The Epidemiology of Plague in Madras Presidency, India.

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Thesis submitted for the Degree of M.D. of Glasgow University.

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Preface.

The Work on which this Thesis is based was carried out by me while a Member of the Plague Research Commission. The Madras Government having asked the Commission to make an investigation into conditions affecting the spread of Plague in the Presidency , I commenced work in April 1911 and continued the investigations until September 1912 and the results of my personal observations are given here. The Thesis embodies my own opinions as to the various factors affecting the spread of Plague in the Presidency and must not be taken as representing the opinion of the Commission as a whole, as the Members of the Commission are not yet entirely agreed as to the interpretation of the facts elicited during the investigations.

Contents.

Introduction.

The Madras Presidency has shown a remarkable immunity from Epidemic Plague as contrasted with the other more Northerly parts of India and the relatively low prevalence in this Presidency will be well seen in Table No. *1*. While the death rate per mille from Plague calculated on the whole population is very low in Madras, the distribution of plague is not a general one of mild intensity over the whole Presidency, but the disease in epidemic form is fairly sharply limited to certain areas, while the other parts, representing the greater portion of the Presidency, have entirely escaped. Madras thus shows within its own limits conditions which are apparently suitable for the occurrence of Epidemic Plague in some parts and adverse to its occurrence in other parts, and provides an opportunity for investigating the influence of Climatic and other factors on the spread of Plague within a comparatively small area showing considerable contrasts.

No such marked variations of Plague Distribution and Climatic conditions in any one area previously investigated have been found, and the investigation of the Epidemiology of Plague in Madras is likely to add considerably to our knowledge of the relative importance of the different factors influencing the spread of Bubonic Plague.

Table No. 1.

Plague Mortality per Mille in different parts of India.

	1901	1902	1903	1904	1905	1906	1907	1908	1909	Average.
Punjab	.74	8.52	10.22	19.71	16.65	4.56	30.27	1.53	1.77	10.44
Bombay	6.94	10.00	15.22	12.12	3.86	2.79	5.06	1.48	1.32	6.53
United Provinces	0	.84	1.77	3.75	8.05	1.46	6.90	.48	.1	2.59
Central Provinces	0	1.55	4.13	3.43	1.07	1.53	3.18	.52	1.61	1.89
Bengal.	1.05	.44	.88	1.01	2.52	1.17	1.65	.31	.23	1.03
Madras	.1	.3	.4	.5	.2	.02	.1	.1	.1	.2

Madras Presidency.

Natural and Administrative Divisions:

The Madras Presidency occupies the greater part of the Southern and Eastern portions of the lower part of the Peninsula and is prolonged upward on the East Coast as far as Latitude 20° North. On the West it has a very short Coast Line of about 3 degrees.

The centre of the Peninsula is occupied by the native State of Mysore and the South-West extremity by Cochin and Travancore States.

For administrative purposes the Presidency is divided into 23 Districts. *

The Districts have an average area of 7000 square miles and an average population of 1,879,000.

Each District is divided into smaller areas called Taluqs. For our purpose the Districts may be conveniently divided into the following six main groups:-

(1) The Northern Circars.

- Ganjam District.
- Vizagapatam "
- Godavari "
- Kistna "
- Guntur "

(2) The Deccan of Ceded Districts.

- Kurnool District
- Bellary "
- Anantapur "
- Cuddapah "

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* (This was the Division up to 1910 and as all the Plague figures, Maps, etc., available for investigation are in accordance with this Division, we have found it necessary to keep to this arrangement for our purposes although a few re-arrangements have been recently made.)

(3) The East Coast Districts.

Chingleput District.
Nellore "
South Arcot "
Tanjore "
Trichinopoly "
Madura "
Tinnevelly "

(4) The Central Districts

North Arcot District
Salem "
Coimbatore "

(5) The West Coast Districts:

South Canara District.
Malabar "

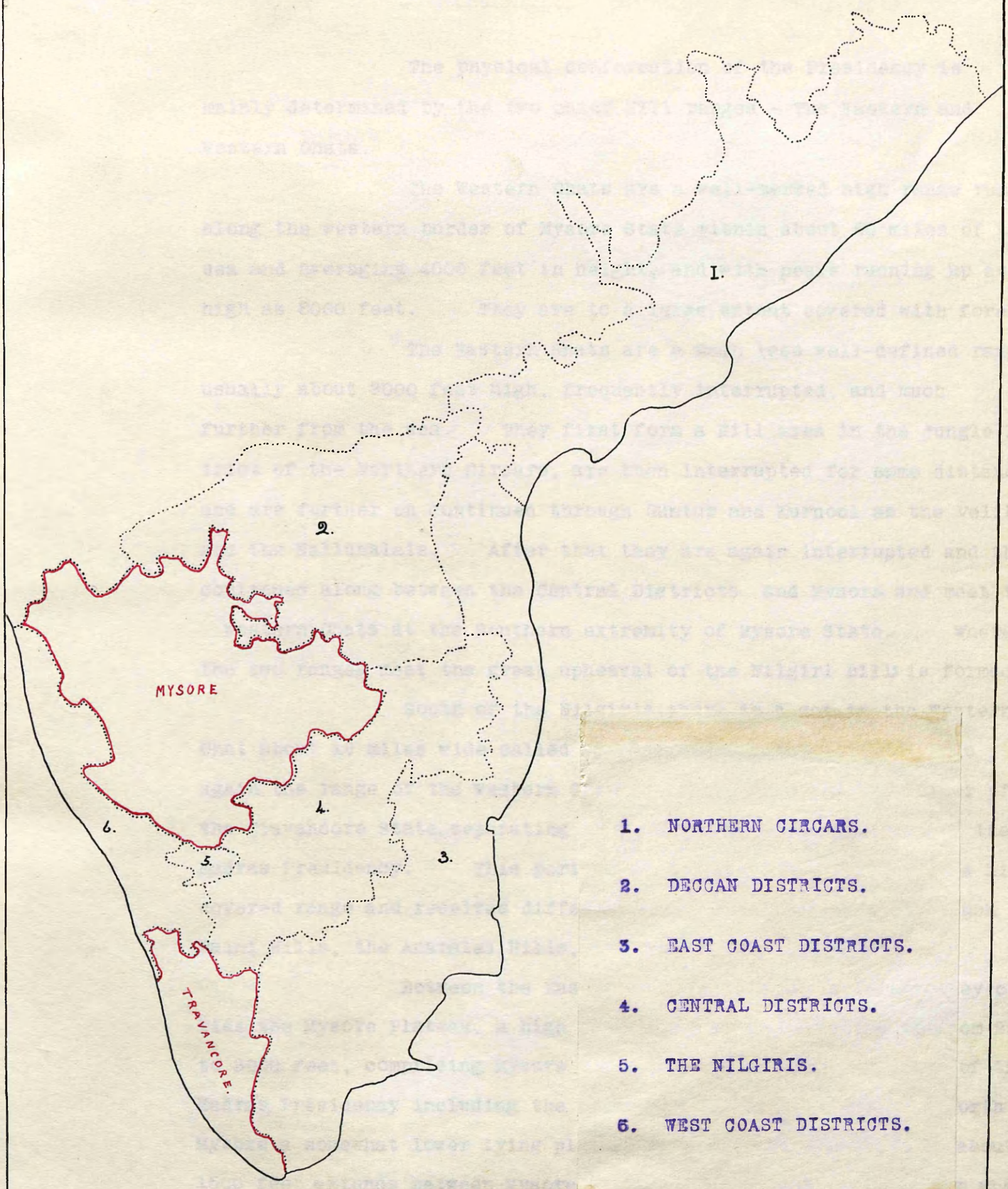
(6) The Nilgiris.

This is a Division based on physical and climatic conditions and varies somewhat from the usual classification.

These Divisions are shown on Map No.1.

MAP No. 1.

MADRAS PRESIDENCY



1. NORTHERN CIRCARS.
2. DECCAN DISTRICTS.
3. EAST COAST DISTRICTS.
4. CENTRAL DISTRICTS.
5. THE NILGIRIS.
6. WEST COAST DISTRICTS.

PHYSICAL ASPECTS.

The physical conformation of the Presidency is mainly determined by the two chief Hill ranges - The Eastern and Western Ghats.

The Western Ghats are a well-marked high range running along the western border of Mysore State within about 50 miles of the sea and averaging 4000 feet in height, and with peaks running up as high as 8000 feet. They are to a large extent covered with forest.

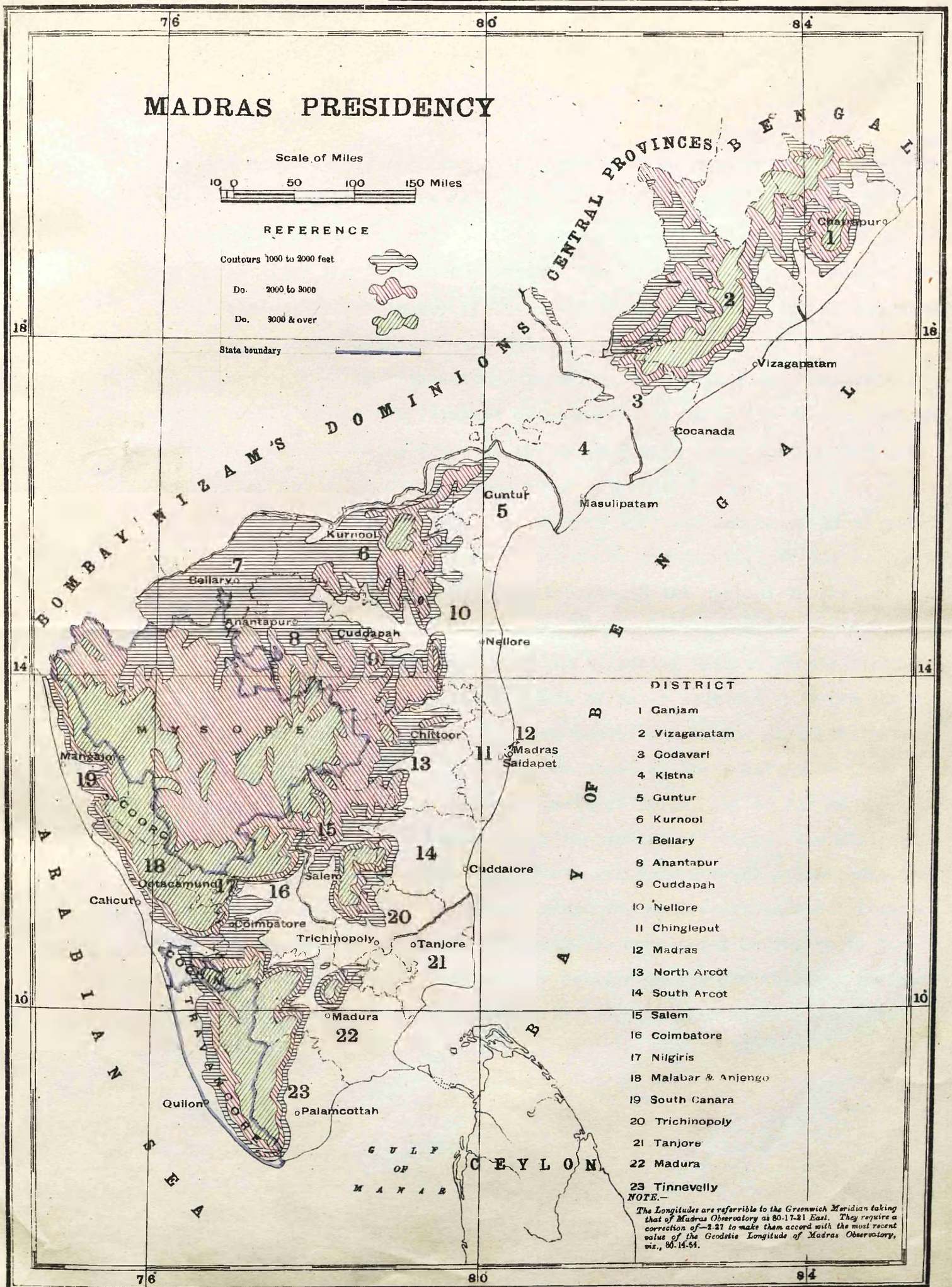
The Eastern Ghats are a much less well-defined range usually about 2000 feet high, frequently interrupted, and much further from the sea. They first form a Hill area in the jungle District of the Northern Circars, are then interrupted for some distance, and are further on continued through Guntur and Kurnool as the Velikondas and the Nallamalais. After that they are again interrupted and then continued along between the Central Districts and Mysore and meet the Western Ghats at the Southern extremity of Mysore State. Where the two ranges meet the great upheaval of the Nilgiri hills is formed.

South of the Nilgiris there is a gap in the Western Ghat about 16 miles wide called the Palghat Gap, and south of this again the range of the Western Ghats is continued along the border of the Travancore State, separating it from the adjacent Districts of the Madras Presidency. This portion of the Western Ghats is also a high jungle covered range and receives different names in different parts, such as the Palni Hills, the Anamalai Hills, the Travancore High Range.

Between the Eastern and Western Ghats, before they converge, lies the Mysore Plateau, a high table-land at an elevation of from 2000 to 3000 feet, comprising Mysore State and the adjacent portions of the Madras Presidency including the Hosur and Kollegal Taluqs. North of Mysore a somewhat lower lying plateau at a general elevation of about 1500 feet extends between Mysore and the Deccan, and includes the whole of Bellary District and parts of Anantapur and Kurnool.

The general elevations of the Presidency are well shown

MAP No. 2.



DISTRICT

1 Ganjam
2 Vizaganatam
3 Godavari
4 Kistna
5 Guntur
6 Kurnool
7 Bellary
8 Anantapur
9 Cuddapah
10 Nellore
11 Chingleput
12 Madras
13 North Arcot
14 South Arcot
15 Salem
16 Coimbatore
17 Nilgiris
18 Malabar & Anjengo
19 South Canara
20 Trichinopoly
21 Tanjore
22 Madura
23 Tinnevelly

NOTE.—

The Longitudes are referrible to the Greenwich Meridian taking that of Madras Observatory as 80-17-21 East. They require a correction of—2-27 to make them accord with the most recent value of the Geodetic Longitude of Madras Observatory, viz., 80-14-54.

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Vandyke, Survey Office, Madras.
1912

in the accompanying Map (Map No.2.) and it will be seen from this map that, with the exception of the hill area in the Northern Circars, the high lying portions of the Presidency form a ring round the Mysore Plateau and a strip along the Travancore border. The largest continuous area at over 1000 feet elevation in any of the District of the Presidency is the Deccan area in Bellary, Anantapur and Kurnool.

In considering the effect of the physical conformation of the country on the distribution of Plague it is to be remembered that while some of the elevations shown on the Map, high are lying flat ground, well populated and under cultivation, other elevations represent definite hills, many of them covered with forest and very sparsely inhabited, if at all.

Under the latter class come the greater part of the hill area in the Northern Circars, the Nallamalis Hills in the east of Kurnool District, the High Range between Travancore and Madura and Tinnevelly Districts, the greater part of the Western Ghats, the Sirumalai Hills in Madura District, and portion of the hills in the South-East of Salem District. While the high-lying Plateau areas represent the same conditions, so far as inhabitants, villages, communications etc., are concerned, as the lower-lying parts of the Presidency and the plains in other parts of India, and so far as these factors go, are equally suitable for the spread of Plague, the Hill and Jungle areas with their few inhabitants and poor communications make the existence or the spread of Plague almost impossible within their limits. These areas do not therefore require to be considered in regard to the distribution of Plague. The further details of the elevations of various parts of the Presidency will be considered when dealing with each District separately.

CLIMATIC CONDITIONS IN MADRAS PRESIDENCY

Extending as it does over 12 degrees of Latitude and presenting such varieties of physical configuration, Madras Presidency naturally presents considerable differences in the climates of the different parts. The low-lying plain area which forms the greater part of the Presidency is fairly hot all the year round. Its cold season is short, and never so marked as in the more Northerly parts of India. As the country slopes up to the Borders of Mysore the more elevated areas become cooler until the parts situated at an elevation of 3000 feet above sea level are reached. These parts have a delightful Cold Season and are never very hot. In the large Deccan Plateau area which is at an elevation of about 1500 feet, and which is more Northerly situated than the other elevated areas of the Presidency, the Cold Weather is well marked although the Hot Weather is fairly severe. In the Nilgris, the climate is more like that of the Temperate Zone; the Normal Mean Temperature in Wellington, for example, (6200 feet) varying from 56° F to 67° F during the year.

A general idea of the Climatic conditions in the different parts of the Presidency can be gathered from the series of charts which have been prepared from the readings taken at the following Meteorological Stations:-

	Station	District.	Elevation.
Coast Stations	Berhampur	Ganjam	67 feet.
	Waltair	Vizianagram	226 "
	Coconada	Godavari	26 "
	Masulipatam	Kistna	15 "
	Madras	Chingleput	31 "
	Cuddalore	South Arcot	37 "
	Negapatam	Tanjore	31 "
	Mangalore	South Canara	Sea level.
	Calicut	Malabar	do.
	Cochin	Cochin	do.
	Nellore	Nellore (12 miles inland)	

Inland Stations/

	Station	District	Elevation.
Inland Stations.	Bellary	Bellary	1475 feet
	Kurnool	Kurnool	926 "
	Cuddapah	Cuddapah	433 "
	Anantapur	Anantapur	
	Vellore	North Arcot	707 "
	Salem	Salem	940 "
	Coimbatore	Coimbatore.	1348 "
	Trichinopoly	Trichinopoly	255 "
	Madura	Madura	447 "
	Tinnevelly	Tinnevelly	168 "
	Guntur	Guntur	
	Bangalore	Mysore State	3021 "

Normals of temperature and Humidity are available for all these places with the exception of Anantapur, Vellore and Guntur, and these Normals are shown in Charts No. 1 to No. 21. in ten-day figures.° These are the Normals used by the Madras Observatory. For Vellore a monthly Mean for the 13 years from 1898 to 1910 has been made. The Anantapur and Guntur Observatories were started in the middle of 1910 so that only one complete year's figures are available.

It will be seen that a considerable number of observing stations are on the Coast Line. The readings at these Stations are not necessarily typical of the climates of the inland portions of the Districts in which they are situated, and the inland parts are probably about 3 degrees hotter and somewhat less humid.※ These Stations were established with the provision of storm warnings as one of their main objects.

Three main factors influence the Temperature in the different parts of the Madras Presidency. These are:-

(1) Distance North of the Equator.

(2) Elevation above Sea Level.

(3) Monsoon influences.

Taking these in order,

(1). Distance/

° Temperature Series. ※ See Chart No 24.

(1) Distance north of the Equator; the effect of this is seen in the series of charts of the Coast Line Stations on the East Coast where the factor of elevation does not come in. Starting with the most Southerly Station and taking them in order - Negapatam, Cuddalore, Madras, Nellore, Masulipatam, Coconada, Waltair, and Berhampur, it will be seen that the Cold Weather becomes more marked the further north one goes. Cuddalore is the only one which is somewhat out of the line. Nellore, in its intermediate position between Madras and Masulipatam would be expected to be perhaps a degree cooler than it is. Its being 12 miles inland probably accounts for this and also for the fact that its Hot Weather is more marked than that of either of these Stations above and below it.

The same effect of latitude is seen in low level inland stations (below 500 feet) in the case of Tinnevelly, Madura, Trichinopoly, Cuddapah and Guntur.

Nellore should perhaps also be included in this series.

(2) Elevation above Sea Level. We have a series of observing Stations representing elevations of:-

(a) About 1,000 feet or somewhat above or below this.

(b) Over 3,000 feet.

(c) Over 6,000 feet.

In the first class are:-

Salem 940 feet

Kurnool 924 "

Bellary 1475 "

Coimbatore 1348 "

Of these Coimbatore is peculiar on account of its situation and its Monsoon conditions, which will be dealt with later. For the greater part of the year the temperature is below 80°F. Of the others, Salem is the most Southerly and at much the same elevation as Kurnool, just under 1000 feet. It has a moderate Cold Weather. Kurnool, the most Northerly, and Bellary the most elevated, and also situated well North, have well marked Cold Seasons.

In/

In the second class, Bangalore in Mysore State, (elevation 3021 feet) may be taken as more or less representing the 3000 feet elevations in Madras Presidency - - Hosur and Kollegal Taluqs. (Compare the Denkanikota chart with the Bangalore Normal) The Mean Temperature at the 3000 feet level is below 80°F for the greater part of the year and falls below 70F for a short period. It is never above 85°.

In the third class, are Wellington and Ootacamund in the Nilgris. Wellington is at an elevation of 6200 feet and its normal Mean Temperature does not rise above 67 F. Ootacamund is still higher and is even cooler.

The comparative Cold Weathers in these low-level and High-Level Inland Stations are shown in the combined Chart No.28, in which the portions of the Normal Years' curve below the 80 degree line are given.

(3) Effect of Monsoon Conditions. The Main rain-bearing Monsoon of India is the South-West Monsoon which breaks on the southern parts of the West Coast in June and continues for four months. The rain-fall on the West Coast Districts of the Madras Presidency during these months is very high and their Annual Rainfall is over 100 inches. The greatest precipitation takes place on the inland portions of South Canara District on the Slopes of the Western Ghats and in the similar portion of the Wynaad in Malabar.

The Western Ghats cut off the greater part of this Monsoon from the Eastern and larger part of the Presidency. The Eastern portion of the Presidency receives the greater part of the North-East Monsoon which occurs in the Months of October, November, and December, and in the same way, the Western Ghats cut off this Monsoon to a large extent from the West Coast Districts.

A comparison of the average Rainfall for 25 years in Madras City and Calicut shows that Madras receives 16 inches in June, July, August and September, and 31 inches in October, November, and December, while Calicut receives 87" in the first period and 16" in the second of which 10" come in October and are probably not due to the North-East Monsoon which reaches its/

its height in November, and would be later in reaching Calicut than Madras.

These Monsoons have a marked effect on the Temperatures of the portions of the Presidency on each side of the Western Ghats. On the West Coast, the Southerly-lying Districts of Malabar and South Canara receive the South-West Monsoon early and the Hot Season is cut short before the Temperature reaches any great height. The Mean Temperature only rises above 80° F. during the months of April, May, and the beginning of June, and does not reach much higher than 85° F. It falls rapidly just below 80° with the onset of the Monsoon which keeps the Temperature down to this level, till the cold weather is due. The absence of the cooling wind, and the slight rainfall, in what should be the North-East Monsoon season during the so-called Cold-Weather months results in the Temperature not falling much at this time and as a result there is no definite "Cold Weather". The Temperature thus maintains a steady level for 9 months in the year and is very equable.

On the other hand, on the east of the Ghats, the slightness of this Monsoon and its later arrival permit the Hot Weather to become well established and the Temperature to rise much higher, and the North-East Monsoon coming in the proper Cold Weather Months still further adds its influence in reducing the Temperature at that period, with the result that these two Seasons are more marked on the East Coast than on the West Coast. The Eastern Districts thus have a well marked Hot Weather and a moderate Cold Weather while the Western Districts have an equable all-the-year-round Temperature with a slight rise before the South-West Monsoon.

The Western Ghats as before mentioned are interrupted at one point for 16 miles at the Palghat Gap. Coimbatore is situated opposite this Gap and receives the cool South-West Monsoon wind although not much rain actually falls. It is thus kept cool from June onwards, and when the North-East Monsoon arrives in the Cold-Weather Months it receives a fair share of the rainfall and has thus a good Cold Weather. Its

elevation (1348 feet) also assists in keeping it cool, and Coimbatore has one of the most pleasant climates in the Presidency.

For comparison with the Normal Charts of Temperature and Humidity of different parts of Madras Presidency, a similar series of Charts of other parts of India have been prepared for Belgaum and Poona in Bombay Presidency, Lucknow in the United Provinces, and Lahore and Rawalpindi in the Punjab.* It will be seen that the only places in the Madras Presidency in which the Cold Weather approaches that of these more Northerly parts of India are, Berhampur, in the extreme North of the Presidency where the Cold Weather Curve approaches the United Provinces and the Punjab type in lowness of Temperature, and Bangalore and Denkanikota as representing the 3000 feet elevation, where the length and coolness of the portion of the Curve below 80 F. resembles the Belgaum type. Next to these comes Bellary and Kurnool for the depth of the Cold Weather Curve and Coimbatore for length.

* Nos. 22 to 26.

DISTRIBUTION OF PLAGUE IN MADRAS PRESIDENCY:

Plague first entered Madras Presidency in the latter half of 1898,--- Mysore State being also first infected in August of that year. From its outbreak up to the end of the 1910, Plague has been responsible for the comparatively small total of about 72,000 deaths, imported and indigenous, in the 13 years -- an extremely small amount compared with other parts of India. The Mortality from Plague in the Presidency in no way compares with that from other epidemic diseases such as Cholera and Smallpox.

The following is the order in which the Districts of the Presidency were infected for the first time, and the Total deaths in each District for the years when Plague was indigenous.

District	First Infected	Total Plague Deaths in Years of Indigenous Plague.
Bellary	1898	31510
Salem	do	13312
North Arcot	do	3550
Anantapur	do	3507
Kurnool	do	1042
Coimbatore	1899	12006
South Canara	1902	3010
Nilgiris	1903	1403
Cuddapah	1904	283
Madura	do.	847
Madras City	1905	78
South Arcot	1906	37
Malabar	do	1026
Trichinopoly	1910	25

It will be seen that the Districts which were infected in the earliest years of Plague in the Presidency have returned the great majority of the deaths. Thus the Districts infected in

1898/

1898 and 1899 return 64897 deaths or 90.6% of the total, and if the Districts infected before 1904 be taken, these will show a plague mortality of 69340, in indigenous years or 96.7% of the total.

The Districts which were infected after 1903, Cuddapah, Madura, Madras City, South Arcot, Malabar, and Trichinopoly return a total of only 2296 deaths in indigenous years, so that beyond the limits of the Districts infected in the earlier years Plague has made extremely little progress.

Table No. 5 Shows the annual Plague deaths in each infected District. The years of indigenous Plague are underlined. The figures in other years represent imported cases. The imported and indigenous cases are included in all years, but as the majority of the cases returned as "imported" come from one place to another within the limits of the District, and as it is not easy to separate the two classes of figures in a satisfactory manner, the figures for years of indigenous plague are taken as they are and represent satisfactorily the degree of prevalence of the disease.

From these figures the annual Plague death rate per mille has been calculated on the Populations of the Districts according to the 1901 Census, and these figures have been used to construct a series of Maps to show the distribution and severity of Plague in each year. Maps No. 2 to No. 14 show the annual Plague Death rate per Mille, and Map No. 1 shows the average prevalence of the 13 years.

These Maps and figures show that Plague is confined to certain Districts which are infected with some regularity from year to year, and that there is no tendency for a regular outward spread from these Districts to the surrounding parts of the Presidency, such extensions as have taken place beyond the limits of the Districts infected in the early years having been very slight and irregular and the total Plague mortality in other Districts having been so slight as to be almost negligible.

An analysis of the figures of Plague in the affected Districts in more detail in regard to its distribution in Towns and Rural areas and in certain Taluqs, will give a better idea of the way in which it affects these

districts, and is necessary to elucidate some of the problems affecting its spread. The figures of Plague deaths in Towns, and Rural areas separately, are available for the years from 1901 to 1910 and these 10 years will be dealt with.

From these figures Tables No. ? have been constructed. Table No. 7. shows that 28477 deaths have occurred in Town circles and 39972 in Rural areas. The proportions are--

Plague deaths in Rural areas.....63.8%
.. .. .. Towns over 10000 pop.....30.9%
.. .. .. 5000 to 10000 " 5.3%

Of the Deaths in Rural Areas 83.8% have occurred in Bellary, Salem, and Coimbatore Districts.

Table No. 3. shows the average annual plague death rate per mille in the Towns and Rural areas of the Districts, and it will be seen that the only District which returns a high Rural death rate is Bellary.

The Plague Death rate per mille in Bellary District is -

Rural Areas.....2.52
Town Circles.....6.59
In Rural areas of Hosur Taluq.....3417 or 9.1%
In Rural Areas of Kellegal Taluq.....2785 or 7.5%
In other Rural Areas.....13911 or 37.3%

The Average Annual Plague death rate per mille and in Bellary District is-------

In the 8 Large Towns.....4.82
In other towns over 10000 pop..... .34
In towns of 5000 to 10000 pop..... .68
In rural areas of Hesur Taluq.....1.91
In rural areas of Kellegal Taluq.....3.36
In other rural areas..... .1
In town circles of Bellary District.....6.59
In rural areas of Bellary District.....2.52

This gives a good idea of the manner in which the Districts are affected. The main facts are:-

(1)/

(1) The Rural areas of Kellegal Taluq, Bellary District, and Hosur Taluq are the only parts of the Presidency in which Rural Plague has reached any degree of severity.

(2) In the rest of the rural areas of the affected Districts Plague has been exceedingly slight.

(3) In Bellary District the towns have suffered severely.

(4) In the other Districts, Town Plague has reached a fairly high level in a few large towns only; 8 of them accounting for most of the town Plague. The other towns of these Districts have been very slightly affected; an annual average of 395 being scattered over 40 or 50 towns.

Next in order of severity of Rural death rate, but much lower, is the cold high lying Nilgiri District. Coimbatore and Salem Districts follow next after the Nilgiri District and as will be shewn later, their Rural mortality is to a considerable extent due to the high-lying Taluqs of Kellegal and Hosur which are situated at an elevation of 3000 feet above Sea Level.

The Rural Death Rate in Anantapur is still lower, and in the remaining Districts is extremely low.

Excluding Bellary District, the other Districts Which have been affected return Plague deaths as follows:-

Plague Deaths in Rural areas.....20113
" " " Towns over 10000 pop.....15950
" " " Towns of 5000 to 10000 pop. 1237

of the 17187 deaths in town circles 13237 occurred in the following 8 towns.....

Coimbatore District	....	Coimbatore and Kollegal	3483
Salem	.. ....	Salem, Vaniambadi, Tirrupattur	...5943
North Arcot	.. ....	Vellere and Ambur	1200
South Canara	.. ....	Mangalore	 2611
			13237

of/

Of the deaths in Rural areas, Hosur Taluq in Salem District returned 3417 and Kellegal Taluq in Coimbatore District returned 2785.

The distribution of Plague in the Districts other than Bellary is thus:-

In 8 large towns(mentioned above) .....13237 or 35.5%

In other towns over 10000 pop..... 2713 or 7.3%

In other towns of 5000 to 10000 pop..... 1237 or 3.3%

Thus outside the Bellary District and the endemic areas of Kellegal and Hosur, Plague only reaches epidemic proportions which deserve consideration in a few big towns, 8 of these towns returning nearly as many deaths in a few epidemics as the whole of the rest of the infected Districts with an area of over 60,000 square miles. Apart from the 3 areas, Bellary District, Hosur, and Kellegal, if it were not for the occurrence of occasional severe outbreaks in a few large towns, Plague in the Presidency would be of much less importance than simple Diseases such as Diarrhoea and Bronchitis.

Table No 2.

Average Annual Death Rate per Mille for the Affected Districts for the 13 Years from 1898 to 1910.

Districts.	Total Deaths in Indigenous years.	Population.	Average Annual death rate per Mille.
Anantapur	3507	788,254	.34
Bellary	31510	947,214	2.56
Coimbatore	12006	2,201,752	.42
Cuddapah	283	1.291,267	.02
Kurnool	1042	872,055	.09
Madras City	78	509,346	.01
Madura	847	2,831,280	.02
Malabar	1026	2,790,281	.03
Nilgiris	1403	111,437	.97
North Arcot	3550	2,207,712	.12
Salem	13312	2,204,974	.46
South Canara	3010	1,130,105	.20

Table No. 3.

Average Annual Death Rate per Mille
For Town Circles and for Rural Areas of the Infected Districts
of Madras Presidency for the Years 1901 to 1910.

District.	Town Circles.	Rural Areas.
Anantapur.	.61 per mille	.27 Per Mille.
Bellary	6.59 " "	2.52 "
Coimbatore	2.42 " "	.44 "
Cuddapah.	.03 " "	.02 "
Kurnool.	.02 " "	.10 "
Madura.	.10 " "	.03 "
Malabar	.41 " "	.005 "
Nilgiri	2.89 " "	.71 "
North Arcot.	.79 " "	.07 "
Salem	3.77 " "	.32 "
South Canara	5.01 " "	.02 "

Table No. 4.

Distribution of Plague within affected Districts.

District.	Areas.	Totals.	Percentage.	Average Annual Plague Death Rate per Mille.
Bellary.	Towns over 10000	9632	30.9%	7.32
	Towns of 5000 to 10000	1658	5.2%	4.18
	Rural Areas	19858	63.9%	2.52
Anantapur.	Towns over 10000	266	9%	.36
	Towns of 5000 to 10000	423	14.3%	.84
	Rural Areas.	2264	76.7%	.27
Kurnool.	Towns over 10000	9	.9%	.02
	Towns of 5000 to 10000	1	.1%	.01
	Rural Areas.	891	99 %	.10
Cuddapah	Towns over 10000	33	10.9%	.03
	Towns of 5000 to 10000	10	3.2%	.08
	Rural Areas	264	85.9%	.02
North Arcot.	Towns over 10000	1347	45.9%	.95
	" of 5000 to 10000	14	.4%	.04
	Rural Areas.	1573	53.7%	.07
Salem.	Towns over 10000	6168	51.2%	4.26
	Towns of 5000 to 10000	369	3.1%	1.13
	Rural Area Hosur	3417	28.3%	1.91
	Other Rural Areas	2109	17.5%	.11
Coimbatore.	Towns over 10000	3718	31%	2.72
	" of 5000 to 10000	163	1.4%	.69
	Rural Area Kollegal	2785	23.3%	3.36
	Other Rural Areas	5303	44.3%	.27

Madura)

Distribution of Plague within Affected Districts. (Contd.)

District	Areas	Totals	Percentage	Average Annual Plague Death Rate per Mille.
Madura	Towns over 10000	357	41.8%	.10
	Towns of 5000 to 10000	-	-	-
	Rural Areas	496	58.2%	.03
Malabar	Towns over 10000	912	87.1%	.41
	Towns of 5000 to 10000	-	-	-
	Rural Areas.	135	12.9%	.005
South Canara	Towns over 10000	2611	89.7%	5.92
	Towns of 5000 to 10000	2	-	.02
	Rural Areas.	299	10.3%	.02
Nilgiri	Towns over 10000	529	38.8%	2.86
	Towns of 5000 to 10000	255	18.7%	3.00
	Rural Areas.	577	42.5%	.71

Table No 5.

Yearly Plague Deaths in each District.

	1898	1899	1900	1901	1902	1903	1904	1905	1906	1907	1908	1909	1910	Totals	Totals of Years when Plague was indigenous
Anantapur	205	362	2	9	89	677	1585	381	3	34	174	-	1	3522	3507
Bellary	125	173	64	1009	7354	5896	10751	3490	325	1583	587	18	135	31510	31510
Coimbatore.	1	37	-	44	496	1184	4309	333	30	10	1183	2973	1407	12007	12006
Cuddapah	2	-	-	1	3	2	272	11	5	6	4	3	-	309	283
Kurnool	8	140	-	3	55	491	270	78	3	1	-	-	-	1049	1042
Madras City	-	-	-	1	3	4	8	22	56	3	2	3	5	115	78
Madura	-	-	-	1	-	5	16	3	-	1	-	-	831	857	847
Malabar	-	-	-	2	3	5	8	3	92	78	595	202	59	1047	1026
Nilgiris	-	1	-	-	1	601	81	200	45	49	143	210	31	1405	1403
North Arcot	54	562	15	399	114	887	1116	255	24	47	38	20	34	3565	3550
Salem	109	569	573	1553	1668	3132	1313	48	99	923	412	302	2178	13312	13312
South Canara	1	-	1	1	993	365	382	525	153	126	216	98	152	3013	3010

Table No 6.

Annual Death Rate From Plague per 10000 in Affected Districts from 1898 to 1910.

	1898	1899	1900	1901	1902	1903	1904	1905	1906	1907	1908	1909	1910.
Anantapur.	2.6	4.5	-	-	1.1	8.5	20.1	4.8	-	.4	2.2	-	-
Bellary	1.3	1.8	.6	10.5	77.5	62.2	113.5	36.8	3.4	16.7	6.1	.1	1.4
Coimbatore.	-	.1	-	.2	2.2	5.3	19.5	1.5	.1	-	5.3	13.5	6.3
Cuddapah	-	-	-	-	-	-	2.1	.1	-	.x.	-	-	-
Kurnool	.x.	1.6	-	-	.6	5.6	3.0	.9	-	-	-	-	-
Madras City	-	-	-	-	-	-	-	.4	1.1	-	-	-	-
Malabar	-	-	-	-	-	-	-	-	.3	.2	2.1	.7	.2
Madura	-	-	-	-	-		.x.	-	-	-	-	-	2.9
Nilgiris	-	-	-	-	-	53.9	7.2	17.9	4.0	4.4	12.8	18.8	2.7
North Arcot.	.2	2.5	-	1.8	.5	4.0	5.0	1.1	.1	.2	.1	.x.	.1
Salem	.4	2.5	2.6	7.0	7.5	14.1	5.9	2.1	.4	4.1	1.8	1.3	9.8
South Canara	-	-	-	-	8.7	3.2	3.5	4.6	1.3	1.1	1.9	.8	1.2.

.x. Plague affected but less than 1 death per 100000.

Table No.7

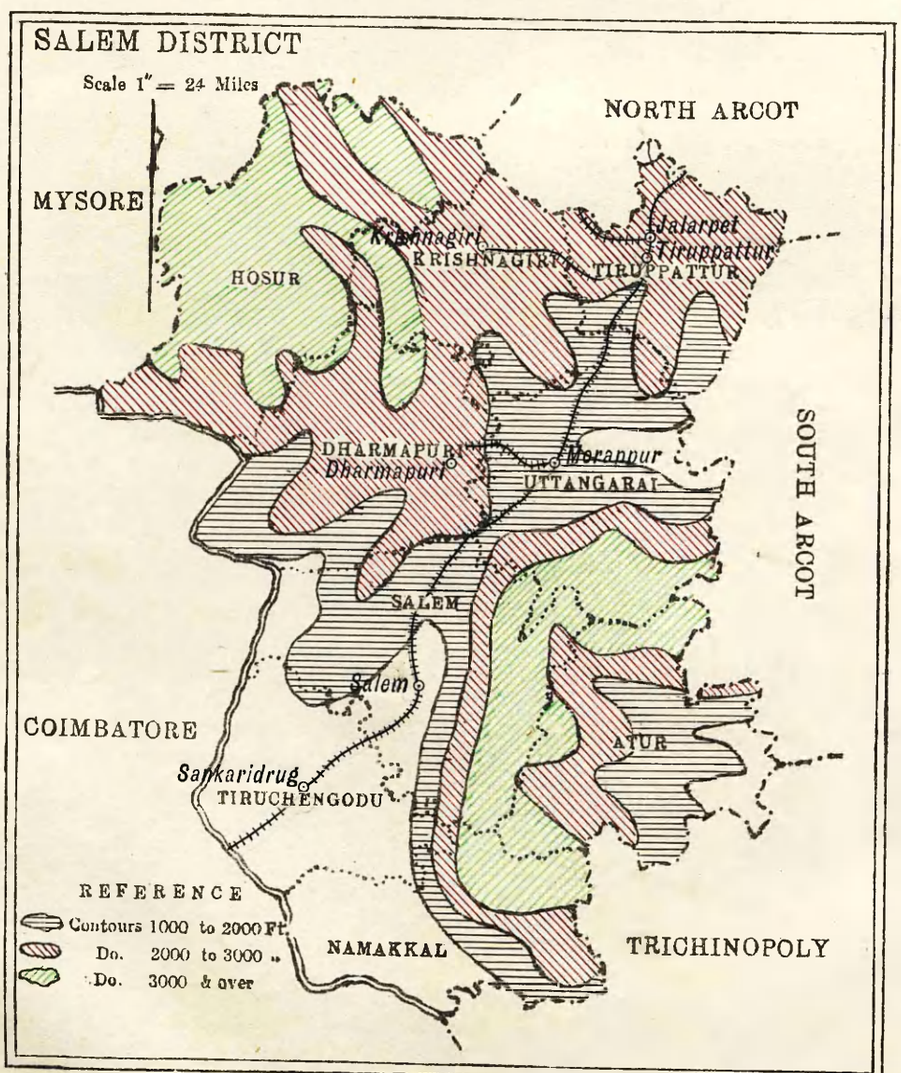
Plague Deaths in Towns and Rural Areas in Infected Districts from 1901 to 1910.

District	Population of Town circles	Population of Rural Areas.	Plague deaths in town circles	Plague Deaths in towns over 10000	Plague deaths in Rural Areas.
Anantapur	111500	810332	689	266	2264
Bellary	171205	785872	11290	9632	19859
Coimbatore	160254	1835933	3881	3718	8088
Cuddapah	118830	1037276	43	33	264
Kurnool	46515	824933	10	19	891
Malabar	218007	2567300	912	912	135
Madura	339015	1493134	357	357	406
Nilgiris	27121	80552	784	529	577
North Arcot	171499	2035618	1361	1347	1573
Salem	177269	1719712	6537	6168	5526
South Canara	52149	1092240	2613	2611	299
Totals	1593373	14272902	28477	25582	39972

RELATION OF THE DISTRIBUTION OF PLAGUE TO ELEVATION.

