Chapter - I

General

Historical Aspects for the emergence of Haryana as a State

The origin of the demand of Haryana State can be visualised in its historical perspective. Due to emotional participation in the Ist war of Independence by the Haryanvis, a spirit of vengeance was smouldering in the hearts of the British rulers. Hence Haryana region was tagged with the Punjab in 1858 as a political punishment to the people of this region. "Of course, it was their political isolation but they were still more related socially and culturally to the people of Delhi and the Western U.P.[1]". They had lost political boundaries but they maintained the cultural ties of *Roti* and *Beti.*

Perhaps, it was due to the repressive policy of the British Government that no significant development was made in the region in the sphere of education, trades, industry,means of communication and irrigation .Consequently it remained backward socially,educationally, economically and politically throughout the 19th century.

With the change of capital[2] from Calcutta to Delhi on December 12,1911, the Haryana region was further isolated . In 1920, certain changes in Delhi district were suggested .The Muslim League also suggested the extention of the boundaries of Delhi with the inclusion of Agra, Meerut and Ambala Division in it[3]. A similar demand was made to Sir.J.P. Thomson,the Commissioner of Delhi by the people . In 1928, all parties conference at Delhi again made a demand for extention of the boundaries of Delhi.

Some prominent leaders of Haryana like Pt. Neki Ram

Sharma,Lala Desbandhu Gupta and Sri Ram Sharma met Gandhi ji and requested him that the districts of Haryana region be merged with Delhi[4]. In 1931, at the Second Round Table Conference, Sir Geoffrey Corbert, Financial Commissioner of the then Punjab Government and Secretary of the Indian Delegation to the Round Table Conference,suggested the reorganisation of the Punjab boundaries and the separation of the Ambala Division from Punjab. He argued, "historically Ambala Division was a part of the then Hindustan and its inclusion in the province of the then Punjab was an incident of British rule."

In 1932, Desbandhu Gupta of Panipat forcefully stated that "Hindi speaking region had never been a part of Punjab.Ever since its inclusion in Punjab, the region

1. S.C. Mittal : *Haryana, A Historical Perspective*, 1986,p.148.

2. *Delhi District Gazetteer* ,1976, p.3.

3. Bhagwan Dev :*Vir Bhumi Haryana,*1965, Page 102.

4. Sri Ram Sharma : *Haryana Ka Itihas (Hindi)*, p. 93.

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had been suffering economically, politically and culturally. It was essential for the development of this region to separate it from Punjab proper and form a new State by uniting with it certain adjoining parts of Delhi,Rajasthan and of the U.P."

In fact, the demand of the creation of the Greater Delhi or Vishal Haryana was actively supported by several leaders like Mahatma Gandhi, Moti Lal Nehru, Asaf Ali, Sir Chhotu Ram and Pt. Thakur Dass Bhargava[1].

The Government of India appointed an All India State Reorganisation Commission on 29th October,1953 to view the reorganisation of Indian provinces . Its members were Justice Fazal Ali, Sri Kvelem Madhava Pannikar and Hirdey Nath Kunjru. The Commission considered the question of reorganisation and recommended the merger of Pepsu area into Punjab region and the districts of Mahendragarh and Jind into Haryana region.

However, the Commission rejected the demand of greater Delhi or Vishal Haryana on the ground " that the separation of Haryana areas of Punjab which are deficient areas will be no remedy for any ills, real or imaginary, from which this area at present suffers". Similarly, the State Reorganisation Commission rejected the demand of creation of a separate Punjabi Suba. Its main arguments were the lack of popular support, difficulty in demarcating linguistic boundaries, opposition of a large section of the Punjab population, no real language problem and that the demand would not solve the problem of internal tension.

The Government put off the division of Punjab many times but the leaders had to rethink it under the agitations and communal strife. The Government of Punjab gazetted the establishment of the Haryana Vikas Committee on 2nd March, 1961. It was to give suggestions for the social and economic uplift of the region. Sri Ram Sharma was appointed as Chairman with Chaudhry Chand Ram, Rao Nihal Singh and G.L. Bansal as its members .It sent its recommendations after nine months.

On September 23, 1965, the Government of India appointed a Parliamentary Committee under the chairmanship of Sardar Hukam Singh, Speaker of Lok Sabha, to study the question of the division of Punjab. This committee submitted its report on March 18,1966. A number of memoranda were presented by the representatives of Haryana Lok Samiti, Haryana All Parties Action Committee ,Haryana Arya Samaj and other organisations . The committee recommended the creation of Punjabi speaking State and also proposed the establishment of a Hindi speaking State of Haryana. It also recommended the inclusion of Chandigarh and Kharar tahsils in Haryana[2] .

1. Ranbir Singh : *Genesis and Exposition of the Demand for Vishal Haryana (Research Journal), Kurukshetra,*1968, p.216.

2. S.C. Mittal : *Haryana, A Historical Perspective*, 1966, p. 153.

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The Government of India accepted most of its recommendations and set up Shah Commission popularly known as "Punjab Boundary Commission" to settle the boundaries of the new States[1]. The Punjab Reorganisation Bill was passed by the Parliament on 10th September, 1966 and on November 1,1966 the Haryana as the seventeenth State of India came into existence.

The Haryana State then comprised Gurgaon, Mahendragarh, Rohtak, Hissar, Karnal and some parts of Sangrur and Ambala districts.

Origin of the name of the State

Regarding the origin of the name as *Hariyana* (Haryana), there are diverse interpretations[2]. *Hariyana* is an ancient name. During the olden period, this region was known as *Brahmavarta, Aryavarta* and *Brahomoupdesa*. These names are based on the emergence of Brahama-Lord on the land of Haryana ; the abode of Aryas and home of the preachings of vedic cultures and other rites.

According to Professor H.A. Phadke, "with an inter-mingling of various peoples and races, Haryana's contribution to the making of the composite Indian culture has been remarkable in its own way. Quite significantly, the region has been hailed as the matrix of creation and the very heaven on earth. Its other names *Bahudhanyaka* and *Hariyanka* suggest abundance of food supply and vegetation".

As per the inscription found from Bohar village, Rohtak district, this region was known as *Hariyanak*. The inscription

pertains to the period of Balban during 1337 *Vikram Samvat*[3]. Later, the word `Haryana' was inscribed on a stone found during the reign of Sultan Mohammad-bin-Tughlaq.

Dharanidhar in his work *Akhand Prakash* says that "this word comes from *Haribanka*, connected with the worship of Hari, the Lord Indra. Since the tract is dry one; its people worship Indra (Hari) always for rain[4]". Another thinker, Girish Chander Avasthi traces its origin from *Rigveda* where *Hariyana* is used as a qualifying adjective with the name of a king (Vasuraja). He says, the king ruled over this region and as such the tract came to be known as *Hariyana* after him[5].

According to Acharya Bhagwan Dev,the name of Haryana has been derived from Har, the Lord Mahadeva, who was worshipped and is being worshipped even today very popularly by the people of this area. Maha Pandit Rahul Sankritya yana

1. For details .See Report of the Punjab Boundary Commission, 1966.

2. Dr. Budha Parkash, *Glimpses of Hariyana* , 1967, page I.

3. Dr. Satya Pal Gupta :*Goravmai Haryana (Hindi),* 1981, P.1.

4. Cited by Shankar Lal Yadav, *Haryana Pradesh ka Lok Sahitya,* pp.37-38.

5. Dr. Buddha Prakash: *Glimpses of Hariyana*, 1967,p.2.

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was of the view that this word Haryana is a corrupt form of *Haridhankya*,a term often used for this region , in the ancient literature.

Buddha Prakash says that since this region was inhabited by the *Abhiras* during the post *Mahabharta* period, it came to be known after their name : *Abhirayana-Ahirayana-Hirayana-Hariyana* . The eminent historian, Hari Ram Gupta held this view that this region being the earliest home of the *Aryan* was called *Aryana* or the abode of *Aryan*; as it came to called as Haryana, corrupted from *Aryana* .

As per the traditional theory , the incarnation of Hari (Lord Vishnu), Lord Krishna connected deeply with this region. Lord Krishna while on his way to Dwarika passed through the region, that is why, this region came to be called as *Hariyana*. Jadu Nath Sarkar, an eminent historian of international fame, was of the view that on account of the presence of various types of herb and vegetation, there was a greenery *(Haryali)* all around . So this region was known as Haryala, later corrupted into Haryana[1] .This view is corroborated by the British writers. As per *provincial Gazetteer and the Settlement Report of Hissar,* the region is abundant in greenery and that is why it is known as Haryana .

As per the latest research, the Hariyana was referred by Jain poet, Sridhar during *Vikram Samvat*, 1189. He expressed the view while writing his important book, *Parasnath Character* and claimed that he was the resident of Haryana. He gave an interesting description of *Hariyana* in his book. The use of *Hariyana* word was prevalent in very olden times; as per *Skand Purana*, Kurukshetra was referred as *Harishetra*. This shows the religious sanctity of the Haryana region. An inscription presently kept in Delhi Museum pertaining to 1328 *Isvi Purvi* states that *Hariyana* is just like a heaven on the earth.

The Indian historians such as Professor Avinash Chander Dass and Radha Kumud Mukerji are of the opinion that present *Hariyana* region was the foremost abode of Aryans; from here they spread in other parts of the country.

Shri Jagdev Singh Sidhanti and Ram Prakash based their theories of the origin of the word Haryana on religious sanctity of Haryana region since vedic to this date.

The Palam Baoli Inscription traces the origin of word Haryana from *Hari*,the name of God. According to the above inscription,this region was known *Hariyana* in the ancient period[2]. On the basis of religious sanctity of this region, to call it Haryana seems to be correct view because the culture of Haryana has been the fountain

1. Dr. Satyapal Gupta; A special issue_featured in *Dainik Tribune* on the Haryana Day,
November 2, 1994.

2. Dr. Buddha Prakash : *The Glimpses of Hariyana*.1967, p. 10.

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of Indian culture .According to modern thinkers that the origin of the word Haryana is attributed to the ten famous forts (Dassaran)which existed some time in Haryana. Previously, it was known as Dassarana but with the passage of time, it corrupted into Haryana[1].

History of the state as an administrative unit

Haryana in the sense of geographical unit was not known before the 12th century A.D. Although the term Haryana is of late origin yet the antiquity of this area has never been questioned.

The Tomara Rajputs ruled over `*Hariyana*' from Delhi when the Ghaznavids invaded India from north -west. The kingdom of Lahore was annexed by the Ghaznavids in 1020. Sultan Masud, the successor of Sultan Mahmud, in the effort to extend his power,advanced towards Hansi and invested the fort. After the fall of Hansi he marched to Sonipat and defeated its governor, Dipal Hari[2]. While the Tomaras of Delhi succeeded in recovering these territories,they made no attempt to oust Muslims from the kingdom of Lahore. The position, however, changed with the fall of Ghaznavids, when the kingdom of Lahore fell into the hands of Ghuris

and the Tomaras of Delhi were overpowered by the Chahamanas.

The Chahamanas of Ajmer,after subduing the Tomaras by the middle of the 12th century soon came face to face with the Ghuris. After taking Lahore in 1186 A.D. :Muhammad Ghuri encountered the Chahamanas under Prithvi Raj. Beaten in his first encounter in 1190-91 at Tarain (Traori) in the Karnal district, he came back the following year to defeat Prithvi Raj in 1192. Prithvi Raj was defeated and taken prisoner or killed in the neighbourhood of the river Saraswati[3]. During this encounter he destroyed the most important town of Meham of Rohtak district. After the battle of Traori in1192, the Karnal area more or less firmly attached to Delhi.

On June 24, 1206, Qutab-ud- din Aibak sat on the throne of Delhi and inaugurated Muslim rule in North India . The Turks of central Asia, professing the religion of Islam in a fanatic and militant form became masters of a country, the teeming millions of which believed in diverse cults collectively described as Hinduism. In spite of relentless pressure and ruthless persecutions,a vast majority of people offered an unflinching resistance to the alien conqueror and their creed and showed a dogged persistence in shunning their contacts and maintaining their exclusiveness.

1. Dr. S. P. Gupta, *Haryana Pragati ke path par (Hindi.),* 2001, P.3.

2. R.C. Majumdar, *The History and Culture of Indian people,Vol. V, The Struggle for Empire*.p.93.

3. *Karnal District Gazetteer,* 1976,p.21.

In 1215, Iltutmish captured Taj-ud-din Yaldz in open battle on the old field of Traori when the latter challenged the authority of Sultan.

As already referred, Qut-ud-din-Aibak became the sovereign of Delhi but he did not establish meaningful control over Haryana .Seizing this opportunity, a Rajput clan, Jatus, extended their sway over paraganas of Agroha, Hansi, Hissar and Bhiwani[1]. The Jatus probably did not render more than a nominal submission to the Sultan of Delhi.

After the assassination of Bahram in A.D. 1242, the fief of Hansi was given to Ulugh Khan, a high official of Delhi court (who later ascended the throne as Balban), who governed change wisely and well[2]. In March A.D. 1253 when Ulugh Khan was banished from Delhi Court by Nasir-ud-din, he was asked to go to his estates in the Shiwalik hills and Hansi.Later royal armies marched from Delhi to Hansi with the design of ousting Ulugh Khan who retired to Nagaur (Rajasthan)and his fief of Hansi was bestowed upon prince Ruknu-din[3].

In February, A.D. 1254, Balban returned to power and later went to Hansi to superintend the military organization of Shiwalik hills. After having arranged according to his expectations, he returned to Delhi.

In 1290, the areas of Hissar, Sirsa and Bhiwani slipped from the control of Shams-ud-din, the last of so called slave kings and came into the possession of the Khaljis . The Khaljis followed a policy of repression of the people because of the following reasons:-

"A Turk administrator reported to Ala-ud-din Khalji that if the Hindus do not find mighty sovereign at their head, nor behold crowds of horse and foot with drawn swords and arrows threatening their lives and property , they fail in their allegiance,refuse payment of revenue and excite hundreds tumults and revolts.[4]"

The next important events occurred in Haryana during the reign of Firuz Tughlq (1351-1388). The ruler came to have somewhat unusual fancy for the tract (Hissar). This place was admirably adopted as a starting point for the hunting expeditions in which Sultan frequently indulged .It is a great credit to him that he established new towns of Fatehabad and Hissar and built two canals; one taking off from Ghaggar at Phulad and following the course of the Joiya upto the new

town of Fatehabad and second from Yamuna to the towns of Hansi and Hissar and is Known as Western Yamuna (Jamuna) canal. The headquarters of the division of Hansi which was

1. *Hissar District Gazetteer,* 1915, p.20.

2. Iswari Prasad : *History of Medieval India,* 1952, p.175.

3. *History of India as told by its own Historians* by Elliot and Dowson, 1969, Volume-II,
pp. 352-53.

4. Dr. Buddha Prakash : *Glimpses of Hariyana,* 1967, p.38.

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included the tract comprising present Hissar district was shifted from Hansi to Hissar. He maintained his rule from Delhi over Karnal, Hissar and Hansi areas.

Marching eastward along the valley of Ghaggar,the fierce invader first entered Sirsa and then after a day's stay reached Fatehabad. The town of Fatehabad was captured without any opposition from inhabitants. Then Timur went to Tohana and from there he marched to Samana.

Timur marched through Karnal district on his way to Delhi. From Kaithal (now a separate district), the invader marched and passed through Assandh to Tughlaqpur, probably Salwan. The whole of this region became desolate as the inhabitants had fled to Delhi. Then he marched to Panipat which he reached on December 3,1398[1]. The people had deserted the town in obedience to the orders from Delhi. After looting the property, he left India.

After the departure of Timur, confusion prevailed over a large part of north -western India. Khizr Khan, who was appointed

governor of Multan, Lahore and Dipalpur annexed Samana, Sunam, Hissar and Sarhind (Inclusive the areas covering Ambala and Yamuna Nagar districts[2]).

Karnal and Panipat were on the high road from Sarhind and Ferozepur to Delhi; and from the time of Timur to that of Akbar or for 150 years the Karnal-Panipat area witnessed important and decision-making battles fought between the ruling powers of Delhi and those of coming from the north-west with the intention of supplanting their authority.

Babur, the founder of Mughal empire in India, fought the Ist Battle of Panipat in 1526 against Ibrahim Lodhi. Then he went to Delhi and Agra. Then Babur turned towards Hissar-Sirsa areas.

Hissar was the headquarters of a strong garrison since Firuz's days .At the time of Babur's invasion , too big force was stationed there under the command of Hamid Khan who confronted with Humayun near Hissar. Humayun became successful. Babur was very much pleased with Humayun on his first victory on the Indian soil and gave him Hissar as a reward[3].

Humayun's rule proved short- lived . He was thrown out by an Afghan ruler, Sher Shah Suri in 1540. Rao Kalian Singh, the ruler of Bikaner was driven out of his State by the chief of Jodhpur.The displaced Rao occupied the Sirsa district, made his

1. *Karnal District Gazetteer,*1918, p.16.

2. R.C. Majumdar : *The History And Culture of the Indian People*,1967, p.122.

3. B.S.Nazzar : *Punjab under the Great Mughals,* 1526-1707 A.D., 1968, p. 16.

headquarters for a time until the defeat of his enemy at Ajmer by Sher Shah enabled him to return Bikaner.

Sher Shah divided his whole kingdom into sixty six *sarkars*, Sirsa came under the *Sarkar* of Hissar whose administration was carried on by two officials; *Shiqdar-i-Shiqdaran* and *munsif-i-munsifan*. But this area came again under the Mughal sway during 1556.

In 1556, Akbar succeeded Humayun. The extent of his empire was very vast. Akbar divided his empire into well defined provinces and established uniform administration in them. The provinces numbered 15. They were Allahabad, Agra, Awadh, Ajmer, Ahmadabad, Bihar, Bengal, Delhi, Kabul, Lahore, Multan,Malwa, Berar, Khandesh and Ahamadnagar. Kashmir and Kandhar were districts (sarkars)and were included in the province of Kabul. Orissa formed a part of Bengal. The provinces were not of uniform size or income. They were known as subas[1].

The unification of the territories of Haryana began to a great extent during the reign of Akbar, the Great. The *Ain-i-Akbari* mentions that *mahal* of Ambala, Khizarbad, Sadhaura and Mustafabad (covering mostly the area lying in present Ambala district) formed part of Sarhind *sarkar* of Delhi *subah*.

Placed in metropolitan province (Delhi-Subah), Hissar was one of the important *sarkars.* It had 27 *mahals* with an area of 31,14,497 bighas yielding the revenue of 5,25,54,905 *dams* and revenue grant of 14,56,519 *dams.* The mahals included Agroha, Ahroni, Bhattu, Barwala, Tohana, Hissar, Fatehabad and Hansi. These paraganas were administrative-cum-fiscal units under the charge of Shakdars. Sirsa was one of the *dasturs* of Hissar Feroza *sarkar.* Darba and Bhatner(or Hanumangarh of Rajasthan) were also important *mahals*[2].

During the reigns of Akbar and his successors the Mughal empire was so firmly established that the Karnal district could hardly be said to have possessed a separate history. The whole of Karnal district was included in Delhi *suba*. Most of it was in *sarkar* - Delhi but some portions of it also lay in *Sarkar*-Saharanpur, *sarkar*-Hissar and *sarkar* - Sarhind.

During the Mughal period territories in the Rohtak area often

changed hands as a consequence of constant fighting between the Sikhs, Jats, Marathas and the
Rajputs. Some changes were made to serve the administrative purposes of the rulers

1. A.L. Shrivastava : *The Mughal Empire*, 1993, p.185.

2. J. Wilson : *Settlement Report of Sirsa District* (1879-83) pp. 26-27.

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in Delhi. Under Akbar the Rohtak district, a part of the *suba* of Delhi, fell within the *sarkars* of Delhi and Hissar Feroza and enjoyed political stability.

During the time of Akbar, the Great Mughal, the area covered by the present Gurgaon and Faridabad districts was contained in *suba* of Delhi and Agra, and comprised wholly or partly, the following *sarkars* and *dasturs*[1] :-

Suba Sarkar Dastur Mahal of paragana

Delhi Delhi 1. Palwal

2. Jharsa

Rewari 1. Bahora _

2. Taoru _

3. Rewari _

4. Sohna _

5. Lohana _

Agra Sahar or 1. Hodal 1. Indor

Pahari-
Tijara 2. Tijara 2. Ujina

3. Umri-Umra

4. Pinangwana

5. Bisru

6. Bhasohra

7. Jhamrawat

8. Khanpur

9. Sakras

10. Santhwari

11. Ferozepur

12. Kotla

13. Ghasera

14. Nagina

The present Mahendragarh and Rewari districts(areas)were in the *subas* of Delhi and Agra and the *sarkar* of Rewari had principal *mahals* of Rewari and Bawal while the *sarkar* of Narnaul consisted of principal *mahals* of Kanaud, Kanti, Khudana and Narnaul[2].

1. *Gurgaon District Gazetteer,* 1910, p.19.

2. *Mahendragarh District Gazetteer,* 1988, p.2.

Jind area was part of Hissar *sarkar* which was a further division of Delhi suba. Jind, Khanda and Dhatrat were important *Mahals*[1]. The above administrative set-up remained intact during the reign of Akbar's successors-Jahangir(1605-1627), Shah Jahan and Aurangzeb (1658-1710).

In 1709-10, Banda Bairagi, originally a Rajput, a disciple of Guru Gobind Singh, in an effort to continue the fight against the oppression, collected an army of Sikhs and occupied the whole of the country, west of the Yamuna. He laid waste the whole neighbourhood of Karnal, where he killed the *faujdar* . He was repulsed by Bahadur Shah about 19 kilometres north-east of Sadhaura[2]. Banda Bahadur set-up his headquarters at Sehri -Khanda (Sonipat district). He also trampled under his feet the *paraganas* of Mustafabad, Ambala and Sadhaura[3].

Emperor Farrukh Siyyar granted the Rohtak area alongwith the rest of Haryana in 1718 to his minister Rukn-ud-din who transferred it a few years later to the Nawab of Farrukhnagar.

On the retirement of Ahmad Shah Durani from Punjab in December 1762, the Sikhs appeared on the scene in the areas of Karnal, Pundri and Kaithal . On January 14,1764, they defeated and killed Jain Khan, the Durani Governor of Sarhind, and took possession of the whole of Sarhind province as far south as Panipat[4]. The noted Sikh chiefs who commanded sub-contingents of troops under the *misaldars* at once dispersed in various directions and according to their strength seized what fell in the way of each. Raja Gajpat Singh seized Jind, Safidon, Panipat , Karnal , Bazidpur and Rohtak. Mehar Singh Nirmala seized the paragana of Shahbad & Ismailabad. Sahib & Gurjit Singh seized Ladwa, Indri, Babain and Shamgarh. Bhai Mit Singh, together with his two nephews Bhanga Singh and Bhag Singh seized the territories of Pehowa and suburbs of Thanesar. Duleha Singh Karor Singhia occupied Radaur and Damli. The Afghan Nawab of Kunjpura managed with difficulty to retain a total of 53 villages; in the case of others he was forced to give a share to the Shamgarh chief and Sikhs of Churmi[5].

After the defeat of Marathas in the Third Battle of Panipat, Raja Suraj Mal of Bharatpur got an opportunity to extend his kingdom. He attempted to capture the large parts of Haryana. After killing the Mughal faujdar-Musavi Khan-he conquered

the territories of Pataudi, Rewari, Rohtak and Bahadurgarh.

1. *Jind District Gazetteer,* 1986, p.23.

2. Wolseley Haig : *The Cambridge History of India, Volume IV*,1963, p. 323.

3. Khuswant Singh, *A History of the Sikhs, Volume-I,* p. 104.

4. Hari Ram Gupta: *History of the Sikhs,Volume-I,* 1952, p.197.

5. *Karnal District Gazetteer,* 1918, p. 21.

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After humiliating the refractory chiefs of western Haryana, Najaf Khan-a Rohilla sardar, sent his troops to conquer the remaining territories. The Jamindars of Mahendragarh and Narnaul surrendered before him.

Then Najaf Khan paid his attention towards northern Haryana, i.e. Karnal, Jind, Shahbad, Thanesar and Ambala which were still under the Sikh chiefs.

In winter of 1774, the Sikhs under the leadership of Amar Singh of Patiala marched against the Bhatti chief. They captured the fort of Begran in Hissar district. They also took possession of Fatehabad and Sirsa and invested Rania which was under the control of Mohammad Amin Khan Bhatti.

Meanwhile, Shah Alam sent Rahim Dad Khan, the Governor of Hansi, to attack Raja Gajpat Singh of Jind, but former was defeated. Gajpat Singh took possession of parts of Gohana and Rohtak. But soon Najaf Khan recovered Karnal and parts of Rohtak from the Sikhs. A conciliatory meeting was also arranged at Jind in which a compromise was made. Amar

Singh surrendered the districts of Hansi, Hissar and parts of Rohtak and was allowed to retain Fatehabad, Rania and Sirsa. Gajpat Singh of Jind was also allowed to retain of villages from the territory he had seized. In 1779, Najaf Khan sent Mirza Shafi against the Sikhs in the Sonipat-Panipat districts, he wrested territory from the Sikhs.

During this period, Balwat Singh, the Raja of Mahendragarh had occupied many villages in the Hansi-Hissar districts,which belonged to Najaf Quli's *Jagir*. Consequently, Najaf proceeded to Mahendragarh in the last week of November. As he found water scarce, he adopted foul methods. He invited the Raja for negotiating a treaty but treacherously assassinated his son.On 5th February,1780, Narnaul was plundered by the Mughals. Similarly, in 1780, Mitrasen Ahir, the Raja of Rewari had to surrender.

With the death of Mirza Najaf Khan on 6th April, 1782, a period of uncertainty, anarchy and confusion prevailed . The Sikhs, the Mewatis and the Gujars started plundering northern Haryana and adjacent territories of Delhi. Under these circumstances Marathas came on scene.

Mahadji, a very important personality of Marathas turned his eyes towards Haryana. It was divided into a number of small principalities. Three main powers may be mentioned . The northern Haryana including Ambala, Karnal and Jind had been under the Sikh chiefs. Najaf Quli Khan had occupied the territories of Rewari, Narnaul, Gurgaon, Jhajjar and Rohtak. He posed to be an independent ruler with Gokalgarh near Rewari as his capital . The north-east territory of Haryana was under

Bhattis. They had in their possession Fatehabad, Rania and Sirsa. So, practically the whole of Haryana was independent. Mahadji had to make tremendous efforts to conquer and administer the territories.

After conquering most of the territories, Mahadji divided Haryana region into four districts as under:

(i) **Delhi** -It included the emperor's palace and family and surrounding areas of Haryana.

(ii) **Panipat**- It consisted of the districts of Karnal, Sonipat, Ambala and Kurukshetra.

(iii) **Hissar**-It included Hissar and some parts of Rohtak district.

(iv) **Mewat**-It included Gurgaon, Rewari, Narnaul and Mahendragarh.

In 1793, George Thomas was invited by Maratha General Apa Khande Rao who directed him to raise a battalion of 1,000 regular army. In 1794, Apa Khande Rao enlarged his troops and George Thomas was assigned the territories of Tijara, Tapukra and Ferozepur Jhirka as fiefs for the maintenance of the army. But before he could obtain his fiefs, he had to prove himself equal to the occasion. In March -July, 1794, he occupied Tijara, looted Bahadurgarh and captured Jhajjar and marched towards Pataudi. All these territories were included in his *jagir* . Hence he built a fort known as Georgegarh which came to be known as Jahazgarh. He also subdued the rebel *zamindar* of Rewari. He too compelled Ganga Bishan, an Ahir, who was one of the strongest *zamindars* of Haryana having 14,000 fighting men on his side . He captured Beri[1].

Then George Thomas conquered the fort of Gokalgarh in September, 1798, which was under the possession of local governor of Mahadji . In 1800, he made an attack on Patiala at the request of princess Sahib Kaur, who had been imprisoned by her brother,Sahib Singh, the Raja of Patiala. George plundered the city and made a treaty in March, 1800 with Raja of Patiala. It was agreed that the districts of Bud-Sikri, Jamalpur and Toham from Patiala; Karipori from Kaithal and Safidon from Jind would be given to George Thomas.

George Thomas besieged Sirsa, a part belonging to the tribe of Muslim Bhatti. He retained them for seven months and

collected huge booty and captured Bhatner. Before his death on 22nd August, 1802, major Bourquien captured his territories. There-after, the Georgegarh fort later came into the possession of the Nawab of Jhajjar and he named it Hassangarh.

1. S.C. Mittal : *Haryana, A Historical Perspective*, 1986, p.17.

General

Haryana remained under the control of the Maratha till 1803 A.D. General Lake marched towards Delhi and overthrew the Marathas and dispersed the Sikhs. With the battle of Laswari on Ist November, 1803, the Maratha power vanished from Haryana.

On December 30, 1803, Daulat Rao Sindhia ceded the territory of Haryana to the British East India Company through the treaty of sirji Anjangaon. Haryana was included in the Presidency of Bengal with a Resident at Delhi to administer it . The British kept under their direct supervision the territories which included Panipat, Sonipat, Samalkha, Ganaur, Haveli, Palam, Nuh, Hathin, Tijara Bhora,Tapukara, Sohna, Rewari, Indri-Palwal, etc. These territories were placed under the administrative control of the Resident and known as assigned territory . The remaining region was divided among different Chiefs and sardars. For example, Nawab Isa Khan and Ahmad Baksh Khan were granted *jagirs*. Faiz Talab Khan and Ahmad Baksh Khan were given the *parganas* of Pataudi, Loharu, Ferozepur Jhirka, respectively. Rao Tej Singh got the territory of 87 villages in Rewari *pargana*. Similarly, Murtaza Khan and Mohammad Ali Khan got Hodal and Palwal *parganas.* Rohtak , Meham, Beri, Hissar, Hansi, Agroha, Tosham, Barwala and Jamalpur were given to Rohilla Chief, Bambu Khan. Later they were transferred to Abdus Samad Khan. Mohammad Ali Khan of

Muzaffarnagar got possession of villages in *parganas* of Karnal and Gurgaon. Other *jagirs* remained as earlier. For example, Nawab Delar Khan of Kunjpura, Raja Bhanga Singh of Thanesar, Bhai Lal Singh of Kaithal, Gurdit Singh of Ladwa and the sardar of Shamgarh remained in possession of their territories.

The British Government put a strong garrison at Hansi fort to subdue the Muslim Bhatti Rajputs of western Haryana. The British distributed these territories among the Nawabs of Jhajjar, Loharu and Dujana.

The British paid their attention towards native chiefs and sardars in the-Sutlej tracts. The Government changed the policy of keeping the Yamuna as the boundary of their kingdom on the north -west. The Chhachhrauli State was annexed to the British territory in 1818.

In 1819, the political and civil affairs of the Resident were divided between the Resident and Commissioner,respectively. The assigned territory was divided into three divisions; (i) northern division, including Panipat, Sonipat, Rohtak, Hansi and Hissar; (ii) central division including the city of Delhi and its environs and (iii) southern division including Palwal, Hodal, Mewat, Gurgaon and Rewari. All these three divisions were kept under the Assistant Commissioner.

During the British period the formation of districts in Haryana began and era of *sarkars* and *dasturs* as prevailed during the Mughal period, disappeared. The

administrative division with a view to controlling the territorial units took shape in this region .

The formation of the Rohtak district began when the gift was abandoned by the Dujana chief. The Gohana and Kharkhauda-Mandothi estates lapsed to the British Government on the death of Lal Singh in A.D. 1818 and Bhag Singh 1820. When the Hissar district was created in 1820, the Beri and Meham-Bhiwani tahsils were included in it. In 1824, the Rohtak district was formed. The period from 1819 to 1832 was very significant because the beginning of the districts of Delhi, Rohtak, Gurgaon, Hissar and Panipat took place[1]. In 1832, all the above five districts were included in North-Western Provinces.

The Sikh chiefs and confederacies confirmed in their principalities with the decline of Mughal power. Kaithal lapsed to the British Government in 1849. The British Government organised these lapsed territories into Thanesar district in 1849. A part of Thanesar was already lapsed to the British. The whole of Haryana region was tagged with the Punjab administration in 1858.

After the war of independence (1857), great territorial changes were made. Except the three small states of Pataudi, Dujana and Loharu, all other important states like Jhajjar, Dadri, Farrukhnagar, Ballabgarh, Buria and Kalsia were confiscated. These were either merged with other states or were given to the loyal chiefs. Maharaja Narender of Patiala was rewarded with the *parganas* of Narnaul-Mahendragarh. Maharaja Sarup Singh of Jind received Dadri (now in Bhiwani district). Similarly Raja Bharpur Singh of Nabha was rewarded with the *parganas* of Bawal and Kanti in the confiscated territory. The Rajas of Ballabgarh, Dadri and Jhajjar were executed in Delhi and their properties were confiscated.

India bifurcated on August 15,1947 into Hindustan (India) and Pakistan.A wave of bloody riots took place.

Consequently, normalcy returned to the region after a short while. A good number of Muslims, especially the Meos, gave up the idea of going to Pakistan[2]. Hundred of thousand of Hindus and Sikhs came into Haryana from Pakistan. Upto 1947, the following districts existed in Haryana which was a part of Punjab:-

1. Hissar

2. Rohtak

3. Karnal

4. Ambala

5. Gurgaon

1. More details about the beginning of the districts will be given in the following pages.

2. Sri Ram Sharma : *Hariyana Ka Itihas (urdu)*,pp.143-46.

General

In 1948, with the formation of PEPSU, Mahendragarh territory from Patiala State, Dadri territory from Jind State and Bawal territory from Nabha State were constituted into Mahendragarh district with the headquarters at Narnaul. Since the merger of PEPSU with (major portion) Punjab in 1956, the Mahendragarh district became one of the 19 districts of the then Punjab, and 6th district in the Haryana territory.

With the creation of Haryana State, Jind district came into existence on Ist November, 1966. Thereafter, the Bhiwani and Sonipat districts came on the scene as on December 22, 1972. Karnal district was bifurcated on January 23, 1973 and another district of Kurukshetra was carved out. Similarly, in September, 1975, Sirsa and Dabwali tahsils were constituted into a separate district with headquarters at Sirsa. Gurgaon district was reorganised separating Faridabad area and new district of Faridabad came into existence on August 15, 1979. After a gap of ten years, another series of formation of districts started . On Ist November,1989, Rewari, Panipat, Kaithal and Yamuna Nagar districts were formed[1]; adding the strength of districts to 16 in Haryana.

The separate history of each district having the position as on March 31, 1991, is given as under:-

1. Hissar Distict.- In 1820, the north-western part of Delhi territory was sub-divided into two districts the northern and western. The western district included Bhiwani, Hansi, Hissar and Sirsa. The Hissar district which was basically constituted in 1820, had its headquarters at Hansi. In 1824, Rohtak district which had previously been under the western part of territory of Delhi was constituted into a separate district to which Bhiwani tahsil was transferred.

In 1832, the Haryana territory officially designated as Delhi division, comprising the districts of Hissar, Delhi, Rohtak, Panipat and Gurgaon was brought under the Regulations of the East India Company and included in North-Western Provinces[2]. So, in 1832, Hissar was made the headquarters of the district in place of Hansi.

The district was then divided into 4 tahsils; Hissar, Fatehabad, Hansi and Tosham. In 1837, Ratia and Tohana *parganas* were added to Hissar district and formed into a separate tahsil of Tohana.

Sirsa tract was detached in 1837 from the Hissar district and placed under a separate officer styled as superintendent of Bhatiana. The *pargana* of Darba& *pargana* of Rori were transferred to Bhatiana in 1838 and 1847, respectively. In 1852, the *pargana* of Ratia was transferred from Tohana tahsil to Fatehabad Tahsil and Barwala

1. *Vide Haryana Govt. Notification, S.O. 156 PA 17/187/S.S. 89, dt. 16th October, 1989.*

2. *Imperial Gazetteer of India(Provincial Series of Punjab),Volume-I,* 1908, p.250.

pargana was detached from Hissar tahsil and was formed into a separate tahsil of Barwala along with Tohana. The whole of Delhi territory alongwith Bhatiana and Hissar was transferred to the Punjab and district of Bhatiana was renamed as Sirsa.

In 1861, Bhiwani tahsil was detached from Rohtak and added to Hissar district. The Tosham tahsil was abolished and added to Bhiwani tahsil in the same year. The Hissar district gained 24 villages from Meham- Bhiwani tahsil of Rohtak district;18 villages including the town of Bhiwani were added to Bhiwani tahsil and 6 villages to Hansi tahsil.

In November, 1884, the Sirsa district was abolished and Sirsa tahsil with 159 villages was added to Hissar district and formed the Sirsa tahsil . In 1889, 15 villages forming a detached block known as Budhlada *illaqa*, were transferred from Kaithal tahsil to Fatehabad tahsil. The Barwala tahsil containing 139 villages was abolished with effect from January 1,1891 and its area was distributed between 3 contiguous tahsils; 13 villages going to Hansi, 24 to Hissar and 102 to Fatehabad[1]. At the same time 13 villages were transferred from Hissar tahsil to Bhiwani tahsil and a sub-tahsil was established at Tohana in Fatehabad tahsil. In 1923, the Tohana sub-tahsil was transferred from Fatehabad to Hissar tahsil.

No transfer of territory to or from the district took place till the passing of the Provinces and States (Absorption of Enclaves) Order, 1950 by which the erstwhile princely state of Loharu was merged in the district and 15 villages comprising Budhlada *illaqa* were taken out from Hissar district and added to Bhatinda district.

With the view to decentralising the authority in the administrative set-up, the district was divided into sub-divisions; Fatehabad and Hansi sub-divisions were created in 1961 and 1964, respectively. Hissar sub-division was created in 1965.

Haryana as a State was created on November 1, 1966. In 1968, Sirsa tahsil was bifurcated into Sirsa and Dabwali tahsils and Bhiwani tahsil was bifurcated into Bhiwani and Loharu. The above administrative arrangement continued till 1972 when whole of Loharu and Bhiwani tahsils, 32 villages of Hansi and 17 villages of Hissar tahsils were excluded and

included in the then formed Bhiwani district[2]. Tohana sub-tahsil of the Hissar tahsil was upgraded to a tahsil in 1972.

1. *Hissar District Gazetteer*, 1915, p. 46.

2. *Haryana Government (Revenue Department Notification* No. 6050-E(iv)-72/45,723, dt. December 22, 1972.

General

In 1975, Sirsa and Dabwali tahsils were excluded from the district and a new district of Sirsa was carved out[1]. In 1979 two sub-tahsils, one at Ratia of tahsil Fatehabad comprising 67 villages and other at Adampur of Hissar tahsil comprising 32 villages were created. A sub-division was formed at Tohana in 1981. Ratia sub-tahsil was upgraded to a tahsil in 1981.

The position having tahsils, sub-divisions and sub-tahsils by the beginning of 1991 was as under: the district had 4 sub-divisions (Hissar, Tohana,Fatehabad, and Hansi); 6 tahsils (Hissar, Tohana, Fatehabad, Ratia, Hansi and Narnaund); 3 sub-tahsils (Adampur, Uklana Mandi and Bhuna). There is divisional headquarters at Hissar.

2. Gurgaon District._ After the annexation of Gurgaon in 1803, the headquarters of civil offices of the district were at Bharawas near Rewari. Gurgaon was then a cavalry station to check the troops of Begum Samru of Jharsa. After the cession of the Ajmer territory, the Bharawas force was transferred to Nasirabad and civil offices were shifted to Gurgaon which was formed a district headquarters in 1821.

The Gurgaon district was transferred from the North Western Provinces to Punjab in 1858. The *pargana* of Kot Kasam,

which was annexed to the district after the Uprising of 1857, was made over to the then Jaipur State in 1860. In 1861, the district was re-arranged into five tahsils; Gurgaon, Ferozepur Jhirka, Nuh, Palwal and Rewari[2].

Ballabgarh was one of the three tahsils comprising the then Delhi district. A part of this tahsil was transferred when the decision to shift the imperial capital from Calcutta to Delhi was taken in 1911. The Ballabgarh tahsil was made into a separate province.

During the decade (1941-51), some major changes took place. Under the Provinces and States (Absorption of Enclaves) Order, 9 villages of the district including Shahjahanpur were transferred to Rajasthan, whereas the district gained with the merger of Pataudi State and the transfer to it 2 villages from Rajasthan and 78 villages from PEPSU. As a result of these changes, the area of the district stood at 2,358 square miles (6,107 square kilometres) in 1951. The Pataudi State had 45 villages . It was converted into a sub-tahsil and 45 villages of the Rewari tahsil were included in it thus making a total of 90 villages.

Nuh and Rewari sub-divisions were created in 1955; Ballabgarh and Ferozepur Jhirka in 1964 and 1965. In March 1967, Gurgaon and Ferozepur Jhirka sub-divisions were abolished and merged with Rewari and Nuh sub-divisions respectively, but

1. *Haryana Government (Revenue Department Notification No.4130-E(iv)-75/26,094, dt. the 26th August, 1975.*

2. *Gurgaon District Gazetteer,* 1910, p. 26.

they were created again in March, 1968.

The limits of the district were varied on December 22, 1972. The Rewari tahsil (except 61 villages transferred to Gurgaon tahsil) was excluded from the Gurgaon district and included in the Mahendragarh district . During 1978, the district was divided into 5 tahsils, viz. Gurgaon, Ballabgarh, Ferozepur Jhirka, Nuh and Palwal and two sub-tahsils, namely, Hathin which was a sub-tahsil of Nuh & Pataudi which was a sub-tahsil of Gurgaon. A sub-division was created at each of the five tahsils.

Gurgaon district was bifurcated on August 15, 1979 and the new district of Faridabad comprising the tahsils of Ballabgarh and Palwal was carved out of it. In this adjustment, 98 villages formerly in the Nuh tahsil, 31 villages formerly in the Ballabgarh tahsil and 3 villages formerly in the Gurgaon tahsil were shifted to the Palwal tahsil. The 98 villages, transferred from Nuh tahsil, constituted the Hathin sub-tahsil and another group of 72 villages was formed into Hodal sub-tahsil.

By the beginning of 1991, the position of Gurgaon district was : the district had 3 sub-divisions (Nuh, Gurgaon and Ferozepur Jhirka); 4 tahsils(Nuh, Gurgaon, Pataudi and Ferozepur Jhirka) and 3 sub-tahsils (Taoru, Sohna and Punana). There is divisional headquarters at Gurgaon.

3. Rohtak District._ In 1824, the Rohtak district was formed as a separate unit consisting of Gohana, Kharkhauda-Mandothi, Rohtak- Beri and Meham -Bhiwani tahsils. The Bahadurgarh territory formed its eastern and Jhajjar its southern boundary. Until 1832, the whole area, including Rohtak, was under the Resident at Delhi; but when in that year it was brought under the same regulations as the rest of North India, the Resident became Commissioner.

The district was abolished in A.D. 1841, Gohana going to Panipat and the rest of the tahsils to Delhi; but in the very next year it was created again. The two districts of Rohtak and Jhajjar together with the rest of the Delhi and Hissar divisions were detached from North-Western Provinces after 1857 and passed to the Punjab by the Goverment of India Notification No. 606 of the 13th April, 1858.

After its transfer to the Punjab the Rohtak district experienced several changes before assuming its final form. The Bahadurgarh estates were added to the Sampla tahsil, five detached villages to the east, going to Delhi. Jhajjar,

including some areas of Narnaul, Kanaudh (present Mahendragarh) and Dadri was first created as a new district but was abolished shortly after wards in 1860 when large parts of it were assigned to the Phulkian chiefs as a reward for their services. While the Jhajjar tahsil was added to Rohtak, several Badli villages were transferred either to Delhi or Gurgaon, and two detached Jhajjar estates were given to the Raja of Jind . In the following year, the Meham tahsil was abolished and after making necessary territorial

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adjustments in favour of Hissar and Delhi; rest of the area was added to the Rohtak tahsil . All these changes were completed by the Ist July, 1861[1]. The Rohtak district remained a part of the Hissar division until 1884.

On the abolition of the Hissar division in 1884, the Rohtak district was transferred to the Delhi division .It consisted of four tahsils;Rohtak, Gohana, Jhajjar and Sampla but in April , 1910, the Sampla tahsil was abolished for reasons of administrative economy, and its area was divided between the Rohtak and Jhajjar tahsils. The Sonipat tahsil which had remained attached to the Delhi district since 1861, was added to Rohtak district in September, 1912, on the separation of Delhi territory from Punjab[2]. The district was then attached to the Ambala division.

In 1948, Dujana State was merged in Jhajjar tahsil and new sub-tahsil of Nahar was created. By March 31, 1966, the Rohtak district was sub-divided into 4 tahsils, namely,Sonipat, Rohtak, Jhajjar and Gohana and a sub-tahsil of Nahar . The sub-divisions were created at Rohtak Sonipat, Gohana and Jhajjar.

The major territorial changes were made when Sonipat

district was carved out of Rohtak district by taking Sonipat and Gohana tahsils on December22, 1972. Gohana sub-division of Sonipat district was included in the Rohtak district[3]. Beri and Badli were created sub-tahsils of Rohtak district as on Ist November, 1989. By the beginning of 1991, the administrative set-up of Rohtak district was : the district had 5 sub-divisions (Rohtak, Jhajjar , Bahadurgarh, Meham and Gohana); 5 tahsils (Rohtak, Jhajjar, Bahadurgarh, Meham and Gohana); and Badli, Beri and Matanhail were created as sub-tahsils. The divisional headquarters started functioning at Rohtak from Ist November, 1989.

