

Chapter I

GENERAL

ORIGIN OF THE NAME OF THE DISTRICT

Bhiwani, one of the eleven districts¹ of Haryana State, came into existence on December 22, 1972, and was formally inaugurated on January 14, 1973. It is named after the headquarters town of Bhiwani, believed to be a corruption of the word Bhani. From Bhani, it changed to Bhiani and then Bhiwani. Tradition has it that one Neem, a Jat Rajput, who belonged to village Bawani², then in Hansi tahsil of the Hisar (Hissar) district, came to settle at Kaunt, a village near the present town of Bhiwani. This was resented by the local Jat inhabitants, and they plotted his murder. Neem was warned by a Jat woman, named Bahni, and thus forewarned, had his revenge on the local Jats. He killed most of them at a banquet, the site of which was mined with gunpowder. He married Bahni and founded a village named after her. At the beginning of the nineteenth century, Bhiwani was an insignificant village in the Dadri pargana, under the control of the Nawab of Jhajjar. It is, however, referred to as a town when the British occupied it in 1810.³ It gained importance during British rule when in 1817, it was selected for the site of a *moodi* or free market, and Charkhi Dadri, still under the Nawabs, lost its importance as a seat of commerce.

LOCATION, BOUNDARIES, AREA AND POPULATION

Location and boundaries. The district of Bhiwani lies in between latitude 28° 19' and 29° 05' and longitude 75° 28' to 76° 28'. It is bounded in the north by the Hisar (Hissar) district, in the east by the Rohtak district, in the south by the Mahendragarh district of Haryana and the Jhunjhunu district of Rajasthan and in the west by the Churu district and a part of the Jhunjhunu district of Rajasthan.⁴

Area.—With an area of 5,090 square kilometres, Bhiwani is the second

1. The twelfth district of Faridabad has been created on August 15, 1979.

2. Amin Chand, *Tawarikh-i-Zila Hisar*, 1866, p.15. Bawani is apparently Bawani Khara, now the headquarters of a tahsil of the same name in the district.

3. *Hisar District Gazetteer*, 1892, p.41.

4. *Source* : Survey of India, North Western Circle, Chandigarh.

largest district in the State following Hisar (Hissar). It comprises four tahsils covering the areas shown below¹ :

Tahsil	Area (Square kilometres)		
	Total	Urban	Rural
Bhiwani	1,470.33	11.66	1,458.67
Bawani Khara	1,032.86	—	1,032.86
Dadri	1,421.25	4.51	1,416.74
Loharu	1,165.56	2.59	1,162.97
Total :	5,090.00	18.76	5,071.24

Population.—The district as such was not in existence at the last Census of 1971 and separate population data have not been published. However, the population, computed on the basis of the 1971 Census, was 7,61,953 persons.² In population, it is the eighth among eleven districts of the State following Gurgaon, Hisar (Hissar), Rohtak, Ambala, Karnal, Kurukshetra and Jind and stands ahead of Mahendragarh, Sonapat and Sirsa.

HISTORY OF THE DISTRICT AS AN ADMINISTRATIVE UNIT

The first record of the administrative division now comprising the Bhiwani district, is found in *Ain-i-Akbari*. Akbar divided his kingdom into subahs, *sikars* and *mahals* or parganas. The whole of what is now the Bhiwani district was mostly in *sikar* of Hisar Firoza (principal *mahals* being Tosham, Seoran and Siwani)³ and *sikar* of Delhi (principal *mahal* being Dadri Taha)⁴ of subah Delhi. With the decay of the Mughal Empire this area remained disturbed in consequence of fighting between the neighbouring chiefs till 1803, when the greater part of it came under British rule by the Treaty of Surji Arjunsan. Thereafter conditions settled down. The present district has been formed by

1. *Source* : Deputy Commissioner, Bhiwani.

2. *Statistical Abstract of Haryana, 1975-76*, p.3. (Issued by the Economic and Statistical Organization, Planning Department, Haryana.)

3. Abul Fazl, *Ain-i-Akbari*, Volume II (English translation by H. S. Jarrett, corrected and further annotated by Sir Jadunath Sarkar), 1919, pp. 298-300.

4. *Ibid.*, pp.291-93.

merging three separate units, viz. (i) Bhiwani and Bawani Khera, which formed a part of the Hisar (Hissar) district; (ii) Dadri, which was formerly a part of a princely State and later of the Mahendragarh district; and (iii) Loharu, which was a princely State and later merged with the Hisar (Hissar) district after Independence. These three tracts have different administrative histories.

The first tract consisting of the two tahsils of Bhiwani and Bawani Khera, was a part of the territory known as Haryana immediately prior to the British conquest in 1803 and was nominally subject to the Marathas, who ruled it in the name of Mughal Emperor at Delhi. Siwani and Bahl were 2 of the 19 districts into which Haryana had been divided at that time.¹ In 1810, the date of the actual establishment of the British authority in this part, the whole of the Delhi territory ceded by the Marathas was subject to the Resident of Delhi, and was divided into two districts: Delhi, already under the Resident, and the outlying districts including Hansi, Hisar (Hissar), Sirsa, Rohtak, Panipat and Rewari, under the immediate charge of an Assistant to the Resident. In 1819, the Delhi territory was divided into three districts: the central district which included Delhi, the southern including Rewari, and the north-western including Panipat, Hansi, Hisar (Hissar), Sirsa and Rohtak. In 1820, the latter (north-western) was again sub-divided into a northern and a western district; of which the latter (western) included Bhiwani, Hansi, Hisar (Hissar) and Sirsa, the headquarters being at Hansi. In 1824, Rohtak which had previously been in the western district, was constituted into a separate district to which Bhiwani was transferred.

In 1861, 24 villages of the Maham-Bhiwani tahsil of the Rohtak district were transferred to the Hisar (Hissar) district, 18 including the town of Bhiwani to the then constituted Bhiwani tahsil and 6 to Hansi. In addition to this, 5 villages, confiscated from the Nawab of Jhajjar for siding against the British in the events of 1857, were in the same year added to the Bhiwani tahsil.² On January 1, 1891, 13 villages were transferred from the Hisar (Hissar) tahsil to the Bhiwani tahsil.³

Of the history of the second tract, Loharu, little is known. It once formed a part of the Jaipur State, but towards the middle of the 18th century some adventurous Thakurs, after the fashion of the day, shook off the

1. Griffin L.H., *The Rajas of the Punjab*, 1870, p.168; *Hisar District and Loharu State Gazetteer (Hisar District)*, 1915, pp.39-40.

2. *Hisar District Gazetteer*, 1892, p.53.

3. *Hisar District and Loharu State Gazetteer (Hisar District)*, 1915, p.46.