A comparison of the Maps illustrating the Distribution of Plague with the Contour Map of the Presidency (Map No. 2) will demonstrate the fact that Plague has almost entirely been confined to the Districts in which there are elevations of over 1000 feet above the Sea Level. It will be now further shown by a detailed examination of the figures for each District and a comparison of these figures with larger scale Contour Maps of the separate Districts, that except on the West Coast the parts of the infected Districts lying below 1000 feet have also had very little Plague. The 1000 feet level is necessarily an arbitrary standard but will indicate the existence of a factor which will have effect on influencing climatic conditions although local conditions will also modify this effect. Examples of such local modifying factors are the existence of the Palghat Gap, the wind through which keeps Dharapuram Taluq (below 1000 feet) somewhat cooler, and the shut-in airless valley in Cuddapah which keeps that part hotter, than would otherwise be expected. Of course slight variations under or over the 1000 feet level will have little effect on the Temperature.
The Districts to be specially considered are:-

Bellary, Anantapur, Cuddapah. Kurnool.
North Arcot, Salem, Coimbatore, Madura.



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S a l em D i s t r i c t.

This is one of the Central Districts of the Presidency. The North-West Corner of the District borders on Mysore State, Hosur Taluq forming part of the Mysore Plateau and lying at a general level of about 3000 feet above Sea-level.

The two-southern Taluqs lie below the 1000 feet level and slope down to the Cauvery Valley. The Uttangarai Taluq slopes down to the lower level of the East Coast Districts. The high area in the South-West of the District is formed by the Sheveroy Hills, the Kalryan Malai, and the Koolimalli Hills. This area is comparatively uncultivated, sparsely populated, and with poor communications. (See elevation map of Salem District). Communications between Hosur Taluq and the rest of the District are indifferent, the usual method of reaching Hosur Town, for example, from Salem being to go round by rail via Jalarpet to Malur or Bangalore in Mysore State and then drive 20 miles. The Contour Map shows the Railway as running at an elevation of over 2000 feet through Tirupattur Taluq. This is an error in contouring, as Jalarpet and Vaniambadi, 14 miles north of it, lie at an elevation of about 1300 feet.

Taluq distribution of Plague.

Table No. 9 shows the Annual Plague Deaths in each Taluq and in three large Municipalities for the years 1902 to 1911, and Table No. 8 shows death rate per mille in these areas. The same facts are shown in graphic form in Chart No. A .

It will be seen that the three low-lying Taluqs of Namakkal, Tiruchengodu and Uttangarai have had extremely little Plague, and that the high-lying Taluq of Hosur has suffered severely. Table No. 10 which shows the Monthly Plague Deaths in Hosur Taluq will indicate that this Taluq in spite of its small area and population (184971) is practically an indigenous centre of Plague.

Tirupattur Taluq would appear at first sight to have suffered almost as much as Hosur Taluq, but it will be seen from Table No. 8 that/

that the Plague in this Taluq has been almost entirely in the Municipalities of Vaniambadi and Tirupattur, the Plague incidence in the rest of the Taluq only averaging 75 deaths per annum.

The Plague in the rest of the Taluqs of the District has been very slight.

The main facts of the distributions of Plague in Salem District thus are:-

(1) The high-lying Hosur Taluq has suffered most severely and is practically an indigenous centre.

(2) The three lowest-lying Taluqs -- Namakkal, Tiruchengodu, and Uttangarai -- have almost entirely escaped Plague.

(3) The three Municipalities of Salem, Vaniambadi and Tirupattur account for a considerable proportion of the Plague in the rest of the District.

(4) The Taluqs, other than Hosur, have suffered very slightly except for the mortality in the three Municipalities.

Relative Plague Prevalence in Talugs of Salem District. Diagrammatic.

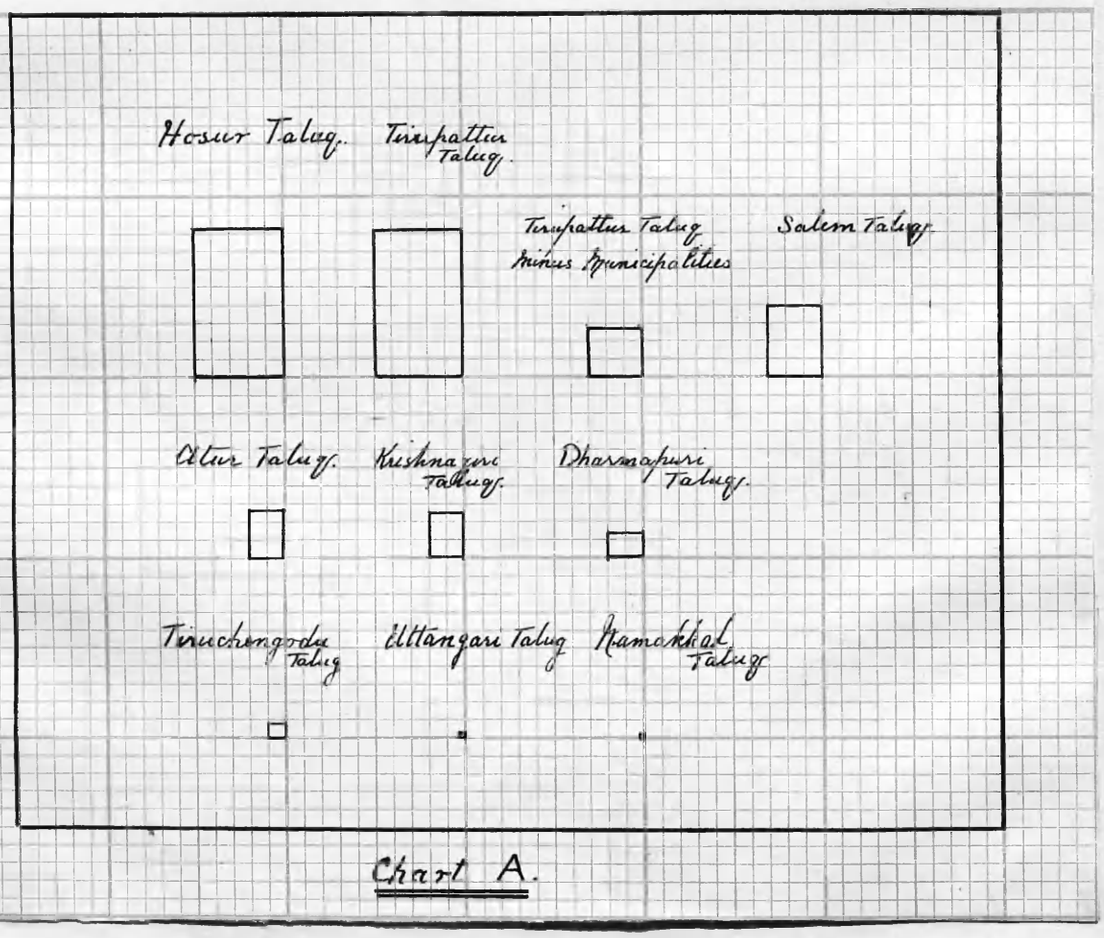


Chart A.

Table No. 8.

Taluq distribution of Plague

in

Salem District.

Taluq	Plague Deaths 1902 to 1911	Population 1901 Census	Average Annual Plague. Deaths per Mille.
Atur.....	549	199475	.275
Dharmapuri..	297	206030	.144
Hosur.....	4003	184971	2.164
Krishnagiri.	444	175300	.253
Salem.....	2920	470181	.621
Tiruchengodu..	115	289717	.039
Uttangarai....	10	159419	.006
Namakkal.....	14	313895	.004
Tirupattur....	4508	205986	2.140

	Deaths	Population.	Average.
Tirupattur Taluq. Minus Vaniambadi and Tirupattur Municipalities.	750	175292	.428
Salem Taluq Minus Salem Municipality.	1335	399560	.446

Table No. 9.

Plague Deaths in Taluqs of
Salem District.

Taluq.	1902	1903	1904	1905	1906	1907	1908	1909	1910	1911.
Atur.....	-	-	-	-	-	-	-	-	151	385
Dharmapuri..	8	5	--	-	-	-	-	2	2	280
Hosur.....	578	378	660	140	92	906	313	185	40	711
Krishnagiri...	18	199	60	3	1	-	25	105	2	31
Omalur)			-	-	-	-	-	-	162	181
)										
Salem)	1	2	2	1	-	1	64	-	353	568
Tiruchengodu..		-	30	-	-	-	-	2	31	52
Uttangari....	-	4	-	1	1	-	-	1	2	1
Tirupattur....	90	514	94	16	-	6	9	-	21	
Namakkal.....	-	-	3	-	-	-	-	-	11	-
Municipalities.										
Salem..... ...	-	2	2	-	-	-	-	1	1397	183
Vaniambadi.....	961	1365	10	2	-	-	1	1	1	-
Tirupattur.....	12	617	443	326	5	3	-	1	10	-

Table No. 10.

Deaths from Plague in Hosur Taluq.

Month.	1900	1901	1902	1903	1904	1905	1906	1907	1908	1909	1910	1911	Totals.
January.	12	18	135	141	23	60	1	26	84	50	6	13	569
February	-	20	59	139	14	57	-	26	69	32	4	16	436
March.	3	23	36	36	5	9	-	18	53	12	-	39	234
April	1	11	14	6	6	10	4	35	5	3	3	24	122
May	-	10	-	-	17	-	5	12	10	1	-	24	79
June	-	17	6	-	27	1	-	32	5	-	-	44	132
July	-	14	25	6	48	1	-	64	21	10	1	75	265
August	23	33	19	16	95	1	1	124	16	21	5	109	463
September	9	24	39	24	127	1	7	200	15	28	1	116	591
October.	2	33	27	18	144	-	51	127	15	20	10	100	527
November	12	59	42	18	92	-	8	131	42	7	3	75	489
December	13	174	176	15	56	1	35	111	37	1	7	63	689
	55	436	578	419	564	141	62	906	372	185	40	698	

Table No 11.

	Total Deaths in Salem Dist, Minus Hosur Taluq.	Total Deaths in Hosur. Taluq.
1900	454	75
1901	1022	436
1902	1276	578
1903	2612	419
1904	769	654
1905	407	141
1906	29	92
1907	Figures not reliable.	
1908	38	372
1909	111	185
1910	2274	40

Explanatory Note.

Hosur Taluq contains no large Municipalities, and the Plague in this Taluq is village-plague spread over the greater part of the year.

In the rest of the Salem District, the high figures in 1901 to 1904 are due to the Epidemics in the Municipalities of Vaniambadi and Tirupattur, and in 1910 and 1911 to the Epidemic in the Salem Municipality.

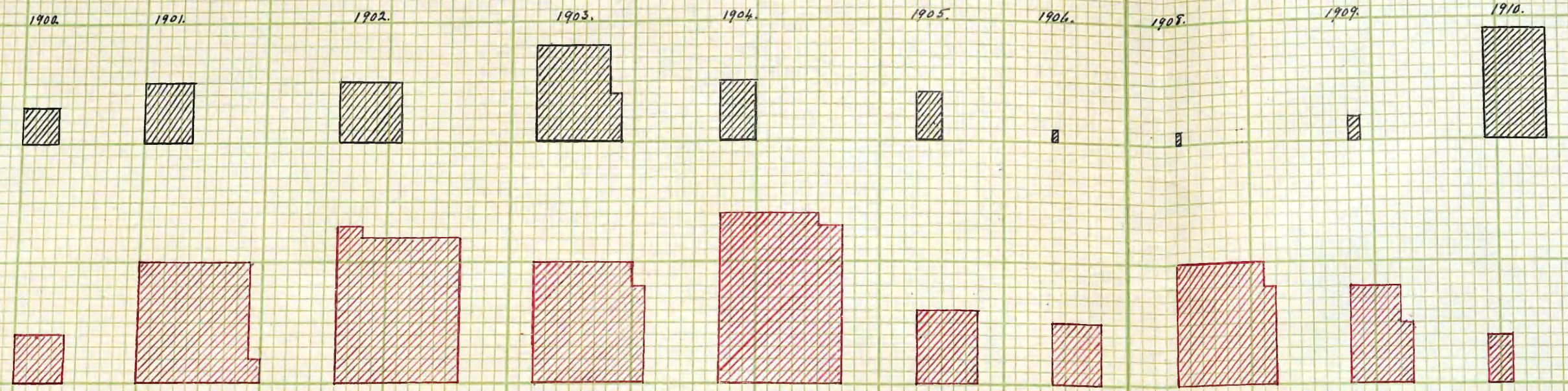
Table No. 12.

Annual Death Rate per 10000 in Salem District
Minus Hosur Taluq and in Hosur Taluq
separately.

Year	Deaths per 10000 of Population. Salem Minus Hosur.	Hosur Taluq.
1900	2.25	4
1901	5.08	23
1902	6.3	30.4
1903	13	22
1904	3.8	34.4
1905	2	7.4
1906	0.14	5
1908	0.18	19.6
1909	0.55	9.7
1910	11.3	2
	Average of 10 years	13.75

Average for Salem District minus Hosur Taluq, and the Municipalities of Tirupattur, Salem and Vaniambadi.------1.20

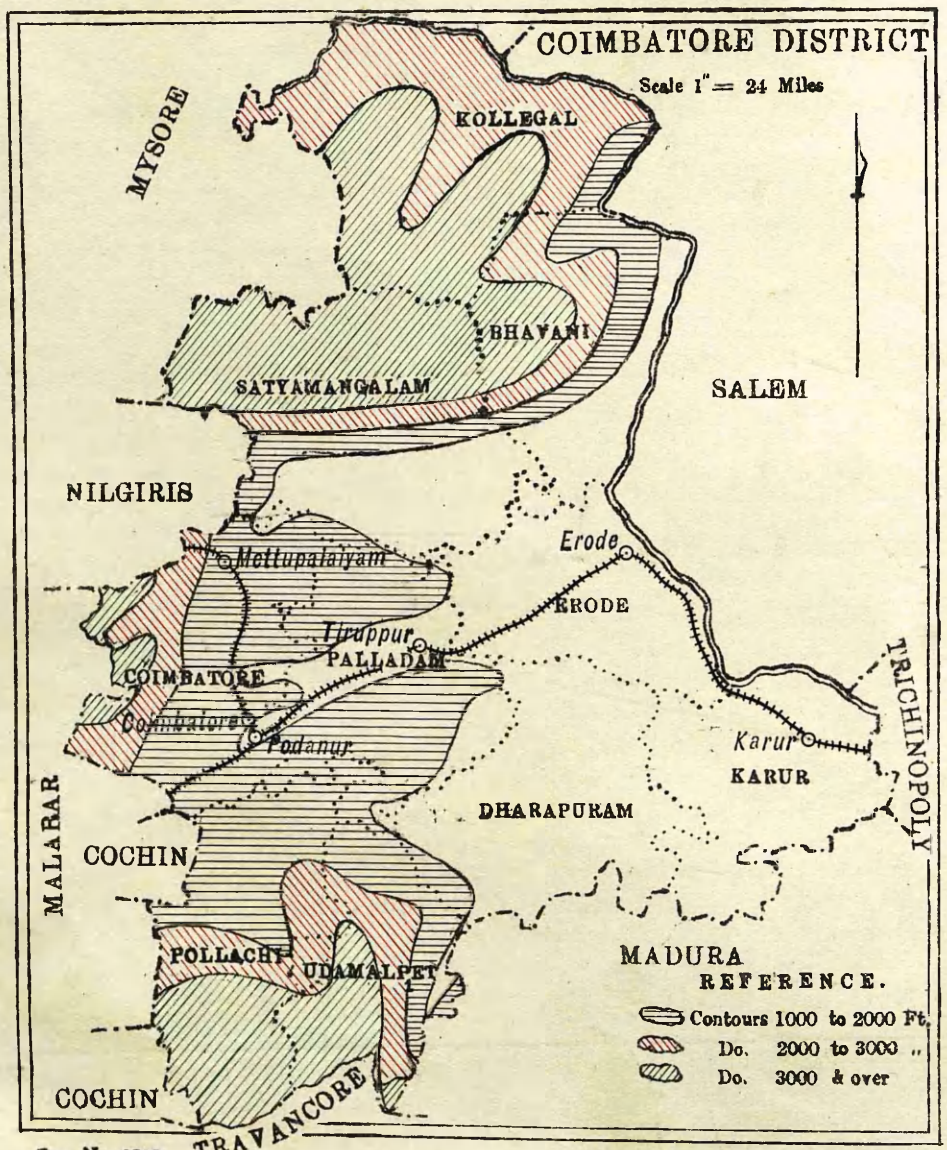
(1907 has been omitted as the figures were unreliable.



Each small square represents .25 deaths per 10,000.

Chart showing the Plague Death rate per 10,000 for Salem District minus Hosur Taluq and for Hosur Taluq separately.

1907 has been omitted as the figures are unreliable.



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--Coimbatore District--

In the North of the District, the Biligiri-rangan and the Bargur Hills run across the upper portions of the Satyamangalam and Bhavani Taluqs and extend into Kollegal Taluq. The Hill Portions of Satyamangalam and Bhavani and the greater part of Kollegal Taluq are covered with forest and are little inhabited, and have no proper roads. The portion of Kollegal Taluq adjoining Mysore State is a cultivated Plateau area. The total population of this large Taluq is only 96563 and the density is only 90 per square mile. This is due to the large area of the Taluq which is dense Jungle. The inhabited parts of Kollegal have no direct communications with the rest of the District. In the West of the District, there is an area lying over 1000 feet which lies opposite the Palghat Gap. This area includes the Taluqs of Coimbatore and Pollachi, and these Taluqs receive the cool winds from the West Coast through the Gap and are kept cool by them for a considerable part of the year. Dharapuram also receives some benefit in the same way, but it is less marked here as the Gap widens out. In the Southern portion of Pollachi and Udamalpet the high Contour shown represents the Jungle-covered Anamalai Hills.

Kollegal Taluq has suffered most severely from Plague. The total number of deaths would be high even for a populous Taluq, and the incidence per mille is very high. Coimbatore Taluq has suffered next most severely. Udamalpet, Palladam, and Pollachi, the other high lying taluqs, have suffered less, but a considerable portion of the highest parts of Pollachi and Udamalpet are Jungle areas. Dharapuram is the only low-lying taluq which has suffered, but on account of its situation, the climate of this taluq is at least as cool as that of places at 1000 feet elevation in other parts of the Presidency. The low-lying Taluqs of Erode and Karur and the Taluqs of Bhavani and Satyamangalam, of which the populated parts are low-lying, have had very little Plague.

Table No 13.

Taluq distribution of Plague.

in

Coimbatore District.

Taluq	Plague Deaths 1904 to 1911.	Population 1901 Census	Average Annual Plague Death per Mille.
mbatore	5337	330684	2.017
legal	4375	96563	5.667
de	238	275460	.108
vani	40	145982	.034
ladam	1097	300904	.455
rapuram	1231	271127	.566
ur	13	220843	.007
yamangalam	91	214101	.053
lachi	483	195608	.308
malpet	635	150480	.527

Table No 14.

Plague Deaths in Taluqs of

Coimbatore District.

Taluq	1902	1903	1904	1905	1906	1907	1908	1909	1910	1911
Coimbatore	-	-	1122	156	13	-	6	1071	310	577
Bhavani	-		14	8	-	-	3	1	1	13
Dharapuram	-		71	-	-	-	16	1	34	1
Kollegal	-		2060	97	16	1	1151	657	234	159
Palladam	-		841	20	-	-	1	84	56	95
Satyamangalam	-		24	3	-	6	10	31	16	1
Karur	-		1	-	-	-	-	8	1	-
Avanashi	-		-	-	-	-	-	-	-	25
Pollachi	-		62	25	-	-	-	5	305	14
Udumalpet	-		148	9	-	2	9	-	304	163
Erode	-		27	2	-	1	1	8	1	4
M.T.Coimbatore	-		203	5	1	-	-	1051	55	767
M. T. Erode	-		76	8	8	-	-	85	11	6
M. T. Karur	-		-	-	-	-	-	3	-	-
Zem.Pollachi	-		6	-	-	-	-	-	57	9
Zem. Udumalpet.	-		-	-	-	-	-	-	1	1

Table No 15.

Population of Coimbatore District.....2201752

.. .. Taluq..... 330684

.. .. Municipaility 53080

.. Kollegal Taluq..... 96563

.. Coimbatore District minus Kollegal Taluq.....2105189

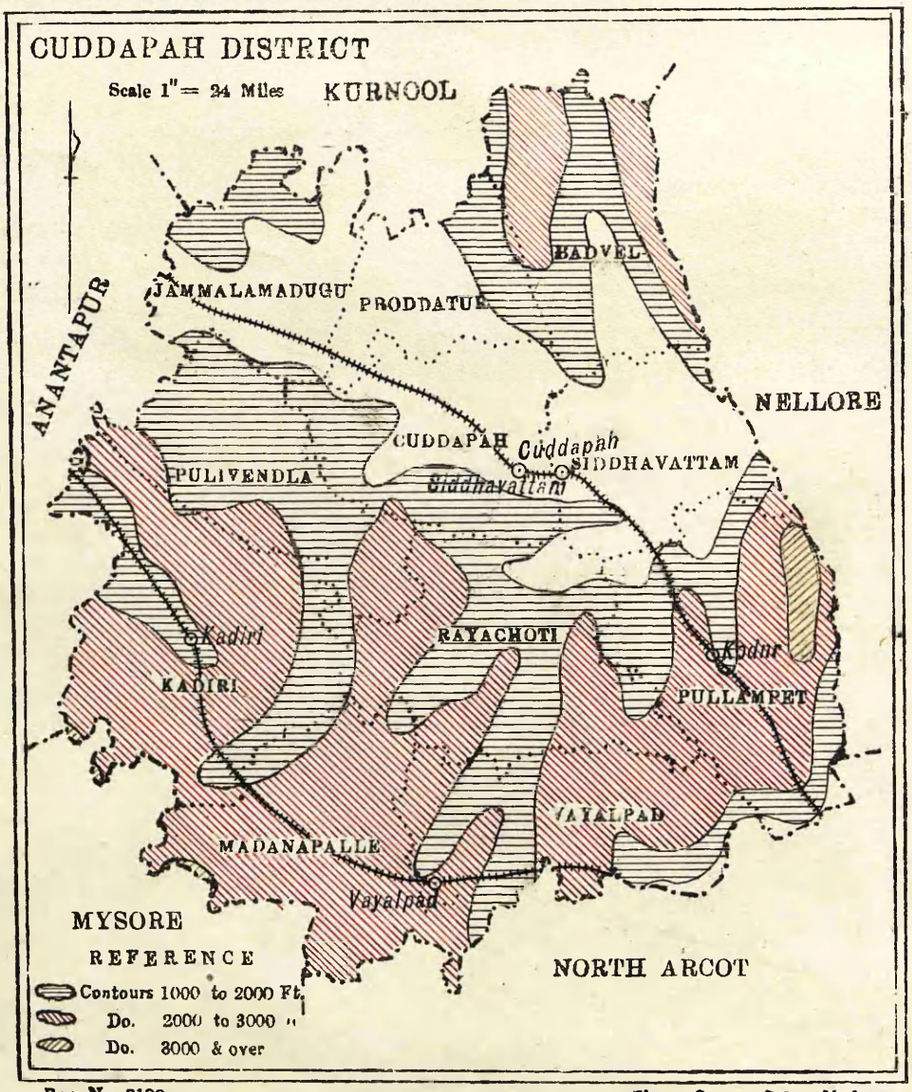
.. Coimbatore Taluq minus Coimbatore Municipality,, 257604

Annual Plague Deaths.

	1904	1905	1906	1907	1908	1909	1910	1911	Totals.
Coimbatore Town	203	5	1	-	-	1051	55	767	2082
Coimbatore Taluq minus Coimbatore Town	1122	156	13	-	6	1071	310	577	3255
Kollegal Taluq...	2060	97	16	1	1151	657	234	159	4375
Coimbatore District minus Kollegal Taluq.	2595	236	14	9	46	2348	1152	1676	8176

Annual Plague Deaths per Mille.

	1904	1905	1906	1907	1908	1909	1910	1911	Average.
Coimbatore Town	3.83	.09	.01	-	-	19.83	1.03	14.09	4.86
Coimbatore Taluq minus Coimbatore Town.	4.35	.60	.05	-	.02	4.15	1.20	2.24	1.57
Kollegal Taluq.	21.34	1.00	.16	-	11.92	6.80	2.42	16.47	7.51
Coimbatore District minus Kollegal Taluq.	1.23	.11	.006	.004	.02	1.11	.54	.79	.47



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Cuddapah District.

Although this District is usually classed as belonging to the Deccan area it does not form any part of the Deccan Plateau. The Northern Half of the District, including the Taluqs of Siddhavattam, Cuddapah, Prodattur, and Jamalmadugu, forms the low-lying Cuddapah Valley, which is one of the hottest parts of the Presidency. The Southern half of the District slopes up to the Mysore Plateau, Madanapalle being the highest lying Taluq. In the north of the District the Nallamalai Hills run down into Badvel Taluq.

The main line of Rail from Bombay to Madras, and from Bellary to Madras runs through the Cuddapah Valley and this area has also good road communications. Cuddapah Town lies within 5 to 7 hours by rail from Gooty, Guntakal Adoni, and Bellary which all have been Plague-infected.

A Metre Gauge branch line runs across the South of the Cuddapah District from Dharmavaram in Anantapur District to Pakala in North Arcot.

Plague has been very slight in the District. The high-lying Madanapalle Taluq has suffered most and the adjoining Taluqs of Voyalpad and Kadiri next in order. There has been no Epidemic Plague in the Cuddapah Valley.

Table No 16.

Taluq distribution of Plague

in

Cuddapah District

Taluq.	Plague Deaths 1902 to 1911.	Population 1901 Census	Average Annual Plague Deaths per Mille.
Badvel.....	3	89361	.004
Cuddapah....	14	155541	.011
Jammalamadugu	0	103707	-
Prodattur	3	102570	.003
Pulivendla..	2	103396	.002
Royachoti...	6	113947	.006
Pullampet...	3	143521	.002
Siddhavattam.	3	68087	.005
Madnapalle...	211	136997	.154
Voyalpad....	28	128692	.021
Kadiri.....	29	145503	.019

Table No 17.

Plague Deaths in Taluqs.

of

Cuddapah District.

Taluq.	1902	1903	1904	1905	1906	1907	1908	1909	1910	1911.
Badvel.....	-	-	3	-	-	-	-	-	-	-
Prodattur....	-	-	1	-	-	-	1	1	-	-
Sidhout.....	-	-	-	-	-	3	-	-	-	-
Rajampet.....	-	-	-	-	2	-	-	-	-	-
Cuddapah.....	-	-	6	-	3	-	-	-	-	-
Jammalmadugo..	-	-	-	-	-	-	-	-	-	-
Pulivendla....	-	-	-	-	-	1	-	1	-	-
Rayachoti.....	-	-	6	-	-	-	-	-	-	-
Kamalapur.....	-	-	-	-	-	-	-	-	-	-
Pullampet.....	-	-	3	-	-	-	-	-	-	-
Kadiri.....	-	-	27	-	-	-	1	1	-	-
Vayalpad.....	-	1	26	-	-	-	1	-	-	-
Madnapalle....	-	-	199	10	-	1	1	-	-	-
M. T. Cuddapah.	1	1	1	1	-	1	-	-	-	-

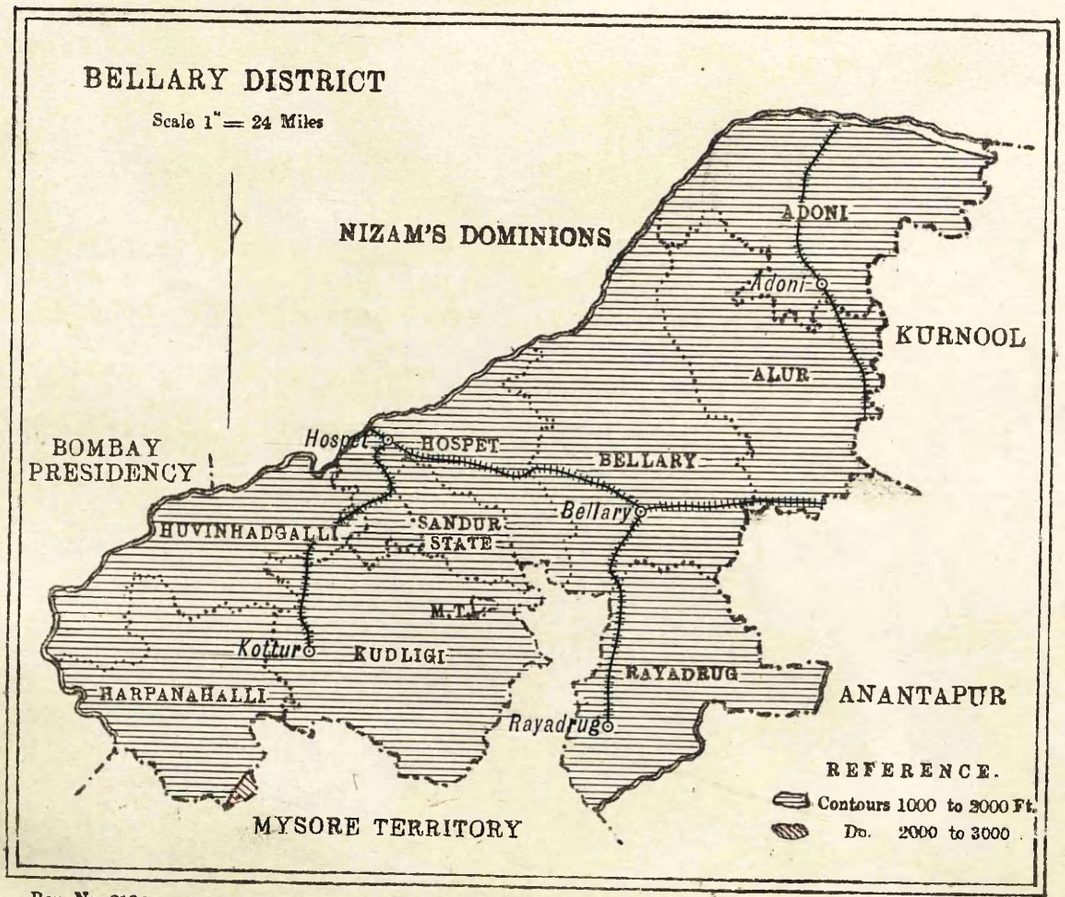

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Table No 18.

Taluq distribution of Plague

in

Bellary District.

Taluq	Plague Deaths 1902 to 1910	Population 1901 Census.	Average Annual Plague Deaths per Mille.
Bellary	10542	193401	6.057
Alur	1706	98568	1.924
Adoni	4901	178784	3.047
Rayadrug	2615	82789	3.513
Hospet	5774	101947	6.295
Hadagalli	2741	92094	3.310
Harpanahalli	996	95646	1.1157
Kudligi	1052	103985	1.125
Bellary Taluq Minus Bellary Town.	9333	135154	6.908
Adoni Taluq Minus Adoni Town.	2542	148308	1.714

Table No 19.

Plague deaths in Taluqs of

Bellary District.

Taluq	1902	1903	1904	1905	1906	1907	1908	1909	1910	1911.
Siruguppa.	-	-	-	-	-	-	-	-	-	1678
Bellary	1471	723	3191	593	16	360	130	-	-	2849
Kayadrug	337	589	803	108	14	294	273	-	-	234
Adoni	755	705	727	297	1	3	15	-	-	39
Alur	257	384	826	239	-	-	-	-	-	474
Hospet	1778	1658	818	1212	158	88	59	3	-	1696
Hadagalli	362	814	1036	403	91	9	15	5	6	741
Harpanahalli	96	174	501	102	12	10	25	10	66	499
Kudligi	16	85	428	398	27	22	62	-	14	486
Kottur	-	-	-	-	-	-	-	-	-	179
M.T.Bellary	1401	719	975	110	6	797	5	1	49	396
M. T. Adoni	879	45	1447	27	-	-	-	-	-	183
Zamindaries.	-	-	-	-	-	-	2	-	-	188

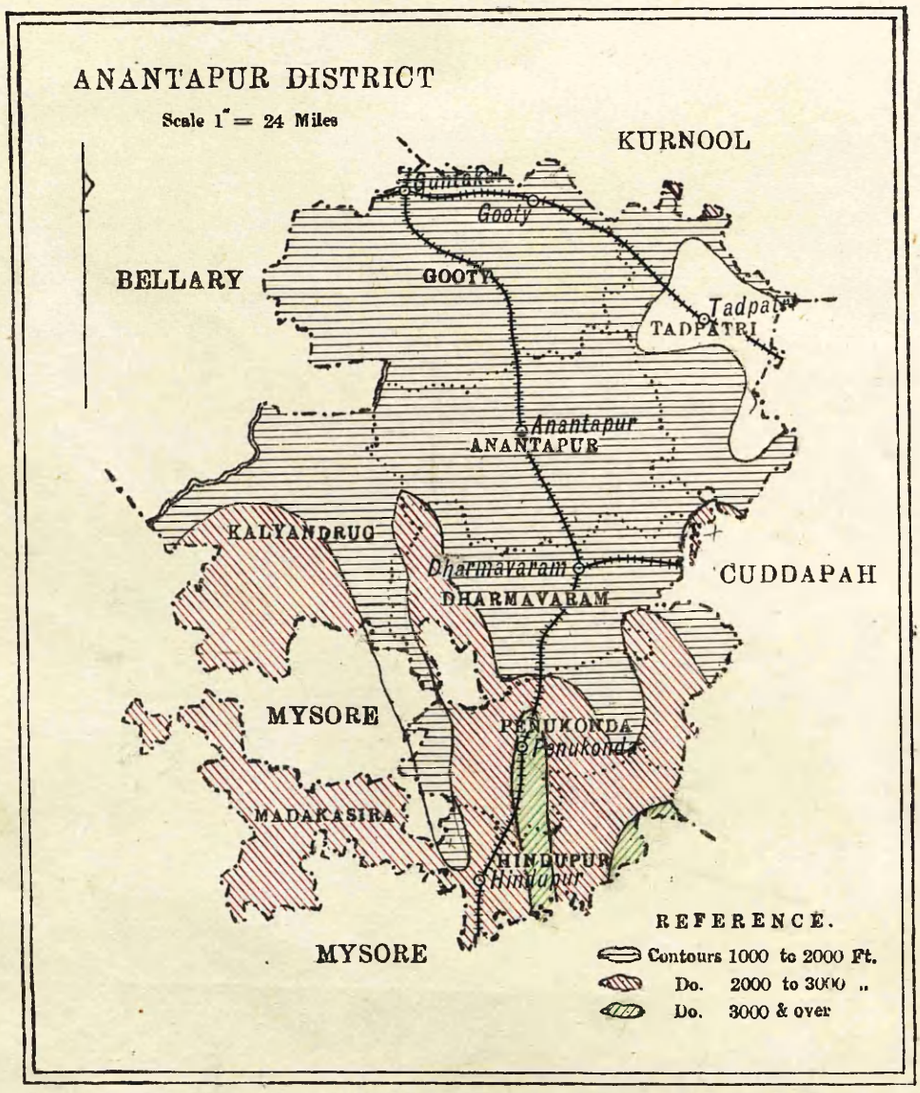
Table No 20.

Monthly Plague Death rate per mille.

Bellary District.

Average of the Years 1900 to 1911

January	....	....	.602
February	....	....	.436
March	....	....	.182
April	....	....	.035
May	....	....	.008
June	....	....	.013
July	....	....	.087
August	....	....	.293
September	....	....	.505
October.	....	....	.603
November.	....	....	.407
December	....	....	.491



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ANANTAPUR DISTRICT.

The Northern part of the District forms part of the Deccan Plateau, and in the South the Country reaches the Mysore Plateau level, Hindupur being the highest lying Taluq of the Deccan area; the portion of the Gooty Taluq adjoining Bellary District is the highest part, and from this part the country slopes down towards the East, the lowest-lying Taluq-Tadpatri-lying at the upper extremity of the hot Cuddapah Valley.

Gooty and Hindupur Taluqs have been the most severely infected. Gooty with its proximity to Bellary District and its direct Railway communication with this District and with the Bombay Presidency has suffered more than Hindupur. Anantapur Taluq, somewhat lower than Gooty and further off from the infected areas has suffered less. The lowest-lying and hottest Taluq - Tadpatri - has escaped epidemic Plague although it is only 1½ hours from Gooty by Rail.

Table No 21.

Taluq distribution of Plague in Anantapur District.

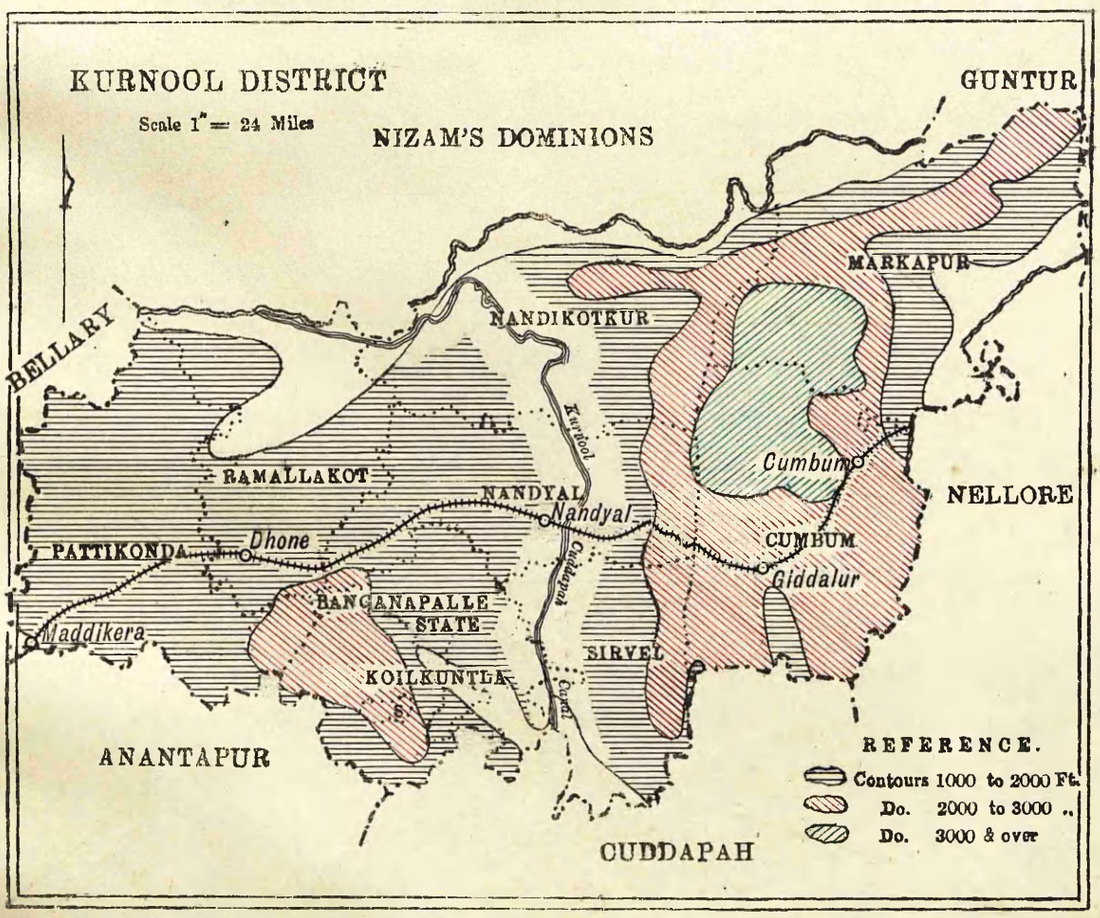
Taluq.	Population 1901 Census	Plague Deaths 1902 to 1911.	Average Annual Plague Deaths per Mille.
Anantapur.	108731	148	.136
Gooty.	156155	1511	.967
Tadpatri	109421	6	.005
Penukonda	92482	167	.180
Dharmavaram	70943	66	.093
Hindupur.	92088	734	.797
Madakasira	81457	201	.246
Kalyandrug.	76977	173	.224

Table No 22.

Plague deaths in Taluqs of

Anantapur District.

Taluq.	1902	1903	1904	1905	1906	1907	1908	1909	1910	1911.
Anantapur	-	1	21	32	1	-	-	-	-	21
Gooty	56	510	590	64	2	27	163	-	-	99
Tadpatri	-	-	-	-	-	3	1	-	-	2
Penukonda	-	3	54	106	-	-	-	1	-	3
Dharmavaram	1	-	65	-	-	-	-	-	-	-
Hindupur	5	121	192	115	-	1	-	-	-	-
Madakasira.	-	-	138	58	-	-	-	-	-	5
Kalyandrug	22	24	116	-	-	2	9	-	-	-
M.T.Anantapur.	-	3	44	1	-	1	1	-	-	22



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Kurnool District.

The Contour Map of this District gives a very imperfect idea of its physical conditions, the contouring being very rough and presenting considerable inaccuracies.