4. Ambala District._ Upto 1847 certain chiefs were deprived of their sovereignty and their villages were lapsed to the British area under the policy of lapse. In 1849 Ambala became the headquarters of district[4]. Brief details of lapsed estates in the present Ambala district (covering Yamuna Nagar area) are given below:_

Name of the Estate Date of lapse No. of villages

Ambala tahsil

1. Patti Ambala 1823 63

2. Pargana Sulhar 1843 46

3. Pargana Adhoya 1850 39

1. *Land Revenue Settlement (Revised)of Rohtak District*, 1880, p.44.

2. *Rohtak District Gazetteer, Volume-II (Statistical Tables),* 1936, p.3.

3. *Vide Haryana Government Notification S.O. 156/PA 17/1887/SS/89, 16th October, 1989, it became effective from Ist November, 1989.*

4. *Ambala District Gazetteer, 1923-24*, p.130.

Jagadhri tahsil

1. Bilaspur 1819 16

2. Jagadhri 1829 36

3. Buria 1836 28

4. Milak 1841 15

5. Dialgarh 1851 16

Naraingarh tahsil

1. Majra 1833 20

2. Gadauli 1840 5

3. Lalpur Nagla 1846 12

4. Naraingarh and Bharog 1847 89

The then district of Ambala had five tahsils of Ambala, Kharar, Jagadhri, Naraingarh and Ropar with enclaves which were part of the princely states. The changes involving inclusion or exclusion of certain areas after 1862 reflected the immediate administrative requirements.

In 1862, Thanesar district was broken and *parganas* of Shahbad, Ladwa and a part of Thanesar came to Ambala and were constituted into Pipli tahsil. In 1866, Pehowa *pargana* from Karnal was transferred to Pipli tahsil of Ambala but in 1876,14 villages and in 1889 the remaining villages were transferred from Pipli to Kaithal tahsil of the then Karnal district . Again in 1897, the Pipli tahsil was transferred to Karnal district. In 1899, Kalka-cum-Kurali estates and Kasauli and later in 1916, Sanawar were transferred from Shimla district to Ambala district.

In 1950, the Ambala district lost Kasauli and Sanawar to Kohestan district of PEPSU and 17 villages to Fatehgarh Sahib district of PEPSU and gained 6 villages from Patiala district and 115 villages and some forest area from erstwhile

Kalsia State. In 1959, Nalagarh tahsil and Pinjore *Kanungo* circle of Kandaghat tahsil of Patiala district were transferred to Ambala district. The Pinjore *Kanungo* circle was added to the Kharar tahsil.

The State of Haryana came into existence on November1, 1966. During the re-organisation of areas, the Ambala district was very much reduced in size. Of its six tahsils, the district lost Nalagarh tahsil to Simla district of Himachal Pradesh; Ropar tahsil and major portion of Kharar tahsil(282 villages and Kharar and Kurali towns) to the then constituted Ropar district of Punjab State and 36 villages and Chandigarh and Manimajra towns to the Union Territory, Chandigarh.

General

After the formation of Haryana State, the district comprised 3 tahsils (Ambala, Jagadhri and Naraingarh). The Naraingarh tahsil got 153 villages and Kalka town from the Kharar tahsil. In 1967, the above 153 villages and Kalka town were taken out of the Naraingarh tahsil and formed into Kalka tahsil. In 1978, the district had 4 tahsils (Ambala, Jagadhri, Naraingarh and Kalka).

The administrative set up was decentralized into sub-divisions; Jagadhri (created in 1954); Naraingarh (created in 1956) and Ambala (created in 1968). A sub-tahsil of Raipur Rani was created in December, 1979.

During November, 1989, the sub-divisional headquarters of Kalka were shifted to Panchkula. Panchkula and Buria tahsils were created in the Ambala district. Yamuna Nagar district was carved out of Ambala district by taking Jagadhri tahsil and Sadhaura sub-tahsil from Ambala district and Radaur block from Kurukshetra district.

By the beginning of 1991, the district was divided into 3 sub-divisions (Ambala, Panchkula and Naraingarh); 5 tahsils (Ambala, Kalka, Panchkula, Naraingarh and Barara) and 2 sub-tahsils (Morni and Raipur Rani).

5. Karnal District .- In 1851, the Panipat district was divided into Panipat and Karnal tahsils with tahsil headquarters at Panipat and Gharaunda, respectively. After three years, i.e. in 1854, the district headquarters were shifted to Karnal. In 1858, the Karnal district, alongwith territory of Delhi, from the North -western Provinces was added to the Punjab.

The Thanesar district was broken up in 1862 and its areas were included into Karnal and Ambala districts. The *parganas* of Guhla, Pehowa, Kaithal, Indri and a part of Thanesar were included in the Karnal district. In 1866, Pehowa *pargana* of Karnal district was transferred to Ambala district. The tahsil headquarter was moved from Gharaunda to Karnal in 1868. In 1875, 14 villages of Pehowa *pargana* were shifted to Karnal district; 89 villages of Pehowa *pargana* were transferred from Ambala to Karnal district in 1888 and included in Kaithal tahsil. The Pipli tahsil, transferred to Ambala district in 1862, came back to the district in 1897, and headquarters of the tahsil were shifted to Thanesar in the same year. A sub- tahsil of Guhla was created in 1890 and Kaithal tahsil was formed into a sub-division in 1896.

After independence, three sub-divisions were formed; Panipat in 1955; Thanesar in 1960 and Karnal in 1964. Guhla sub-tahsil of Kaithal tahsil was raised to the status of a tahsil on August 13,1969. The sub- division at Karnal was abolished in March, 1967 but revived in August, 1968.

The Karnal district was bifurcated on January 23, 1972 and a new district of Kurukshetra comprising tahsils of Thanesar, Guhla and Kaithal was carved out of it.

In this adjustment 77 villages, formerly in Kaithal tahsil, were shifted to the adjoining areas, *viz*.22 to the Karnal tahsil of Karnal district; 44 to the Jind tahsil; 5 to the Safidon tahsil and 6 to the Narwana tahsil of Jind district.

On 1st November, 1989, by taking Panipat and Assandh tahsils[1] of Karnal district, a new district of Panipat was created . During the same period, new sub-divisions were formed at Panipat and Assandh. Ballah was also formed a sub-tahsil in Panipat district . By the beginning of 1991, the Karnal district had; 1 sub-division (Karnal); 1 tahsil (Karnal) and 4 sub-tahsils (Indri, Nissang, Nilokheri and Gharaunda).

6. Mahendragarh District.- In 1948, with the formation of PEPSU Mahendragarh territory from Patiala State, Dadri territory (Now Charkhi Dadri) from Jind State and Bawal territory from Nabha State were constituted into Mahendragarh district with the headquarters at Narnaul. At that time, there were three tahsils, namely; Narnaul, Charkhi Dadri and Bawal and Mahendragarh was a sub-tahsil. In 1949, Mahendragarh sub-tahsil was made a tahsil.

In 1950, Bawal tahsil was broken up and 78 villages were transferred to Gurgaon district forming Bawal as a sub-tahsil and remaining villages were added to Narnaul and Mahendragarh. Since the merger of PEPSU with Punjab in 1956, the Mahendragarh district became one of the 19 districts of the then Punjab.

The limits of Gurgaon and Mahendragarh districts varied on December 22, 1972. The Rewari tahsil (except 61 villages) was excluded from Gurgaon district and included in Mahendragarh district . The number of villages, as shown below, was included in Mahendragarh district from Gurgaon district:-

Tahsil/sub-tahsil Number of villages Total

Inhabited Uninhabited
1. Rewari 249 12 261

2. Bawal sub- tahsil 74 1 75

3. Pataudi (sub-tahsil partly) 25 4 29

348 17 365

The Charkhi-Dadri sub- division was excluded from Mahendragarh district and included in the newly constituted district of Bhiwani.

In 1977, 81 villages of Rewari tahsil was constituted into Bawal tahsil. In 1978. the district comprised 4 tahsils (Mahendragarh , Rewari, Narnaul and Bawal);

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1. Assandh tahsil of Panipat district was again included in Karnal district after census operation of 1991.

General

3 sub-divisions-Mahendragarh sub-division (created in 1958), Narnaul sub-division (created in 1968) coincided with the tahsil area and Rewari sub-division (created in 1965) covered Rewari and Bawal tahsils.

Rewari and Bawal tahsils (taken from Mahendragarh district) and Kosli tahsil except 10 villages (taken from Rohtak district) were constituted into a new district of Rewari as on 1st November, 1989. During this re-organization, Kosli was made a sub-divisional headquarters.

By the beginning of 1991, the district had 2 sub-divisions (Narnaul and Mahendragarh)and two tahsils (Mahendragarh and Narnaul).

7. Jind District ._ With the formation of the Patiala and East Punjab States Union (PEPSU) in 1948, the States were grouped into eight districts, namely; Patiala, Barnala, Bhatinda, Kapurthala, Fatehgarh Sahib, Sangrur, Mahendragarh and Kohistan, (Kandaghat). In 1953, the number of districts was reduced to five, by merging Barnala with Sangrur and Kandaghat and Fatehgarh Sahib with

Patiala. Thus, the Sangrur district comprised five tahsils, viz. Barnala, Malerkotla, Sangrur, Narwana and Jind . However, in 1956 with dissolution of PEPSU , the major area was transferred to Punjab. Subsequently, on November 1, 1966, the Jind district comprising tahsils of Jind and Narwana was created.

In 1967, Jind tahsil was bifurcated into two tahsils; Jind and Safidon. In January,1973, 54 villages of Kaithal tahsil were transferred to Jind district; 43 going to Jind tahsil, 5 to Safidon tahsil and 6 to Narwana tahsil.

In 1975, the Jind district had 3 tahsils (Jind, Narwana and Safidon) and two sub-divisions, Jind and Narwana. Jind and Safidon tahsils together formed Jind sub-division with its headquarters at Jind, while Narwana sub-division comprised Narwana tahsil having its headquarters at Narwana.

In November, 1989, some territorial changes occurred when the new district of Kaithal was formed . A part of Rajaund block and Kalayat sub-tahsil of Jind district were included in the Kaithal district.

As on 31st December, 1990, the district was as such :_

Sub-Division Tahsil Sub-Tahsil

1. Jind 1. Jind 1. Julana

2. Safidon 2. Safidon 2. Pilukhera

3. Narwana 3. Narwana 3. Uchana

8. Bhiwani District._ According to the *Phulkian States Gazetteer (Patiala, Jind and Nabha)*,1904, Charkhi Dadri town was formerly in the possession of

Nawab Bahadur Jang, a relative of Jhajjar Nawab.
In the action of 1857, the estates of the Nawab of Charkhi Dadri were escheated and he was slain by the British in Delhi. The Dadri area (1, 554 sq. kilometres) was first included in the newly created district of Jhajjar, which was abolished in 1860 and the area was assigned to the Phulkian chiefs as a reward for their services to the British in the war of Independence (1857). Dadri was conferred on Raja Sarup Singh of Jind. Till 1904, Dadri was a tahsil of the Jind *Nizamat*. In that year Dadri was made into a separate district[1].

On May 5, 1948, the Dadri area was included into Mahendragarh district. The district of Bhiwani comprising the Charkhi Dadri, Loharu, Bhiwani and Bawani Khera tahsils, with the headquarters at Bhiwani, was created on December 22, 1972, by varying the areas of Mahendragarh and Hissar districts so as to exclude the areas of Charkhi Dadri tahsil of Mahendragarh district and Loharu, Bhiwani and Bawani Khera tahsils of Hissar district[2].

On March 31, 1977, the district had the following villages:

Tahsil Villages

1. Bhiwani 125

2. Bawani Khera 58

3. Charkhi Dadri 172

4. Loharu 119

Total: 474

Tosham tahsil was created as on November 1, 1989. By the end (December 31, 1990), the district had 6 tahsils (Bhiwani, Bawani Khera, Tosham, Loharu,

Charkhi Dadri and Siwani) and 4 sub-divisions (Bhiwani, Loharu, Charkhi Dadri and Siwani). Badra was given a status of sub-tahsil.
9. Sonipat District._ Sonipat district came into existence on December 22, 1972. It was carved out of Rohtak district to which Sonipat tahsil was attached since 1912. By taking 69

villages from Sonipat tahsil, Ganaur as a sub-tahsil was created in February, 1980. Kharkhauda with 38 villages was created as a sub-tahsil on

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

2. *Vide Haryana Government, Revenue Department, Notification No. 6050-E(iv)-72/45723,*

dt. December 22, 1972.

March30, 1982. The sub-tahsil of Ganaur was upgraded to the level of tahsil on April 19, 1982. Gohana sub-division of Sonipat district was included in Rohtak district[1]. The position as on December 31, 1990 is as under: 2 sub-divisions (Sonipat and Ganaur); 2 tahsils (Sonipat and Ganaur) and Kharkhauda as a sub- tahsil.

10. Kurukshetra District._ With the passage of time, a few Sikh principalities lapsed to the British Government. Ladwa was lapsed to the British Government in 1846.; Kaithal in 1849 whereas Thanesar(only a part)was got by the British in 1850.The British Government organised these lapsed territories into the Thanesar district in 1849. The district was broken up in 1862 and the area distributed into two districts, Karnal and Ambala. The *parganas* of Guhla, Pehowa, Kaithal, Indri and a part of Thanesar were included in Karnal district and remainder was allotted to Ambala district . In 1866, Pehowa *pargana* was transferred from Karnal to Ambala district. It was transferred back to Karnal district (14 villages in 1875 and remaining 89 in 1888) and included in the Kaithal tahsil. The headquarters of Pipli tahsil were

shifted to Thanesar in 1897.

Kurukshetra district was formed with Thanesar and Kaithal tahsils by bifurcating the Karnal district as on January 23, 1973. During November, 1989, some new districts(Panipat, Rewari, Yamuna Nagar and Kaithal) were raised .In that re-organization the territories of Kurukshtra district were also varied to some extent.

Radaur block of Kurukshetra district was included in Yamuna Nagar district; Kaithal and Guhla tahsils (taken from Kurukshetra district) were included in the Kaithal district which was formed on 1st November, 1989. At that time Pehowa was made as sub-division. The administrative position of the district as on December 31, 1990, is as under:-

The district had 2 sub-divisions (Thanesar and Pehowa); 2 tahsils (Thanesar and Pehowa); 2 sub-tahsils (Shahbad and Ladwa).

11. Sirsa District._ In 1837, Sirsa and Rania *parganas* were taken out of the then Hariyana district and alongwith Guda and Malaut *parganas* were formed into separate district called Bhatiana. The *pargana* of Darba from Hissar district and the small *pargana* of Rori confiscated from erstwhile princely state of Nabha were transferred to Bhatiana in 1838 and 1847, respectively[2].

In 1884, Wattu *pargana* running upto Satluj was added to Bhatiana district[3]. The whole of Delhi territory alongwith district of Bhatiana and Hissar was transferred to Punjab in 1858 and the district of Bhatiana was renamed as Sirsa.

1. *Vide Government Notification No. SQ. 156.P.A., dt October 16, 1989.*

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

3. *Settlement Report of Sirsa District* (1879- 83), pp.26-27.

The Sirsa district which comprising three tahsils; Sirsa, Dabwali and Fazilka was abolished[1] in 1884 and Sirsa tahsil consisting of 199 villages and 126 villages of Dabwali tahsil formed one tahsil and the same was merged with Hissar district . Then Sirsa tahsil was formed a sub-division of Hissar district .

In 1968, Sirsa tahsil was bifurcated into Sirsa and Dabwali tahsils and on

September 1, 1975, Sirsa & Dabwali tahsils were constituted into a separate district with headquarters at Sirsa. Sub-division was created at Ellanabad on November 1, 1989. During the same period, Ellanabad and Rania were given the status of tahsils. Nathusari Chopta and Chautala were declared as sub-tahsils.
The administrative set- up explaining sub-divisions, tahsils and sub-tahsils as on December 31, 1990 is given here:

Sub-division Tahsil Sub-tahsil

1. Sirsa 1. Sirsa 1. Chautala

2. Dabwali 2. Dabwali 2. Nathusari Chopta

3. Ellanabad 3. Ellanabad 3. Kalanwali

4. Rania

12. Faridabad District._ Gurgaon district was bifurcated on August 15, 1979 and a new district of Faridabad comprising the tahsils of Ballabgarh and Palwal was formed. In this adjustment, 98 villages formerly in Nuh tahsil, 31villages formerly in Ballabgarh tahsil and 3 villages formerly in the Gurgaon tahsil were shifted to Palwal tahsil. As 98 villages, transferred from Nuh tahsil, constituted the Hathin sub-tahsil and another group of 72 villages was formed into Hodal sub-tahsil.

The position of Faridabad district as on August 15, 1979, is as under :-

Tahsil/Sub-tahsil Villages Total

Inhabited Uninhabited

1. Ballabgarh 179 31 210

2. Palwal 116 9 125

3. Hathin (sub-tahsil) 96 2 98

4. Hodal (sub-tahsil) 72 _ 72

463 42 505

1. *Vide Notification of Punjab Government* No. 684, dt. October 15, 1884.

General

During 1981-1991 censuses, the district experienced intra-inter district transfers, and changed position of tahsils and towns on that score, is as detailed below:-

By taking 97 villages from Ballabgarh tahsil of Faridabad district *vide* Government Notification No. S.O. 163/PA /17/1887/S.S./89, a new tahsil of Faridabad was created on 17th October, 1989. The said notification varied the limits of Ballabgarh tahsil by excluding the area comprising Faridabad sub-tahsil except revenue estates as mentioned in Notification[1]. Therefore, it was to form a new tahsil known as Faridabad tahsil with effect from the Ist day of November, 1989.

Ballabgarh tahsil with 210 villages in 1981 census had also been subjected to wide jurisdictional change. As a result of it 97 villages went to newly formed Faridabad tahsil and18 villages to U.P. State due to riverain action, thus reducing its strength of villages to 95 in 1991 Census.

Palwal tahsil, the biggest tahsil in the district with 295 villages in 1981 census, was deprived of 99 villages during

1981-91, (13 villages to Nuh tahsil of Gurgaon,

1 village to Gurgaon tahsil and 85 villages to newly formed Hathin tahsil) thus bringing down its rural units to 196 in 1991 Census.

The fourth tahsil of Hathin was created on 11th February, 1980[2]. The said notification varied the limits of the areas of Palwal tahsil so as to exclude the areas comprising Hathin sub-tahsil therefrom and to declare the areas so excluded to be known as Hathin tahsil. Hathin tahsil was created with 98 villages from Palwal tahsil.

By the beginning of 1991, the district had 2 sub-divisions (Ballabgarh and Palwal); 4 tahsils (Ballabgarh, Palwal, Faridabad and Hathin) and Hodal as a

sub-tahsil.

13. Panipat District .- The Panipat district, including the area of Panipat, Karnal and Sonipat, was formed in the re-organisation of 1824. In 1832, the district was included in N.W.P.

In 1851, the Panipat district was divided into Panipat and Karnal tahsils with the headquarters at Panipat and Gharaunda. In 1854, the headquarters of the district were shifted to Karnal. So, in place of Panipat, Karnal district began to function.

Upto the end of October, 1989, the Panipat tahsil remained a part of Karnal district. On November 1, 1989, after taking Panipat and Assandh[3] tahsils from Karnal district, the Panipat district was formed. During this re-organisation[4] Ballah as a sub-tahsil was created .The administrative set-up on December 31, 1990, is as under :-

1. *District Census Handbook of Faridabad District*, 1991, p.1.

2. *Vide Haryana Government Notification No. 716-E(VI)-80/5163.*

3. After census operations of 1991, Assandh tahsil was included in Karnal district.

4. The Panipat district remained abolished during the period from 24th July, 1991 to

31st December,1991. It was revived again on 1st January,1992.

The district had two sub-divisions (Panipat and Assandh); 2 tahsils (Panipat and Assandh); and 3 sub-tahsils (Samalkha, Israna and Ballah).

14. Kaithal District. The Kurukshetra and Jind districts were re-organised after the mid of 1989. By taking the Kaithal and Guhla tahsils from Kurukshetra district and a part of Rajaund block and Kalayat sub-tahsil from Jind, new district of Kaithal was created as on November 1, 1989.

By the beginning of 1991, the district had 2 sub-divisions (Kaithal and Guhla); 2 tahsils (Kaithal and Guhla) and two sub-tahsils (Fatehpur-Pundri and Kalayat).

15. Yamuna Nagar District. The limits of two districts, Ambala and Kurukshetra were varied to a greater extent when the district of Yamuna Nagar was created on 1st November, 1989. Jagadhri tahsil and Sadhaura sub-tahsil from Ambala district and Radaur block of Kurukshetra district constituted into Yamuna Nagar district.

By the end of December, 1990, the district was divided into one sub-division (Jagadhri); two tahsils (Jagadhri and Chhachhrauli) and 3 sub-tahsils(Bilaspur, Sadhaura and Radaur).

16. Rewari District. The boundaries of Mahendragarh and Rohtak districts were altered so as to make the Rewari district. Rewari and Bawal tahsils (taken from Mahendragarh district) and Kosli except 6 villages of Rohtak district constituted into Rewari district as on November,1,1989. Kosli was upgraded to the level of sub-division during the same period.

By 31-12-1990, the district had two sub-divisions (Rewari and Kosli) and

3 tahsils (Rewari, Bawal and Kosli). Rewari sub-division has been functioning since 1965.
Rewari, Khol, Jatusana, Bawal and Nahar were as block headquarters.

17. Panchkula District ._ Though the district came into existence in the mid of last decade of 20th century, yet its antiquity is beyond any doubt. The earliest inhabitants of the district were a primitive people using stone tools of the lower palaeolithic age such as choppers, unworked flakes, cleavers, hand-axes, etc. These have been discovered from Mansa Devi area (Bilaspur), Pinjore and Suketri.

In the ancient time Aryans traversed the region emotionally. The district is also associated with Pandavas who enroute to Himalayas during their exile stayed here for some times. The place was known as Panchpura later corrupted to Pinjore. The name Panchpura was deciphered from the Pinjore Baoli Inscription found from here. Pinjore is also mentioned in ancient literature[1].

1. Panini's *Astadhyais.*

The region was also indirectly under the sway of the foreign Kushan and Yaudhey rulers. This fact is corroborated from the recent finding of Kushan bricks from the adjacent territories of present Ambala district. According to Majumdar, this region had been a part of Gupta dynasty. This fact is based on discovery of silver coins of Gupta dynasty.

Towards the close of the seventh and first part of the eighth century A.D., the district fell a prey to the imperial ambitions of Yasovarman of Kanauj and Lalitaditya, the ruler of Kashmir. During the 12th century A.D., the area was acquired by the Chauhans of Delhi. They restored peace and order in the area including adjoining district of Ambala. The inscription , dated A.D. 1164 gives an idea of the role which the region played in resisting the Muslim invaders. In this context, it is said that Kilhana , maternal uncle of Prithviraj-II was appointed as governor of Hansi and he defeated the ruler of Panchpura (Pinjore) and extended Chauhan rule over that region. The district finally passed on to the Muslim rule as a result of the decisive victory of Shihab-ud-din Ghuri over Prithviraj -III in the Second Battle of Tarain (A.D. 1192).

After the death of Shihab-ud-din Ghuri, Qutb-ud-din Aibak established Muslim rule in North India. The region was also included in the Delhi Sultanate. *Tabakat-i-Nasiri* refers to the victories of Sultan Nasir-ud-din Mahmud in the vicinity of Pinjore and the loot of the spoils from there. After Firuz's death, the region felt the full force of those intensive discords which also disturbed Delhi-kingdom. Consequently, the adjacent territories and this area went out of the control of Tughlaqs. The invasion of Timur(1398) destroyed the whole countryside in the region upto Siwalik hills (possibly including Pinjore). But his sway did not last a long period.

Thereafter the area passed on the Mughals. Akbar, the Great, had a vast area under his control including this region. Fidai Khan, Aurangzeb's Master of Ordnance laid a beautiful garden at Pinjore.

The region was conquered by Rohillas but they were soon expelled by the Marathas. The Marathas were badly run over by the British and major portion of this region passed under the British in 1803. The area now forming part of Bilaspur village about three kilometres of east of Manimajra was under the ruler of Manimajra. The ruler of Manimajra (Gurbaksh Singh) got built the old shrine of

Mata Mansa Devi in 1815 A.D. The area now including Kalka was a part of erstwhile princely State of Patiala but was acquired by the British in 1846. Later on it was included in Simla district.

After taking over the Chiefs of Ambala area under their protection, the British controlled the affairs of all the states in the region in a most effective manner through

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political agency at Ambala. The political agency of Ambala was transformed into Commissionership under the Commissioner of Cis-Satluj States and the political supervision and control over the States was intensified . By 1846, several chiefships had lapsed owing to their failure to have male heirs and so called break-down of administrative machinery. The British acquired strips of territory around of Ambala which was included into Ambala district. By 1858, the whole of Haryana territory was a part of the Punjab. The Kalka area, a part of Simla district, was transferred to Ambala district in 1899. No change could be effected till 1966.

Prior to the formation of Haryana in November, 1966, Ambala district had six tahsils but during the re-organisation it lost Nalagarh tahsil to Himachal Pradesh, Rupnagar tahsil and major portion of Kharar tahsil to Punjab and a few villages including the Chandigarh Capital Project Area to the newly formed Union Territory Chandigarh .Ambala district retained only 3 tahsils -Ambala, Jagadhri and Naraingarh including 153 villages and the Kalka town transferred from Kharar tahsil. Later, in 1967, 153 villages and Kalka town were taken out of Naraingarh tahsil and formed into a separate Kalka tahsil.

There was no jurisdictional change during the decade1971-81

with reference to the Kalka tahsil. The Ambala district experienced jurisdictional changes during the decade1981-91. Panchkula tahsil was created by transfering 77 villages of Kalka tahsil and 19 villages of Naraingarh tahsil in October, 1989. Out of these 96 villages, four villages were fully merged in Panchkula Urban Estate . The full-fledged Panchkula district came into existence with effect from 15-8-1995. Now it had two tahsils Kalka and Panchkula.

18. **Fatehabad District ._** Aryans at first on the banks of the rivers -the Saraswati and the Drishadvati, and in the course of their expansion covered a wider area of Hissar and Fatehabad. The area was probably included in the kingdom of Pandavas and their successors[1]. Panini mentions quite a few towns of the region-*Aisukari*, *Taushayana* (Tohana) and Rori which have been identified with Hissar, Tohana and Rori, respectively[2]. According to Puranas, the areas of Fatehabad district remained a part of Nanda empire.

The discovery of Ashokan pillars at Hissar and Fatehabad shows that the area of the district remained a part of Mauryan empire. The people of Agroha area assisted Chandra Gupta Maurya in the war against Greeks.

1. H.C.Ray Chaudhary, *Political History of Ancient India,* 1953, P. 44.

2. V.S. Aggarwal, *Panini Kalin Bharatvarsha* (Hindi).

General

After the fall of the Mauryas and Sungas, the Agras alongwith the Yaudheys-the republican tribes of the region-asserted for their independence. The Agras settled in the region covering Agroha and Barwala. They issued coins from Agroha, the capital headquarters.

As attested by the discovery of coin-moulds and terracottas, the region was a part of Kushan empire. According to A.S. Altekar, the Yaudheys made a second bid for independence towards the end of the second century A.D., came out successful in their venture and succeeded in freeing their home-land and ousting Kushans. This finds support from the Agroha seal[1].

The early 11th century saw the Ghaznavid inroads in this area. Sultan Masud led the expeditions towards Agroha.The Chauhans seem to have taken special measures for protecting the area against Muslim incursions. The area of Agroha passed on to the Muslim rule after the defeat of Prithvi Raj III in the Second Battle of Tarain (1192).

After the Battle of Tarain, Sultan Shihab-ud-din Muhammad Ghuri placed one of his ablest generals in the Indian campaigns. But it appears that any meaningful control could not be established. Seizing the opportunity, a Rajput clan, Jatus, believed to be an offshoot of Tomaras, widely extended their power in Fatehabad area including Agroha[2].

Firuz (1351-88) shot these areas into prominence. The ruler came to have somewhat unusual fancy for the tract (Hissar). It is a great credit to him that he established new towns of Fatehabad and Hissar and built two canals; one taking off from Ghaggar at Phulad and following the course of Joiya upto the town of Fatehabad. After the death of Firuz (1388), chaos and confusion spread all round . The situation deteriorated still further when Timur invaded in 1398. During his marching, Timur invested Fatehabad which was captured without any opposition from the inhabitants. Lastly, the invader reached Tohana but he could not set- up his permanent rule over the area. He soon left for Samana after looting these areas.

The areas of Fatehabad came under the control of Mughals-Babar and Humanyun. There is a small and beautiful mosque known as Humanyun mosque at Fatehabad . The legend assigns the association of the mosque to the Mughal Emperor Humanyun who in his flight after his defeat at the hands of Sher Shah Suri happened to pass through Fatehabad. Fatehabad was one of important *Mahals* during Akbar's time.

1. A.S. Altekar, *A New History of the Indian People, VI,* 1946 pp. 21-29.

2. *Hissar District Gazetteer*, 1915, p.20.

By 1760, the areas became the scene of a sort of triangular duel between the sturdy Sikhs of north-east, marauding Bhattis of north-west and the Muslim chiefs of the south. None of them could, however, hold the region permanently except for the Bhattis who became the masters of Fatehabad *pargana.*

In 1774, Maharaja Amar Singh of Patiala alongwith his famous minister

Dewan Nanumal laid seize to the stronghold of Bighar near Fatehabad which fell shortly afterwards. The Raja then took Fatehabad and Sirsa and invested Rania held by Bhattis. Tohana also was seized by the Chief of Patiala. But after a treaty of Jind in 1781, Fatehabad and Sirsa were made over to the Bhattis and remaining territories were allowed to be retained by the Sikhs .
By 1798, Agroha and Tohana were important *parganas* under the control of George Thomas. When George Thomas was driven out from here by the

Sikh-Maratha-French Confederacy, a French Officer Lt. Bourquian controlled these areas on behalf of Marathas . He is said to have rebuilt the towns of Tohana and Hissar. Later these areas were placed under the charge of Illias Beg, a Mughal noble of Hansi.
With the treaty of Surji Anjangaon 1803, the British became the rulers of this area and Marathas were vanquished forever.

In November, 1884, the Sirsa district was abolished and Sirsa tahsil after the distribution of villages was formed . In 1889, 15 villages forming a detached block known as Budhlada were transferred form Kaithal tahsil to Fatehabad tahsil. The

Barwala tahsil containing139 villages was abolished with effect from

January 1, 1891 and its area was distributed between 3 contiguous tahsils ; 13 villages going to Hansi, 24 to Hissar and 102 to Fatehabad. At the same time 13 villages were transferred from Hissar tahsil to Bhiwani tahsil and a sub-tahsil was established at Tohana in Fatehabad tahsil. In 1923, the Tohana sub-tahsil was transferred from Fatehabad to Hissar tahsil.
In 1972, Tohana sub-tahsil was upgraded to tahsil. Two sub-tahsils, one at Ratia of tahsil of Fatehabad and other at Adampur of Hissar tahsil were created in 1979. By the end of 1978, the Hissar district comprised 486 villages, divided between tahsils of Fatehabad -166; Hissar-115, Hansi-119 and Tohana-86. Fatehabad came into existence as a full-fledged district with effect from 15-7-1997, now having three sub-divisions, three tahsils and three sub-tahsils.

19. Jhajjar District ._ The Sultanate of Delhi established in 1206 depended on the support of Muslim nobles. Jhajjar was also a Muslim State and on account of its

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nearness to Delhi, the area of Rohtak-Jhajjar influenced the struggles among the aspirants for the throne of

Delhi. One instance in this regard supports the above statement. Towards the end of the Tughlaq period just before the invasion of Timur, the nobles of Delhi and Haryana were sharply divided in their loyalties towards the rival claimants to the throne. One group supported Mahmud Shah at Delhi but the Amirs of Ferozabad, Panipat and Jhajjar favoured Nusrat Shah who set-up a rival court at Firozabad close to Delhi[1].

With the decline of the Mughal empire, the territorial ambitions were let loose. The Maratha Chieftains Holkar and Sindhia were vigorously engaged in extending their territories in this area. Emperor Shah Alam-II also followed this course when he visited the various parts of Rohtak district. In his campaign of collection of revenue, he (Mughal Prince) alongwith Marathas came to restore his outpost at Jhajjar[2].

Suraj Mal, the then ruler of the Bharatpur State dislodged the Nawab of Farrukhnagar from his estate. Later while Jhajjar passed into hands of Walter Reinhardt, husband of Begum Samru of Sardana. Now we should turn our attention to the colourful personality of George Thomas who carved out a principality in Haryana in 1798 including Beri, Meham & Jhajjar.

George Thomas came to India in 1780-81 and remained in the service of Begum Samru before being adopted by Appa KandeRao as his son. The Maratha chieftain operating under the overlordship of Mahadji Sindhia gave the *parganas* of Jhajjar and Beri to George Thomas in return for the forces which he was required to maintain. It was a gift only in name. In the beginning George Thomas only succeeded in obtaining possession of Beri; eventually, he asserted his authority over the adjacent territory and made Jhajjar his headquarters. In the end, this area came under Marathas under Sindhia.

The rising power of Sindhia in North India was completely broken by the British under General Lake in the Second Maratha war. As a consequence, the area passed on to the British rulers . Lord Lake established a number of estates to serve buffer outposts between the British border and the Sikhs. Territories were thus granted to the Chiefs of Dujana, Jhajjar and Bahadurgarh.

General Lake granted Jhajjar and Bahadurgarh to Nawab Nijabat Ali Khan, a leader of free lancers who like Abd-us-Samad Khan had also transferred his allegiance to the British. The Bahadurgarh Jagir was included in the Jhajjar estate.

1 R.C Majumdar : *The History and Culture of the Indian People,* Vol. VI, *The Delhi Sultanate*,

p. 113.
2 Jadu Nath Sarkar, *Fall of the Mughal Empire*, Vol. II, p. 116.

During the movement of 1857, Abd-ur-Rahman Khan, Nawab of Jhajjar, was suspected of having abetted the freedom fighters and others who were waging war against the British Government. The Jhajjar territory was placed under the management of Col. Lawrence pending the result of Nawab's trial. Having been found guilty, the Nawab was sentenced to be hanged. He was executed on the 23rd December in front of the Red Fort and his body was consigned to the ignominy of a nameless pit.

Bahadur Jang Khan, Nawab of Bahadurgarh was at Charkhi-Dadri in May, 1857 and remained there until he surrendered to the British like his cousin, the Nawab of

Jhajjar. The Nawab of Bahadurgarh assisted the freedom fighters indirectly. Keeping into the consideration of his old age, it was decided not to try him for life but to confiscate his possessions. Nawab was removed to Lahore where he was given a pension of Rs. 1,000 a month.

The district of Rohtak including Jhajjar areas together with the rest of the Delhi and Hissar divisions were detached from North-Western Provinces after 1857 and passed on to the Punjab by the Government of India Notification No. 606 of the 13th April, 1858.

After transfer to the Punjab, Rohtak district experienced several changes before assuming its final form. Bahadurgarh estates were added to the Sampla tahsil. Jhajjar, including some areas of Narnaul, Kanaudh and Dadri was at first created as a new district but was abolished shortly afterwards in 1860 when parts of it were assigned to the Phulkian Chiefs as a reward for their loyal services. While the Jhajjar tahsil it-

self was added to Rohtak district. As already said, Bahadurgarh was added to Rohtak district in 1860.
On the abolition of the Hissar division in 1884, the Rohtak district including Jhajjar areas was transferred to the Delhi division. In 1908 Bahadurgarh area was a part of Sampla tahsil. The Rohtak district consisted of four tahsils, Rohtak, Gohana, Jhajjar and Sampla but in April, 1910 the last named tahsil was abolished for reasons of administrative economy, and its area was divided between the Rohtak and Jhajjar tahsils. Thereafter, the Jhajjar areas including Rohtak district was then attached to the Ambala division. In 1948, Dujana State was merged in Jhajjar tahsil and a new sub-tahsil of Nahar was created.

Jhajjar district became full-fledged district for the second time as on 15.7.1997. The district had two sub-divisions; three tahsils and one sub-tahsil as on the

18th January, 2000.
The district-wise administrative structure of Haryana as on 31st December, 2001 is given below :-

General

Ambala Division

District Sub-Division Tahsil Sub-tahsil

1. Ambala 1. Ambala 1. Ambala 1. Ambala Cantt.

2. Naraingarh 2. Barara 2. Mulana
3. Naraingarh 3. Saha
2. Panchkula 1. Panchkula 1. Panchkula 1.Barwala

2. Kalka 2. Kalka 2.Morni
3. Raipur Rani
3. Yamuna Nagar 1. Jagadhri 1. Jagadhri 1. Bilaspur

2. Chhachhrauli 2. Radaur
3. Sadhaura
4. Mustafabad
4. Kurukshetra 1. Thanesar 1. Thanesar 1. Ladwa

2. Pehowa 2. Pehowa 2. Ismailabad
3. Shahbad 3. Babain
5. Kaithal 1. Kaithal 1. Kaithal 1. Fatehpur pundri

2. Guhla 2. Guhla 2. Kalayat
3. Siwan
4. Rajaund
5. Dhand

2. Rohtak Division

6. Karnal 1. Karnal 1. Karnal 1. Nissing

2. Assandh 2. Assandh 2. Ballah
3. Nilokheri 3. Nigdhu
4. Indri
5. Gharaunda
7. Panipat 1. Panipat 1. Panipat 1. Bapauli

2. Samalkha 2. Samalkha 2. Madlauda
3. Israna
8. Sonipat 1. Sonipat 1. Sonipat

2. Gohana 2. Ganaur
3. Ganaur 3. Gohana
4. Kharkhoda

I II III IV
9. Rohtak 1. Rohtak 1. Rohtak 1. Sampla

2. Meham 2. Meham 2. Kalanaur
10. Jhajjar 1. Jhajjar 1. Jhajjar 1. Matanhail

2. Bahadurgarh 2. Bahadurgarh
3. Beri

3. Gurgaon Division

11. Gurgaon 1. Gurgaon 1. Gurgaon 1. Nagina

2. Nuh 2. Pataudi 2. Farukh Nagar
3. Ferozepur Jhirka 3. Nuh
4. Ferozepur Jhirka
5. Punhana
6. Sohna
7. Taoru
12. Faridabad 1. Faridabad 1. Ballabgarh

2. Ballabgarh 2. Faridabad
3. Palwal 3. Palwal
4. Hodal 4. Hathin
5. Hathin 5. Hodal
13. Rewari 1. Rewari 1. Rewari 1. Dharuhera

2. Kosli 2. Bawal
3. Kosli
14. Mahendragarh 1. Mahendragarh 1. Mahendragarh 1. Ateli

2. Narnaul 2. Narnaul 2. Nangal -
Chaudhari
3. Kanina

4. Hissar Division

15. Hissar 1. Hissar 1. Hissar 1. Uklana Mandi

2. Hansi 2. Adampur 2. Barwala
3. Hansi 3. Baas
4. Narnaund
16. Fatehabad 1. Fatehabad 1. Fatehabad 1. Bhuna

2. Tohana 2. Tohana 2. Bhattu Kalan
3. Ratia 3. Ratia 3. Jakhal

General

I II III IV

17. Sirsa 1. Sirsa 1. Sirsa 1. Nathusari

2. Dabwali 2. Dabwali Chopta
3. Ellenabad 3. Ellenabad 2. Kalanwali
4. Rania
18. Jind 1. Jind 1. Jind 1. Alewa

2. Safidon 2. Safidon 2. Pillukhera 3. Narwana 3. Narwana 3.
Uchana
4. Julana
19. Bhiwani 1. Bhiwani 1. Bhiwani 1. Badhra

2. Charkhi Dadri 2. Bawani Khera 2. Bond Kalan
3. Loharu 3. Tosham
4. Siwani 4. Charkhi Dadri
5. Loharu

6. Siwani

Flora

Haryana is rich in flora but there are various kinds of flora. Almost there is a general type of flora but some pockets of the region give a special types of herbs and bushes. Some types of vegetation are seasonal and other type is permanent one. Before going into the depth of floral properties of Haryana, it would be better to have a assessment about the topography and soils of Haryana State briefly.

There are hardly any hilly tracts in Haryana except a few in Panchkula district-its sub-montane area and the range of Aravalli chain in Gurgaon, Rewari, Faridabad and Mahendragarh districts. In Panchkula, the hilly areas are generally devoid of vegetation other than rough scrub, and the low bleak hills are of little use except as grazing grounds. The tract around Kalesar and Morni, however, is more valuable. There are some high ridges running through out in tract from the north-west, with numerous spurs branching out in all directions. These hills are known as Morni. In the Gurgaon and Mahendragarh districts the hill ranges are connected with Aravalli chain.

Formed almost entirely of alluvium, the state is situated towards the depressions of the rivers, Ganges and Indus.It is a broad plain standing nearly on the watershed between the basins of the two rivers. It is vast ground of moist land.

So, under the situations, flora also differs. First of all, the flora in the Gurgaon division within Aravalli chain is grouped here.

Kikar is found all over the State; not to talk of any part of the area. This is a very famous tree which is found in abundance in Rewari, Gurgaon, Faridabad and Mahendragarh districts. It has come up very well in the Nuh tahsil of Gurgaon district, particularly along the roads. In Palwal and Ballabgarh tahsils of Faridabad district, besides private and village *Shamlat* lands, it has been grown successfully in the notified areas by the Forest Department. Its wood is used locally for many purposes. *Khair* has been mostly grown on Aravalli hills. Generally, it is available in the hilly area of Mahendragarh district; particularly near Khudana ridge. *Neem* is generally found growing along Gurgaon- Alwar, Nuh-Palwal, Palwal-Rewari and Tarao-Pataudi roads and also in and around village-ponds and near the habitation where *Pipal* and *Bar* trees occur frequently every where in the region.

The *Jand* tree is found every where in the fields or along the roads. Its uses are many; it is used as a fodder for camels and other cattle; as a wood manure by its leaf fall and it gives shade in the fields. Besides, it does not harm the field crops as it is a deep-rooted tree and derives its sustenance from the region far below the root-zone of the field crops.The *Jand* trees are abundant even in Rewari and Mahendragarh areas. Even they are available in the hilly areas.

In some parts of Gurgaon district, particularly low-lying flooded areas such as Sultanpur and Sarai in which soil is sandy, *Khajur* grows abundantly, but fruit is of very inferior quality. In the areas of Rewari and Ferozepur Jhirka of the Gurgaon district, there are a few scattered species of *tari.*

Ballabgarh tahsil (Faridabad district) is the best wooded in spite of large scale cutting and removal of trees. The greater part of vegetation ordinarily found is *Bans* and reserve forests consist of *Karir, Hins, Jal* and *Raunj. Dhak, Gular, Papri* and *Lasura* are also found. *Kadam* is fairly common towards Palwal and Hodal. *Barna*, *Odora* and *Imli* are also met with, though not very commonly. *Amaltas* is found at various places. *Ber* tree is very common in these areas. The *Ber* fruit of Guryani, Mahendragarh and Narnaul is very sweet and delicious. This fruit is a common speciality of Mahendragarh and Rewari districts. *Bers* are exported to other areas. *Shisham* and *Siris* are mostly confined to road sides where these have been planted by the Government. *Bakain* and *Arjan* are also seen along the roads.

Special tree of the hill range is *Dhauk* which covered the hills

in the past. Later, except in few places, where villagers preserved the trees until they reached a size which suited them for sale, every sapling was cut down or eaten by the goats. However, as a result of the protection of the Government, the natural regeneration of *Dhauk* has gone up in abundance. Here and there, especially in Palwal tahsil, a few scattered *semul* trees are also found and at the same places ornamental trees like *Jacaranda* and *Gulmohar* have been planted.

General

One of the most characteristic plants of Rewari, Faridabad, Gurgaon and Mahendragarh districts is Pala or *Jhar-beri*.This is a common in these areas except in low-lying inundated tracts. In September and October the fields are often thickly covered with this prickly shrub. It is very valuable plant. Its leaves are thrashed and given as fodder to the cattle, particularly to the camel. Its fruit is eaten, thorny branches are used for hedges or as a fuel and roots for dyeing leather. The *Munj* grass is very useful. It flourishes both in high sandy lands and low flooded tracts. It is found in abundance in waste lands along the Yamuna and is grown quite frequently by the people along their boundaries to serve as wind break. In Rewari and Mahendragarh districts Munj is quite common.

Jhao covers the low alluvial lands along the banks of the Yamuna; its twigs are used for basket making. *Bansa* grows abundantly near the hills. *Khip* grows on salty lands and in the past was used in salt pans to quicken the crystallisation of the salt. *Wilayati akra* sprouting in sub-merged lands is also grown along field boundaries to serve as a hedge.It has also come up along some roads. *Ban* or *Basuti* and *Ak* are also found in these southern districts of Haryana.

In poor soils near the hills, there often grows *Kans* grass and *Bhurt* with its trouble and prickly *burs*. In flooded land of some villages in the north of Ferozepur Jhirka is found *Narsal*, an aquatic plant which is very difficult to eradicate. Out of its reeds, pipe stems are made. *Nagphani* forms a thick hedge in these areas.

The xerophyte type of flora dominates the Mahendragarh and Rewari areas. *Dhok, Babool, Rehera, Farash, Arind* and *Kandu* are the special trees of Rewari and Mahendragarh areas. *Farash* is common in Rewari district. *Jand* and *Jal* are the dominant species of the sandy areas. *Phog* and *Amarbel* are common parasite climbers of these districts. *Nagphani* forms thick hedges around many villages in Rewari area.

Medicinal plants found here and there are : *Indirain, Asgandha, Glo, Kharanthi, Bhakhra* and *Dhatura. Kair* or *Karir* and *Dela* is a specific plant of this area.