Jaipur authority and formed an independent State. The Raja of Khetri, a dependency of Jaipur, attempted to subdue them but was slain in battle at Loharu. The State was, however, re-annexed to Jaipur for a time, but it soon regained its independence. Subsequently it acknowledged British suzerainty. The British rulers gave the taluk of Loharu (738 square kilometres) in reward to the Maharaja of Alwar, who had loyally aided them during the 1803 campaign against the Marathas. The sanad given by General Lord Lake to Raja Siwasee Bakhtawar Singh of Alwar on this occasion is translated as follows¹ :-

"To all Mootsaddies, present and future, as well as to Amils, Chondhrees, Kanoongoes, Zamindars and Cultivators of Parganas, Ismacelpooro, and Moodawar with the Talookas of Darbarpore, Rutsee, Nimrana, Mandan, Ghelote, Beejwar, Surai, Dadree, Loharoo, Boodwanah and Bhoochalnahur, under the Soobah of Shahjehanabad : Let it be known that between the Honourable the East Indian Company of England and Maharao Raja Sewasee Bakhtawar Singh the friendship which existed has been strengthened; therefore, with a view of proving and making this fact public to every one, General Lord Lake directs that the above-mentioned district be made over to the Maharao Raja for his expenses, subject to the concurrence of the Most Noble the Governor-General, Lord Wellesley.

"On the permission of the Governor-General being received, another Sanad will be given in place of the present one, which will be recalled.

"Until another Sanad arrives, this one will remain in possession of the Maharao Raja.

"Parganas Ismacelpore and Moodawar, with the Talookas of Darbarpore, Rutsee, Nimrana, Mandan, Beejwar and Ghelote and Surai, Dadree and Loharoo, Boodwanah and Bhoochalnahur.

"Dated 28th November, A.D. 1803, corresponding with the 12th of the Shaban, 1218 Hijree or Aghun Sood Pooranmassee, Sambat, 1860.

"(Signed) G. Lake."

The Maharaja in turn, with the assent of the British Government, entrusted Loharu to his vakeel, Ahman Bakash Khan, who had fought gallantly on the British side under the title of Nawab.² His descendants ruled this

1. Powlott, P.W., *Gazetteer of Ulwar*, 1878 (London), p. 172.

2. *Hisar District and Loharu State Gazetteer (Loharu State)*, 1915, pp. 2-3; *Alwar District Gazetteer*, 1968, p.65.

State till it was merged, except 15 villages, with the Hisar (Hissar) district under the Provinces and States (Absorption of Enclaves) Order, 1950.¹

According to the *Phulkian States Gazetteer (Patiala, Jind and Nabha)*, 1904,² Charkhi Dadri town was formerly in the possession of Nawab Bahadur Jang, a relative of the Jhajjar Nawab. In the events of 1857, his estates were confiscated. Dadri area, covering nearly 600 square miles³ (1,554 square kilometres) was first included in the newly created district of Jhajjar, which was abolished shortly afterwards in 1860 when large parts of it were assigned to the Phulkian Chiefs, as a reward for their services to the British Government.⁴ Dadri was conferred on Raja Sarup Singh of Jind.⁵ Till 1904, Dadri was a tahsil of the Jind district (Nizamat). In that year, Dadri tahsil was made into a separate district.⁶ After Independence (1947), and the subsequent formation of PEPSU (Patiala and East Punjab States Union) on May 5, 1948, the Dadri area of the Jind State was included in the Mahendragarh district. Under the States Re-organisation Act, 1956, PEPSU was merged with Punjab on November 1, 1956, and consequently the Mahendragarh district, of which Dadri was a part, became one of the then 19 districts of Punjab. The four villages of the Dadri tahsil, viz. Umrawat, Halluwas, Dharana and Rajgarh, with a total area of 31.49 square kilometres were transferred to the Bhiwani tahsil of the Hisar (Hissar) district. The village Umrawat was actually transferred on October, 6, 1969, while the other three villages had been transferred on August 10, 1962.⁷

This entire area was included in the new State of Haryana on November 1, 1966. The above administrative arrangements continued till the new district of Bhiwani comprising the Dadri, Loharu, Bhiwani and Bawani Khera tahsils with headquarters at Bhiwani was constituted on December 22, 1972, by varying the limits of the Mahendragarh and Hisar districts so as to exclude the areas of the Dadri tahsil of the Mahendragarh district, and Loharu, Bhiwani and Bawani Khera tahsils of the Hisar district.⁸

1. *Census of India, 1961, District Census Handbook, Hisar District, 1960*, p. 11.

2. *Ibid.*, p. 333.

3. *Ibid.*, p. 216.

4. *Rohatak District Gazetteer, 1970*, p. 3.

5. *Phulkian States Gazetteer (Patiala, Jind and Nabha)*, 1904, p. 333.

6. *Phulkian States Gazetteer, Statistical Tables (Jind State)*, 1913, p. 3.

7. *Census of India, 1971, District Census Handbook, Mahendragarh District, 1973*, p. 5.

8. Vide Haryana Government, Revenue Department Notification No. 6050-E(IV)-72/45723, dated December 22, 1972.

The following table shows the number of villages in each tahsil on the eve of the formation of the Bhiwani district and thereafter :—

Tahsil	Number of villages on the eve of December 22, 1972	Number of villages on December 22, 1972	Remarks
Bhiwani	148	114	(i) 37 villages were transferred to the Loharu tahsil. (ii) 6 villages were transferred to the Bawani Khara tahsil. (iii) 9 villages were added from the Dadri tahsil.
Bawani Khara	Nil (tahsil not in existence)	55	(i) 6 villages were added from the Bhiwani tahsil. (ii) 32 villages were added from the Hansi tahsil of the Hisar district. (iii) 17 villages were added from the Hisar tahsil of the Hisar district.
Dadri	180	191	(i) 9 villages were transferred to the Bhiwani tahsil. (ii) 20 villages were added from the Mahendragarh tahsil of the Mahendragarh district.
Loharu	72	111	(i) 2 villages were added from the Mahendragarh tahsil of the Mahendragarh district. (ii) 37 villages were added from the Bhiwani tahsil.

On April 23, 1974, 12 villages (Jarwa, Basri, Sohari, Nanwan, Nangal Mala, Satnali, Birsingwas, Sureti Jhakar, Sureti Piana, Sureti Maveryana, Dhana and Bas) were transferred from the Dadri tahsil to the Loharu tahsil. 5 villages (Nimriwali, Pahludgarh, Nandgaon, Ruggarh and Madh Mathvi) were included in the Bhiwani tahsil from the Dadri tahsil. One village, Indiwali, was also included in the Bhiwani tahsil from the Loharu tahsil.¹ On the same day, 3 villages of the Dadri tahsil (Bhurjat, Kharkhara and Adilpur) were incorporated in the Mahendragarh tahsil of the Mahendragarh district; 5 villages of the Mahendragarh tahsil (Barda, Dalanwas, Gadarwas, Madogarh and Degrota) were transferred to the Loharu tahsil and 1 village, Nasuha, of the Mahendragarh tahsil was transferred to the Dadri tahsil.² On June 11, 1974, 5 villages of the Loharu tahsil (Isharwal, Dewawas, Rodhan, Sathawali and Hasan) were included in the Bhiwani tahsil and 3 villages (Kakral, Sewani and Naloi) in the Bawani Khera tahsil.³ Thus the Bhiwani district, on March 31, 1977, comprised 474 villages, divided between tahsil Bhiwani: 125, tahsil Bawani Khera : 58, tahsil Dadri: 172 and tahsil Loharu : 119.