On the West the Pattikonda and Ramallkot Taluqs form a flat plateau adjoining Bellary District. East of this lie the Erramalai Hills - running up from the extreme South-East corner of Pattikonda Taluq into Nandyal. These Hills are not separately represented on the Contour Map only a part of them being indicated by the 2000 feet elevation South of Baganapalle State. East of the Erramalais lies the Nandyal Valley extending through Nandikottur, Nandyal, and Sirvel Taluqs. The Kyrnool-Guddapal Canal runs North and South through this area and the area has a general elevation of 700 to 800 feet above sea level. This is not shewn at all in the Elevation map of the whole Presidency and is only roughly indicated on the Contour Map of the District, the part below 1000 feet being much broader than is indicated by the shading on either side of the Kurnool-Cuddapah Canal.

East of the Nandyal Valley lies the Nallamalai Hills. These are almost entirely covered by jungle. They cover 2000 square miles most of which is reserved forest. The Nallamalais are crossed by two passes, the railway and the best road taking the more Southerly of the two. The District, although affected early, has had little Plague. Taluq figures of Plague Deaths which are available from 1903 show that the only Taluq that has had any considerable amount of Plague is Pattikonda and that even this Taluq has not had very much.

Table No 23.

Taluq distribution of Plague

in

Kurnool District.

Taluq.	Population 1901.	Plague Deaths 1903 to 1911.	Average Annual Plague Deaths per Mille.
Pattikonda.	143033	773	.600
Nandikottur.	104167	6	.006
Nandyal	110292	0	.....
Koilkuntla.	88147.	1	.001
Sirvel	73387.	2	.003
Cumbum	115881	15	.014
Markapur	94293	6	.007
Ramalakot	142855	37	.038

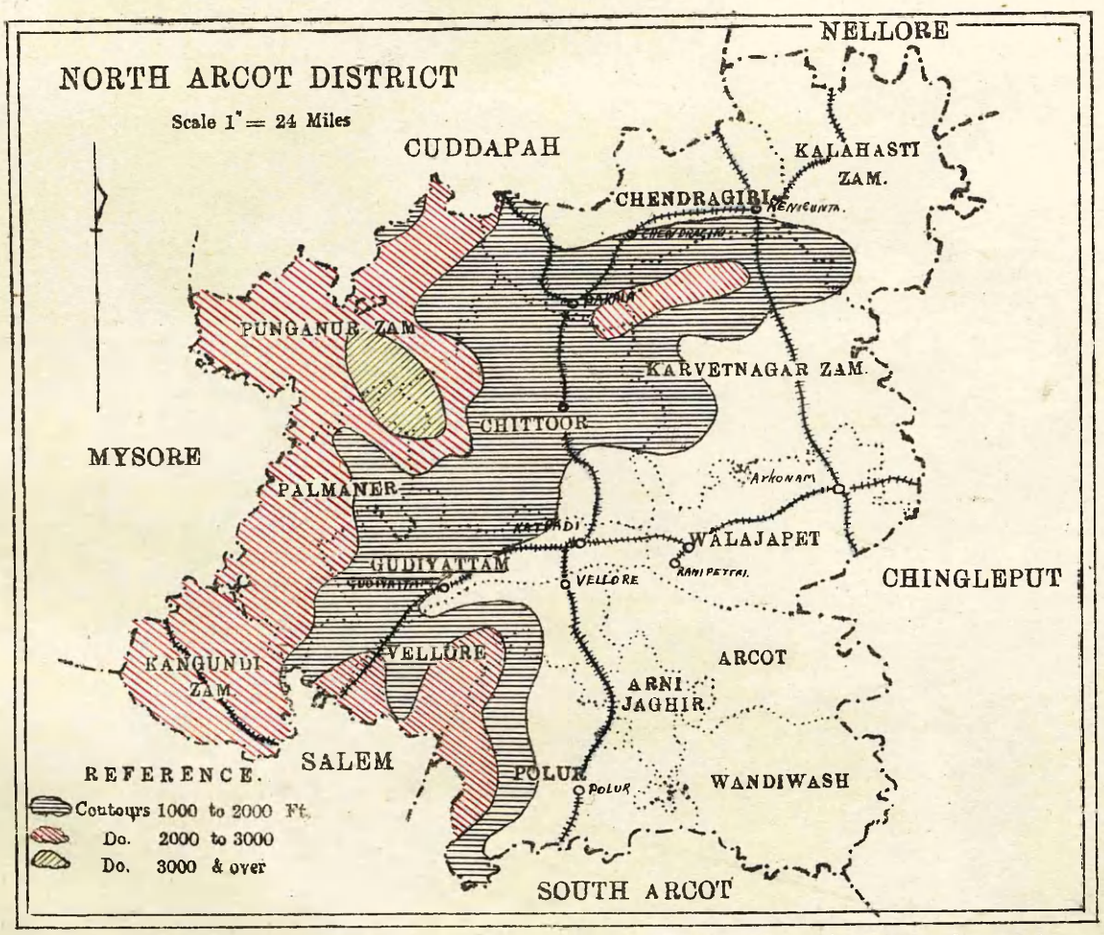
Table No 24.

Plague Deaths in Taluqs

of

Kurnool District.

Taluq.	1902	1903	1904	1905	1906	1907	1908	1909	1910	1911.
Pattikonda.		b453	252	68	-	-	-	-	-	-
Kurnool		-	-	-	-	-	-	-	-	-
Nandikottur		-	3	2	1	-	-	-	-	-
Nandyal		-	-	-	-	-	-	-	-	-
Koilkuntla		-	-	-	-	-	-	-	-	-
Sirvel		2	-	-	-	-	-	-	-	-
Gumbum		1	13	1	-	-	-	-	-	-
Markapur b		-	-	6	-	-	-	-	-	-
Dhone		-	-	-	-	-	-	-	-	-
Ramalakota		30	-	-	2	-	-	-	-	-
M. T. Kurnool	1	4	1	-	-	-	-	-	-	-
M.T.Nandyal		1	1	1	-	-	-	-	-	-



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North Arcot District.

On the East where the District borders on Chingleput the country is low-lying and hot. On the West it slopes up to the Mysore Plateau and the higher parts of Cuddapah District. In the Vellore and Polur Taluqs lie the Javadi Hills. Where Vellore and Gudiyattam Taluqs border on the Tirupattur Taluq of Salem District, there is an elevated area somewhat over 1000 feet through which the M. & S.M. Railway passes connecting at Jalarpet in Tirupattur Taluq with the S.I.R. and the line to Bangalore in Mysore State! A metre gauge line connects Katpadi with Pakala and Renigunta.

Plague has only reached epidemic proportions in Vellore and Gudiyattam Taluqs. Of the other high-lying Taluqs Chittoor, Polur, Kangundo, and Palmaner have suffered slightly, and Punganur has escaped. Of the low-lying Taluqs Chendragiri, Kalahasti, Karvetnugar, Walajapet, Arcot, and Wandiwash return a total between them of 112 deaths in the 11 years for which figures are available. Arni Jaghir returns 189 deaths in a single outbreak in 1903-1904.

Table No 25.

Taluq distribution of Plague in

Arcot

North District.

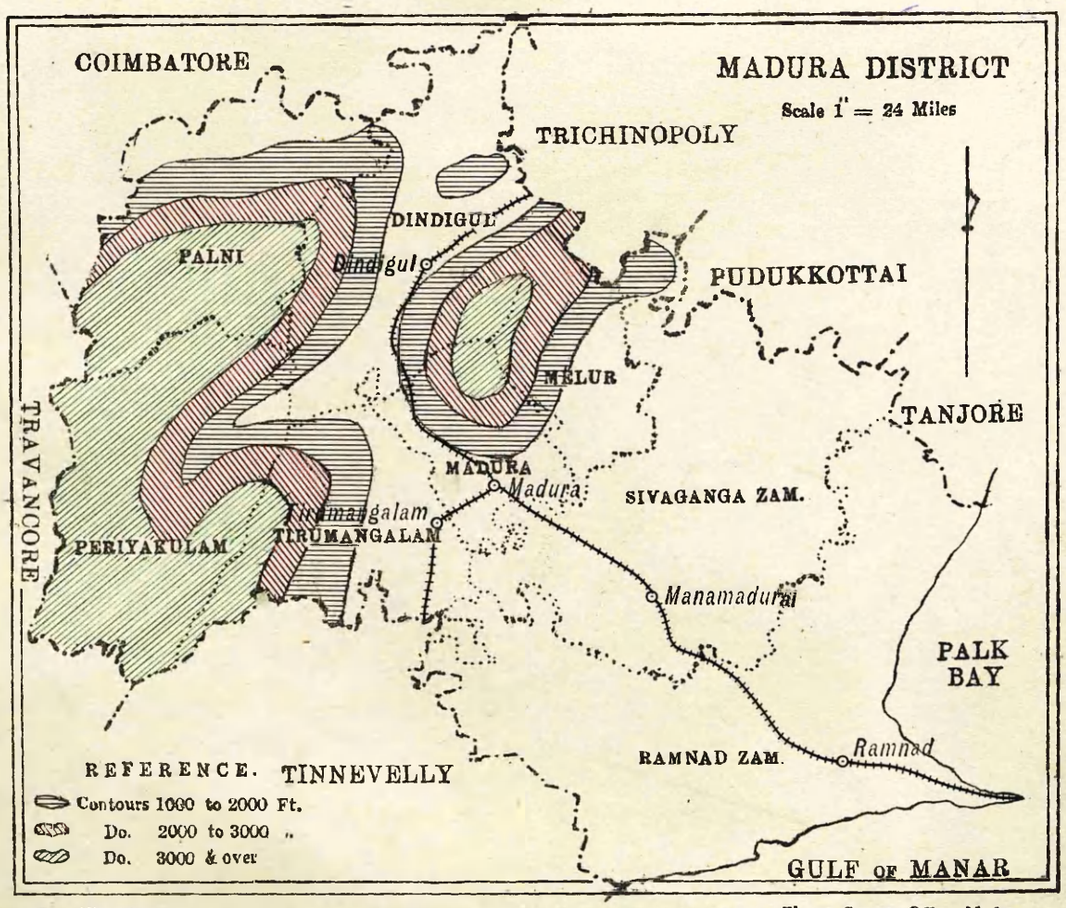
Taluq	Population 1901.	Plague Deaths 1900 to 1910	Average Annual Plague Death rate per Mille
Vellore.	200541.	1557	.706
Cudiyattam	195665.	439	.204
Chittoor.	209868.	144	.062
Polur	155673.	129	.075
Palmaner	51575.	40	.070
Arcot	180564.	96	.048
Wandiwash	185252.	18	.008
Chandragiri	113550.	5 (not indigenous)-	
Walajapet	221812.	40(25 indigenous).	.010
ZEMINDARIES.			
Panganur.	96852.	10 (not indigenous) -	
Kangundi	64542.	96	.092
Karvetnagar.	341240.	17 (not indigenous) -	
Kalahasti.	94132.	11 (not indigenous) -	
Arni.	96542.	207	.195
Vellore Taluq.			
minus Vellore town	157004.	759	.438
Vellore town.	43537.	798	1.667

Table No 26.

Plague Deaths in Taluqs of

North Arcot District.

Taluq	1900.	1901	1902	1903	1904	1905	1906	1907	1908	1909	1910.
Vellore	–	331	45	636	499	8	5	9	11	7	6
Guditattam	–	26	20	151	194	22	4	4	8	2	8
Chittoor	6	–	2	16	23	82	11	2	1	0	1
Polur	–	1	5	4	72	40	–	5	2	–	–
Palmaner	4	2	14	7	12	–	1	–	–	–	–
Arcot	–	5	15	17	48	3	–	2	1	3	2
Wandiwash	–	–	–	2	14	–	–	1	1	–	–
Chandragiri	–	–	–	–	–	4	–	1	–	–	–
Walajapet	–	2	1	1	11	6	2	8	6	–	3
ZEMINDARRIES.											
Panganur	–	–	2	1	4	3	–	–	–	–	–
Kangundi	–	–	4	20	59	2	–	5	2	–	4
Karvetnagar	–	–	2	1	1	4	–	1	3	4	1
Kalahasti	–	–	–	3	4	–	–	1	–	–	3
Arni	–	–	2	22	171	–	–	7	3	3	–



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Madura District.

The greater part of the populated area of Madura District is low-lying and hot. On the West of the District, separating it from Travancore State, the elevated area shown on the Contour Map represents the Palni Hills, the Cardamon Hills, and the Travancore High Range as it is variously called in different parts. These are for the most high Jungle-covered Hills, sparsely populated, and with poor communications. Some of the peaks run up to 7000 or 8000 feet and parts of this area are almost inaccessible. The conditions here are very unfavourable to the spread of Plague. The detached Hill area on the North-East of the District is the Sirumalai Hills, an uncultivated area with only a few Jungle villages.

The Contouring in this District is very rough, Madura appears to be close to the 1000 feet contour of the Sirumalais, but is in fact considerably further off and its actual elevation above Sea-level is 447 feet. On the other hand, the strip shown as below 1000 feet in the Dindugal Taluq between the two 1000 feet contours on either side has a general elevation of 900 feet, Dindugal Town lying close on 1000 feet above Sea-level. The area stretching from Dindugal across the Palni Taluq to the Coimbatore District is the only considerable one at about 1000 feet or slightly under excepting the Hill areas. This region is considerably cooler than the rest of the Plain area of the District.

The Palni and Dindugal Taluqs account for all the epidemic Plague in the District with the exception of 20 deaths in Kodaikanal. Palni Taluq accounts for most of the deaths, the epidemic Plague in this Taluq having occurred at an elevation about 1000 feet. Most of the deaths in Dindugal Taluq occurred in Dindugal Town. Palni Taluq was infected in 1904, 10 or 12 deaths occurring in that year. It was not again infected until 1910 and after the 1910-1911 outbreak remained free till date. (August 1912)

Kodaikanal Taluq (not shown on the Contour Map) is on the Northern edge of Periyakulam Taluq. The deaths here occurred at the foot of the Palni Hills. The very small population of this Taluq gives the death rate per mille, as it has been calculated, a higher value than it deserves. Madura Town, although within two hours' railway journey of Dindugal and receiving an enormous passenger and grain traffic from it, has escaped Plague. Madura is also a great centre for pilgrimage, thousands of pilgrims arriving from all parts of the Presidency every year.

Table No 27.

Taluq distribution of Plague

in

Madura District.

Taluq	Plague Deaths 1902 to 1911	Population 1901	Average Annual Plague Deaths per Mille.
Madura	4	308140	.001
Melur	1	154381	.0006
Periyakulam	1	320098	.0002
Tirumangalam	0	265396	.....
Kodaikanal	20	19677	.102
Dindugal	173	430524	.04
Palni	820	214972	.38

Table No 28.

Plague Deaths in Taluqs of

Madura District.

Taluq.	1902	1903	1904	1905	1906	1907	1908	1909	1910	1911.
Madura,	-	-	1	-	-	1	-	-	-	-
Tirumangalam	-	-	-	-	-	-	-	-	-	-
Periyakulam.	-	-	-	-	-	-	-	-	-	-
Dindugal.	-	1	-	-	-	-	-	-	10	27
Palni	-	2	15	2	-	-	-	-	406	160
Kodaikanal.	-	-	-	-	-	-	-	-	-	20
Melur.	-	-	-	-	-	-	-	-	1	-
MUNICIPALITIES:										
Madura	-	-	-	-	-	-	-	-	1	1
Dindugal	-	-	-	-	-	-	-	-	120	15
Palni	-	2	-	1	-	-	-	-	228	4
Periyakulam	-	-	-	-	-	-	-	-	1	-

Rat & Flea Prevalence in Different Parts of Madras Presidency.

For the purpose of observing the rat and flea prevalence under the varying Climatic conditions in different parts of the Presidency, four laboratories were established in the middle of the year 1911 in places showing these varying conditions and also a varying incidence of Plague.

These laboratories were stationed at ---

(1) Denkanikota - representing the Mysore Plateau level, and conditions favourable to endemic Plague.

(2) Coimbatore. representing the peculiar conditions in the area opposite the Palghat Gap.

(3) Vaniambadi -representing the Central Districts at an elevation of about 1000 feet where occasional large outbreaks have occurred in Municipalities.

(4) Madura - representing the hot Southern Districts which have escaped Plague.

Observations were carried out in each of these four places for a complete year, rats being trapped systematically and flea counts done on them daily. The methods used were exactly similar to these which the Commission had previously employed in Poona, Belgaum, and other parts of India.

The following is an account of the observations in these stations.

Observations in Vaniambadi and Tirupattur.

Vaniambadi was selected as one of the centres for a years observations, partly on account of its peculiar Plague history and partly as representing the conditions in the Central Districts of the Presidency at an elevation of about 1000 feet above Sea Level; as a considerable proportion of the Plague in this area has occurred in Municipalities similarly situated.

Vaniambadi is a large Municipality in the Tirupattur Taluq which, up till December 1910, formed part of the Salem District, but in that month was transferred to North Arcot District. It is situated on the banks of the Palar River, the branches of which divide it into three portions. It is on the main line of Rail from Madras to Bangalore and Madras to Erode and the West Coast.

Its elevation above Sea Level is 1872 feet.

The population according to the 1901 Census was 12,005, and according to the Census of 1911, was 20,340.

The number of houses is now 3743 of which 374 are unoccupied. Two-thirds of the inhabitants are Labbai Mahomedans, a people particularly difficult to deal with in Sanitary matters, and with whom any attempt at preventive measures which in the least approaches coercion is liable to lead to trouble. Even in the presence of Plague they will frequently refuse to evacuate their houses and will remain on and run the risk of infection, with the result that (any) the number of human cases during an Epidemic is sure to be much greater than it would be in a Hindu village where the people readily evacuate their houses and go into Camp. This partly accounts for the severity of the epidemics of 1901-1903, and prompt evacuation would probably have very much reduced the mortality.

The houses are of two main types:-

(1) The well built house of the rich Merchant, These are built of baked bricks covered with cement.

They have good foundations, well raised plinths, flat terraced roofs, and cement floors. These houses at first sight would appear to be rat-proof, as they (appear) seem to afford no shelter to burrowing or climbing rats. The inhabitants, however, almost invariably store/

store bags of grain, etc., in the dark corners of their houses, and these piles of grain bags and other accumulated rubbish furnish abundant shelter for colonies of rats, and rats can always be trapped in such houses.

(2) The poorer class of house. These are built of rough baked or unbaked bricks, uncemented or lightly plastered, with poor foundations. The roofs are composed of several layers of the ordinary "country" tiles, and a ceiling of bamboo lathes under the roof forms, in some cases, a loft in which rubbish is stored. The floors are of mud plastered with cowdung. Rats burrow in the walls and floors and find shelter in the roofs and lofts.

A certain number of the houses have thatched roofs.

Previous Plague History of Vaniambadi.

The first outbreak occurred in the beginning of January, and the Epidemic continued till April of the same year. No imported case preceded the outbreak, and its origin is obscure. It is thought that infection probably came from Bangalore or Ooregam in Mysore State. Plague re-appeared in January 1902 and continued until the end of April 1903, when the town was flooded by the rising of the Palar River and Plague ceased. This outbreak was also not preceded by an imported human case. Grain from Mysore State was suspected to be the source of infection.

From April 1903 up till the time our work was commenced in Vaniambadi the town was free from Plague. Work was commenced in Vaniambadi on 6th June 1911, A Laboratory being established under canvas. A hundred and fifty traps were set daily from that date onwards, and the rat and flea prevalence, as shown by the results of the trapping, are given in the accompanying series of tables and charts. The highest weekly average number of rats per 100 traps was 16.6 and the lowest was 2.6. The average for the whole period was 8.9. The flea prevalence varied from 2 to 14.8 as a weekly average. The lowest fortnightly average was 2.4 and the highest/

highest was 10.4. The flea prevalence reached its greatest height in January and February, and this rise was associated with an outbreak of Plague. These months have been the months of greatest severity of Plague in previous Epidemics in Vaniambadi. Temperature and Humidity records were kept, and it will be seen from Chart No. I that the flea curve follows the Humidity curve with fair regularity at an interval of about six weeks. The flea curve reached its height shortly after the lowest temperature and with a Humidity about 80°.

Plague commenced in Vaniambadi on the 3rd January 1912, the first death occurring on that date. The epidemic continued till April 11th, 464 deaths in all occurring. The daily and weekly deaths are found on table No. 13-16.

No imported human case preceded the outbreak, and its origin is uncertain. Infection may ~~be above~~ have come from a village about 12 miles off which was infected.

After 10th February it was found impossible to catch any more rats on account of the opposition of the people who thought that the trapping was responsible for the outbreak, the town having been free from Plague for 8 years before we started work. Some of the houses still took traps but would not return rats. We have frequent experience of the tricks the villager will indulge into prevent one obtaining rats; such as stuffing up the entrance of the trap, covering it over with a basket, hanging it on a peg out of reach of rats, or letting out the rats before the traps were collected.

This is often done from the fear that any rats caught will be declared infected and that the Authorities will insist in disinfecting the house, a proceeding which is very much objected to especially in the case of Mahomedans whose women are "Purdah."

To continue the flea count it was necessary to obtain rats from some place in the vicinity and the laboratory was shifted to Tirupattur a town about 14 miles from Vaniambadi. This town is situated on the/

the main line of Rail at an elevation of 1266 feet and is climatically similar to Vaniambadi. Its flea prevalence will thus be influenced in the same way as that of Vaniambadi as far as Climatic factors go, and the flea counts obtained here have been used to complete the curve. Too much insistence will not be laid on this.

The population of Tirupattur, according to the 1901 Census, was 18689 and according to the 1911 Census was 10470.

The lower count in 1911 was due to the fact that the town was partly evacuated on account of a Plague Epidemic.

The Mahomedans and Hindus in Tirupattur are about equal in number and there (are) is a considerable number of Brahmins.

The houses are very similar to those in Vaniambadi.

Tirupattur has previously suffered from Plague.

The first Epidemic lasted from December 1899 to April 1900. Subsequent Epidemics occurred in 1903-1904 and 1910. Only 4 or 5 cases occurred this year (1912) up till the time the Commission finished work in June.

Trapping was commenced on 19th February and continued till 8th June. It will be seen from the tables that the number of rats per 100 traps was low. This is probably due in some degree to the rat population not having recovered from the Epizootic of 1910-1911. The period from the middle of March to the middle of June in? the hottest season and is? in the natural off-plague season here, and the flea count, is? then at its lowest.

An experimental test of the relative susceptibility of the Vaniambadi rats to Plague was made in June 1911, those rats being compared with rats from other parts of India. The test was done 8 years after the previous outbreak of Plague in Vaniambadi and before the 1912 outbreak.

The result of the experiment was as follows:-

Percentage of rats dying of Plague.

Vaniambadi rats	100%
Madras "	100%
Madura "	100%
Cawnpore "	20%
Adult Bombay "	45%
Young Bombay "	48%
Young Poona "	28%

The same dose of Plague Bacilli was given to all rats.

Vaniambadi and Tirupattur.

Flea Prevalence -- Weekly Average.

Vaniambadi:

Week Ending		Week Ending.	
10th June	5.4	9th Dec.	6.9
17th "	6.1	16th "	7.1
24th "	4.8	23rd "	5.7
1st July	6.1	30th "	6.5
8th "	4.3	6th Jan.	12.5
15th "	3.5	13th "	9.1
22nd "	4.0	20th "	8.4
29th "	5.4	27th "	8.9
5th August	7.0	4th February	14.6
12th "	6.9	10th Feb.	4.8
19th "	3.9		

		Tirupattur.	
26th "	3.4	24th "	2.9
2nd Sept.	3.4	2nd March	2.3
9th "	2.0	9th "	9.8
16th "	2.9	16th "	3.9
23rd "	3.4	23rd "	2.6
30th "	3.4	30th "	2.4
7th Oct.	4.8	6th April	1.6
14th "	3.1	13th "	1.9
21st "	4.3	20th "	2.0
28th "	6.4	27th "	1.6
4th Nov.	6.9	4th May	3.1
11th "	6.3	11th "	1.9
18th "	7.6	18th "	2.6
25th "	5.3	25th "	3.4
2nd Dec.	8.7	1st June	2.4

Vaniambadi and Tirupattur.

Flea Prevalence - Fortnightly Average.

Vaniambadi.	Fortnight Ending.	Average Fleas per Rat.
	10th June	5.4
	24th "	5.2
	8th July	5.4
	22nd July	3.8
	5th August	6.0
	19th "	5.1
	2nd Sept.	3.5
	16th "	2.4
	30th "	3.4
	14th Octo.	3.5
	28th "	5.4
	11th Nov.	6.6
	25th "	6.5
	9th Dec.	8.1
	23rd "	6.4
	6th Jan.	10.2
	20th "	8.8
	4th Feb.	10.4
	17th "	3.8
Tirupattur	2nd March	2.6
	16th "	7.3
	30th "	2.5
	13th April	1.9
	27th "	1.9
	11th May	2.0
	25th "	2.8

Vaniambadi and Tirupattur.

Rats per 100 Traps -Weekly Average.

Vaniambadi.

Week Ending.		Week Ending.	
10th June	10.3	9th Dec.	7.7
17th June	13.5	16th "	15.8
24th "	9.3	23rd "	8.4
1st July	13.1	30th "	3.6
8th "	5.5	6th Jan.	5.6
15th "	7.7	13th "	4.2
22nd "	10.0	20th "	5.6
29th "	7.7	27th "	6.8
5th August.	6.4	4th Feb.	2.0
12th "	8.5	10th "	2.8
19th "	13.4		
		Tirupattur.	
26th "	16.6	4th Feb.	12.6
2nd Sept.	7.4	2nd Mar.	5.1
9th "	6.6	9th "	12.0
16th "	7.0	16th "	6.3
23rd "	15.8	23rd "	4.0
30th "	7.3	30th "	6.4
7th Oct.	4.1	6th Apri.	2.6
14th "	11.7	13th "	10.0
21st "	4.0	20th "	11.5
28th "	9.2	27th "	5.0
4th Nov.	15.8	4th May	4.0
11th Nov.	12.6	11th "	4.3
18th "	10.4	18th "	4.5
25th "	11.5	25th "	1.3
2nd Dec.	15.3	1st June.	3.6

Vaniambadi.

Weekly Mean Temperature and Humidity.

Week Ending	Temp.	Hum.	Week.Ending.	Temp.	Hum.
17th June	F 82.1°	63.8	16th Dec.	F 75.2°	84.5
24th "	90.7	64.5	23rd "	74.2	81.4
1st July	88.0	63.5	30th "	73.3	81.2
8th "	84.6	71.4	6th Jan/12	72.1	82.0
15th "	72.2	70.7	13th "	70.7	79.0
22nd "	80.9	74.4	20th "	77.6	81.1
29th "	84.0	65.2	27th "	75.3	80.5
5th Aug.	89.8	61.4	3rd Feb.	80.6	79.5
12th Aug.	84.4	61.1	10th "	82.4	80.5
19th "	83.9	62.9	17th "	82.6	78.0
26th "	84.4	64.8	24th "	81.0	73.2
2nd Sept.	84.6	65.8	2nd March	85.9	72.5
9th "	87.6	73.1	9th "	89.7	64.4
16th "	85.8	71.8	16th "	84.8	65.5
23rd "	82.5	78.0	23rd "	87.2	68.2
30th "	86.1	70.4	30th "	89.3	67.4
7th Oct.	83.5	77.8	6th April	91.7	76.1
14th "	84.1	80.1	13th "	91.2	71.3
21st "	78.0	86.8	20th "	91.2	70.4
28th "	78.8	72.1	27th "	92.5	70.1
4th Nov.	78.9	81.5	4th May	92.9	64.2
11th "	79.1	80.0	11th "	92.7	63.1
18th "	79.1	77.8	18th "	94.5	62.7
25th "	76.3	88.2	25th "	95.1	
2nd Dec.	80.7	83.5	1st June	94.4	
9th "	74.8	88.4	8th "	91.6	

Fortnightly Mean Temperature and Humidity.

Fortnight Ending	Tem.	Humidity.
24th June /11	86.4	64.1
8th July	86.3	67.4
22nd July	79.5	72.5
5th August	86.9	63.3
19th "	84.1	61.7
2nd Sept.	84.5	65.3
16th "	86.7	72.4
30th "	84.3	74.2
14th Oct.	82.8	78.9
28th "	78.4	79.4
11th Nov.	79.0	80.7
25th "	77.7	83.0
9th Dec.	77.7	85.9
23rd Dec.	74.7	82.9
6th January/12	72.7	81.6
20th "	74.1	80.0
3rd Feb.	77.9	80.0
17th "	82.5	79.2
2nd March	83.5	72.8
16th "	87.2	64.9
30th "	88.2	67.8
13th April	91.4	73.7
27th "	91.8	70.2
11th May	92.8	63.6
25th "	94.8	
8th June	93.0	

Vaniambadi.

Weekly Mean Temperature and Humidity.

Week Ending	Tem.	Hum.	Week Ending	Temp.	Hum.
17th June 1911	92.1	63.8	16th Dec.	75.2	84.5
24th "	90.7	64.5	23rd "	74.2	81.4
1st July	88.0	63.5	30th "	73.3	81.2
8th "	84.6	71.4	6th Jan.1912	72.1	82.0
15th "	72.2	70.7	13th "	70.7	79.0
22nd "	80.9	74.4	20th "	77.6	81.1
29th "	84.0	65.2	27th "	75.3	80.5
5th Aug.	89.8	61.4	3rd Feb.	80.6	79.5
12th "	84.4	61.1	10th "	82.4	80.5
19th "	83.9	62.9	17th "	82.6	78.0
26th "	84.4	64.8	24th "	81.0	73.2
2nd Sept.	84.6	65.8	2nd March	85.9	72.5
9th "	87.6	73.1	9th "	89.7	64.4
16th "	85.8	71.8	16th "	84.8	65.5
23rd "	82.5	78.0	23rd "	87.2	68.2
30th "	86.1	70.4	30th "	89.3	67.4
7th Oct.	83.5	77.8	6th Apr.	91.7	76.1
14th "	84.1	80.1	13th "	91.2	71.3
21st "	78.0	86.8	20th "	91.2	70.4
28th "	78.8	72.1	27th "	92.5	70.1
4th Nov.	78.9	81.5	4th May	92.9	64.2
11th "	79.1	80.0	11th "	92.7	63.1
18th "	79.1	77.8	18th "	94.5	62.7
25th "	76.3	88.2	25th "	95.1	59.8
2nd Dec.	80.7	83.5	1st June	94.4	61.4
9th "	74.8	88.4	8th "	91.6	64.5

Vaniambadi

Fortnightly Mean Temperature and Humidity.

Fortnight Ending	Tem.	Hum.
24th June	86.4	64.1
8th July	86.3	67.4
22nd "	79.5	72.5
5th August	86.9	63.3
19th "	84.1	61.7
2nd Sept.	84.5	65.3
16th "	86.7	72.4
30th "	84.3	74.2
14th Oct.	83.8	78.9
28th "	78.4	79.4
11th Nov.	79.0	80.7
25th "	77.7	83.0
9th Dec.	77.7	85.9
23rd "	74.7	83.9
6th Jan.1912.	72.7	81.6
20th "	74.1	80.0
3rd Feb.	77.9	80.0
17th "	82.5	79.2
2nd March	83.5	72.8
16th March	87.2	64.9
30th "	88.2	67.8
13th April	91.4	73.7
27th "	91.8	70.2
11th May	92.8	63.6
25th May	94.8	61.2
8th June	93.0	62.9

Plague Deaths in Vaniambadi.

1912 Epidemic.

Date.	Daily Deaths	Weekly Deaths.
3rd January	1	
4th "	-	
5th "	3	
6th "	-	4
7th "	1	
8th "	-	
9th "	1	
10th "	1	
11th "	4	
12th "	3	
13th "	6	16
14th "	2	
15th "	6	
16th "	1	
17th "	3	
18th "	5	
19th "	5	
20th "	1	23
21st "	5	
22nd "	2	
23rd "	6	
24th "	2	
25th "	4	
26th "	55	
27th "	12	36
28th "	4	
29th "	6	
30th "	7	
31st "	7	

Date	Daily Deaths	Weekly Deaths
1st February	8	
2nd "	15	
3rd "	4	51
4th "	14	
5th "	8	
6th "	8	
7th "	8	
8th "	11	
9th "	6	
10th "	12	66
11th "	19	
12th "	11	
13th "	10	
14th "	9	
15th "	11	
16th "	9	
17th "	7	78
18th "	5	
19th "	17	
20th "	9	
21st "	6	
22nd "	11	
23rd "	10	
24th "	4	62
25th "	4	
26th "	13	
27th "	6	
28th "	6	
29th "	6	
1st March	2	37

Date.	Daily Deaths	Weekly Deaths.
2nd March	5	
3rd "	3	
4th "	9	
5th "	8	
6th "	13	
7th "	10	
8th "	3	51
9th "	3	
10th "	4	
11th "	5	
12th "	1	
13th "	5	
14th "	2	
15th "	4	24
16th "	1	
17th "	3	
18th "	3	
19th "	3	
20th "	0	
21st "	5	
22nd "	5	20
23rd "	3	
24th "	2	
25th "	1	
26th "	1	
27th "	1	
28th "	-	
29th "	-	8
30th "	2	
31st "	0	
1st April	3	
2nd "	1	
4th "	1	
6th "	1	7
10th "	1	
11th "	1	3

No more deaths

Monthly Plague Deaths in Vaniambadi during Epidemic Years.

	1901	1902	1903	1904
January	-	9	772	-
February	-	91	508	-
March	-	164	78	3
April	-	44	3	-
May	-	6	-	-
June	-	4	-	1
July	-	5	-	1
August	-	8	-	3
September	-	27	-	1
October	-	57	1	-
November	-	175	1	1
December	-	371	1	-

Fortnightly Mean Temperature + Humidity + Average Flea Prevalence — Veniambadi.

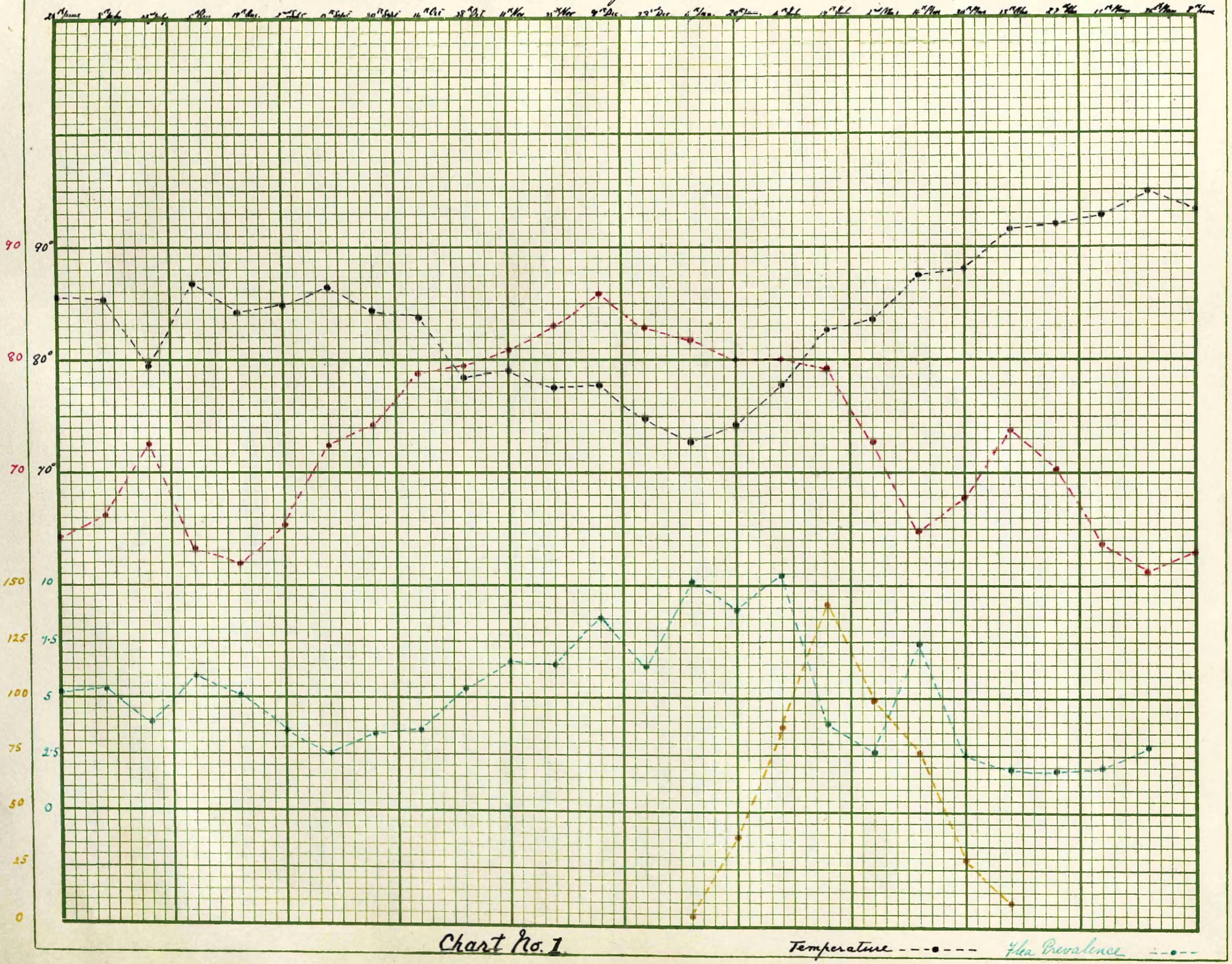


Chart No. 1.

Temperature ---●--- Flea Prevalence --●--

Humidity ---●--- Plague Deaths --●--

ALLIANCE SERIES

Observations in Denkanikota.

Denkanikota was chosen as one of the centres for a continuous years observations, as representing the conditions in the Mysore Plateau areas of the Presidency. It was originally intended to work in Hosur Town, but as this town was suffering from an Epidemic at the time of our arrival and was largely evacuated and most of the houses were shut up, it was impossible to carry on trapping. Denkanikotta was, therefore, chosen as the nearest village of any size representing very much the same conditions. Denkanikota is a village of 5732 inhabitants situated in the Hosur Taluq of Salem District at an elevation of 3020 feet above Sea Level. It is 16 miles from Hosur Town and 41 miles from Bangalore by road.. The nearest Railway Station is Malur, 38 miles off. Its communications with the rest of Salem District are poor. The village has little trade and no manufactures, most of the people being engaged in agriculture.

The houses are of the poorest description, most of them being built of mud walls, with bamboo rafters covered with several layers of country tiles as a roof. There are a very few houses of a better description.

The village first suffered from Plague in 1901 and was again infected in 1902, 1906, 1907, 1908, 1909.

Operations were commenced here on 11th August 1911 and carried on till 15th August 1912, 100 traps being set daily for the greater part of that period. Readings of Temperature and Humidity were taken from 16th Sept. onwards.

The results of the work are shown in the accompanying Tables and Charts. The average number of "rats per 100 traps" for the whole period was 6.6. The Flea prevalence varied from a fortnightly average of 14.9 to 3.1, the highest weekly average was 15.8.

Denkanikota

Flea Prevalence - Weekly Average.

Rats per 100 Traps Per Cent

Week Ending		Week Ending.	
19th August	15.8	17th Feb.	6.0
26th "	11.3	24th "	5.3
2nd Sept.	12.3	2nd March.	6.2
9th "	12.1	9th "	8.0
16th "	13.2	16th "	7.8
23rd "	11.0	23rd "	6.3
30th "	9.8	30th "	7.0
7th Oct.	11.6	6th Apr.	4.8
14th "	9.2	13th "	5.6
21st "	9.0	20th "	6.0
28th "	14.0	27th "	6.9
4th Nov.	10.9	4th May	4.1
11th "	8.7	11th "	3.4
18th "	11.8	18th "	3.5
25th "	8.0	25th "	2.8
2nd Dec.	7.6	1st June	3.7
9th "	8.5	8th "	5.6
16th "	9.8	15th "	5.5
23rd Dec.	7.1	22nd "	7.1
30th "	8.0	29th "	5.3
6th Jan.1912.	11.8	6th July.	6.0
13th "	10. 0	13th "	8.4
20th "	8.3	20th "	5.7
27th "	10.2	27th "	11.1
3rd Feb.	7.2	3rd Aug.	9.6
10th "	6.6	10th "	10.5

Denkanikota.

Flea prevalence - Fortnightly average.

Fortnight Ending:	
19th August	14.9
2nd Sept.	12.2
16th "	12.5
20th "	10.4
14th Oct.	10.6
28th "	11.8
11th Nov.	9.9
25th "	9.8
9th Dec.	8.1
23rd "	8.8
6th Jan.	9.7
20th "	9.0
3rd Feb.	8.4
17th "	6.2
2nd March	5.9
16th "	7.9
30th "	6.7
13th April	5.3
27th "	6.4
11th May	3.7
25th "	3.1
8th June	4.5
22nd "	6.1
6th July	5.5
20th "	7.5
3rd August	10.0

Denkanikota.

Weekly Mean Temperature and Humidity.