In Sonipat and Rohtak districts, besides *Pilu, Jand, Karir, Kikar* and *Neem*, there are some medicinal plants. *Hingo* and *Hins* are trees and shrubs which are widely spread. The common climbers of Rohtak district are *Kutra* (Kanduri), *Aaksan* and others.

During the rainy seasons a number of herbs appear on the ground giving a green appearance.Among these herbs may be recognised species of *Hulhul, Kanteri, Kagrote, Kundra, Kulfa, Jhajhru,Santhi* and *Kasni.* In waste land, *Kutra* is commonly seen. This is an introduced plant which is rapidly spreading and is troublesome on account of fruit which have *hooked* bristles. Other plants found in the waste lands are *Madar,* the exotic weeds; *Kala Bhangra* and *Satyananshi.*

The characteristic plants of sandy areas of Rohtak district are *Dholi mundi, Jawasa, Rattenjot, Meini, Khi*p and *Harmala*. Many of these are used medicinally. *Farash* is also found in the Jhajjar area. This tree grows readily from cuttings, does not need much water and is therefore, planted along roadside, canal banks and around cultivated fields.

Babul, Siris, Pipal, Bar and *Shahtoot* are commonly found in Haryana. In Sonipat and Rohtak areas, some trees occasionally met with are *Kachnar, Barna, Sohan, Jna, Kain* and *Jhor. Aam* and *Jamun* the fruit trees are also found in the area.

Among the cultivated fields, many types of seasonal weeds are found available. Such weeds are *Dadain, Dona-Jhan, Piazi, Sarwali, Hulhul, Hirranpaddi, Gulabi, Kundla, Kangi, Daudhi, Maldoda* and *Sufed-Phul-Kee.* The aquatic flora includes flowering plants such as *Chhota Kamal, Singhara* and *Utricoloria.*

The Panipat district is not rich in its forest wealth. Tropical dry deciduous forests are found here. Mostly the vegetation consists of *Khair, Kikar, Shisham* and *Safeda. Ber, Aam* and *Jamun* are the main fruit trees[1].

In the districts of Karnal, Kurukshetra and Kaithal, the main trees are: *Dhak, Hingot, Jal, Kaindu, Jand, Jhar, Arni, Jawasa, Neel* and *Nagphani*. During the monsoon, a number of herbaceous plants appear as undergrowth in the jungles. These include *Kanana, Gokhru, Bishkapra* and *Chichra. Kikar and Khajur* are very common in swampy or marshy localities or in low lying areas. Motilana are common herbs in saline areas.

Shisham is extensively planted along banks and road sides. Some of the other planted species along canal banks and road sides include *Akas Nim, Maharukha, Jand, Kanda, Vilayati Imli, Nimbar, Sirish, Tut* and *Safeda.*

The irrigated forest plantations have been taken up to meet the demand for fuel wood and timber for furniture, sports goods industry, paper pulp, electric poles, etc. The main plantation block is the Saraswati plantation near Pehowa in Guhla tahsil, raised with species of *Safeda, Shisham* and *Kikar*. In waste land are found *Aak*, *Chhota Dhatura* and *Dhatura*.

Several medicinal plants of local repute include *Punarnva, Bala, Nigundi, Tulatipati, Denti, Gulabi* and *Gokhru.* The

aquatic flowering plants are poorly represented. In ponds, lakes and canals are found *Jala, Sawala* and *Azolla*. *Pinnata* is a floating aquatic form which some times covers ponds and pools. In cultivated fields are found *Gulabi*, *Dhuti, Kangi* and *Piazi. Sarsum banda* is a common root parasite on mustard plants and it does considerable harm to the crop.

1. *District Census Handbook (Panipat District)*, 1991, p.18.

General

The Panchkula, Ambala and Yamuna Nagar districts have abundant vegetation due to availability of rainfall and elevations extending upto 1,500 metres above mean sea level. The plains and foothills contain mainly tropical type of vegetation.

Shisham, Kikar and mango are important tree species grown in the alluvium plains. *Safeda* was introduced on a big scale since 1963 in the forest areas as well as on private lands. The wood of this tree is used for the manufacture of paper pulp and fuel. It has been extensively planted on forest strips and also in the cultivated land near Jagadhri, Sirsgarh, Serpur and lehroundi. Besides, *Jamun*, Semul and mulberry are occasionally met within the plains.

Chil is the main sub-tropical species. The Shiwalik hills and sub-Himalayan tract contain a number of miscellaneous hard wood species like *Chhal*, *Khair* and *Jhingan*. The growth is more dense on northern and north-eastern slopes. In more the areas where soil is deep, this dry deciduous type forms into pure bamboo forest. On outer hills where the incidence of grazing and biotic interference is considerable, the dry deciduous type degenerates into scrub forest. Besides the above mentioned trees, *Amaltas, Sain, Dhak* and *Bahera* are main species of trees.

Sal occurs on the northern slopes of Shiwalik hills in Kalesar forest

(Yamuna Nagar district). The Kalesar reserve forest is only *sal* forest in the whole of Haryana State. Other tree species of occasional occurrence are *Sandhan, Phaldu, Amla, Kachnar, Papri, Toon* and *Rohini.*
Chil (pine) grows in patches in the Morni hill area. This is lower limit of the natural habitat of *chil* and hence the growth is not comparable to that of the higher hills. Some poorly grown trees of *chil* are found in Darpur forest. *Ban* occurs in the Morni hills on the right side of the Ghaggar and in most pockets along northern slopes. The extent of the area is very small near Tipra. Bamboo forms extensive patches in the dry deciduous forests.

A number of medicinal plants are also found in this region (Ambala-

Yamuna Nagar area); some of which are *Bahera, Harar, Amla, Kamela* and *Amaltas*. Cactus park at Panchkula contains hundred of varieties of cactus and draws a large number of plant lovers to see it.
The Jind area is not very rich in flora. However, many kinds of tree species are available there. Mainly *Shisham, Bakain, Kendu,Gular, Kachnar, Bottle brush* and *Lasura* are found here.

Apart from the naturally growing species, the Forest Department plants/grows *Farash, Neem, Siris* and *Dhak* trees. In dry development blocks of Uchana & Julana

Kikar and *Jal* are met with.In the moist localities, the soil is favourable for *Jamun, Tut* and *Am.*

Beri is also found in cultivated fields. *Hins, Arand, Garaunda, Jhar, Aak, Akra, Amerbel, Dhatura* (medicinal plant) and *Satya nasi* are commonly found in the area.

The Jind district is very rich as far as species of medicinal plants are concerned. Aquatic flowering plants are poorly represented. Various species of weeds, which are found in the forest area and cultivated and uncultivated agricultural fields are *Piazi* and *Satyanasi.*

The Bhiwani district in arid zone, comprises xerophytic type of flora. Soils in the district are predominantly sandy with strong 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 level is abnormally low.

The flora varies according to local factors and soil types. In saline and alkaline soils of Bawani Khera tahsil mesquite is common along with *Farash, Neem* and *Jal.* In moist localities and irrigated areas are found *Shisham* and *Tut*. In sandy areas *Jand, Rahera and Babool* are quite common. *Jand, Kikar, Rahera* and *Shisham* are very common in Charkhi Dadri tahsil. *Sarkanda, Khip* and *Phog* are frequent in sandy localities. *Bhakra* and *Dhatura* are the specific medicinal plants. *Thor* is occasionally met.

Biological barriers in the form of trees and shrubs play a vital role in different operations of desert control. They are the cheapest methods of reducing wind velocity and to control the movement of sand. Such works are done along canals, roads, railway lines and drains. Species planted include *Kikar, Shisham, Parkinsonia, Neem, Bakain,* eucalyptus, *Jand, Sirish, Gulmohar, Farash, Khairi, Castor* and *Kana.*

The flora of Sirsa district is sparse and scanty. It varies according to local factors and soil type. In saline and alkaline part of the district, mesquite is common along with *Farash* and *Jal.* In moist localities, Shisham and *Tut* are found in abundance. In sandy area, *Jand, Rahera* and *Babool* are common. *Sarkanda, Khip* and *Phog* are also frequent in sandy areas.

Cardinal Grasses

In poor soils near the hills, thereafter grows *Kans* grass.

Besides, *Anjan, Khabbal* or *Dub, Dab, Khas, Pari, Sanwak* and *Palwan* are also found. *Anjan* grass is very nutritious for cattle. *Sanwak* is available in Gurgaon and Faridabad districts. The seeds of this grass are eaten by the poor.

General

A large number of grasses are also met with in Ambala and Yamuna Nagar districts. *Babbar* is an important grass growing naturally in many areas. This is used for manufacturing of paper. An area of 359 hectares in the Morni hills was planted with *Babbar* grass to increase the supply of raw material for paper mills.

Congress grass is a very obnoxious weed in the Panchkula and Chandigarh areas. The Government warns the people to destroy it as it causes skin diseases.

The Karnal-Panipat area has some specific kinds of grass. *Sarkara, Munj* and *Dab* are three important grasses of this area. The leaves of these grases are used for thatching huts and baskets; chairs, screens etc are made of the stem of *Sarkara. Munj* fibre is strong and is used in making rope strings and mattings. The fibre of *Dab* is inferior to that of *Munj. Khus-Khus* is often found in water-logged areas and along canal banks. *Singhara* is cultivated in water ponds. Besides *Anjan, Paliva* and *Sarla* are fodder grasses.

In Rohtak and Sonipat area, the grasses are numerous. Most conspicuous of all is the *Sar* whose uses are too wellknown to need mention. This is abundant on the sand hills and also grows on the stream sand thrown out by excavation of the canal channels. It is proverb *Aur Ghas Jal Jayegi, Dub Rahegi Khub.* (Though all other grass be burnt up, the Dub will remain fresh). The *Motia* is a troublesome weed especially in irrigated land but bulbous root is edible. *Dab* is

often troublesome weed but when young it is readily grazed and when times are bad it is stored and chopped up as fodder. *Sambhlu* and *Kans* are other grasses which are considered very useful for animals.

In Jind area, common fodder grasses are *Dublu, Anjan, Palwa, Sarila* and *Sanwak. Khus-Khus* is also found in abundance. *Dub* is known as *Khabbal* in this area. *China* and *Dhaman* are also occasionally met.

In Bhiwani area, there are no specific and different grasses other than mentioned above. *Anjan, Dhaman* and *Dub* are palatable fodder grasses which are dwindling on account of uncontrolled grazing. In *Kairu* closure, *Anjan* and *Dhamtain* grasses were raised artificially over an area of 70 hectares during 1978-80 by the Forest Department to augment fodder resources. The grasses in waste lands are poor or are grossly inadequate for requirements.

The shrubs, bushes and principal grasses of Hissar/Sirsa District.-The forest of Hissar District fell under the category of tropical desert, which comprised predominantly of xerophytes. The flora of Hissar district during 1892 covered a very

wide range and it is worth-while to give an account of the then flora and

principal grasses here. Some paragraphs detailing important shrubs and bushes from the *Hissar District Gazetteer,*1892 are reproduced here:

"The commonest trees of the district are the *jand (Prosopis spicigera)* and the *kikar* (*Acacia arabica*) which are indigenous to the soil. The *Jand* is generally of short and stunted growth and in favourable localities attains a height of 25 feet. Its wood is soft and liable to attacks of insects; it is however preferred in some parts *to kikar* for agricultural implements, as it is not so liable to split with the heat.

The *kikar* grows to a height of 35 or 40 feet, its wood is hard and is used for agricultural implements in many parts. These trees are found generally not in groups but scattered over the fields, except in the tract on either side of the Ghaggar. The leaves are used as fodder and its bark is employed as a tanning agent.

The *babul* (*Acacia jacquemontii*), a smaller species of *kikar*, is very common in the Bagar. A tree peculiar in a considerable degree to this district is the *Rohira (Tecoma undulata)*. It is found principally in the Bagar and is remarkable for its beautiful yellow flowers. Its wood is used for the legs of *charpais.*

In the Nali tract on either side of the Ghaggar are found the *farash* (*Tamarix articulata*) and the *hins* also called *thor (Capparis sepiaria)* and the *dhak* (*Butea frondosa*) is very common in addition to the above. These are also found in the canal tract, especially the *hins*. The latter is a tree or large bush with big thorns. The *dhak* is the *Punjabi chachra*. Its leaves make a very good fodder for buffaloes. The tree itself seems to be regarded as more or less sacred; its wood is used as fuel for the *hom* or sacred fire, and atleast a few pieces of it are put in the funeral pyre. Its soft but tough wood stands the action of water well, and it generally affects stiff low-lying soil *(dabar)*. The *hingo* or *kangera* (*Balanitis roxburghii)* is not uncommon in the district.

Close to and on the canal banks the *shisham* (*Sisoo dulberghia*), *Sartut* (*Morusnigra*), *penda* and *bakain* (*Melvi azedarach*) are found in considerable numbers in addition to the more common trees. Near the village sites and tanks the

pipal (*Ficus religiosa)*, *siris* (*Albizzia lebek*) and *Nim* (*Melia indica*) are frequently found. The *bar or* baniyan (*Ficus bengalensis*) and the *Tunt* (*Morusalba*) are common as roadside trees in and near the canal tract. The *Ber* (*Zizyphus Jujuba*) is not frequently seen in the firmer soils of the district. Its wood is durable and is employed for doors, etc., but it is too expensive for common use".

Shrubs & Bushes

"The commonest bushes of the district are the *kair* or *karil* (*Capparis aphylla*) and the *jal* or *van* (*Salvadora oleoides).* They are met with all over the district except

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in the sandy soil of the Bagar. The fruit of these bushes, called respectively *tend* and *pilu,* play a not unimportant part in the diet of the people. The *pilu* berry makes its appearance in *Baisakh* (April) and ripens at the end of May, attaining the size of a pea, it is generally swallowed in handfuls-skins, stones and fruit. It is eaten by the poorer classes, who consider it a good alternative, but it is said to be somewhat heating. The *kair* bush, which produces the *tend* berry is a straggling shrub devoid of leaves. From *Chait* (April) to *Jeth* (June) it is covered with blossoms (*barwa)* of a red coral tint. "The poorer classes, especially in times of scarcity, boil these blossoms and eat them as a relish". The green unripe berry (*tend)* is also used in the same way. The berry when it ripens is called *pinju* and is eaten raw, but is not considered wholesome. In seasons of drought the bush is twice covered with blossoms. which the people consider to be a special provision of Providence, as this is not the case in ordinary years.

"Other common shrubs are the *ak* (*Calotropis procera*) which is found in all parts and is eaten by goats, and the *phog* (*Calligonum polygonoides*) which is confined to the Bagar sand hills; its wood is largely used as fuel and its green, thread-like leaves, are eaten by camels. Perhaps the most useful and commonest bush in the tract is the *pala* or *Jharberi* (*Zizyphus nummalaria)*, which ripens twice in the year in *Baisakh* (May) and in *Katik* (October) and supplies excellent fodder for cattle. The bush grows best untended in land under tillage and the increase of cultivation has largely encouraged the growth of the plant. Its fruit is eaten, while its thorns make capital quickest hedges (*jhari*) for the protection of crops. *Pala* sells generally at three maunds per rupee and the profits derived by zamindars from the sale of surplus stock are often large. When protected and tended it will obtain a height of 12 feet, but is generally not more than a bush 4 feet high.

" The *bui (Anabasis mulliflora)* is a plant with white tufts. It grows generally on poor and sandy soils. The *arni (Cherodendron phlomoides)* is a shrub or small tree commonly found in the hedge rows of Hariana. Its wood is hollow and is used for pipe stems. *Murel* is a shrub fairly common in the Bagar. *Alao is* a shrub with pink flowers and deep and strong roots. *Basumba* or *tumba* (*Citrullus colocynthus*) is a plant with trailing stem and green and yellow orange fruit, bitter to the taste; it grows on sandhills and light soil. It is eaten by goats and is also some-times used as medicine. The *Khip, khimp* or *sani (Crotalaria burrhea*) is the wild Indian hemp and is common in the *Rohi* of Sirsa; it is often used in making ropes.

"The *janwasa* or camel thorn is very common on the hard alluvial clay of the *Sotar* valley. It is eaten by camels and goats. The *satyanas (Argemone nexicana)* is a prickly plant or weed with yellow flowers which grows on the *sotar* and also on

barani soil. Floods destroy it. The *sarnala* (wild *convolvulus*) is a creeping plant with broad leaves and is found near water or on the rice beds of the Ghaggar and on the canal bank. Its white flowers or blossoms are eaten by buffaloes. It is not met with in *barani* soils. *Babul* is an aquatic plant with broad flat leaves which float on the water, and with white flowers; it is found only on the flooded land of the Nali. The *kachra* or bel (*Cucumis pubescene)* is a trailing plant with yellow flowers, it is distinct from the *basumbha. Angniti* is a bush with round green leaves found in the *Bagar. Santhi* is a wild plant common on the *Bagar tibas* or sandhills. Its long spreading feathery leaves are eaten by camels. The *bunra* a small plant or shrub, is not uncommon, and is a species of wild indigo".

Specific Grasses

"The grasses are a very important part of the vegetation in the district, having regard to the large number of cattle possessed by the *zamindars.*

The best grass for fodder is the *dhaman (Pennisetum cenchroides)*. It has a long and broad blade with a feathery tuft, and is generally found in good soil which has not yet been brought under the plough. The spread of cultivation has rendered it a rarity, but it is still common in the Hissar *Bir* and is often found in other parts of the district growing among the roots of the *kair* bushes, especially in the *Nali* tract.

The *anjan (Cenchrus montanus)* is also found; it is apparently very similar to the *dhaman,* but is much more common than the latter.

The commonest grass is the *ghantil (Eleusine flagellifera)*, it is readily eaten by cattle. It throws out runners and grows on moist soils except those which are light and sandy. The *bhobria (Eleusine scindica)* is very similar to the *ghantil.*

Dubh (Cynodon dactylon) is a jointed grass which is very common in the firmer soils of the district, and is specially abundant in the hard clay of the *Sotar.* It is not uncommon even in sandy soils. It supplies excellent fodder for cattle.

The *dab* is a coarse grass generally found in low-lying moist spots, especially on the Ghaggar and canal tracts. It is largely eaten by buffaloes.

The *sanwat (Panicum colonum)* is a dark green grass with a broad blade and grows only on the hard *Sotar* clay; it is very good as fodder.

The *dila* or *sedge (Cyperus tria)* is a thin bladed grass, confined almost entirely to low-lying moist spots in the *Nali* tract . It is eaten as fodder by cattle when other grasses fail.

General

The *bur or khawi (Andropogon laniger)* is a common grass, it is most nutritious as fodder, and when ripe it gives a red tinge to the ground".

"The *sewan* or *sani (Elionurus hirsutus)* is commonly found in the *Bagar*. It supplies excellent fodder when young, when older it is used for the weaver's brush (*kunch)*. The *palwa* or *parwa (Andropogon pertusus)* is found in the Hissar district, and is also good for grazing. The *gandi (Iseilema laxum)* is not unknown. The *tandla* is a small weed with a red flower, having much the same appearance as *gawar;* another weed is *banghara*, it grows on light soil and is of a light colour. *Mandusi* is a grass with a thin blade of a dark green colour which grows on the sand hills.

Sarkanda or *sarr (Saccharum sara)* and the *panni (Andropogon muricatus)* seem to be not uncommon in sandy parts of district. A grass grows there strongly resembling the *sarkanda* of the irrigated tracts, which is called *annior sarkanda* indifferently. The *sarkanda* or *sarr*, pure and simple, is found on the Ghaggar and near the banks of the canal. The thin stalks *(kana)* are used for thatching, for

coverings for carts and for making the *chajj* or winnowing basket. The *panni* is found mostly in low-lying damp spots near the Ghaggar, and it resembles *dab* strongly in both appearance and habitat. The stalks are only grazed when young and tender; they are mostly used for roofing. The roots of the grass are the fragrant *khaskhas* used for making tatties.

Kundra, didhan and *chaupara* are three grasses or weeds which spring up in great abundance upon the first fall of rain and are largely used as green fodder for cattle. The first can be distinguished by its pink flower, the *didhan* by its small oval leaves, and the *chaupara* by the four branching tufts which give it its name. *Baru (Sorghum halepense)* and *takria* are two other common grasses or weeds which supply fodder, they both have a long blade and the former a feathery head. *Ghamur* or *garham (Panicum antidotale)* is a grass with a long, thin stalk; it is very common near the canal, and is often found at the roots of *kair* bushes. It is only grazed when young; it is also said to be used as a disinfectant. The *keo* grass *(Sporobolus orientalis)* is found on *tibas* and sand hillocks, it is good for grazing and resembles the *palinji,* which is used as foods by the people in times of scarcity.

Duchab (Cyperus sp.) is common on the *Bagar* sandhills and poor soil. It has long spreading roots and is grazed by cattle, but interferes largely with cultivation. The *bhurt (cenchrus catharticus)* is very common on the sandy soil of *Bagar,* and with its prickly corn or seed vessels interferes considerably with the progress of the passers-by. *Motya* is a common grass in the *tahs* or valleys of the *Bagar,* where it springs up on the first rain".

The florae with local names and botanical names are listed below:-

Botanical name Local name

1. Mangifera indica Am

2. Carissa spinarum Murelan

3. Phoenix sylvestris Khajur

4. Calotropis procera Ak

5. Leptadenia pyrotechnica Khip

6. Millingtonia hortensis Akash neem

7. Tecomella undulata Rajasthani Teak, Ruhira

8. Cordia dichotoma Lesora or lassura

9. Commiphora wightii Gugal

10. Opuntia dillenii Nag Phani

11. Capparis decidua Karir

12. Capparis zeylanica Hins

13. Crateva adansonii Barna

14. Anogeissus pendula Dhauk

15. Diospyros montana Kaindu

16. Euphorbia royleana Thor

17. Ricinus communis Arind, Handoli

18. Acacia leucophlaea Raunj

19. Acacia jacquemontii Babul

20. Acacia nilotica Kikar

21. Albizia lebbeck Siris

22. Butea monosperma Dhak

23. Cassia fistula Amaltas

24. Dalbergia sissoo Shisham

25. Prosopis cineraria Jand

26. Tamarindus indica Imli

27. Flacouritia indica Kakero

28. Azadirachta indica Neem

General

29. Melia azedarach Bakain

30. Ficus bengalensis Berh

31. Ficus racemosa Gular

32. Ficus religiosa Pipal

33. Syzyguim cumini Jamun

34. Ziziphus mauritiana Ber

35. Ziziphus nummularia Pala

36. Mitragyna parvifolia Kadam

37. Salvadora oleoides Jal

38. Balanites roxburghii Hingo

39. Tamarix aphylla Farash

40. Timarix dioica Jhao

41. Holoptelea integrifolia Papre

42. Eucalyptus Safeda

43. Mulberry (morus alba) Sahtoot

44. Anogeissus latifolius Chall

45. Terminalia alata Sain

46. Terminalia bellrica Bahera

47. Shorea robusta Sal

48. Mitragyha parvifolia Phaldu

49. Mallotus philippensis Rohini

50. Quercus indica Ban

51. Dendrocalamus strictus Bans/Bamboo

52. Ficus infectoria Pilkhan

53. Ricinus communis Castor/Araundi

54. Erianthus munja Sarkanda

55. Bauhinia racemosa Kachnar

56. Saccharum bengalenese Kana

57. Calligonum polygonoides Phog

58. Carrisa ohaca Karaunda

Medicinal Plants

59. Adhatoda vasida Bansa

60. Citrullus colocynthis Indirain

61. Withania somnifera Asgandha

62. Tinospera cordifolia Glo

63. Sida acuta Kharuthi

64. Tribulus terrestrial Bhakra

65. Datura stramonium Dhatura

Grasses

66. Cenchrus ciliaris Anjan

67. Cenchrus setigerus Dhaman

68. Cynodon dactylon Dub

69. Desmostachya bipinnatta Dabh

Rainy Season herbs

70. Vleome viscosa Hulhul

71. Commelina Kanteri

72. Corchorus Kag-roti

73. Digera arvensis Kundra

74. Portulaca Kulfa

75. Tephrosia Jhojhru

76. Tribulus alutus Bhankdi

77. Trianthema Santhi

78. Trimfelta tomentsra Kasni

79. Adhatoda vasia Basuti

80. Xanthium strumartum Kutra Bhurat

81. Argemone mexicana Satyanasi

82. Cnicus arvensis Rissa

83. Aerva preudotomentosa Dholi nundi

General

84. Farsetia hamiltonii Faridbuti

85. Moringa oleifera Sohanjna

86. E. hirta Dudhi

87. Vetiveria zizanoides Khas Khas

88. Balanites aegvptica Hingot

89. Clerodendrum phlomidis Arni

90. Alhagi pseudalhagi Jawasa

91. Pergulania dacmia Karial

Miscellaneous

92. Tribubus terristris Gokhru

93. Suaeda fruti-cosa Motilana

94. Ailanthus excelsa Aruna

95. Inga dulats Vilayati Imli

96. Acacia leucophloca Nimbar

97. Xanthium strumarium Chhota dhatura

98. Sida cordifolia Bala

99. Vallisneria spiralis Sawalia

100. Crotalaria medicaginea Gulabi

101. Duphorbia dracunculoides Kangi

102. Qrbanchi indica Sassim banda

103. Trapa bispinosa Singhara

104. Cynodon dactylon Dublu

105. schinochloa colonum Sanwak

106. Cuscuta reflexa Nilothari

107. Hetero pogon contortus Chirya

108. Sorghum hele pense Basu

109. Prosopis Juliflora Mesquite

Special write-up on flowers and general grasses

with their medicinal uses

General Grasses

Grasses belonging to the family *Gramineae* (which forms the second largest family of Monocots), are quite prevalent in Haryana. Intraspecific, interspecific and intergeneric polyploidy, introgressive hybridization and genetic drift have blurred the taxonomy of its many taxa and to pin-point the exact number of genera and species in the world seem to be quite an arduous job. However, Hitchoock (1950) estimated about 650 genera ranging into 7,000 species and Hutchinson

(1959) listed only 620 genera. In India the family is represented by 500 species comprising about 50 genera (Bor, 1960).

Identification of grasses is mainly based primarily on the structure of spikelet. The lowest scales of each spikelet are the glumes, although in a few grasses one or both the glumes are absent. The principal scales above the glume are called lemmas and may number from 1 to over 50 in a single spikeket. If there are 2 more lemmas they usually differ in size but in some grasses sterile lemmas are present. These may differ considerably the fertile ones; may be located either above or below fertile ones. A palea is not found within the glumes, but one is regularly associated with each fertile lemma (except in *Agrostis* and *Alopecurus*); the sterile lemmas when present, sometimes also have paleas. In a few grasses the palea is so large that it may be mistaken for another lemma. In most grasses there is a joint or articulation either just below the glumes or between the upper glume and the lowest lemma. The location of this articulation can be determined readily by pulling a spikelet with forceps and observing its point of detachement. Post mature inflorescenes usually show persistent glumes, if the joint is above them or naked pedical, or the joint is below the glumes. In the *Andorpogons* and *Hordeums*, the articulation is in the rachis, the rachilla being continuous or tardily disarticulating and the spikelet falling attached to the rachis joint. The rachilla is some times prolonged the upper most lemma, lying on the side next to the palea.

In this family the tribes traditionally recognised are only partly natural. Numerous attempts have been made to set tribal classifications in the Gramineae, (Hubbard, 1948; Stebbins & Crompton, 1961: Potztal, 1964; Tutin 1962). Recent classifications tend in general to include larger members of tribes, several of them monotypic, and emphasise the difficulty of adherence to strict tribal delimitations by the inclusion of a variable number of isolated genera. The positions of some of these genera are considered equivocal by many agrostologists and it has proved difficult either to assign them to existing tribes or even to indicate to which tribes

they are most closely related. Even the relationship of the accepted tribes is a matter of some dispute and disparity as for example in the Nardeae and the Arundinelleae.

Recent studies on the relationships of grass tribes and genera have been rather broadly based and have included considerations of chromosome morphology, anatomy, chemistry and morphological evidences. Within the limits laid down by natural fertility barriers, biosystematics can help to elucidate problems of relationships but beyond these barriers one is compelled to rely on phenetic evidences only. Biochemical variation is one fact of this evidence which may have an increasingly useful part to play, particularly the information revealed by comparisons of primary and Secondary semantides (Zuokerkkandt and Pauling, 1965). Recently Smith (1968,1969 a,b,) has applied serology to the study of systematics which may provide an independent source of reliable information on their relationships. Though this work is quite interesting yet needs extensive extension and application. An excellent review on cytological studies on North Indian Grasses was given by Mehra et. al (1968). This paper also discusses at length about the base number, phyllogeny, role of polyploidy and aneuploidy in the family and is an important and useful contribution devoted to the study of grasses.

General Characters of Grasses.- Herbs are rarely somewhat woody, usually hollow stemed; leaves elongate with a distinct basal sheath (usually split) and a short appendage, the ligule at the junction of the sheath and the blade; spikelets few to many, aggregated into spikes, racemes, panicles or even heads; flowers perfects or less often unisexual one alone or several together, closely subtended and enveloped by membranous to herbaceous or indurate bracts forming small primary inflorescences known as spikelets; perianth none or reduced to 2 or 3 minute scales, the lodicules separate (1-3,3-6), the filaments slender, and the oval to linear anthers usually plumes. Fruits are usually indehiscent and seed like, sometimes permanently enclosed between the lemma and

palea, the seed coat usually adnate to the overy wall; spikelets consisting of a short axis, the rechilla,bearing 2 distichous rows of alternate bracts, of which one or more subtend each an axillary flower; lowest 2 bracts, the glumes sterile (i.e. not subtending flowers), each succeeding bract or lemma, usually enclosing a flower subtending between itself and rachilla by another bract, the palea, this usually 2-nerved.

Plant Description.- In the following pages an account of morphological descriptions, habitat and economic importance of some common grasses growing in Haryana is given. Besides those described herewith specimen of *Bothrochloa incolptta* (r.Br.) Acamus, *B. odora-ta* (Lisboa) A. Camus, Cybopogon citratus (DC) Stapt, *Saccharum bengalense* Retz, Brachiaria brizantha (Hochtst ex A. Rich) Stapt, Digitaria bicornis (Lamk) Roem. D. Stricta Roth, Paspalidium notatum fleugge, Pennisetum

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triflorum staptf, Urochloa mosambiensis (hack) Dandy, Avena Barbata pott. ex. Link Cynodon Plectostachyas, Eragrostic charis (Schult) Hitche, E. curvella (Schrad Nees; Oryza australiensis Dom. have also been collected from various places of Hariana (Haryana). But the descriptions of these could not be completed for want of adequate specimen.

Apluda mutica Linn (Syn. A aristata Linn, Hack; Avaria Hack) ._ It is an

erect, leafy, perennial grass branching from the base, decumbent near the base, bent at the joints; culms many noded, smooth, glabrous solid; leaves flat, rough, linear-lanceolate, long, attenuate towards the base, almost petiolate, tapering above to a fine setaceous point, mid rib white above; ligule short and rounded. Inflorescence is a leafy, densely

flowered, panicle of many solitary simple racemes or spikes each enclosed within a shorter narrowly ovoid pointed bract and born on the dialted extremely of a slender glabrous stalk; spikelets (in trios) two-flowered, 3-nate, one sessile, bisexual, two pedicelled, one of the pedicelled is reduced to a flat pedicel and represented, by lemma only; the other is terminal, male or neuter; glumes unequal, or nearly equal, transparent, upper floral glume hyaline, less glabrous, cleft half way down, awned in the cleft, awn twisted; empty glume nearly equal, flowering glume smaller, awnless containing a male flower.

Flowers and fruits from September to February

Common in abandoned lands, fallow fields, neglected gardens, waste-lands, back-yards of houses etc.

Aristida adseensionis: Linn.- It is slender, ascending, branched tall, tough grass with tufted stems and narrowly linear upto 30cm. long leaves; inflorescence an open, pyramidal, lax, narrowly linear, spike like panicles, usually interrupted with erect or nodding filiform branches (lobulate); spikelets one flowered, contracted panicled, not jointed on their stalk; rachilla not produced beyond the lemma, 7-8 mm long (excluding awn), react, green when young, light purplish at maturity; involucral glumes acute, awnless; floral glumes laterally compressed, slender one nerved keeled; lemma convolute bearing 3-filiform awns; tripartite from the base, central ones longer than the laterals; palea minute; lodicules 2, long, narrow; caryopsis as long as the glume, basal glume, awnless, styles short, free; grains free.

These are common in wastelands, fallow fields, dry gravelly-soils and low lying lands; near the banks of canals, pools, water courses, forming compact dense pure stands of its own there in.

In Madagascar an ointment consisting of lard and ashes of the flower is used for itch and ring-worm.

General

Aristida hystrix; Linn (syn. Chaetaria hystix Beauv).- It is diffuse, ascending, filiform tough, robust perennial grass with a creep-ing root-stock, tufted stems; leaves flat, narrowly lanceolate-linear, thick, tough, strong, finely acuminate; panicles diffuse, open, pyramidial, effuse; rachis stout thick, flexuous; spikelet one flowered, not jointed on their stalks, excluding awn measures about 10+Imm. in length, green when young then gradually turns; jeta coloured and finally becomes purplish during maturity periods; basal glumes slender, one-nerved and keeled; lemma convolute with

3-partite filiform awns; palea minute; lodicules 2, long, narrow; styles free, short;
grains free.
This is a xerophytic grass and commonly grows on dry hot exposed habitats in dry, stony and open gravelly soil forming dense troublesome tufts for a long distance. It also forms continuously linear populations in wastelands, fallow fields, along railway lines, roadsides etc.

Aristida setacea Retz.- It is geniculately ascending filiform grass near about a metre high having slender glabrous, smooth, tufted stems; leaves smooth, polished, coriaceous; panicles inclined, contracted, narrow, branches filiform, fasicled, and erect; spikelets 12 to 15 mm. long, 1-flowerd, panicled, not jointed on their stalks, rachilla not produced beyond the lemma, involucral glumes awned, callus bearded, with long hairs, silky; lemma convolute with 3-partite filiform awns, subequal middle one longest; palea minute, lodicules two, long, narrow; styles short, free; grain free.

Flowers and fruits from August to October

It occurs in similar habitats as that of *A. hystrix* Linn.

Aavena fatua Linn (wild oat).- A semi-tall perennial grass with flat leaves; culms stout, branching from the base, sheaths smooth, blades scabrous, 5-15mm. wide; inflorescence lax-like, slender with fasicled branches, branches usually spreading horizontally, spikelets 3-flowered in spikeform panicles; rachilla hairy, free disarticulating

above the basal glume and between lemmas; lemmas hairy, all over; basal glumes subequal, 9-nerved; lemmas lower and upper scabrulour, shortly bifid; lower with stout awn, awns 3-4 cm; palea bifid shorter than lemma; lodicules 2-fid, lowest floret bisexual, callus of lower lemma short.

Although a native of Europe is frequently adventive or established as a weed of cultivated ground, on waste places, abandoned fields etc.

Borthriochloa pertusa (Linn) A. Cammus (Syn. Holcus pertusus Linn, Antropogon pertusus, Amphilophis pertusa Nasch ex staff).- A slender erect geniculately ascending perennial grass having nodes beared with spreading hairs;

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leaves linear, lanceolate, narrow; spikes fragile, subdigitately fasicled in clusters of 3-7silky, whitish, purple, pale purplish; joint and pedicels densely ciliate; spikelets 2-nate (one sessile and other pedicelled); in shortly peduncled semidigitate racemes; sessile spikelets dorsally compressed, 3 x 1 mm, oblong-lanceolate, bearing bisexual floret at the upper part and male or sterile at the lower part of callur of sessile spikelet small, shortly pubescent; lower basal glume membranous, papery 2-keeled and often with a deep pit above the middle; upper, basal glume3-nerved, keeled; lower lemma linear, oblong, glabrous, nerveless, male; upper lemma small, paleate, bisexual,

awned palea minute or absent.The pedicel of pedicellate spikelet is longitudinally furrowed; pedicillate spikelet awnless lower lemma male or sterile; upper lemma small, awnless, sterile; lower basal glume of pedicellate spikelets many nerved and ciliolate.

It is very variable and commonly found grass, common in lawns, gardens, pastures, wasteland, abandoned fields, cultivated and fallow fields; along road sides, field borders, bunds walls, in stony crevices of building walls, compounds, temples, on roofs of old buildings, on dilapidated houses, roofs and walls.

The grass is universally esteemed as a fodder grass both for grazing and stacking.It is one of the best grasses to stand long droughts and is useful as a winter grass if weather is not too severe.

Panicum distachyum (Linn) Falle creeping paspalum .- It is profusely branched grass with a creeping stem and which roots from the nodes; and has flat linear lanceolate leaves. Spikes oblong to ovate, 2-4, each, 2-flowered in spicate racemes, dorsally convex, the lower basal glume often adpressed to the rachis and is considerably shorter than upper one; spikelets ellipsoid, upper basal glume ovate, acute, 7-nerved; lower lemma paleate or neuter; upper lemma faintly rugulose and tips rounded.

A good fodder grass for our cattle here.

Brachiaria romosa (Linn)Stapt (Syn. Panicum romosum Hook.-This is an

annual tall grass having ascending stems that branch right from the base and creeping stems that root from the base. Leaves are lanceolate, with a round but clasping base, sheath mouth ciliate, ligule short; panicles long, slender, sub-pyramidal, rachis terminating in a spikelet, rachis flattened to triquetrous; recemes 5-10 or even more, flexuous, spreading or erect-patent, rather distant, sometimes divided at the base spikelets, 5-many turgid, alternate, ellipsoid, ovoid, obtuse, close usually in pairs,one sessile and other pedicellate and pubescent, lower basal glume often adpressed to the rachis and is considerably shorter than the upper one, the upper basal glume almost equal to the lower, 5-7 nerved; lower lemma with narrow palea, upper lemma

minutely rugulose, lower florets neuter, upper one hermaphrodite floral glume and palea transversely rugose, basal glumes and lemmas all obtuse caryopsis broadly

elliptic.
Flowers and fruits from August to October.

They are commonly found in gardens, lawns, fields, wastelands, pasture lands, during and after rainy season, mostly in moist areas.

As leafy grass, it is much liked and selectively browsed by stock.

Brachiaria reptans (Linn) Gard & Hubbs (Syn. ***Panicum*** reptans Linn. P. prostratum Lamk).- It is rambling annual creeping grass having geniculately ascending culms and knotty nods with the nodes. Leaves are lanceolate to ovate, amplexicaul, thin, obtuse, hairy on both the surfaces, leaf margins whitish, thickened; rachis triq-uetrous; panicles comprise 5-9 hairy racemes which, when young are erect but spread out at maturity; spikelets hairy, crowded, pale, 2-flowered in spicate racemes, dorsally convex, the lower basal glume often adpressed to the rachis and is considerably shorter than upper one; the upper basal glume almost equal to the lower lemma, 5-7 nerved, ellipsoid, glabrous, abaial (i.e. back of upper floral glume turned away from the rachis and lower involucral glume facing the rachis); lower involucral glume semilunar, small nerveless; upper seven-nerved, ovate-acute; lower lemma paleate, upper lemma short rugulose; floral glume mucronate, and finely transversely wrinkled.

Flowers and fruits from August to September

These are common in gardens, fallow fields, abandoned lands, cultivated fields, roadsides and field borders.

Cenchrus biflorus Roxb. (syn. C. catharticus Delile) .- It is an erect, geniculately ascending, branched from the base, leafy grass with finely acuminate, narrow glabrous or hairy lanceolate leaves, mouth of sheath hairy: racemes 5-10 cm.

long, solitary, cylindric, 2-4 cm. in number, green; involucels 1-2 flowered, composed of subulate hard spines without filiform tids, connate below into a short coriaceous cup, which is surrounded by erect or squarrose bristles, short, loosely imbricate, lanceolate-subulate erect, dorsally flattened, the outer short spreading or reflexed or recurved, inner ones hard sharp and spiny; caryopsis ovoid-oblong, pale and rugulose.

Flowers and fruits from August to October.

They are common on exposed and dry habitats, in waste grounds, unused lands, field borders, partitions and along field channels, bunds, canals, ponds etc. In shallow waters of low lying lands it grows partly submerged.

Its young plants are used as fodder; in La-Reunion used as decoction, fruits are taken as diuretic and pectoral.

Cenchrus ciliaris Linn(syn. Pennisetum cenchroides Rich., P.ciliare Link).- It is a huge decumbent grass with numerous ascending branches (perennial grass) bearing long, linear, finely tapering to a point-leaves; racemes cylindric, dense, lightly purplish, upto16 cm. long and 1cm. broad; involucre of 2 series of bristles, outer bristles numerous, fine, filiform, inner bristles, flattened, and thickened at the base, connate below into a ring; spikelets awnless,1-3 in each involucel, oblong lanceolate, subtended by bristles forming a cup.

Flowers and fruits: appears to flower and fruit all through the year.

A most frequently met grass, growing practically in all the types of habitats where growth and development of plant is possible; once it colonizes an area it quickly spreads and is not easily killed out. It occurs abundantly in waste lands, fields, gardens, lawns, field borders, near ancient monuments; along bunds, canals, tanks and other such temporary or permanent water reservoirs.

Cenchrus setigerus Vahl (C. biflorus Hook).- It is an annual tufted grass with ascending glabrous stems having knotted nodes; leaves linear-lanceolate finely acuminate, rough with long scattered hairs; racemes solitary, cylindric, green at first but turn black at maturity; spikelets not awned, subtended by bristles forming a cup; involucles usually have 3 spikelets, the outer row of bristles short, erect; the inner row erect, subulate lanceolate, all connate into a short cup; spikelets ovate-oblong 2- flowered, lower floret barren and upper hermaphrodite.

This is one of the most pernicious weed, forming gregarious colonies, growing in tufts on a very wide range of habitats preferably on dry, sandy-gravelly soil (loose and porous). It is a dominant weed of waste lands, abandoned fields, unused gardens, lawns etc.

Chloris barbata(Linn) S. W. (Syn. Andropogon barbatus Linn).-It is a huge tufted perennial grass ascending from the geniculate, creeping base, proliferously branched; leaves narrowly linear; rachis of spikes scabrous; spikes 1 cm; suberect, digitately arranged in terminal fasicle; spikelets minute, second, 2.5X 1.5 mm, 2-flowered, awned, digitate; rachilla produced bearing 2, small awned barren glumes and third uppermost very minute (rudimentary) awned lemma, second upper lemma being shortly awned; involucral glumes lanceolate, empty glumes oblanceolate above the florets (2 or 3), lowest floret hermaphrodite; glumes broadly-elliptic densely bearded on the margins above the middle, awned, more or less globose, ovate, upper lemma smaller than lower one, awned; lodicules small; styles free and grains free.

General

Flowers and fruits from August to October

They are common in cultivated fields, pasture lands, gardens, lawns,

abandoned fields (in moist and shady places), on recently deposited soils and
sandy soils.
Chloris virgata sw. (Syn. Rhabdo-chloa virgata Beaut)._ This is an erect spreading tufted leafy grass having a few creeping stems that root underneath; stems somewhat flattened, upper most sheath inflated; leaves less narrowly linear,slightly broader than species. Spikes are 8-15, 3-6mm. wide tapering to a shorter point, digitate; young ones enclosed in an inflated sheath, long, slender, awned, more than 3, crowded erect or ascending, 3-8 cm. long; spikelets 2-rowed with 4 acuminate glumes; empty glumes above the floret solitary, oblanceolate, truncated, upper involucral glume awned, awn 3-7mm. long; lower floral glume bifid at the apex, long ciliate on the margins in the upper half (distantly) almost to the tip, and towards the base, awned, rachilla bearing a well developed auricled awned glume; caryopsis polished, shortly produced trigonous.

Flowers and fruits from July to October

These are common in dry hot and exposed habitats in waste grounds, fallow and cultivated fields, gardens, abandoned fields, along field borders, bunds; road sides and in deserted areas.

Decoction of the plants or only of the roots is used by xosag of S.Africa as an addition to baths; for the treatment of colds and rheumatism.

Chrysopogon aciculatus (Retz) Trin. (syn. Andropogon aciculatus).- It is an ascending perennial stout grass over about a metre high with a woody creeping rhizome and lower internodes too close while the upper ones elongated. Leaves are folded in buds, otherwise at maturity densely tufted, linear, margins, spinulose panicles erect, pale-green or

purplish narrow, branches fragile, filiform, spreading; spikelets in threes, born at the ends of branches, falls entirely, awned, callus very long, aci cular; one floret sessile hermaphrodite, slender, awned, the two lateral male or neuter pedicellate, pedicels scabrous, slender without furrows, the lower basal glume of sessile spikelets chartaceous, upper 1-nerved, acuminate, lower lemma linear, oblong, 2-nerved hyaline, empty, upper lemma with a scabrid awn; lodicules smooth and small; palea small,

2-cleft; peduncle hairy and fullvously beard at the top and caryopsis linear.

Flowers and fruits from September to October

It occurs in waste lands, fields, pasture lands, backyards of houses; on heaps of sands, soil, rubbish, cinder; on construction materials, on recently deposited soil etc. Its awns that are very small stick firmly to the clothes of human beings and to the fur of passing animals and the seeds thus get dispersed to far off places.