SUB-DIVISIONS, TAHSILS AND THANAS

The district has 4 tahsils : Bhiwani, Bawani Khera, Dadri and Loharu. Sub-divisions were created at Bhiwani, Dadri and Loharu on September 3, 1954, September 4, 1968 and November 10, 1976 respectively. The Bawani Khera tahsil is under the Sub-Divisional Officer, Bhiwani.

There are 9 *thanas* (police stations) and 8 police posts.⁴ Details may be seen in the Chapter on 'General Administration'.

TOPOGRAPHY

According to the *Hisar District and Loharu State Gazetteer (Hisar District)*, 1915, the general aspect of the district, (which included much of the present Bhiwani district), may be described as a level plain or prairie, stretching from the north-west to the south east, and unbroken by any natural irregularity, except in the south-western corner where some of the detached peaks

1. Vide Haryana Government, Revenue Department Notification No. 2278-RIV-74/11546, dated April 23, 1974.

2. Vide Haryana Government, Revenue Department Notification No. 2778-RIV-74/11547, dated April 23, 1974.

3. Vide Haryana Government, Revenue Department Notification No. 2039-RIV-74/19359, dated June 11, 1974.

4. The police post of Bahl having been up-graded as police station on April 1, 1977, there are now 10 police stations and 7 police posts.

of the Aravalli range stand out against the horizon. The highest of these is the Tosham hill, 800 feet (244 metres) high. A sandy tract stretches down the western portion of the district till the Bhiwani area is entered, where the district presents the appearance of a sea of sandy billows of a more or less fluctuating nature. The whole of the Bhiwani tahsil, leaving out a small portion in the east which was a part of the so-called Haryana tract, was known as Bagar. Here the prevailing characteristic is a light sandy soil and shifting sand-hills interspersed in places with firmer and in part loamy bottoms. The sand-hills are known as *tibbas* and the firmer valleys between as *tals*.¹

As regards the Loharu tahsil, "The aspect of the country is uniform throughout the State. It presents a prospect, dreary and desolate, a treeless waste dotted with sand-hills, and sparsely covered with vegetation. No natural divisions can be said to exist and the hill system is comprised in two hills which rise in rocky isolation in the centre of the State."²

As regards the Dadri area, according to the *Phulkian States Gazetteer (Patiala, Jind and Nabha)*, 1904,³ it lay in Haryana tract and Badhara in the Bagar which was a continuation of the Bagar of the Bhiwani tahsil, though water was 50 to 54 feet (15 to 16.5 metres) below the surface.

As regards the river system in the Dadri tahsil, the *Phulkian States Gazetteer (Patiala, Jind and Nabha)*, 1904, records that "Tahsil Dadri, which has no canal irrigation, is watered by the Dohan, a stream which rises in the lands of Ghoghra and Bhugaur, two villages of the Jaipur State, whence it flows past the Patiala town of Kanaut and thereafter irrigates the Jind villages of Palari, Badhwana, Jawa, Jhohru Kalan, Balali, Abidpura, Mandola, Kaliana and Dadri for some 15 or 16 miles (24 or 26 kilometres), disappearing in the dakar land of kalyawas (Kaliawas) in Rohtak. When in flood in the rainy season, it is used to fertilize the lands below its level for two or three years, but it was apt in years of heavy rainfall to cause damage both to houses and crops, and is now controlled by three dams, of which the first, raised in 1874, lies between the roads leading from Dadri to Kaliana and Jhajjar, while the second is between those leading to the Dadri railway station and the Johawala tank near the town, and the third, made in 1886, adjoins Dadri station, lying between the road leading from the town to Rawaldhi and that leading from the town to the Station. The worst floods occurred in 1862 and 1885. In the latter year considerable damage was done in the town of Dadri both to

1. *Ibid.*, pp. 2A.

2. *Hisar District and Loharu State Gazetteer (Loharu State)*, 1915, p. 1.

3. *Ibid.*, p. 212.

private property and to the State *Khatas* or grain stores, which were destroyed. The loss to the State alone was estimated at a lakh of rupees. The *bands*, which kept the water of the Dohan from entering the town, also prevented the surface drainage of the town itself from finding an outlet, and thus injury to the place resulted."¹

The waters of Dohan have, however, ceased to flow into the Dadri tahsil. At least since 1947, no floods from this stream have afflicted this tahsil. The stream gets absorbed in the arid and sandy tract of Mahendragarh district and completely vanishes near villages Akodah and Bassi which are situated on the Narnaul-Mahendragarh-Dadri Road close to the northern border of the Mahendragarh district.

The newly carved out district occupies a transitional position between the fairly flat and featureless Punjab-Haryana Plains on the one hand, and the Rajasthan desert and the Aravalli hills on the other. A major portion of this transitional tract is a sandy, undulating plain dotted with sand-dunes of varying shapes and dimensions occurring in different directional dispositions. The monotony of the sandy plain is broken in parts by the hills which once were a part of the Aravalli mountain system, one of the oldest in the country. The north-eastern part of the district, by contrast, is a fairly flat plain. The highest point in the district is 1,470 feet (448 metres) above sea level near Kaliana in the Dadri tahsil. The general topography of the district bears distinct imprint of the influence of both wind and water. In several parts it has the characteristics of desert topography and arid landscapes. This is also confirmed in the term 'Bagar' which is a climatic term indicating arid conditions. Of the districts comprising the State of Haryana, Bhiwani comes next to Gurgaon and Mahendragarh in physiographic diversity.

A close examination of the relief of the area reveals a fourfold division of the district into physiographic units :

- (i) the north-eastern part, which is fairly flat ;
- (ii) the central and north-western zone with a fair spread of low hills of different dimensions, occurring in varying directions, and interspersed by sand-dunes in parts;
- (iii) the sandy triangular zone enclosed by Bhiwani, Loharu and Jhumpa; and

1. Ibid, pp. 212-13.

- (iv) the eastern and north-eastern part of the Dadri tahsil which has a mixture of plain and hill topography, the hills being small and sporadic in occurrence.

(i) The North-eastern Zone

This zone includes a large part of the Bawani Khera tahsil and the north-eastern section of the Bhiwani tahsil. It is generally flat, with a north-east to south-west inclination. The southern and south-western limits of this topographic unit are marked by the termination of distributaries of the Western Yamuna (Jumna) Canal System. The predominance of hills and sand-dunes west of this zone reverse the inclination of the land characteristic of the canal irrigated area. The area north-east of the Bhiwani-Dhamiyan (Dhamana) axis is practically flat and presents a plain's landscape.