Week Ending	Temp.	Hum.	Week Ending	Temp.	Hum.
3rd Sept.	75°	84	23rd March	81.3	58
30th "	76	80	30th "	84	63.5
7th Oct.	76	83	6th April	83.8	63.
14th "	77	82	13th "	87	62.5
21st "	74	90	20th "	83.8	66.4
28th "	74	73	27th "	86.6	68.4
4th Nov.	75	77	4th May	85	68
11th "	74	79	11th "	84.5	68
18th "	73	80	18th "	85.2	69.5
25th "	72	89	25th "	85	76.5
2nd Dec.	75	Humidity	1st June	83.5	73.4
9th "	71	Figures	8th "	81.5	76
16th "	70	not reliable	15th "	79.5	80.5
23rd "	70	apparatus	22nd "	79	79
30th "	70	out of order	29th "	78.6	78.8
6th Jan.1902.	69.7	87	6th July	79.7	73.
13th "	68.7	70	13th "	79.2	77.5
20th "	72.3	71	20th "	77.8	83.8
27th "	71.6	52	27th "	77	84.8
3rd Feb.	73.3	73	3rd Aug.	76.7	81
10th "	75	77.5	10th "	78.4	81
17th "	76.3	75.5			
24th "	76.6	55.5			
2nd March	79.8	67			
9th "	80.9	55			
16th "	79	56			

Denkanikota.

Fortnightly Mean Temperature and Humidity.

Fortnight Ending	Tem.	Hum.
30th Sept. 1911.	75.5° F	82
14th Oct.	76.5	82.5
28th "	74	81.5
11th Nov.	74.5	78
25th "	72.5	84.5
9th Dec.	73	Humidity
23rd "	70	Figures
6th Jan. 1912	69.8	Not reliable:apparatus out of order.
20th "	70.5	70.5
3rd Feb.	72.4	62.9
17th "	75.6	76.5
2nd March	78.2	61.2
16th "	79.9	55.5
30th "	82.6	60.7
13th April	85.4	82.7
27th "	85.2	67.4
11th May	84.7	68
25th "	85.1	73
8th June	82.5	74.7
22nd "	79.2	79.7
6th July.	79.1	75.9
20th "	78.5	80.6
3rd August.	76.8	82.9

Fortnightly Mean Temperature & Humidity & Average Tsetse Prevalence – Donkanikota

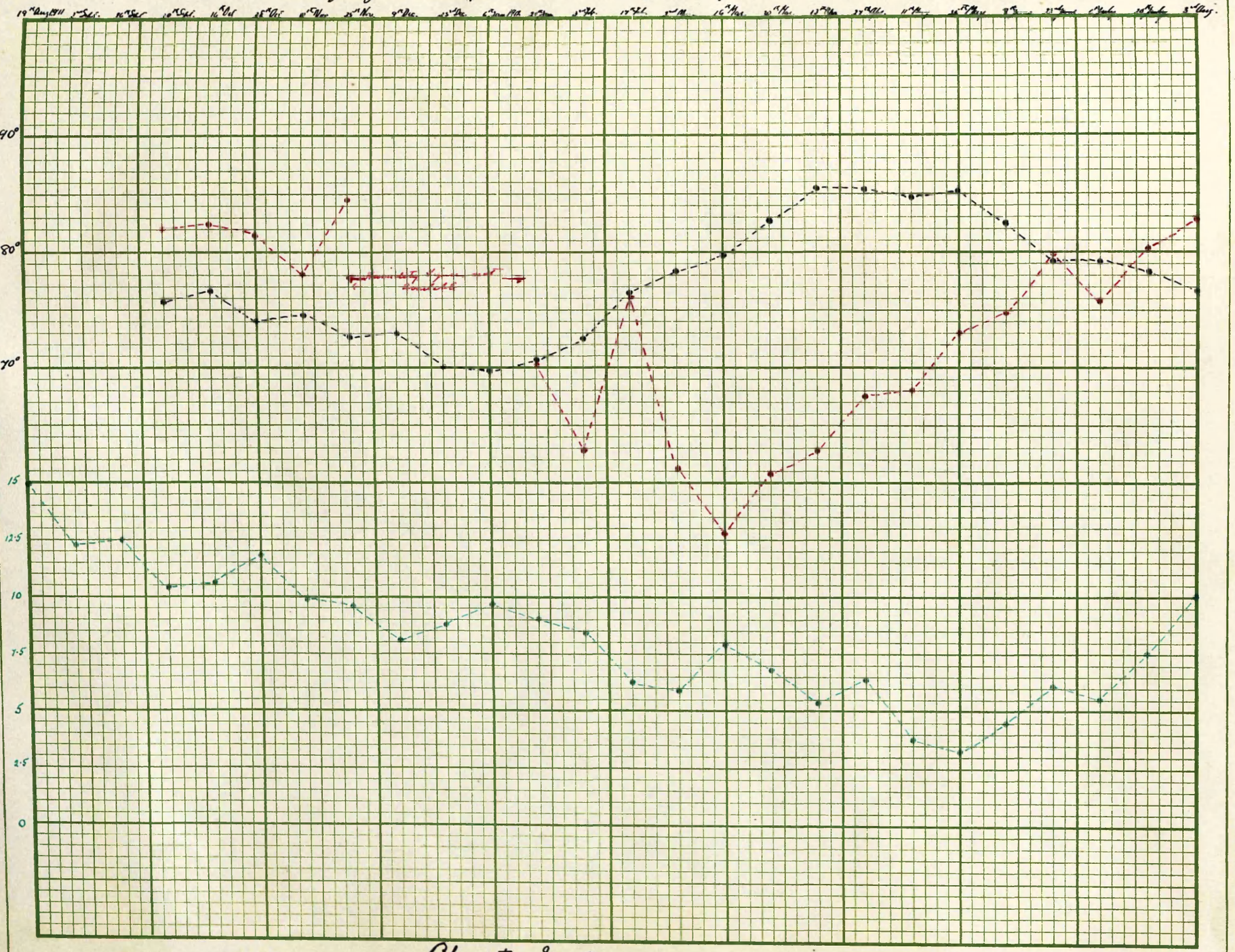


Chart No 2.

Observations in Coimbatore.

Coimbatore is the headquarters town of the District of the same name. It is situated at the mouth of the Palghat Gap on its Eastern side, and lies at an elevation of 1348 feet above Sea Level. The line from Podanur to Mettapulliam and the Nilgiri Hills runs through it, and through Podanur, which is 4 miles off. Coimbatore has communications with the West Coast towns on the one side and with the Central Districts and Madras City on the other. Mysore State can be reached by a circuitous journey through Erode and Jalarpet Junctions to Bangalore. There is road communication with Pollachi, Mettapulliam, and Satyamangalam. The population of Coimbatore in 1901 was 53080, and according to the Census of 1911 was 40007. The 1911 Census was taken when the town was partly evacuated on account of Plague.

Coimbatore is an important Industrial and trading centre. Its industries include Cotton-spinning (both Hand- and Mechanical-Loom weaving) Coffee-curing , Sugar refining, etc.

The town is for the most part badly built, and there are several badly congested areas. The houses are mostly of the type common in the Central Districts - mud or brick walls with roofs of country tiles in several layers. The proportion of houses of a better type is small. Coimbatore has a mild and pleasant climate which has already been commented upon. The normal mean temperature falls below 80°F at an earlier period than in most other parts of the Presidency. The Hot Weather is very short and the temperature is never very high.

Coimbatore suffered from Epidemic Plague in the years 1903, 1904, 1909, 1910, 1911, and 1912. The deaths in these years being.

1903-------571		1910.....55	
1904-------781		1911.....764	
1909------1101		1912.....748	up to 17th Feb.

The Seasonal prevalence of Plague is earlier than in most parts of the Presidency, Plague reaching a considerable height as early as August and September.

Infection is usually supposed to come from the Nilgiris.

Operations were commenced in Coimbatore on 1st May 1911, 150 to 300 traps being set daily, and flea counts done on the rats collected. The results are shewn in the accompanying tables.

The average number of rats caught per 100 traps set during a complete year's work was 4.4, the highest weekly average being 13.2, and the lowest 0.8.

The fortnightly average number of fleas per rat varied from 1.6 to 10.4, the height of the curve being reached in September, and the highest weekly count being 11 per rat. The figures of weekly and fortnightly Mean Temperature and humidity as obtained from the Official records are given for the period of our observations.

While the work was being carried on in Coimbatore Plague became epidemic. An imported and an indigenous case occurred on 11th May 1911, but these were not immediately followed by an outbreak. Epizootic and Epidemic Plague commenced in the beginning of July and continued up to the middle of February, 1912.

After the cessation of the Epidemic, Plague rats were still found for some time, and another indigenous Plague case occurred on 27th May. A dead rat was found on 18th May, and rats were again found infected on the 20th August. It is likely that a mild epizootic continued to bridge over the off-season on this occasion.

Statement showing average Fleas Mus Rattus.

in Coimbatore - In Weekly Periods.

Week-Ending on	Average Fleas per Rattus.	Week-Ending on	Average Fleas per Rattus.
May 6th 1911	1.9	Nov.11th 1911.	8.5
...13th	3.2	18th	10.5
...20th	1.6	25th	6.5
...27th	1.3	Dec. 2nd.	6.4
Jne.3rd	1.7	" 9th	7.8
" 10th	1.5	" 16th	7.3
" 17th	2.0	" 23rd	7.6
" 24th	4.0	" 30th	5.6
Jly.1st	3.6	Jan.6th 1912.	7.6
" 8th	2.4	" 13th	6.2
" 15th	5.1	" 20th	5.6
" 22nd	6.2	" 27th	7.5
" 29th	6.6	Feb.3rd	5.0
Aug.5th	6.1	" 10th	3.7
" 12th	7.6	" 17th	4.7
" 19th	8.0	" 24th	4.4
" 26th	7.6	Mar. 2nd	4.3
Sep.2nd	10.0	" 9th	5.4
" 9th	11.0	" 16th	3.0
" 16th	9.9	" 23rd	3.4
" 23rd	10.1	" 30th	4.6
" 30th	8.9	Apr. 6th	1.8
Oct.7th	9.9	" 13th	2.0
" 14th	7.3	" 20th	2.0
" 21st	9.8	" 27th	2.3
" 28th	7.9	May 4th	2.1
Nov.4th	8.3		

Statement showing the average Fleas per Mus Rattus in Coimbatore -- in fortnightly periods.

rtnight ending on	Average Fleas per Rattus.
y 13th 1911	2.5
. 27th	1.4
ne10th	1.6
. 24th	3.3
ly. 8th	3.0
.. 22nd	5.4
ug. 5th	6.3
.. 19th	7.8
ep. 2nd	8.7
16th	10.4
30th	9.7
ct.14th	8.5
28th	8.8
ov.11th	8.4
25th	8.1
ec. 9th	7.2
23rd	7.5
an. 6th 1912.	6.7
20th	5.9
eb. 3rd.	6.2
17th	4.2
arch 2nd	4.3
16th	4.1
30th	3.8
pril 13th	1.9
27th	2.1
ay 11th	2.1

Statement showing the number of Mus Rattus

Caught per 100 Rawalpindi Traps Set - in Coimbatore.

Weekly Periods.

Ending on	No. of Rattus per 100 Trap Set.	Week ending on.	N. of Rattus per 100 trap Set.
May 6th 1911	Not observed	Nov.11th 1911	3.8
...13th	7.7	....18th	2.0
...20th	13.2	....25th	3.9
...27th	5.5	Dec. 2nd	3.2
June 3rd	5.3	... 9th	3.5
... 10th	6.6	... 16th	2.3
... 17th	5.6	... 23rd	2.9
... 24th	7.8	... 30th	1.6
Jly. 1st	7.0	Jan. 6th 1913.	2.6
... 8th	4.8	... 13th	2.4
... 15th	6.8	... 20th	0.9
... 22nd	4.2	... 27th	2.7
Jly.29th	3.8	Feb. 3rd	1.5
Aug. 5th	6.6	... 10th	0.8
... 12th	6.0	... 17th	1.6
... 19th	7.3	... 24th	3.1
... 26th	10.4	Mch. 2nd	1.3
Sep. 2nd	12.8	... 9th	1.2
... 9th	6.0	... 16th	1.7
... 16th	5.8	... 23rd	1.6
... 23rd	6.0	... 30th	3.7
... 30th	3.2	Apr. 6th	2.8
Oct. 7th	4.8	... 13th	2.4
... 14th	5.3	... 20th	3.8
... 21st	4.1	... 27th	4.3
... 28th	4.2	May 4th	2.9
Nov. 4th	5.8		

Statement showing the Average Temperature and Humidity in Weekly periods at Coimbatore.

(Figures taken from Government meteorological reports.)

Week ending on	Average Temperature.	Average Humidity.	Week ending on.	Average Temperature.	Average Humidity.
May 6th 1911	85.9	88.3	November 4th.1911	77.6	87.3
" 13th "	87.0	85.5	" 11th "	78.7	91.1
" 20th "	84.8	90.0	" 18th "	78.2	89.3
" 27th "	84.8	90.1	" 25th "	76.5	93.4
June 3rd "	81.6	87.9	December 2nd "	76.2	87.7
" 10th "	80.2	83.4	" 9th "	76.6	92.4
" 17th "	77.6	88.4	" 16th "	73.0	92.3
. 24th "	76.5	91.9	" 23rd "	73.9	90.0
Jly.1st "	80.5	85.7	" 30th "	75.0	90.9
" 8th "	78.1	89.9	January 6th 1912	70.6	80.9
" 15th "	77.2	88.7	" 13th "	70.7	76.6
" 22nd "	74.7	74.9	" 20th "	76.4	79.0
" 29th "	78.6	83.3	" 27th "	74.5	82.1
Aug.5th "	78.6	79.1	February 3rd "	78.5	85.3
" 12th "	79.3	92.4	" 10th "	80.6	88.4
" 19th "	78.4	88.7	" 17th "	81.4	87.4
" 26th "	78.8	90.9	" 24th "	80.6	90.1
Sep.2nd "	79.0	90.3	March 2nd "	83.2	90.3
" 9th "	80.7	89.6	" 9th "	83.3	89.0
" 16th "	81.0	83.1	" 16th "	83.5	75.3
" 23rd "	80.4	88.6	" 23rd "	84.5	89.9
" 30th "	80.1	88.7	" 30th "	85.0	90.0
Oct.7th "	81.1	86.7	April 6th "	85.9	87.3
" 14th "	81.3	87.6	" 13th "	86.6	81.6
" 21st "	77.9	90.8	" 20th "	87.0	90.0
" 28th "	77.9	78.5	" 27th "	86.7	88.3
			May 4th "	86.2	85.3

Statement showing Average Temperature and Humidity for Fortnightly periods at Coimbatore.

(Figures taken from Government Meteorological reports)

Fortnight Ending on	Average Temperature.	Average Humidity.
May 13th 1911	86.4	86.9
,.. 27th "	84.8	90.0
June 10th "	80.9	85.6
... 24th "	77.0	91.1
July 8th "	79.3	87.8
" 22nd "	76.0	81.8
Aug. 5th "	78.6	81.2
" 19th "	78.9	90.6
Sept. 2nd "	78.9	90.6
" 16th "	80.9	86.3
" 30th "	80.3	88.6
Oct. 14th "	81.2	87.1
" 28th "	77.9	84.6
Nov. 11th "	78.1	89.2
" 25th "	77.3	91.3
Dec. 9th "	76.4	90.0
" 23rd "	73.4	91.1
Jan. 6th 1912.	72.8	85.9
" 20th "	73.5	77.8
Feb. 3rd "	76.5	83.7
" 17th "	81.0	87.9
Mar. 2nd "	81.9	90.2
" 16th "	83.4	82.1
" 30th "	84.7	90.0
Apr. 3rd "	83.3	84.4
" 27th "	86.8	89.1
May 11th "		

Statement showing the number of Plague Deaths in Coimbatore Municipality in Weekly Periods.

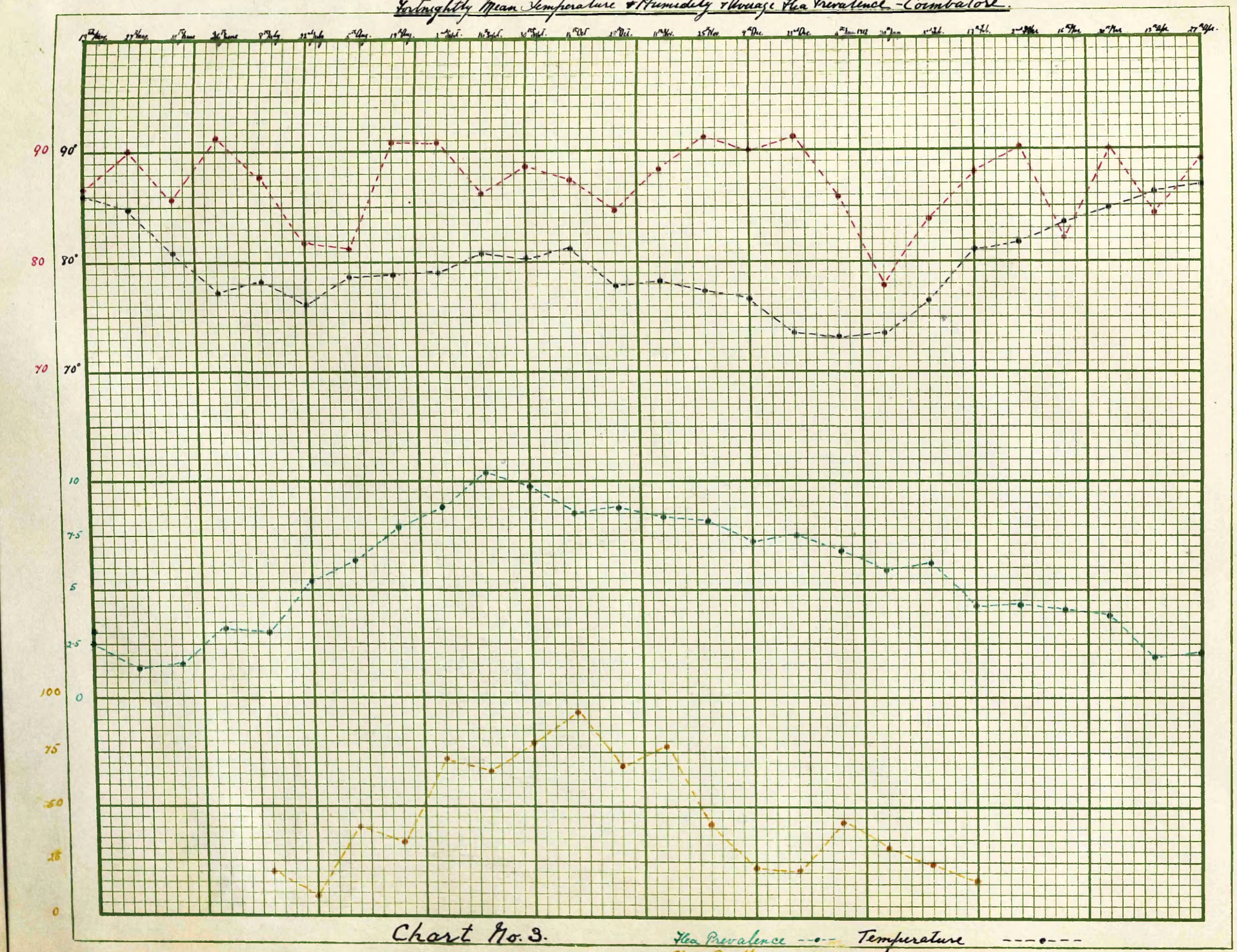
(Figures taken from Municipality reports)

Week Ending on	Plague Deaths	Week Ending on	Plague Deaths.
May 6th 1911	nil	November 11th 1911	34
" 13th "	1	" 18th "	31
" 20th "	-	" 25th "	11
" 27th "	-	December 2nd "	9
June 3rd "	-	" 9th "	13
" 10th "	-	" 16th "	12
" 17th "	-	" 23rd "	9
" 24th "	-	" 30th "	19
July 1st "	8	January 6th 1912	24
" 8th "	12	" 13th "	14
" 15th "	4	" 20th "	17
" 22nd "	4	" 27th "	15
" 29th "	15	February 3rd "	9
Aug. 5th "	25	" 10th "	10
" 12th "	20	" 17th "	6
" 19th "	14	" 24th "	-
" 26th "	36	March 2nd "	-
Sept. 2nd "	36	" 9th "	-
" 9th "	31	" 16th "	-
" 16th "	35	" 23rd "	-
" 23rd "	44	" 30th "	-
" 30th "	35	April 6th "	-
Oct. 7th "	45	" 13th "	-
" 14th "	48	" 20th "	-
" 21st "	34	" 27th "	-
" 28th "	35	May 4th "	-
Nov. 4th "	43		

Statement showing the number of Plague Deaths in the Coimbatore Municipality in Fortnightly Periods.

(From Municipality reports)

Fortnight ending on	Plague Deaths.
May 13th 1911	1
" 27th "	nil
June 10th "	nil
" 24th "	nil
Jly. 8th "	20
" 22nd "	8
Aug. 5th "	40
" 19th "	34
Sept. 2nd "	72
" 16th "	66
" 30th "	79
Oct. 14th "	93
" 28th "	69
Nov. 11th "	77
" 25th "	42
Dec. 9th "	22
" 23rd "	21
Jan. 6th 1912	43
" 20th "	31
Feb. 3rd "	24
" 17th "	16
Mar. 2nd "	nil
" 16th "	nil
" 30th "	nil
Apr. 13th "	nil
" 27th "	nil
May 11th "	nil


Fortnightly Mean Temperature & Humidity & Average Flea Prevalence - Coimbatore.
90
80
70
90°
80°
70°
10
7·5
5
2·5
0
100
75
50
25
0
Chart No. 3.
Flea Prevalence
Plague Deaths
Temperature
Humidity
ALLIANCE SERIES

14

Observations in Madura.

Madura is the Head Quarters of the District of the same name, and is the largest City in the South of India. It is the second largest City in the Madras Presidency, with a population of 105,984 according to the 1901 Census and according to the Census of 1911.

Its famous temples are an object of Pilgrimage to large numbers of Hindus annually from all parts of India, and it is also an important industrial and trading centre.

It is situated on the main line of the South Indian Railway at an elevation of 447 feet above Sea Level.

After Cuddapah and Tinnevelly it is one of the hottest cities in the Presidency, and it will be seen from Chart No. 9. which gives the Normal Temperature and Humidity that its lowest Normal Temperature is 77.7°F. and that the Temperature is only below 80°F. for 7 weeks in the year.

The highest Normal Humidity is 75.7%.

Madura has never suffered from Plague, and on this account was chosen as a control to our work in Places which have had Epidemic Plague.

The nearest place to Madura which has had Plague, is Dindigul, a town on the South Indian Railway within 2 hours' journey by rail from Madura. There is a great deal of traffic between the two places, and Dindigul sent 18,702 Maundas of Grain and 45,964 passengers to Madura in the year 1910 in which it suffered from Plague.

The house construction in Madura is very similar to that in other towns in the South of India, the commonest type of house being composed of brick walls on a low plinth with a roof of country tiles. There are also a large number of well built houses with cemented walls and floors and flat terraced roofs. These houses, like the similar ones in Vaniambadi, harbour large numbers of rats, and for the same reasons.

Operations were commenced in Madura on 17th April 1911, and continued until 13th April 1912. Trapping was at first started with 130 traps, the number being later increased to 250 and then reduced to 200. Opposition to trapping was met with in some quarters of the town, and some small areas had to be omitted from the scope of our work, but the trapping results gives a fair idea of the rat population of the town as a whole.

The rat population of Madura, as shown by the number of rats per 100 traps, is greater than any of the other places in the Presidency in which a continuous year's trapping was carried out. The lowest weekly average of rats per 100 traps was 17.7 and the highest was 52.7. The average for the whole year was 30. The flea prevalence varied from a weekly average of 2.8 to 7.7 and formed a flat curve. The lowest and highest fortnightly averages were 3.5 and 6.8 respectively. The lowest flea prevalence occurred in the hottest months, and the highest followed the coldest period with a humidity of about 80.

There was no marked correspondence between the flea curve and the curve of Relative Humidity. The Flea Curve corresponds more with the inverse curve of the Temperature.

A comparison of the Temperature and Humidity curves for the year with the normal curves will show that the Temperature was lower and the Humidity considerably higher than the Normal, and it is possible that this lower Temperature and higher Humidity produced a higher flea prevalence than the Normal.

A test of the susceptibility of the rats from Madura in comparison with rats from other parts of India was made, and they were found to be 100 per cent susceptible to a dose of B.Pestis which only killed 20 per cent Cawnpore rats and 45 per cent Bombay rats.

Madura.

Rats per 100 Traps -- Weekly Average.

April	22nd	38.7	Oct.	21st	21.3
....	29th	34.6	....	28th	32.2
May	6th	52.7	Nov.	4th	33.4
...	13th	36.5	....	11th	36.1
...	20th	46.7	...	18th	32.1
...	27th	42.5	...	25th	36.2
June	3rd	31.7	Dec.	2nd	33.2
...	10th	17.7	...	9th	28.9
...	17th	20.6	...	16th	32.4
...	24th	18.9	...	23rd	32.3
July	1st	17.6	...	30th	35.1
...	8th	22.3	Jan.	6th	34.4
...	15th	23.0	...	13th	35.2
...	22nd	17.7	...	20th	39.3
...	29th	22.3	...	27th	29.5
Aug.	5th	22.3	Feb.	3rd	27.2
...	12th	24.1	...	10th	30.3
...	19th	24.7	...	17th	33.2
...	26th	29.3	...	24th	34.9
Sept.	2nd	29.7	Mch.	2nd	34.3
...	9th	30.8	...	9th	32.2
...	16th	27.2	...	16th	28.0
...	23rd	27.6	...	23rd	30.1
...	30th	26.2	...	30th	21.4
Oct.	7th	21.4	Apr.	6th	32.8
...	14th	36.3	...	13th	33.9

Madura.

Weekly Average Fleas per Rat.

April	22nd	3.4	Oct.	21st	4.0
...	29th	3.6		28th	4.2
May	6th	4.2	Nov.	4th	5.2
...	13th	2.8	"	11th	5.3
...	20th	3.6		18th	4.7
...	27th	3.6		25th	4.7
June	3rd	3.0	Dec.	2nd	5.3
...	10th	4.4		9th	5.7
...	17th	3.2		16th	5.0
...	24th	3.8		23rd	5.2
July	1st	4.9		30th	5.9
...	8th	3.7	Jan.	6th	5.4
...	15th	4.3	"	13th	5.9
...	22nd	3.7	"	20th	6.3
...	29th	3.8	"	27th	6.4
August	5th	4.7	Feb.	3rd	5.5
...	12th	3.9	"	10th	6.4
...	19th	4.2	"	17th	5.9
...	26th	3.8	"	24th	6.6
Sep.	2nd	3.3	Mch.	2nd	6.9
...	9th	4.0	"	9th	7.7
...	16th	3.6	"	16th	5.9
...	23rd	3.3	"	23rd	5.6
...	30th	4.6	"	30th	4.9
Oct.	7th	4.9	Apr.	6th	4.1
...	14th	5.0	"	13th	3.4

Madura

Fortnightly Average Fleas Per Rat.

Fortnight Ending.	
April 29th	3.5
May 13th	3.7
May 27th	3.6
June 10th	3.6
June 24th	3.6
July 8th	4.2
July 22nd	4.0
Aug. 5th	4.3
Aug. 19th	4.0
Sept. 2nd	3.6
Sept. 16th	3.8
Sept. 30th	3.9
Oct. 14th	4.9
Oct. 28th	4.1
Nov. 11th	5.2
Nov. 25th	4.7
Dec. 9th	5.5
Dec. 23rd	5.1
Jan. 6th	5.6
Jan. 20th	6.1
Feb. 3rd	6.0
Feb. 17th	6.1
Mch. 2nd	6.8
Mch. 16th	6.6
Mah. 30th	5.3
April 13th	3.7

Madura.

Weekly Mean Temperature and Humidity.

Week Ending	Mean Temp.	Meam Humidity.
22nd April.	F 87.7°	71
29th "	89.6	66
6th May	90.5	70
13th "	91.4	66
20th "	91.5	63
27th "	90.1	68
3rd June	89.3	69
10th "	85.2	78
17th "	82.1	70
24th "	85.4	68
1st July	87.6	66
8th "	86.6	64
15th "	84.3	65
22nd "	82.6	71
29th "	86.2	67
5th Aug.	87.2	64
12th "	87.7	61
19th "	87.2	61
26th "	87.0	62
2nd Sept.	87.4	65
9th "	85.6	67
16th "	85.8	72
23rd "	84.0	69
30th "	85.8	65.

Week-Ending	Mean Temp.	Mean Humidity.
7th Oct.	85.1	71
14th "	85.7	75
21st "	81.7	83
28th "	81.8	73
4th Nov.	81.8	76
11th "	81.6	75
18th "	80.0	82
25th "	78.9	90
2nd Dec.	81.3	80
9th "	79.7	90
16th "	78.0	81
23rd "	77.0	82
30th "	76.3	85
6th Jan.	74.5	74
13th "	75.4	78
20th "	78.8	83
27th "	77.5	76
3rd Feb.	83.2	82
10th "	89.0	85
17th "	88.2	81
24th "	84.4	78
2nd March	89.1	75
9th "	87.5	75
16th "	85.0	64.7
23rd "	86.3	72.6
30th "	87.6	72.6
6th April	88.8	76.6
13th "	89.0	76.1
20th "	89.8	76.6

Madura.

Fortnightly Average Temperature and Humidity.

Fortnight Ending	Mean Temp.	Mean Humidity.
29th April 1911	88.6	68.5
13th May "	90.9	68.0
27th " "	90.8	65.5
10th June "	87.2	73.5
24th " "	83.7	69.0
8th July.	87.1	65.0
22nd " "	83.4	68.0
5th Aug. "	86.7	65.5
19th Aug. "	87.4	61.0
2nd Sept. "	87.2	63.5
16th " "	85.2	69.5
30th " "	84.9	67.0
14th Oct. "	85.4	73.0
28th " "	81.7	78.0
11th Nov. "	81.7	75.5
25th " "	79.4	86.0
9th Dec. "	80.5	85.0
23rd " "	77.5	81.5
6th Jan. "	75.4	79.5
20th " "	77.1	80.5
3rd Feb. "	80.4	79.0
17th " "	88.6	82.0
2nd March "	86.8	76.5
16th " "	86.7	69.8
30th " "	86.9	72.6
13th April "	88.9	76.4

Fortnightly Mean Temperature & Humidity & Average Flea Prevalence — Madura.

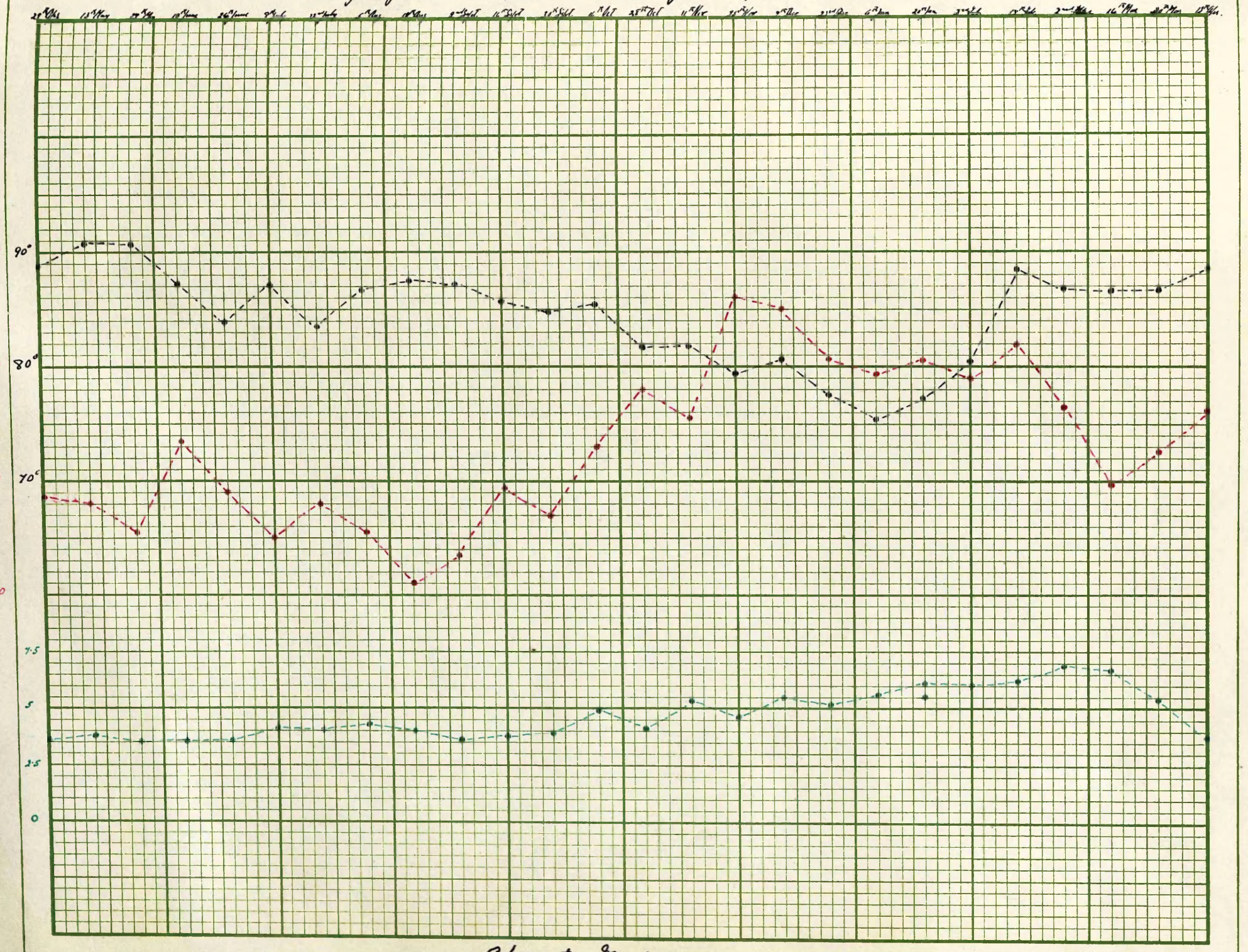


Chart No 4.

Temperature
Humidity
Flea Prevalence

ALLIANCE SERIES

Other Observations on Rat & Flea Prevalence.

In addition to the systematic observations in the four main centres just described, observations on a smaller scale were also made at the following places:-

On the Nilgiri Hills - at OOtacamund and Conoor.

On the West Coast - at Mangalore, Calicut, & Cochin.

At scattered points in the Presidency - Bellary, Trichinopoly, Vizianagram & Cuddalore.

At some of these places the observations were made personally for short periods, and at others the work of counting fleas was left in the hands of a Native Sanitary Inspector whose work was supervised at intervals.

Nilgiri Hills.

Ootacamund.

Two observations were made as follows:-

	M. Rattus per 100 traps	Average Fleas per M. Rattus.
3rd August to 15th August 1911.	6.0	4.2
16th November to 26th November 1911.	4.5	2.5

Continuous Observations made by the Sanitary Inspector gave the following figures.:-

Month	Average Fleas per M. Rattus.
Aug. 1911.	4. 2
Nov.	3. 9
Dec.	3. 5
Jan. 1912.	3.4
Feb.	2. 1
Mar.	1. 3
Apr.	0. 9
May.	0. 9

Of the Fleas examined.

58.6% were Xenopsylla Cheopis.

Of the Fleas examined.

58.6% were Xenopsylla Cheopis.
22.4% " Ceratophyllus Fasciatus.
7.9% " Ctenopsylla Musculi

The remainder were Ctenocephalus Felis, and Pulex Irritans.

Conoor

The Monthly flea prevalence was as follows:-

Month	Average Fleas per M. Rattus.
May 1911.	4.0
June	4.2
July	3.0
Aug.	3.2
Sept.	3.2
Oct.	6.3
Nov.	5.0
Dec.	7.6
Jan. 1912.	3.4
Feb.	4.9
Mar.	3.7
April.	3.1

Of the Fleas on M. Rattus.:-

76.9% were Xenopsylla Cheopis
12.5% " Ceratophyllus Fasciatus
6.9% " Ctenopsylla Musculi
3.7% " A species of Pygeopsylla

West Coast:

Mangalore.

Three Observations gave the following results:-

	M. Rattus per 100 traps.	Average Fleas.
29th June to 15th July 1911.	2.3	4.5
10th Sept. to 21st Sept.1911.	2.7	4.3
20th Jan. to 29th Jan.1912.	2.5	5.9

Calicut.

Three Observations gave the following results:-

	M. Rattus per 100 Traps.	Average Fleas.
21st to 28th June 1911.	24.4	4.0
30th August to 9th Sept. 1911.	13.4	3.1
7th to 16th Jan. 1912.	15.1	4.1

The continuous flea count made by the Sanitary Inspector gave the following monthly averages:-

	Average fleas per M. Rattus.
June 1911.	4.0
July	4.2
Aug.	3.3
Sept.	3.4
Oct.	3.7
Nov.	4.6
Dec.	3.8
Jan. 1912.	4.3
Feb.	5.3
Mar.	6.
Apr.	4.6
May.	5.0

Cochin

Two Observations were made as follows:-

	M. Rattus per 100 traps.	Average Fleas.
5th to 19th Feb. 1912.	7.6	2.3
11th to 22nd May	3.4	1.6

Bellary.

This town was visited on four occasions for the purpose of taking flea counts.

	Average Fleas per rat.
4th to 13th Oct.	5.5
11th to 20th Nov.	5.6
20th to 29th Jan.	7.3
13th to 22nd March.	2.6

Vizianagram.

This town is situated on Vizagapatam District in the Northern Circars. It gave the highest Rat Prevalence of any place visited in the Presidency as judged by the figure of "Rats per 100 traps set". The following are the figures of Rat and Flea Prevalence at one visit.

23rd Feb. to 3rd March, 1912.

Rats per 100 traps.	Average Fleas.
79.1	4.4

Trichinopoly

This town was visited once and the Rat and Flea Prevalence was as follows:-

13th to 20th Oct. 1911.

Rats per 100 traps.	Average Fleas.
26.5	2.5

Cuddalore.

One Observation gave the following figures.

16th to 28th Oct. 1911.

Rats per 100 traps.	Aver. Fleas.
25.3	6.1

Table No. w.16

Table showing the plague attacks and deaths in the Callicut Municipality.

th	1908 Attacks	1908 Deaths	1909 Attacks	1909 Deaths	1910 Attacks	1910 Deaths	1911 Attacks	1911 Deaths	Total for 4 years Att.	Total for 4 years Deaths.	Average for 4 years from Jan.08 to Dec.1 Attacks	Average for 4 years from Jan.08 to Dec.1 Deaths
uary.	Nil	Nil.	Nil	Nil	Nil	Nil	5	2	5	2	1.3	.3
ruary	11	10	Nil	Nil	Nil	Nil	13	8	24	18	6.0	4.5
ch	141	120	Nil	Nil	Nil	Nil	44	34	185	154	46.3	38.5
il.	78	66	Nil	Nil	Nil	Nil	8	7	86	73	21.5	18.3
	2	Nil	Nil	Nil	Nil	Nil	Nil	Nil	2	Nil	.5	Nil
e	7	7	Nil	Nil	Nil	Nil	Nil	Nil	7	7	1.8	1.8
y	Nil	Nil	27	21	Nil	Nil	Nil	Nil	27	21	6.8	5.3
st	Nil	Nil	69	47	Nil	Nil	1	1	70	48	17.5	12.0
ember	Nil	Nil	4	3	Nil	Nil	Nil	Nil	4	3	1.0	.8
ber.	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil
mber	Nil	Nil	Nil	Nil	7	7	Nil	Nil	7	7	1.8	1.8
mber	Nil	Nil	Nil	Nil	15	14	Nil	Nil	15	14	3.8	3.5

Table No. W8.

Table showing the Plague attacks and deaths in the Mangalore Municipality 1902.-1912.

1902		1903		1904		1905		1906		1907		1908		1909		1910		1911		1912		Total per 10 years from Jan. 1902 to Dec.1911.		Average 10 years from Jan. 1902 to Dec.1911	
A.	D.	A.	D.	A.	D.	A.	D.	A.	D.	A.	D.	A.	D.	A.	D.	A.	D.	A.	D.	A.	D.	At.	D.	At.	D.
0.	0.	2	2	63	51	59	43	5	4	10	6	5	5	5	3	29	22	32	21	34	23	244	182	24.4	18.2
0	0	0	0	50	43	105	76	17	12	13	11	4	3	9	6	20	14	37	34			255	199	25.5	19.9
0	0	15	10	86	66	153	125	43	36	17	13	11	6	23	17	39	31	33	23			420	327	42.0	32.7
0	0	18	20	45	34	173	144	44	34	8	6	13	12	5	3	19	16	18	18			343	287	34.3	28.7
9	9	19	16	19	15	21	17	6	5	6	6	10	10	1	1	10	10	0	1			101	90	10.1	9.0
61	51	19	18	20	19	16	10	1	0	5	5	6	5	2	2	0	0	3	3			133	113	13.3	11.3
183	161	79	68	42	33	20	17	5	4	13	9	15	13	3	3	0	0	0	0			360	308	36.0	30.8
st 283	232	65	54	38	32	18	18	7	5	15	15	65	53	3	3	0	0	3	2			497	414	49.7	41.4
267	234	35	27	23	20	16	11	19	13	30	22	56	41	3	3	1	1	8	7			458	379	45.8	37.9
128	102	37	26	8	6	10	10	14	13	7	8	36	32	25	20	11	9	1	1			277	227	27.7	22.7
18	14	28	19	2	2	8	7	18	16	5	3	9	4	9	9	17	15	6	5			120	94	12.0	9.4
0	0	30	23	14	8	4	3	3	3	"	1	18	14	18	13	24	17	16	13			127	95	12.7	9.5

Table showing the Plague Attacks and Deaths in the Coonoor Municipaility.