Cymbopogon narduras (Linn) Rendll (Syn. Andropogon nardus (Linn).— It is aromatic densely tufted grass with oil cells in the leaves. The leaves are coarse,long and linear; stem 0.7 to 1.7m. long; spikes or racemes of spikelets 4-5; spikelets in binate racemes, one of them sessile, the other shortly stalked, subtended by violet or reddish spathiole; such paired racemes are arranged in large panicle; spikelets of each receme pair differ in sex or more or less in size also except those of the lower racemes which are homogamous, male or neuter; spikelets also paired, one sessile, other pedicelled, sessile spikelets 2-flowered, upper floret bisexual, the lower reduced to an empty lemma; sessile spikelets usually dorsally compressed, awned or very much reduced;

callus short; lower basal glume of sessile spikelets with keels, narrowly winged, dorsally flat, papery, 2-keeled; upper basal glume keeled, lower lemma hyaline ciliolate, binerved; upper lemma hyaline, soft, bilobed, or cleft, awned, almost stipitate below the insertion of awn, upper palea O; lodicules, minute, smooth; pedicelled, spikelet as long as the sessile; awned male; upper lemma and palea.

The plant (Known as Asian grass) is a source of citronella oil which is obtained by steam distillation, used in perfumery, for scenting soaps, varnishes, insecticides, spraying liquids for households and theaters, disinfectants, shoe-polishes, and other preparations; leaves employed as tea in some villages; infusion of leaves is stomachic and carminative; oil-simulant, carminative antiseptic, diaphoretic, sudorific, and rubefacient. It yields an useful essential oil having about 60% citronella.

Cynodon dactylon (Linn) Pers Sy. Panicum dactylon Linn).— A perennial soft slender, glabrous grass it has an extensive creeping base and having slender many noded wiry culms forming matted tufts. leaves have linear, acuminate, 2-4mm. wide, flat; ligule short, hairy; spikes 4-6 digitate, divergent, arcuate spreading, green, short; spikelets 3-6cm, green on purple awnless, laterally compressed, sessile, adressed imbricate, lanceolate one flowered; floret bisexual, in digitate umbellate spikes, not articulate at the base; floral glumes boat shaped 1.5-2.2mm. the first curved, second nearly straight; basal glumes persistent or separately deciduous, narrowly keeled, lemma longer than basal glumes, callus short, glabrous, lemma 3-nerved; palea as long as the glume, 2-nerved; lodicules 2, small; lemma awnless; grains oblong, free, laterally compressed; rachilla produced above the lemma as a five bristly structure or minutely pubescent to longivillous on the keel 2-2 to 5mm. long.

Flowers and fruits throughout the year.

It is a very common and most prevalent lawn grass that spreads widely by stolons and rhizomes forming mats; the flowering culms being erect or ascending.

It is a common and easily available fodder for cattle especially for the horses. It varies considerably in its nutritive qualities according to the nature of soil and

climate and can withstand moderate grazing. It is an important pasture grass which finds use also for hey. It is palatable and nutritious for livestock. Its decoction of roots is diuretic, used in dropsy and in secondary syphillis. Infusion of roots is used for stopping of bleeding from piles, crushed roots mixed with curd are used in chronic gleet. The juice of the plant is astringent, used as application to fresh cuts and wounds, diuretic, used also in dropsy and anasarca, hysteria, epilepsy, insanity, chronic diarrhoea and dysentery; it is also useful catarrhal ophthalmia.

Dactyloctenium aegypicum. (Linn) Beauv. (Synosurus aegytius Linn Eleuisne aegyptia Desf, D. Aegypticum willd).— The grass is with some erect culms, prostrately spreading branches rooting at nodes and also from the branched nodes. Leaves are distichous, acute, ciliate, narrowly linear with flat blade, liguleless; spikes 2-6, terminal, digitately radiating at right angles to the rachis of the spike; rachis keeled, ending in a mucro;spikelets laterally compressed, densely crowded, spreading at right angles to the rachis, florets bisexual, upper ones reduced, glumes pungent; lower involucral glumes broad, ovate, cuspidate, cusps obliquely recurved, one nerved, upper abruptly shortly awned; palea as long as lemma, very broad, 2-fid, keels hispid; grains obovoid-globose, very rough; pericarp evanescent.

Flowers and fruits from June to October

This plant is quite variable in form, morphology and phenology. Three different morphological (phenetic) types viz. erect, prostrate and decumbent types were detected in this area. In general the plant occurs in dry open habitats as well as in moist shady habitats; in low lying lands, in depressions; amongst bushes and shrubs as a common weed of rice and other cultivated fields, often becoming gregarious therein. It is also found to grow on waste-lands, gardens,

lawns along roadsides, foot paths, field borders, bunds, water channels, building walls etc.

Its grains are used by natives as a source of food; these being parched and eaten by women who suffer from belly-ache after delivery. Decoction of seeds is reckoned in Africa as an alleviator of pain in kidney region.

Desmostachya bipinnata (Linn) Stapf (syn. Briza bipinnata Linn, Uniola bipinnata Linn, Eragrostis cyno suroides Beauv).- A perennial tall grass branching from the base having long, erect tufted, smooth, erect culms and a ciliolate ridge is like ligule and creeping rhizomes. Leaves are linear-lanceolate,rigid with filiform tips margins hispid; panicles very long, narrowly pyramidal or columnar, reddish brown at maturity; spikes numerous, short, upto 3 cm. long, much aggregated or crowded; spikelets sessile, secund, 2-serriate, deflexed, linear, strongly laterally compressed in two ranked spikes, many flowered; basal glumes unequal membranous, I-nerved and keel, lemmas ovate, entire blunt tikpped 3-nerved acutely kneeled palea

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almost as long as lemmas; 2-keeled; lodicules 2, large, hyaline; stamens 3, grains loosely enclosed by lemma and palea.

Flowers and fruits from August to October

It commonly grows in pure stands of its own in unused fields, abandoned lands, fallow fields, waste lands; along roadsides, foot paths, field borders; on deposited soil, on construction materials, on wet sandy yellowish brown soil often growing in dense tufts and represents a dominant specie therein.

Its culms are diuretic, stimulant, used in dysentery and menorrhoca.

Dichanthium annulatum (Forsk) Stapf (Syn. Andropogon annulatus Forsk).- It is an ascending densely tufted perennial grass, upto 1m. tall having nodes usually conspicuously bearded; leaves linear, setaceous-acuminate; racemes subdigitately fasicled, spiciform, greenish or usually purplish or violet 3 or more, joints and pedicel silky-hairy. spikelets have 2-nate, one sessile, the other pedicelled, structurally similar except the lowermost 1 or 2 pairs in many jointed shortly stalked racemed panicles; sessile spikelets hermaphrodite, closely imbricate; upperfloral glume reduced to a slender awn; lower involurcral glumes without pits, papery, oblong obtuse or flat with keels, ciliate above not winged; upper lemma small, linear, thinned below pedicelled spikelet male or neuter, caryopsis planoconvex, oblong; palea and lodicules very mintute.

Flowers and fruits in winter season

This is a common plant of gardens, lawns, pastures, waste-lands, fields, roadsides, foot-paths; along water courses, bunds and building wall. When grazed it produces fresh prostrate shoots and resembles much to *Bothrochloa pertusa* but can be recognized by an absence of pit in lower glume.

Dichanthium caricasum (Linn) A Camus (Syn. Andropogon caricosus Linn).—As stoloniferous perennial grass with stems has many joints and with leaf sheaths compressed and ligule ciliate membranous; spikelets 2-nate, one sessile, the other pedicelled, structurally similar except the lowermost 1 or 2 pairs in many jointed shortly stalked racemed panicle; sessile spikelets bisexual, pedicelled male or sterile, callus in spikelets short, hairy in the sessile spikelets; lower basal glume of spikelets, papery, ovate or oblong, tip truncate, denticulate, hairy on back more or less; keels with ciliate wings, median nerve O; upper basal glume 3-nerved with scabrous keel; lower lemma hyaline, ovate-oblong, nerveless, upper lemma of awn 2-2.5 cm. with colum scabrid; lodicules minute; pedicelled spikelets awnless and grains elliptic.

General

Digitaria adscendens (H.B. & K.) Henr.(Syn. D.fimgiata link, D. marginata (Link) D. Stapf; D. sanguinalis (Link) Scop var, marginata (Link).- A decumbent annual tufted grass that grows upto one metre tall, branched, rooted at nodes and bears linear-lanceolate, flat, leaves, 4-10 cm x 5.10mm, spikes 2 or more, usually 3-6 in each of the 1-3 whorls, 5-15cm. long; spikelets 2.5-3.5 mm., in 4-6 subdigitate violet racemes, lateral angles of rachis winged, spikelets bearded with soft spreading hairs, caducuous, small, lanceolate-elliptic, blunt, dorsally convex, oblong, acute, apressed to the rachis 1mm. wide, broadly winged, scabrous on the margins; floral glume, densely beardd with soft spreading hairs; lower basal glume reduced to a membranous scale, upper involucral glume ciliate, upper lemma bisexual, oblong-lanceolate; upper place of the same length; hair of floral glumes dull white, turning brownish later; lodicules 2 small, cuneate; stamens 3 style 3 and grains oblong.

Flowers and fruits from July to October

It is a very commonly met grass growing abundantly in varied types of habitats from dry and exposed habitats to moistshady protected areas. It is easily recognised by its conspicuously bearded spikelets. This plant seems to grow anywhere and everywhere and is quite an aggressive grass forming gregarious colonies wherever it colonises.

Echinochloa colona, (Linn) Link (Syn. Panicum colonum Linn).- An annual geniculately ascending usually branched grass and grows about 70 cm. tall. Leaves are flat, lanceolate, upto 25 cm. in length; spikes 8-20, sessile, simple, sub-erect and appressed to the axis, usually distant, upto 2 cm. long, pointing upwards, dull green in appearance and hairy. Spikelets are crowded, globose, ovoid, 2 flowered, ovate-lanceolate apically acuminate; glumes with bristly hairs, lower and upper basal glumes dissimilar; the former shorter and ovate. The other features are 3-5 nerved, acuminate, upper basal glumes as long as the spikelets, concave 5-7 nerved, mucronate or shortly awned; lower lemma similar to

upper basal glume, almost awned paleate, male; upper lemma ovate to elliptic, smooth, shinning, strongly convex on the back with convolute margins, not enclosing the apex of palea, strongly hardened; upper lemma and palea coriaceous, the latter white; grains plano-convex.

Flowers and fruits from July to October

Grows in similar habitats and situations as described for *Paspalidium flavidum* Stespf.

It is an important fodder grass.

Eleusine compressa (Forsk) Aschors & Schwfth (Syn. Panicum compressum Forsk; Eleusine flagellifera Nees.— It is creeping grass, being prostrate, long spreading

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proliferously branched perennial that roots at the nodes; stems smooth, stiff, thickened, having leafy nodes and produces slender branches; internodes 10.20 cm. long; leaves linear, long dark-green, entire, rigid; spikes 3-6 digitate, rachis flexuous; spikelets laterally compressed, imbricate, 4-6 flowered, digitate; florets bisexual, second, imbricate, in digitate spikes rachilla continuous between lemmas; basal glumes slightly unequal, persistent; upper obtuse, acute, awnless, keeled, lemmas 3 nerved, palea smaller than lemma, oblong; lodicules 2, and cuneate grains free.

Flowers and fruits from August to October

The plant by virtue is of a quick development of many aerial suckers spreads very rapidly in short span of time and establishes itself as a dominant plant in the area it invades. It grows luxuriantly and abundantly in dry and open habitats on loose, porous, sandy soil; along bunds, canals, road sides,

foot paths, fields etc.

Eleusine indica (Linn) Gaertn (Syn. Cynosurous indicus Linn).- The grass is an erect, 30-60 cm. tall, simple or branched, soft stemmed; annual grass having compressed and glabrous culms. Leaves are distichous, folded or flat; sheaths ciliate narrow and flaccid; spikes 2-7 laterally compressed digitate with 1or 2 below the umbel; suberect, or sub-recurved; rachis flattened, more than 2 flowered. Spikelets in long terminal contain spikes, biserriate, second, pointing forward at an angle, 3-6 flowered, compressed; imbricate in umbellate spike; rachilla continuous between the lemmas; basal glumes slightly unequal, persistent; acute, awnless, keeled lemmas 3-nerved; palea smaller than lemma; upper obtuse/lodicules 2-cuneate; grains free and oblong obtusely trigonous.

Flowers and fruits from August to October

It is found commonly along the edges of fields, roadsides, foot-paths, in pasture lands, fields, waste-lands, gardens and abandoned fields. It appears immediately after the first shower of monsoon. It is also found to grow along bunds, near canals, old temple buildings, on the roofs of ancient houses, along walls of drainage channels etc.

Whole plant especially the root is considered to be sudorific and febrifuge in Cambodia; used in liver trouble; young seedlings are consumed in Java with rice; stems are used for making mats. It is also a good fodder grass for livestock.

Eleusine verticellata Roxb.- The plant has the qualities, viz an erect, robust, annual herb having tufted,erect 30 to 59 cm. tall simple and with less branched culms than the other species. Leaves are linear, lanceolate, flat, rather broad,`flaccid, acuminate, glabrous, white subdenticulate-margins; sheaths compressed and ligule of a few hairs. Rachis end in a spikelet; spikes 6-20, scattered or whorled, opposite or

alternate, suberect, 6-12 flowered; each floret laterally compressed, bisexual, 2-3 serriate and secund, shinning green when young, imbricate in umbellate spikes; rachilla continuous between the lemmas; rachis slender; basal glumes unequal, persistent; keels subdenticulate, glumes one, broadly ovate, 3-nerved, acuminate or arisulate; lemma usually 3-nerved; palea smaller than lemma; lodicules 2, cuneate; keels excurrent, lateral nerves ending in small teeth;grains oblong, rugose and free pericarp canducuous.

Flowers and fruits from August to October

The plant is commonly found in abundance in moist-shady habitats, in lowlying lands, in depressions and in shades of bushes. It is also found in waste-lands, abandoned fields, gardens, along road sides, foot paths, field borders and in cultivated fields on dry sandy soils.

Eragrosits ciliensis (All) Link (Syn. E. majar Host, E.Megastachya poa cilansis All; Briza eragrostis Linn Love grass).- A very commonly found much branched, densely cespitose annual grass grows upto a metre in height and has geniculately branched leafy culms ascending from a decumbent base. Leaves are glandular along the margins, panicles erect, upon ovoid to subcylindric, 5-15 cm, branches spreading, capillary, pedicels 1-2 mm. spikelets in open panicles, laterally compressed longer than their pedicel, multiflowered, oblonglinear, 10.40 fid (few to many flowered); lemma broadly ovate to closely imbricate, glandular, on the keel, subacute palea, wide obovate, much curved; involucral glumes glabrous, falling away from its base upwards, lower involucral glume1-3 nerved upper 3-nerved; palea long ciliate, imparting hairiness to the infloresence (palea with ciliolate keels) lodicules2, minute; ligule reduced to fine hairs, stamens 3, ovary glabrous, styles 3 and grains glabrous, reddish brown free.

Flowers and fruits from July to October

It is a grass of very common occurrence in gardens, lawns, fields, waste lands, abandoned buildings, building walls,

bunds roadsides, field borders, along water channels; drains etc.

Eragrosts ciliaris (Linn) (Syn. Poa-ciliaris Linn.).- An erect, or inclined slender, annual about 10 cm. high having geniculately ascending glabrous soft culms; its leaves are very narrow. Panicles are compact, short cylindric, spike-like nearly 2 cm. hairy due to the presence of long cilia on palea with branches divided from the base. Spikelets are pale, densely aggregated, 5-12 flowered, strongly laterally compressed;

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floral glume about 1mm. long, spreading glabrous, palea long ciliate, imparting hairiness to the whole inflorescence; lodicules 2, minute, ligule reduced to fine hairs, stamens 3, ovary glabrous, style 2 and grains free.

Flowers and fruits immediately after rains

These are common in waste grounds, abandoned lands, fields, moist shady loam near canal banks, along road sides, footpaths, in lawns, bunds; near buildings, building walls etc.

Eragrostis diplachnoides Stapt (Syn. E. interrupta Var. diplachnoides Stapf).- This is huge, tall, stout branched grass with geniculately ascending erect stems and narrow long-lanceolate leaves. Panicles are long, effuse or contracted flaccid, branches solitary or 2-3 in a whorl elongate, simple or if branched the whorl rarely over topped by 1 or 2 branches, 5-12 cm. long, ultimate branches not diverticate.

Spikelets are strongly compressed, 6-12 flowered in long effuse panicles; branches long and flaccid; basal glume and lemma 3-nerved, lemma very much obtuse, lodicules 2,

minute, ligule reduced to fine hairs, stamens 3, ovary glabrous, styles 2 and grains free.

Eragrostis nigra Nees ex Steud .- An annual herb is with mouth or leaf bearded and narrow leaves; stem erect, usually stout and leafy at the base, leaves in small form basal and fiat, in taller forms elongate; leaves flat, usually narrow, panicles oblong or pyramidal loose; spikelets in contracted panicles, strongly laterally compressed, branches of panicles, many mostly in whorls, clusters, rarely solitary, olive green, usually few, scattered; 3-9 flowered; basal glumes small, subequal, distinctly one nerved with scabrid keels, lemma ovate, palea obtuse, denticulate, empty glumes membranous, persistent; ligules reduced to fine hairs,stamer 3, ovary glabrous, style 2, grains free and oblong-ovoid.

Eragrostis pilosa (Linn) Beauty (Syn. Poa Pilosa Linn.- it is densely tufted annual grass having soft, erect, slender, geniculate culms about 39 cm. high, the culms densely cespitose, ascending from a decumbent base. Leaves are narrowly linear, 2-3 mm. wide, scabrous on the margins, mouth of the sheath bearded. Panicles are numerous, erect, usually in whorls, clusters, rarely solitary spreadig at anthesis, nodes hairy; panicle branches capillary, flexuous with pedicels almost as long as the spikelets, divergent; spikelets not versatile, small, 4 mm. long or less linear, 4-10 flowered ; basal glume subequal, distinctly 1-nerved with scabrid keels; lemma ovate, acute floral glumes 3 nerved, the lateral nerve fading above the middle; keel of palea subenticulate, subpersistent, long ciliate, imparting hairiness to the inflorescence; anthers violet colours, ovary glabrous 2, grains obovoid or ellipsoid (truncate at both the ends) short cylindric, 0.5-0.7 mm. and two thirds as thick.

Flowers and fruits from July to November

It is commonly found in moist wet shady places, near the margins of pools, puddles, canals, channels, in marshy places, near backyards of house, along walls, and borders of cultivated fields, water and drainage channels.

Eragrostis poaeoides Beauv (Syn. E. Minor Host).- An annual densely tufted slender grass bearing 3-10 cm. long and 2-5 mm. wide has flat leaves; spike oblong to linear oblong, with spreading branches, laterally compressed; spikelets pedicelled, 10-20 fid, 1.5-2 mm. wide, pale green to dark purplish or olive grey, glistening, rachilla tough, branches of panicle filiform, spreading when ripe; basal glume small, one nerved, lemma 3-nerved, 1.7-1.9 mm., glandular on keel, closely imbricate, broadly elliptio-ovate; lodicules two, minute; ligule reduced to fine hairs, leaf margins glandular, mouth of sheath slightly bearded; ovary glabrous, styles 2, grains free, bright brown in colour, about 50 mm. in length and 0.6-0.8 mm. in width and dorsally rounded or slightly flattened.

These are commonly found in moist soils, waste lands, gardens, lawns, along road sides, fields, etc.

Eragrostis tenella (Linn) Roem & Schult(Syn. Poa tenella Linn).- It is geniculately ascending 15-30 cm. tall, tufted annual having smooth glabrous non-viscous culms. Leaves are narrowly linear, tapering to a fine point; panicles plumose loose and open or contracted, light green or purplish excessively branched, oblong-ovate or cylindric, strongly laterally compressed; basal glumes small, upper basal glume and lemma 3-nerved spikelets oblong, 2-4 x 1mm., rachilla breaks up from above downwards; palea ciliate on the keels; imparting a hairiness to the inflorescence, stamens3, lodicules 2, minute ligule reduced to fine hairs; and ovary glabrous, style 2, grains free.

Flowers and fruits from June to October

These are common in moist and shady as well as in moist and open habitats throughout monsoon periods.It occurs in similar habitats as that occupied by *Eviscosa*.

Eragrostis tremula Hochst ex stud (Syn. Poa tremula Lamk).- It is a tall huge tufted ascending annual grass having leafy geniculate culms with leaf margins glandular; panicles much diffuse, branches solitary filiform and ascending. Spikelets are oblong or narrowly linear, versatile, about 2 cm.

long branches, branchlets with long white hairs in all axils of the panicles; rachilla quite tough; floral glumes broad-ovate, 3-nerved, glabrous, subacute, palea long ciliate, ovate, oblong, persistent, imparting hairiness to the inflorescence; palea slightly shorter than lemma; grains nearly globose, glabrous free; stamens 3, styles 2, and ovary glabrous.

Flowers and fruits from August to November

This is a common grass in fallow and cultivated fields; on damp sandy brown clay soils, recognizable by its versatile spikelets.

Eragrostis viscosa (Retz) Trin (Syn. Poa viscosa Retz, E. Tenella Roem and Scult Var.Viscosa Stapf).-It is a huge tufted sweetly scented viscous grass, 10-30 cm. tall, having minute glands scattered all over stems, rachis panicle, pedicles and glumes. Leaves are flat, or convolute, erect, with rigid tips, panicle dense, cylindric or oblong, feathery, longer open or more or less contracted; branches spreading numerous are very short. Spikelets are purplish and rachilla fragile 3-16 flowered; basal glumes unequal, lemma oblique, not mucronate; glumes strongly nerved; lodicules 2; minute ligule reduced to fine hairs; palea ciliolate on the keels, imparting hairiness to the inflorescence; stamens 3, ovary glabrous; styles 3, grains pale brown, polished, smooth and free.

Flowers and fruits from June to October

This commonly grows on moist shady habitats, during monsoon periods, in fields, gardens, lawns, along field borders, walls, temples, drainage channels backyards of houses near ponds, pools, puddles canals etc.

Erianthus ravennae (Linn) Beauv (syn. Andropogon revennae Linn, Saccharum ravennae Linn).- It is a tufted robust solid stemmed perennial over 3 m. tall grass having smooth polished and solid culms. Leaves are variable in length linear, acuminate, margins scabrid greyish or purplish, flat with a convolute vernation. Joints and pedicles of the racemes are long ciliate with thickened tips. Spikelets are paired, awned, one sessile (the secondary) and the other pedicellate, apparently

1-flowered in spicate panicle, rachis fragile, lower basal glume keeled with curved or inflexed margins; callus very short and hairy: awn of upperglume distinctly exerted from spikelets; callus very short, hairs purplish or brownish; upper basal glume, keeled 1-3 nerved; upper lemma apically awned; upper palea hyaline, nerveless; lower lemma also hyaline; lodicules 2, cuneate.
Flowers and fruits from September to November

These commonly occur in dense tufts on unused ground, abandoned lands, waste places, along railway lines and canal banks, near pools, puddles, water channels, in marshes and along raised embankments around fields etc.

Its fibre is used in making chairs, *mudas,* temporary house roofs and ropes.

General Characters of Composites

In general the Composites are characterised by the following characters: annual or perennial herbs rarely shrubs, heads arranged in various shorts of determinate

inflorescences, flowers sessile in a close head on a common receptacle; sometimes individually subtended by a small bract; individual flowers epigynous, perfect or unisexual, gamopetalous, regular or irregular, commonly 5-merous, without definite calyx; stamens alternate with the corolla-lobes epipetalous, usually with elongate anthers united into a tube; ovary bicarpellate but 1-celled with a single erect ovule, style usually 2-cleft, fruit an achene unappendaged or more commonly crowned with a pappus consisting of hairs or scales.

Mostly corollas of Composites are of three types; in the simplest type they are tubular or slenderely trumpet, shaped straight and regular, with typically 5 short terminal lobes; in the second type the corolla is tubular only at the very base, above which it is flat (ligulate), commonly bent to one side, and often exhibits traces of its lobes as small terminal teeth; in the third type the corolla is bilabiate, with the outer side generally the larger. A single head may be composed exclusively of tubular flowers (discoid head), or ligulate flowers (ligulate head), or of both together (radiate head); in the latter the tubular flowers invariably occupy the centre of the head (the disk), while the ligulate flowers are marginal, the corollas projecting as rays. If the head is composed solely of ligulate flowers, the flowers, are generally perfect. If it is composed solely of tubular flowers, the flowers are usually perfect, but may be unisexual, in which case there may sometimes be 2 different kinds of discoid heads on the same plant or on different plants of the same species. If both ray and disk florets are present in the same head, the rays are always either pistillate (with a definite style) or neuter (without reproductive parts), while the central flowers are either perfect (usually) or functionally staminate. In both perfect and functionally staminated florets the style pushes up through the another-tube and ejects the pollen.

Plant Notes

After describing the general characters of the family Composite a brief description of the individual plants of the family growing in Haryana is given below:

Ageratum conyzoides.- Linn (Syn. A. album Steud, A caruleum Baily. A. cordifol lum Roxb, A. hirtum Lamm, A. humile Salish, A. latifolium Hemsl,A. mexicanum Sims, A. obtusifolim Lam A. odoratum Vis).

It is an erect hairy annual herb 40+10 cm. tall hispidly hairy: stem purplish white; leaves broadly ovate, ramal and cauline,

petiolate, opposite, upper ones alternate, ovate, subacute tips, younger ones cuneate at the base but mature ones subcordate, crenate, pubescent; heads white, pale-blue, faintly pinkish-purple homogamous discoid, born in terminal dense crymbs; bracts striate, acute, 2-3 seriate, linear, subequal and campanulate. Calyx-represented by pappus of 5 scales, connate below, acuminately aristate, serrulate, nearly equalling corolla, pappus setose; basically

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pappus is a scarbid seta composed of uniseriate rows of cells fused together with the obtuse terminal end cell of each row free and projected outwards as a lateral cilium; Corolla-white-pink violet. Gamopetalous, tubular, limb 5-fid or toothed with valvate aestivation equal, swollen at throat, 2-3 mm. long, epigynous; Anroecium-5 inserted in the corolla and alternate with its segments, stamen composed of hairy filaments which are free above, glabrous, the anthers, are syngenesious, 2-celled with introrse dehiscence, cohering into a tube which sheaths the style, appendiculate at the apex and obtuse base, the anther, connective, apical appendage pollen and prolongation of the connective below the anther from the antherfere; basal appendage absent, basses of anther lobers truncate; Gynaeciumsbicarpellary, syncarpous, median unilocular, sharply angled with minute spines at angles attenuated with a basal aeroleovule solitary, anatropous; style bifid, stout with two blunt feathery glandular exerted linear arms, appendaged; fruit indehiscent, black, 5 angled, crowned with pappus of 5 scales, a cypsellar achene.

Flowers and fruits from November to May

It is a common weed of disturbed communities such as on waste grounds, arable lands, ditches, road sides, grass embankements, field partitions, bunds, in pastures and grass

fields, neglected gardens, on waste refuses, backyards of houses; near swamps, marshylands, pools, puddles, water channels, wet ditches, etc. It organises into thick rough dense strips along railway track, borders, roads, etc.

The juice of the plant is antihelmintic, antilith; leaves styptic, applied to cuts and sores and externally in ague, dressing wounds and ulcers, also employed as purgative, antipyretic and roots for treating colic.

Bidens biternatea(Lour) Merr and Sheriff (Syn. B. pilosa auct., Coreopsis biternata Lour).-This is a highly variable much branched erect glabrous, pilose or pubescent, 25 cm. to 1m. tall herb having a robust glabrous at base, pubescent above-stem and opposite,compound variable , glabrous, pinnate leaves with 3-5 ovate toothed leaflets. Heads born on long stout peduncle or radiate on the long thick diverging stalks; yellow and corymbosely panicled heterogamous. Involucral bracts with broad scarious margins, campanulate, linear, rough, sub- 2- serriate, bases connate, outer hertaceous short or leafy or inner membranous; ray florets female,

i- serriaate, ligulate, spreading ; disc florets bisexual, fertile, tubular and limb cylindric 5- fid. Another cells entire or subsagittate are style arms hairy above tips short acute for long and subulate. Achenes are linear, rough, quadrangular ribbed, glabrous, black Pappus 2-4(mostly 3) awned, stiff short stout bristles covered with recurved hooks and is a well known pest from the adhesion of its barbed achenes to the garments and body.

General

Flowers and fruits from April to September

It is found on moist shady habitats, in gardens, lawns along

field borders, bunds, water channels, canal, ponds, tanks and along other such water reservoirs.

In-fusion of the plant is taken in Malaya for coughs; in Brazil leaves used as styptic an as vulnerary applied to foul ulcers and swollen glands; in Gold Coast, the Juice of the leaves is squeezed in to eyes and ears or to cure certain complaints;the igorots of Benguet (Phillipines) mix the plant with half boiled grains of rice for making a rice- wine calle *Tafei*; is also used by the igorots for making a wine called "*Sinitist*".

Blumea lacere (Burmif) D.C. (Syn, Conyza lacera).-A tall erect, villous or glandular, the herb is erect stem and densely leafy; leaves petioled, ovate, dentate- serrate and non-lobbed. Heads are clustered in short, axillary cymes or terminal, spiciform panicles, receptacle glabrous; involucral bracts narrow, acuminate, hairy; florets yellow. Achenes are not ribbed, glabrate, sub-gonous.

Flowers and fruits from March to June

It gives a strong characteristic smell of turpentine and occurs on moist shady habitats, grows under the shade of trees; along wells, canal banks, bunds etc; in the vicinity of old monuments, ancient buildings, walls, temple walls etc.

In Indian medicine the juice of the leaves is regarded as antihelminthic astringent, diuretic, stimulant, febrifuge, as diuretic and increases the flow of urine consid-erably. It also used as antiscorbutic in W. Africa; leaves as vegetable in a Indonesia; roots in cholera; herb gives 0.085% of essential oil containing blumea camphor; large quantity of L- Borneol is currently being extracted from it.

Blumea mollis (D. Don) Merr(Syn. B. Wightiana D.C. Frigeron molle D. Don).- It is an erect silky hairy or wooly leafy herb bearing ovateobovate or lanceolate, petioled, serrate and leaves; stem erect subsimple and densely leafy. Heads are numerous in spiciform cymes of panicles; involucral bracts narrow, acuminate, receptacle glabrous and corolla purplish. Achenes are terrete or indistincly and angular is sparsely hairy.

Flowers and fruits from March to May

This plant does not give smell of turpentine. It is a common weed of fallow weeds, abandoned lands, recently deposited soil; also grows on heaps and mounds formed of recently deposited soils, construction materials, silt and *kankar*

deposits.

Blumea obliqua (Linn) Druce(Syn.B. amplectans DC, Erigeron obliquns

Linn).- It is a decumbent woody deep rooted herb, having densely, villous, divaricate branches, spreading from the base; leaves are sessile, semiamplexicaul, ovate-oblong,

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lower ones distinctly dentate, upper most often entire. Heads are disciform, solitary on the branches; involucral bracts slender, inner hair pointed,; receptacle glabrous; ray florets pinkish; disc florets yellowish, and lobes of corolla hairy, achenes hairy oblong, pappus reddish and long.

Flowers and fruits from February to June

Common in dry exposed habitats in waste lands, gardens, fallow fields, along bunds, near old construction walls, building material etc.

Cirsium arvense(Linn)Scop.(Cnicus arvensis Hoffim, Serratula arvensis Linn).- It is an erect, branched, foliaceous over in tall herb, with a cobwebby, tomentose stem and sessile, linear, obovate, dark-green, huge leaves that are wooly beneath and whose margins are tipped with spines; leaves are sinuate or pinnatifid; lobes divergent and tips speneseent and tomentose beneath, heads are dioecious, solitary, fasicled or corymbose variable or shortly peduncled, globose male; female much longer, more campanulate with more lax involucral bracts; involucral bracts glabrate or cobwebby, outermost short ovate, or triangular-ovate, foliaceous ending in a short spine;inner gradually longer with undulate often recurved tips, innermost narrow linear-

lanceolate and scarious; corolla pink to dingy purple, limb 5-partite. Achenes are small smooth shinning brownish-white.

Flowers and fruits from March to May

It grows in dry hot open habitats, especially in waste places, along field borders, field partitions , road sides ,foot paths etc.

The plant is emetic, tonic, diaphoretic, used for coagulating milk; it has a volatile alkaloid and cnicin-a crystalline bitter glucoside possessing emetic and emmenagogue properties.

Echinops-echinatus Roxb.- The plant is erect and profusely branched from base, spreading , rigid, white wooly, annual; branches widely diverging and leaves beneath white with cottony-wool,oblong pinnatifid, sessile leaves whose lobes are triangular and end in long, rigid, narrow and spines . Heads are white uniflowered , born in compact globose capitula with many stout spines; involucre surrounded by strong white bristles, glabrous, scaberulous, villous or cobwebby above: outer involucral bracts 6-8, oblanceolate,glabrous pungent are often spinescent, inner long connate tips ciliate, hardens around the obconic silkily villous achene.The florets are light bluish; filaments glabrous; anther bases sagitate, auricles connate, tails short entire or fimbriate; style arms thick and with a thick basal ring at length spreading; achenes obconic, silky, elongate; pappus and crown of many short bristles.

General

Flowers in March-April; fruits in May-June

It grows commonly in dry hot and open(exposed) habitats in waste gardens, waste grounds, abandoned-fields; along road

sides, railway lines, and in low lying lands mostly confined to the margins of the depressions. Plants are alternative, diuretic, nerve tonic, used in hoarse cough, hysteria, dyspepsia, scrofula and ophthalmia; powdered roots applied to wounds in cattle to destory maggots; mixed with acacia gum, applied to hair to destory lice etc.

Eclipta prostrate (Linn) Linn (Syn. E. erecta Linn, E. alba Hassk)._ this is an erect, weak or spreading strigose annual herb with stems branching and often rooting at the nodes and having oblong lanceolate, lance-elliptic acute, narrowed to sessile base, leaves with shortly petidar base remotely serrulate margins. Heads are white, radiate, 1-3 in terminal or axillary clusters on the branches; disk 4-6 mm. wide; involucral bracts or some of them usually a little exceeding the disk, leaf like; rays minute whitish; ligules 2-toothed, entire, receptacle flat, covered with broad folded scale enclosing several florets. Achenes are narrowly oblong ribbed, tipped with pappus teeth, appearing hairy above, rugose or warty, winged on the margins with warty excrescences; pappus of 2-5 minute teeth. The plant appears to flower and fruit almost throughout the year except from May to July, when only a few stray seedlings growing in moist-shady habitats appear to flower and fruit normally.

The plant is tonic and deobstruent in hepatic and spleen enlargements, emetic; plant juice in combination with aromatics administered for catar and jaundice; leaves are applied in scorpion bite; leaf juice along with honey is used as remedy for catarrh to infants; root-emetic, purgative, applied externally as antiseptic, to ulcers and wounds in cattle. The plant is a source of black stain used to colour the hair; a black- bluish dye is used by some races in India for tattooeing after puncturing the parts of skin; decoction of leaves in water is spread over the head of new born child to stimulate the growth of the hair: used by elderly women who wash hair with the mixure in order to remain young, the decoction being mixed mostly with coconut oil.

Elephantotopus scaber Linn.- This is dichotomously branched strigose scabrid villous rigid herb plant bearing alternately arranged radical leaves which are obovate-oblong, crenate and few cauline and sessile leaves; its larger leaves lie flat on the ground and it has a tuberous root from which it regenerates when the shoot is removed. Heads are homogamous of 2 -5 flowers collected into a 2.5+2 . cm. head like cluster that is surrounded by cordate leafy bracts; involucre compressed, bracts about 8, dry, stiff, alternately

flat and conduplicate, pungent; receptacle naked; flowers are all equally 4-lobed and cleft on one side and with the lobes spreading somewhat palmately; anther bases obtuse; style arms subulate; achenes are hairy,truncate, 10 ribbed; pappus of 4-5 rigid bristles slender and dilated at the base.

It is a common weed of lawns, gardens, cultivated grounds and waste lands in moist and shady places. The plant is astringent,cardiac, tonic, alternative, febrifuge in snake bite; decoction of roots and leaves emollients given in dysuria, diarrhoea, dysentery and in swellings and pain in stomach; root is given to arrest vomitting, powdered with pepper applied to toothache;bruised leaves boiled in coconut oil and applied to ulcers and eczema. It is also diuretic.

Erigeron Canadensis Linn.- It is a tall glabrous profusely branched above, stoutly robust, chairy and leafy herb growing upto 1 m. tall; leaves are narrow, entire, linear-lanceolate, alternate, ciliate and acute. Heads are yellowish, heterogamous, numerous, upto 6 mm. across, peduncled in elongated branched panicles; involucral bracts acuminate, narrow, glabrate; ligules are pale rosy or purplish, scarcely exceeding the pappus; ray florets in several rows 6+1 mm. in diameter, white, female, with very slender ligules; disc florets 1mm. diameter, perfect pale yellow, tubular, 5-cleft; style flattened, army tips lanceolate; anthers blunt at base and entire.Achenes are flat nearly glabrous, obovoid, hairy and narrow; pappus double, outer of a few short hairs or bristles and grey coloured.

Flowers and fruits from April to June

It occurs in moist shady habitats, along building wall; near cultivated grounds, fields, lawns, kitchen gardens etc.

The plants are astringent, stimulant, haemostatic and diuretic; used in diarrhoea, dysentery, internal haemorrhage, gonorrhea, bronchial catarrhal and cystitis and other urinogenital diseases.

Erigeron bonariensis Linn (Syn. Elinifolius Willd).- It is a very strong, stout, deep rooted, hispid herb, 60+10 cm. tall, profusely branching right from the base; stem and branches covered with a crowded closely set mass of ascending leaves; leaves alternate, sessile some lower ones stalked, broad, coarsely toothed (serrated here and there); linear, entire, thick and dark green. Heads are numerous on slender stalks forming a leafy corymbose panicle, 6-12 mm. across, haterogamous, subpaniculate; ray florets pale purple or whitish, many serriate, fertile, ligule slender pappus slightly exceeding disc florets fertile, tubular, corolla pale yellow, and 5-cleft. Achenes are oblong, slightly curved, brown, laxly hairy, narrow, nearly glabrous; pappus two rowed, outer of a few short hairs or bristles.

Flowers and fruits in summer and rainy season

It grows gregariously in gardens, lawns, along roadsides, cultivated abandoned fields, in grass-lands, along field borders, channels, canal banks, bunds etc.

General

Gnaphallium Indicum Linn.- The plant is slightly bent, white-wooly, polymorphic, cottony-soft,

fleshy herb; leaves are alternate, linear, obovate or spathulate, apiculate, entire; heads are small, pale brown, clustered in branched, leafy spikes forming ovoid paniculate clusters, heterogamous, disciform florets all fertile, seriate, filiform, 3-4 toothed; disc florets fewer, slender, limb 5 toothed; anther bases sagittate cells with slender tails; style arms of truncate or capitate; involucral bracts linear oblong acute,light reddish-brown or yellowish, many seriate, scarious; achenes are ovoid, very minutely papillose; pappus hairs are not coherent at the base, one serritute slender and caducous.

Flowers and fruits from January to April

It is common winter weed of cultivated fields,

grasslands, lawns, gardens, wastelands, along foot paths, roadsides, along canal banks etc. It is distinct from most probably of this species which is much slender, thicker and taller, found in moist and shady habitats below trees and in crop fields.

Gnaphallium Iuteo-album Linn (Syn. G. affne D. Don; G. Luteo album Var. pallidum Hook)._ The herb is white, quite variable, annual, wooly producing, ascending branches; leaves are alternate, entire, oblong-subspathulate, semi-amplexicaul, wooly on both the surfaces; obtuse upper lanceolate, acute semi-amplexicaul. Heads are small, pale-brown, lightly coloured leaflets in dense, corymbose, glistening clusters, heterogamous; disciform flowers all fertile, filiform, 3-4

toothed, disc floret slender, limb dilated, 5-toothed; anther bases sagittate, cells with slender tails, truncate or capitate; involucral bracts oblong, obtuse, many serriate and scarious. Achenes are brown-oblong, tubercled with minute curved bristles; pappus are hairy, one serriate, slender and caducous.

Flowers and fruits from March to May

It grows frequently along the banks of pools, puddles, ponds, canals, on moist-silty or loamy soils, in low lying areas, along foot paths, road sides, cultivated fields and gardens but mostly in shady areas. There seems to be a natural interspecific hybridization between the above two species as most probably their hybrids were also detected adjoining National

Dairy Developlment Institute, Karnal.

Launaea aspenifolia Hook.- A perennial glabrous herb flowering and fruiting throughout the winters; leaves are sessile of shortly petioled narrowly obovate; these are sinuate-lobed or pinnatified; cauline, few, mostly radical; floral shoots many from the base (root) ascending branches almost naked, dichotomous, divaricating or paniculately branched, peduncles with usually one or two subulate bracts; involucral bracts quite glabrous, cylindrical, many seriate, herbaceous, margins membranous outer involucral bracts small, inner linear, margins membranous sub-equal; anther

bases sagittate, auricles setaceous; style arms slender; achenes minute pale, columnar, angled and ribbed; ribs rough, much shorter than pappus, truncate at both the ends, not beaked: pappus white, soft and silky, deciduous, many serriate, simple, slender, white, all connate at the base into a deciduous ring.

It is a common plant in cultivated and fallow fields, in abandoned land, in waste ground, dry places on gravelly soils, on heaps, of old constructions materials, on dunes and mounds of waste, rubbish, cinder and sand. The roots in combination with other drugs given as lactagogue.

Launaea nudicaulis Hook.- It is a glabrous and annual herb with yellow juicy roots, thin wiry stems and broad oblong pinnatified, sinuately lobed, radical leaves having runcinate lobes or irregular lobes or sharply toothed and cartilaginous lobes. Floral shoots naked, decumbent or spreading irregularly branched, procumbent long, fligliform, rooting and leafing at the nodes; heads yellow, narrow, sessile solitary or clustered subracemose and terminal; involucral bracts with white membranous margins; outer intermediate longer, or short-ovote inner long linear, mid rib at the base hardening in fruit; anther bases, sagittate, auricles setaceous; style arms slender; achenes columnar, thickly ribbed, outer compressed much shorter than the pappus; pappus white and silky, straight and truncate at both the ends.

It is a common weed of moist and shady habitats growing in lawns, gardens, fields, field borders, along bunds, near water recourses and water channels. It is also found in waste lands, abandoned fields, grasslands, and near deposits of cinder and rubbish etc.

Its leaves when applied to the head of suffering children serve as a cure for high fevers.

Pluchea lanceolata CI.- The plant grows tall upto 1 m. erect robust, hoary-pubescent, profusely branched herbaceous erophytic shrub; leaves sessile, thick, coriaceous ascending oblanceolate, pungent, quite entire, strongly nerved; pale when dry and with distinctly strong very oblique nerves on both surfaces; heads pinkish or light purplish , born in terminal leafless compound corymbs, heterogamous, disciform, liliac, outer floret, many serriate, fertile, filiform; disc florets to few; sterile tubular limb involucre many serriate, outer bracts purple tinged, short rounded obtuse, contracted at the mouth; outer bracts ovoid, hoary, many serriate, tinged with purple, dry rigid; receptacle flat, naked ; anther bases sagittate cells tailed; style arms, entire, bifid. Achenes are minute, narrow, subterate angled, truncate at both the ends, ribs 4-5(4-5 angled), stout, closely set; pappus copious, hairs many seriate, simple, very slender and connate at the base into a deciduous ring.

General

Flowers and fruits from March to August

This is an aggressive weed growing along foot paths, lawns, gardens, roadsides, field borders, bunds, field partitions; on abandoned fields, waste lands, mounds; on slopes and deposited soils it forms quite thick gregarious patches. It grows in dry exposed habitats as well as in moist and shady habitats, in former habitat it is a typical shrub but in the latter habitat it is a mere fragile herb.

Leaves aperient,substitute for senna, eaten raw or cooked, also as tea; it stimulates perspiration in fever.

Sonchus arvensis.- It is perennial erect and tall glandular-hairy herb, having deep vertical roots that creep below the ground and a hollow stem umbellately branched and glabrous below. Leaves are prickly margined, lower leaves oblong, rencinate, pinnatifid, margins aciculate; upper lanceolate, acute, amplexicaul with cordate appressed auricles; the lower and middle ones usually pinnately lobed becoming less lobed more strongly auriculate upwards, the upper reduced and distant. Heads are yellowish white, umbellately corymbose, ovoid campanulate-cylindric,

3-5 cm. wide. Fruiting involucre 15-22 mm., involucre and peduncles copiously hairy and provided with coarse spreading gland tipped hairs , the involucre with small and obscure tufts of tomentum as well, imbricate; florets 12 mm. long, pale yellow. Achenes dark brown , compressed, ovoid, 2.5-3.5 mm. long 0.7 mm. wide with prominent ribs on each face, strongly transversely rugulose. Pappus are copious, hairs many serriate, slender, simple, whitish, united at the base into a deciduous ring.

Flowers and fruits from January to April

It is a common weed of arable and waste lands, abandoned fields, deserted areas, near old temple buildings, in moist and shady as well as in dry hot place. Its latex finds use in some eye troubles. Roots are given in jaundice. Plant- cooling, sedative, diuretic, diaphoretic, antiseptic, hypnotic, expectorant useful in the treatments of the coughs in bronchitis, asthama and pertussis; decoction of seeds used as demulcent; grains contain alkaloid bitter substance lactucin; fresh plants contain oxalic acid and lactacpricrin etc.