Throughout this belt the altitude ranges between 695 and 741 feet (212 and 226 metres) above sea level. However, there is a stray occurrence of sand-dunes even here; such as near villages Balyali and Badesra in the Bawani Khera tahsil, and near villages Chang and Rewari in the Bhiwani tahsil.

(ii) The Central and North-western Zone

This zone is practically enclosed by the lines joining the places : Tosham-Bajina-Rodha-Jhumpa-Gureta-Barwa-Dhamiyan (Dhamana)-Tosham. The characteristic feature of the topography is the relic type of hills occurring all over the area. These hills are part of the old Aravalli mountain system, subjected to the forces of erosion for long and now only those parts of the mountain system survive which have withstood the ravages of the agents of change. These are now in fact only relics. Generally, these hills are interspersed with fairly level surfaces with occasional sand-dunes. The highest point of this tract is 1,125 feet (343 metres) above sea level on the hill near village Khanuk. Another high point is at Ningana which is 1,122 feet (342 metres). The hill at Tosham is 800 feet (244 metres). On the other hand the area near Siwani is the lowest in altitude, 679 feet (207 metres) above sea level. Barring the hills, the altitude of this tract varies between 679 and 780 feet (207 and 238 metres). The direction of these hills varies from area to area. Immediately west of Tosham, they generally extend in a north-south direction while their alignment between Jhumpa and Barwa is often south-west to north-east. Several of the hills are small, broken and irregular in shape.

(iii) The Sandy Triangular Zone

The area enclosed by lines joining Bhiwani-Loharu-Jhumpa-Bhiwani is a typical sandy tract which shares the topography characteristic of parts

of the adjoining Rajasthan desert. This zone is clustered with sand-dunes of varying shapes and dimensions. In between the sand-dunes are fairly level sandy surfaces which constitute the main agricultural land. Of course, the general topography is marked by irregularities and undulations. The direction of the sand-dunes is inconsistent. The general altitude of this tract varies between 750 and 870 feet (229 and 265 metres). However, there is a hilly point called 'Pahuri' which is 1,064 feet (324 metres). The sand-dunes, which are quite closely spaced, represent an extension of the landscape across the State border in Rajasthan.

(iv) The Eastern Dadri Zone

This tract includes the eastern part of the Dadri tahsil. It is a true transition between the canal irrigated, and fairly flat area of the Rohtak district in the north-east and the irregular and sandy topography on the south-west. The proportion of level surface is higher here than in the sandy tract. The sand-dunes and relic hills are only sporadic in occurrence. These relic hills or kopjes are some 34 in number. The general surface is around 700 feet (213 metres). The highest point near Kaliana, south-west of Charkhi Dadri and 1,470 feet (448 metres) above sea level, is on a hill. The other high point 1,084 feet (330 metres) is another hill near Mankawas. A further hill is near Siswala with its highest point 1,332 feet (406 metres). There are similar isolated hill tops to the south.

Although the basal foundation of the district is practically uniform, the presence of sand-dunes, sand-hills and relics of the Aravalli mountain system lends diversity to its topography.

The 'Bagar', closely dotted with sand features of varying shapes and sizes, in the southern and south-western parts of the district is in marked contrast to the fairly level landscape of the Bawani Khara area in the north-east. Thus the district provides a true physiographic transition between the Punjab-Haryana plains in the northeast and the Rajasthan desert to the south-west.

NATURAL DRAINAGE, RIVERS AND OTHER SURFACE WATER RESOURCES

The Bhiwani district is one of the very few areas in the whole State of Haryana, which does not bear the imprint of any river or even a regular seasonal stream. The water seasonally flowing down the slopes of the Aravalli relics in northern part of the Mahendragarh district has carved out gullies, some of which extend into the southern parts of the Dadri tahsil. But these gullies disappear within a few kilometres after entering the district. During the monsoon water rushes into them from the adjoining hillocks, but is soon

absorbed in sand through percolation and evaporation. Thus the only limited signs of natural drainage in the district are of ephemeral inland drainage. There are no other traces of even seasonal rivulets or streams elsewhere in the district. Nevertheless, in the central and north-western parts, where there is a fair scattering of the remains of the Aravalli system, water does collect in low-lying areas after the rains, forming ponds or what are locally called *tals*. These ponds/*tals* dry up during summer. There is, however, hardly any village where there is no pond. These ponds are formed in naturally low-lying areas, or locations from where the earth has been removed for making mud bricks for house construction.

In most parts of the district water-table is fairly deep, and the water brackish. Both these conditions render difficult well or tubewell irrigation. The only conspicuous water channels to be seen in the district are those of canals, distributaries and minors dug and constructed recently.¹ Thus the general lack of natural drainage or water bodies symbolises the arid conditions dominant in this district.

GEOLOGY

A large part of the district is covered by recent to subrecent deposits of alluvium and blown sand. The rock exposures are very few and these are generally in the form of a chain of discontinuous hills.

The general stratigraphic sequence of various litho units encountered in the district is given below :

Recent and subrecent	Alluvium, blown sand and <i>kankar</i>
Extrusives	Rhyolite
Intrusives	Granite, amphibolite, quartz veins, pegmatite and porphyry
Delhi Super Group	
Ajabgarh Formation	Slates and phyllites with quartzite intercalations, quartzite, schists and gneisses
Alwar Formation	Massive ferruginous and calcareous quartzites, schistose quartzite with thin bands of carbonaceous phyllite, quartz-sericite-muscovite schist, quartz-biotite schist.

1. For details, see Chapter on 'Agriculture and Irrigation'.

Delhi Super Group

Alwar formation.—Alwar series of the Delhi Super Group are represented by massive quartzite and schistose quartzite with subordinate bands of pelitic schists.

Quartzite.—Two parallel quartzite ridges are seen in the southern part of the district, the Baskhard ridge and the Khodana-Main Khurd ridge. These ridges trend in N-S to NNE-SSW direction with steep westerly dips. The quartzite of these ridges display sedimentary features like cross bedding, ripple marks and mudcracks indicating shallow water deposition. Small occurrences of ferruginous, calcareous and schistose quartzite within the massive quartzite are seen around Khodana. Along the joint planes in quartzite, tourmaline is also observed around Khodana.

Pelitic schists.—Quartz-sericite-muscovite schist, quartzbiotite schist and fibrolite-andalusite schist constitute the pelitic group of rocks occurring in the area. Good exposures occur to the north, west and south of Khodana, west of Gadhi and south of Naurangabad, etc. The rocks are interbedded with quartzite and occupy the small valley portion formed due to differential weathering. The schists are brown to green in colour with phyllitic look. Most of these are carbonaceous. South of Khodana, porphyroblasts of andalusite are present in the quartzbiotite schist and quartz-sericite schist.

A highly ferruginous chiastolite schist is exposed in the eastern part of Tosham hill about 22 kilometres north-west of Bhiwani. The rocks trend in NNE-SSW direction with steep dips. The central and the western side of the ridge is composed of felsite and microquartz porphyry.

Ajabgarh formation.—It is represented by massive quartzites with interbedded phyllites and slates. The exposures are located south of Kaliana and form the hills at Kaliana, Kalali and Balab.