Month	1903		1904		1905		1906		1907		1908		1909		1910		1911		1912		Total Average for 7 years from 1905 to 1911.			
	Att.	Ds.	At.	D.	At.	D.	At.	D.	At.	D.	At.	D.	At.	D.	At.	D.	At.	D.	A.	D.	A.	D.	A.	D.
January				8					2	2			21	14			2	2	5	4	30	22	4.3	3.1
February				2					1	-			8	7			-	-			9	7	1.3	1.0
March				1					-	-			3	2			-	-	-	-	3	2	0.4	0.3
April				-					-	-			-	-			4	3			4	3	0.6	0.4
May				1					-	-			2				-	-	-	-	2	0	0.3	-
June				-					-	-			10	8			-	-	-	-	10	8	1.4	1.1
July							6	-	-	-			1	1			2	1	-	-	9	2	1.3	0.3
August	-	1	-		17	13	1	-	-	-					7	5	1	-	-	-	26	18	3.7	2.6
Sept.	-	1	-		32	19	-	-	-	-	4	4	-	-	5	4	24	18	-	-	65	45	9.3	6.4
Oct.	-	39	2		26	10	4	4	-	-	3	3	4	4	1	1	8	3			46	25	6.6	3.6
Nov.		60	-		6	4	5	4	-	-	3	2	3	2	1	-	8	5			26	17	3.7	2.4
Decem.		16	-		4	1	1	1	-	-	6	3	-	-	2	1	5	5			18	11	2.6	1.6

Relation of Plague Distribution to Climatic Conditions, Elevation, Flea Prevalence, and Communications.

Putting aside the high plateau of the Nilgiri Hills and the West Coast Districts for later discussion, it has been shown that in the rest of the Presidency only the more elevated parts have suffered from Plague, and that the highest of those areas are those in which plague continues in Endemic Form. It has also been shown that at the elevations of 1000 and 2000 feet, rural Plague has been extremely slight except in Bellary District. The degree of severity of Plague all over a district rather than the occurrence of occasional large outbreaks in a few large towns may safely be taken as an index of the suitability of the area for Plague, (in most cases) where no special cause of factor permitting the continuous importation of infection from outside the area exists. Also the regularity of Plague from year to year and its occurrence at a fairly regular level in the same month in each year, together with the occurrence of a certain number of cases in the off-season months in all years, will shew that the area is suitable for the continuance of Plague. On the other hand the occurrence of occasional severe epidemics with a very marked seasonal prevalence and a marked tendency to disappear in the hot weather, (and) the irregularity of epidemics from year to year, and the absence of Plague deaths in many months throughout a period of several years after Plague has first entered the District, will show that, although severe epidemics can occur, the conditions are not favourable to the continuance of Plague in Endemic form. A comparison of the tables of monthly Plague Deaths for Mysore State, Hosur Taluq, Kollegal Taluq, and Bellary District will show that, immediately on the first introduction of Plague into Mysore, it obtained a good hold and continued with considerable regularity from the start, all months returning deaths up till the end of 1910, and most months (returning a considerable number even in the off-season months) in some years. The epidemics in this State were never so severe as some of those which have occurred in Bellary District, but they have been more regular/

regular and continuous, and the average of all years is higher than in Bellary.

In Bellary District although Plague was introduced in 1898 and obtained a slight hold, Plague did not assume epidemic proportions till the end of 1901, 18 of the months in the interval not returning a single death. Then followed four years of very severe epidemic Plague, but in only two of these years the hottest month returned more than 1 death. Another moderate outbreak followed in 1907 after which Plague was very slight. Plague has thus occurred in severe epidemic form in Bellary District but has not carried over from year to year with any regularity and has had the greatest difficulty in carrying over even in the most severe epidemic years when a large number of centres would be left infected at the beginning of the Hot Weather.

Even considering that the population of Mysore State is six times that of Bellary District the tendency to carry over in the off-season is very well marked in this state in comparison. In the Hosur Taluq, with a population only a fifth of that of Bellary District, Plague is particularly indigenous and carries over fairly well throughout the year.

The still smaller Taluq of Kollegal with a population only a tenth of Bellary returned deaths in nearly all months of the year in which it was infected and a considerable number in the offseason months in many cases. With its very small scattered population however, plague died out in some years and fresh importation was necessary and Plague then followed a similar course when re-imported. The population of this Taluq is too small and scattered to make it a completely indigenous area.

It may be said that in any place in which the mean temperature goes below 80° Plague can become epidemic when once successfully imported, this is, when a plague epizootic has been started, and the longer the period of mean temperature below 80° and the further the temperature dips below this level the greater the likelihood of a severe epidemic . If the period below 80° is short and thetemperature rises rapidly towards 90° the epidemic will become limited in duration and the chances of it carrying over the hot-weather will become less and less the higher the temperature rises. These changes will be in-

creased/

increased somewhat if the epidemic has been severe during the cold weather period and if a large number of centres have been infected at this time. Now in Bellary District the Normal Mean Temperature is below 80° for about 4 months of theyear and the temperature comes down 73°. The Kurnool District has a very similar temperature curve but has not suffered much from Plague while Bellary has suffered severely. Anantapur has a slightly less marked cold weather than Bellary District and Cuddapah is still hotter. The Cold Weather in the Central Districts is not very marked and the Normal Mean Temperature comes down to about 75° on an average. The East Coast Districts are still warmer except actually on the sea-board, and the Southern Districts have practically no hot weather, the Normal Mean Temperature being still higher in the cold weather months in these Districts.

These Districts are thus unfavourable in the reverse of the order in which they are given, and none of them except the Bellary and Kurnool Districts can be said to approach the temperature conditions which we have found favourable to plague in other parts of India, and even these two Districts are not very favourable so far as temperature goes. The total deaths in Bellary and Kurnool Districts are less than the deaths in Poona city in the same period.

The rural plague death rate in all these Districts except Bellary is extremely low and is practically nil in the Southern Districts and in the East Coast Districts.

The most northerly parts of the Presidency in the Districts of Ganjam and Vizagapatam present temperatures of the Bellary type but are well removed from centres of infection.

Contrast these temperature conditions with what is found on the Mysore Plateau, including the Taluqs of Hosur and Kollegal. Here we have a Normal Mean Temperature which is below 80° for 10 months of the year and goes down as low as 67°. The mean temperature is never much above 80°. The temperature curve here is very like that of some other parts of India in which there has been severe plague and is almost exactly similar to that of Belgaum. Its hot weather is not so marked as Poona.

In a previous section of this report we have shown the effect of elevation

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on temperature and the relation of the distribution of plague to elevation, and must now enumerate certain facts with regard to the effect of climate on the rat flea and on the plague bacillus before considering the relation of climate and flea prevalence to one another and to the distribution of plague.

The facts to notice are:-

(A) In relation to the length of life and the breeding of fleas.

(1) the rat flea lives longest at low temperatures. If the temperature be sufficiently low (50° or 60°) it may live for several months. At higher temperatures the life of the flea is correspondingly shortened. When moderately high temperatures (about 80°) are reached a high degree of relative humidity helps to lengthen the life of the flea. I. II. III Ref.

(2) At high temperatures the breeding of the flea is interfered with, and it is also less active at very low temperatures. IV

(3) At temperatures between 65° and 80° breeding is active and the length of life of the flea is considerable, the lower temperatures being the most favourable. At temperatures between 70° and 75° a high flea population will be thus established.

(4) A long period of temperature just somewhat below 80° will have somewhat a similar effect on the establishment of a flea population as a short dip of several degrees lower, a summation of breeding impulses occurring in the first case and taking a longer time to act.

(B) The effect of temperature on the Plague Bacillus.

(1) The Plague bacillus in the flea's stomach disappears rapidly at temperatures over 80° and at a temperature of 90° its disappearance is most rapid. V At temperatures below it persists longer. At 70° it will remain in the flea's stomach for a considerable time.

(2) The highest degree of septicaemia is developed in rats when the temperature is about 75° or 76°, a lesser degree developing at temperatures over and under this. VI At very low temperatures the degree of septicaemia developed is slight.

Applying/

Applying these facts to the climatic conditions prevailing in the different parts of the Presidency and considering their relation to the problem of the distribution of plague the following would be the deductions made.

At the 3000 feet level of the Mysore Plateau including Hosur and Kollegal Taluqs the low temperature in this area for the greater part of the year will make the length of life of the flea greater than in any other part of the Presidency except in the Nilgiri Hills. A flea carrying plague bacilli in its stomach will thus be likely to survive long enough when transported from one place to another even at a considerable distance to start an epizootic amongst fresh rats. In addition the long life of the flea at these temperatures and the suitability of the climatic conditions to active flea breeding will result in the establishment of a large flea population and a high flea prevalence per rat, which we actually find to be the case. The number of fleas available for carrying infection will be great and the chances of importation within the cool area will be correspondingly increased, and when infection is once imported the large number of fleas present will still further increase the likelihood of the continuance of the epizootic. In addition the degree of septicaemia developed by the rats at the climatic conditions prevailing at this level will be fair in most months and high for a considerable part of the year, and the rate of disappearance of the plague bacillus from the fleas stomach will never be rapid. The conditions will thus be favourable for the carrying on of plague throughout the year and its occurrence in epidemic form in some seasons, the temperature never being high enough to affect the degree of septicaemia developed by the rats, the length of time of persistence of the bacillus in the flea, or the length of life of the flea, very adversely, all at the same time.

In Bellary District the high temperature and the low humidity throughout the greater part of the year will be adverse to the long life of the flea and also to active breeding, so that the flea prevalence will be very low for many months, and the distance over which the rat flea can be successfully transported alive will be short in these hot months. Also the total number of fleas available for carrying infection being low and the bacillus disappearing rapidly from the fleas stomach, the chances of successful

successful importation of infection will be further reduced.
With the onset of the cold weather the flea prevalence will rise for 3 or 4 months but will not reach a great height, the number available to breed from being small.
In the coolest months the length of life of the flea will be moderate and the degree of septicaemia developed by the rats will be high, so that a severe epidemic will be possible when a successful importation has taken place. The transmission of infection from place to place will, however, never be so easy as at the climatic conditions prevailing at the 3000 feet elevations, the length of life of the flea being shorter at the higher temperatures of Bellary Districts; but with a large number of villages in the same elevated area it will be sufficient for spread at short distances.
The length of life of the flea may be read, for epidemiological purposes, as the distance over which it can be successfully transported alive, and it is noticeable that the further one passes away from the infected parts of Bombay Presidency and away from the Railway line in this Deccan area the less prevalent plague becomes. In Bellary District the Taluqs furthest away from the Railway have suffered least, and the adjoining Taluqs in the Anantapur and Kurnool Districts have suffered very little. It appears that while Plague infection once implanted will cause a severe epidemic, the distance over which it can be carried is short under the climatic conditions prevailing in this area. The Railway lines act as shortners of distance, and plague to a certain extent follows these lines, but even on the railways it does not go very far.
The Anantapur and Kurnool Districts show very similar climatic conditions to Bellary, Anantapur having a slightly less marked cold weatner.
Plague does not carry far into these Districts; only the Taluqs adjoining Bellary Districts suffering, and these only slightly. Gooty and Anantapur towns on the line have suffered to some extent, an occasional big outbreak having occurred. The Southern Taluqs of Anantapur are probably infected from Mysore side, and the highest Taluq with the Railway running through it has suffered most.
Anantapur and Tadpatri Taluqs are almost equally distant ~~distant~~ by rail from

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the infected areas of Bellary Districts but only the higher lying Taluq has suffered from Plague. Tadpatri is a larger town than Anantapur and on the more important railway line, but being lower-lying and hotter than Anantapur, where the temperature conditions are not favourable to importation of plague infection, it is still less favourable.

Following down the main line of the M. & S.M. Railway through Tadpatri, it passes on into the hot Cuddapah valley and continues at a low level right right through to the East Coast Districts. This is the main line of the communication of these Districts with Bellary Districts and Bombay Presidency, and any fleas carrying infection from these areas will be submitted to conditions very unfavourable to survival, especially when removed from their hosts, for the whole period in which they are carried through. It has been shown that the conditions are unfavourable for the carriage of infection for more than very short distances even in the areas immediately around Bellary District, and the even less favourable temperature conditions along this railway through Cuddapah and into the East Coast and the further distance from infected centres makes it extremely unlikely that these places will be successfully infected.

The higher-lying and cooler Southern Taluqs of Cuddapah District are the only parts which have suffered from plague where they adjoin Mysore State, with which, however, they have no direct railway communication. A comparison of the large contour map of the Presidency with the figures of "Taluq distribution of Plague" will show that, although practically all the Taluqs at an elevation of over 2000 feet have suffered in some degree, the only Taluqs outside Bellary District which have suffered at all severely are those very small areas at an elevation of 3000 feet in Hosur and Kollegal. We have already shown in what way these places are specially suitable for plague, and even in the absence of railway communications plague infection can be carried for considerable periods.

Coming to the North Arcot and Salem Districts we find that excluding Hosur Taluq, the cold weather is even less marked here than in the

Deccan/

Deccan area, the lowest normal mean temperature being on an average 2 degrees higher than in Bellary District and in this way still less favourable to the prolonged life of the flea and to successful importation to infection. These districts are infected from Mysore State from which the M. & S.M. Railway runs down to Jalarapet in Tirupattur Taluq, from which junction it continues North-East through North Arcot and the S.I. Railway runs south through Salem District. In no part of these Districts has rural plague been other than extremely slight. On the other hand, occasional severe outbreaks have occurred in 5 or 6 of the large towns on the railway line. In Salem Districts these epidemics occurred in the largest towns within the shortest distance of Mysore, Vaniambadi and Tirupattur, in the earliest years, Vaniambadi being infected in 1901-1913 and Tirupattur in 1903-1905. Salem further off was not infected till 1910.

Plague followed a similar course in North Arcot, the towns of Vellore and Ambur having severe outbreaks, but Rural Plague being even less in this District than in Salem District. Although Vellore lies below 1000 feet, its distance from Mysore by rail is less than that of Salem town, and infection in this case has carried far enough to produce plague below the 1000 feet level. It, however, does not carry much further along the line at this level, Arni Taluq close by and within a very short Railway journey, having had a very limited outbreak of 180 deaths of very short duration, places further off practically escaping.

The peculiarity of the distribution of plague in large towns and the occurrence of severe epidemics in these towns especially on the line of Rail, as contrasted with the slightness of plague in the rural areas in their neighbourhood, under the climatic conditions which we have found to be unfavourable to the successful importation of plague, which conditions prevail in these Central Districts, is explained in the following manner:— When the conditions are unfavourable for the importation of infection the greater the number of attempted importations the greater the chance of one of them being successful.

In large towns with a large human and grain traffic the number of attempted/

attempted importations will be greater than in similar towns and villages with less traffic, and the larger and more important the town is, and nearer it is situated to the infected area and to the railway line, the greater the chance of a successful importation. The climatic conditions have been shown to be suitable for the occurrence of epidemic plague in these central Districts although not favourable for importation. Once an epizootic has been successfully started in one of the large Municipalities in this area we may have an Epidemic of 1000 cases or more. If the successful importation had occurred in a small village the result might be an epidemic of 40 or 50 cases, yet from the point of view of importation of plague each of these outbreaks only represents one successful importation. Also the chances of this successful importation into the small towns or villages is much less than in the large Municipalities, and a very large number of successful importations would require to take place into a large number of villages to make the rural plague death rate as severe as that of the large towns. The history of plague in these areas shows that, even when plague was severe in the few large Municipalities, the rural areas around them suffered very slightly. Within the limits of an infected town the conditions present will permit of transference of infection from place to place once an epizootic has commenced at the right seasons, the distance over which infection requires to be transmitted to continue an epizootic in the town area being very slight. When it comes to transporting infection to villages and towns in the neighbourhood, the factors adverse to the life of the flea and to transmission have an opportunity of coming into play. Not that these factors during the cold weather have the power to stop transmission entirely to places close by, but they very much limit extent and severity. The quick onset of the hot weather after the period at which plague reaches its height in the Municipalities further limits the chances of plague catching a good hold in the rural areas.

In Coimbatore District we have three sets of Climatic conditions which act on flea prevalence and plague' (1) The conditions in Kollegal which have already been dealt with, (2) the conditions in the area opposite the/

the Palghat Gap with its peculiar temperature and humidity unlike that of any other part of the Presidency, and (3) the conditions in the lower lying Taluqs adjoining Salem and Trichinopoli Districts. The Characteristics of the climate in the second of these areas are a high degree of humidity usually over 80% throughout the year, and a period of over 8 months during which the mean temperature is rarely more than a degree over 80°. For the first half of this period of even temperature, the temperature itself is not very favourable to the long life of the flea, but when the effect of high humidity is added the fleas will live for a fair period and breeding will be fairly active. The long duration of these moderately favourable conditions will permit of the flea population gradually reaching a considerable height without any sudden increase, and this is what we find. The flea population is well established at an earlier period than in other parts of the Presidency, and the plague season is also earlier. Although the temperature drops lower after October the flea prevalence does not go any higher, but the length of life of the flea will be increased although breeding does not appear to be so active. The hot weather is not very marked, the mean temperature only rising to about 86° for a short time. The effect of temperature on the degree of septicaemia developed by the rats in this area will be to produce a moderate degree during the greater part of the year and a high degree for a few months. The rate of disappearance ~~from~~ of the bacillus from the flea's stomach will never be very rapid. The characteristic of all the factors affecting the flea and the plague bacillus under the climatic conditions here prevailing, is their mildness of action. None of the factors are ever extremely unfavourable even in the hottest months, and they are not extremely favourable in the coolest ones. It is thus possible for plague to carry over through the year in a large town when once successfully implanted. The least favourable of all the factors is the temperature, in its influence on the length of the life of the flea, and this is aided in some degree by the high humidity, but not sufficiently to help importation to occur with any regularity or certainty in the rural areas. It is however somewhat

more/

more favourable than in the other parts of the Central Districts. In this area where the conditions are mildly favourable a variation of temperature and humidity in a favourable direction, (this) is, an excessive humidity or a cooler temperature, in any year will increase the likelihood of an epidemic; and it is noticeable that the epidemics have usually occurred in the coolest and moistest years, and in fact (they) could practically be predicted from an examination of the Temp. and Humidity curves for a series of years.

In other parts of the Central Districts where the climatic conditions are normally less favourable than in this part of Coimbatore District, the variation of these factors of temperature and humidity will be less likely to be effective in their action. The part of Coimbatore District now being dealt with is usually infected from the Nilgiri Hills, with which it is in direct communication by rail and road, It is unlikely that infection could come round from Mysore, with which it has no communication except by a very long railway journey, or from Bellary District or from Bombay. as Plague infection has the greatest difficulty in coming even as far as Salem, and would have further to come through the lower-lying Taluqs of this district and of ~~Bellary~~ Coimbatore District which are still less favourable to importation and which have themselves escaped.

The third area of Coimbatore District which includes the low lying parts of the Taluqs of Bhowani, Erode, and Karur, is along with the adjoining Taluqs of Namakkal and Tiruchengodu hotter than any other part of the Central Districts, being low-lying and situated in the Southern part of these Districts.

This area has had extremely little plague, and even the large town of Erode has had very few cases. Karur town has entirely escaped. Infection has practically failed to come from Salem District on the one side and Coimbatore on the other, although the distances from places which have been infected are not very great and the traffic with these places is heavy. This area presents climatic conditions which are very unfavourable for importation of infection and which are only for a short time/

time favourable for the occurrence of epidemic Plague if successful importation did occur, and not even for that short period as favourable as the cooler parts of the same Districts. The temperature conditions in the East Coast Districts are still less favourable to the importation of Plague infection than the 1000 feet levels in the Central Districts. Although the cold weather temperature in some of the Sea-Coast towns is as low as in some parts of the Central Districts the general temperature all over this Area in the cold weather is higher. We have shown in what way the Central Districts are unfavourable to the successful importation of plague infection, and the higher temperature of the inland parts of the East Coast Districts and (their) further distance from infected centres will render these parts still less favourable.

Although the parts of the East Coast Districts on the Coast line are unfavourable in much the same degree, (so far as temperature goes) as the 1000 feet levels of the Central Districts where occasional large outbreaks of Urban Plague have occurred, the further distance over which plague infection has to be carried, and the very unfavourable area through it has to pass, make it very unlikely that infection will be successfully implanted there, especially when it is considered what a short distance it will travel even under somewhat more favourable conditions. Infected fleas carried to the towns on the seaboard will be submitted to temperature conditions both unfavourable to their long existence and to the existence of the Plague Bacillus in their stomachs, and the chances of their starting an epizootic will, therefore, be small. The temperature conditions in these East Coast Districts are also unsuitable for the establishment of a large flea population, as instance the curve of flea prevalence in Madras City.* Cuddalore, somewhat cooler, will have a slightly higher flea prevalence, and our single observation there suggests that this is the case.

The low flea prevalence will have a limiting effect on Plague if introduced.

The total indigenous Plague Deaths in the East Coast Districts were, 37 in South Arcot, of which 27 occurred in the highest Taluq adjoining Tirupattur Taluq of Salem District, 78 deaths in Madras City, and 6 or 8 in Poonamallee.

* Not reproduced but similar to the Madura curve but averaging about 1 flea less per rat.

The Madras outbreak occurred in a small fishing village on the outskirts of the town, and the town itself escaped, partly no doubt from the fact that this village was somewhat separated from the City and was very favourable to active preventive measures; but not entirely on account of the preventive measures taken, for in spite of energetic operations against rats the epidemic dragged on at a low level over several months showing that a mild epizootic was still going on.

A more active epizootic would have resulted in a quicker disappearance of the rats from the limited area affected, but with the small flea prevalence existing this was less likely to occur. Infection did not manage to reach the City, but Madras was probably in greater danger of infection at this time than before or since, infection requiring to travel a much shorter distance than from the usual infected areas. In a case of this sort every preventive measure possible is of value, and if no person or article from the infected area was allowed to enter the City it would be possible to prevent spread, especially when the conditions for spread were (as) minimally favourable. The original infection probably came from Rangoon or some other port in Burma by sea and not through the unfavourable areas of the Presidency. Madras City has a very extensive passenger and grain traffic with the infected parts of Mysore, Bellary, and Bombay, and a certain number of imported cases occur each year. The number of attempted importations every year must be considerable, and it is a striking fact that this large city with its half million inhabitants should have entirely escaped Plague, especially when the extreme susceptibility of the rats in the City to Plague, when tested experimentally, is considered.

The Southern Districts of the Northern Circar group are similar in climate to the East Coast Districts and similarly unfavourable to the importation of plague. Only the most Northerly parts present a fair cold weather of the Bellary type, but to reach this area Plague infection would have to travel a very long way through unfavourable conditions from the infected parts of Madras Presidency.

The Southern Districts are extremely unfavourable to the importation

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of plague. They are the hottest parts of the Presidency, (and) have no cold weather to speak of, and are far removed from centres of infection. The only part in this area which has had any plague is the elevated tongue of land at about 1000 feet elevation adjoining Coimbatore District and stretching across to Dindigul (between 900 and 1000 feet).

The first successful importation into this area occurred in 1904, but only resulted in 16 deaths. A more extensive outbreak occurred in 1910. This is the coolest part of the Southern Districts except the high hills and the strip along their base and the Sea-Coast. These parts are still further away from infected areas and still less accessible for importation.

In the West Coast Districts the temperature runs at a fairly steady level throughout the year and there is no definite cold weather.

The hot weather temperature is not very high. Here the Rural Plague death rate is the lowest of any of the infected Districts in the Presidency. The proportion of the Urban Plague death rate per mille to rural plague per mille is approximately 250 to 1 in South Canara and 82 to 1 in Malabar, and the rural plague deaths from an exceedingly small total. The absence of any period throughout the year at which the normal mean temperature drops more than a degree or two below 80° will make the life of the flea short at all times and will be very unfavourable to importation, although, once Plague is established, the slightness of the variation of the temperature throughout the year will permit it to continue in some degree. The very high relative Humidity on the West Coast will assist in partly increasing the length of life of the flea, and will probably increase it sufficiently to help transmission within a limited area, such as from one part to another of a large Municipality, but will not be sufficiently effective to help transmission to Rural areas at a further distance. Taking the three towns of Mangalore, Calicut, and Cochin in descending order along the Coast, we find the longest and highest period of Humidity in Mangalore, a lesser marked degree in Calicut, and still less in Cochin. Plague in these three places follows the same order, Mangalore having

suffered/

suffered most, Calicut much less, and Cochin having escaped altogether. So far as our observations go in which flea counts were made in these three places almost simultaneously, the flea counts in all were low, and slightly less in the more southerly of the towns. Mangalore was probably infected from Bombay with which it has much traffic by sea. After the first severe outbreak, when the rats would have probably been most susceptible, Plague settled down to a mild annual level and remained indigenous, never assuming serious epidemic proportions or dying out. The slight annual variation of the temperature will account for this once Plague has caught hold, and the high Humidity will also help in keeping it going. The fact that after the first year the epidemic was of slight proportions will also indicate that the epizootic was not of such severity as to materially reduce the number of rats available to continue the disease, so that a sufficient number were always available to allow the epizootic to smoulder on. In other parts of the Presidency where big epidemics of limited duration in large towns have occurred, for example, the 1910 epidemic in Salem and the 1912 epidemic in Vaniambadi, the reduction of rats was so great that it became almost impossible to obtain any rats by trapping or otherwise. Here in Mangalore the catch goes on fairly regularly throughout the year. On the high plateau of the Nilgiri Hills at a general elevation of 6000 to 7000 feet we have climatic conditions quite different from those in any other part of the Presidency and more like that of the temperate zone. The peculiar effect of the temperature conditions prevailing,-an average annual variation of approximately from 55° to 65°,- is seen in the kind of rat fleas found. Here in this isolated area we find, in addition to Cheopis, Ceratophyllus Fasciatus, which is not again found on rats in India until we come to the parts of the United Provinces and the Punjab, where there is a very marked cold weather and where this flea is chiefly present at the coldest times of the year. Ct. Musculi also occurs in the Nilgiris, the rat fleas in this area thus being the same as the common ones in Europe with the addition of X.Cheopis.

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At the cold temperatures prevailing in these hills fleas will live for a very long time, and the Plague Bacillus will persist for a long time in the stomach of the flea. A flea will thus be able to carry infection for a considerable period and over long distances within the District. Two factors tend to limit the severity of epidemic Plague in this area. These are (1) the low flea prevalence, and (2) the low degree of septicaemia developed by rats at the very low temperatures The very low temperature prevailing throughout the year and the comparatively low Humidity will be adverse to the active breeding of fleas, these temperatures being much lower than the moderately low temperatures which have been found to be the optimum for active breeding and the establishment of a high ~~rat~~ flea population. When an epizootic is once started there will be only a small number of fleas available to carry infection, and with the low degree of septicaemia developed by the rats and the small percentage of rats which will develop satisfactorily any degree of septicaemia, only a small percentage of the fleas will be effective carriers. In the two towns on the Hills, OOtacamund and Conoor, the first outbreaks, when the rats were most susceptible, were the most severe, although never so severe as in towns at a lower level where rats would develop a higher degree of septicaemia, and where the flea prevalence for a short period would be higher. After the first outbreak Plague became very mildly epidemic.

The outbreaks now usually consist of a few cases scattered about adjoining parts of the bazars, followed by an interval of a week or two, or even longer, and then a few more cases, either in the same parts or at some distance, Plague going on in this way over several months or almost throughout the year.

Dead rats are also found at long irregular intervals and in very small numbers. The manner in which such an epidemic will becarried on can readily be surmised. One rat perhaps dies of plague but without a sufficient degree of septicaemia to make its fleas infective. The next one develops a higher degree of septicaemia and some of its 3 or 4 fleas will be infective. These may immediately bite another rat which

may/

may develop Plague and in its turn may or may not be able to carry on the disease according to the degree of development of septicaemia at its death. On the other hand the fleas may not bite another rat for a considerable period according to their chances of finding a host, and as at these low temperatures fleas do not require to feed so often as at higher temperatures and can live for a long time without blood, it may be a week or two before another rat is infected by them. There may in this way be an epizootic with groups of cases, or cases at irregular intervals and corresponding chances of infection of human beings. In spite of the small and scattered Rural population of this area and the factors which tend to limit epidemics, the Rural Plague death rate per mille is higher than in any other part of the Presidency except the parts on the Mysore Plateau and Bellary District. The extremely favourable temperature conditions for the transportation of fleas alive, and for the persistence of the Plague bacillus in their stomachs, will account for this even although the number of infected fleas will be small. In the two areas in which the Rural Death Rate is higher, the larger number of fleas and the higher degree of Septicaemia developed and the more favourable conditions for epidemic Plague, including the denser population, will account for the higher death rate. The Nilgiri Hills are infected from the Mysore side, and infection never requires to pass through an area much below 3000 feet.

Some considerations of the relation between

Flea Prevalence and Plague.

Under ordinary Indian conditions in such places as the Nilgiri Hills, being the flea prevalence of exceptional, will indicate the suitability of that locality for Plague, not merely from the fact that a high flea prevalence is in itself of value, but because the climatic conditions which produce a high flea prevalence are also these which have a favourable effect on the other factors concerned in the spread of the disease; (of course special facilities for importation will have a modifying effect). The influence of the varying degrees of temperature and humidity on thefactors of Flea population, length of life of the flea, persistenceof the Plague bacillus in the flea's stomach, and degrees of septicaemia developed by the rats, has already been discussed in connection with the different parts of the Presidency showing these variations; and it has been shown that the temperatures favourable to a high rat-flea prevalence are also favourable in an equal degree to the length of life of the flea and of thePlague bacillus in it, and consequently favourable for importation of infection from place to place within the area showing these suitable climatic conditions. The lesser degree of septicaemia developed by rats in the colder months is largely compensated for by the favourability of the other factors, and for part of the year this factor is also favourable, so that these areas with a high flea prevalence will also befavourable to epidemic Plague. A long period of high flea prevalence will indicate a long period of suitable climatic conditions, and a shorter period or a period of lesser prevalence will indicate correspondingly less favourable climatic conditions.

A very short period of high flea prevalence will mean a short favourable season which will increase in favourability with the height to which the flea prevalence rises. A long low flea curve throughout the year will indicate continually unfavourable conditions.

It/

It might almost be possible to take a definite height at which the flea prevalence will indicate unsuitable climatic conditions. On Chart No. 5. the Annual curves of flea prevalence for Denkanikota (on the Mysore Plateau), Coimbatore (opposite the Palghat Gap), Vaniambadi (at the 1000 feet level in Central Districts), and Madura (in the Southern Districts) are shewn. Across the first three of these curves a dotted line hasbeen drawn at the level of the highest point reached in the Madura curve. It will be seen that the Denkanikota curve lies above this line for the greater part of the year, and that this curve reaches a higher point than that attained by any of the others. This corresponds with the fact that Plague goes on all the year round on theMysore Plateau, has a comparatively short off-season, in which it does not die out entirely, and it reaches epidemic height for a considerable number of months.

The shorter portion of the curve above the dotted line, and its lesser height, in Coimbatore also corresponds with the smaller amount of Plague here, and with the fact that Plague is not indigenous in this area. The very short rise in Vaniyambadi agrees well with the incidence of Plague there. Madura has had no Plague. Of course it is not intended to argue that epidemic Plague can not occur with a flea prevalence even as low as 3 or 4 per rat. We know that it can; but the indications that the flea prevalence gives of probable effect of the climatic conditions which influence this flea prevalence on the other factors also concerned in the spread of Plague, which effect has already been discussed, are of considerable value, and will with some of degree of certainty show the particular suitability or unsuitability of the various localities, for the spread of plague, andin a lesser degree, for the occurrence of epidemic Plague once successfully implanted.

June. July. August. September October November. December. January. February. March April. May.

Dankanikota

15. 12·5 10. 7·5 5. 2·5 0.

Coimbatore

10. 7·5 5. 2·5 0

Vaniambadi.

10 7·5 5 2·5 0

Madura.

10. 7·5 5. 2·5 0.

The Curves of Dankanikota, Coimbatore, Vaniambadi & Madura.

The dotted lines on the three upper charts are drawn at the highest level of the Madura curve.

Chart No 5.

Conclusions.

(1) The distribution of plague in Madras Presidency can be largely explained by the action of the climatic conditions on

(a) The length of life of the Rat Flea at the varying temperatures and humidities in different areas.

(b) The length of life of the plague Bacillus in the flea's stomach at the different temperatures.

(a) & (b) Together determining the number of days a flea will remain capable of transmitting Plague, and, consequently, the distance infection can be carried, and the comparative certainty or uncertainty of establishing a fresh epizootic focus.

(c) The degree of septicaemia developed by rats at different Temperatures.

11. The conditions favouring the occurrence of a severe outbreak of Plague in any one place, once a focus of infection is started, are not exactly the same as those favouring the continuous spread of plague from place to place within a given area.

111. For the continuous spread of Plague the necessary conditions are those which prolong the life of the Flea and its period of infectivity, these conditions being, (a) a comparatively low mean temperature or (b) where the temperature is higher with a high degree of humidity. Of these factors the more important is the low mean temperature, and the effect of this being well shown in all the areas lying at elevations of over 3000 feet. The effect of high humidity is seen in the case of Coimbatore and the West Coast Districts, but with the higher temperatures of the West Coast the prolongation of length of life of the flea appears only sufficient to permit of continuous spread within the limits of large Municipalities.

IV. For the occurrence of a severe outbreak of Plague in any one town or Village a low temperature is not necessary once infection is established. A high degree of Septicaemia is developed by rats at a temperature of about 77°F. and a large proportion of Rat Fleas will thus carry large numbers of Plague Bacilli and be infective. Within the limits of a town the distance the Rat Flea has to travel to find a new host is short, and at temperatures which are not favourable to the prolonged life of the flea, it will still live long enough to transmit infection. This represents the conditions found at elevations between 1000 feet and 3000 feet where the temperature is only moderately favourable to prolonged life of the flea for a short period of the year. The chances of any particular place becoming infected in this area diminish with the distance by which it happens to be separated from an infected area. Places which are situated close to the infected part of Bombay Presidency and Mysore and in closest relation to the Railway lines will be most liable to infection, while those places situated on the limits of the 1000 feet contour line and furthest removed from infected areas will only occasionally suffer, but when infection is successfully implanted (that is, when an epizootic is started) in any large town in this area the outbreak may be severe.

V. The chances of infection being successfully implanted in the lower-lying hot areas of the Presidency are small, on account of the short life of the flea and the Plague Bacillus in its stomach at the temperature conditions prevailing in these areas, and the distance they are removed from centres of infection. Infected fleas brought from epidemic or endemic centres are not likely to reach these parts of the Presidency still alive and infective with any regularity or in any considerable numbers so as to make it likely that they will be able to infect fresh rats and start an epizootic.

VI. There is a marked correlation between the Flea Prevalence and the

Plague incidence in different parts of the Madras Presidency. Where the Flea Prevalence is high throughout the year, Plague is Endemic. Where there is a definite short "Cold Weather" rise in the Flea curve, Plague occurs in epidemic form with a marked Seasonal Prevalence. Where the flea prevalence is low throughout the year Plague does not occur.

The special circumstances affecting the Flea Prevalence in the Nilgiri Hills and on the West Coast with Climatic conditions very different from the rest of the Presidency can be explained by the effect of special temperature and humidity conditions which lengthen the life of the flea while not being favourable to active breeding.)

References

1. Nicoll, British Medical Journal 12th Oct.1912.

11 & 111. Many of the statements with regard to the effect of Climatic conditions on the life of the rat flea are based on

(1) Experiments conducted by Captain Kunhardt M.S. and Dr. Chitre at Poona.

and (2) Experiments conducted by Mr Bacot at the Lister Institute in London.

Their results have not yet been published but I have had access to their results which will be published shortly.

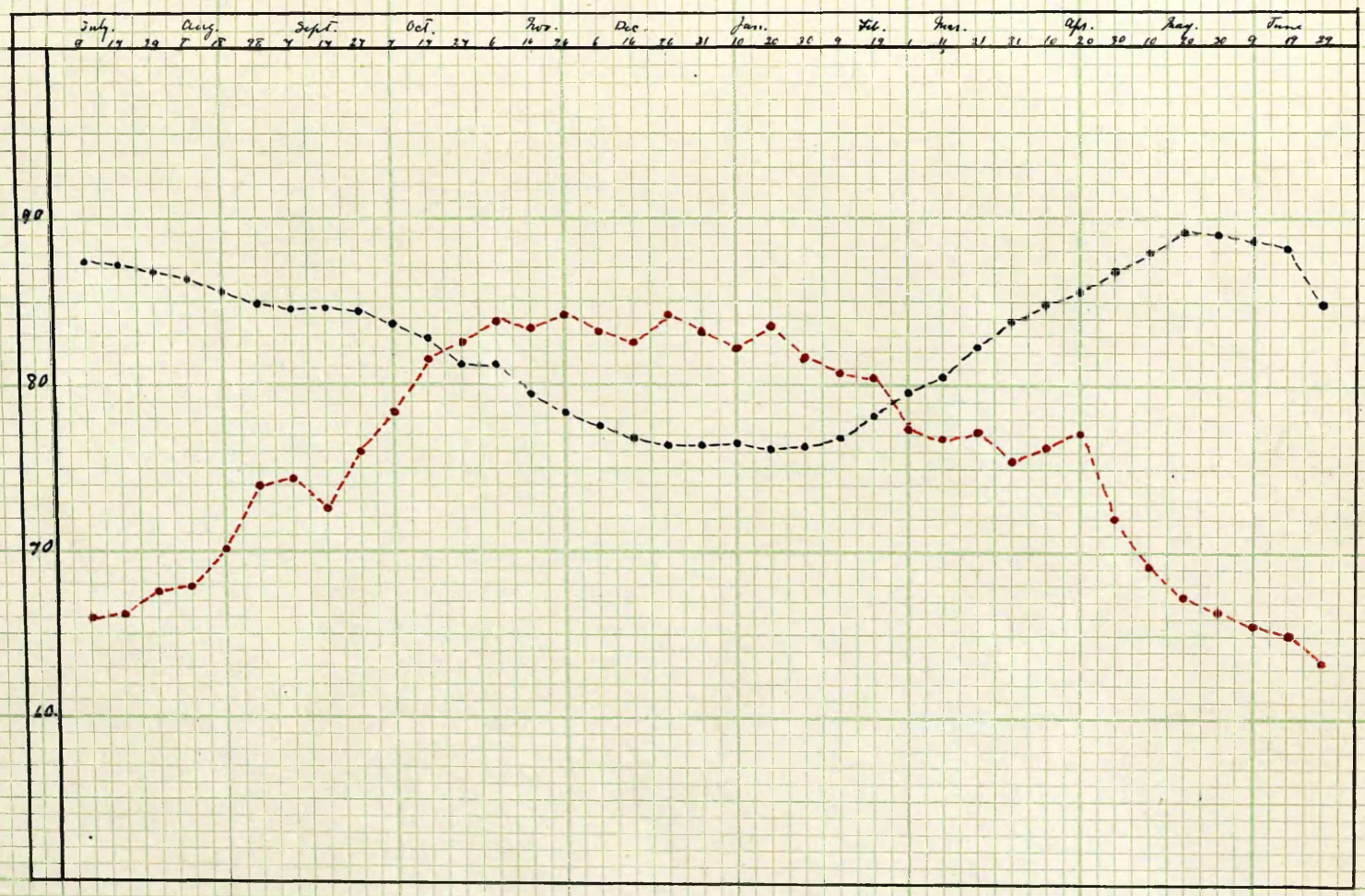
1V. Journal of Hygiene Vol.V111. Pages 242-244.

V. Journal of Hygiene Vol.V111. Pages 260-262

Vl. Journal of Hygiene. Vol.V111. Pages 286.