Sonchus asper (Linn) Hill (Syn. S. oleraceous var. asper Linn).- A tall thin erect annual stout glabrous or sparsely glandular above subumbellately branched herb, it has semiamplexicaul leaves, slightly wrinkled about the midrib, lanceolate, rencinate (or obovate and lobeless), lateral lobes pointing downwards, basal lobes acute, terminal lobes rather small, spiny or aciculate on the margins; upper leaves with blunt, orbicular appressed auricles. Involucre are ovoid, campanulate often dilated thickened and conic at the base; bracts many serriate, imbricate herbaceouslouter smaller, receptacle flat and naked. Floral are heads in umbellate cymes, much crowded, yellow ovoid, 20 mm. diameter, forming a many flowered terminal corymb. Achenes

have 3-5 ribbed on each face, slightly compressed ellipsoid, not rugulose although there may be minute projections from the marginal ribs, compressed with longitudinal ribs but without transverse wrinkles surmounted by a white pappus of hair. Pappus are copious hairy, many serriate, slender simple usually white and united at the base into a deciduous ring.

Flowers and fruits from November to March

It occurs in dry hot habitats in wastelands, abandoned grounds, along wall of field borders, lawns etc.

The plants are pounded and applied to wounds or boils in villages.

Sonchus oleraceus Linn.- It is an erect annual, 90+5 cm. tall herb having a short tap root; stem glabrous except sometimes a few spreading gland tipped hairs on the involucre and peduncle. Leaves are dark green having very small closely placed teeth, lowermost prominently auriculate, auricles well rounded but eventually sharply acute, lower leaves not wrinkled about the midrib, obovate; auricles spreading, and margins weakly or sparsely prickly, leaves are progressively less divided upwards and reduced. Heads are several, born in umbellate cymes or in corymbiform inflorescence, ovoid, cylindric; florets 15-2-5 mm. wide, ligulate, 16 mm. long, ciliate, pale yellow; involucral bracts glabrous, 9-13 mm., lanceolate, imbricate; achenes 2.5-3 mm, 3-5 ribbed on each side but mostly 3 ribbed, muricate, with longitudinal ribs and transverse wrinkles surmounted by a white pappus of simple hairs; pappus copious, hairs many serriate, white, united at the base into a deciduous ring .

Flowers and fruits from November to April

Occurs in close association with S. asper Gum formed by evaporation of the juice of the plant is a powerful hydragogue

cath, infusion of root and leaves is a tonic and febrifuge, used as vegetable by the Laps, occasionally consumed as pot herb. In some parts of Switzerland the plant is collected as food for feeding commercial edible snails; its juice is recommended for ailments of liver and abdomen; as a food for swines, grat and rabbits.

Taraxacum officinal Wigg.- It is tap rooted perennial, lactiferous, scapose herb having basal leaves, glabrous crown and scapeaus wooly vertical root. It grows erect from the centre of a rosette of leaves. Leaves are commonly sparsely hairy beneath and on the mid rib, otherwise generally glabrous or sometimes completely so, oblanceolate, runcinate-pinnatifid or lobed, the terminal lobe tending to be larger than the others, tapering to a narrow, obscurely winged petiolar base. Scape 5-50 cm, glabrous or villous especially upwards; heads are usually large, solitary; receptacle flat and naked, yellow flowered, 15-35(27+2) mm. across, on leafless simple spikes;

General

the involucre mostly 1.5-3.5 cm. the inner bracts 13-20; these at first are erect but soon becomes reflexed finally thickned and clawed at the tip; outer involucral bracts are a little shorter and scarcely wider than the inner ones, reflexed; the mature achenes and pappus then form a conspicuous ball; body of the achene 3-4 mm, pale grey-brown to olive-brown or stramineous muricate above or sometimes to near the base, the beak 2. 5-4 times as long as the body; pappus white, copious and hairs simple unequal.

It is generally found in pastures, lawns, wastelands, field borders, along bunds,building walls, road sides, foot-paths,etc.

Root-diuretic, tonic aperient, used as remedy for chronic disorders of kidney and liver; cultivated as vegetable in some parts; used as salad as greens or when bleached; ground roasted roots are sometimes used as substitute for coffee; leaves are used for fomentations. A bitter crystalline principle taraxacin (inulin) and a crystalline substance taraxaceri then, phytoserols and taraxasterols and homotaraxasterol also present in the drug; certain useful saponins have also been detected recently.

Tridax procumbes Linn.- A much variable commonly found erect, hispid herb, its leaves are ovate or lanceolate, dentate or pinnatisect, opposite having a few segments which are narrow. Heads are creamy or whitish, very long, slender, solitary, peduncles, heterogamous, rayed, ray-florets, fertile, ligulate or 2-lipped with the outer lip large, 3-fid, the inner small, ligulate or 2-lobed , ligules of ray florets quite large; disc florets bisexual, fertile, tubular, limb elongate, 5-rid; involucral bracts few seriate, outer short broad, herbaceous, receptacle flat or convex; anther bases with short, acute auricles; style arms of hairy above and tips subulate. Achenes are brown, turbinate or oblong, silky; pappus long and shinning of aristate feathery bristles, awned and plumose.

Flowers and fruits from January to May

It grows in open and dry habitats, in wastelands, abandoned fields, deserted areas, grasslands, fallow fields, lawns, gardens, along roadside, foot-paths and canal banks. It is a very commonly seen plant over the walls of old monuments, ancient buildings, temples, old walls etc.

Vernonia cinerea (Linn) Less (Syn. Conyza cinerea Linn).- A tall upto 1m. even, huge profusely branched, erect-prostrate, annual- perennial herb, exhibits great variation in morphology, phenology and in ecological habitats, perhaps comprises of many biotypes and ecotypes. There seems to be some introgression between the various forms also . Leaves are ovate-lanceolate; heads homogamous, distinct, many flowered, pink, violet or rosy pink or liliac in corymbs about 1+0.3.x0.6+0.2 cm. across-heads; florets bisexual, tubular; anthers cleft at base; achenes terret, hairy; pappus white, long copious.

Flowers and fruits throughout rainy and winter season

It is a common associate of *Ageratum conyzoides* Linn and both occur in similar habitats.

Plant is considered diaphoretic; used in decoction to promote perspiration in febrile condition: used as a remedy of spasm of the bladder and strangury; juice of the plant is given in piles, root given for dropsy; flowers administered for conjunctivitis; seeds used as anthelminthic, alexipharmic and as a constituent of masalas for horses.

Vicoa indica (Willd) DC(Syn. Inula indica Willd; Vicoa auriculata Cass).- A tough tall, erect, much branched robust rigid herb; leaves are sessile, lanceolate, basal auricles rounded or hastate; floral heads bright yellow, 10+3 mm. in diameter, heterogamous; involucral bracts erect; pappus of ray florets absent, of dis florets few (scanty) and hairs slender.

Flowers and fruits from October to March

It occurs in exposed and dry habitats, abandoned fields, waste lands, around old buildings, walls, temples, on waste refuses, old deposits of rubbish and soil, heaps and mounds.

Vicoa vistita Benth ex Hook(Syn. Inula vestita).- An erect, wooly, soft fleshy, hairy, faintly scented herb having a reddish tinged stem; leaves are sub- acute from a broad auricled base, serrate, broadly auriculate, heads are bright yellow, corymbose, heterogamous, radiate; involucral bracts squarrose, tips filiform, recurved, numerous, narrow ligules: achenes oblong-cylindric, subsilky, sparsely hairy; pappus are scanty.

Flowers and fruits from March to May

Mostly found in waste places, on recently deposited soil, on heaps of sand, cinder, soil, rubbish etc; along water channels. In abandoned fields and waste lands it is quite gregarious.

Voluterella ramosa (Roxb) Santapau (Syn. Carduus ramosus Roxb., Voluterella duvarucata Benth and Hook).- An erect annual, straggling, stiff, dichotomously branched, it is a troublesome weed from its head with spiny involucral bracts; possesses a white tomentose rough stem, angled smooth or scabrid branches; leaves are sessile but quite variable, alternate, spreading, obovate-lanceolate, usually pinnatifid lobed, lobes rounded, mucronate often undulate or crisped; heads are homogamous, ovoid; involucral bracts, glabrate reddish, many serriate with a long spreading or recurved spinescent awn; receptacular bristle short; florets purplish; corolla straight, pale- purple; achenes light brown, 4-5 angled narrow, *acutely* angled grooved (striate) punctate between the angles, base narrow, aerole small, laterally deeply excavated, top broad-truncate; pappus spiny of many unequal, scaberulous hairy, slivery-brown; 3 or 4 innermost flattened and long.

General

Flowers and fruits in winter

These are common in dry waste-lands, deserted areas, along bunds, railway lines, near ancient building walls, temple gates, on deposits of soil, cinder, sand, *kankar* etc.

The plant is used as blistening agent.

Xanthium strumarium Linn Var. strumarium.- A scabrous, erect, herbaceous- undershrub, grows upto even 2m. tall, having appressed hairy or subglabrous stem; leaves scabrid, triangular, cordate or orbicular lobed or toothed irregularly toothed, long petioled, base cuneate, alternate; heads axillary monoecious in recemes of 2 forms, male above, female clustered at the base, in several short axillary inflorescences; involucre of heads short bracts few, 1-2 serriate, narrow; receptacle cylindric with hyaline paleas enclosing the flowers

involucre of heads with the bracts united into an ovoid 2-beaked, herbaceous auricle with 1-2 fid celles, clothed with hooked bristles; filaments monoadelphous anthers free, bases obtuse tips mucronate and inflexed. Fruiting involcres clothed with stout hooked prickles, broadly cylindric to ovoid or sub- globose, straight beaked and yellow green.

Flowers and fruits from October to June mostly, although many stray plants of the species flower all through the year here and there.

It is the most predominant plant of waste places, abandoned lands, fallow fields, gardens, neglected fields; along bunds, field borders, foot-paths, roadsides grass-embankments; near water channels, margins of pools, puddles, canals; upon deposits of soil, cinder, sand, rubbish, etc; in backyards of houses; in compounds of old monuments, temples, buildings etc. Along railway lines it forms a continuously gregarious pure linear patches. Infact it seems to grow anywhere and everywhere.

The plant is diaphoretic, diuretic, sedative, sudorfic, sialagogue; also cosidered useful in long standing cases of malaria; roots bitter, tonic useful strumous, diseases and cancer; fruits cooling, demulc, given in small-pox; it is an adulterant of *Datura strumarium* Linn.

Fauna

In olden times, lions and tigers were not uncommon. The Nardak area of the then Karnal district was once a favourite spot of the Mughal emperors for hunting lions and tigers. Francois Bernier states that "lions which were scarce in India except in Kathiawar were still found in this area and that lion hunting as a sport was the privilege of the emperors[1]". As late as 1827, Archer says that lions were some times seen[2] within a 20-mile (32-kilometre) radius of Karnal while tigers were exceedingly numerous in its immediate vicinity. These species completely disappeared."

1. Francois Bernier: *Travels in the Mughal Empire*, 1891,pp. 378-79.

2. Archer's *Tours in Upper India and in parts of the Himalayan Mountains*, 1833.

As already stated, there was a time when dense jungles harboured various kinds of wild birds and animals. But with the growth of communications,clearance of jungle, increase in irrigational facilities and extension of cultivation, the rich stocks have considerably dwindled; nonetheless the areas of Karnal, Panipat, Kaithal and Kurukshetra still hold a good position as regards the stock of wild life. In the Kaithal district and the area bordering Jind territory, black buck and chinkara are still available, though not in plenty. Hog deer which was once quite abundant in swampy parts and along the banks of the Yamuna, is now available in traces only.

Grey partridges are sufficiently available throughout Haryana except in *Khadar* areas. Black partridges are found along the bank of the canal irrigated and riverain areas. Hares are commonly available. Peafowl is abundantly available in the cultivated fields in groves and orchards. Blue rock pigeons are also commonly noticed . Common quails come with the ripening of wheat crop. The *jheels* abound in ducks and geese. The pintail, mallard, pochard, shoveller, teals, comb-ducks, spot-bills and geese are the common species of ducks available. The grey-leg goose is to be found on the large marshes and black-barred goose is to be seen on river side. The jack snipes are also available in the rice fields of Karnal and Kurukshetra areas. The pelicans, cranes, perons, bitterns and many sorts of waders cover *jheels; saras* and *kunj* are particularly conspicuous.

The old history of fauna pertaining to old district of Rohtak is worth-mentioning. Early in the 20th century, the Rohtak area was well-known for its large herds of antelope (black-bucks) and gazelle. As no Hindu would kill them and gun-licences were rare, the herds in some parts were very numerous. Now position changed.

The position of game birds, given by the Deputy Commissioner and Settlement Officer, Rohtak in 1910 is as

under :-

"Of game birds, the black partridge, snipe, duck, geese, teals and cranes are common in suitable localities. The grey partridge, common sand grouse and quail may be found all over the district, though quails are no where plentiful.The imperial sand grouse is not uncommon and bustard are said to be occasionally found. Peafowls run wild every where, but the people, even Muhammadan Rajputs, object to their being shot. Birds of all kinds are extraordinary common in the district and many of them are of singularly brilliant plumage".

Generally, three kinds of ducks are met with in the State, *viz,* divers, dabblers and mergansers with saw-like bills. Besides, there are other types which visit the *jhils* and ponds in winter from distant lands beyond Himalayas. Of these mention

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may be made of Brahminy duck or ruddy sheldrake *(Chakwa)*, common teal, gargeny teal(vegetarian), pintail, gadwall, widgeon, shoveller, pochard, mallard, etc.

The geese found are also of three types, *viz*. grey leg, bar-headed and large white-fronted. Duck and geese are found in the *jhils* and ponds in general and particular in the *jhils* and ponds at Kiloi, Dhamer, Ladhod and Nayabas villages of Rohtak tahsil; Raiya Dawla, Bakra and Dhurana in the Jhajjar tahsil; Kheri Sargthal, Rana Kheri, Bhainswal, Mundlana and Bali in the Gohana tahsil and Dobeta, Sersa, Khubra, Barwasni and Murthal in the Sonipat tahsil. Snipes, cranes and coots are found near lakes and ponds along with ducks and geese. The green pigeons are greenish-yellow, olive-green and ashy-green with black patches on the shoulders and yellow bars on the blackish wings. They are

found on banyan, *peepal, beri* or fig trees. Blue rock pigeon is commonly found throughout the State.

There is no shortage of peafowl. Common sand-grouses are found in open, barren plains, stubble fields and land away from water. They come to drink water regularly in the morning and at sun-set.

Apart from the game birds described above, there are numerous other common birds such as sparrow, crow, kite, vulture, babbler, kingfisher, hornbill, egret, heron, stork, tit, bulbul, cuckoo and the dove. *Baya*, tailor-bird, is also common in Haryana State. It mostly makes its nests in the trees of *kikar* which are in abundance.

The other common birds which can be seen everywhere are large Indian parakeet, rose-ringed parakeet, blue cheeked bee-eater, coppersmith, Indian golden oriole, pied crested cuckoo, *koel,* crow pheasant, red-vented bulbul, white-eared bulbul, verditer flycatchers, Indian magpie robin, Indian purple sunbird, Indian spotted munia and crested bunting. Besides such attractive birds as hoopoe, Indian white eye is also seen in and around villages.

There are some categories of birds, which fall under the class of birds of economic importance. Such birds are: The Indian scavenger vulture, besides feeding on dead animals, consumes a large quantity of human excreta. Predators like black winged kite, Indian shikara, lagger falcon & keatrel are resident birds. Others like pale harrier & eastern steppe eagle visit the state in winter season. These along with spotted owlet and eagle owl keep a check on the population of not only rodent pests but also various insect-pests by consuming them.

The pariah kite, brahminy kite, white backed vulture, tawny eagle, Indian jungle crow and Indian house crow keep the area cleared of dead animals by feeding on them.

The insects and caterpillars harmful to agriculture are consumed by the large number of birds. Swifts such as Indian house swift, Indian palm swift and swallows

like western swallow use the insects as their staple diet. Shrikes or butcher birds as they are popularly called, feed upon a considerable quantity of insects. Some other insect-eating birds are king crow, brahminy myna, Indian pied myna, bank myna, babblers,warblers and fly catchers of various species. Larks and wagtails feed upon a considerable amount of worms in addition to insects. Rosy pastor and common Indian starling which are winter visitors may specially be mentioned for their role in destroying numerous insects including grass-hoppers on a large scale and thus helping in saving crops to some extent.

Under the highest category of mammals, the common *langur* and *bandar* are the main species.The tiger and leopard are no more seen in the state. But some times the leopard may be seen near Kalka or hilly areas. Some other carnivorous animals which may be available in the state: the jungle cat , the small Indian civet, the common mongoose, *giddar* and the Indian fox. Only one species of shrew and two species of bats, the common yellow bat and the tickells bat are found here. The five striped palm squirrel or *gilheri,* the Indian porcupine or *sehi*, the Indian gerbille, the common house rat, the house mouse and the Indian hare comprise the rodent fauna.

Reptiles

The common lizards of the area are the house lizards found in the buildings and the blood sucker or garden lizard is met with in hedges and bushes. Besides tortoise, there are three kinds of frogs; the paddy-field frog and the skipping frog. The Indian toads are there.

The important varieties of food fish available in the state are as under:-

1. **Rohu.-** It is a column-bottom feeder and grows to 3 feet or more in length. It is a very popular variety.

2. **Kalbans.-** It is relatively slow growing and attains a size of three feet.

3. **Thaila.-** It is a surface feeder and fast growing carp fish in India. It is quite popular when exceeding two feet in size. The specimens, reaching upto six feet, are rare.

4. **Mori.-** It is a bottom feeder and grows to three feet or more.

5. **Mahaseer.-** It grows upto 5½ feet in length. It is premier sporting fish of India. It travels towards the headwaters at the beginning of the rains, and travels down- streams afterwards.

6. **Malli.-** It is predaceous and piscivorous fish and grows to the size of about six feet. It is a good game fish.

General

7. **Gonch.-** It grows upto six feet in size and is probably the largest fish caught on rod and line in India.

8. **Silond.-** It prefers strong and clear deep waters. It grows upto a size of 6 feet, and is considered good for eating.

9. **Seenghla.**- It attains a length of over four feet.

10. **Moh.**- It is a game fish growing to about 1-1/ 4 feet in size.

The other kinds of fish are : *Seenghari, Tengara, Khagga, Moh, Pari, Saul, Daula, Karrar, Dauli,* and *Groj*. Besides, there are hill stream fishes in Ambala district (now Panchkula). The feather back fish *katla* and *bata*, and the snake head fishes such as *dolla* and curd are found in Sirsa district.

Goh and Bis-cobra type of lizards are found in Gurgaon area, *girgit* and mongoose are in plenty. There are different kinds of snakes, and scorpions. Cobra and Bis sanda species of

snakes are found. *Bis sanda* is known as Daboia. The common poisonous snakes are Krait, viper and *phoors* which are found in Mahendragarh and Narnaul area. The non-poisonous snakes are blind snakes , Indian python, sand boa, wolf snakes and rat snakes of the Mahendragarh district.

There are many kinds of scorpions in the State. A very dreadful scorpion is found in the hilly area of Kapuri village near Charkhi Dadri in Bhiwani district. It can cause death of a person. The centipeds are very common in Charkhi Dadri tahsil of Bhiwani district.

The zoological names with English names of the fauna are listed below :-

English name Zoological name

1. Spotbill duck *Anas pceilorthyncha*

2. Cotton teal *Nettapus coromandelianus*

coromandelianus
3. Tree duck *Dendrocygna javanica*

4. Dabchick *Podiceps refcollis*

5. Eastern greyleg goose *Anser anser rubrirostris*

6. Barheaded goose *Anser indicus*

7. Brahminy duck *Tadorna ferruginea*

8. Pintail *Anas acuta*

9. Mallard *Anas platyrhynchos*

10. Gadwall *Anas strepera strepera*

11. Common teal *Anas crecca crecca*

12. Wigeon *Anas penelope*

13. Blue winged teal *Anas querquedula*

14. Shoveller *Anas clypeata*

15. Common pochard *Aythya ferina*

16. Ferruginous duck *Aythya nyroca*

17. Tufted duck *Aythya fuligula*

18. Black partridge *Francolinus francolinus asiae*

19. Grey partridge *Francolinus pondicerianus*

Interpositus
20. Grey quail *Conturnix conturnix conturnix*

21. Rain quail *Conturnix coromandeliea*

22. Jungle bush quail *Perdicula asiatica punjaubi*

23. Rock bush quail *Perdicula argoondah*

24. Western turtle dove *Streptopelia orientailis*

25. Indian spotted dove *Streptopelia chinensis suratensis*

26. Senegal dove *Streptopelia senigalensis*

27. Indian emerald dove *Chalcophas indica indica*

28. Indian sandgrouse *Pterocles exustus erlangeri*

29. Black bellied sandgrouse *Pterocles orientalis orientalis*

30. Pintail sandgrouse *Pterocles alchata caudacutus*

31. Spotted sandgrouse *Pterocles senegallus*

32. Large cormorant *Phalacrocorax carbo sinensis*

33. Little cormorant *Phalacrocorax nigar*

34. Snake bird *Anhinga rufa melanogaster*

35. Eastern grey heron *Ardea cinerea rectirostris*

36. Paddy bird *Ardeola grayi*

General

37. Eastern large egrets *Egretta alba modesta*

38. Median egret *Egretta intermedia intermedia*

39. Little bittern *Ixobrychus minutus*

40. Cattle egret *Bubulcus ibis coromandus*

41. Eastern common crane *Grus grus lilfordi*

42. Demoiselle crane *Anthropoides virgo*

43. Indian sarus crane *Grus antigone antigone*

44. Painted stork *Ibis leucoceohalus*

45. Openbill stork *Ananstomus oscitans*

46. White ibis *Thereskiornis melanocephala*

47. Blacknecked stork *Xenorhynchus asiaticus*

48. Indian black ibis *Pseudibis papillosa papillosa*

49. Eastern Baillon's crake *Porzana pusilla pusilla*

50. Spotted crake *Porzana porzana*

51. Slaty legged banded crake *Rallina eurixzonoides amuroptera*

52. Northern Ruddy crake *Amaurornis fuscus bakeri*

53. White breasted water-hen *Amaurornis pheonicurus*

54. Water cock *Gallicrex cinerea cinerea*

55. Indian moorhen *Gallinula chloroprins indica*

56. Coot *Fulica atra atra*

57. Dusky redshank *Iringa erythropus*

58. Eastern Redshank *Iringa totanus eurhinus*

59. Marsh sandpiper *Iringa stagnatilis*

60. Green shank *Iringa nebularia*

61. Green sandpiper *Iringa ochropus*

62. Wood sandpiper *Iringa glariola*

63. Common sandpiper *Iringa hypoleucos*

64. Pintail snipe *Capella stenura*

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65. Fantail snipe *Capella galinago*

66. Temmincks stint *Calidris temminchii*

67. Pheasant tailed Jacana *Hydrophasisanus chitur gus*

68. Painted snipe *Rostratula benghalensis*

69. Indian blackwinged stilt *Himantopus himantopus himantopus*

70. Indian river tern *Sterna aurantis*

71. Black bellied tern *Sterna acuticauda*

72. Indian whistered tern *Chlidonats hybrida indica*

73. Indian pied kingfisher *Ceryla rudis leucomelanura*

reichenbach
74. White breasted kingfisher *Haleyon smyrnensis smyrnensis*

75. Indian small blue kingfisher *Alcedo atthis bengalensis*

76. Common peafowl *Pavo cristatus*

77. Large Indian parakeet *Psittacula eupatria*

78. Rose ringed parakeet *Psittacula kramari borealis*

79. Indian house crow *Coryus splendens splendens*

80. Indian house sparrow *Passer domesticus Indicus*

81. Blue cheeked bee eater *Merops superciliosus*

82. Golden backed woodpecker *Dinopium benghalensis*

83. Blue Jay *Corais benghalensis benghalensis*

84. Coppersmith *Megalatma haemaoephala*

85. Indian golden Oriole *Oriolus oriolus kundoo*

86. Pied crested cuckoo *clamator lacobinus serratus*

87. *Koel Eudynamys scolopacea*

88. Common crow pheasant *Centropus sinensis sinensis*

89. Rediented Bulbul *Pycnonotus cafer*

90. White eared bulbul *Pycnonotus leucogenys*

91. Verditer flycatcher *Muscicapa thalassina thalassina*

General

92. Indian magpie robin *Copsychus svecicus svecicus*

93. Indian purple sunbird *Neetarania asiatica asiatica*

94. Red munia *Estrilda amandava amandava*

95. Indian spotted munia *Lonchura punctulata punctulata*

96. Crested bunting *Melophws lathami*

97. Hoopoe *Upupa epops*

98. Indian white eye *Zosterops paepebrosa paepebrosa*

99. Parriah kite *Milvus migrans*

100. Brahminy kite *Haliastus Indus indus*

101. White backed vulture *Gyps benglensis*

102. Tawny eagle *Aguila rapa vinahiana*

103. White eyed buzzard eagle *Butastur teera*

104. Indian jungle crow *Corvus macrorhynchos culminaters*

105. Indian scavenger vulture *Neophron percnopterus givginianus*

106. Black winged kite *Elanus caeruleus vociferus*

107. Indian shikara *Accipiter bodius dussumieri*

108. Lagger falcon *Falco biarmicus*

109. Kestrel *Falco tinnunculus*

110. Marsh harrier *Circus acruging sus aeru ginous*

111. Eastern steppe eagle *Aguila nipalensis nipalensis*

112. Spotted owlet *Athena brama*

113. Eagle owl *Bubo bubo*

114. Indian houseswift *Spus affinis affinis*

115. Indian palm swift *Cypsiurus parvus batasiensis*

116. Western swallow *Hirundo rustica rustica*

117. Indian wire tailed swallow *Hirundo smithi filifera*

118. King crow *Dicrurus adsimilis albirictus*

119. Brahminy myna *Sturnus pagodarum*

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120. Indian pied myna *Sturnus contra contra*

121. Indian myna *Acridotheres tristis tristis*

122. Bank myna *Acridotheres giniginianus*

123. Rosy pastor and starling *Sturnus roseus*

124. Common Indian Krait *Bungarus caeruleus*

125. Indian Cobra *Naja naja*

126. Russels viper *Vipers russelli*

127. Phoorsa *Echis carinalus*

128. Blind snake *Typhlops porrectus*

129. Indian python *Python molurus*

130. John's sand boa *Eryx johni johni*

131. Wolf snake *Lycodon straitus*

132. Rat snake *Plyas mucosus*

133. Common lizard *Hemidactylus brooki*

134. *Girgit Calotes versicolour*

135. *Sanda Uromastix hardwicki*

136. Tortoise *Kachunga dhongoka*

137. Indian bull frog *Rana tigrina*

138. Indian cricket frog *Rana Limoncharis*

139. Indian burrowing frog *Rana breviceps*

140. Common toad *Bufo melanostictus*

141. Parri *Notopterus notopterus*

142. Katla *Catla catla*

143. Mrigal *Cirrhinus mrigala*

144. Bata *Labeo bata*

145. Kalabans *Labeo rohita Calbasu*

General

146. Rohu *Labeo rohita*

147. Ruthia *Puntius sarana*

148. Magur *Clarias batrachus*

149. Singhara *Aovichihys seenghala*

150. Ghally *Qmpok bimaculatus*

151. Mallee *Wallago attu*

152. Dolla *Channa punctatus*

153. Curd *Channa striatus*

154. *Bandar Macaca mulatta*

155. Common langur *Presbytis entellus*

156. Tiger *Panthera tigris*

157. Leopard *Panthera pardus*

158. Jungle cat *Felis chaus*

159. Indian small civet *Vivericula indica*

160. Common mongoose *Herpestes edwardsi*

161. Jackal *Canis aurius*

162. Indian fox *Vulpes benghalensis*

163. *Chucchunder Suncus murinus*

164. Common yellow bat *Hespero Scoteshilus*

165. Tickelli's bat *Hesperoptenus tickllli*

166. *Gilheri Funam bulus pennati*

167. Indian porcupine *Hystrix indica*

168. Indian gerbille *Tetera indica*

169. Common house rat *Rattus rattus*

170. Mouse *Mus musculus*

171. Indian hare *Lepus nigricollis*

172. Chinkara *Gazella gazella*

173. Black buck *Antelope cervicapra*

174. Blue bull *Boselaphus tragocamelus*

As per the above account, it has been proved that Government is making vigorous efforts to preserve the wild animals in the state. Some of the noted wild animals and birds still available in Haryana, of course in lesser numbers than before, are mentioned below :-

Sambhar, barking deer, spotted deer, wild boar, black buck, ravine deer, blue bull, panther, hyena, hare, Kalij pheasant, red jungle fowl, peafowl, black partridge, grey partridge, quails, sandgrouse, green pigeon, ducks, geese, spoonbill storks and cranes, flamingo and pelican are found in the state. Certain other elegant birds and birds of common occurrence still exist here. Black partridge is a state bird.

Tiger is a casual visitor to the Kalesar forests and Aravalli hills. There are wet lands in Gurgaon, Rohtak , Sonipat, Karnal and Kurukshetra districts and offer good opportunities for water fowl study and shoot. The fauna regions of Kalka, Pinjore,Morni hills, Kalesar and Kalsia forests yet provide adequate wild life and possess good potential for future development.

The account of some important wild life sanctuaries and zoological parks and centres under the aegis of Haryana Government is as under:-

Kalesar as a wild life sanctuary

Situated on the banks of the holy Yamuna in the Shivalik foot hills, Kaleser provides a panorma of nature's beauty. Kalesar is just 130 km. from Chandigarh and can be reached *via* Nariangarh, Kala Amb, Sadhaura, Bilaspur and Chhachhrouli.

It has been recently declared as a wild life sanctuary and lot of work to protect the wild life is being carried out. Kalesar is

a reserve forest and a visitor needs to get permission in order to enter it which provides beautiful *sal* forests and the rich diversity of flora and fauna. The special mention of the flora of Kalesar is already given in the heading of `flora'.

In the Kalesar forest, one can see many species of deer, jackals and foxes and may be even leopard. A lot of animals are here. All these animals roam the Kalesar forest- including at least a dozen panthers. Tigers, too, visit the forest occasionally.

Spotted deer graze in the fire lines and sambars come out into the fields at night. Though sambars have no favourite spot in the forest. There are water holes for the animals. These water holes are not enough and animals cross over to Yamuna to drink.

One can see the red feathered jungle fowl, black partridge, grey partridge, peafowl, kalij pheasant , green pigeon, rock pigeon, bee-eater, spotted dove, hawk, cuckoo, Indian great horned owl, common myna, wagtail, white breasted king fishers in the forest .

General

If the visitors come to Kalesar forest in winter, they can find an opportunity to see the migratory birds like Surkhab pintail, common pochard, bar headed goose and comb-duck.

Snakes also live in the forest; few species being poisonous are cobras, Russels, Vipers, pitsipers and Rat snakes and large monitor lizards are also found but they are not poisonous. The place is an improtant tourist spot.

Pheasant breeding centre, Morni

Pheasants are fascinating birds, known for their brilliant plumage and elaborate courtship displays. Whether it is a Khaly pheasant or red jungle fowl, the white peacock or the normal , each is a delight to behold. These beautiful birds also occupy an imprtant niche in nature's great scheme.

Peafowls are the best known members of pheasant family and occupy a prominent place in the Indian lore. At one time these hills were home not only to the exquisite *mors* and *mornis* but to many other worthy members of the pheasant family. And even now one can see them .

At the red fort at Morni, the Haryana wild life Department has assembled a superb collection of these feathered monarchs: red jungle fowl, chir pheasant, khaly pheasant, chukor, bantam and domestic fowls. The fort has been converted into a restricted area under the Haryana Wild life Department and it is here that a painstaking experiment is under way, pheasant breeding[1].

The mother pheasants are not great home-makers. A simple scrape in the ground is good enough for their egg-laying . So, the mongoose, snake, monkey, jungle cat and monitor lizard make such holes. The number of pheasants should increase at the rate of 100 per year. But this is not so and it speaks volume for the high mortality rate of pheasant chicks. But even when bred in captivity and protected from prowling carnivores, the chicks have plenty of dangers to face.

The family *phasianidae* includes pheasants, partridges and quails. For centuries they have been game birds that have provided entertainment and food to man. Their bill is a bit like the parrot's; thick and short with the upper beak overhanging to lower one. They are not fussy eaters, seeds, tender shoots, grains, fruits and insects. They fly swiftly but only for a short distance.

The chikor prefers to rocky sides with grass and sparse bushes, and feed on grains, vegetables, leaves and grass. Another nature of this region is the chir pheasant. It stays nearer the plains than the chikor preferring altitudes of 1,500 to 2, 700 metres. The birds of breeding centre enjoy healthy diet of leaves, grass, grains, berries and poultry feed.

1. The write up is mainly based on the news-item appeared in *Chandigarh Newsline* on

October 5, 1994.

Sultanpur Bird Sanctuary

Sultanpur *jheel* is situated at a distance of almost 42 km. from Delhi and approached from Gurgaon by the old road to Farrukhnagar *via* Dhankot. The Sultanpur jheel bird sanctuary, may be well termed as a Rising star in the wild life horizon of Haryana. The *jheel* offers interesting concentration of bird life including a concourse of ducks and geese during winter, which may vouchsafe its significance as a good wild life-cum tourist spot. Necessary wild life study and tourist amenities have been provided at the *jheel*. There is a posh rest house. A wild life library and necessary catering facilities are provided in it. Binoculars are available for intending bird watchers. A *Manch* has been built for getting comfortable view of the birds and the countryside. Further development efforts are afoot. The aesthetic scene all around is fascinating. The *jheel* undoubtedly offers bright future prospects as an attractive and popular wild life study-cum tourist spot.

Thus in a suitable habitat like bird sanctuary at Sultanpur, one can see/observe more than 100 species of birds in a single day. This is one of the famous lakes in the country in so far as the variety of migratory birds is concerned. These birds come in the winter season from as far as Europe and Siberia and fly back home before the advent of the summer season[1].

The areas falling within ten kilometres around Sultanpur *jheel* bird sanctuary[2] and comprising of villages, viz. Jhunjrol Sultanpur, Iqbalpur, Farrukhnagar, Patli Hajipur, Saidpur Mohamad pur, Khetatwas, Dhanawas, Mubarkpur, Budhaira, Mamkrola, Chandu, Sadharana, Garhi Hansru, Dhankot,

Wazirpur and Hamirpur have been declared as closed area under Wild Life(Protection)Act, 1972. No hunting is permitted in these areas.

Black buck breeding centre, Pipli

Black buck is a state animal of Haryana. During the last decade, its population decreased in most parts of the state.The Central Government had decclared it as endangered specie and included in schedule-I appended to the Wild Life(Protection) Act, 1972.

During the 7th Plan breeding programme of black buck in a capacity of multiplication was undertaken at Pipli(Kurukshetra district) on the National Highaway-I, 1 kilometre from Pipli bus stand.

1. Gurgaon District Gazetteer, 1983, p. 30.

2. It is a find of Peteer Jackson, the world famous authorty on bird watching. Till then only it was a large sheet of shallow water, the sanctuary at Sultanpur lake was formerly opened as a tourist resort on February 6, 1972.

General

This project was taken up in 1981-82 and 15 black bucks were first kept there. Now the population increased to 45; thus the results are encouraging. Haryana Government has also supplied six pairs to Tripura Government; three pairs to National Fertilizers, Panipat; two pairs to Chandimandir Cantonment and one pair to Chhatbir Zoo(Punjab).

Crocodile Farm, Baur Saidon

There is a tank situated in village Baur Saidon on Pehowa-Kurukshetra road, 15 kilometres from Kurukshetra where large number of crocodiles rear therein. The area of the tank was acquired and its management was taken over by the Forest Department in 1982-83.

The habitat of this farm has been increased and the periphery fenced. Four pairs of crocodiles were obtained from crocodile Bank, Madras. Now the population increased to 18.

A high mound inside the tank has been maintained for watching the reptiles from close- range.

There is a famous deer park at Hissar. Besides, there are mini zoos in Haryana. Rohtak mini zoo is noted. The zoo at Pinjore in Yadvindra garden is very famous. Many kinds of species have been kept here. There were game reserves: Kalsia and Kalesar forests; Bir Jhadugarh near Kalka; Bir Shikargarh near Pinjore; Saraswati Plantation in Kurukshtra district; Bir Kohli Khera; Bir Rehrian and Bir Sewian in Kurukshetra and Bir Kanda Kheri.

Bhindawas Bird Sanctuary

Bhindawas lake is the winter home for a large variety of winged visitors from Siberia, Central Asia and Tjakistan. Located 25 km. from Jhajjar, the sanctuary, spread over an area of 1, 016. 94 acres, the largest wetland of the State, is a natural habitat for birds. The periphery of the lake is about 12 km. It is motorable, which makes the sanctuary a paradise for bird watchers.

The area was declared a wildlife sanctuary by the Haryana Government in 1985, for the purpose of protecting and developing wildlife.

The sanctuary is surrounded by five villages Kanwash, Nawada, Sajadpur, Chadwana and Radhuwas. The main source of water in the area is the Jawahar Lal Nehru Canal (JLN) and it also has a lift system whereby the excess water is siphoned off into drain number eight.

The lake area was the village revenue land used for crop cultivation before it came under the control of the Irrigation Department and later the Forest Department.

Eucalyptus, Acacia and some other species like Azadirachta Indica, Zizyphus have been grown in the area around the lake to provide nesting facilities to the winged guests.

At present, however, the bird sanctuary is facing grave danger from the water hyacinth which impairs the quality of water making it unfit for human consumption, fosters water-borne diseases, increases entrophication, silting and gradual drying up of water bodies. Chief Wild Life Warden(Haryana) added that the worst of its effects is that it provides a suitable habitat for the breeding of mosquitoes by preventing the access of predators and causes enormous water loss due to evapo-transpiration through its luxuriant growth.

Its seeds sink to the bottom where they can remain viable for as long as twenty years and under ideal conditions. Water hyacinth plants can double their number in ten days, he further informed. It was not possible to remove these growths by mechanical means and the process of removal was, in fact, a very costly exercise. Last year, nearly 400 acres were cleared of water hyacinth, but it resurfaced in the same area.

He also ruled out the possibility of using chemical sprays as that would affect the ecology and habitation of the area.

"In view of the seriousness of the problem and ineffectiveness of other methods, natural enemies can help to solve the problem," he said. S. P. Singh of the Directorate of Biological Control, Bangalore is of the considered opinion that it can be controlled with the help of insects like the weevils and mites. The process is called the bio-control of water hyacinth. Weevils grow in the roots of the hyacinth, while the mites eat the leaves of the plant. He has assured to start work by the end of February or beginning of March when the insects are more active.

More than 197 species of birds, migratory as well as local, visit this lake from November to March. The birds that

spotted include the Painted Stork, Spoon Bill, Mallard, Flaming Duck, Spot Bill, Pochard and Common Crane.

In the first phase, 36,000 weevils and 75,000 mites will be released. The impact of bio-control agents may not be clearly visible for a year after the release of these insects.

Chief Warden of Wild Life has expressed the fear of an ecological succession whereby, the niche vacated by the water hyacinth may be occupied by another alien weed.

General

The details pertaining to Bhindawas and Khaprawas bird sanctuaries are given below:-

Sr. Species found Season of

No. migratory
Local Migratory species
1 2 3 4

1. Grobe Little Pelican Rosy October to

March
2. Cormorant Shelduck, Ruddy ,,

3. Shag, Indian Pintail ,,

4. Cormorant, Little Teal, common ,,

5. Darter Duck, common ,,

6. Heron, Grey Mallard ,,

7. Heron, Purple Gadwall ,,

8. Egret,Large Wigeon ,,

9. Heron, Little Green Garganey ,,

10. Heron, Pond Shoveller ,,

11. Egret, Cattle Pochard, Common ,,

12. Egret, Smaller Pochard, White-eyed ,,

13. Egret, Little Teal, Cotton ,,

14. Heron, Night - ,,

15. Stork, Painted - ,,

16. Stork, Openbill - ,,

17. Stork, Whitenecked - ,,

18. Stork, White - ,,

19. Stork, Blacknecked - ,,

20. Adjutant, Lesser - ,,

21. Ibis, White - ,,

22. Ibis, Black - ,,

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1 2 3 4

23. Ibis, Glossy - October toMarch

24. Spoonbill - ,,

25. Flamingo - ,,

26. Goose, Grey Leg - ,,

27. Goose, Barheaded - ,,

28. Duck, Spotbill - ,,

29. Duck, Comb - ,,

30. Kite, Blackwinged - ,,

31. Buzzard, Honey - ,,

32. Kite, Pariah - ,,

33. Kite, Brahminy - ,,

34. Shikra - ,,

35. Eagle, Greater, Spotted - ,,

36. Vulture, Indian Longbilled - ,,

37. Vulture, Egyptian - ,,

38. Harrier, Marsh - ,,

39. Eagle, Short-toed - ,,

40. Eagle, Crested serpent - ,,

41. Osprey - ,,

42. Kestrel, Lesser - ,,

43. Partridge, Grey - ,,

44. Partridge, Black - ,,

45. Quail, Common - ,,

46. Quail Blackbreasted - ,,

47. Peafowl, Common - ,,

48. Crane, D Common - ,,

General

1 2 3 4

49. Crane, Sarus - October toMarch

50. Crane, Demoselle - ,,

51. Water Moorhen Whitebreasted - ,,

52. Moorhen - ,,

53. Moorhen, Purple - ,,

54. Coot - ,,

55. Jacana, Pheasant-tailed - ,,

56. Snipe Painted - ,,

57. Wtilt, Blackwinged - ,,

58. Avocet - "

59. Curlew, Stone - "

60. Courser, Indian - ,,

61. Prat incole, Collared - ,,

62. Pratincole, Small Indian - ,,

63. Lapwing, Whitetailed - ,,

64. Lapwing - ,,

65. Lapwing, Redwattled - ,,

66. Plover, Little Ringed - ,,

67. Plover, Kentish - ,,

68. Curlew - ,,

69. Godwit, Blacktailed - ,,

70. Redshank, Common - ,,

71. Redshank, Dusky - ,,

72. Sandpiper, Marsh - ,,

73. Greenshank - ,,

74. Sandpiper, Green - ,,

75. Sandpiper, Wood - ,,

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1 2 3 4

76. Sandpiper, Common - October to March

77. Snipe, Fantail - ,,

78. Stint, Little - ,,

79. Stint, Temminck's - ,,

80. Ruff and Reeve - ,,

81. Tern, Whiskered - ,,

82. Tern, Gullbilled - ,,

83. Tern, Indian River - ,,

84. Tern, Blackbellied - ,,

85. Sandgrouse, Indian - ,,

86. Pigeon, Green - ,,

87. Pigeon, Blue Rock - ,,

88. Dover, Indian Ring - ,,

89. Dove, Red Turtle - ,,

90. Dove, Little Brown - ,,

91. Parakeet, Roseringed - ,,

92. Cuckoo-Pied Crested - ,,

93. Hawk-Cuckoo, Common - ,,

94. Cuckoo-Indian Plaintive - ,,

95. Koel - ,,

96. Cuckoo - ,,

97. Crow-Pheasant - ,,

98. Owl, Great Horned or Eagle Owl - ,,

99. Owl, Dusky Horned - ,,

100. Owl, Brown Fish - ,,

General

1 2 3 4
101. Owlet, Spotted - October to March

102. Wsift, House - ,,

103. Kingfisher, Lesser Pied - ,,

104. Kingfisher, Common - ,,

105. Kingfisher, Whitebreasted - ,,

106. Bee-eater, Bluecheeked - ,,

107. Bee-eater, Green - ,,

108. Roller, Indian - ,,

109. Barbet, Crimsonbreasted - ,,

110. Wryneck - ,,

111. Woodpecker, Lesser Goldenbacked - ,,

112. Lark, Redwinged, Bush - ,,

113. Finch-Lark, Ashycrowned - ,,

114. Lark, Crested - ,,

115. Skylark, Eastern - ,,

116. Martin, Dusky Crag - ,,

117. Swallow - ,,

118. Martin, Plain sand - ,,

119. Swallow, Wiretailed - ,,

120. Swallow, Indian Cliff - ,,

121. Swallow, Redrumped - ,,

122. Shruje,Grey - ,,

123. Shrike, Baybacked - ,,

124. Shrike, Rufousbacked - ,,

125. Oriole, Golden - ,,

126. Drongo, Black - ,,

127. Myna, Brahminy - ,,

1 2 3 4
128. Pastor, Rosy - October to March

129. Starling - ,,

130. Myna, Pied - ,,

131. Myna, Bank Common - ,,

132. Myna Bank - ,,

133. Tree, Pie, Indian - ,,

134. Crow, House - ,,

135. Crow, Jungle - ,,

136. Raven - ,,

137. Shrikem, Common Wood - ,,

138. Minivet, Small - ,,

139. Bulbul, Redvented - ,,

140. Bulbul, Whitecheeked - ,,

141. Babbler, Yelloweyed - ,,

142. Babbler,Common - ,,

143. Babbler, Large Grey - ,,

144. Babbler, Jungle - ,,

145. Flycatcher Redbreasted - ,,

146. Flycatcher, Greyheaded - ,,

147. Flycatcher, Paradise - ,,

148. Warbler, Streaked Fantail - ,,

149. Wren-warbler Franklin's - ,,

150. Wren-warbler, Plain - ,,

151. Wren-warbler, Ashy - ,,

152. Tailorbird - ,,

153. Warbler, Indian Great Reed - ,,

154. Warbler, Blythos Reed - ,,

155. White throat, Lesser - ,,

General

1 2 3 4
156. Warbler, Brown Leaf - October to March

157. Warbler, Yellowbrowed Leaf - ,,

158. Blue throat (Warbler) - ,,

159. Magpie-robin - ,,

160. Redstart, Black - ,,

161. Chat, Brown Rock - ,,

162. Chat, Stone - ,,

163. Chat, Pied Bush - ,,

164. Creeper, Spotted Grey - ,,

165. Pipit, Indian Tree - ,,

166. Pipit, Tree - ,,

167. Pipit, Paddyfield - ,,

168. Pipit, Tawny - ,,

169. Wagtail, Yellow - ,,

170. Wagtail, Yellowhead - ,,

171. Wagtail, Grey - ,,

172. Wagtail, White - ,,

173. Wagtail, Large pied - ,,

174. Sunbird, Purple - ,,

175. White-eye - ,,

176. Sparrow, House - ,,

177. Sparrow, Yellow throated - ,,

178. *Baya* - ,,

179. Weaver Bird, Black throated - ,,

180. Weaverbird, Streaked - ,,

181. Munia, Red or Avadavat - ,,

182. Munia White throated - ,,

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1 2 3 4

Nahar

183. Black Buck 1st November

to 31st March

184. Partridge ,,

185. Jackal ,,

186. Fox ,,

187. Blue Bull ,,

188. Hare ,,

Jind (Jind District)

189. Blue Bull ,,

190. Hare ,,

Abubshahar

191. Black Buck ,,

192. Jackal ,,

193. Fox ,,

194. Porcupine ,,

195. Jungle Cat ,,

Protection of wild fauna

As per the saying of late Prime Minister, Pt. Jawarhar Lal Nehru, "Life would become very dull and colourless, if it did not have these magnificent animals and birds to play".