Flexible sandstone occurrence is reported at the 1,470 feet (448 metres) ridge near Kaliana. The band is about one metre thick and is covered by debris. Flexibility is best seen in thin sections, fresh thick sections are malleable.

At the Mankawas ridge, the Ajabgarh are overlying the Alwar quartzites with a faulted contact.

Intrusives

Granite.—Granite exposures occur on the south, west and south-west of Tosham hill. This has resemblance with rocks of Malani suite. It is

coarse grained and rich in tourmaline and muscovite. At places black mica is also seen in place of muscovite. In the northern portion of Tosham hill, granite veins range from a few centimetres to a few metres in thickness.

In Khanak hill, located 5 km north-west of Tosham hill, porphyritic granite is exposed. Grey coloured fine grained granite porphyry with large phenocrysts of quartz, feldspar and dark mica in a micro-crystalline ground-mass is seen. Medium to coarse grained porphyritic granite is also exposed at Deosar about 4 kilometres west of Bhiwani.

Amphibolite.—Amphibolite rock occurring as sills or dykes is present in the north-western part of Khodana. It is dark grey in colour and consists of small needles of hornblende, small amount of feldspars and quartz. Because of alteration of quartz feldspars with amphiboles, the rock at places attains a gneissic appearance.

Quartz veins, pegmatite and porphyry. Small bodies of pegmatite occur around Khodana. The pegmatites consist of quartz, feldspar, white mica and tourmaline. The maximum length of the mica flake is about 2.5 cms. Numerous small quartz veins occur throughout the area. The porphyry is exposed in the northern and eastern face of the Tosham hill. It consists of phenocrysts of feldspars and a little quartz embedded in a dark fine grained groundmass. Feldspars include both orthoclase and plagioclase and some of them show rapakivi texture too. The phenocrysts have very sharp outlines.

Extrusives

The central mass of Tosham hill is mainly composed of rhyolite containing microphenocrysts of quartz in a ground mass of feldspar, quartz, iron ore and some ferromagnesian minerals with evident flowage structures at places. The entire rhyolitic complex stands out as a pillar in the metasediments Delhi Super Group along a volcanic pipe. Four distinct flows of rhyolite separated by thin ash beds ranging in thickness between 0.3 and 0.5 m are quite conspicuous. The ash beds are predominantly horizontal with gentle dips towards the centre of the hill.

Recent and Subrecent

A major part of the district is covered by alluvium and blown sand. The sand dunes are of permanent as well as active type. Permanent dunes are at places under cultivation because sand is fine grained compact and almost altered to or mixed with soil of a greyish brown colour. The active dunes are the sand mounds which are formed, blown off and again formed at a different

place. These have ripple marked surfaces because of wind action and are unstable and unfit for cultivation.

Mineral Occurrences

Iron ore.—In Kalfana hill at places lenses of iron ore, mainly magnetite, occur in black quartzite. At a number of places in the area heaps of slags, presumably of iron, are seen suggesting some type of iron smelting activity in the past.

Copper.—Malachite, azurite stains and specks of chalcopyrite are noticed in quartzite and mica schist near Khodana. An old vertical shaft, three metres in diameter, exists just north-west of Khodana. Mineralisation is feeble and seems to be at the contact of quartzite and schist. Recently the mineralisation of copper has been reported from Toshum hill. It is in the form of intense stainings of secondary minerals of copper in malachite, azurite and chrysocolla. Primary sulphide, viz. chalcopyrite, pyrite, pyrrholite and galena are present as disseminations, stringers and cavity fillings.

Mica.—Small flakes of mica 2.5 cm to 3 cm in length are found in pegmatites around Khodana.

Pyrite.—Pyrite dissemination is noticed all over the area in quartzite and mica schist around Khodana.

Building material.—Quartzites occurring in the area serve as road metal and building construction material. Several stone crushers are working in Adalpur, Khodana and Kalfana.

Glass sand.—Quartzites occurring near west of Atela are friable in nature and can be used for manufacture of window glass and bottle glass. Samples from here analysed Si 0295.4% and Fe 203 x 0.36%.

Kankar.—The term has been used for travertine or tufa which is met with at various places, generally at a depth of one metre below the soil cover. It is greyish white, hard and fragmentary in nature. Its basal part is, however, soft and silicious. The thickness of *kankar* varies from a few cm to 1.5 m and occurs in the form of small pockets. It contains rich fauna of gasteropod shells which attributes its deposition in lakes and ponds in which fresh water organism have thrived.

Saltpetre.—Seasonal encrustation of this mineral is observed in the vicinity of brooks and ponds at various places. It is presumed that the neighbouring rhyolitic hills might be the source of contribution of potash which leads to the formation of salt.

Flexible sandstone.—It occurs at the 1,470 ridge near Kaliana. The band is about 2 to 3 ft (0.61 to 0.91 m) thick and is reported to extend for a distance of 15 ft. (4.6 m). Another occurrence has been reported from southern tip of the 1,260 ridge but its flexibility is not so well marked.

FLORA

The Bhiwani district, in the arid zone, comprises xerophyte type of flora. Soils in the district are predominantly sandy with stray occurrence of loamy sand and loam. They are devoid of humus and are prone to shifting by strong winds. High to medium sand-dunes are common features. The water-table is abnormally low. The land is cultivated and very little natural forest has been left intact for preservation of flora. Only 1.6 per cent of the total area of the district is under forests which is very low as compared to 20 per cent area prescribed in forest policy. This includes private areas, closed under section 38 of the Indian Forest Act, 1927 and sections 4 and 5 of the Punjab Land Preservation Act, 1900.

According to a recent classification, the forests of this district fall under the description desert thorn (6 B/C. 1 Type). Flora is scanty and sparse. Tree species found in forests, cultivated fields, waste lands and habitations are *Jand* (*Prosopis cineraria*), *Rahera* (*Tecomella undulata*), *Khatri* (*Acacia senegal*) *Beri* (*Zizyphus Maritima*), *Reru* (*Acacia, leucophloea*), *Jal or Van* (*Salvadora oleoides*), *Mullah* (*Zizyphus nummularia*), *Barh* (*Ficus bengalensis*), *Peepal* (*Ficus religiosa*), *Mesquite or Pahari Kikar* (*Prosopis juliflora*), *Kachnar* (*Bauhinia racemosa*), *Amaltas* (*Cassia fistula*) *Poplar* (*Populus nigra*), *Lusura* (*Cordia dichotoma*), *Imli* (*Tamarindus indica*) and *Barna* (*Crataeva religiosa*). *Shisham* (*Dalbergia sissoo*), *Kikar* (*Acacia nilotica*), *Israilikikar* (*Acacia tortilis*), *Siris* (*Albizia lebbek*), *Neem* (*Azadirachta indica*), *Bahain* (*Melia azedarch*), *Gulmohar*, (*Delonix regia*) and *Parkinsonia aculeata* are being artificially planted along rail, road and canal strips and in other private areas. *Eucalyptus* is planted in agricultural fields under the farm forestry scheme.