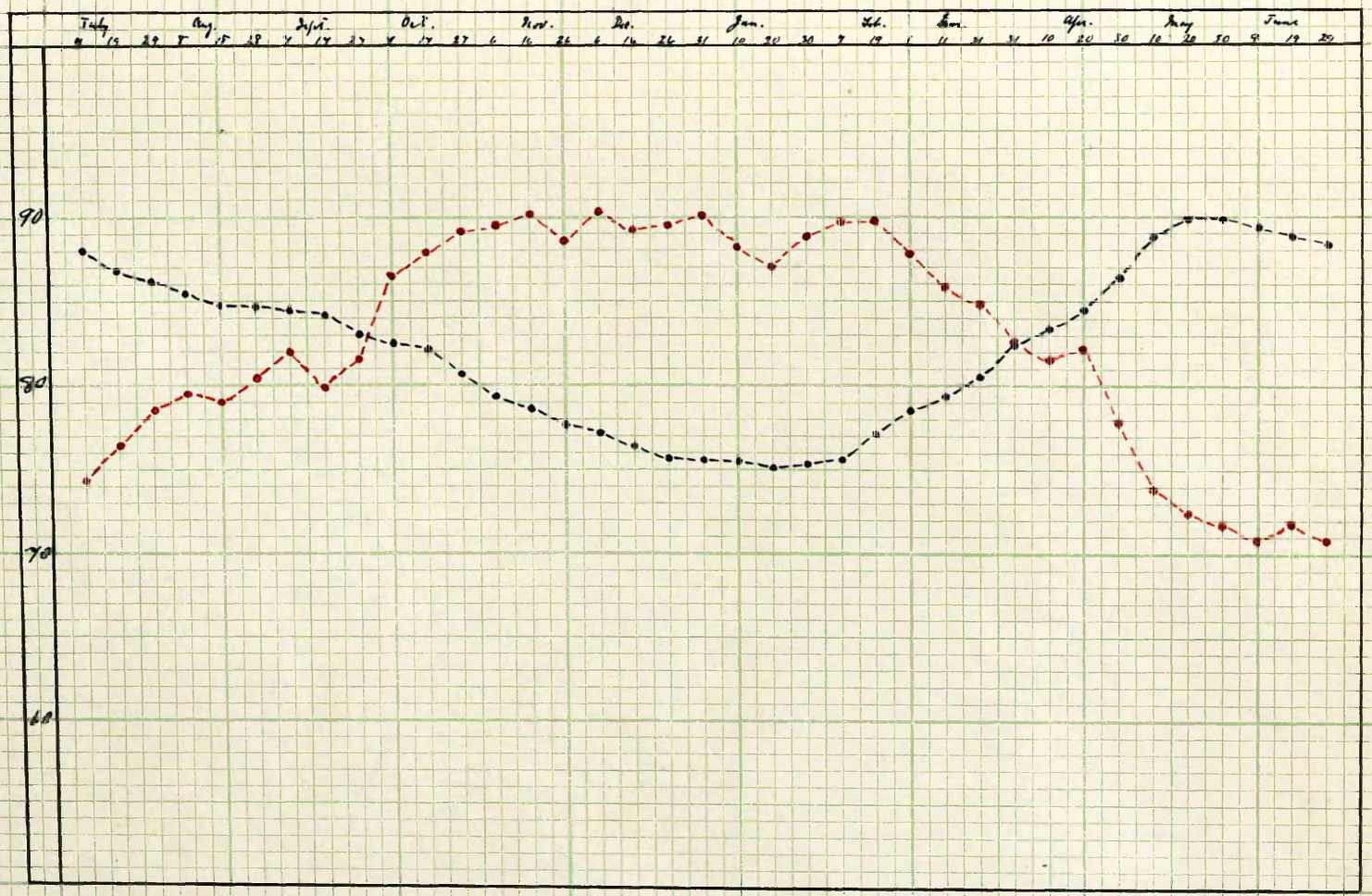
Temperature & Humidity Charts.

East Coast Stations.



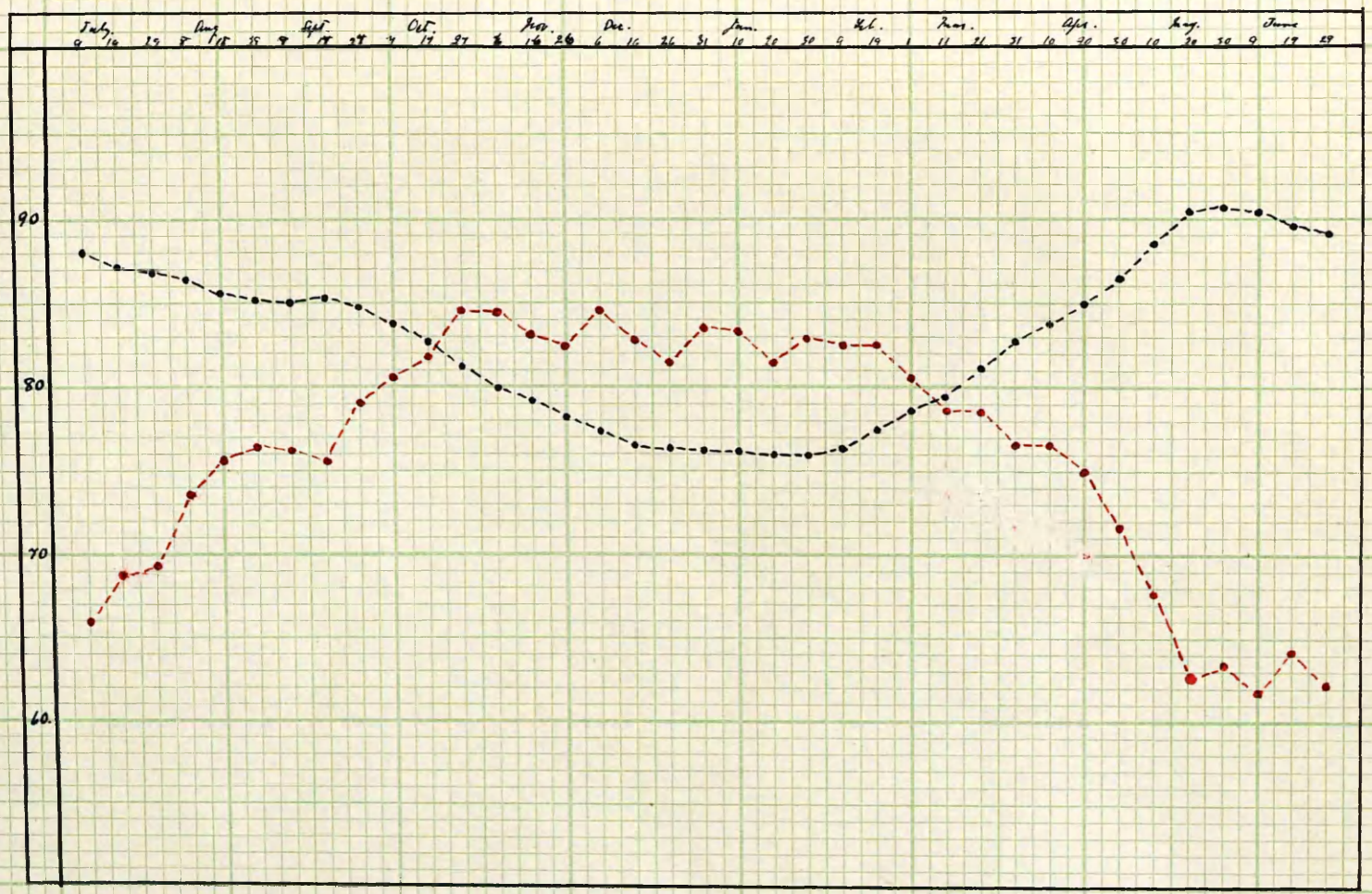
10 day Normal Mean Temperature & Humidity — Negapatam.

No 1.



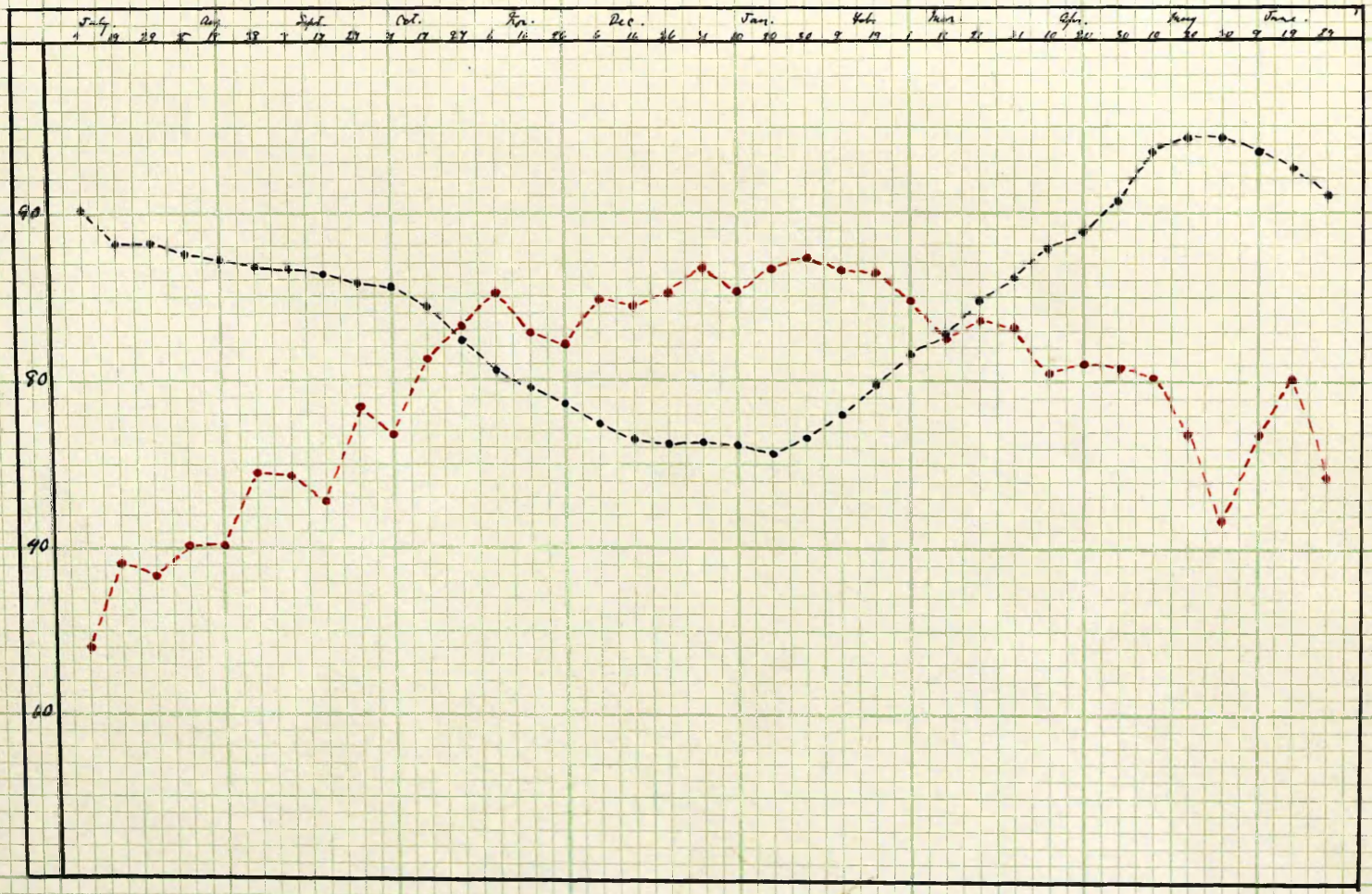
10 day Normal Mean Temperature & Humidity — Cuddalore.

No 2.



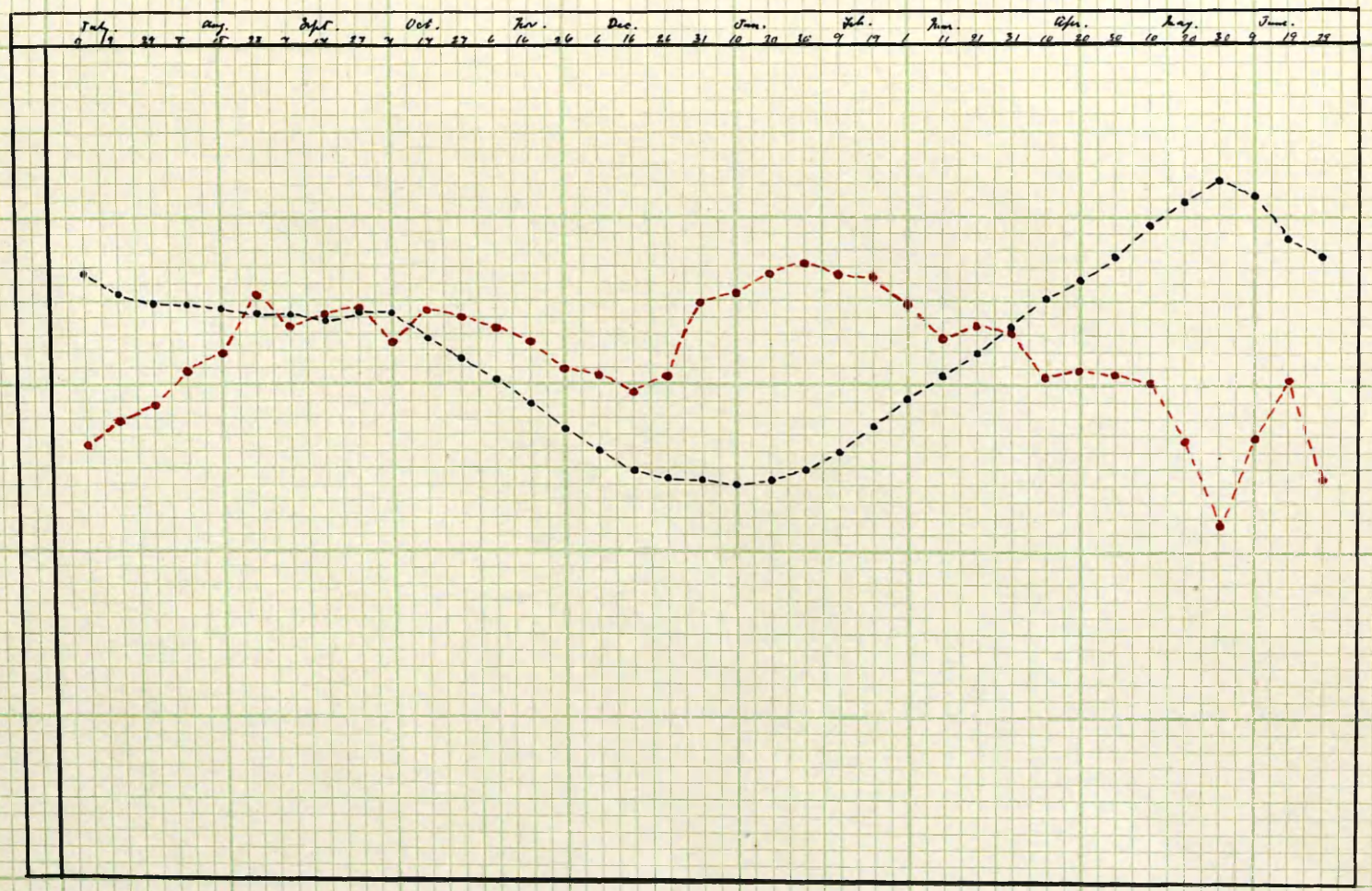
10 day Normal Mean Temperature & Humidity — Madras.

No3.



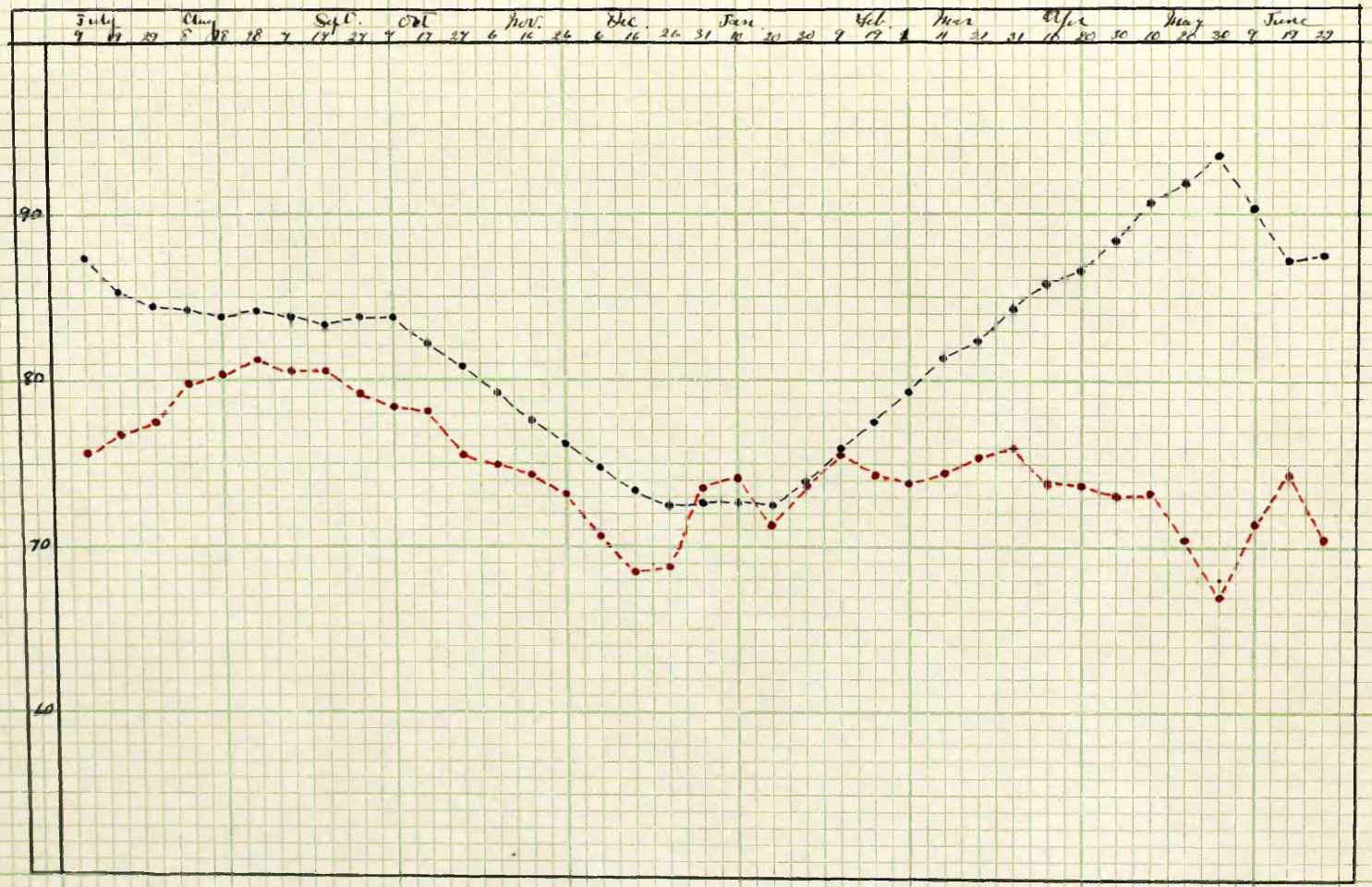
10 days Normal Mean Temperature + Humidity – Kellore

No 4.



10 day Normal Mean Temperature & Humidity — Masulipatam.

No 5.

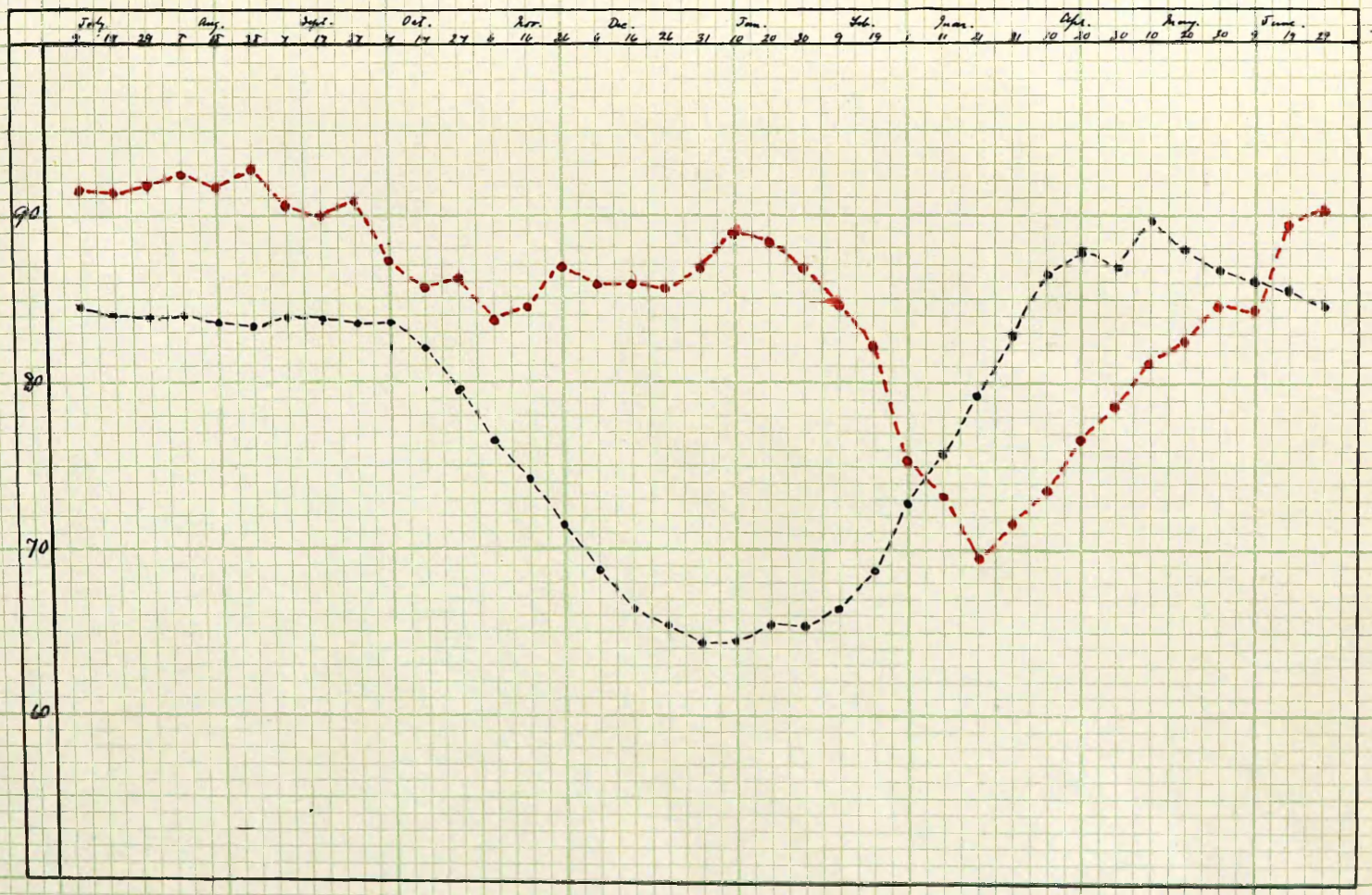


10 day Normal Mean Temperature + Humidity — Coconada.

No. 6.

10 day Normal Mean Temperature & Humidity — Waltair.

No 7.

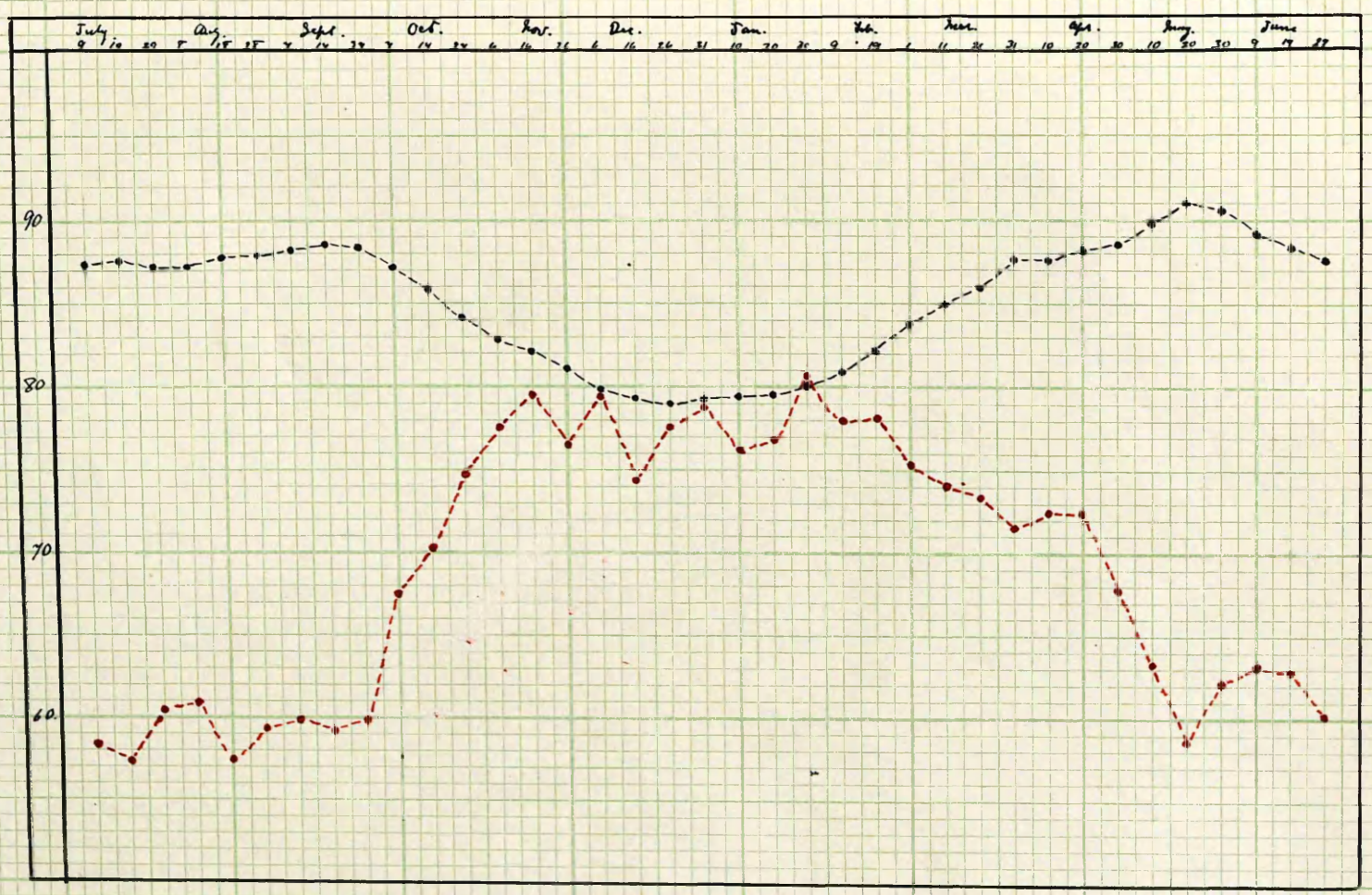


10 day Normal Mean Temperature & Humidity – Berhampore

No. 8.

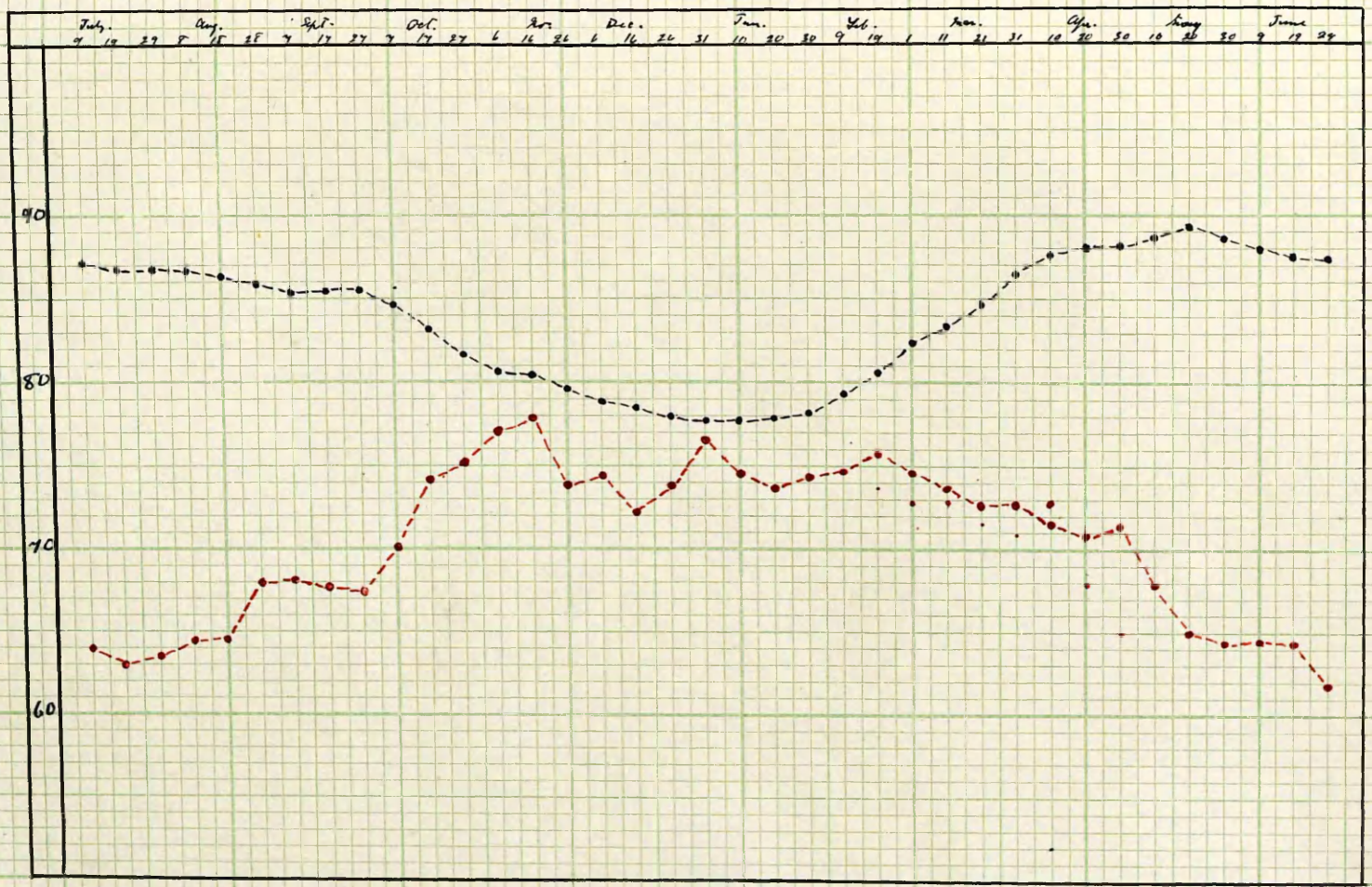
Temperature & Humidity Charts.

Inland Low Level Stations.



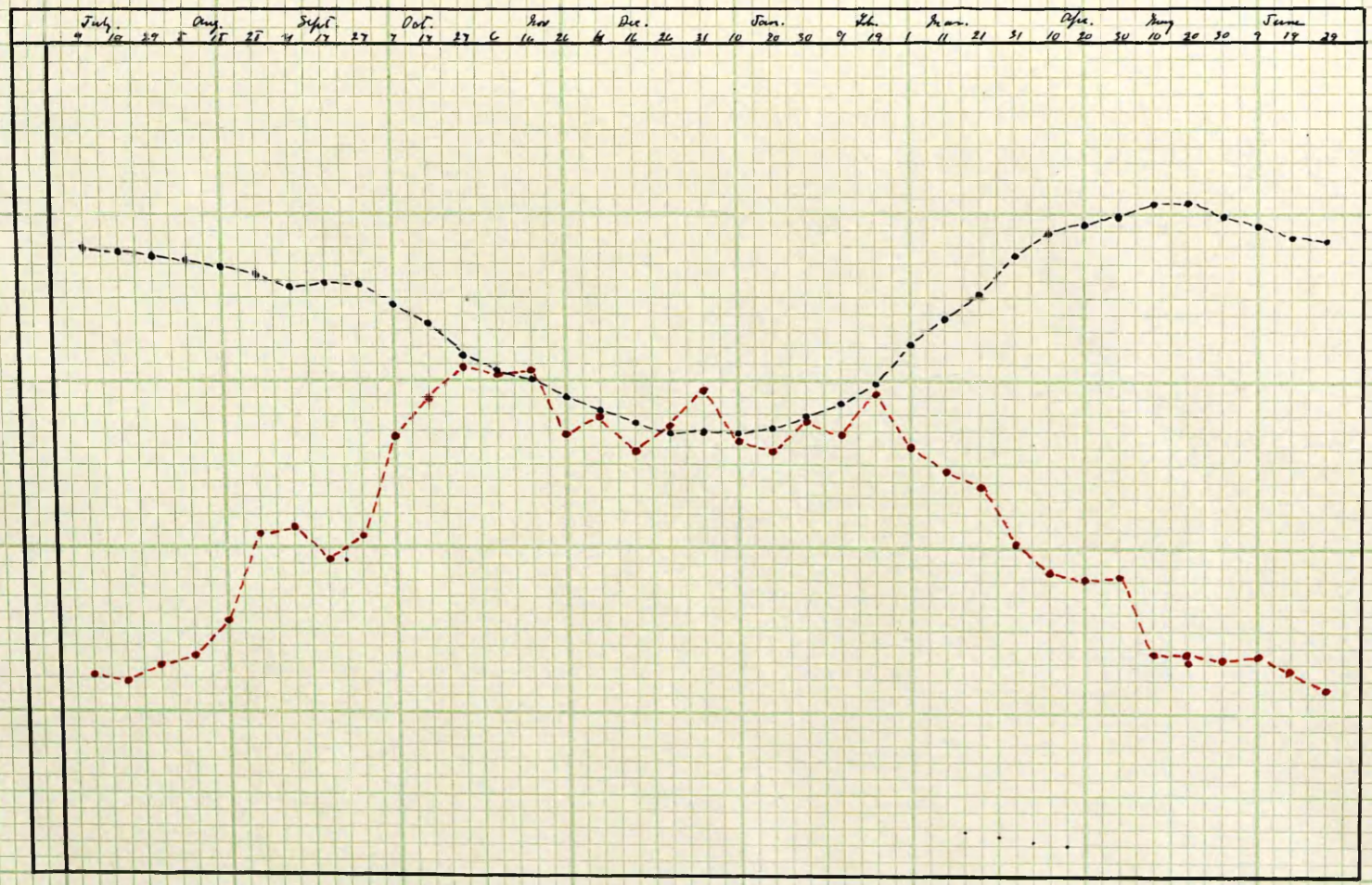
10 day Normal Mean Temperature & Humidity — Tinnevelly.

No 9.



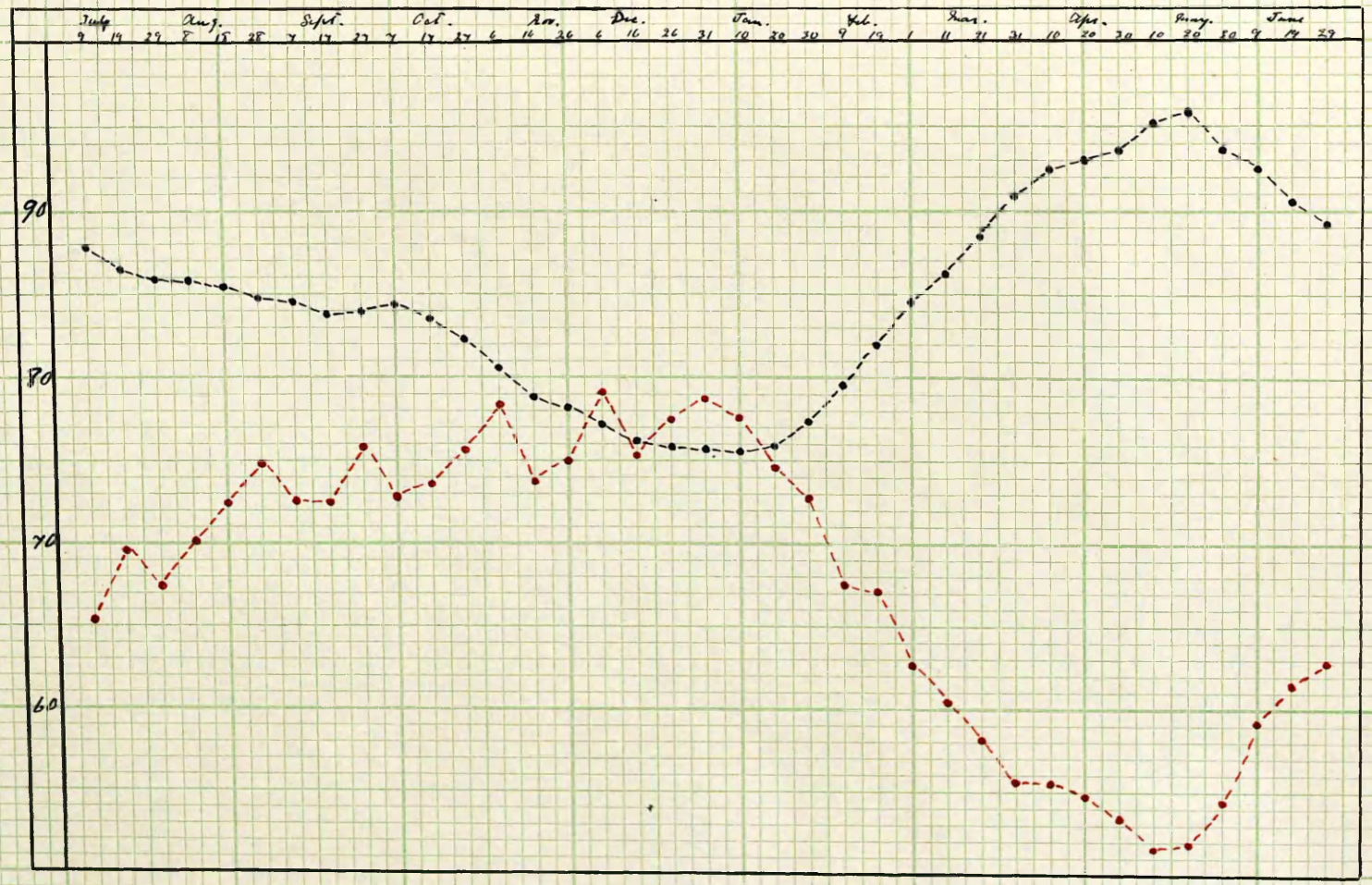
10 day Normal Mean Temperature & Humidity — Madura

No 10.



10 day Normal Mean Temperature + Humidity — Trichinopoly.

No. 11.

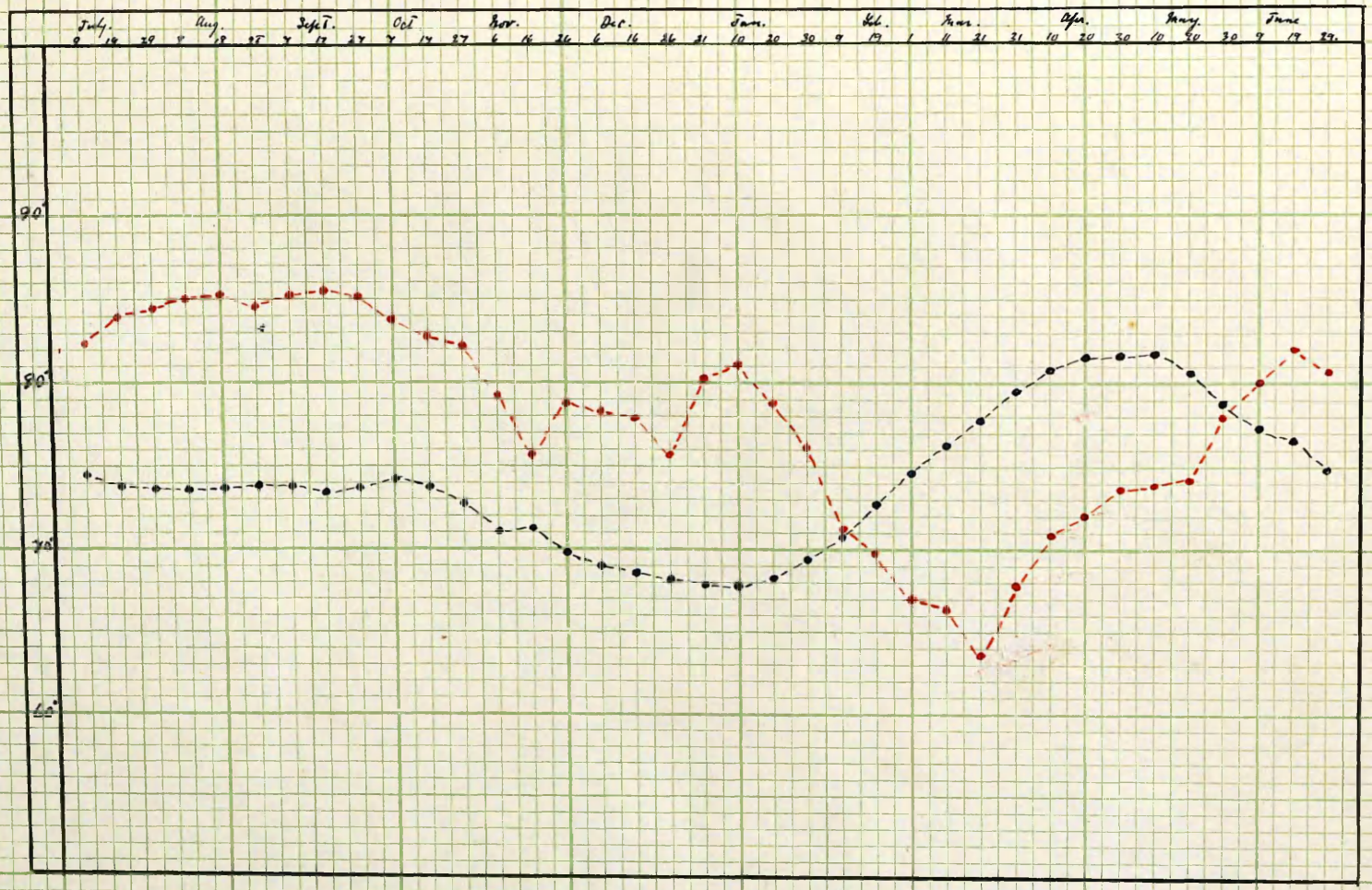


10 day Normal Mean Temperature & Humidity — Cuddapah.