The Central Government Act *viz*. *Wild Life (Protection) Act, 1972,* has been enforced in Haryana State, mentioned below :-

(1) No person shall

(a) hunt any wild animal, from or by means of a wheeled or mechanically propelled vehicle on water or land or by aircraft;

(b) use an aircraft, motor vehicle or launch for the purpose of driving or stampeding any wild animal;

(c) hunt any wild animal with chemicals, explosive, nets, pitfalls, poisons, poisoned weapons, snares or traps in so far as they relate to the capture of wild animals under a Wild Animals Trapping Licence ;

(d) hunt any special game other than with a rifle, unless specially authorised by the licence to hunt with a shot gun using single slug bullet ;

(e) for the purpose of hunting, set fire to any vegetation;

(f) use any artificial light for the purpose of hunting, except when specially authorized to do so under a licence in case of carnivora over a kill;

(g) hunt any wild animal during the hours of night, that is to say, between sun-set and sun-rise, except when specially authorised to do so under a licence in case of carnivora over a kill;

(h) hunt any wild animal on a salt lick or water hole or other drinking place or on path or approach to the same, except sandgrouse and water birds;

(i) notwithstanding that he holds a licence or the purpose, hunt any wild animal during closed time (1st March to 30th September-each year); and

(j) hunt, with the help of dogs, any wild animal except water birds, *chakor,* partridge or quail.

2. Trade in wild animals and animal articles has been regulated under this Act.

In addition, a licensee has to observe the following restrictions :-

Killing and capturing of all deer, antelope, gazella, blue bull, giral, Indian bustard, peafowl and black partridge stand totally banned throughout the State.

The Haryana Government is making best efforts to retrieve the wild life glory of the State as far as practicable through measures for its protection, propagation and conservation. This is, however, undeniable that there exists a vivid and acute competition between men and other animals.

Rivers and Natural Water Resources

Hydrographic changes during the past and the effects of topographic depression in southern Haryana have produced an ensemble of many ephemeral streams with inland drainge basins, the exception being the perennial Yamuna river which forms the eastern boundary of the State with Uttar Pradesh.

The State is mainly drained by non-perennial streams. The Yamuna is the only perennial river which borders the eastern boundary of the State. The account of natural water resources is given below :-

1. The Yamuna and its tributaries

2. The Chautang, the Rakshi and the Saraswati

3. The Markanda and its tributaries

4. The Dangri (Tangri) and its tributaries

5. The Ghagghar and its tributaries

The Yamuna.— Rising from the snow-clad peaks of the middle Himalayas at Yamnotri, the Yamuna enters the Haryana State i.e. from its north-eastern corner through a narrow corridor in the Shiwalik hill range. After flowing due south for about 7 kilometres, the river takes a little turn towards south-east near village Faizabad (Saharanpur district-UP) and henceforth it maintains a south-westerly direction. From this point onward the river channel becomes braided and starts widening. The mainstream of the river then runs along the border of the Ambala and Saharanpur districts as far as village Nawazpur below which there are a few villages of the Saharanpur district on the western side of the river. The combined Somb and Pathrala streams join the Yamuna at Mehar Majra. From the eastern side, the river is joined by the Budhi Yamuna near village Daryapur and a few kilometres lower down, it leaves the area near village Naharpur and flows forward to the Karnal and Panipat districts.

The Yamuna has a great history, mostly shrouded in mystery. It is mentioned in connection with Dasarjana, the battle of the ten kings mentioned in the *Rigveda.* There are both physical and historical grounds for the belief that the Yamuna during early times discharged into the Indus system through the now neglected bed of the Saraswati. For reasons yet to be fully investigated, the Yamuna-Satluj plain is said to have experienced an uplift which dismembered the then river system, the Satluj

shifting to the west and the Yamuna to the east, leaving the Ghagghar a truncated independent stream with utterly inadequate water supply for maintaining its flow upto the Rann of Kutch. The presence of the vast flood plains and abandoned river channels on either side of the river suggests that the river has been changing its course in the past.

The Pathrala *nadi* and Somb nadi are tributaries of the Yamuna. The Pathrala also known as Palasi *Khad* or Boli *nadi* rises on the border of the Sirmaur district (Himachal Pradesh) and after about a course of 32 kilometres due south discharges its water into the Western Yamuna (Jamuna) Canal near Dadupur. The Somb *nadi* rises in the Sirmaur district and takes a southerly course. After about 40 kilometres, it discharges its water into the Western Yamuna at Dadupur, there is level crossing over the combined Pathrala and Somb torrents. During rains, the surplus water of these streams is diverted from the Western Yamuna (Jamuna) Canal through a regulator at Dadupur and the combined streams join the Yamuna at village Mehar Majra.

The Chautang, Rakshi and Saraswati .- The Rakshi takes its birth in the plains while the Chautang and the Saraswati originate in the lower hills. The Chautang and the Saraswati run parallel to each other until the point of their secret junction. From this point, the bed of Chautang strikes more to the south and runs parallel for some distance with the Saraswati and then turns westward. In ancient times, it used to feed the Ghagghar but now it disappears before joining it. The old bed is quite apparent as far as the Ghagghar.

The Rakshi is a small stream rising in the plains at Shahpur near Bilaspur. It flows south-west and joins the Chautang near Ladwa (Kurukshetra district). Its course is through a well defined bed with steep banks.

The Saraswati is considered to be very sacred throughout the country, next only to the Ganga. It rose in the lower hills just near the border of the Y. Nagar district in Sirmaur area and emerged in the plains at Ad Badri. A short distance below the hills, a branch stream connected it with the Somb. The peculiar characteristic of this stream is that it disappeared at some places and then re-emerged. At a place it apparently lost itself in the Chautang and then reappeared and flowed onwards in south-westerly direction.

The Saraswati has been referred to as the river par excellence and occurs most frequently in the Rigveda. It seems to have been a holy stream of the Vedic age. It is possible that it was as large as the Satluj in the Vedic age, and actually reached the sea, as the Rigveda describes it as going down to the ocean. It was the first of the Vedic rivers and its banks witnessed the development of the Vedic sacrifices. The Ghagghar was said to be a tributary of the Saraswati rather than the Saraswati being a triburary of the Ghagghar. Now the river disappeared completely.

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The Markanda and its tributaries . - The Markanda which drains the southern slopes of Dharti Dhar range (Himachal Pradesh), cuts through the Shiwalik ranges and enters the plains near Kala Amb. The stream is joined by the Run *nadi*, the Begna nadi and the Nakti *nadi*. It flows towards the south and forming a southerly curve turns towards the south-west and enters the Kurukshetra district.The river channel which is broad between Kala Amb and Mullana becomes narrow south of Mullana . During the rainy season the river carries enormous water which causes flooding in its lower course.

The Ruh *nadi*, a tributary of the Markanda, rises in the Sirmaur district (Himachal Pradesh), and flows southward carrying a large body of water into the Markanda, which it joins near village Bari Rasaur. The Nakti nadi also known as Sadhaurawali or Sadadani is formed slightly above the Sadhaura town by the confluence of Sukar *rao*, Fandi *rao* and Khundra *rao*. It joins the Markanda just north of village Jafarpur. The Begna, a wide torrent having two sources in Morni and Sirmaur (H.P.) hills, emerging in the plains near the village Fatehpur and flowing almost due south falls in the Markanda west of Mullana. Like the Markanda, it is also subject to sudden and violent floods.

The Dangri (Tangri) .- The Dangri (Tangri) stream rises in Morni hills and flows in a southerly direction up to village Chhajju Majra where it is joined by the Baliali *nadi.* It further follows a southerly course running on the eastern side of the Ambala Cantonment. After crossing the Ambala Cantonment and Ambala-Jagadhri railway line, it takes south-westerly direction. Near the villages of Segta and Segti, the torrent of Omla and Amri (also locally known as Shahazadpur wali or Gadri) joins the Dangri (Tangri). It is here that the Narwana branch of Bhakra Main Canal crosses the Dangri (Tangri) stream. Thereafter, the Dangri (Tangri) takes a westerly course up to village Niharsi where it turns due south and leaves the then Ambala district to enter Patiala district of Punjab.

The Dangri (Tangri) rising from Morni hills, used to flow on a southerly direction up to Panjokhra, a village in the north-east of Ambala from where it is separated into two main channels. These two channels still kept a southerly course running on either side of the Ambala Cantonment. The Dangri (Tangri) seems to have changed its course towards the close of the 19th century when the drainage was confined to the eastern channel.

The Baliali *nadi* rises in the southern slopes of Morni hills and joins the Dangri(Tangri) stream near village Chhajju Majra.

The Amri (also known as Shahazadpurwali or Gadri) is formed of water collected in plains during the rainy season. It starts near Rataur and flows south-west

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and takes the torrents of the Omla and joins the Dangri(Tangri) between the villages of Segta and Segti.

The Ghagghar.-The Ghagghar, another important river also traverses the Panchkula district for some distance in the north-east. The river originates in Sirmaur district of Himachal Pradesh and enters near village Bariser where it takes a sudden rise towards the south and cuts across the northern ridge of the Morni hills. After flowing for about 4 kilometers, it again takes a sharp turn towards the north-west near village Pritnagar. From this village to village Thapli Sikh, a straight distance of about 10 kilometers, the river follows a tortuous course through a deep gorge. Near village Thapli Sikh, the river is joined by another tributary of the same name from the north. From this point up to the north of Ghagghar water gap, the river flows in an east-west direction along the Shiwalik range. The river is joined by the Jhajra and Koshallia *nadis* at this point and then it debouches on to the Punjab area (Patiala district, Punjab) through the Ghagghar water gap in the Shiwalik range. It traverses the Ambala district near Ambala city for very short distance and then flows parallel to the district boundary outside the district. While in its upper course, the river contains some water throughout the year, in its lower course, it is generally dry in summer and carries water only during the rainy season.

"Geomorphic History of Ghaggar .- The largest of the ephemeral streams draining the Himalayan and the Shiwalik slopes and substantial area of the Sutlej-Yamuna plains in Haryana is the Ghaggar. It enters Haryana near Kalka (about 10 km) from its source at an elevation of 1927 mts. near Dagshai in Himachal Pradesh. The stream receives a number of tributaries of which Sarswati of the Vedic fame and Chautang are more important effluents. The Ghaggar flows roughly in a southwesterly direction and at places demarcates the northern boundary of Haryana with Punjab. The stream has about 291 km. length of its course which terminates a little to the east of Hanumangarh in Bikaner district, Rajasthan. Several abandoned channels in Ambala, Yamuna Nagar, Kurukshetra, Kaithal, Karnal, Panipat and Jind districts may be identified in the field but it is often difficult to relate these exclusively to the once the mighty Ghaggar or the Saraswati river.

The geomorphic history of the Ghaggar is far from established. Several hypothesis have been presented by different scholars to explain the misfit nature of the stream. For example, one view holds that Ghaggar was tributary

either of the Satluj or the Yamuna and suffered deep water percolation in the process of which it dried up completely. Another hypothesis suggests that from the earliest times the Ghaggar and its tributaries drained very little water, and that it started drying-up before the 13th century A.D. Some geologists are of view of beheading of the upper Ghaggar catchment by the Giri river, now a tributary of the Yamuna, as a sole cause

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of the misfit nature of the Ghaggar stream. It has also been suggested that in early historic times Ghaggar was an important river system of northern India. Due to hydrographic changes its two important tributaries, *viz.* the Sutlej and the Jamuna abandoned the Ghaggar river in favour of Indus and Ganga, respectively. Still others opine that the Ghaggar was the final channel of the hypothetical `Indobrahm'."

The stream is tapped for irrigation at Ottu headwork in Sirsa district. The total discharge of the Ghaggar is estimated to be 2,159 m.cu.m.

Apart from the streams which have been mentioned above, there are many other seasonal streams descending from the Shiwalik range. The streams are locally known as *nadis, nalas* or *choes*. Water swells in these streams during the rains but they become dry afterwards. There are two major areas of concentration of these streams: the Pinjore Dun and the foot-hill zone. In the Pinjore Dun, these streams form a closely spaced sub-parallel drainage pattern. Streams are deeply entrenched with wall-like vertical banks. Their beds are strewn with boulders and pebbles. Apart from the Jhajra and the Koshallia *nadis*, which join the Ghagghar, the Sirsa is another important stream in the area which flows towards the

Satluj river. The Sirsa and the Jhajra flow closely parallel to each other in their upper course, but after reaching the foot of the Shiwalik hills, they adopt opposite directions. In addition to the *nadis* mentioned earlier, the area is infested with numerous minor *choes.* The physiography of Panchkula area, its land-use and alignment of transport lines are affected by gullies and choes which originate within the tract.The *choes* in this district do not disappear suddenly rather they join same higher order stream and ultimately, the Ghaggar, the Markanda or the Yamuna forming a dend-rite drainage pattern.

The Joiya Stream.— The Joiya takes off from the south bank of the Ghaggar about 8 kilometres north of the district Hissar boundary at Phulad (Sangrur district-Punjab). The channel makes snake like meanderings and its supply has been seriously lessened by silting up of the head. It is said that it was much bigger than the Ghaggar and used to flow through the Hissar area and on through Mansa tahsil (Bathinda district-Punjab) into Sirsa district where it rejoined the Ghaggar. Another dried up channel known as Sukar or Sakru is indicated to the south of Joiya channel. The old dried up courses of these streams run parallel to the Ghaggar and can still be traced-the land between them is known as Sotar valley. The valley is 2 to 4 kms. wide and even more at places. From the appearance of the valley and numerous ancient mounds and remains of old settlements all along its both banks, it is evident that at one time it conveyed a much larger volume of water and probably was the channel of a perennial stream. This may possibly be dried up course of the Saraswati of the Rigvedic fame.

The Joiya stream had long ceased to carry water to Sirsa and onward and had become very much smaller than the Ghaggar. This is due in part to the silting up of

the head of the former stream and deepening of the bed of the Ghaggar into the Joiya at Phulad. Initially, it is said, that Firuz Shah Tughlaq channelled this stream up to Fatehabad town. Later during the 19th century, a Rangoi channel to utilise flood flow of the Ghaggar was dug to connect the Ghaggar with the Joiya and it ran from Qasimpur to Kalandargarh beyond which it ran into the Joiya. Later, the old Joiya channel below Kalandargarh was also canalized. The Rangoi Inundation canal is now used for utilising flood flow of the Ghaggar for irrigating some areas in Tohana and Fatehabad tahsils.

The Krishnawati Stream .- Kasaunti or Krishnawati originates about 1.6 kilometres south-east of Nim Ka Thana in Jaipur hills (Rajasthan). Flowing in a northerly direction it enters Narnaul tahsil near Bhadanti and Dostpur, about 25 kilometres south of Narnaul. It passes about 1.6 kilometres east of Narnaul town. The stream has a course of about 49 kilometres which terminates near Dahina village at the northern boundary of the Rewari tahsil. When in flood, the water of the stream spreads towards Nuni Kalan, Saloni and Budlana villages in the Narnaul tahsil.

The Dohan Stream.- Dohan also takes off from Jaipur hills about 6 kilometres short of Nim Ka Thana (Rajasthan). It flows for 29 kilometres in Rajasthan territory before entering the Mahendragarh tahsil. Dohan is an important source of drinking water for the areas of the Narnaul and Mahendragarh tahsils. It runs a length of about 50 kilometres in the Mahendragarh district. The stream peters out at Bassai[1] village which is about 16 kilometres north of Mahendragarh town.

The seasonal flow in Sahibi, Kasaunti and Dohan periodically raises the level of fresh quality of sub-soil water. Besides, base flow during early part of the dry season can take place. The surface water potential of these streams has, however, not been determined.

Sahibi or Sabi *Nadi.-* The Sahibi rises in the sewar hills of the Jaipur district of Rajasthan. It enters Haryana one kilometre east of village Gaduwas of Tijara tahsil in the Alwar district of Rajasthan. After traversing just 4 kilometres into the southern tip of the Rewari tahsil, it leaves the Mahendragarh district one kilometre north-west of village Baghola Ahir (tahsil Tijara). Continuing in north-easterly

direction for about 20 kilometres, the stream takes a northerly turn 1½ kilometres north of Kot Qasim(tahsil Tijara) and re-enters the district at half a kilometre to the north of village Akoli(tahsil Tijara). Hereafter, it flows northwards into the Rewari tahsil for about 30 kilometres; after crossing Sohna-Rewari Road, it leaves the Rewari district and entres the Gurgaon tahsil of the Gurgaon district. After crossing Rewari-Pataudi Road, previously it used to enter the south-eastern corner of the Jhajjar tahsil (2 kilometres south east of village Lohari) in the Rohtak district. Maintaining its northward flow, it used to pass through this corner of the Jhajjar tahsil, re-enter the north-western part

1. Recently, the Rajasthan Govt. built a barrage on the Dohan River; as a result, the free flowing of water suffered to some extent.

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of the Gurgaon district (one kilometre north-west of village Faridpur in the Gurgaon tahsil). After traversing about 13 kilometres of Gurgaon tahsil, it finally used to leave the district and re-enter the Jhajjar tahsil[1] (of the Jhajjar district) one kilometre north-west of village Kutani finally to empty its waters in the Najafgarh *Jheel*. The length of the Sahibi in the Gurgaon district was 13 kilometres approximately, while its average breadth varied from 15 to 40 metres; but according to the latest survey, the *Nadi* disappears in the Gurgaon tahsil near Rewari[2]-Pataudi Road.

Owing to its long passage through arid and sandy country, the stream flows with strength only during the rainy season. During floods it carried a heavy load of sand and silt. Normally the waters of the Sahibi are a great boon to the Rewari tahsil where it charges the brackish sub soil water, but in the event of heavy floods, vast areas get submerged causing considerable loss to crops[3]. Heavy floods were

recorded in 1845, 1873, 1917, 1930, 1933, 1960,1963, 1972 and 1977. However, as the stream moves into the level areas of the Gurgaon district, its speed slackens and the load deposited raises the bed of the stream and checks its flow. Consequently, the stream some time changes its course and wanders aimlessly.

The Indori *Nadi*- It originates from Aravalli hills in Rajasthan near village Indaur. After passing through villages Nanuka, Khaika, Bhogipur, Chundhika, Sunari, Untwan, Bhudka, Rathiwas, Sidhrawali and Baspadamka, it joins Sahibi *Nadi* on the upstream side of Pataudi Railway Station. It is supplemented with so many tributaries coming from Aravalli hills. The total catchment of the *nadi* up to its submergence is 197.9 sq. km.There are 13 bunds constructed at Indori *Nadi* and its tributaries in Haryana and three bunds in Rajasthan.

The general discharge of the *nadi* in peak rainfall in the catchment is such which can pass without too much loss to life and crops of the area. If there is any breach in the bunds, the pounded water comes simultaneously with the natural run-off and creates havoc to life, crops, roads, etc. There is only a small defined course which carries general run-off or seepage water up to 50 to 80 Cs. The balance discharge during rains spreads over the area and changes its water-table.

Ghata or Badshahpur *Nala* .- It rises in the Delhi hill near Mehrauli and flows southwards. It enters the Gurgaon district about one kilometre north-west of village Gwalpahari of the Gurgaon tahsil. It drains to the Ballabgarh hills and the adjoining parts of the Union Territory of Delhi. Eventually it flows into Najafgarh Jheel near

1. Now Jhajjar is a full-fledged district.

2. Now Rewari is a separate district.

3. To control the flood fury of the stream Sahibi, a barrage near Rewari was constructed by the Haryana Government.

village Dhankot of the Gurgaon tahsil. Formerly, it flowed south-wards through the Bhundsi valley, but it was diverted by the construction of a bund into its present course. Its average breadth varies from 15 to 40 metres.

The Landoha *Nala*.- A monsoon torrent, it flows east of the main Aravalli ridge. It originates in the Alwar district of Rajasthan and is formed by the union of two streams, one flowing south from the direction of Tijara and the other joining it nearly at right angles from the west at a point near village Kharkhara. After pursuing its south-ward course to a point almost directly west of the southern end of the Firozepur Jhirka tahsil, it sweeps round in a curve, and crossing the inter-State border near village Shakarpuri, flows northwards into the Firozepur Jhirka tahsil, originally, from near Kharkhara, it flowed eastwards to Noagaon. During the Jat ascendency in the 18th century, a bund known as Ataria was constructed near Kharkhara which diverted the waters to the south and by a semi-circular sweep brought it back to rejoin the old channel near Noagaon. Before reaching this point, there were two gaps in the hills near Kharoli through which the waters ran to the south and to the east. A bund was also erected in the gap opening to the east (known as Jat Bund) with a *pakka* sluice and this enabled regulation of waters to be poured either into Ramgarh(east) or Firozepur Jhirka(north). In the early years of the 19th century, the Alwar rulers re-built and strengthened the Ataria bund and allowed the second bund to go to ruin. In consequence, for several years, the stream did not enter into the Firozepur Jhirka area which was then under the local Nawabs. In 1838, after the last Nawab was hanged and the area became a part of British India, an agreement was reached with the Alwar ruler as a result of which the second bund was restored and a channel dug to facilitate the passage of the stream into the Gurgaon district.

Landoha was notified a natural channel for the purpose of section 4 of the Punjab Minor Canals Act in 1909 and the collector was authorised to regulate its flow and to remove or modify any obstructions to it .These powers were, however,

never exercised by the collectors. In many villages, the Zamindars constructed bunds on the stream at their own expense and this led to constant disputes between different interests. Three bunds namely, Kanmeda, Madapur and Nagli were, however, constructed at the expense of the Zamindars with the object of utilizing to the best advantage of the Landoha floods. These bunds were notified under Schedule II of the Punjab Minor Canals Act. The maintenance of these bunds was subsequently neglected.

It was, however, felt all along that great improvement could be effected if by a scientific survey and examination of levels, a permanent work could be constructed to regulate the general distribution of the waters and secure the full benefit of irrigation from the stream. The following observations recorded by John Lawrence(afterwards Lord Lawrence) are very much relevant in this connection :-

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"The small bunds erected by individual villages, are more numerous than there would be any necessity for on a more comprehensive plan. They sometimes interfere with one another but are always insufficiently built, the community in whose land they are situated only caring to raise the water to level required to flood its own lands and the neighbouring villagers benefiting by a higher overflow, neglecting(unless compelled to do so) to take the necessary repairs, in the months following each rainy season. These bunds are, moreover continuously carried away by the strong floods, and the expense of rebuilding them a new falls very heavily upon the individual communities while the Government revenue is endangered if the lands are not sufficiently flooded".

Although the waters of Landoha charge the sub soil water

and thus prove beneficial to agriculture, these have in the circumstances described, also been causing considerable damage in the Firozepur Jhirka and Nuh tahsils particularly when there is no direct outlet for these waters to be drained out. The Ujina Drain is the only further carrier of these waters. It joins the Pahari Kaman Drain in Rajasthan which further joins the Goverdhan Drain in Uttar Pradesh and later falls into the Yamuna, below Mathura. The State Government is now taking all suitable steps to control and channel the waters of the Landoha in the Gurgaon district.

A number of streams and hill torrents join the course of the Landoha up the Firozepur valley independently irrigating large areas of land on the way. The Tirbeni which rises in Bharatpur territory and comes through Alwar only flows a few kilometres in the tahsil before it joins the Landoha at Doha. The Bhond, the Jhir and the Baloj are other important torrents on the west and the Ghata, the Darur and the Jhamrawat nullah on the east. The *Jheel* which rises just above town of Firozepur Jhirka makes a sweep northwards after crossing the metalled road and provides useful flooding to many villages. A branch of this stream joins the Landoha near Sakaras.

The Baloj rises in Alwar territory in the hills which forms the western boundary of the Firozepur Jhirka tahsil and joins the Landoha at Nagina. It often flows with great volume and brings down large quantities of sand.

A mention may also be made of a small stream called Thek Nala which flows from the Alwar hills on the west and irrigates a portion of Dhona (Rambas) in the Firozepur Jhirka tahsil. There was an arrangement with the erstwhile Alwar State authorities by which the Gurgaon district was entitled to use half the water of this stream secured by means of a bifurcation a few kilometres upstream at Rambas. In 1936, the State authorities constructed a bund further upstream and obstructed the flow of the stream into the Gurgaon district.

General

The eastern side of the central or eastern range of hills is much cut up by a small *nala* and the only important stream is the Darur, branches of which flow east into the Ujina drain as well as the west of the range into the Landoha.

The Mehndwari *Nala*.- It emerges from the Rajkha hills at a place in the Gurgaon district one kilometre east of village Gosainwala Johar of the Gurgaon tahsil and disappears in the Khalilpur depression 2 kilometres north-east of village Indri of the same tahsil. A siphon has been provided under the Nuh Sub-Branch of the Gurgaon Canal at R.D. 20 for the flow of its waters on to the southern side, where it spreads out. It is proposed to connect it from this point with the Nuh Drain so that the waters may flow into the Sangel-Ujina basin without causing any damage in its upstream reaches. Its average breadth varies from 15 to 40 metres. In normal times, this *nullah* is helpful in draining away the waters of the Sohna valley into the Khalilpur depression.

The Bhuriya *Nala*.- Bhuriya *Nala* (or Tilpat Drain) still originates from the hills at a distance of 2 kilometres south-west of village Meola Maharajpur of the Ballabgarh tahsil of Faridabad district. This *nala* falls into the Yamuna half a kilometre north-west of village Muzzamabad and 2 kilometres east of Akbarpur. Its average breadth varies from 15 to 50 metres. Siphons have been constructed under Gurgaon Canal Feeder and Agra Canal so that the water of the *nala* when in floods may pass on to the river Yamuna without causing any much damage to the adjacent area. But in spite of this, the area between the Delhi-Mathura Road, the Agra Canal is flooded during the heavy rains. In order to discharge the water collected in the depression into the Agra Canal, a drain known as the Ballabgarh Drain was constructed. Later on, it was used to work the other way as channel for bringing water from the Agra Canal into the Ballabgarh ponds. These days, it is used for discharging water collected in the rains into the Agra Canal.

Lakes

In the topographic saga of the southern Haryana, and particularly in the Gurgaon area, are found a number of lakes *viz* Khalilpur lake, Chandaini lake, Ujina lake, etc.. The detailed account of lakes is given here :-

The following account of these *jheel* and the inland drainage is based on the description given in the *Gurgaon District Gazetteer,* 1910 :-

Khalilpur *Jheel*.- This *jheel* is situated in the north-east of the Nuh tahsil. It is the deepest part of a low piece of country about 10 miles (16 kilometres) in extent around Khalilpur, Indri and other villages. The whole of this is flooded during an ordinary rainy season. A part of it, just north of Khalilpur village, has more marked depression with the result that more than one meter deep water stands there after the

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rains turning the land more or less into a permanent swamp. Its area may be reckoned at about 1,500 acres (607 hectares).

Chandaini *Jheel* .- This *Jheel* lies about 10 miles (16 kilometres) to the west of Khalilpur *Jheel* and is situated in the north-west of Nuh tahsil. It is also a permanent swamp with standing water, which rarely dries up together. The area of its permanent basin does not exceed 1000 acres (400 hectares).

Sangel-Ujina *Jheel* .- Lying in the south of Nuh, this *jheel* has not so clearly defined a basin as the other *jheels*. The waters coming down from the other *jheels* spread over a larger area than is covered at Khalilpur or Chandaini.The lands of numerous villages near Sangel and Ujina are widely flooded and the damage caused is extremely serious.

Kotla Dahar *Jheel*.- The largest *jheel* in the district, it is about 3 miles

(5 kilometres) long and about 2½ (4 kilometres) broad. It lies in both the Nuh and Firozepur Jhirka tahsils where these adjoin each other at the foot of the Alwar (Aravalli) hills.
The line of watershed separating the flow towards Kotla Dahar and that towards Najafgarh is found at about 11kilometres south of Gurgaon. The Ballabgarh portion of the drainage falls first into Sikri and Sarmathla depressions and then spills over into the Khalilpur basin where it also joins the flood water of the Bhundsi valley coming down the mehndwari *Nadi*. From there, the drainage takes south-west course into the Chandaini *Jheel*. A small part of the floods from the Sohna hills also reaches this Jheel after filling a small depression near Kherli Kankar. The over flow from this depression flows south-wards into the Kotla Dahar Jheel into which also collects the drainage water of the Firozepur Jhirka valley from the south. There is no outlet from this *jheel* and very wet years, the surrounding country, for many kilometres, is a sheet of water which gradually escapes through the Sangel-Ujina depression to the east of the central range of hills, known as the Lohinga valley into the Bharatpur Jheel of Pahari Kandla in the Bharatpur district of Rajasthan. This describes the course which the drainage of the area would take if not artificially controlled.

In order to prevent too much swelling of the volume of water in the Kotla Dahar *Jheel,* a bund was constructed on the downstream in 1838 to divert the water from the Firozepur Jhirka valley into the Sangel-Ujina basin. This bund was extended right upto Ujina in 1865-66. Simultaneously, a canal or drain was dug to bring down the waters of the Chandaini *Jheel* also to the Sangel-Ujina basin. In 1890, a dyke was constructed across the middle of the Chandaini *Jheel* running east and west to prevent water from the northern half from flowing down into the southern half. A small drain known as Chandaini cut was also dug to carry the surplus water from the north of the bund into Chandaini Canal.

General

The damage caused by the *jheels* was incalculable. These kept good lands out of cultivation and permanently flooded the low lands best suited for cultivation; detrimentally affected the health of the tracts in which these were situated and in times of flood, seriosly endangered the position of the town of Nuh and of all the nearby villages or along the line of the overflow.

The evils resulting from swamping and uncontrolled flooding had long been recognised and attempts were made early in the history of the area to drain the swamps and control the floods by means of embankments. The Kotla Dahar and Chandaini works already described were the earlier steps in this direction.

Like Sikri and Sarmathla depression, there are a few other small depressions, of which the most important are Badshahpur and Indri. The southern waters of Badshahpur are drained off into the Mehndwari *Nadi*. The Indri depression situated on the north-eastern side of the Indri hill, has mostly local rain water which dries up by November.

Many drainage works, including *bunds* and link drains, constructed during the last about 90 years, have protected inhabited villages, diverted the course of drainage to avoid overflooding of agricultural lands and utilised the flood-water to irrigate the fields.

But it may be stated that the waters of Khalilpur, Chandaini and Kotla Dahar *jheels* are now completely drained off by means of Nuh,Chandaini and Kotla Dahar drains latest by the middle of November and the lands are made available for *rabi* crops. These drains bring the waters into the Sangel-Ujina *Jheels*. That *jheel* is also, unless there are exceptional rains, drained off in time for the *rabi* crops by means of the Ujina drain, which takes off from the point where the drains mentioned above meet in the *jheel*. Thus not much water is collected even in the rainy season in the Sangel-Ujjna basin which also comes available for bumper *kharif* crops.

Badkhal Lake near Faridabad is an artificial lake formed by damming parts of the Aravallis. So are the Dum Dumma Lake near Bhundsi, Peacock Lake at the Surajkund and Dhauj Lake at the Dhauj Bund. The Sultanpur Lake near Farrukhanagar is another artificial lake which has been developed as a bird sanctuary. Most of these lakes have become great tourist attraction.

Water Resources

Rainfall, stream flow and subsurface water constitute water resources. Water for irrigation in Haryana is obtained from surface and subsurface resources. The bulk of irrigation potential is provided by the Yamuna river and ground water resources.

Groundwater Resources

Ground-water levels are monitored by 680 observation wells maintained by the Irrigation Department, 1,725 observation wells established by the State Exploratory Unit and by nearly 1,000 State owned tubewells in different parts of Haryana.

In the areas where canal irrigation was introduced since the middle of this century the water table has generally risen but in old irrigated tract of Western Jamuna Canal a declining trend in the water table has been noted.

The subsoil water occurs near the surface to depths greater than 52 mt. in various parts of Haryana. In general terms the water table is relatively shallow east of the 76º 15' east longitude while to the west of this line the water table is from deep to very deep. This meridian roughly coincides with the

westward limit of the largest body of fresh and marginal quality ground water reservoir.

The subsoil water occurring to a depth of 6 m. occupies parts of Ambala, Yamuna Nagar, Kaithal, Jind, Karnal, Panipat, Sonipat, Rohtak,Faridabad and Gurgaon districts covering the largest area. Isolated pockets of groundwater reservoir deeper than 6 m. also occur in this zone. The area benefits from the groundwater recharge from the Shiwalik hills, the Yamuna river and the seepage from numerous irrigation channels. However, the water table is deep to very deep in the Shiwalik hills. In rest of Haryana the groundwater is generally saline, and deep to very deep, except where it is sufficiently recharged from the canal networks and infiltration from seasonal ephemeral streams. The deepest depth of water table, more than 52m, occcurs in parts of Mahendragarh district. Saline aquifer, arid climate and impermeable Aravalli substratum and highly permeable sand dune surfaces characterise a major part of this zone.

The major thrusts in agricultural sector due to exension and development of canal irrigation and concomitant exploitation of groundwater resources since 1967 have significant effect on the groundwater reservoir in Haryana. Changes in groundwater storage between 1967 and 1974, assumed 10 percent specific yield, suggest that the highest rate of accretion to the groundwater has occurred in the Bhakra Canal area (864.21 m. cu. m.). This is followed by the Gurgaon Canal area (52.93 m. cu.m.). Unfortunately, the largest increments to the groundwater reservoir have occurred in the deep saline unusable resource. The average rate of groundwater withdrawal for irrigation in the above canal command areas is , 433.28 m. cu. m. for the Bhakra Canal area, 105.85 m.cu.m. for the Western Jamuna Canal area and 105.85 m. cu. m. for the Gurgaon Canal area.Only sketchy data are available for the area commanded by the tertiary irrigation systems and hence, the groundwater potential in the arid western and south-western tracts of Haryana has not been suggested.

General

In spatial terms the largest groundwater depletion has occurred in the fresh and marginal aquifer zones mostly in Ambala, Yamuna Nagar, Kurukshetra, Kaithal, Karnal, Panipat, Sonipat and Gurgaon districts. A net accretion to the groundwater has taken place in deep saline water table, in the largest area covering a major part of the Jind, Hisar, Sirsa, Bhiwani, Mahendragarh, Rewari and Rohtak districts of the State.

Spring

The only notable spring in Haryana is at Sohna, a tourist attraction in Gurgaon district. The temperature of the hot sulphur spring remains between 46 and 52º c and a bath in the spring water is considered by many to cure several kinds of diseases.

Swamps

Patches of older alluvium are either exposed or occur at shallow depths beneath a veneer of sand in *tals* or topographic depressions enclosed by fixed dunes. Such swamps are found in Hisar and Sirsa districts. In Hisar district, the formation of swamps have been experienced in the old bed of the Ghaggar.

The *Nali* tract of Sirsa district is wide and shallow. The result is that a far larger area is flooded in the south west of Sirsa district, known as the Arkai Swamp. Sand dunes are common as it lies close to the Indian Desert. These dunes are of shifting nature and crescentric in shape. Their march has been checked with the extension of irrigation facilities. The major part of the area has been reclaimed and brought under cultivation during the fifties on account of its suitability for irrigated farming.

Physiography

The general slope of the terrain of Haryana is from north-east

to south-west and west with an exception in the south in Bhiwani, Mahendragarh, Rewari and Gurgaon districts where the slope is/towards north. In Faridabad district, the land in general slopes towards south and south-east. Infact, the variable slope tendencies and resultant topographical differences are responsible for the formation of a saucer-like depression on the eastern margin of the Rohtak district. In about 68 percent of the total area of the State the gradient is very gentle. In the extreme north-east, i. e. the Shiwalik hill zone, and in the south, i. e. the outcrops of the Aravalli hills, the gradient varies from steep to moderately steep,which creates the problem of soil erosion. On the whole the gentle gradient of the plain makes movement of surface water sluggish leading to waterlogging and flooding. During the rainy season soil salts are washed down. In the hot dry season, extensive evaporation takes place resulting in capillary action. On reaching the surface, these salt solutions evaporate

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and the salts crystallise as a white incrustation on the surface. Such incrustations are common in the low lying saucer-like depression of Rohtak and Sonipat, the bowl of Karnal, lower plains of Panipat, some areas of Kurukshetra, Kaithal and Jind districts.

In its major parts, the Haryana plain slopes imperceptibly towards the south-west and the west. Any uneveness of surface is either due to old banks and abandoned channels of the streams or the sand dunes, and extensions of relict outcrops of rocky hills; otherwise the local relief is insigificant.

It is considerably significant to recognise the recent flood plains of the Yamuna, the Ghaggar and the Markanda.

Besides pleistocene alluvial plain, and sandy undulating plain are also significant. An aerial view of the plain shows a continuous vast stretch of level to nearly level land dotted with clusters of mudroofed houses surrounded by green fields which gradually peter out into sandy billows and rocky surface in the south and the south-west and come gradually to an end into the piedmont plain and the hills in the north-east. As such, only a small proportion of the total area (about 4.57 percent) is moderately steep sloped hill-land in the north-east and steep sloped rock-hills in the south.

Of the total area of the State about 68.21 percent, lying below 300 metres is a level to nearly-level plain, and may well be designated as the Ghaggar-Yamuna Plain comprising *Bangar, Khadar, Naili* and *Bet.* Further, 25.55 percent of the total geographical area of Haryana also below 300 metres is undulating and rolling in the districts of Bhiwani, Rewari, Mahendragarh and the north-western extreme of Gurgaon, where it is covered by sand dunes and hilly outliers. As such 93.76 percent of the geographical area of the State is under 300 metres and the major part of the land surface is near to the datum-plane. Of the total area of Haryana, about 1.67 percent lies between 300 and 400 metres in the north-east at the foot of the Shiwaliks in Panchkula and Yamuna Nagar districts and is designated as the piedmont plain, and 1.48 percent lies over 400 metres forming the Shiwalik hills, which when viewed from the Haryana Plain, are dwarfed by the Himalayan ranges of Sirmur district (Himachal Pradesh) over-looking them. The remaining 3.09 percent lies above 300 metres in the south covering the districts of Mahendragarh, Rewari, Bhiwani and Gurgaon in the form of rocky surfaces.

Haryana may be divided into five natural topographic divisions which provide a suitable framework upon which a systematic study of landform environment may be founded. These are :

(i) The Bagar and the undulating sandy plains-the sand dunes and the *tals* 230-350 metres);

(ii) The Alluvial Plain or the Ghaggar-Yamuna Plain comprising *Bangar, Khadar, Naili* and *Bet* (below 300 metres).

(iii) The Aravali outliers (300-600metres);

(iv) The Shiwaliks-The hills (over 400 metres), and

(v) The Foot Hill Zone-The piedmont plain (300-400 metres).

(i) The Bagar and the undulating sandy plain. Sand dunes of various shapes and sizes form a thirsty land, covered by stoppe vegetation in the south-western parts of Haryana. The *Bagar* lies in parts of Sirsa, Hisar and Bhiwani districts. Of significance is the great amount of wind blown sand, piled-up several metre high above the local flats, and stretched for several kilometres in length. This forms a continuous strip of significant concentration of sand dunes adjacent to the thar desert on about 11 per cent of the total area of the State. Sand dunes, found on a massive scale in this belt, extend from the south-east of Sirsa district along the Rajasthan border with Hisar district and the sand dune belt widens gradually through the Bhiwani district. The region resembles practically treeless undulating arid desert, and is locally known as *Bagar.* Sand dunes of varying magnitude are the main features of the south-west. At places, the local relief is as high as 15 metres but generally the dunes are mobile, while most are stationary. Their axes may be parallel to the wind direction. Generally, longitudinal dunes are common. The region is not altogether, as the name implies, a desolate treeless waste, but it does support a thin scruby vegetation in *tals.* Further, the monotony of sand heaps is broken by the rocky projections, such as in Bhiwani district. The region gradually rises in elevation towards the south-eastern part terminating in Sohana Plateau of Aravalli ranges. The mobile sand dunes seriously threaten to impair the prosperity of fertile alluvial plains lying to their north and north-east.

As a result of meagre rainfall and its highly unreliable character, the climatic conditions of the Bagar and the undulating sandy plains are arid. Most of the arid region

possesses a very scanty vegetation partly due to cultivation and grazing practices, and primarily due to the prevailing desert conditions. The soil moisture deficit is very acute and it persists throughout the year.

(ii) The Alluvial Plain._ The alluvial plain of Haryana as usual has the alluvial richness. It is one of the socio-economic hinterlands of India, contributing a major and significant share to the foodgrain reserve of the nation. Besides, it occupies an important position in the sub-continent as it forms the water divide between the two mighty river systems of the Ganga and the Indus flowing into the Bay of Bangal and the Arabian sea respectively. It comprises vast riverine plains of the older and the newer alluvium and, therefore, the lithological diversity in alluvial monotony has a strong bearing upon the distributional pattern of land use, cropping pattern and agricultural productivity.

The Ghaggar and Markanda streams and Yamuna river have left their imprint on the local relief of the alluvial plain. The region is considerably vast , more fertile and populous.

Indeed, the 300 metres significant contour represents a more meaningful boundary between the plain and the upland. The plain imperceptibly slopes from north-east to south and south-west, the gradients to which follow the lines of natural drainage. The plain is remarkably flat in the districts of Ambala, Yamuna Nagar, Kurukshetra, Karnal, Kaithal, Jind, Sonipat and the north-eastern part of Hisar. Within the alluvial plain are the narrow low lying flood plains, known as *Khadar* of Yamuna, *Nali* of Ghaggar, and *Bet* of Markanda. Besides, the flat of the saucer in Sonipat and northern parts of Rohtak districts forms a part of the said plain. At places, there are occasional local undulations forming old rolling

alluvial plains which include the *Rohi* of Dabwali and Sirsa tahsils (Sirsa district). The *Rohi* has many abandoned beds of old streams, in particular that of the Ghaggar, which provide fertile land suited to agriculture. The *Rohi* is not completely flat because of the presence of *tals* and *tibbas.* The local relief of the *tibbas* is very insignificant and these have either been under the process of levelling or completely graded on account of the extension of irrigation facilities with Bhakra Canal.

The older alluvial plain is covered by the Pleistocene deposits. The old alluvial plain (*Bangar*) at a varying depths contains carbonate of lime, usually occurring in nodules called *Kankar*, which are from less than one centimetre to more than 5 centimetres in diameter. In *Bangar* these *Kankar* formations occur much below the root-zone of the soil and such parts of the land are known as *Nardak*. In the upper reaches of the Saraswati stream in Thanesar tahsil of Kurukshetra district, the Kankar seems to occur in the form of a pan close to the root-zone and this tract is termed as *Chhachhra*. The older alluvium of the *Nardak* and the *Chhachhra* has lower level of fertility as compared to the *Bangar* alluvium on account of the *Kankar* formations in the former. On the whole, the *Bangar* region is characterised by patches of saline efflorescence which is the result of the mechanical composition of alluvium, gentle slope of the land and the capillary action during hotdry season. The damage caused by salinity has, however, been considerably minimised by the tubewell and canal irrigation facilities. On the east of the alluvial plain is the flood plain of the Yamuna extending from its existing course to its old high bank. It is narrow in the tahsil of Jagadhri in Yamuna Nagar district, it broadens towards Sonipat after passing through the district of Kurukshetra, Karnal and Panipat and again narrows down in the district of Faridabad. In the north-west of the alluvial plain lie the flood plains of the Ghaggar and the Markanda called *Nali* and *Bet* respectively. Gulha *Nali,* Shahbad *Bet*, and Sirsa *Nali* are wide and a larger area is liable to inundation during the floods. The

wide flood plains gradually merge into adjacent old plains. On the other hand, the flood plain in Fatehabad tahsil is narrow with a recognizable change into the old plains. Ghaggar *Nali* is gently sloping, and largely cleared of natural vegetation for cultivation. This area has experienced agricultural revolution of significant magnitude during the fifties resulting from agricultural colonization of the cultivable waste land, where the irrigation facilities provided through the minor irrigation schemes and the Bhakra Canal brought dynamic changes in agrarian economy.

Sirsa *Nali* is wide and shallow. The result is that a far larger area is flooded in the south-east of Sirsa tahsil. In this part sand dunes are common as it lies close to the *Marusthali* of Rajasthan. These dunes are of shifting nature and crescentric in shape. Their march has been checked with the extension of irrigation facilities.