Shrubs found are *Huis* (*Capparis sepiaria*), *Carissa spinarum*, *Puthkanda* (*Achyranthes aspera*), *Bansa* (*Adhatoda vasica*), *Panwar* (*Cassia tora* and *Cassia occidentalis*) *Babool* (*Acacia jacquemontii*) *Mullah* (*Zizyphus nummularia*), *Karir* (*Capparis decidua*), *Phog* (*Calligonum polygonoides*), *Khip* (*Leptadenia pyrotechnica*), *Ak* (*Calotropis procera*) and *Amarbel* (*Cuscuta reflexa*) which is a common climber.

The flora varies according to locality factors and soil type. In saline

GE

and alkaline soils of the Bawani Khara tahsil. *Nesquite* (*Prosopis juliflora*) is common along with *Farash* (*Tamarix aphylla*), *Noem* (*Azadirachta indica*) and *Jal* (*Salvadora oleoides*). In most localities and irrigated areas are found *Shisham* (*Dalbergia sissoo*) and *Tut* (*Morus alba*). In sandy areas *Jand* (*Prosopis cineraria*), *Rahera* (*Tecomella undulata*) and *Babool* (*Acacia jacquemontii*) are quite common. *Sarkanda* (*Saccharum munja*), *Khip* (*Leptadenia pyrotechnica*) and *Phog* (*Calligonum polygonoides*) are frequent in sandy localities.

He

Medicinal herbs found in the district are *Bansa* (*Adhatoda vasica*), *Indirain* (*Citrullus colocynthis*), *Asgandha* (*Withania somnifera*), *Glo* (*Tinospora cordifolia*), *Kharanthi* (*Sida acuta*), *Ak* (*Calotropis procera*), *Bhakra* (*Tribulus terrestris*) and *Dhatura* (*Datura stramonium*). Their collection becomes uneconomical because these are available in scattered form.

C

In village waste lands and uncultivated fields, tree species are scattered and are of little commercial value. With the increase of irrigation, and due to land hunger, such lands are being broken for cultivation. Grazing is very heavy in these areas and they are in the last stage of retrogression. Such lands may be utilised for raising fodder grasses like *Anjan* (*Cenchrus ciliaris*), *Dhaman* (*Cenchrus setigerus*), etc.

c

The forest areas are confined along the strips of rail, road, canal and drains. Of the compact areas, some are protected forests under State Government, while others are private forests managed by the Forest Department.

N

Biological barriers in the form of trees and shrubs play a vital role in different operations of desert control. They are the cheapest method of reducing wind velocity and to control the movement of sand. Desert control can be achieved partially by conserving the existing vegetation and at the same time by undertaking large-scale afforestation works. Soil erosion by high velocity winds is checked by raising biological barriers across the wind direction in the form of wind breaks and shelter belts. Such works are done along canals, roads, railway lines and drains.¹ Species planted include *Kikar* (*Acacia nilotica*), *Shisham* (*Dalbergia sissoo*), *Parkinsonia* (*Parkinsonia aculeata*), *Neem* (*Azadirachta indica*), *Bakain* (*Melia azedarach*), *Eucalyptus*, *Jand* (*Prosopis cineraria*), *Siris* (*Albizia lebbek*), *Gubghar* (*Delonix regia*), *Farash* (*Tamarix aphylla*), *Khairi* (*Acacia senegal*), *Caster*, and *Kana* (*Saccharum munja*).

¹ It is the root system of shrubs and trees planted which plays a significant role in holding together loose soil or sand. Such plants serve as biological barriers even if the canals, roads, railway lines and drains along which they stand, may not necessarily be perpendicular to the wind direction.

Afforestation works are done for fixation of sand-dunes and preservation of moisture in the soils in available areas, which are already with the Forest Department. In farm forestry scheme, plants are raised on the periphery of fields of the farmers to create breaks so that the crops are protected from desiccating winds. By December 1974, afforestation works had been achieved only in small areas and they have demonstrative value for farmers. In fact the only practical effective and cheap method of solving the problem of desert control is growing of trees and shrubs on a large scale to provide blanket protection against high velocity winds¹.

The important grasses found in the district are *Anjan* (*Cenchrus ciliaris*), *Dhaman* (*Cenchrus setigerus*), *Dub* (*Cynodon dactylon*), *Kana* (*Saccharum munja*) and *Dabh* (*Desmostachya bipinnata*). *Anjan*, *Dhaman* and *Dub* are palatable fodder grasses which are dwindling on account of uncontrolled grazing. In Kairu closure, *Anjan* and *Dhaman* are being raised artificially over an area of 70 hectares by the Forest Department to augment fodder resources. The grasses in waste lands are poor in quality or are grossly inadequate for requirements.

FAUNA

There is a general scarcity of naturally available water in the district; wild animals common to semi-arid tracts only are found.

Mammals

The primates, the highest group of animals are represented by *Macaca mulata* (Zimmermann), the Rhesus Macaque or Bander and *Presbytis entellus* (Dufresne), the Common Langur.

Panthera tigris (Linnaeus), the Tiger and *Panthera pardus* (Linnaeus), the Leopard once abundant in the district are not seen now.

Other carnivorous animals occasionally met in are *Felis chaus* Guldensuedt, the Jungle Cat; *Viverricula indica* (Desmarest), the Small Indian Civet; *Herpestes edwardsi* (Gepffrey), the Common Mongoose; *Genis aurina* Linnaeus, Gidhar and *Vulpes benghalensis* (shaw), the Indian Fox; *Hyena hyaena* (Linnaeus), the Stripped Hyena and *Canis Lupus Linnaeus*, Bheriya.

Only one species of Shrews, viz. *Suncus murinus* (Linn) and two species of

1. For more details about the forests and desert control measures, see Chapter on "Agriculture and Irrigation."

Bats *Scotophilus heathi* (Horsfield), the Common Yellow Bat and *Hesperoptenus tickelli* (Blyth), the Tickell's Bat are sometimes observed.

The Five Stripped Palm Squirrel, or Gilheri *Fummbulus pennati* Wronghon, the Indian Porcupine or sahi, *Hystrix indica* Kerr; the Indian gerbille *Tatera indica* (Hardwicke) ; the Common House Rat, *Rattus rattus* (Linnaeus) ; the House Mouse, *Mus musculus* Linnaeus and the Indian Hare *Lepus nigricollis* Cuvier comprise the rodents fauna though not very commonly seen.

Chinkura, *Gazella gazella* (Pallas) and Blackbuck, *Antelope cervicapra* (Linn.) have also been seen in the district in limited numbers.

The Blue Bull or Nilgai, *Boselaphus tragocamelus* (Pallas), once very common, is still found all over the district.

Birds

In the past the following water birds were seen : Spotbill Duck, *Anas poscillorhyncha* Forester and Dabchick, *Podiceps ruficollis capensis*. Wherever there are sizeable tanks and other stretches of water, these birds can still be seen along with king fishers and waders like sand pipers stints, stilts and the like.