No. 12.

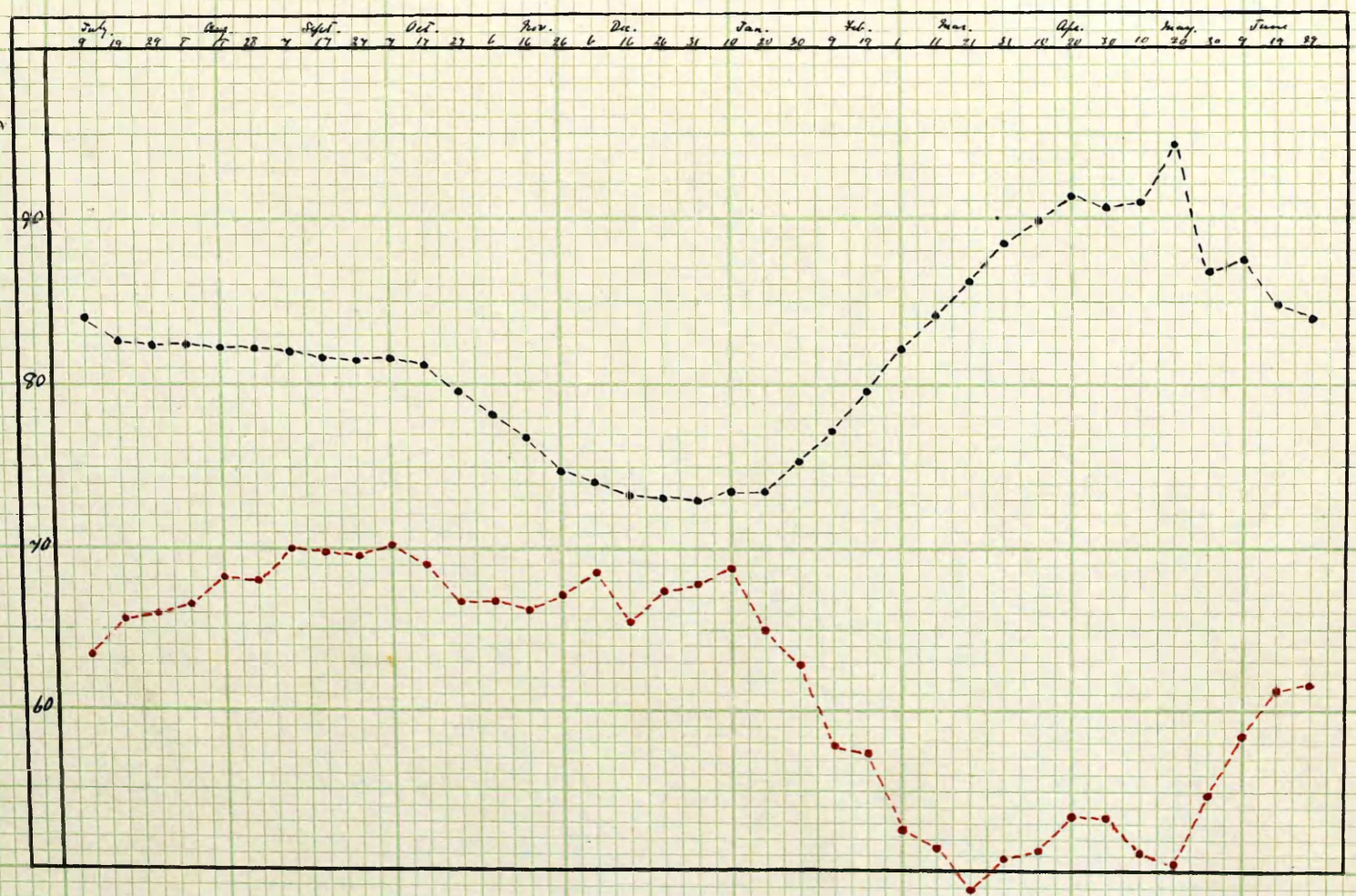
Temperature & Humidity Charts.

Inland High Level Stations.



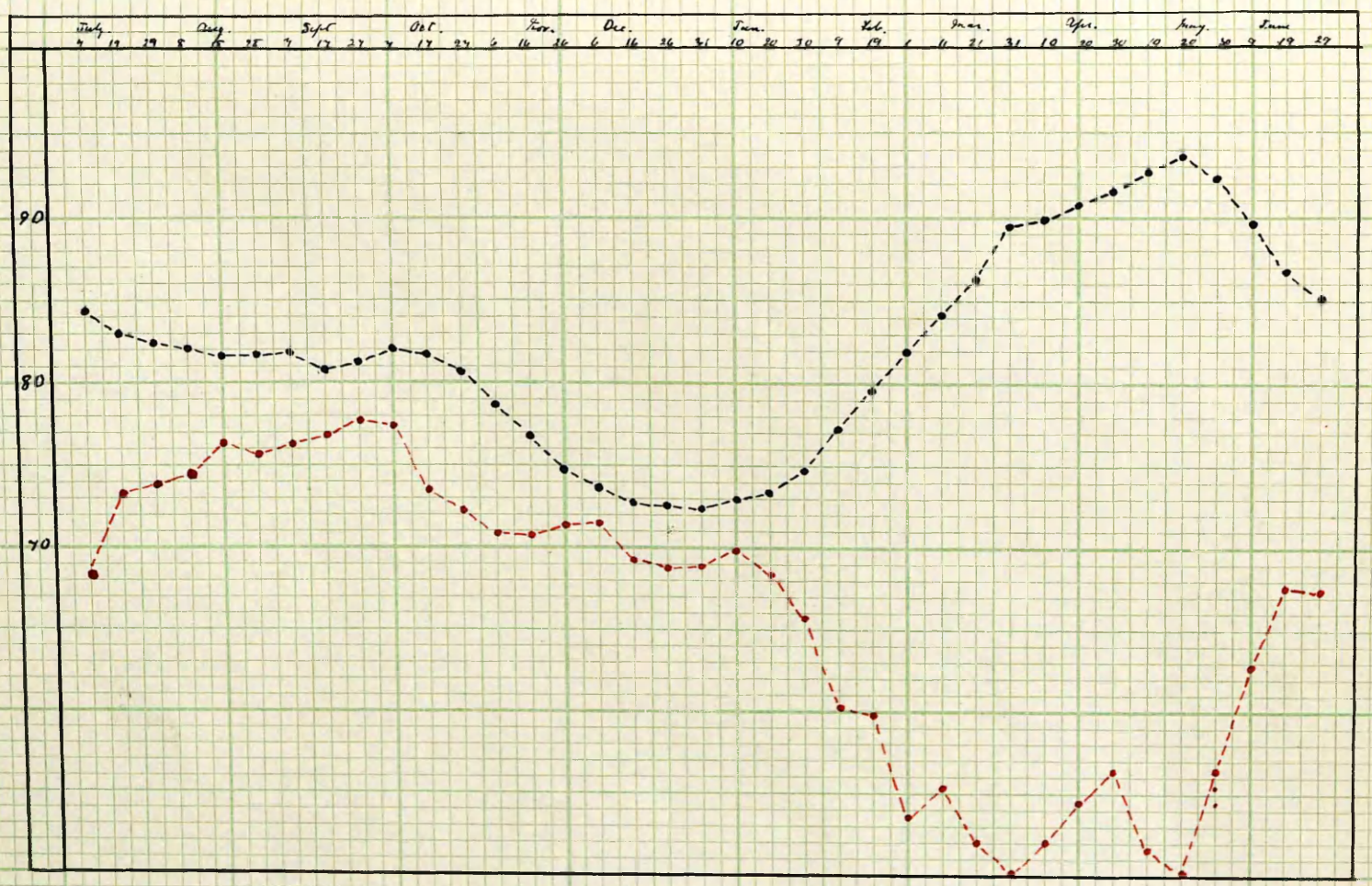
10 day Normal Mean Temperature & Humidity — Bangalore

No 13.



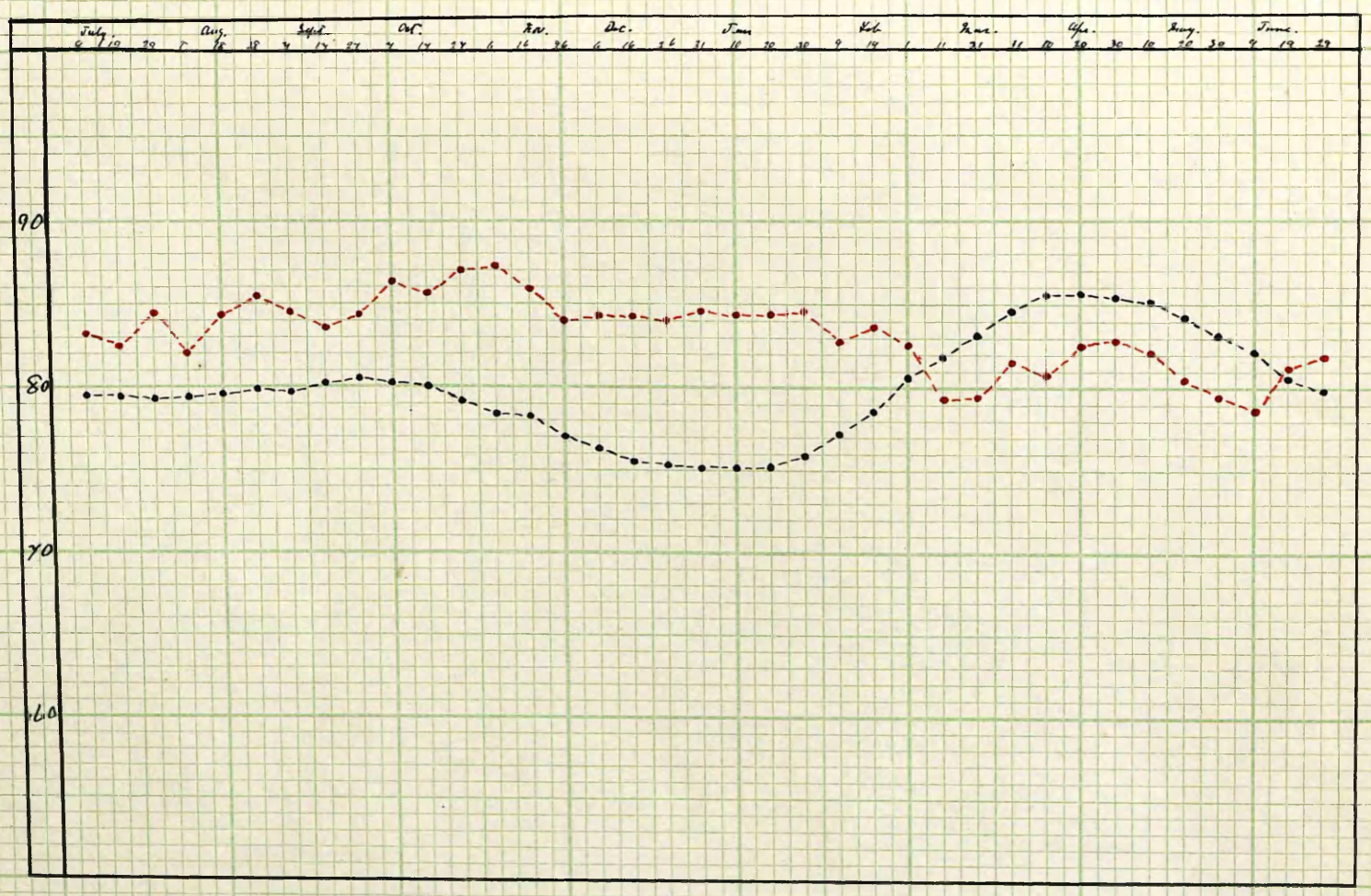
10 day Normal Mean Temperature & Humidity - Bellary.

No. 14.



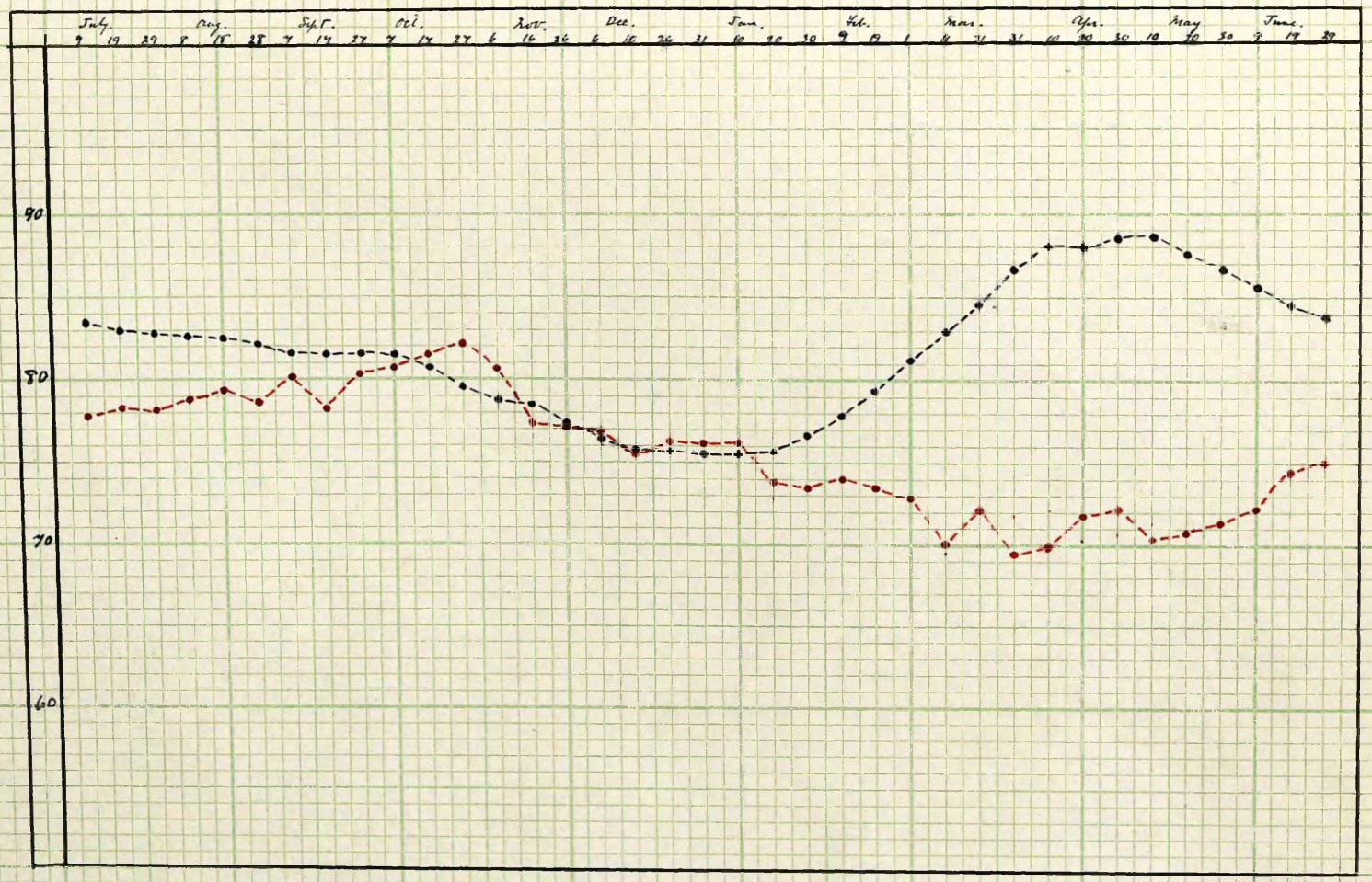
10 day Normal Mean Temperature x Humidity — Kurnool.

No 15.



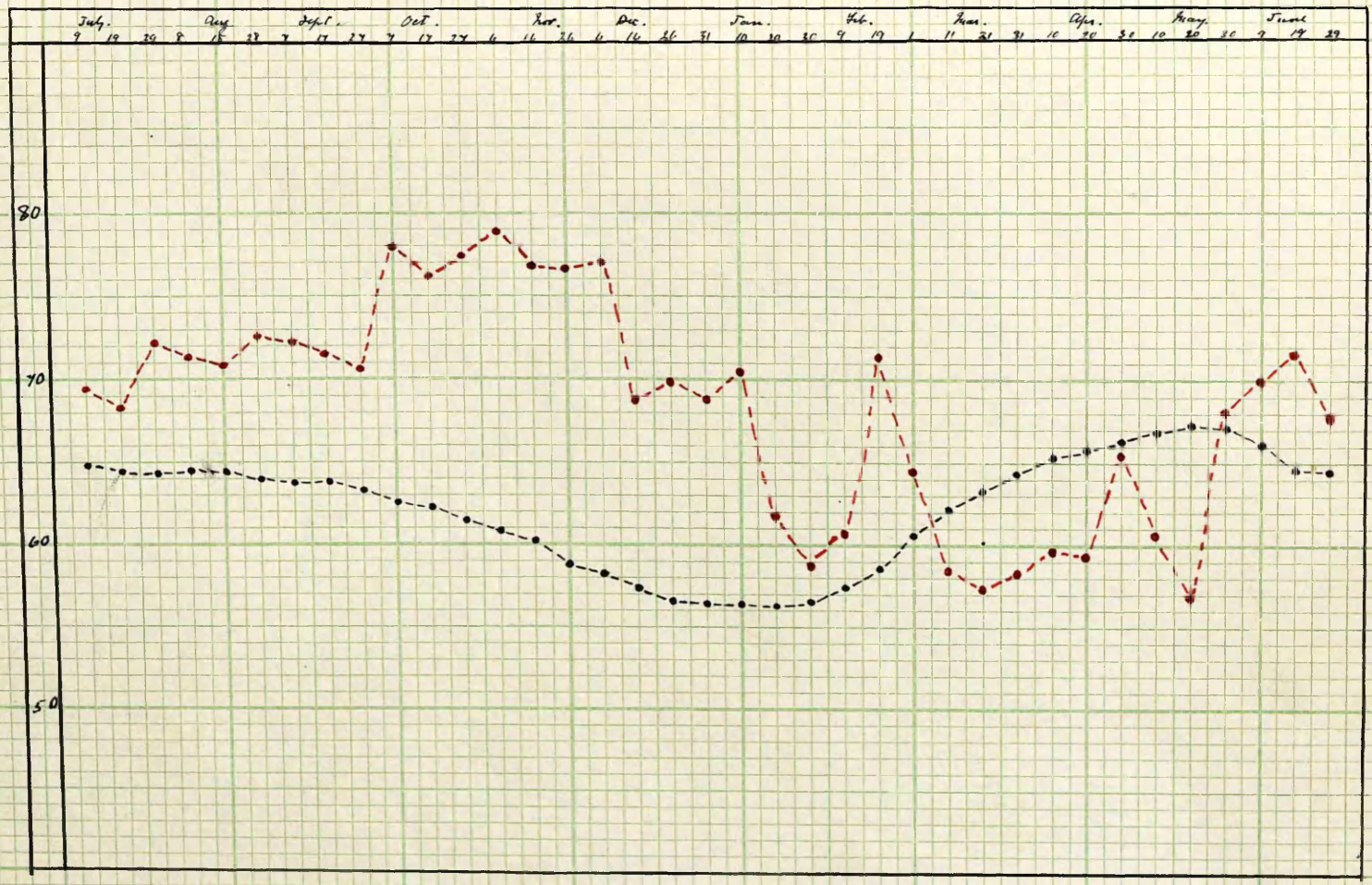
10 day Normal Mean Temperature & Humidity — Coimbatore

Ro 16.



10 day Normal Mean Temperature + Humidity – Salem.

No. 17.

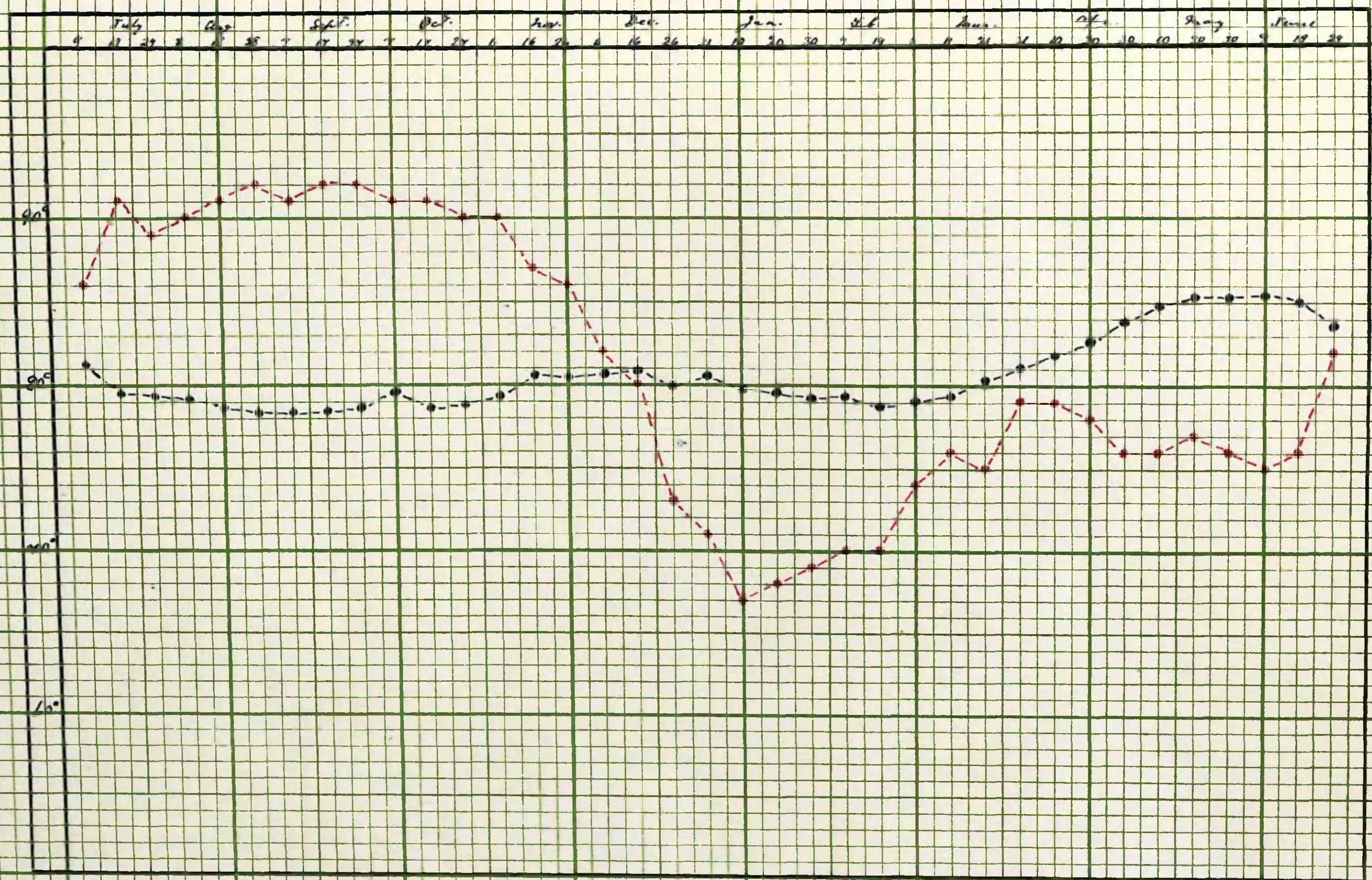


10 day Normal Mean Temperature & Humidity – Wellington.

No. 18.

Temperature & Humidity Charts.

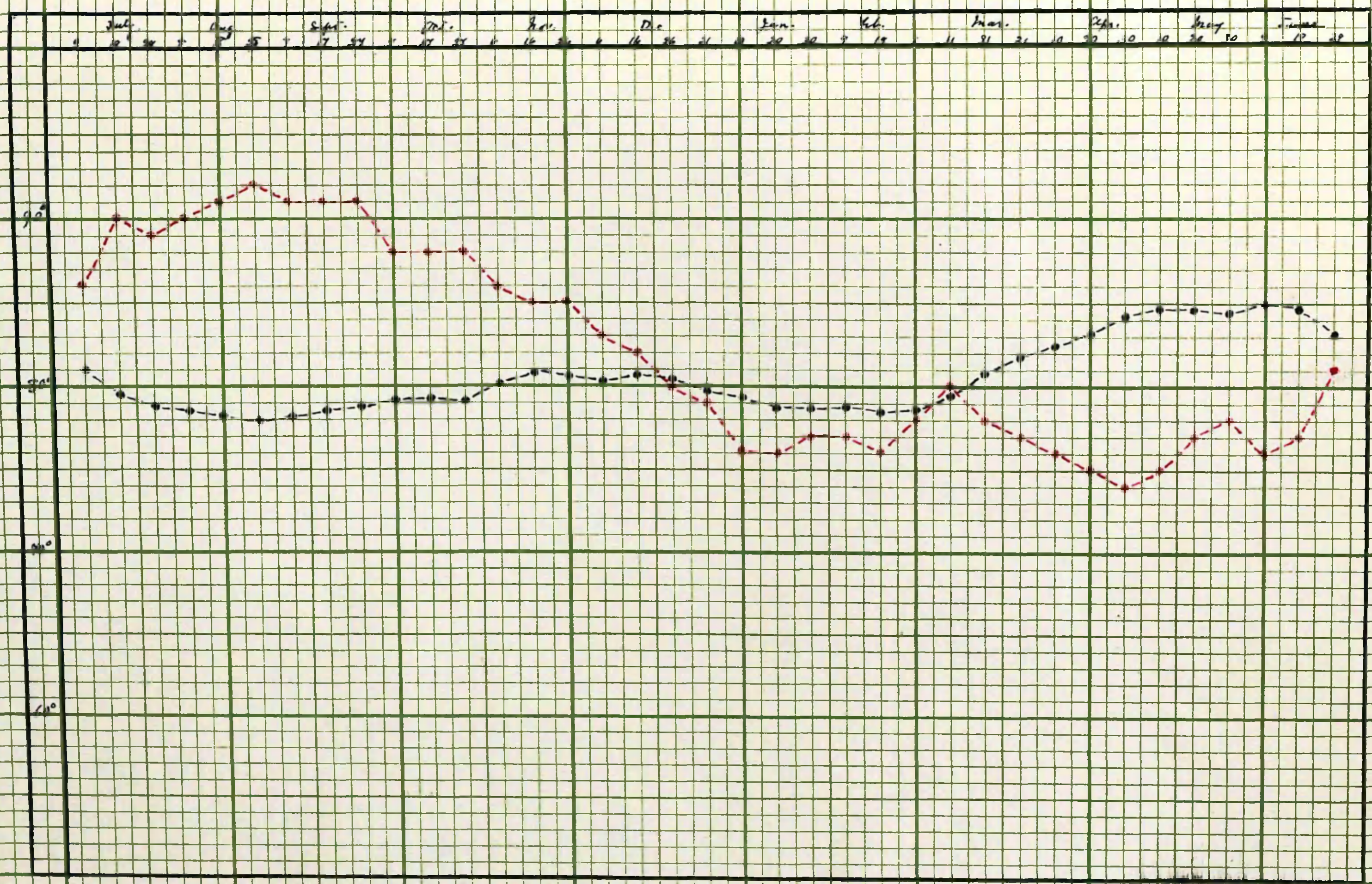
West Coast Stations.



10 Day Normal Mean Temperature & Humidity – Mangalore.

Temperature ----•---
Humidity ----•----

No 19

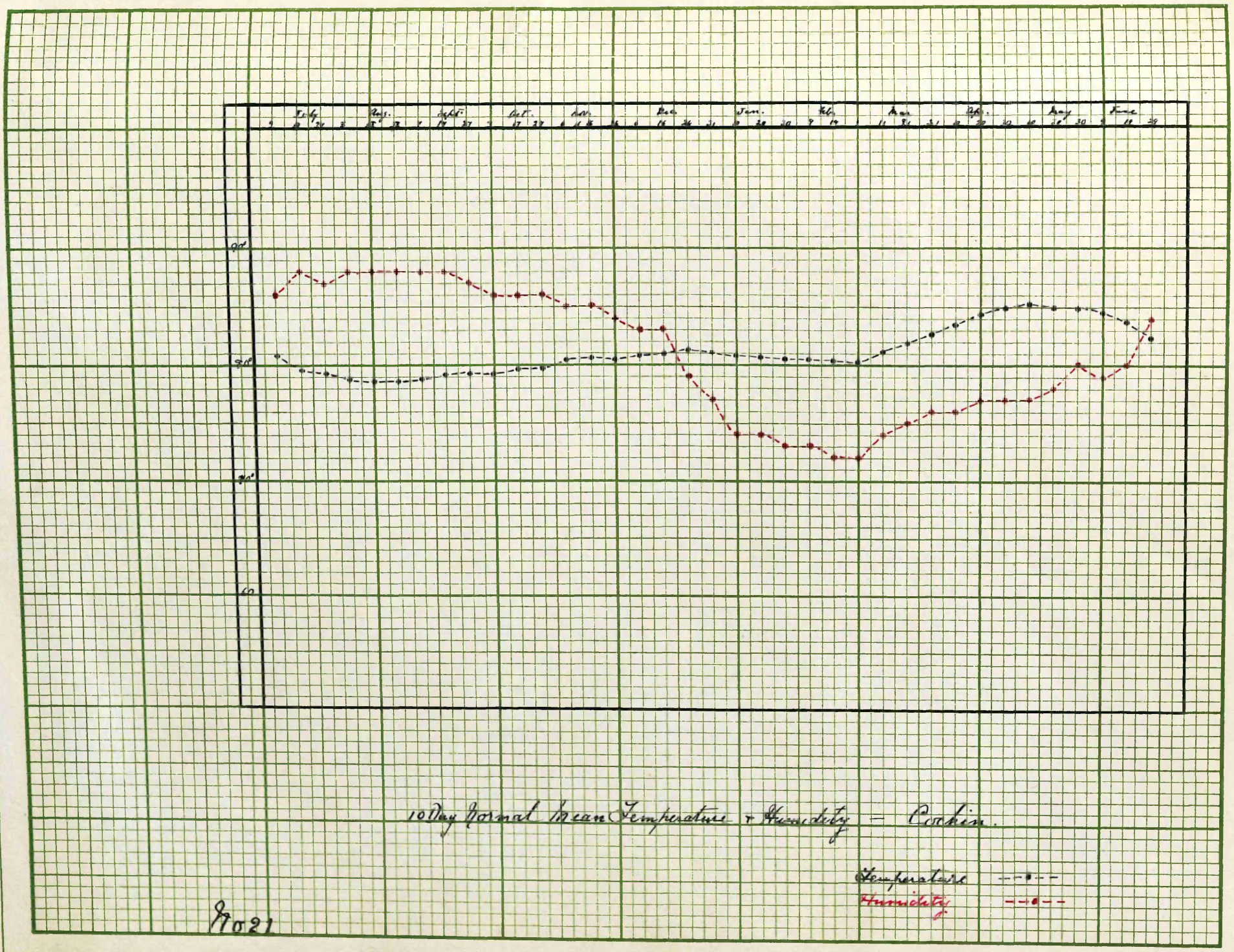


10 Day Normal Mean Temperature & Humidity – Calicut.

Temperature - - • - -

Humidity - - • - -

No 20.

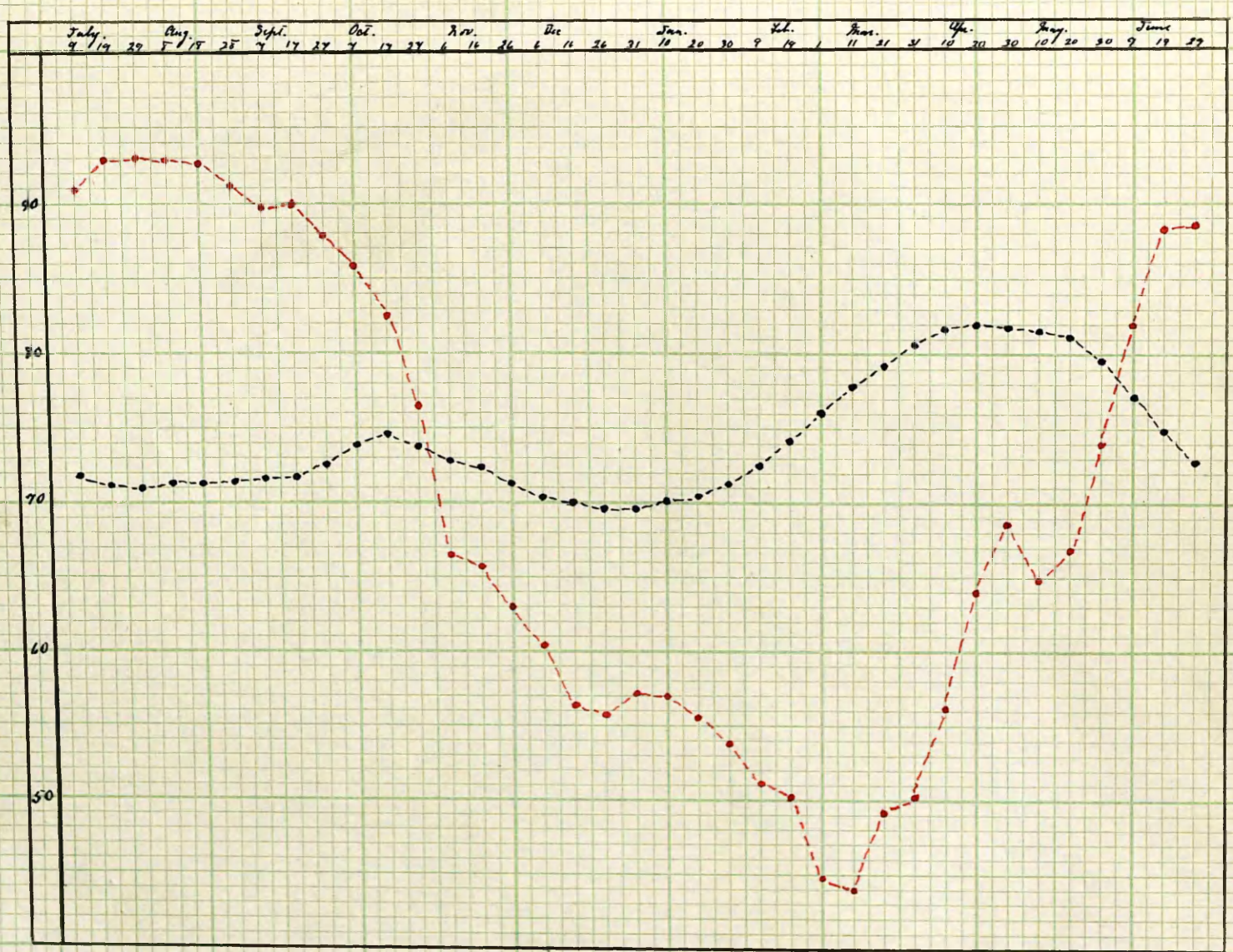


10 Day Normal Mean Temperature + Humidity = Comfort.

8021

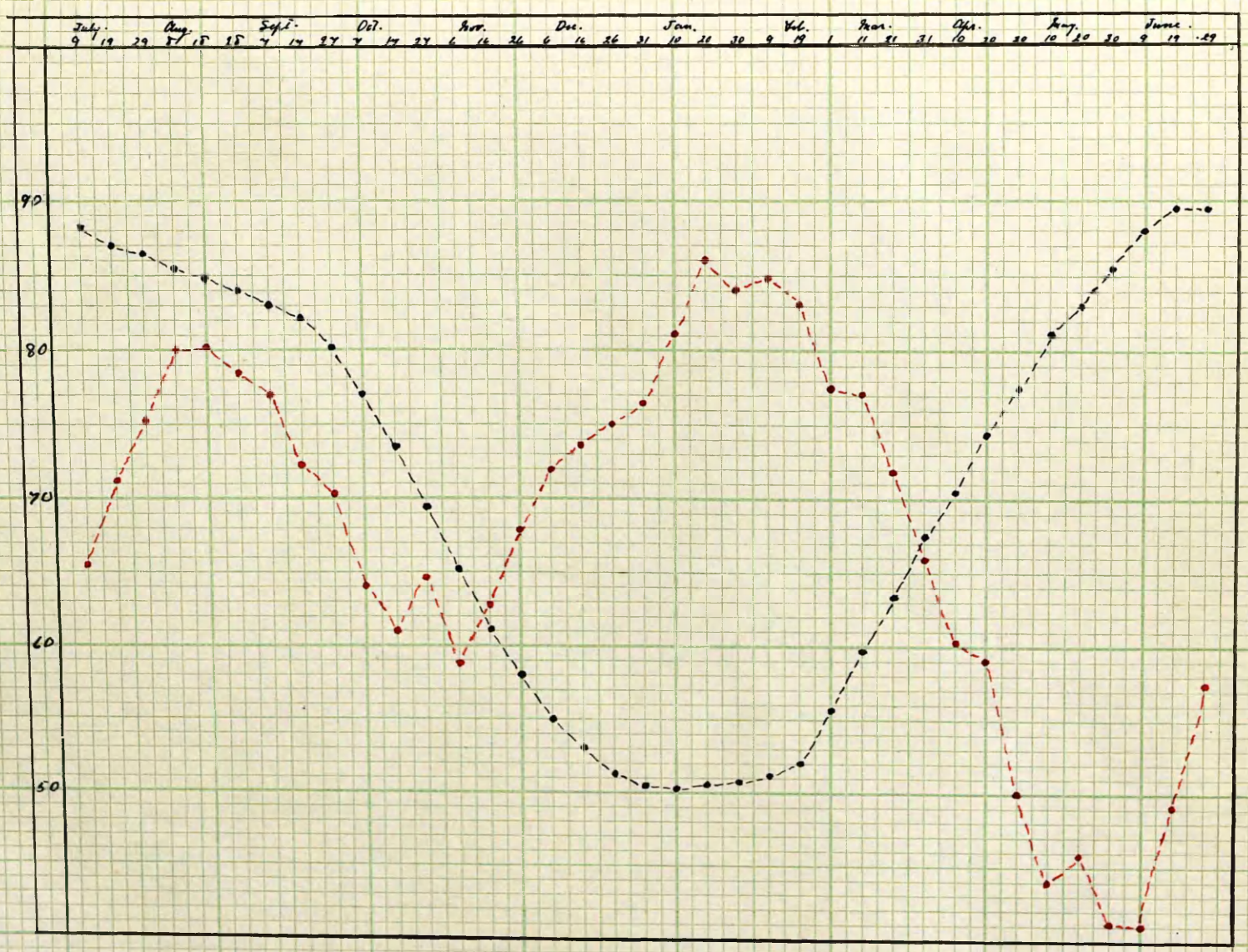
Temperature & Humidity Charts

Places outside Madras Presidency.



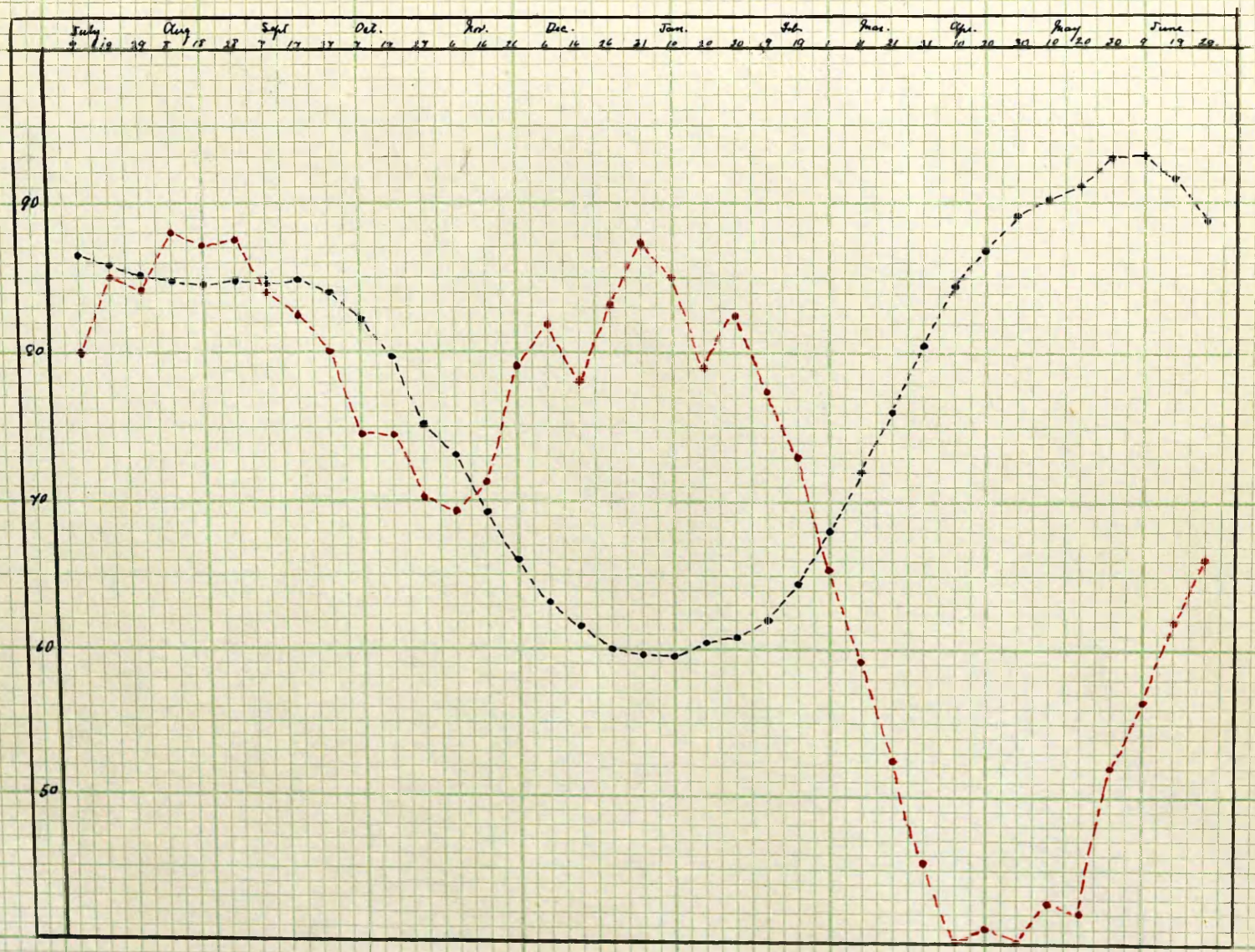
Normal 10 day Mean Temperature & Humidity – Belgaum.