The water table in the *Khadar, Nali* and *Bet* regions is fairly high, facilitating irrigation from tubewells. The regions have fertile soils of recent deposits which are replenished every year.

The topography of Haryana offers both opportunities and challenges to agricultural pursuits. Topography as such has little effect on agriculture, for the proportion of the land which is too steep or too rocky & to cultivate is considerably small. Paradoxically, in the saucer and the bowl which are often the marginal lands in the plains of Haryana, the surface drainage is rather poor. Actually, Haryana, is blessed with extensive level land possessing a wealth of agriculture. The vast alluvial plain forms the heartland binding the hilly region and the sand dune belt together. The combination of level or rolling land and favourable temperature conditions is the most promising aspect of the State. In its extensive areas lie the future prospects for the development of irrigation, agriculture and dry farming. Topographically large areas of level to nearly-level land are suited to cultivation and extensive use of farm machinery, provided the fields can be adequately supplied with irrigation water.

(iii) The Aravalli Outliers. Consisting of Alwar and Ajabgarh series, the Arvallis extend for 90 kilometres in the Gurgaon rolling plain and Mahendragarh *Tals* and *Tibbas.* The hills traverse a north-east-south -west direction and at places extend upto Delhi and reach the Yamuna river like isolated ridges. In Haryana, the absolute relief of the outliers is at no point higher than 650 metres. Besides Gurgaon, the Aravalli outliers are scattered in Mahendragarh , Rewari and Bhiwani districts and stand out distinctly against the level horizon above the sand dunes. Tosham hills, attaining an absolute relief of 398 metres, in the district of Bhiwani have steep drops. Similarly, the Aravalli extensions in Gurgaon have also moderately steep falls. These with bold and rounded forms present wind-borne and water-eroded topography. Equally apparent is the abundance of debris produced by mechanical disintegration

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of the bare surfaces. The main south west-north-east alignment of the hills is remarkably regular in the district of Gurgaon.

On the whole, these form series of flat-topped ridges, half-buried either in the alluvium or the aeolian deposits giving a low local relief.

The Aravallis are fairly dissected by generally dry but at times viciously flowing *nullahs*. Dry channels, gullies and ravines, the relict hills, the boulders scattered over gullied surfaces, and the undulating dales and vales have made the Aravallis. The water table may be as much as over 150 metres down making traditional irrigation impracticable. It is observed that about 50 per cent of the hills, comprise sharply rising areas where soil erosion is active and soil cover is

either thin or absent. Due to inadequacy of rainfall and rocky nature of the terrain, the Aravalli hills generally lack vegetation cover. At best these support some stunted trees of Kikar and Karir or thorny shrubs or bushes of *ber* and other hardy varieties. Pastures are not widespread but, on gentler slopes, there are patches of grass and shrubs which support a certain amount of pastoral activity.

(IV) The Shiwalik Hill Tracts ._ The Shiwalik hills, which have a north-west, south-east deposition, flank the northern boundary of the Panchkula district. At places the district boundary penetrates deep into the hills and encloses pockets of hilly tract. The Chandigarh Shiwalik range tract, Morni hill tract and Kalesar hill tract are the three main pockets of Shiwalik range tract within the area. These tracts are not only physically separated from each other but also differ from each other in many aspects.

The Chandigarh Shiwalik Hill Tract._ This tract is a narrow strip in the Shiwalik hills north of Chandigarh and flanks the southern side of the Pinjore Dun in the Kalka tahsil. The strip, which is only 2 to 5 kilometres wide encloses the northern slopes, the main water dividing line and some parts of the Shiwalik range. It stretches west, from river Ghaggar in the south-east to a point opposite Balad *nadi* in the north-west, a distance of about 20 kilometres. The Shiwalik range north of Chandigarh presents a typical Shiwalik hill topography.There are hogback ridges formed on gently dipping alternating beds of clay, silt, loam and gravel. The tract is badly dissected and gives the appearance of bad land topography. Numerous hills, gullies and *choes* are continuosly transforming the face of the area at a very fast rate. Because of unconsolidated nature of the bed rocks, the rate of landslides and mass wasting is high.

The northern slope of Shiwalik range is steep and less extensive. Streams descending from the northern slope join either Sirsa *nadi* or Jhajra *nadi*, flowing

beyond in opposite directions. The main ridge in this section of the Shiwalik range is almost missing. There is only a water dividing line, which is pushed upward very close to the northern limits. The crest of this water dividing line, which separates the northward flowing streams from southward flowing streams, is at many places lower than the crest of the transverse ridges in the area. The highest point in this ridge is *Kala Tiba* which is 625 metres above mean sea level. The southern slopes of the Shiwalik range are much more extensive. Transverse *choes*, which cut across almost the entire width of the Shiwalik range, have pushed back the main water dividing line to almost the northern fringes of the hills. These *choes* have transformed the southern slopes of the Shiwalik hills into alternating ridge and valley topography. They have carved out series of transverse parallel ridges, which run in a direction perpendicular to the grain of the area. The crests of these ridges are like razor's edge and are broken at many places. Slopes of the transverse ridges are steep and unstable, thus unsuitable for human occupation.

The Morni Hill Tract._ The continuity of the Shiwalik range further east is broken by a transcurrent fault north of Panchkula township. Due to this fault, a narrow water gap has been created through which river Ghaggar debouches on to the Punjab plains. This narrow water-gap, which has wall-like vertical eastern bank and terraced western bank, separates the Chandigarh Shiwalik range tract in the west from the Morni hill tract in the east. From the water-gap the Morni hill tract extends up to the tributatries of *Begna nadi* and *Run Cho*, in the east, a distance of about 30 kilometres. The northern limit of the tract is marked by the crest of the ridge north of the river Ghaggar. The tract is the largest pocket hilly area within the Panchkula district and comprises two north-west, south-east running parallel ridges separated by the deep and narrow valley of the river Ghaggar. Of the two ridges, the southern one is more massive and extensive, but the highest peak Dharot Kahlong, 1,499 metres above mean sea level lies on the northern ridges.The highest peak on the southern ridge is only 1,246 metres high. The crest of the southern ridge supports a number of small settlements

including that of Morni from the tract derives its name.

The tract is badly dissected by numerous streams forming deep narrow valleys. With the exception of *Begna nadi* there is hardly any other stream which forms a broad open valley like the one formed by the major *choes* in the Chandigarh-Shiwalik hill tract. However, with the exception of the southern fringes and the western part of the tract, the degree of dissection is much less as compared to the Chandigarh-Shiwalik hills tract. This is because of the thick vegetation cover and the comparatively consolidated nature of bed rocks which belong to Degshai and Nahan for the northern and southern ridges respectively. Slopes are moderate to steep but stable. However,

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there are steep escarpments at many places formed by landslides and faults. To the south of Morni there is also a small patch of flat land with two tiny lakes. The genesis of this flat land seems to be structural in nature but needs proper investigation.

The Kalesar Hill Tract.- Another important pocket of hilly tract within Shiwalik range lies in the north-eastern corner of the then Ambala district(now Panchkula district). The tract comprises two parallel ridges separated by a broad and open valley of a seasonal stream Sukh *rao* which flows from north-west to south-east and joins the Yamuna river in the extreme north-eastern corner of the Panchkula district. Numerous torrents originating from the slopes of ridges flanking the Sukh *rao* valley drain into the Sukh *rao*. The sharp crest of the northern ridge forms the common boundary of the then Ambala (now Panchkula distict) district with Himachal Pradesh. The crest of the southern ridge is also

sharp and broken giving the appearance of saw teeth. The highest peak on the northern ridge is 650 metres high and Kalesar peak on the southern ridge is 659 metres above mean sea level. Topographically, the tract is not much different from other parts of the Shiwalik hills. The southern slope of the southern ridge is comparatively more dissected and extensive than its counter-part in the northern ridge as well as the northern slope of the same ridge.

In addition to these main hilly tracts, there are three minor tracts of hilly areas, not much different from those discussed above. Of these tracts, the one to the north of Sadhaura town is a small winding ridge, extending in east-west direction. The highest point on this ridge is 711 metres above mean sea level. Another minor hilly tract is at the mouth of Somb *nadi* and its tributaries. The tract encloses slopes of jutting out spurs. Rampur peak with a height of 662 metres is the highest point in the area. The third and the last tract is narrow valley of Boli *nadi* which is flanked on either side by transverse ridges and extends upto the main ridge in the north, a distance of about 7 kilometres . The average width of the valley is about 1.5 kilometres. The transverse ridge slopes down steeply to the stream banks. The relative height of these ridge from the valley to bottom varies fom 200 to 250 metres. The highest point in the tract with a height of 701 metres lies in the extreme north on the crest of the main ridge.

The Pinjore Dun.- Pinjore Dun is a structural valley, about 5-8 kilometres wide, sandwiched between the outer Himalayas in the north and the Shiwalik range in the south. It extends from the river Ghaggar in the south-east to the river Satluj outside the limits of the Panchkula district, in the north-west. However, within the area its extent is limited between the river Ghaggar and Balad *nadi*, a distance of about 25 kilometres. The Dun is flanked in the north by alluvial fans at its contact zone with the Himalayas and the seasonal streams in the south along the Shiwalik hills. The major slope of the area is from north-east to south-west, and it is steeper in

the north and gentler in the south. The average gradient of the area which is about

40-50 metres per kilometre is a bit misleading as it is broken into various terrace levels, separated by 5-13 metres high terrace scarps. The underlying alternating beds of loam and gravel are almost horizontal as the dip angle is less than 3º. The minor slope of the area, which is perpendicular to the major slope, divides the area into three different segments.Two segments east and west of Koshallia *nadi* which flows from north to south dips inwards towards the river. The third segment west of an imaginary line joining village Khera at the foot of the Shiwalik range with Tagra Kaliram in the north-east near Kalka railway station, dips outward towards north-west. The minor slope of the area is also responsible for dividing the Sirsa drainage system from Ghaggar-Jhajra drainage system.

The drainage density in the area is very high as a number of seasonal streams descend from the ridges and spurs, flanking to northern side of the valley. In addition to these, a number of streams originate in the Dun itself. The drainage lines form a very closely spaced sub-parallel drainage pattern. The streams flow from north-east to south-west direction across the entire width of the valley and then join the major streams like the Sirsa *nadi,* the Jhajra *nadi* or the river Ghaggar which flow at the foot of the Shiwalik range in a direction perpendicular to these streams. Jhajra *nadi* and Koshallia *nadi* join the Ghagghar river at the mouth of Ghaggar water-gap in the Shiwalik range, through which it escapes into the Punjab plains. The Sirsa *nadi* along with its tributaries drains into the river Satluj in the north-west. The streams are generally entrenched and have wall-like vertical banks. At places these banks are as high as 25 metres. The average spacing between the streams is about 500 metres. Almost all the streams are seasonal and carry water only during the rains. Streams beds are strewn with gravel and boulders. Gravel beds are also exposed at some terrace levels.

(V) The Foothill Rolling Plain.- This is a long belt of undulating, fairly sloping plain with elevation between

300-400 metres, adjoining the Shiwalik range stretching from the river Ghaggar in the north-west to the river Yamuna in the south-east. Its width varying from 10 to 25 kilometres, is maximum in Naraingarh tahsil. Collateral coalescence of alluvial fans at the foot of the Shiwalik range has created a continuous belt of steeply sloping undulating land all along the hills. These alluvial fans have been formed by the deposit of material brought down by the seasonal streams from the Shiwalik range near the hills, the deposited material is very coarse like sand and gravel but as one moves away from the hills, the material gets finer and finer. Gully formation on the alluvial fans and its extension into the adjoining clay uplands has extended and accentuated the undulations in the area. Gully formation on the two major clay uplands, one between Dangri *nadi* (Tangri stream) and Begna *nadi* and

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the other between the Markanda river and Somb *nadi* is most intense. Here, the flat land has been devoured extensively by the gullies. Generally, these gullies are entrenched 2-5 metres deep but at places these are as deep as 10 metres, maximum erosion in this tract has been done by the gullies and streams which originate in the tract itself and not by those which come down from the Shiwalik range. It is only in small tracts like the one between the river Yamuna and Somb *nadi* that erosion is largely due to streams descending from the Shiwalik range. Drainage density in the tract is very high and the streams are fairly closely spaced.

Geology

The geological achievements during the past one hundred years are very bright. The geological mapping of the state for the first time was done in 1857. During the attempt, the

north-eastern parts of the state were surveyed. Secondly, the southern Haryana was reconnoitred by the notable geologists in 1897. The western parts of this area were surveyed in 1950-51. While the eastern parts were mapped by the notable geologists in 1971-73. The detailed description of geology is as under:

Geologically, sub-recent to recent alluvium and wind blown sand is the predominant unit occupying nearly the whole of Haryana State, excepting its southern and north-eastern extremities. The southern limits of the state are characterised by the presence of rocks which extend from Delhi in the north-east to Gujrat in the south-west with their best development in the main Aravalli hill ranges near Ajmer and western Mewar in the Rajasthan.The crystallines exposed here comprise various types of metamorphic schists, quartzites, marble and crystalline limestone of Precambrian age with associated acid and basic intrusives. The north-eastern extremities of the state are bounded by Shiwalik hills comprising Pre-tertiary and Tertiary formations.

Rock Units

1. Stratigraphy.- In view of the restricted occurrences of Delhi Supergroup of rocks and Tertiary and Pre-tertiary sediments towards southern and north-eastern extremities of the state of Haryana respectively and the absence of major part of palaeozoic and entire Mesozoic formations in between these two broad groups, the stratigraphic sequences of Delhi Super group and the younger sediments in the region is given below:-

Broad Group of Stratigraphic Rock Units

(i) Quarternary Recent and Alluvium and blown

Sub-recent sand dune deposits,
flood-plains of
Ghaggar and its
tributaries, sub-recent
gravel beds
(ii) Tertiary - Upper Siwaliks Boulder conglomerates sand

stone, clay and pebble
bed
- Middle Siwaliks Sandstone with

variegated clay
- Lower Siwaliks Sandstone, shale

limestone
- Sabathu Fine grained sandstone,

clay and limestone
(iii) Pre-Tertiary - Tunda Pathar Limestone

series

Lower Palaeozoic to Upper Proterozoic

Proterozoic Delhi Ajabgarh Quartzite and basic

Super Group flows Mica Schists
group (granitised phylite &
slates calc-schists,
dolomites marbles,
Calcgneisses
amphibolites
hornblendeschist,
micaschists, phyllites
& carbon phyllites
Alwar Group Quartzites, conglo-

merates amphibolites,
micaschists, and
arkosic quartzites

Raialo Group Marbles, dolomites

conglomerates and
quartzites
Tosham Rjyolites Granite (Erinpura),

Migmatites and
pegmatites and
Ultramafics
(a) Delhi Supergroup

The rocks of Delhi Supergroup are confined to the southern limits of the state of Haryana and extend from Delhi in the north-east to the southern and south-western territories of the state.

The stratigraphic sequence of the Delhi Supergroup of rocks in the Haryana state is detailed below:-

Delhi Super Group of Rocks in Haryana

Recent & Sub-recent, Instrusives Alluvium & blown sand, Pegmatite,

Quartz vein and aplite granitic gneiss.
Amphibolite (meta-dolerite)
Ajabgarh Formation Shale and slate with quartzite

intercalations, Impure crystalline
limestone, Breccia and brecciated
quartzite Biotite-quartzite schist,
Massive quartzite, Quartzite with calc-
silvicate rock and micaceous sand-stone
calc-schist, calc-gneiss, marble and
associated Calcareous and Mangani
ferrous Shale
Alwar Formation Massive Quartzite, often ferruginous and

sometimes associated with micaceous and

Calcareous inter-calations, Carbonaceous
phyllite and schist and Calc-amphibolite

The Alwar group of rocks comprises predominantly of Qrenaceous sediments and are represented by massive quartzite, usually felspathic in nature, micaceous quartzite with subordinate bands of mica schist and carbonaceous phyllite. These rocks are well developed in the hill ranges of Delhi and Ferozepur Jhirka, Bhondsi ridges in the south-eastern part and Khodana ridges between Sohla and Charkhi Dadri in the south-western part of the state.

General

The quartzites are white, brown, grey to dark in colour, massive, hard and compact, non-calcareous and contain thin argillaceous bands which are carbonaceous. They are generally fine to medium-grained. But at certain places like Arangpur, coarse-grained grity quartzites are also seen which give rise to potential sources of silicate sand in the area. Volcanic fragments have also been reported to be associated with these quartzites at places, especially in the Delhi ridge. The Khodana ridge near Mahendragarh, besides containing massive quartzite also contains thinly bedded-dark grey quartzite with schist intercalations, and at places garnetiferous. The rocks compose of quartz and white mica accessories like iron oxide, sphens, epidote, rutile, ziron and apatite. The fine-grained massive variety of quartzite usually contains pyrite-pyrrhotite and arsenopyrite, well disseminated throughout the rock. These quartzites are intruded by small bodies of amphibolite, tourmaline bearing pegmatite and quartz veins, at some places. At least five limonitised zones were reported from this ridge, which prospected for sulphide minerals mainly pyrrhotite with subordinate pyrite, minor chalcopyrite and sphalerite and rare galena at Khodana.

The complete sequence of `Alwar Formation' does not occur

in Haryana. However, due to the predominance of the finegrained quartzite, it is believed that these rocks constitute the upper horizons of the `Alwar Formation'.

The Ajabgarh Group of rocks in the area prominently displayed in two linear stretches are as under:-

(i) The first is the south-eastern margin of the state, a more or less continuous hill range stretching from Mandkaula in the north to Biwan in the south with some isolated hill ranges around Jamalgarh, and

(ii) A series of parallel isolated hill rocks stretching from Jatusana (Rewari district) in the north-east to Gohoro in the south-west.

The main rock of this group is characterised pre-dominantly by argillaceous sediments and include shale, slate, phyllite, pelitic schist, crystalline and impure limestone, marble, calc-schist and gneiss with intercalations of quartzite. The shale, slate and silt stone occur together with a few quartzitic and cherty bands, silt stone being more predominant than the other two varieties. Slates in the area around Kund, Behali and Rampur are famous for their superior quality and are being extensively used as building material. They are generally greyish black and black.

Greenish black and multicoloured slates are also not uncommon. The pink to pinkish white and grey to dark grey finegrained quartzite is associated with calcareous and impure calcsilicate rocks where as massive, white quartzite is generally associated with argillaceous rocks. Impure Calc-silicate rocks are typical of this group and are found in this area from Calanla in the north to Gohoro and Donkhoro in the south(near

Narnaul). Among these, the main varieties are calc-bio-tite schist, calc-gneiss, calc-amphibolites and a variety of different shades and colour. The banded calc-gneiss occurs near Khalra, Meghot, Baja, Mosnota, Gohoro and Donkhoro. Shally phyllite and carbonaceous phyllite are quite common in the south-eastern part of the state.

The pelitic schists include biotite quartz-schist, garnetiferous staurolite schist and sericite-biotite schist.

Biotite schist, the lowest member of the Ajabgarh Group is intruded by pegmatites and aplites as veins and lit-per lit injections. Gradation from phyllite and biotite schist to calc-schists and gneisses is also noticed. At Antri-Beharipur, it contains magnetite crystals in contact with the iron ore bands. Garnetiferious biotite schist occurs at some places and sometimes contain staurolite crystals, as well. Quartzite occurs together with all the above described rocks, but it always is the subordinate rock type.

Post Delhi Intrusives and Tosham Rhyolite

Post-Delhi intrusives include amphibolite (metadolerite), granite and pegmatite with quartz veins and aplite. Chronologically, the amphibolite is formed earlier than the acid intrusives as the former is intrusive into the Alwar and the Ajabgarh rocks but it is absent in granitic rocks. The aplites and pegmatites in turn are intrusives into granite. Some of the pegmatites are predeformational in origin, as evinced by their co-folding with the host argillites. The granite of the area has been correlated with the Erinpura Granite of Rajasthan (Heron 1917).

The Tosham rhyolites were first examined in the year 1883 and were correlated with the Malani suite of acid volcanics mainly on the basis of their petrological similarity.

(i) **Amphibolite.-** Large sills of amphibolite are found around kaur-ka-Mangal, Durga-ka-Nangal and Pachnauta whereas small amphibolite dykes are recorded from Bail, Donkhoro and Khodana in Mahendragarh district. Small sills and dykes of these rocks are also noted from Pinangawon, Kalinjar, Mandanaka and west of Tauro in Gurgaon district. These rocks intrude both Alwar and Ajabgarh rocks and are dark in colour with shining needles of hornblende and some white

patches of felspar. Microscopically, it is composed of hornblende and plagioclase, with accessories like opaque ore, quartz, rutile apatite and rarely allanite.

(ii) **Granite and granitic gneiss.-** These rocks occur around Dhosi, Maroli, Dhanuta, Tehla and Makandpur. The granites are generally pink grey and medium-grained and can be classified into : Leuco-cratic granite,

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hornblende granite and biotite granite. Hornblende granite grades into biotite granite and varies from medium to very coarse grained, containing at places concordant bands of hornblende schist quartzite and calc-silicate rocks, which show gradual transformation into hornblende granite. A number of pegmatite and quartz veins have permeated through these bosses in the area.

(iii) **Pegmatites and Quartz veins.-** Pegmatite and veins of quartz are prolific in the area but the best development is seen at Durga-Ka -Nangal, Pachnauta-Bail area in Mahendragarh district and Sikandarpur, Ghausgarh, Alipur, Ghamrauj and Arangpur in Faridabad district. Pegmatites of Faridabad district differ from those of Mahendragarh district, orthoclase in the chief constituent in the former area, whereas plagioclase and micocline is dominant in the latter area. Quartz forms the other main mineral and the accessories are tourmaline, muscovite, biotite beryl and traces of apatite. These pegmatite veins have given rise to workable deposits of China clay in Faridabad district. Some of the pegmatite veins contain unassimilated graphite of the country rocks as well.

Quartz veins vary in thickness from thin to as thick as 10 m. and contain at times, tourmaline crystals. They are milky

white to dirty white with greasy or opalescent lusture. Some of these veins contain bladed and fibrous forms of kyanite and near Bhondsi these kyanite crystals are as large as 8 cm. long, whereas there are others which have yielded rock-crystals in the past.

(iv) Basalt.- Small exposures of melanorratic, hard and compact, aphinitic foliated rock occur near Mandanake and Kalinjar. The rock contains acicular, platy plagioclase altered into epidote surrounding sericitised augite and little grey amphibolite. Other minerals present are biotite muscovite and iron-ores. The plagioclase is mostly of oligoclase-bytowhite composition. Quartz is very little and perhaps devitrified from glass. The rock shows ophitic texture and contain xenoliths of siltistone.

(c) Malani suite of Igneous Rocks.- The Malani suite of igneous rocks is represented by Khanak, Nigana, Dulhero, Riwasa and Deosar granites, with their volcanic, representative as the Tosham rhyolite, including felsite and hyroclastic material. The Malani rocks are intrusive into the Delhi' s and are later than the Erinpura granite. The magmatic rocks of Tosham area include granite, monzonite prophyry, rhyolite and felsite. Granite is leuco-cratic to melanocratic medium to coarse grained

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at times, porphyritic in nature. The rock consists of orthoclase, plagioclase, quartz, microcline, tourmaline, little biotite, opaque ores, zircon and sphene. Saussurition has been noted at many places, particularly as Deosar. The granites are traversed by bands of aplite and granite porphyry.Aplites are white to pink in colour and have the same composition as the granite. Porphyry consists of orbicular phenocrysts of felspar

and smaller quartz in a very fine grained granitie groundmass.

Rhyolite is dark brown to dark grey in colour and almost all the varieties, except dark grey type, show flowage.The rock contains small crystals of quartz in an aphinitic groundmass. There are three thin ash beds separating the different rhyolite flow. Presence of explosion breccia having angular fragments of the meta sediments in the first rhyolite eruption indicates its explosive nature.

Because of the isolated and scattered nature of out-crops of the Malani Igneous suite, with which the Tosham rocks have often been correlated, no definite idea can be formed about their geological position and age. Recent age determination of the rocks of north Peninsular India(in 1970 and 1971) show that the provisional correlation of the Malanis with the Tosham rocks and Kinana rocks is no more valid and should be abandoned.

(II) Tertiary

The north-eastern boundary of Haryana is characterised by the sub-Himalayan formations comprising Subathus, Dagshais, Kasaulis and Shiwaliks. A general stratigraphic sequence in the area is shown below:-

Tertiary Rock units Formation in Haryana

Recent Upper Alluvium river terraces

Pleistocene to sub-recent
Middle Pleistocene Upper Boulder Coarse conglomerates, sands

Conglomerate grits and some clays
Unconformity
Lower pleistocene Lower Boulder Conglomerates sand stones

Conglomerates,
Pinjore stage Coarse grits, red sandstones

and clays conglomerates
Upper Pliocene Tatrot stage Friable sandstones and

variegated clays

General

Lower Pliocene Dhokpathan stage Brown sandstone, gravels and orange clays

Nagri Stage Hard grey sandstones and

minor shales
Middle Miocene Nahans/Chinji stage Coarse gritty clays and red

sand stone, grey micaceous
sandstone often calcareous,
brownish shales with lignite
lenticles, greenish white
quartzite
Lower Miocene Kasaulis Grey sandstone, green shales

and grey clays
Dagshais Purple and green sandstone,

deep red gritty clays, white
sandstone with ferruginous
concretions
Upper Eocene Subathus Sandstone with gritty clays,

impure fossiliferrous
limestone calcareous slates,
greenish shales and dark
brown quartzite
The great ceromanion transgression during the cretaceous was world-wide and in the Upper Cretaceous, there were fairly distinct faunas in the lands bordering the Indian Ocean.The end of the Cretaceous was marked by important changes in flora and fauna. These changes were brought up by the first phase of the compression of the Tethys in the Upper Cretaceous, resulting in the shallowing of the Tethys and ridging up of its bottom in the Himalayan region.

Among the earliest formations deposited in this basin are the Eocene and Oligocene which are characterised by numerous for aminifera, highly useful for correlation. Nummulitics, occur in both these, Assilines and Orthopharagina are confirmed of the Eocene while Lepidocyclines occur in the Oligocene. In view of the Nummulitics occurring over the rocks of different ages, it is apparent that a considerable part of Himalayan area was beneath the sea during the Tertiary times and that there must have been extensive erosion accompanied by or origenic activity before, the deposition of the Nummulitics began. The Nummulitics were succeeded

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by the deposition of Dagshais and Kasaulis roughly/equivalent to lower and upper Murrees of Jammu and Kashmir area. The transition between the Nummulitics and Dagshais is, however, some what abrupt, representing a stratigraphical gap between these. The lithology indicates that the Dagshais are brackish water deposits, while the Kasaulis are fresh-water ones.

The termination of Murree period was followed by the mountain building activity in the Tethyn belt, resulting into a long, narrow depression in front of these rising Himalayan mountain ranges towards the side of Peninsula. This depression foredeep, was the site of deposition of the Shiwalik strata, which commenced in middle Miocene and in which most of the sediments were derived from the denudation of the mountains.

The lower shiwaliks in this region are represented by the Nahans and the junction between these and the underlying Kasaulis is generally a thrust plane.

The rock formations comprising Subathus, Dagshais and

Kasaulis were included formerly under Sirmur system and represent the deposition during un-interrupted period, excepting a small stratigraphical gap between Subathus and Dagshais.

The transition between the two is somewhat abrupt and is marked by pisolitic marl(a red clay containing calcareous concretions), purple shale and white sandstone with ferruginous concretions.

(a) Subathu Beds

The Subathus generally consist of calcareous and argillaceous rocks including thick beds of gritty clays, generally of subdued neutral colours, of very finetexture and weathering in splinters, both acicular and cuboidal.The calcareous element occurs most frequently in irregular; sub-concretionary, earthly bands of impure limestone which are also highly fossiliferrous. These are also occasional beds of hard, coarse grits of fine sandstones of dull colour towards the top.

(b) Dagshai Beds

The Subathus are succeeded by thicker beds of sandstone having purplish tint and contain beds of gritty clays, bright and deep red in colour. A well-defind white, quartzitic sandstone intervenes between the Dagshais and the Subathus. The change from grey and brown Nummulitic to deep bright red clays in abrupt which are gypsiferous at various places. The top of the Dagshais is marked by a purple and green sandstone and clays become subordinate and alternation of purple cindery shales and purple and green sandstone become frequent.

(c) Kasauli Beds

The Dagshais pass conformably up into the Kasauli beds in which there is an absence of bright red clays and comprise essentially a sandstone group with minor

argillaceous bands, the sandstone being grey to greenish in colour and generally softer, coarser and more micaceous than the Dagshai sandstone. The shales are soft and less cindery and more green in colour. Grey clay slates also occur in these rocks. The transition between Dagshais and Kasaulis is very gradual and the lower beds pass almost imperceptibly into the upper.

(d) Shiwalik Series

The Shiwaliks in the area are mainly represented by lower and upper Shiwaliks, stretching from Kala-Amb to north-west of Kalka. Middle Shiwaliks,however, are also present in patches within the State of Haryana.

(e) Lower Shiwaliks

The lower Shiwaliks in the area are known as Nahans, which are exposed along a linear belt striking NW-SE and form the low flanking ridges along the north-east edge of the Pinjore-Dun near Kalka. At Kalka, they consist of coarse gritty clays and red and purply, hard earthy sandstones, both coarse and fine-grained. The clays preponderate over sandstones in the lower beds. The sandstones, at times, are calcareous with the development of calcite.

(f) Middle Shiwaliks

South of the Nahans, are exposed middle Shiwaliks along the NW-SE trending Shiwalik belt bordering the recent alluvium, south-east of Kala Amb. These beds are composed of alternating red, pink and orange coloured claysand, fine to medium grained grey micaceous sandstone, which are harder as compared to the sandstone of upper Shiwaliks. Sandstones, at certain places, contain lenticles of coal pallets of red clays and sulphur encrustations. They also contain pebblets of granite and quartzite and show current bedding.These characters are suggestive of rapid deposition with alternation of calm and flood condition in which the clays were reworked and deposited. Some bands of pseudoconglomerate and siltstone are also associated with these. The paucity of

fossils and general similarity of the lithology of the two stages of middle Shiwaliks i.e. Nagri and Dhokpathan, limits the scope for identifying the boundary between them.

The following vertebrate fossils have been recorded around Kairi-Taprian village from pseudo-conglomerate beds: Dorcatherium, Stegodon, Bovidean teeth and reptilion scales. Besides vertebrate fossils, fossil wood is also found.

(g) Upper Shiwaliks

Upper Shiwaliks are exposed in a linear belt, north and east of Chandigarh, south of the middle Shiwaliks. No discontinuity or discordance is, however, observed

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from middle Shiwaliks to lower boulder conglomerate of the Upper Shiwaliks, except for the decreasing amount of dip towards the top horizons. Further because of the paucity of fossils and gradual gradation from middle Shiwaliks to the Upper Shiwaliks, it is very difficult to demarcate the boundary between Dhokpathans and Tatrots in this part of the area.

The Tatrots are characterised by variegated clays and interbanded friable grey-coloured sandstone. Sandstones are akin to sandrock and grade into conglomeratic bands, at some places.

The lower variegated clays show profuse distribution of vertebrate fossils along the stretch north-west of Talokpur, bordering the plains. The middle thick sandstone band has not yielded any fossil while the upper interbedded sandstone and clays yielded occasional fossils. Hippopotamus, Stegodon, Mastodon, Elephas, Hipparion, Leptabos,

Sivatherium, Camelus, Gazells, Lectitherium, Colossochelys and Gavalis are founding this area.

The Tatrots pass on conformably to Pinjore with a sharp contact in between them. The overlying Pinjore beds began with the red clay (occasionally yellow clay or sandstone) and are followed by massive soft sandstone and occasional interbedded conglomerates. These beds have little in common with those of Tatrots, as both the stages though comprised of clays and sandstones, are deposited under different environmental conditions, which are reflected upon the vertebrate fauna, as well. Whereas, the Tatrots stage is characterised by an assemblage which included Hipparion the obaldi, Archidiskdom Planifrons and Profuse distribution of Hippopotamus, Promphibos, Leptobos, Camelus etc., the Pinjore stage include Eggus, Rhinoceros, Hyselephas, Hysudricas, occasional Hippopotamus and profuse Giraffids and bovids, as most of the genre prevailing during Tatrots became extinct in Pinjore. The predominance of red beds and complete absence of grey beds in Tatrots is a strong indication of prevailing arid climate. In addition, occasional yellow beds indicate brief cold spells during this period.

The time interval between the Tatrots and Pinjors, as evident by sharp lithological changes due to changes in environment and climatic conditions, saw the advent of arid climatic conditions from the more humid during Tatrots period and arrested rapid erosion. Conditions for the survival of Hipparion became extremely unfavourable and it disappeared before the advent of a new cold and arid period of Pinjors. Hippopotamus also suffered heavily as most of the lakes, river swamps etc. disappeared.

A beautiful section of Tatrot, Pinjor beds is exposed north of Gobindpur in an eroded dome. Picturesquely banded Tatrot clays and sandstone pass on to Pinjor red

beds of soft sandstone, silt stone and clay, with a sharp contact at the top of the grey sandstone horizon of Tatrots.

Pinjors are conformably overlain by the massive beds of lower Boulder Conglomerate stage as seen in the area between Dudhgarh, Mandhana and Tanda Kotian villages. They occupy a core of a large syncline and form escarpments towards the plains. The passage from Pinjors to Boulder Conglomerate is gradual and definite boundary cannot be drawn.

The massive conglomerate beds contain occasional interbedded red clays and sandstone.

The lower conglomerate beds are succeeded by a small elongated patch of unconsolidated boulders on a hillock south-west of Samlasan Devi temple and comprise the Upper Conglomerate stage. Boulders, here are larger in size with little matri and horizontally laid. Again, south-west of the Surajpur Cement Works a small patch of the same stage lies unconformably over the Tatrots and Pinjor stages and has yielded some Elephas and bovidean remains.

Recent to Sub-Recent

Alluvium, blown sand, *Kankar,* soils and terrace material constitute the Recent to sub-Recent deposits; Alluvium is confined to existing river courses and palaeochannels in the area; whereas the wind blown deposits occupy the greater part of the state. Terrace deposits are mostly confined to the Ghaggar stream and its tributaries in the area, mostly towards the north-eastern boundary of the state. *Kankar* and related evaporation mostly occur along the palaeochannels, in their flood-plains, while certain concretionary and nodular deposits are found in the aeolian deposits, either due to pedogenic process or capillary rise from groundwater. F2-folds differ from F1 in their wavelengths and plunge amount but otherwise have the same exial trend i.e. NNW-SSW and can be distinguished from F1 easily, since azilian plane cleavage of earlier folds cuts across their hinges, while the folds of later generation are concentric with respect of these planes. F3- folds in the area are generally broad and open type and are found on the limbs of the earlier folds and plunge at low to moderate angles towards east and west.

The Firozepur Jhirka-Bhondsi ridge is an anticlinal ridge with its southerly closure located at Nowganwa(Podipur) and having 20º plunge towards S 20º W. The western limb of the fold dip at about 45º towards west, whereas the easterly dipping of eastern limb is truncated by a fault. The Delhi-Harchandpur ridge is a part of this regional anticline, which is separated from the former due to block faulting.

The eastern ridge in the area belongs to Ajabgarhs, which contain four main zones of quartzite near Pinangwan. The first two of which , counting from west. are straight and continuous, the third and the fourth curve away in great loops from these at Biwan and more interrupted. These straight ones continue upto Mandkaula in the north. These ridges represent very tightly folded anticlines and synclines, so much so that the beds in the Gore have become almost vertical. The detached isolated straight exposures upto Mandkaula represent the western limb of a syncline,which has probably been affected by a fault. The southern most continuation of this hill is seen near Karoli in Rajasthan area, which however, is thought to be the southern extension of Ferozepur Jhirka-Bhondsi ridge.

A broad structural pattern of Delhi Supergroup of rocks is summarised as under:-

Khodana and its surrounding areas form a part of doubly plunging anticline with closures at Siswala in the north and Sohla-Chhajwas in the south. These rocks(Alwars) generally trend in NNE-SSW direction with moderate to steep westerly dips. At least four styles of folding could be recognised, of which N-S trending oppressed isoclinal folds are E-W trending cross folds are the most pronounced and prolifically developed fold patterns. The different litho-units of the area

represent a series of longitudinal oppressed isoclinal folds with NNE-SSW trend with steep westerly dipping axial planes. These oppressed folds have been affected by a later shallow open cross-fold, plunging at 40º-80º towards west, the axial trend varying from NW-SW. The westward concavity of the regional doubly plunging anticline is the effect of this cross-fold. A number of faults on shears have developed in the limbs of tight overturned folds and are sub-parallel to the strike of the strata. A number of large cross faults striking east-west are also recorded.

The Ajabgarhs exposed south-west and north-east of Narnaul are thrown into a series of anticlinal and synclinal folds of both oppressed (asymmetric to antisoclinal) and open types with their axes trending NW to NE. Here, in all, three phases of deformations are noted, resulting into varying structural trends. Folds of first and second generation are co-axial, while the folds of third generation are at right angles to the earlier folds. FI-folds are generally symmetrical to asymmetrical in low-lying surfaces like *Tals* are also characterised by the presence of *Kankar* deposits in the area. Saline soils and saltpetre efflorescences are mostly confined to north-eastern tract of the state.

A large part of the area is, however, covered by aeolian deposits of very huge thickness, covering the rocks of Delhi Super Group and Malani suits, which rise at places above the desert sand. Existence of Thar desert towards the south-western boundaries of the state has resulted into more or less similar condition in the western

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margins of the state, where a series of longitudinal and transverse ridge like dunes are predominantly seen at the

surface. Earchains of all sizes, from smaller to as big as few kilometres in dimensions, are also noted; which indicate, in general, a wind direction towards east and north-east. Many of the transverse dunes in the area represent reworked river sands, as apparent from their relationship with the palaeochannels in the area.

The Delhi Super group of rocks continue uninterruptedly from the northern parts of the Rajasthan State to Haryana and maintain the similar structural trends. The sedimentary structures observed in these rocks include both characteristics of shallow and deep water.While current beddings, load casts, ripple marks and mud cracks present in Ajabgarh rocks denote structural characteristic of shallow water deposits; presence of flute casts in Alwars indicate deep-water conditions. Flute casts range in width upto 1 m. and length up to 2 m. with apex buckling down 10º to 20º.

In contrast, the structure of Tertiary rocks present in north-eastern extremity of the area is remarkably different. The general strike of the rocks here in NW-SW with low to moderate north-easterly dips in Siwaliks and low to very high dips in Subathus, Degshais & Kasaulis.The subathus occur both as thrusted over the Nahans and as outliers of varying size and are exposed as the faulted crests of tightly folded anticlines. These outliers very often disappear suddenly along the strike having been cut by strike faults. Dagshais in the area overlie the nummulitic outliers and at places nummulitics are brought over the Kasaulis by normal strike faults.

Nahans(Lower Siwaliks) in the area occur as thrusted over the Subathus and Boulder Conglomerate beds(Upper Siwaliks). Middle Siwaliks in this part cover a part of the large westerly plunging anticline whose southern limb is missing either due to faulting or erosion.

Mineral Resources

In Haryana, mineral resources are scarce. Whatever, mineral wealth exists, it is mostly mapped in Panchkula, Ambala, Gurgaon, Mahendragarh and Bhiwani districts. The availability of mineral ores of different kinds is described below:-

1. Arsenopyrite.- Arsenopyrite is an ore of arsenic and is present as disseminations in dark grey quartzite bands of the Alwar Formation in Ferozepur-Jhirka and Nuh tahsils of

Gurgaon district. The metal arsenic is chiefly used in medicines.

2. Asbestos.- It occurs in minor quantities in calcschist rocks around Gohoro in Mahendragarh district. It is used for making fire proof cloth, in brake linings, insulation mats and asbestos ropes. It is mixed with magnesia brick which is used for heat insulation. Asbestos cement sheets are used for roofing .

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3. Barytes.- Barytes is valued for its chemical inertness and high specific gravity. It is used in preparing muds required during oil well drilling. Other important uses are in paint and lithopore industry and as a source material barium chemicals.It is also reported from Haripur in Ambala district.

4. Beryl.- Beryl, silicate of beryllium and aluminium, is the principal source of beryllium metal which is lighter than aluminium. When alloyed with copper and after suitable heat treatment, the alloy develops high tensile strength and ability to withstand repeated stress. Since the discovery of atomic energy, beryl has become very important because the metal is used as moderator in nuclear reactor. A small quantity is used in the chemical industry in the manufacture of beryllium salts and ceramic glaze. The green transparent variety of beryl is precious stone known as emerald.

In Haryana, large crystals of beryl have been recorded from a few pegmatites adjacent to Bail-Ki-Dhani, Mosnuta and Sarai in Mahendragarh district.

5. Building Stones.- Haryana is famous for its slates which are extensively used as ornamental building and decorative stones and form an important source of foreign currency. The

multicoloured variety is mainly exported. Other building materials include marble, limestones, sandstones, quartzite, granite, etc.

(a) ***Slate.-*** In Haryana, slate is associated with the Ajabgarh Formation of Delhi Supergroup. The chief deposits of slate occur in Mahendragarh & Rewari districts and are situated near Kund, Bahali, Rampura and Bas. In Kund area alone, slate reserves have been estimated at 8.78 mt. out of which nearly 60 percent is of multicoloured variety. Other important deposits in the area are located near Bajar and Ganiar. Poor quality slate bands, about 7.5 to 12.5 cm-thick occur near Basai Meo in Gurgaon district.

(b) ***Marble.-*** Impure calc silicate rocks or micaceous impure marbles of Ajabgarh Formation are mostly confined to Mahendragarh district and are quarried at Dholera, Meghot Hala, Dhancholi and Gangutana. The white sacchoridal rather silicious marble of Antri Beharipur extends for about 3 km. and is about 100 m. thick. Together with this a banded and variegated marble of different shades is also found. These are being quarried for making table-tops and other building materials. Other occurrences of marble of different shades are found near Gangutana, Mosnuta, Bail-ki-Dhani, Islampur, Khalra, Gohoro and Niaz Alipur of Mahendragarh district.

(c) ***Quartzite.-*** Alwar formation in particular and Ajabgarh at places have yielded good quartzite for use as building material. All along the Alwar formation in Faridabad and Gurgaon districts several quarries exist to exploit these deposits.

In Rewari district, these are being worked out in Guraora-Guriani area. In Mahendragarh district, these are quarried at Mandlana, Berondla, Luni, Nasibpur,

Gohoro and near Gaonri. Fissile quartzites are worked for roofing slate and other masonary blocks at various places in Mahendragarh district such as Sareli, Tehla, Mukandpura, Pachnota and Sarai, while almost all the quartzite hills of the district are worked for railway ballasts and concrete aggregates specially at Baliana, Rajawas, Khaspur, Atela, Jhojhu Kalan, Azamnagar, Tankri and Dhantal(Bhiwani district).

(d) ***Granite.-*** Inselbergs of granite in the area are mainly found in the Bhiwani district and the important occurrences are located near Dulheri, Khanak, Dadam, Dharan, Riwasa and Tosham. All these deposits are being quarried to meet the local demand for construction purposes and a number of stone crushers are in operation at Adalpur, Khodana, Tosham, Khanak and Kaliana(near Charkhi Dadri).

(e) ***Sandstone.-*** The sandstone beds of Kasauli, Degshai, Sabathu and certain beds in Nahan provide large sources of good quality building material in Panchkula district. Kundis or stone bowels are also locally made at kalka from some of these sandstone. Sandstone used as building material is found near Kalka (Panchkula district). Boulders and pebbles, transported by the Ghaggar stream are worked out near Panchkula for construction material.

6. Calcite.- Calcite veins are normally associated with the Ajabgarhs and are mostly confined to Mahendragarh district of Haryana. A vein of calcite, about 50m. long and 10m. wide, is associated with quartz vein near Raghunathpura. Another calcite vein about 20m. long and 5m. wide, also occurs in the vicinity. Both these occurrences contain a high quality, but the purer and transparent variety of Ice-land spar is rare. Near Mosnuta also a calcite vein, about 45m. long and one metre wide, occurs in association with pegmatite. All these veins have been quarried in the past. Two to three veins calcite occur in Mundia hill and Sonaro-Ki- Pahari of the Khalra group of hill, Bail-Ki-Dhani and Pachnota. Transparent calcite in association with white milky calcite has been reported from the Rasulpur hill. Pure crystallised transparent calcite is mainly used in making optical instruments. Poor quality calcite is now-a days being used for up-grading limestone.

7. China Clay.- Pegmatite intrusions in the Delhi Supergroup have given rise to workable clay deposits in Faridabad and

Gurgaon districts. The important occurrences are located near Alipur, Aurangpur, Ghamrang, Ghosgarh and Sikandarpur. Other occurrences in the area are located near Kasan, Ghata, Mangar and Nathupura. The clay contains mostly poorly crystallised Kaolinite with little quartz. Chemical analysis of clay from different localities indicate that silica is normally over 60 percent while alumina is around 20 percent and that these are of refractory type. An estimate of pegmatitic material, which yields roughly about 50 percent clay on washing at Aurangpur, Ghosgarh and Sikandarpur is 890, 800 and 5,250 tonnes per metre depth.

Total Kaolin deposits of the two districts are of the order of 0.22 mt. out of which 0.07 mt. is indicated and the rest is inferred.

8. Common Salt.- Salt used to be extracted from Nuh, Ferozepur, Malab, Salaheri and adjoining localities in Gurgaon district in the past. The ground-water in these areas is highly saline and water level is about 4 m. deep. Salt used to be extracted by evaporation of saline water.