Besides, birds like Eastern Large Egret *Egretta alba modesta* (J.B. Gray), Median Egret *Egretta intermedia intermedia* (Wagler) and Little Egret *Egretta garzetta garzetta* (Linnaeus) are found in land water marshes, *jhels*, etc. Cattle Egret, *Bubulcus ibis coromandus* (Boddaert) can be seen moving along with grazing cattle.

In addition to the water birds, other game birds like Partridge and Quail are also common in the district. Indian Black Partridge, *Francolinus francolinus asiae* Bonaparte and Gray Partridge, *Francolinus Pondicerianus interpositus* Hartert are common. Blackbreasted or Ruin Quail, *Coturnix coromandelica* (Gmelin) ; Jungle Bush Quail, *Perdica asiatica panjab* Whistler and Roach Bush Quail, *Perdica argoondah* (Sykes) are resident species.

Coming to Pigeons and Doves, Bengal Green Pigeons, *Treton phoenicoptera* (Latham) are found in the vicinity of villages, chiefly on figus trees. Blue Rock Pigeons, *Columba livia* Gmelin are found in almost all the villages. Western Turtle Dove, *Streptopelia Orientalis moena* (Sykes) ; Indian Ring Dove, *Streptopelia decaocto decaocto* (Frisch) and Indian spotted Dove, *Streptopelia Chinensis swatensis* (Gmelin) are generally found in cultivated fields.

Sandgrouses, namely Indian Sandgrouse *Blerocles exustus orlangeri*

(Neumann) and Blackbellied Sandgrouse, *Pterocles orientalis orientalis orientalis* (Linnaeus) are resident birds while Large Pintail Sandgrouse, *Pterocles alchata* (Günther) and Spotted Sandgrouse, *Pterocles senegallus* (Linnaeus) visit the district in winter. Flocks, large and small, regularly visit some favourite waterholes.

The national bird of India, the Common Peafowl, *Pavo Cristatus* Linnaeus is quite common and is seen in orchards, fields and gardens.

The other common birds which can be seen in the district are : Large Indian Parakeet, *Psittacula eupatria* (Linnaeus) ; Resplendent Parakeet, *Psittacula krameri borealis* (Neumann) ; Indian House Sparrow, *Passer domesticus indicus* Jardine and Selby, Blue checked Bee-eater, *Merops superciliosus* (Linnaeus) ; Blue Jay, *Coracia benghalense benghalense* (Linnaeus) ; Coppersmith, *Megalaima haemacephala indica* (Latham) ; Indian Golden Oriole, *Oriolus oriolus kundoo* Sykes ; Pied Crested Cuckoo, *clavator jacobinus serratus* (Sparman) ; Koel, *Eudynamis scolopacea scolopacea* (Linnaeus) ; common Crow-Pheasant, *Centropus sinensis sinensis* (Stephens) ; Redvented Bulbul, *Pycnonotus cafer* (Linnaeus) ; White-eared Bulbul, *Phononotus leucogenys* (Gray) ; Verditer Flycatcher, *Muscicapa thalassina thalassina* Swainson ; Indian Magpie Robin, *Copsychus saevius saevius* (Linnaeus) ; Indian Purple Sunbird, *Nectarinia asiatica asiatica* (Latham) ; Red Munia, *Estrilda amandava amandava* (Linnaeus) ; Indian Spotted Munia *Lonchura punctulata punctulata* (Linnaeus) ; Crested Bunting, *Melophus lathamii* (Gray), etc.

Besides, such attractive birds as Hoopoe, *upupa epops* Linnaeus ; Indian White-Eye, *Zosterops palpebrosa palpebrosa* (Temminck) are also seen in and around villages.

Birds of Economic Importance

Scavengers like Pariah Kite, *Milvus migrans* (Boddaert) ; Brahminy Kite, *Haliastur indus indus* (Boddaert) ; Whitebacked Vulture, *Gyps bengalensis* (Gmelin) ; Tawny Eagle, *Aquila rapax Vindhiana* (Franklin) ; Indian Jungle Crow *Corvus macrorhynchos culminatus* Sykes ; Indian House Crow, *Corvus splendens splendens* Vieillot, etc., keep the district cleared of dead animals by feeding on them. The Indian Scavenger Vulture, *Neophron percnopterus ginginianus* (Latham), in addition consumes a large quantity of human excreta. Predators like Blackwinged Kite, *Elanus caeruleus vociferus* (Latham) ; Indian Shikra, *Accipiter badius dussumieri* (Temminck) ; Laggur Falcon, *Falco biarmicus* (Temminck) ;

Kestrel *Falco tinnunculus* (Linnaeus) are residential birds of the district. Others like Pale Harrier, *Circus macrourus* (Gmelin); Marsh Harrier, *Circus aeruginosus aeruginosus* (Linnaeus); Eastern Steppe Eagle, *Aquila nipalensis nipalensis* (Hodgson), etc., visit the district in winter. These along with Spotted Owllet *Athene brama* (Linnæus); Eagle Owl, *Bubo bubo* (Linn.) keep a check on the population of not only rodent pests but also various insect pests by consuming them.

The majority of birds found in the district feed on insects and caterpillars injurious to agriculture. Swifts such as Indian House Swift, *Apus affinis affinis* (J.E. gray); Indian Palm Swift, *Cypselurus parvus batasiensis* (G.E. gray); swallows like Western Swallow, *Hirundo rustica rustica* Linnaeus and Indian wiretailed Swallow, *Hirundo smithi filifera* Stephens; consume insects as their staple diet. Shrikes or "Butcher-Birds" as they are popularly called include in their diet a considerable quantity of insects. Some other insect eating birds are King Crow, *Dicrurus adsimilis albirictus* (Hodgson); Brahmany Myna, *Sturnus pagodarum* (Gmelin); Indian Pied Myna *Sturnus contra* Contra (Linnaeus); Bank Myna, *Acridotheres ginginianus* (Latham); Babblers, Warblers and Fly-catchers (Muscicapidae). Larks (Alaudidae) and Wagtails (Motacillidae) feed on worms in addition to insects. Rosy Pastor and Common Indian Starling, both winter visitors may specially be mentioned for their role in destroying numerous insects including grasshoppers on a large scale and thus help in protecting crops.

Reptiles

The common poisonous snakes found in the district are :

I. Family

Elapidae

1. *Bungarus caeruleus* (Schneider)
Common Indian krait

2. *Naja Naja* (Linn.) Indian Cobra.