No. 22.



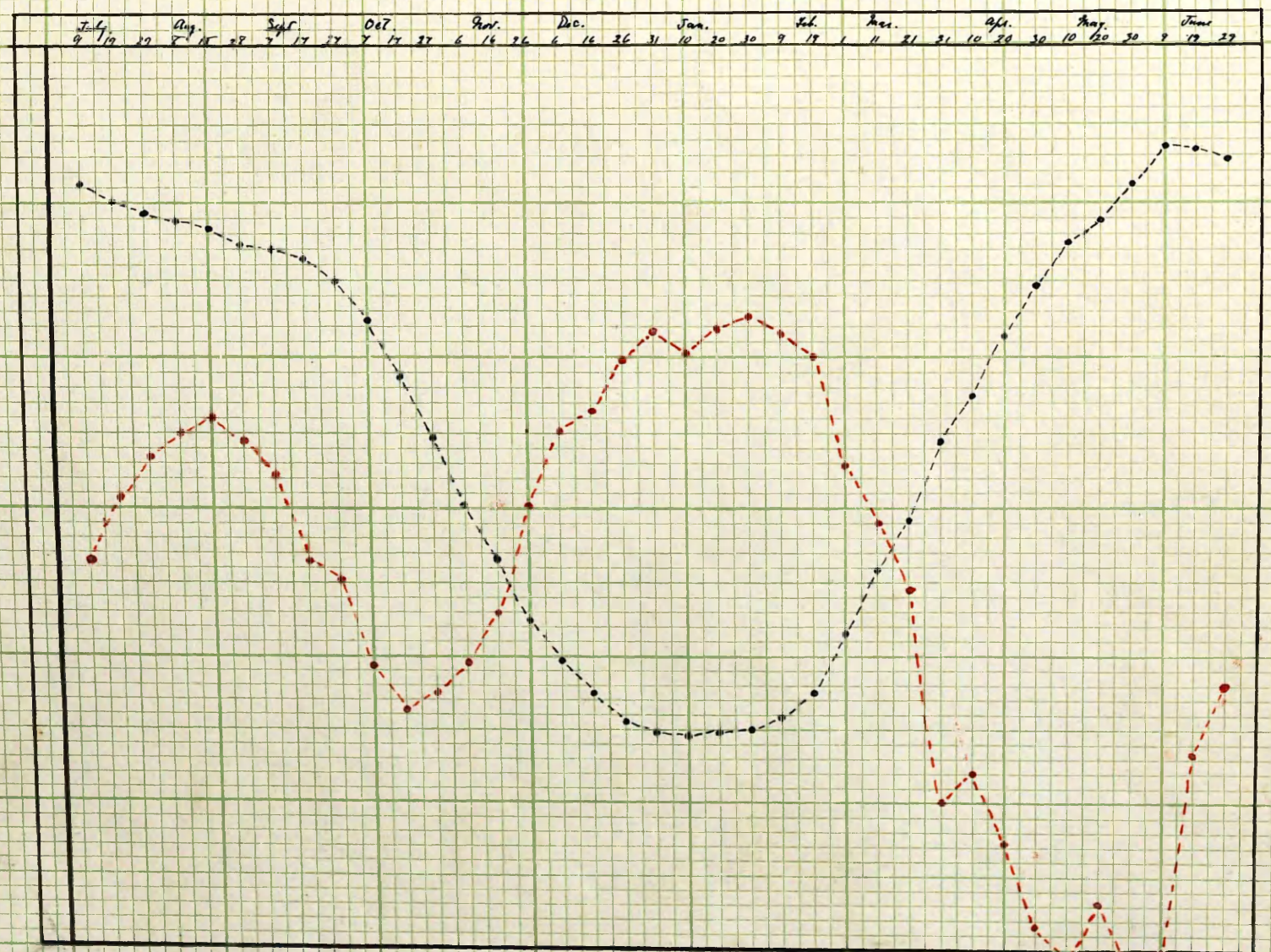
Normal 10day Mean Temperature & Humidity - Rawalpindi

No 23.



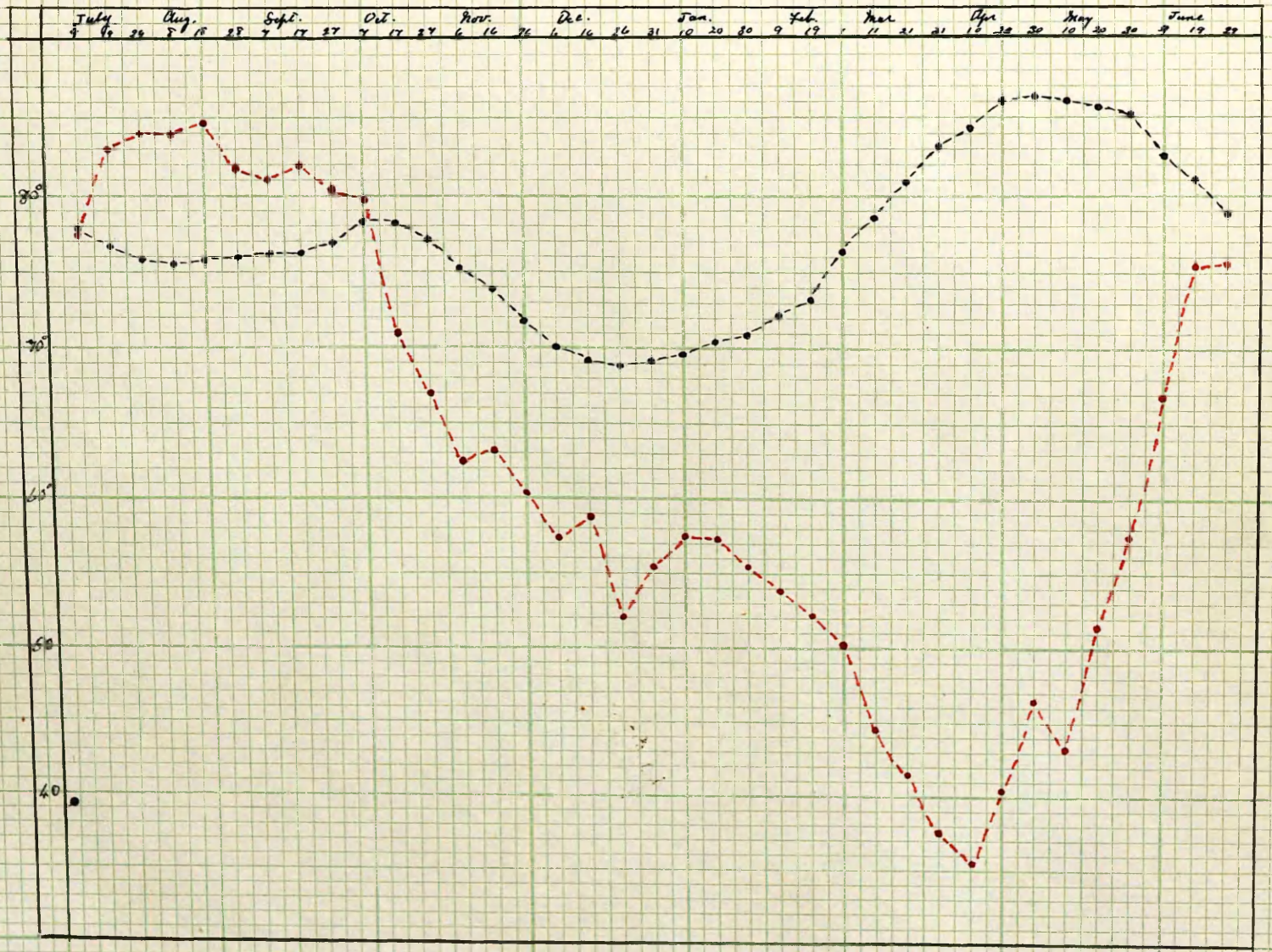
Normal 10 day Mean Temperature & Humidity - Lucknow.

No 24.



10 Day Normal Mean Temperature & Humidity — Lahore.

No 25.

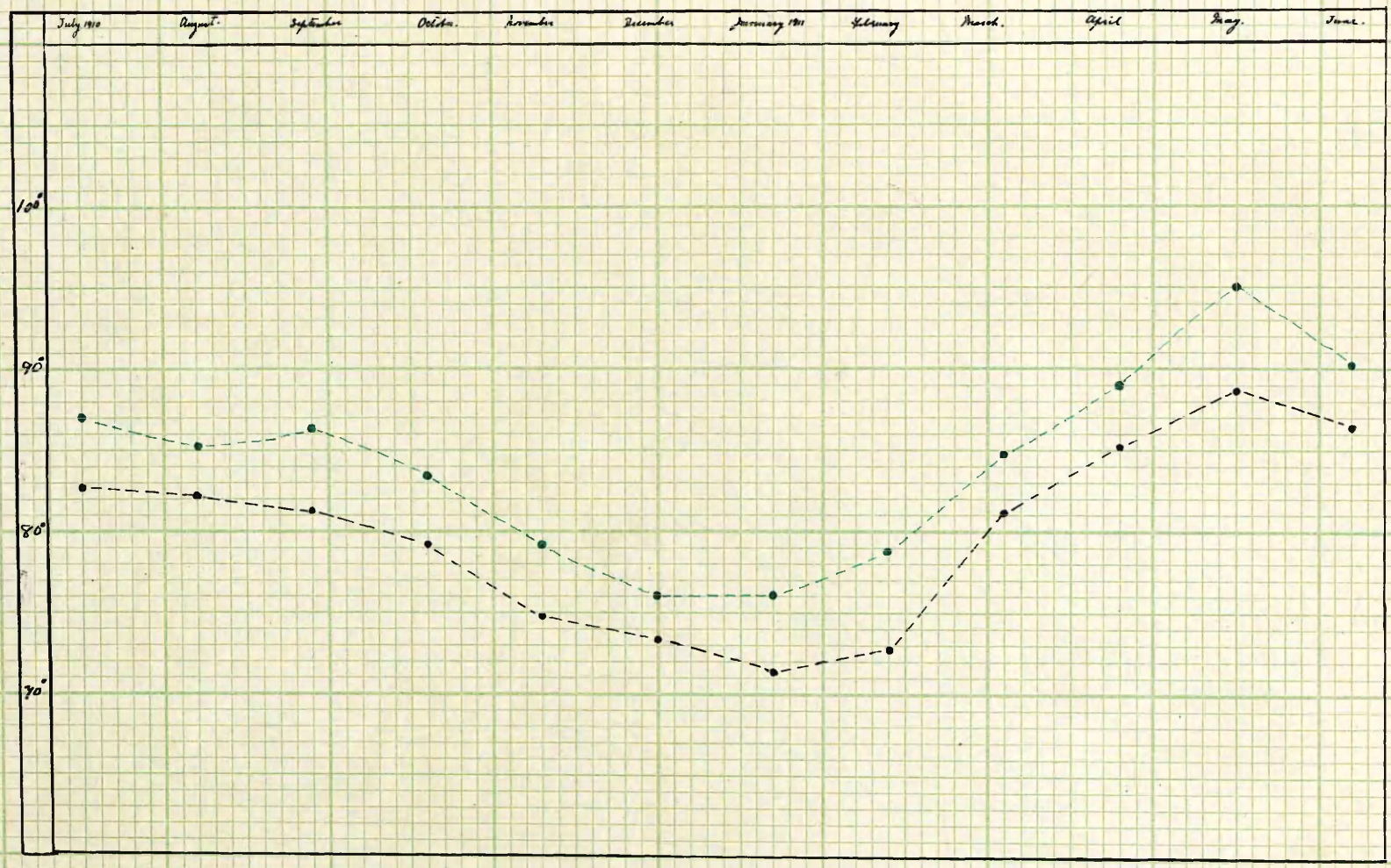


10 day Normal Mean Temperature & Humidity — Poona

Ro 26.

Temperature & Humidity Charts.

Special Charts.



Monthly Mean Temperatures — Masulipatam & Guntur. July 1910 to June 1911.

Guntur & Masulipatam are situated as the same Latitude, Guntur being 40 miles inland.

Masulipatam. - - -●- - -

Guntur - - -●- - -

No. 27.

Inland Districts which have escaped Plague.

Inland Districts which have suffered from Plague.

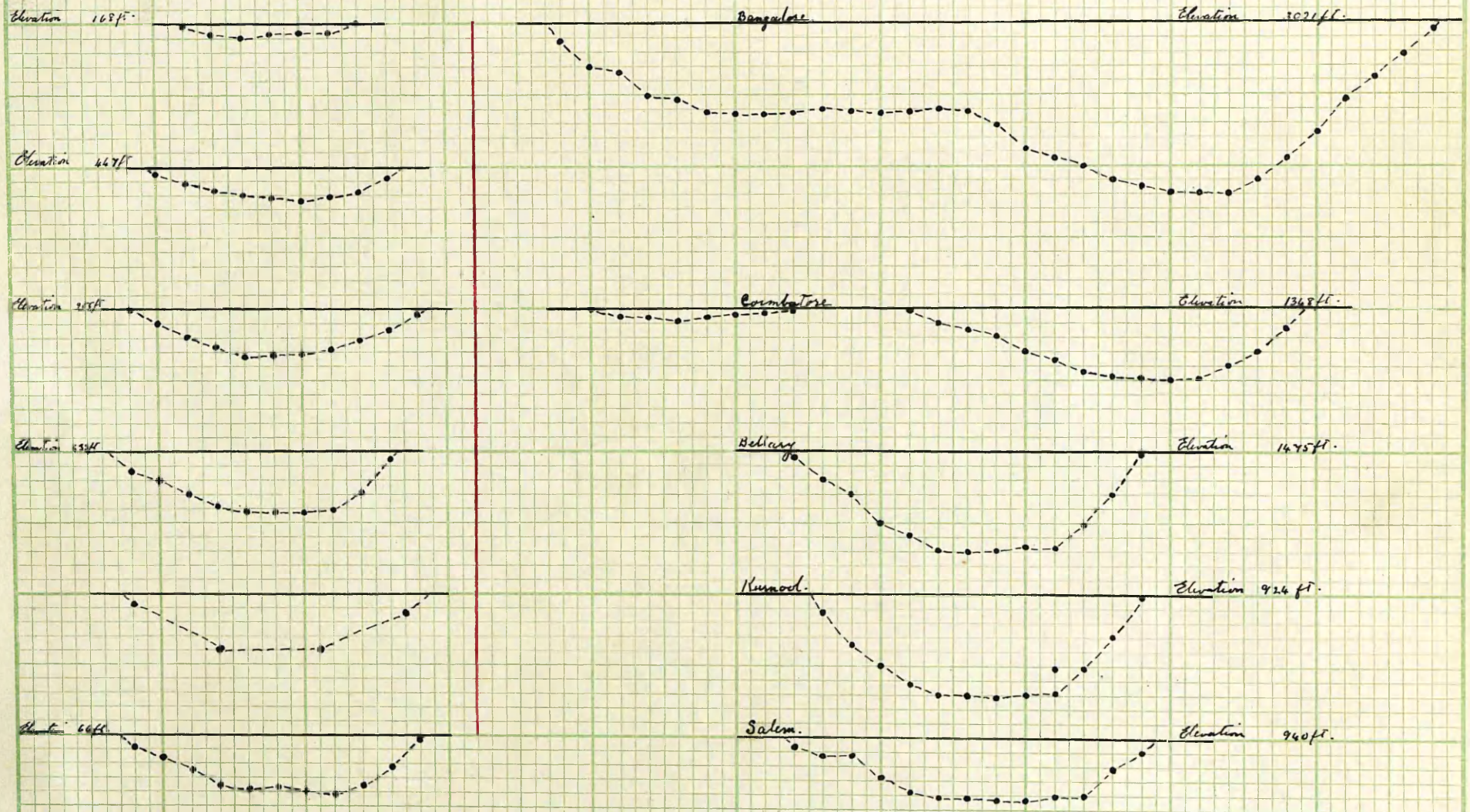


Chart showing the portions of the Annual Mean Temperature curve. below the 80° line.

Cuddapah & Madura have been put with the Non-Plague Districts. as the portions of these districts which have similar elevations & Temperature conditions to those of the observing stations have escaped Plague.

No. 28.

NILGIRI DISTRICT:

MONTHLY PLAGUE DEATHS. Population 111,437. (1901 census)

	1898	1899	1900	1901	1902	1903	1904	1905	1906	1907	1908	1909	1910	Monthly Totals.
January	1					-	25	9	15	3	14	36	11	113
February						6	13	1	5	1	3	16	-	45
March						16	11	-	4	1	2	2	1	37
April				1		2	4	2	4	-	5	28	-	46
May					1	11	1	-	2	2	8	-	-	25
June						26	5	-	-	-	18	9	-	58
July						128	3	2	-	-	17	15	-	165
August						94	2	14	-	-	13	8	3	134
September						44	4	24	4	3	12	22	7	120
October						101	9	29	5	5	10	33	3	195
November						113	4	64	5	18	25	25	2	256
December						55	-	55	1	16	16	10	4	157
Total Deaths	1	1	-		1	596	81	200	45	49	143	204	31	
Deaths of Imported Cases.	1	1	-		1	44	24	2	-	-	-	-	3	
Deaths of Indigenous cases.	-	-	-		-	552	57	198	45	49	143	204	28	

COIMBATORE DISTRICT:

Monthly Plague Deaths. Population,2,201,752 (1901 Census)

	1898	1899	1900	1901	1902	1903	1904	1905	1906	1907	1908	1909	1910	Totals.
nuary	-	-	-	-	88	175	1032	90	16	-	-	35	179	1615
bruary	-	-	-	-	55	82	689	22	9	-	4	51	112	1024
rch	-	-	-	-	18	20	260	13	2	-	13	64	34	424
pril	-	-	-	-	16	-	109	-	1	-	-	38	5	169
ay	-	-	-	-	31	3	131	9	-	-	60	89	24	347
une	-	-	-	-	48	3	281	6	-	-	35	153	84	610
ly	-	-	-	-	35	8	481	13	1	1	143	357	121	1160
gust	-	-	-	-	16	2	476	36	-	1	362	571	135	1599
ptember	-	-	-	-	10	44	289	18	-	-	204	685	139	1389
ctober	-	6	-	-	10	82	216	11	-	4	206	385	78	998
vember	-	8	-	17	56	110	209	71	1	-	127	298	260	1157
cember.	-	23	-	26	113	658	127	44	-	-	29	247	236	1503
tal Deaths	-	37	-	43	496	1187	4300	333	30	6	1183	2973	1407	
ath of Im-rted cases.	-	1	-	-	27	112	229	8	1	1	-	-	-	
tal Indig-ous deaths	-	36	-	43	469	1075	4071	325	29	5	1183	2973	1407	

SOUTH CANARA DISTRICT.

Monthly Plague Deaths.

Population 1,134,713.
(1901 Census)

	1898	1899	1900	1901	1902	1903	1904	1905	1906	1907	1908	1909	1910.
January	-	-	-	-	-	8	55	46	6	9	5	5	22
February	-	-	-	-	-	-	47	78	13	17	4	6	14
March	-	-	-	-	-	11	73	140	37	17	6	18	34
April	-	-	-	-	-	28	36	147	36	8	11	7	17
May	-	-	-	-	10	22	15	24	6	6	10	-	10
June	-	-	-	-	55	24	19	11	1	5	6	3	-
July	-	-	-	-	194	109	37	18	4	12	13	3	-
August	-	-	-	-	288	62	30	22	5	14	59	5	-
September	-	-	-	-	290	29	42	17	12	24	55	6	"
October	-	-	-	-	133	29	7	10	15	9	29	23	21
November	-	-	-	-	21	18	8	7	14	4	4	9	16
December	-	-	-	-	2	26	7	5	4	1	14	13	18
Total Deaths	-	-	-	-	993	366	376	525	153	126	216	98	152
Deaths of Imported cases	-	-	-	-	67	20	21	36	-	-	-	5	2
Death of Indigenous cases	-	-	-		926	346	355	489	153	126	216	93	150

SALEM DISTRICT:

Monthly Plague Deaths. Population 2,204,974 (1901 Census)

	1898	1899	1900	1901	1902	1903	1904	1905	1906	1907	1908	1909	1910	Monthly Totals.
January	-	35	251	156	149	1057	69	282	2	27	84	99	6	2217
February	-	81	104	376	155	1033	114	142	4	26	79	83	4	2201
March	-	68	39	266	214	564	85	37	-	18	53	19	-	1363
April	-	30	8	79	59	98	30	12	4	35	6	3	3	367
May	-	5	8	25	10	14	17	-	5	12	10	1	-	107
June	-	7	8	19	12	18	39	2	1	32	5	0	1	137
July	-	13	3	20	33	29	89	1	-	65	21	10	1	285
August	-	3	24	39	30	73	173	1	1	124	16	22	88	594
September	-	28	11	61	85	71	152	1	7	205	18	29	220	888
October	-	46	28	108	99	104	163	-	32	132	17	26	245	1000
November	-	12	20	115	232	38	110	-	8	134	42	9	709	1429
December	55	57	25	194	584	31	216	3	35	113	61	1	896	2271
Total Deaths	55	380	529	1458	1662	3130	1257	481	99	923	412	302	2178	
Deaths of Imported cases	2	69	175	138	203	231	158	48	-	-	-	-	2	
Deaths of Indigenous cases	53	311	354	1320	1459	2899	1099	433	99	923	412	302	2176	

KURNOOL DISTRICT.

Monthly Plague Deaths. Population 872,055 (1901 Census)

	1898	1899	1900	1901	1902	1903	1904	1905	1906	1907	1908	1909	1910.	Monthly Totals.
January	-	46	-	-	-	177	99	17	-	-	-	-	-	339
February	-	72	-	-	-	173	24	43	-	-	-	-	-	311
March	-	16	-	-	-	48	25	14	-	-	-	-	-	103
April	-	2	-	-	-	3	-5	1	-	-	-	-	-	11
May	-	-	-	-	-	1	1	2	-	-	-	-	-	4
June	-	-	-	-	-	-	-	-	-	1	-	-	-	1
July	-	-	-	-	-	-	2	-	-	-	-	-	-	2
August	-	-	-	-	-	-	6	-	-	-	-	-	-	6
September	-	-	-	-	-	2	32	-	-	-	-	-	-	34
October	-	-	-	-	2	-	29	-	-	1	-	-	-	32
November	-	-	-	-	2	42	33	1	-	-	-	-	-	78
December	6	-	-	2	52	45	14	-	-	1	-	-	-	123
Total Plague deaths	6	136	-	2	56	491	270	78	3	3	-	-	-	
Deaths of Imported cases	0	3	0	2	13	13	14	2	1	-	-	-	-	
Total Indigenous deaths	6	133	0	0	43	478	256	76	2	3	-	-	-	

CUDDAPAH DISTRICT.

Monthly Plague Deaths. Population 1,291,267 (1901 Census)

	1898	1899	1900	1901	1902	1903	1904	1905	1906	1907	1908	1909	1910	Monthly Totals
January	-	-	-	-	-	-	28	4	2	-	-	-	-	34
February	-	-	-	-	1	-	87	4	-	-	1	-	-	93
March	-	-	-	-	-	-	88	1	-	-	-	1	-	90
April	-	-	-	-	-	-	3	-	-	-	-	1	-	4
May	-	-	-	-	-	-	2	1	-	-	-	-	-	3
June	-	-	-	-	-	-	12	-	-	-	-	1	-	13
July	-	-	-	-	-	1	11	-	-	-	-	-	-	12
August	-	-	-	-	-	31	-	-	3	-	-	-	-	34
September	-	-	-	1	1	-	17	-	-	-	1	-	-	20
October	-	-	-	-	1	-	4	-	-	-	1	-	-	6
November	-	-	-	-	-	-	20	-	-	-	-	-	-	20
December	-	-	-	-	-	1	-	-	-	-	1	-	-	2
Total Deaths	-	-	1	3	33	272	11	5	-	4	3	-		
Deaths of Imported cases	-	-	1	3	3	23	5	1	-	1	1	-		
Deaths of Indigenous cases	-	-	-	-	30	249	6	4	-	3	2	-		

ANANTAPUR DISTRICT:

Monthly Plague Deaths.

Population 788,254
(1901 Census)

	1898	1899	1900	1901	1902	1903	1904	1905	1906	1907	1908	1909	1910	Totals
January	-	105	-	1	8	19	173	162	1	1	43	-	-	513
February	-	176	-	-	18	24	373	168	1	-	58	-	-	818
March	-	28	-	-	15	-	171	39	-	1	44	-	-	298
April	-	-	-	1	-	-	12	9	-	-	4	-	-	26
May	-	-	-	-	-	-	6	1	1	-	1	-	-	9
June	-	-	-	-	-	-	1	1	-	-	-	-	-	2
July	-	-	-	-	-	39	73	-	-	-	-	-	-	112
August	5	-	-	1	19	69	141	-	-	-	16	-	-	251
September	14	-	-	1	19	104	67	-	-	3	4	-	-	212
October	22	-	-	-	6	136	116	1	-	6	4	1	-	292
November	79	-	1	1	1	118	254	-	-	11	-	-	-	465
December	214	-	1	4	14	170	198	-	-	12	-	-	-	613
Total Deaths	334	309	2	9	100	679	1583	381	3	34	174	1	0	
Death of Imported cases	2	32	2	9	25	60	81	13	2	7	0	1	0	
Death of Indisenous cases	332	277	0	0	75	619	1502	368	1	27	174	-	-	

M A D R A S C I T Y.

Monthly Plague Deaths.

Population. 509,346.
(1901 Census.)

	1898	1899	1900	1901	1902	1903	1904	1905	1906	1907	1908	1909	1910	Totals
January	-	-	-	1	1	1	2	-	16	-	-	-	-	21
February	-	-	-	1	-	1	1	4	34	-	-	-	-	41
March	-	2	-	1	1	-	1	1	5	-	-	1	-	12
April	-	1	-	-	-	-	2	2	-	-	-	-	-	5
May	-	1	-	-	-	-	-	7	-	-	1	-	-	9
June	-	-	-	-	-	-	-	2	-	1	-	-	1	4
July	-	-	-	-	-	-	-	1	-	-	-	-	-	1
August	-	-	-	-	3	-	-	-	-	-	1	-	-	4
September	-	-	-	-	1	-	1	-	1	-	-	2	-	5
October	-	-	2	-	1	1	1	-	-	1	-	-	1	7
November	5	-	2	-	2	-	-	-	-	-	-	-	2	11
December	2	-	-	-	1	2	-	5	-	1	-	-	1	12
Total Deaths	7	4	4	3	10	5	8	22	56	3	2	3	5	
Deaths of Imported cases	7	4	4	3	10	5	8	2	1	3	2	3	5	
Deaths of Indigenous cases	-	-	-	-	-	-	-	20	55	-	-	-	-	

Madura District.

Monthly Plague Deaths.

Population 2,831,280.
(1901 Census)

	1898	1899	1900	1901	1902	1903	1904	1905	1906	1907	1908	1909	1910
January													
February							1	2		1			
March								1					
April													
May													6
June													12
July													25
August													49
September							2						57
October.							5						54
November						2	8						353
December						3							271
Total Deaths						5	16	3		1			827
Deaths of Imported cases						5	8	2		1			
Death of Indigenous cases							8	1					827

MALABAR DISTRICT.

Monthly Plague Deaths.

Population 2,764,422.
(1901 Census)

	1898	1899	1900	1901	1902	1903	1904	1905	1906	1907	1908	1909	1910.
January	1		2	1	–	3	3	–	23				
February				–	–	1	29	2	9				
March				–	8	–	236	3	1				
April				–	20	–	170	–	–				
May				1	2	–	44	–	–				
June		1	–	–	9	–	41	–	–				
July	2				11	–	42	21	1				
August			2		19	3	20	64	–				
September					11	46	7	6	1				
October					6	9	3	26	–				
November			2	–	4	10	–	40	9				
December		4	2	1	2	6	–	40	15				
Total Deaths	3	5	8	3	54	78	595	202	59				
Deaths of Imported cases.	3	5	8	2	0	0	0	2	3				
Deaths of Indigenous cases.	–	–	–	1	54	78	595	200	57				

BELLARY DISTRICT.

Monthly Plague Deaths.

Population 947,214.
(1901 Census)

	1898	1899	1900	1901	1902	1903	1904	1905	1906	1907	1908	1909	1910	Totals
January	-	39	6	-	1649	1427	2016	1037	137	41	297	9	-	6891
February	-	65	47	-	1481	731	1709	447	49	58	136	3	-	5019
March	-	28	9	-	563	420	679	145	39	39	40	3	-	2103
April	-	11	-	1	72	57	184	42	16	2	4	2	-	419
May	-	2	-	1	2	25	37	13	4	-	2	-	-	95
June	-	-	1	-	-	-	1	65	9	1	-	7	-	- 149
July	-	-	-	-	48	53	300	59	2	9	-	1	-	996
August	-	-	-	1	309	199	1218	360	8	84	3	-	-	3331
September	-	-	-	-	729	249	1509	798	21	497	9	-	-	5742
October	-	2	-	24	763	554	2041	351	6	405	53	1	1	6858
November	-	13	-	205	745	751	949	124	13	201	23	-	28	4640
December	104	5	-	758	993	1422	900	105	29	247	13	-	106	5696
Total Deaths	104	165	63	990	7354	5689	607	3490	325	1583	587	19	135	
Deaths of Imported cases	-	17	13	44	286	224	361	99	-	-	-	2	1	
Total Indigenous cases.	104	148	50	946	7068	5465	246	3391	325	1583	587	17	134	

North Arcot District.

Monthly Plague Deaths. Population 2,207,712. (1901 Census)

	1898	1899	1900	1901	1902	1903	1904	1905	1906	1907	1908	1909	1910	Monthly Totals
January	-	136	3	10	4	140	263	51	10	-	16	1	-	634
February	-	194	-	4	1	336	342	105	10	-	4	3	-	999
March	-	193	2	12	50	200	267	65	-	-	4	-	-	793
April	-	57	1	1	3	37	45	22	-	-	1	1	3	171
May	-	5	-	-	1	2	3	1	-	2	1	-	-	15
June	-	1	-	-	2	-	39	-	1	1	2	-	1	47
July	-	1	-	-	1	18	28	-	-	4	-	2	3	57
August	-	-	-	-	-	3	26	3	-	5	1	4	2	44
September	-	-	-	-	-	4	21	1	2	10	4	1	2	45
October	-	1	5	4	9	17	-	2	-	7	1	6	6	58
November	-	1	2	30	29	39	18	2	1	13	2	2	9	148
December	4	2	1	340	13	91	64	3	-	5	2	-	8	533
Total Deaths	4	591	14	401	113	887	1116	255	24	47	38	20	34	
Death of Imported Cases	-	44	14	47	113	143	139	45	7	39	7	14	30	
Deaths of Indigenous Cases.	4	547	-	354	-	744	977	210	17	8	31	6	4	

SLIGHTLY AFFECTED DISTRICTS.

South Arcot District.

Affected only in 1906.

Tiruvannamalai Taluq	27 Deaths.
Cuddalore Municipality	5 "
Chidambaram Municipality	5 "
Total	37 Deaths.

Death rate per mille in 1906 .. .. .. — .02

Trichinopoly District.

Affected only in 1910.

25 Deaths spread over 5 months.

Death rate per mille..... — .01

Total indigenous Plague deaths in the remaining Districts of the Presidency do not amount to 50 in all in the years 1895 to 1910.

Mysore State.

Monthly Plague Deaths.

Population 5,580,000
(1901 Census)

	1898	1899	1900	1901	1902	1903	1904	1905	1906	1907	1908	1909	1910
January	-	3272	560	1146	2541	3428	2284	1077	269	1119	1505	285	253
February	-	1797	326	793	2075	2076	1738	970	215	565	1095	261	175
March	-	899	132	579	1106	920	1074	491	206	269	593	233	100
April	-	396	50	242	536	321	576	181	38	199	149	27	66
May	-	313	24	119	416	164	340	51	24	317	156	26	14
June	-	247	23	269	576	348	894	54	18	257	178	149	66
July	-	487	130	713	1156	1071	1983	195	100	708	400	211	227
August	15	589	815	1068	2503	1887	3314	357	400	1424	747	442	225
September.	151	639	2091	1451	3725	2331	3045	206	459	2359	702	767	825
October	1273	768	4496	1714	4268	4096	2826	182	595	2459	635	745	1229
November	1542	632	2689	1823	3821	2322	2201	190	519	1957	568	538	1586
December	2367	771	1452	2019	3588	2379	1310	238	288	1476	434	311	1541
Total Deaths	5348	10810	12788	11936	26511	21343	21565	4192	3131	13109	7162	3995	6307

Bangalore.

monthly Plague Deaths from First Outbreak.

Months.	1898	1899	1900	1901	1902	1903	1904	1905	1906	1907	1908	1909	1910
January		47	91	316	455	429	426	112	111	50	112	35	12
February		4	62	137	325	228	285	117	55	104	93	46	2
March		3	19	86	170	61	116	118	41	86	38	44	4
April			3	24	32	5	22	43	21	67	2	2	3
May		1		5	1	1	2	8	1	50			1
June		8	1	3	2		8		1	26			
July		18	4	6	18	1	2		3	28	1		1
August	15	27	45	8	46	18	38	10	4	77		1	37
September	138	30	199	34	127	44	86	18	25	146	7	32	61
October	1097	80	456	113	280	195	90	33	15	190	15	15	155
November	1099	74	594	206	342	293	128	45	25	116	10	11	146
December	253	111	412	337	324	373	77	69	30	140	25	16	127

Plague Distribution Maps.

No.1. Average Plague Prevalence for the 13 years from 1898 to 1910 inclusive.

Nos.2 to 14. Yearly Plague Distribution for each year from 1898 to 1910.

Note: Each Blue Dot represents 1 death per 10,000 of population.

Each Red Dot represents 1 death per 100,000 of population.

MAP No. 1.

AVERAGE — 1898 to 1910.

MADRAS PRESIDENCY ATLAS

KEY MAP

Scale of Miles

Miles 50 25 0 50 100 150 Miles

NOTE.—The Longitudes are referrible to the Greenwich Meridian, taking that of Madras Observatory as 80.17.21 East They require a correction of 2·27 to make them accord with the most recent value of the Geodetic Longitude of Madras Observatory viz., 80·14·54.

Photozincographed from a Tracing, Govt. Photozinco-Office, Poona. 1912.

MAP No. 2.

1898.

MADRAS PRESIDENCY ATLAS

KEY MAP

Scale of Miles

Miles 50 25 0 50 100 150 Miles

NOTE.—The Longitudes are referrible to the Greenwich Meridian, taking that of Madras Observatory as 80.17.1 East They require a correction of 2·27 to make them accord with the most recent value of the Geodetic Longitude of Madras Observatory, viz., 80·14·54".

Photolithographed from a Tracing, Govt Photozinco-Office, Poona. 1912

MAP No. 3.

1899.

MADRAS PRESIDENCY ATLAS

KEY MAP

Scale of Miles

Miles 50 25 0 50 100 150 Miles

NOTE.—The Longitudes are referrible to the Greenwich Meridian, taking that of Madras Observatory as 80.17.1 East They require a correction of 2·27 to make them accord with the most recent value of the Geodetic Longitude of Madras Observatory, viz., 80·14·54".

Photozincographed from a Tracing, Govt Photozinco. Office, Poona. 1912.

MAP No. 4.

1900.

MADRAS PRESIDENCY ATLAS

KEY MAP

Scale of Miles

Miles 50 25 0 50 100 150 Miles

NOTE.—The Longitudes are referrible to the Greenwich Meridian, taking that of Madras Observatory as 80.17.1 East They required a correction of 2·27 to make them accord with the most recent value of the Geodetic Longitude of Madras Observatory. viz., 80-14-54.

Photozincographed from a Tracing. Govt Photozinco Office, Poona. 1912.

MAP No. 5.

1901.

MADRAS PRESIDENCY ATLAS

KEY MAP

Scale of Miles

Miles 50 25 0 50 100 150 Miles

NOTE.—The Longitudes are referrible to the Greenwich Meridian, taking that of Madras Observatory as 80.17.21 East They require a correction of 2·27 to make them accord with the most recent value of the Geodetic Longitude of Madras Observatory, viz., 80·14·54.

Photozincographed from a Trading, Govt Photozinco: Office, Poona. 1912.

MAP No. 6.

1902.

MADRAS PRESIDENCY ATLAS

KEY MAP

Scale of Miles

Miles 50 25 0 50 100 150 Miles

NOTE.—The Longitudes are referrible to the Greenwich Meridian, taking that of Madras Observatory as 80.17.21 East They require a correction of 2·27 to make them accord with the most recent value of the Geodetic Longitude of Madras Observatory, viz., 80·14·54".

Photozincographed from a Tracing, Govt Photozinco-Office, Poona. 1912.

MAP No. 7.

1903.

MADRAS PRESIDENCY ATLAS

KEY MAP

Scale of Miles

Miles 50 25 0 50 100 150 Miles

NOTE.—The Longitudes are referrible to the Greenwich Meridian, taking that of Madras Observatory as 80.17.1 East They require a correction of 2·27 to make them accord with the most recent value of the Geodetic Longitude of Madras Observatory, viz., 80·14·54".

Photozincographed from a Tracing.
Govt Photozinco Office, Poona. 1912.

MAP No. 8.

1904.

MADRAS PRESIDENCY ATLAS

KEY MAP

Scale of Miles

Miles 50 25 0 50 100 150 Miles

NOTE.—The Longitudes are referrible to the Greenwich Meridian, taking that of Madras Observatory as 80.17.1 East They require a correction of 2·27 to make them accord with the most recent value of the Geodetic Longitude of Madras Observatory, viz., 80·14·54".

Photozincographed from a Trading.
Govt Photozinco Office, Poona. 1912.

MAP No. 9.

1905.

MADRAS PRESIDENCY ATLAS

KEY MAP

Scale of Miles

Miles 50 25 0 50 100 150 Miles

NOTE.—The Longitudes are referrible to the Greenwich Meridian, taking that of Madras Observatory as 80.17.21 East They require a correction of 2·27 to make them accord with the most recent value of the Geodetic Longitude of Madras Observatory, viz., 80°-14-54".

Photozincographed from a Tracing. Govt Photozinco Office, Poona. 1912.

MAP No. 10.

1906.

MADRAS PRESIDENCY ATLAS

KEY MAP

Scale of Miles

Miles 50 25 0 50 100 150 Miles

NOTE.—The Longitudes are referrible to the Greenwich Meridian, taking that of Madras Observatory as 80.17.21 East They require a correction of 2·27 to make them accord with the most recent value of the Geodetic Longitude of Madras Observatory, viz., 80°-14-54".

Photozincographed from a Trading, Govt Photozinco. Office, Poona. 1912.

MAP No. 11.

1907.

MAP No. 12.

1908.

MADRAS PRESIDENCY ATLAS

KEY MAP

Scale of Miles

Miles 50 25 0 50 100 150 Miles

NOTE.—The Longitudes are referrible to the Greenwich Meridian, taking that of Madras Observatory as 80.17.1 East They require a correction of 2-27 to make them accord with the most recent value of the Geodetic Longitude of Madras Observatory, viz., 80°-14-54".

Photozincographed from a Tracing, Govt Photozinco Office, Poona 1912

MAP No. 13.

1909.

MADRAS PRESIDENCY ATLAS

KEY MAP

Scale of Miles

Miles 50 25 0 50 100 150 Miles

NOTE.—The Longitudes are referrible to the Greenwich Meridian, taking that of Madras Observatory as 80.17.1 East They require a correction of 2·27 to make them accord with the most recent value of the Geodetic Longitude of Madras Observatory, viz., 80·14·54.

Photozincographed from a Tracing, Govt Photozinco Office, Poona, 1912

MAP No. 14.

1910.