities are located at the low lying areas of Godawari, Bhima and Wardha-Wainganga basin. In the remaining cities the rates were low.

As a whole, Buldhana and Amraoti districts have high rate, while the districts like Bombay, Akola, Yeotmal, Wardha and Nagpur have moderate death rates. The districtwise distribution also tallies with the area^{wise} distribution.

5.13 CONCLUSION :

While studying the spatio-temporal analysis of infectious hepatitis and typhoid and paratyphoid diseases in Maharashtra state, it is observed that there is positive correlation between physico, socio-cultural factors and spatial distribution of the disease. The physiography and percentage of rainfall mainly determines the spread of these two disease as the low lying areas of Wardha-Wainganga and Tapi basins have the places of concentration of these disease. The Bhima river basin show high endemicity.

These are dominant diseases of the low lying areas where people use unsafe and contaminated water. The socio-cultural factors are more effective in disease proliferation rather than physical factors. The water supply for drinking purposes act as the predisposing factor for the distribution.

While studying the spatial pattern of diseases in cities of Maharashtra State, it is observed that prevalence of deaths by infectious hepatitis and typhoid and paratyphoid is more in cities. It is found that Ahmednagar, Pune and Kolhapur cities of low lying areas of Bhima and Krishna river basins and Amraoti, Nagpur, Latur and Parbhani cities of Wardha-Wainganga basin have highest prevalence. The diseases have concentrated in the cities of Ahmednagar, Dhule, Aurangabad, Nanded, Miraj, Sangli and Solapur.

In Maharashtra State, in the ranking order, Diarrhoea disease tops the list. Typhoid ranks second and infectious hepatitis is placed at third rank in Maharashtra. Cholera seems to be a disease of dissipated stage. In case of all waterborne diseases, Buldhana and Amraoti districts are mostly affected. The Gr. Bombay, Akola, Yeotmal, Wardha, Nagpur and districts also show the moderate endemicity.

The supply of fresh unpolluted drinking water to the rural area and sufficient chlorinated water to the cities may check the mortality.

5.14 FINDINGS :

There is a positive relationship between the spread of waterborne diseases and physico-cultural environment. The low rate has been observed in the districts of Raigad and Ratnagiri of Konkan area, while on Deccan plateau the incidences are higher. Temperature and rainfall play the major role in the seasonal distribution of waterborne diseases. The number of deaths start increasing at the onset of monsoon. The deaths are maximum in rainy season than in non-rainy season. The area of strong alkaline soil whose pH value is above 8.5, record the high incidences. It is specially found in the districts of Jalgaon, Sangli, Osmanabad and Nanded. Density of population shows direct relationship with spread. Contamination of water and it's scarcity lead to spread the waterborne diseases like cholera, dysentery and diarrhoea. The places of fairs and festivals have become the regions of seasonal spread of these diseases. The casual, seasonal and temporary migration of labourers has created some health problems and diffusion of many waterborne diseases.

The cholera spread in Maharashtra is also controlled by many factors of physical and socio-cultural environment. The districts like Dhulia, Jalgaon, Parbhani and Nanded show high endemicity of cholera. Low lying areas with gentle slope lead to water stagnation. Use of unsafe contaminated river water of these areas for drinking purposes is responsible

for cholera spread. The steep slope of Konkan with heavy rainfall outwashes the surface and the cholera is almost dormant in Konkan region. The overall trend of cholera incidence show the decreasing tendency. If supply of safe drinking water is made and the immunisation is made in the areas of fairs and festivals, the epidemic of cholera may be checked.

The endemic focii of dysentery and diarrhoea are observed in the low lying areas of Vidarbha. The districts like Amraoti and Wardha of Wardha-Wainganga basin have more spread of dysentery and diarrhoea. Water stagnation, more density of population, insanitation and use of polluted drinking water lead these diseases at the top in the ranking list. The industrially developed major cities of Vidarbha and Konkan division show higher prevalence of these diseases than the small towns.

The prevalence of infectious hepatitis and typhoid is also found in the areas, where dysentery and diarrhoea show higher rates. The Wardha-Wainganga, Tapi and Bhima basins of the state show more prevalence. The Buldhana, Amraoti, Akola, Wardha and Nagpur of Vidarbha, Dhulia and Jalgaon of Tapi basin of Khandesh and Pune, Satara, Sangli and Kolhapur districts of Krishna Valley of Central Maharashtra are the region where the death by different waterborne diseases are highest. The Konkan division shows the lowest rate, as the surface outwash is more due to heavy of and steep terrain.

It seems that amongst the major waterborne diseases, diarrhoea takes the heaviest toll as it ranks first in almost all districts of Maharashtra. Typhoid and infectious hepatitis take the 2nd and 3rd position respectively and cholera is found to be sporadic and local disease. The quality, quantity and continuity in the supply of drinking water to the rural and urban masses play the major role in spreading the diarrhoea. In the slum areas of the cities, the density of population is more, thereby creating the sanitation problems and these areas act as the epicenters for the diarrhoea incidences in the cities. The places of fairs and festivals also are the regions of diarrhoea spread.

The poor disposal of sewage, improvement in the sanitary conditions, supply of fresh and safe drinking water of sufficient quantity and timely immunisation may reduce the heavy incidences of waterborne diseases in the State of Maharashtra.

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