II. Family

Viperidae

3. *Vipera russelli* (shaw Russetts viper)
4. *Echis carinatus* (Schneider) Phoorca

In addition to these, there are various species of non-poisonous snakes;

III. Family Typhlopidae

5. *Typhlop spectectus* (slieiczka) Blind snake

IV. Family Boidae

6. *Python molurus* (Linn.) Indian python7. *Eryx johni johni* (Russell) John's sand Boa

V. Family Colubridae:

8. *Lycodon striatus* (shaw) Wolf Snake9. *Ptyas mucosus* (Linn.) Rat Snake

All the lizards found in the district are non-poisonous. *Hemidaactylus flaviviridis* Ruppell and *Hemidaactylus brooki* Gray are very common. The first is a common sight in and outside the residential quarters on the walls. *H. brooki* is mostly found under stones. *Cadotes versicolor* Daudin is mostly found in gardens and on trees. This is commonly known as blood sucker. The name is erroneous as it has nothing to do with blood sucking. Probably the name is given as during the breeding season the male assumes a brilliant crimson. *Uromastix hardwicki* (Gray) or *sanda* is found in the sandy areas. In bushes and under the dried leaves *Mabuya macularia* (Dum and Bibr.), *Ophiomorus tridactylus* are found. *Varanus monitor* Linn. is the largest lizard found in the district and is useful as it eats rodents.

Two species of tortoises found are : *Gecelmys hamilton* (Gray) and *Kuchuga dhongoka* (Gray).

The following four species of frogs are commonly sighted during the rains in and around water ponds. All these feed mainly on insects.

I. Family Ranidae

1. *Rana tigrina* Daudin Indian Bull Frog2. *Rana limnocharis* Weigman Indian Cricket Frog3. *Rana breviceps* Schneider Indian Burrowing Frog

II. Family Bufonidae

4. *Bufo melanostictus* Schneider Common Toad

Fishes

As water is scarce, so are fish. However, the common commercially important fish of the district are the carps *Catla catla* (Hamilton) (Katla), *Cirrhinus mrigala* (Hamilton) (Mrigal), *Labeo bata* (Hamilton) (Bata), *Labeo rohita* (Hamilton) (Rahu); the cat-fishes *Clarias batrachus* (Linnaeus) (Magur), *Myxus seenghala* (Sykes) (Singhara), *Wallago attu* (Bloch & Schneider) (Mulle), *Ompok bimaculatus* (Bloch) (Ghally); the murrels *Channa striatus* (Bloch) (Curd), *Channa punctatus* (Bloch) (Dolla); and the featherback *Nototopterus notopterus* (pallas) (Parri). Other common species are *Danio devario* (Hamilton) (Parranda), *Esomus danricus* (Hamilton) (Chilwa) *Puntius sophore* Hamilton (Tieher), *Rashbora daniconius* (Hamilton) (Chindola), *Salmostoma bacalla* (Hamilton) (Chilwa), *Heteropneustes fossilis* (Bloch) (Sangi) (*Myxus bleekeri* (Day) (Kangir), *Myxus vittatus* (Bloch) (Kangir) and *Mastacembelus armatus* (Lacepede) (Bum).¹

CLIMATE

The district, bordering on the Rajasthan desert in the north-east and lying far inland, is flat country with elevation around 250 m.a.s. These features have profoundly influenced the climate which is very hot in summer, from April to June, and cold in a fairly long winter period lasting from November to March. It is also characterised by dryness, except during the monsoon, which lasts from July to mid-September. The period mid-September to October constitutes the post-monsoon or the transition period.

Temperature.—There is no meteorological observatory in the district for recording observations for other weather elements. Hence, the description that follows is based on records of observatories in the neighbouring districts experiencing similar climate. Temperatures start rising rapidly from March, when the mean daily maximum temperature is above 30°C, compared with that of about 25°C in February; and the minimum temperature at about 14°C compared to the temperature as low as 8°C in February. By May, the mean maximum temperature reaches 41°C, remaining more or less steady till June by which time the minimum also rises to 28°C. May and June constitute the hottest part of the year. The maximum temperature may occasionally exceed 48°C on individual days during the period. Hot, scorching, and dust-laden winds which blow from across the Rajasthan desert add to discomfort. With the onset of the monsoon, day temperatures fall appreciably

1. For details about pisciculture in the district, Chapter on 'Agriculture and Irrigation' may be referred to.

in July and range between 36°C to 38°C till September. But nights continue to remain oppressively warm, with the mean minimum temperature around 27°C till August. In late September, night temperatures drop to 24°C due to the clearing of skies with the withdrawal of the monsoon. The temperature then begins to fall rapidly and winter conditions set in November. December to January is the coldest period of the year when the mean minimum temperature is 5° to 6° C with the mean maximum temperature around 22°C. In winter cold waves in the wake of western disturbances affect the district, causing temperatures to fall steeply. During severe cold waves, the minimum temperature of 2° to 4°C below the freezing point may occasionally be reached. Even in February minimum temperature may occasionally drop below 0°C. Frost occurs under these conditions.

Humidity.—In the monsoon season, the relative humidity is high, about 70 per cent in the morning and 50-60 per cent in the after noons. Humidity is also high in the morning during December-February. It is dry for the rest of the year. Summer is the driest season when the relative humidity drops to about 25 per cent in the afternoon.

Rainfall.—Records of rainfall are available for 4 stations in the district. Details of rainfall at these stations and for the district as a whole are given in Table I of Appendix. The average annual rainfall over the district is 382.2 mm. Rainfall generally increases from north-west to south-east, varying from about 280 mm in the north-west to 480 mm in the south-east. About 75 per cent of the annual rainfall is received during the monsoon months; while about 10 per cent is accounted for in the pre-monsoon month of June. July and August constitute the rainiest period when about 60 per cent of the annual rain is received. Winter rains during January to March, occurring in association with the passing western disturbances, though small in amount—hardly 10 per cent—are of considerable economic importance. Variation in rainfall from year to year is considerable. Over a long period of years, annual rainfall may be less than 80 per cent of the normal in 25 per cent of the years. Also, as can be seen from Table I of Appendix, rainfall at individual places can be as much as twice the normal in one year and as low as half of it or even lower in another. On individual days, rainfall varies widely. This is illustrated by the fact that the heaviest rainfall recorded at any station in the district was 205.7 mm at Bhiwani on August 9, 1972, which was almost 50 per cent of the annual normal rainfall.

The average number of rainy days (i.e. days with rainfall of 2.5 mm or more) in a year is 21 varying from about 16 to 25 over the district.

Clouds.—Skies are moderately to heavily clouded for 10 to 15 days in July and August, and for about a week during December to March in association with the western disturbances. During the rest of the year, skies are mostly clear to lightly clouded.

Winds.—Winds are generally light with some strengthening in late summer and the monsoon season. During the monsoon months, winds are mostly southwesterly to westerly, with easterlies to southeasterlies on some days. In the post monsoon and winter periods, winds veer to northwest or north, particularly in the afternoon. In summer, winds are mostly confined between southwest to northwest.

Special Weather Phenomena.—A few of the depressions, originating in the Bay of Bengal during the monsoon season and moving across the country, may reach the district and cause wide-spread heavy rain. Dust-storms mostly occur from April to June and thunder-storms in June to September. Thunder-storms in winter during December to February often occur in association with and accompanied by hail. Occasional fog affects the district in the cold season.