9. Copper.- The main occurrences of copper in the state explored so far are around Khodana, Teejanwali hill and Golwagunutana in Mahendragarh district and Tosham in Bhiwani district. Besides these, a number of copper and other base metal occurrences are located in the Aravalli-Delhi matallogenic province. Chalcopyrite grains alongwith pyrite, pyrrhotite and arsenopyrite occur as disseminations near Rajka Meo and Indri in Gurgaon district. Malachite staining is observed in Ajabgarhs of Datla hill near Raghunathpura, Ghataser, Donkhera, Gohoro, Meghot Kalra, Zainpur and Dholera villages in the southern part of Mahendragarh district. Specks of pyrite and Chalcopyrite are also noticed in

the crystalline limestone of Bathonta-ki-Dhani, Kakia-ka-Nangal and Dostpur.

(i) Khodana Occurrence.- Khodana is about 25 km. from Mahendragarh and about 150 km. from Delhi by road *via* Mahendragarh. The Delhi supergroup of rocks(Alwar Formation) exposed at Khodana and surrounding areas form a part of doubly plunging anticline with closures at Siswala in the north and Sohla and Chhajwala in the south. At least five separate limonotized zones were mapped in the area. Sulphide minerals encountered in different boreholes at Khodana consist mainly of pyrrhotite with subordinate pyrite, minor chalcopyrite sphalerite and rare galena. These occur as thin stringers and veins aligned roughly along bedding and schistosity plains and as patches, streaks and disseminations. Broadly, the sulphide mineralisation is strate-bound-thinly bedded, grey to dark grey qartzite in the abode of major sulphide mineralisation. Sulphide mineralisation at Khodana constitutes about 15 percent of the rock as per visual estimates. Analytical results of parts of borehole samples(367 samples analysed) show a maximum of 0.5 percent Cu., 3.1 percent Zn. and 0.13 percent PB. The mineralised zones have been subjected to the major NE-SW trending oppressed isoclinal folding, the earliest recognised fold-pattern of the area. Shearing along the limbs of these oppressed folds has concentrated the sulphides at certain places, thereby producing en-echlon pattern of the ore bodies. The paragenetic sequence of ore minerals is pyrite, arsenopyrite, chalcopyrite, galena and geothite(secondary).

(ii) Teejanwali hill occurrence.- Teejnawali hill is located south of Narnaul and comprised Ajabgarhs of Delhi Supergroup. Suphide mineralisation pyrite and

arsenopyrite with occasional specks of pyrrhotite and chalcopyrite, are mostly found in quartz rich calcsilicate sands along a sheared contact zone between calcsilicate rock and feldspathic quartzite. The mineralised zone is only 0.6 to 0.9 m. wide over a strike length of 21m. and contains a maximum of 0.25 percent copper.

(iii) Golwa-Gangutana Occurrence.- A low grade copper prospect but of sizeable dimensions occur at Golwa-Gangutana in Mahendragarh district. The zone of low grade copper mineralisation with 0.30 to 0.35 percent copper extends over a cumulative strike length of 3,350 m. with widths around 30m. The prospect is likely to contain 15 mt. of copper ore of around 0.3 percent metal content.

(iv) Tosham Occurrence.- At Tosham, base metal prospect where work was initiated during 1975-76 has so far indicated only low grade copper mineralisation i.e. of the order of 0.3 to 0.4 percent Cu over cumulative widths ranging between 8 and 25 m. for strike length of about 500m.

At the surface, the shear zones exposed at the contact of rhyolite and meta-sediments contain shows of copper mineralisation. However, the acid magmatic rocks of the area on re-examination indicated promising results for rare metals i.e. tin and tungsten during 1981-82 and the programme for exploration for copper has since been reoriented to include search for tin and tungsten.

10. Felspar.- Felspar is an alumino-ailicate mineral of potassium, sodium and ore calcium. Though felspar is among the most widely distributed rock forming minerals and occurs as a constituent of most of the rocks. Commercial deposits are mainly confined to pegmatites. Felspar is chiefly used both in the body of the ware and for glazes in the ceramic and glass industries besides insulator-manufacture.

Pegmatite intrusions occur in Alwars of Gurgaon and Faridabad districts where they range in thickness from 2 m. near Gramrang to more than 25m. near Sikandarpur and occasionally, they are as long as 80m. near Alipur . The main constituents of these pegmatites are felspar, quartz, muscovite and tourmaline. Felspars are mostly altered to clay. At Sikandarpur unaltered felspar is greenish white in colour whereas at Ghosgarh felspar is reddish in colour.

In Mahendragarh district, pegmatites are associated with Ajabgarh, where felspars occur in sizes from 64 Sq. Cm. to

about 900 Sq. Cm. The felspar is pure white to greyish and bluish-white in colour. Light green and pink coloured felspars in this area are estimated at 8,000 tonnes upto a depth of about six metres. The important localities in the area are around Mosnota, Panchnota, Durgu-Ka-Nangal and Bail-Ki-Dhani. Good pink felspar occurs in a pegmatite in Dhanota area.

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11. Friable Quartzite.- Friable quartzite having high silica content are easily amenable to crushing for the manufacture of glass. Weathering of these quartzite produces good murrum and angular sand suitable for building purposes. Such materials are found to accumulate in the numerous *nala* beds traversing the Alwar quartzite hills in Faridabad and Gurgaon districts. There are many sand quarries in the Aurangpur(28º 28' :77º 16') area and have reached a depth of 20m. Gritty quartzite at Bajada Pahari is also friable, but limited in its extent.A narrow zone of friable quartzite about 1.2 to 1.5m. wide and traceable for 30m. along strike is seen west of Manesar(28º 21' : 77º 56'), which is suitable for manufacture of low grade glass only. In Bhiwani district, a white friable quartzite about 200m. in length and upto 4m. thick occurs near Pichopa Kalan and the friable zone is confined to a metre depth from surface.

12. Garnet.- The Ajabgarh schists and gneisses around Gohoro(27º 51' :

76º 02'), Mosnuta(27º 53' : 76º 02') and Gangutana (27º 52' 30" : 76º 02' 50") in Mahendragarh district are highly garnetiferous. Garnets are pink in colour, translucent to opaque and vary in size from minute grains to about one centimetre in diametre. They are associated with staurolite crystals of various shapes and sizes. Near the contact of

Alwar micaceous quartzites of Sareli(27º 56' : 76º 02')- Tehla (28º 00' : 76º 05') ridge, with the Ajabgarh calc-argillaceous rocks, bigger crystals of garnet have developed but their concentration is low.
In Gurgaon district, thin bands of grey coloured, soft, garnet-inferous mica schist are seen west of Hariahera. Garnets here are generally quite big about 3 cm. in diametere, but smaller crystals are not uncommon. West of Raisina, the light coloured schists are richer in garnet.

13. Graphite.- Graphite is used in the manufacture of `Brushes' in dynamous as electrodes in electric furnaces and as moderator in atomic reactors.

There are numerous reported occurrences of graphite deposits in the state but are generally of poor grade.

Graphite occurs in association with schists in Gurgaon district . Graphite schist band occurs west of Sohna in which graphite occurs as flakes and amorphous carbon and shows increasing concentration with depth. Near Raisana, the dark schist bands are richer in graphite. Other occurrences in Gurgaon district are at Baghaul and Hariahera in this schist bands interbedded with quartzite.

14. Gypsum.- Gypsum, a hydrated sulphate of calcium, (CASO4, 2H20) is widely distributed mineral and is generally fibrous lumps and transparent plates. Its crystalline variety is known as salenite, and fibrous and silky variety as satinspar. It is used as a retarder in cement, in fertilizers , and as filter in various materials like paper, crayons , paint and rubber.It is also manufacture plaster of paris.

Moderate quantities of gypsum are reported to occur as lumps in the ferruginous clays of the Subathus in Panchkula district.

Gypsum occurring as dissemination in the clay bands interbedded with sandy layers has also been reported from Julana area in Jind district.

15. Iron Ore.- Only small deposits of high phosphorous iron ore are located in Mahendragarh district and another small occurrences is located in Bhiwani district. The details are given below:-

(i) Antri-Beharipur deposit.- A small deposit of iron ore located near Antri-Beharipur was explored both by the G.S.I. and the State agency. The deposit, which is mainly magnetite with subordinate amounts of hematite, extends discontinuosly for a strike length of about 4 km. with a thickness varying from one to six metre and is confined to dolomitic and silicious white marble of the Ajabgarhs. A total of 1. 205 mt. of ore is estimated upto depth of 40m. in this area by the State agency and the grade varies from 55 to 60 percent iron.

(ii) Dhanota-Dancholi deposit.- The iron ore here is also mainly magnetite and is associated with felspathic and epidotised quartzites(Alwars), which has been intruded by granite gneiss the adjoining areas. The Dhanota-Dancholi deposit is exposed for about 2.5 km. strike length with thickness varying from 1to 6m. Total estimated reserve is upto a depth of 75 m. of the order of 1.5mt. with a grade varying from 53.2 percent to 67.2 percent.

(iii) Rajawas-Sohla deposit .- Iron ore occurs here in calcareous quartzite as pockets and lenses in the form of hematite, limonite and jasperiod hematite and stretches from Sohla to Zerpur and beyond upto Khodana in minor amounts. The quartzites are often micaceous tending to become phyllitic and schistose and the iron rich zone assumes a thickness of about 25m.

Total iron ore deposit in the Mahendragarh is of the order of 8.084 mt. out of which 3.398 mt. is indicated and the rest is inferred.

(iv) Kaliana Deposit.- At Kaliana(in Bhiwani district) lenses of iron ore, mainly magnetite, occur in black quartzite. Hematite with little limonite occurs at Tosham hill and stretches for a length of 50m. with width varying between 0.08m. to 0.50m. The iron content varies from 39.2 percent to

58.8 percent and a rough estimate of the ore, mainly Goethite-Hematite, have been recorded from Madhogarh.

16. Kankar.- Kankar a terrestrial accumulation of $CaCo^3$ in the alluvial plains or eolian sands and having a variably purity is mostly confined to Bhiwani district although substantial deposit occur in Mahendragarh, Sirsa, Hissar and Gurgaon districts as well. However, only Bhiwani district has been so far explored

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systematically for these deposits and 2,686 Sq. Km. of area has been covered. The main localities in the district are around Riwasa, Siwani, Dadri, Achina, Lohari Jatu, Baliali, Rupgarh, Mankawas and Kaunt. Kankar in the region occurs both as massive and fragmentary deposits and is mostly confined to palaeochannel courses and interdunal tracts in the area. The maximum thickness of Kankar beds is observed as 1.5 m. and occurs at the surface or at a depth of about 1 metre. At some places, it contains shells of gastropods and lamellibranchs which indicate its deposition in surface water bodies like lakes, ponds and open channels. Although, the average Cao content of these deposites is around 30 percent yet they have often yielded values as high as 46 percent and are being used for cement manufacture at Charkhi Dadri. For this purpose, nearly 8 mt. of shally bedded Kankar with around 41 percent Cao has been estimated around Dadri, while nearly 3.75mt. have been estimated with 38.4 percent Cao, 1.1 percent Mgo and 18.1 percent Al. around Lalas. Over 50 mt. of massive Kankar of all grades has been estimated from this region alone. Besides, having its use in the cement industry, it has found that its use as road aggregate. It is also used for other constructional purposes as a locally available material in the absence of other suitable

hard rock types in the area. In Rohtak district, high grade bedded deposits of Kankar occur at Kaliawas and Bihror and are used in the cement plant at Charkhi Dadri.

Kankar beds ranging in thickness from 0.50 to 1.5 m. have also been reported from Gurgaon and Faridabad districts. The important localities are Garhi, Harsaru, Farrukhnagar, Malab, Jalalpur, Alwalpur, Aluka and Salaheri.

18. Kyanite.- 1.5 km. north of Gohoro in Mahendragarh district, the Ajabgarhs contain impure calcschist rich in garnets and staurelite in an area of 100 m. x 10 m. in which large crystals of kyanite, measuring upto 10cm. in length are found. The associated rock appears to be quartz-kyanite rock and the deposit was worked out in the past. The kyanite is light blue and yellowish in colour and is associated with flakes of muscovite.

Small kyanite crystals are also seen in the graphitic schist, west of Sohna, in quartz vein near Bhondsi and in schist bands in Muhammadpur Gujar area in Gurgaon district.

19. Limestone. _ Limestone is mostly confined to Mahendragarh and Panchkula districts of Haryana. Total deposits of cement lime-stone in the State are of the order of 50.25 mt. out of which 24.01 mt. is measured and the rest in inferred .

The availability of limestone at various places is shown below :-

Crystalline limestone and marble bands occurring in Ajabgarh Formation of Delhi Supergroup of rocks are quarried around Narnaul for use as buiding material

and to some extent for the manufacture of lime. All the different deposits in the area are more or less along the strike continuity, giving an impression that there may be parts of a continuous crystalline limestone belt extending for about 20km. with in the district and then passes into Rajasthan where it is extensively quarried at Rampura. An account of the main deposits of the area is given as under :-

(i) Dochana Limestone Deposit.- The deposit has been proved by the State Geological Wing. The limestone in the area extends over a strike length of 1,200 m. and contains in all about 8 mt. of both crystalline variety and dolomitic limestone.

(ii) Bathonta-Ki-Dhani Limestone deposit.- The metamorphosed limestone extends here over a strike length of 225m. and according to State Geological Wing the total reserves of limestone of all grades are of the order of 0.243 mt. upto a depth of 30m.

(iii) Banihari-Kalba-Bamanwas Limestone Occurrences.- The chemical analysis of Banihari, Kalba and Bamanwas indicate the Cao ranges between 34.5 percent and 44.9 percent, Mgo varies between 1.5 percent to 4.3 percent. Acid insolubles range between 7.2 percent to 28 percent while R_2O_3 varies between 1.4 percent to 6.5 percent. At Banihari grey crystalline limestone occur within dark grey limestone bands. The relatively purer limestone bands have width of 8 to 10m. and extend over a strike length of 300m.

(iv) Mosnota Limestone Occurrence.- Light coloured crystalline limestone at Mosnota grades depth-wise into calcsilicate with quartzite. In all 43,400 metric tonnes of limestone with a depth extension of 30m. and averaging Cao-34.69 percent, Mgo-12.25 percent and acid insolubles 9.79 percent has been assessed for this deposit.

(v) Dhanota Limestone Occurrence.- Light coloured crystalline limestone containing lenticles of quartzite, pseudobreccia and calcirudies occur in between the felspathic quartzite limestone with amphibolites. Three bands of crystalline limestone in this part of the area on an average contain Cao 32.09 percent, Mgo 6.60 percent and acid insolubles 27.28 percent and the total reserves are of the order of 47.7050 metric tonnes with a depth extension of 35m.

(vi) Sadha-Ki-Dhani Limestone Occurrence.- The crystalline limestone here contains Cao as high as 44.9 percent and acid insolubles upto 18.9 percent while magnesia content is generally high. Average chemical analysis for this deposit indicate Cao-33.7 percent, Mgo-13.9 percent and acid insolubles-3 percent .

A number of limestone deposits occur both in Tundapathar series and the Subathus. In addition, Nahans also contain certain lenticular bands of limestone. Total estimated reseves of limestone in Panchkula district are of the order of 17.6 mt. The limestone of Tundapathar series occur as two distinctive bands separated by about 26m. of shale and has been thrusted against the Nahans to the west. The Subathus

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series is characterised by impure earthy limestone and dark in colour.The Nahans contain certain concretionary limestone banks which assume importance in view of the fact that these could be utilised in place of clay after blending them with the high grade limestone of the area for cement manufacture. A tentative estimate of these lenticular deposits may be over a million tonnes in the area.

Limestone from these areas is being used in the Surajpur factory for the manufacture of cement.

(i) Tundapather deposit.- The limestone is massive, grey and is characterised by numerous calcite veins. On an average the deposit indicates CaCo3-85 percent to 92 percent and Mgo percent is very low. This limestone is suitable for chemical industry and the total reserves are of the order of about 6,00, 000 tonnes of high grade limestone.

(ii) Kharag Limestone deposit.- Cement grade limestone,

averaging CaCo3-81 percent and Mgo-3.98 percent occurs near Kharag. A total of 5mt. reserves of good quality limestone occur in the area.

(iii) Sherla deposit.- The limestone is grey and highly brecciated. These limestone contain on an average 84 percent CaCo3 and 2.91 percent Mgo near Sherla.

(iv) Limestone of Subathu series.- Nearly 2.475 mt. at Dahsu and 0.169 mt. each at Ambri and Kharag areas has been estimated. These are generally argillaceous limestone with CaCo3 ranging between 43 percent to 67 percent and Mgo content varying between 1.65 percent to 6.75 percent. A band of thinly bedded Subathu limestone, about 5 metres thick occurs at Baru. The total reserves of limestone at Malla, Janpur, Dabsu, Ambri and Jabrial are of the order of about 12 million tonnes.

20. Mica.- Only at a few places mica is quarried from the mica-pegmatites and the deposits are very small. The maximum size of mica blocks around Bhondsi(28º 21' : 77º 04')is 15 cm. x 10cm. and was quarried in the past. Near Panchnota(27º 54': 76º 00'), muscovite is being quarried from the mica-pegmatites, but the deposit is quite small.

21. Mineral Water.- The hot spring of Sohna in Gurgaon district is famous for its medicinal value. The hot water from the spring is collected in a chamber and is piped into different bath rooms. The hot water from the spring is also taken upto the top of the adjacent hill to the Sohna bath for the tourist complex. The maximum temperature of this water is 47º.

The presence of trace elements like Pt, Ni Co, Mn, Cr, Pb in the thermal water is suggestive of the magmatic source of the hot water.

In addition, two springs with chelybeate and sulpher water occur at Pinjore in Panchkula district.

22. Nickel, Cobalt and Zinc.- Geochemical analyse of samples from shear zones from Sureti area in Bhiwani district has indicated the presence of nickle, cobalt and zinc.

Nickel is used for making nickel steel, which is further used in making utensils armourplate, motor-car parts etc. Metallic nickel is also used in the construction of certain storage batteries.

Cobalt is mainly used in the manufacture of different types of alloys and alloy steels. It is also used in the manufacture of permanent magnets. It is also used in electro-plating and as building material (in the manufacture of tungsten carbide and other carbide tools).

Zinc is used for making zinc sheets, manufacture of tubes containing tooth paste and the like. Zinc oxide and zinc sulphide are used as pigments. Zinc chloride is used in soldering and preventing decay of wood.

23. Pyrite.- Pyrite-pyrrhotite mineralisation is noticed in quartzite and schist at Khodana in Mahendragarh district where the total sulphides are about 15 percent of the rock as per visual estimate.

24. Quartz Crystals.- Crystals of quartz are well-known for their piezoelectric use. For this purpose, quartz must be water clear, perfectly transparent and free from all visible impurities with a minimum weight of atleast 100g. It must have a length parallel in vertical axis of at least 20m. and a diametre perpendicular to vertical axis of atleast 1cm. Quartz of this size must have atleast one identifiable crystal face. The rock crystal is used for making clear fused quartz for optical systems, ultraviolet transmission tubes, cells and lenses, high tension electrical insulater and chemical laboratory wares. Quartz crystals are also used in wireless sets.

Good quality quartz crystals, particularly the piezoelectric quality grade, are rarely found. They mostly occur in pegmatites and quartz veins. Excepting for small deposits of secondary silica, no large deposits of quartz occur in Gurgaon district. Small deposits of rock crystals are, however, located around Nathupur, Raisina, Begampur Khatola,

Arangpur(Faridabad district), and Mohammadpur Gujar. In Mahendragarh district white granular massive quartz veins are seen near Gohoro, Kalrawas, Bail-Ki-Dhani and Beroondla. Crystals of quartz are rarely met within the area, Alwar Quartz in the area also contains a number of quartz veins. Some of them noted near Atela Khurd(Bhiwani district) are white cryptocrystalline bodies. However, some ridge crystals of a few centimetre size are seen on Kapuri ridge (28º 34' :

76º 17') and are associated with ferruginous matters.

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25. Saltpetre.- India has been a source of natural potassium nitrate from very early times and the industry reached its height from 1861 to 1865, when the average annual exports were over 30,000 tonnes. However, after the rise of chilean nitrate deposits, the industry declined and just prior to the First World War exports were only 13,000 to 14,000 tonnes per year. Until 1850 the deposits in India were the chief source of Saltpetre used in Europe and United States for the manufacture of gun powder. One of the largest deposits in India was in the Hissar district of Haryana.

Nitrate in the State of Haryana occurs as natural efflorescence at a number of places but its economic exploitation depends upon its concentration. It is mainly confined to the district of Gurgaon, Faridabad, Bhiwani, Hisar, Sirsa, Ambala, Rohtak, Jind, Sonipat and Kurukshetra, as discussed below :-

(i) Gurgaon and Faridabad districts.- Saltpetre is worked out extensively around Ujina. Other important localities are around Noshera, Mandkaula, Ransika, Swamika, Hathin, Ferozepur Jhirka, Hodal, Nuh, Pataudi and Palwal.

(ii) Bhiwani district.- Saltpetre is locally worked by villagers in Bawani Khera, Baliali and Dang Khurd. Saltpetre used to be extracted around the villages Jatai, Talu, Dhanana, Mandhana, Paluwas, Badesra, Lohari Jatu, Chang and Tigrana.Other deposits are located around Mitathal (Bhiwani district) and Guryani (Rewari district).

(iii) Hisar and Sirsa districts.- The important localities of Saltpetre in the area are around Narnaund, Hansi, Tohana, Barwala, Rania, Badaguda and Ratra.

(iv) Ambala district.- Saltpetre is extracted from the soils around Ambala and Burara.

(v) Rohtak and Jhajjar districts.- Saltpetre encrustations are extensively worked around Rohtak, Jhajjar, Kalanaur, Besi, Achej, Bahai, Sahlawas and Kherkhood.

(vi) Jind district .- The main localities of Salpetre in the area are around Uchana, Narwana, Safidon and Jind.

(vii) Sonipat District.- The important localities in the area are around Sonipat, Gohana and Ganaur.

(viii) Karnal and Panipat districts.- The industry of Saltpetre extraction from the soils has flourished around many localities, particularly at Assandh[1] and Pundri.

(ix) Kurukshetra and Kaithal districts.- The extraction of Saltpetre from the soils has flourished around a large number of localities such as Kaithal[2], Pundri and Thanesar.

1. Upto census operations of 1991, Assandh was a part of Panipat district.

2. Kaithal is now full fledged district.

26. Silica Sand.- There are many sand quarries in the Arangpur area in Faridabad district. Unwashed samples from the area contain more than 95 percent Sio2. These sands are the weathering product of Delhi quartzite material. The sand is being used as *Bajri* for construction work. Total production of silica sand from the area during 1977 for the glass manufacture was 125 tonnes. In Bhiwani district quartzites occurring west of Atela are suitable for the manufacture of window glass and bottle glass. In Sonipat district, foundry sand occurs about three kilometres from Sonipat on the Sonipat-Delhi road. It is high grade silica sand left behind by the change in the course of the Jamuna river. The chemical analysis gives about 79 percent Sio2 and the ignition temperature is about 125º.

27. Tin.- The Tosham hill in Bhiwani district which contains acid magmatic rocks is considered to be very promising for establishing good resources of rare metals. Nearly 400m. long zone of tin mineralisation has already been demarcated with tin content of around 0.20 percent over widths ranging between 20m.-30m. and with tungsten of large quantity at some places.

28. Tin and Tungsten.- The acid magmatic rocks of Tosham hill contain appreciable incidence of tin with tungsten occurring sporadically. A zone of tin mineralisation occurring along the contacts of rhyolite-metasediments and rhyolite granite has so far been established over a length of 750m. on the western side of the hill. Indications of tin mineralisation have also been obtained on the eastern side of the hill.

The rhyolite and its contact rocks, *viz.* the metasedements and the granite have pneumatolytically al-tered . The zone of tin mineralisation occurs within the pneumatolytically altered rocks. Cassiterite occurs as fine dissemination in the zone of tin mineralisation and though megascopically invisible could be seen as discrete grains in the concentrated form obtained by panning. Veins of quartz-cassiterite and cassiterite, upto 3cm. in widths, occurs in the poryphyritic granite from the western flank.A few of the veins could be traced upto 10m. of length.

Sub-surface sampling of ore bearing material indicates a possibility of the zone of tin mineralisation extending for about a kilometre on the western flank of the hill. Its widths varies between 15m. to 30m. The zone is likely to have vertical extent of around 100m. to 150m. from the surface.

The zone of tin mineralisation for the eastern flank of the hill is likely to have an extent of around 800m. with a vertical extent of around 100m.

Analytical data, available by end of April, 1984, indicate that the western zone of tin mineralisation has 0.15 percent to 0.21 percent with over widths of 29 and

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17m., respectively. Over part of these widths, the zone may have 0.25 percent tin over around 10 to 12m. Further exploration now in progress is directed towards working out the potential of tin mineralisation from Tosham hill alongwith the likely associated metals like copper and tungsten.

Seismicity

According to tectonic map, the state lies on Delhi-Lahore Ridge which is bounded by thrusts. No earthquake of any significance has originated in the zone in the past. It has, however,experienced earthquakes originating in the great Himalayan boundary Fault Zone and the Hindukush region. The notable Kangra earthquake of April 4,1905 and Chamba earthquake of June 22, 1945 affected the state, at many places. The maximum intensity was VII..VIII M.M (Modified Mercalli Intensity Scale of 1951) and the state has been assigned to zone II..IV in seismic zoning map of India where maximun seismic intensity may reach VIII M.M.

No major earthquake which had its epicentre near any place of the state, has been located in the recent past. Epi-centre of minor earthquakes, however, have at times been located within 160 km. of Delhi. Sonipat town in the state has the highest frequency of experiencing the earthquakes.

History of the past 200 years for which records are available shows that during the Kangra earthquake of 1905, Ambala district experienced an intensity of VII-VIII M.M. (of 1951 scale).

For important structures founded on consolidated soil, a provision of horizontal acceleration of 4-10 percent gravity and 50 percent regarding its vertical acceleration would ensure a reasonable amount of safety here.

Climatology

Climate

The district of Karnal, Ambala and a portion of Kurukshetra district lying between Karnal and Ambala fall under the climatic type Cwa : Sub-tropical monsoon mild winter; dry winter; hot-summer-Only Sirsa district has got climatic type Bwh: Tropical desert, arid; hot and Hisar district has a climatic type varying between Bwh(Tropical Steppe, Semi-arid; hot).The rest of the State belongs to the climatic type Bsh.

The year is divided into four seasons. The winter season from November to March is followed by summer season fom April to June. The period from July to

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middle of September constitutes the south-west monsoon season and the period from the latter half of September to October forms the post-monsoon period.

Winter prevails over the entire State during the period from November to March and is generally very un-pleasant due to biting cold. In this season a series of western disturbances affect the climate of the State. In the summer months from April to June, weather is very dry and un-comfortable. Due to lower temperature the plateau regions are, however, comparatively less un-comfortable in summer. Weather tends to be humid during July to September due to rise in moisture content of the atmosphere. These monsoon months are fairly comfortable due to reduced day temperature, although humidity continues to be high in comparison with the other months.

Atmospheric Sea level pressure and winds

The seasonal variation of atmospheric pressure over the State takes place in a systematic manner with a maximum in the winter and minimum in the south-west monsoon season. The pressure gradient over the State generally remains weak. During the winter season, the higher pressure is to the north or north-west. In April, the pressure is maximum towards west or north-west and it decreases east or south-east wards. Accordingly, the winds, which are mainly variable in January become westerly to north-easterly.With the advance of summer, a low pressure area develops over the State and the winds become south-westerly to south-easterly. In July, the pressure decreases mainly from south to north over the State and the winds become easterly to south-easterly. October is the month of transition, with the weakest pressure gradient. From October onwards the change over of the pressure and wind pattern to the winter pattern commences.

Temperature

Day temperatures are more or less uniform over the plains except during winter and monsoon when the temperatures increase southwards and north-westwards respectively. In general the night minimum temperatures are lower in higher latitude even during the south-west monsoon months when the influence of monsoon current in the State is practically negligible. Both day and night temperatures are lower over the plateau and at high level stations than over the plains.

May is the hottest month with the mean maximum temperature of 41ºc in the plains, the plateau regions and elevated places recording 2ºc to 5ºc lower. The period from the second half of July is the most favourable one for temperatures to rise 8ºc or more above normal.

The highest temperature recorded at an individual station in the plains is 48.4ºc at Hisar observatory, on 19th June, 1981 which was about 6.8ºc higher than normal of the warmest month.

January is the coldest month when the mean minimum temperature for the State as a whole is 6.6ºc varying from 5ºc in the west to 7ºc in the east and also from 7.5º c in the south to 6ºc in the north. During winter, much lower temperatures may be experienced in the wake of western disturbances. On such occasions minimum temperatures may drop below the freezing point at few stations of western parts of the State. The number of occasions when the temperature in th State falls 8ºc or more below normal are very few and only once in two years.

The lowest temperature on record at an individual plain station was 3.9ºc at Hisar observatory on 31st January, 1929 and this was about 9.4ºc lower than the normal of the coldest month. Both the maximum and the minimum temperatures rise rapidly from February to May. The increase in maximum temperature between the period from January to May,ranges from 17ºc to 20ºc at individual stations proceeding from south to north of the State. From the beginning of June to the end of July the maximum temperature falls by only 4.0ºc to 5.5ºc whereas the minimum temperature falls only by about 3.4ºc from June to September. In September a slight in the maximum temperature is experienced due to increased isolation. The night temperature starts falling rapidly after September while the day temperature follows this trend after October and both attain lowest level by January. The fall in minimum temperature and maximum temperature is about 19.5ºc to 22.0ºc and 18.5ºc to 20.0ºc, respectively during these periods. In both cases, the fall has a tendency to

increase from eastern parts of the State to the western parts.

Humidity

The relative humidity is generally high during the period from July to September. It is about 42 percent in June rising to 72 percent during August, the western parts of the State being less humid than the eastern parts. Among the winter months, December to February, the month of January is the most humid(63 percent). The diurnal variation of relative humidity is least during monsoon season. The relative humidity is lowest during summer afternoons when it becomes about 25 percent to 33 percent. The diurnal variation of relative humidity is highest during the winter period.

Cloudiness

The period from October to December is cloudless or lightly clouded. During the period January to March 2 to 3 Octas, sky will remain covered with clouds. In April and May, 1.5 Octas of sky will be covered with clouds. During the monsoon season(July to September) sky is most clouded specially during July and August, when 4.5 Octas of sky are with clouds. On an average in each of these two months, the sky remains over-cast for 6 days per month and clear on 4 days per month. During

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General

November clouding becomes minimum over the entire state. Clouding generally decreases from south and north and from east to west over the whole of the State and it is more in the afternoon than in the forenoon.

Rainfall

The total annual rainfall in the State is 30 cm. over the extreme western parts adjacent to Rajasthan and the same varies from 56 cm. on the extreme south to 108 cm. over the extreme north along the eastern border of the State.

The northern-most district Panchkula constitutes the area of maximum rainfall in the State and western-most district Sirsa receives minimum amount of rainfall. In the central portion of the State annual rainfall varies from 40 cm. to 48 cm. The districts adjacent to Rajasthan are much more dry than those adjacent to Uttar Pradesh. The State as a whole receives a total annual rainfall to 59.3 cm. Annual rainfall over Sirsa district and Panchkula district are 32.5 cm. to 98.8 cm. respectively and these represent lowest and highest district rainfall.

The feeble currents of south-west monsoon extends over the entire State by the last week of June. The months of July and August are the rainiest months, each accounting individually to about 30 percent of annual rainfall. In each of these months there are 5 to 11 rainy days(with daily rainfall of atleast 2.5mm.) for the State.

The withdrawal of the south-west monsoon begins from the State in the middle of September and by the 3rd week of September monsoon withdraws from the entire State.

During winter (November to March) Haryana receives. 6.0 cm. of rainfall which although small in amount is of great significance for agriculture. The winter rainfall occurs in association with western disturbances which move from west to east across the State.

Rainfall Variability.- Co-efficient of variation of annual rainfall is 30 to 40 percent over the entire State, the co-efficient of variation of eastern portion of the State being less than that of the western portion. The co-efficient of variation of monsoon rainfall over the State follows more or less the same pattern as that of annual rainfall. In the summer, co-efficient of variation is less than 80 over extreme northern parts whereas over other parts of the State it is between 80 to 100. In winter, co-efficient of variation is more than 80 over districts adjacent to Rajasthan and it is between 60 and 80 elsewhere in the State. In the post monsoon season the co-efficient of variation is extremely high.

Droughts

Meteorologically drought over an area or place may be defined as a situation when annual rainfall over the area or place is less than 75 percent of the normal. It is further classified as moderate drought if rainfall deficit is between 25 and 50 percent and `severe drought' when deficit is more than 50 percent .

Areas where frequency of drought as defined above is 20 percent are classified `Drought areas' and areas having drought condition for more than 40 percent of the year under consideration represent ` Chronically drought affected areas'.

During the 80 years period from 1901 to 1980, drought conditions as prevailed over Haryana are described here. Probabilities of occurrence of low rainfall, based on co-efficient of variation of rainfall described in the previous section, are also mentioned.

The number of years in which the districts became the victims of drought and also the total number of years whose rainfall data was considered in this regard are shown below:-

Districts Number of years Total number of years of drought whose rainfall data are

available
1 2 3

1. Hisar 16 79

2. Rohtak 21 71

3. Gurgaon 16 70

4. Karnal-Panipat 15 72

5. Mahendragarh-Rewari 20 71

6. Jind 28 64

7. Ambala-Yamuna Nagar 11 79

8. Kurukshetra-Kaithal 18 71

9. Sonipat 13 71

10. Sirsa 22 66

11. Bhiwani 20 70

12. Faridabad 15 70

General

The districts of Ambala and Sonipat experienced the drought conditions for less than 20 percent of the years under consideration and therefore, do not come under `Drought areas'; while the districts Hisar, Karnal and Faridabad satisfy marginally the criterion for being classed as ` Drought areas' and are marginal between `Drought areas' and `Non-Drought areas'. Other districts may be termed drought areas. However, it is noticed that drought condition over eastern part of the State is not as severe as it is over the remaining part.

Occasions of occurrence of drought conditions in successive years, were very frequent in case of this State. Severity of drought not only depends upon the order of

rainfall deficiency in a single year, but also upon continued occurrence of deficient rain in successive years, even though the deficiency in each such successive year may not be as high as in single year. The following table gives the years of successive drought as found from the available rainfall data during the 80 years period from 1901 to 1980, and the districts in which it occurred:-

Table (i) Haryana

Year of Successive drought	**Affected Districts**
1901-02	Hisar, Jind, Sirsa, Bhiwani
1901-03	Rohtak, Sonipat
1901-05	Jind
1902-03	Mahendragarh, Jind
1904-05	Jind, Kurukshetra
1911-12	Jind
1918-19	Faridabad, Sonipat
1920-21	Hisar, Kurukshetra, Sirsa
1921-22	Jind
1927-28	Sirsa, Jind
1927-29	Jind
1928-29	Gurgaon, Ambala, Faridabad, Jind
1928-30	Karnal
1934-35	Rohtak
1937-38	Faridabad

1937-39 Gurgaon

1937-41 Mahendragarh

1938-39 Hisar, Kurukshetra, Faridabad, Sonipat,

Jind
1938-40 Jind, Sirsa

1938-41 Rohtak, Karnal, Sonipat, Bhiwani

1943-44 Rohtak, Jind

1949-51 Bhiwani

1950-51 Mahendragarh

1951-52 Faridabad

1968-69 Sirsa

The following table depicts further rainfall of less than 50 percent of the annual normal representing severe drought conditions occurred in various districts and the actual rainfall expressed as percentage of the normal rainfall is given in brackets against each district:-

Year Districts affected (with percentage)

1901 Bhiwani (49), Sirsa (41), Jind (42)

1902 Jind (40), Sirsa (45)

1904 Jind(45)

1905 Rohatk (30), Mahendragarh (33), Jind (45)

1915 Sirsa (47)

1918 Rohtak (38), Gurgaon (33), Karnal (45),

Mahendragarh (25), Jind (47),
Ambala(44), Sonipat (43), Bhiwani (43), Faridabad (26)
1920 Hisar (45), Sirsa (34)

1921 Mahendragarh (45)

1927 Jind (19)

1928 Gurgaon (47), Jind (22)

1929 Rohtak (49), Jind (28), Sonipat (48),

Bhiwani (48), Faridabad (46)

General

1938 Hisar (28), Rohtak (32), Mahendragarh (38),

Jind (39),Kurukshetra(49), Sonipat (42),
Faridabad (47)
1939 Rohtak (31), Karnal (42), Mahendragarh (39),

Jind (33), Sonipat (43), Sirsa (46)
1941 Mahendragarh (37)

1949 Bhiwani (47)

1951 Mahendragarh (48), Bhiwani (47)

1968 Hisar (37), Sirsa (43)

1972 Kurukshetra (48)

It can be seen that the lowest rainfall, expressed as percentage of the annual normal, was only 19 in Jind district in 1927.

Almost 1905, 1918, 1929, 1938 and 1939 were the years of

widespread drought. In the year 1918, almost the whole State was affected by drought conditions.

Severe drought conditions occur in the State twice during the period 1901 to 1980 and hence the probability of its occurrence is negligible. The same for drought in the State is about 20 percent.

There was no drought in the State for 30 years i.e. 1906, 1909, 1910, 1914, 1916, 1917, 1923, 1925, 1931, 1933, 1942, 1945, 1947, 1955, 1956, 1957, 1958, 1960, 1961, 1964, 1966, 1967, 1970, 1971, 1973, 1975, 1976, 1977, 1978, 1980.

In the 15 years i.e. 1908, 1912, 1913, 1919, 1922, 1924, 1926, 1930, 1934, 1935, 1948, 1949, 1953, 1954 and 1979 only one district experienced the drought condition. It is interesting to note that during the above period, Ambala is the only district which has fallen in the grip of drought in two consecutive years only once. From what has been stated, it is seen that the whole State is more or less drought-prone in the meteorological sense.

Excessive Rainfall

It may generally be said that rainfall, sufficiently in excess of the normal, is a predominant factor for occurrence of floods, particularly in high rainfall region. Even with co-efficient of variation of rainfall of 20 percent or less, these regions are prone to frequent floods. For the purpose of the present description, annual rainfall of 125 percent or more of the normal is considered as excessive rain.

The following table gives the district-wise excessive rainfall years, the highest annual rainfall with the year of ocurrence:-

1 2 3

Faridabad 1904, 1906, 1908, 1910, 1914, 1916, 104. 8cm in 1917

1917, 1919, 1924, 1933, 1942, 1944, (186%)
1948, 1949, 1955, 1958, 1964, 1970,
1977

From the above table it may be seen that during the period under consideration, the districts of the State recorded excessive rainfall in 46 years, the maximum amount being 327 percent of normal annual rainfall in the year 1917 for the district Sirsa. Faridabad, Sirsa, Hisar and Rohtak had 21, 19, 18, and 16 years of such rainfall respectively. Other districts had 7-15 years of such rainfall . If all the districts are considered each having full years' data, then it is found that in 1917 the State registered maximum rainfall i.e. 186 percent of its normal annual rainfall. Successive years of excessive rainfall are shown against each district as given below :-

District

1. Hisar : 1908, 1909, 1910, 1966, 1967, 1976, 1978, 1979

2. Rohtak : 1908, 1909, 1916, 1917, 1948, 1949, 1957, 1958,

1976,1977
3. Gurgaon : Nil

4. Karnal-Panipat : Nil

5. Mahendragarh-Rewari : 1932, 1933

6. Jind : Nil

7. Ambala-Yamuna Nagar : 1932, 1933

8. Kurukshetra-Kaithal : Nil

9. Sonipat : 1908, 1909, 1960, 1961, 1976, 1977

10. Sirsa : 1908, 1909, 1913, 1914, 1933, 1934, 1935, 1955,

1956, 1976, 1977
11. Bhiwani : 1916, 1917, 1976, 1977

12. Faridabad : 1916, 1917, 1948, 1949

General

The same expressed as percentage of normal :-

District Year of Excessive Rainfall Highest amount of

rainfall (expressed
as % of normal with
year)
Hisar 1908, 1909, 1910, 1914, 1917, 1923, 100.0 cm. in 1917

1926, 1933, 1942, 1945, 1955, 1960, (252 %)
1966, 1967, 1976, 1977, 1978, 1979
Rohtak 1906, 1908, 1909, 1914, 1916, 1917, 90.9 cm. in
1917

1933, 1942, 1945, 1948, 1949, 1957, (192 %)
1958, 1976, 1977
Gurgaon 1908, 1910, 1912, 1917, 1924, 1926 106.7 cm. in
1917

1933, 1942, 1948, 1958, 1964, 1977 (185 %)
Karnal-Panipat 1908, 1914, 1917, 1924, 1925, 1933 103.0
cm. in 1933

1935, 1942, 1955, 1956, 1958, 1961, (148 %)
1964, 1967, 1976
Mahendragarh- 1908, 1917, 1924, 1933, 1957, 1960, 101.2
cm. in 1917

Rewari 1976 (215 %)
Jind 1909, 1917, 1933, 1935, 1942, 1945, 88.9 cm. in 1942

1960, 1964, 1977 (157 %)
Ambala- 1906, 1917, 1932, 1933, 1942, 1950, 164.6 cm. in
1942 Yamuna Nagar 1955, 1959, 1961, 1964, 1973 (167 %)

Kurukshetra- 1909, 1914, 1917, 1933, 1937, 1942, 108.4 cm. in 1942

Kaithal 1950, 1955, 1956, 1958, 1976 (186 %)
Sonipat 1908, 1909, 1914, 1917, 1924, 1933, 106.0 cm. in 1964

1942, 1958, 1960, 1961, 1964, 1976, (187 %)
1977
Sirsa 1908, 1909,1913, 1914, 1917, 1923, 106.5 cm. in 1917

1926, 1933, 1934, 1935, 1945, 1953, (327 %)
1955, 1956, 1958, 1962, 1976, 1977
Bhiwani 1904, 1908, 1911, 1916, 1917, 1953, 87.3 cm. in 1917

1957, 1960, 1964, 1976, 1977 (205 %)
None of the districts of Gurgaon, Mahendragarh, Jind and Kurukshetra experienced two consecutive years of excessive rainfall. Hisar and Sirsa districts

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experienced excessive rainfall in 3 consecutive years only once and Hisar district experienced the same in 4 consecutive years only once. The heaviest one day rainfall on record at any station in the State was 508.0 mm. at Ballabgarh (Faridabad district) on 1st February, 1933.

While noting the vagaries of rainfall over the State, it is seen that in the period 1944-'80, the State as a whole experienced drought conditions only twice whereas during the period that the number of occasions of drought declined considerably during the period 1944-'80. The probability of occurrence of heavy rain of 125 percent or more of the normal over the State is about 18 percent i.e. 9 times in the 50 years in the

long run.

Cyclonic Storms and Depressions

The cyclonic storms and depressions, which mostly affect India, originate or intensify over the Bay of Bengal, mostly during May to November or December. Some of them originating over the Arabian Sea also affect Konkan, Gujarat, Saurashtra and Kutch and north-west India during the above period. They usually travel west, north-west and cross coast. In general, storms and depressions weaken on entering land. Hence, the State situated far inland, does not experience the full fury of the severe storms or depressions like the coastal regions. During their course of movement the disturbances sometimes turn or recurve towards north or north-east. This point of turning progressively shifts westwards till September. For example the disturbances in May recurve while still out in Bay of Bengal. As such, exceptionally few of them which cross the coast and travel inland weaken far away from the State and cannot affect it.

During the period 1877 to 1960, only one such storm originating over the Arabian Sea affected Haryana in 1902. The disturbances during the period from June to September form over the Bay of Bengal and travelling westwards pass across the State of Madhya Pradesh. During this period sometimes they move west or northwestwards as far as Rajasthan and recurve north, north-eastwards under the influence of the deep westerly system moving slowly across west Pakistan and north-west India (including Haryana). With the advance of the year, the bay storms and depressions progressively take southerly course.

The track of the cyclones is still more southerly in October and November and these have no influence on Haryana weather. During the period 1891 to 1970, only two storms, one in 1892 and the other in 1956, originating over the Arabian Sea affected the weather of Haryana. The Bay cyclonic storm or depression which reach the State generally become weak considerably due to long land travel. Maximum number of storms or depressions affect the state in the month of August/September.

Other Weather Phenomena

Thunder Storms and Dust storms .- Convective activity is essential for the occurrence of thunderstorms and duststorms. With the advance of summer thunder activity becomes pronounced due to ground heating. When moisture is insufficient in the atmosphere, dry thunderstorms or dust-storms occur. The maximum number of thunderstorms occur, with the approach of the monsoon current, while dust-storms are mainly confined to the summer months of April to June. Pre-monsoon and monsoon thunder-storms are sometimes severe and accompanied by hail. Squall is uncommon in the State except in extreme south-eastern portion. The average number of days of thunderstorms during monsoon varies from 6.3 in the south to 0.4 in the north, the maximum being in July. The average annual number of thunderstorms varies from 41 in the south to 7 in the north. In the winter months, the State experiences thunderstorms sometimes accompanied by hail in association with western disturbance. Thundery activity is minimum in the months of November and December.

Fog.- Hill fog is not generally observed during the rainy months of July to September. Conditions like light to calm wind, clear skies, etc. which favour the occurrence of radiation fog, exist after the withdrawal of the monsoon till February. But due to lack of sufficient moisture, fog occurs only occasionally, the frequency of occurrence may vary from 3 in January over southern most part to 0.3 in January over northern part of the State.