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Thar Desert: Ultimate Source of Xerophytic Floral Diversity

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ABSTRACT: The **Thar Desert**, also known as the **Great Indian Desert**, is an arid region in the north-western part of the Indian subcontinent that covers an area of 200,000 km^2 (77,000 sq mi) in India and Pakistan. It is the world's 20th-largest desert, and the world's 9th-largest hot subtropical desert.About 85% of the Thar Desert is in India, and about 15% is in Pakistan. The Thar Desert is about 4.56% of the total geographical area of India. More than 60% of the desert lies in the Indian state of Rajasthan; the portion in India also extends into Gujarat, Punjab, and Haryana. The portion in Pakistan extends into the provinces of Sindh and Punjab (the portion in the latter province is referred to as the Cholistan Desert). The Indo-Gangetic Plain lies to the north, west and northeast of the Thar desert, the Rann of Kutch lies to its south, and the Aravali Range borders the desert to the east. The northeastern part of the Thar Desert lies between the Aravalli Hills. The desert stretches to Punjab and Haryana in the north, to the Great Rann of Kutch along the coast, and to the alluvial plains of the Indus River in the west and northwest. Much of the desert area is covered by huge, shifting sand dunes that receive sediments from the alluvial plains and the coast. The sand is highly mobile due to the strong winds that rise each year before the onset of the monsoon. The Luni River is the only river in the desert. Rainfall is 100 to 500 mm (4 to 20 in) per year, almost all of it between June and September.

Saltwater lakes within the Thar Desert include the Sambhar, Kuchaman, Didwana, Pachpadra, and Phalodi in Rajasthan and Kharaghoda in Gujarat. These lakes receive and collect rainwater during monsoon and evaporate during the dry season. The salt comes from the weathering of rocks in the region.Lithic tools belonging to the prehistoric Aterian culture of the Maghreb have been discovered in Middle Paleolithic deposits in the Thar Desert.

KEYWORDS: Thar Desert, Great Indian, Aravalli Hills, Floral Diversity, Xerophytic, Culture, Dry Season, Rajasthan

I. INTRODUCTION

The soil of the Thar Desert remains dry for much of the year, so it is prone to wind erosion. High-velocity winds blow soil from the desert, depositing some of it on neighboring fertile lands, and causing sand dunes within the desert to shift. To counteract this problem, sand dunes are stabilised by first erecting microwindbreak barriers with scrub material and then by afforestation of the treated dunes—planting the seedlings of shrubs (such as phog, senna, and castor oil plant) and trees (such as gum acacia, *Prosopis juliflora*, and lebbek tree). The 649-km-long Indira Gandhi Canal brings fresh water to the Thar Desert. It was built to halt any spreading of the desert into fertile areas.[1,2]

There are several protected areas in the Thar Desert:

In India: The Desert National Park, in Rajasthan, covers 3,162 km^2 (1,221 sq mi) and represents the Thar Desert ecosystem; it includes 44 villages. Its diverse fauna includes the great Indian bustard (*Chirotis nigricaps*), blackbuck, chinkara, fox, Bengal fox, wolf, and caracal. Seashells and massive fossilized tree trunks in this park record the geological history of the desert.The Tal Chhapar Sanctuary covers 7 km^2 (2.7 sq mi) and is an Important Bird Area. It is located in the Churu District, 210 km (130 mi) from Jaipur, in the Shekhawati region of Rajasthan. This sanctuary is home to large populations of blackbuck, fox, caracal, partridge, and sand grouse.The Sundha Mata Conservation Reserve covers 117.49 km^2 (45.36 sq mi) and is located in the Jalore District of Rajasthan. In Pakistan: The Nara Desert Wildlife Sanctuary covers 6,300 km^2 (2,400 sq mi); it is located in is located in Mirpurkhas District. It contains the largest population of the endangered mugger crocodile in Pakistan. The Rann of Kutch Wildlife Sanctuary located in Badin District is an Important Bird Area and Ramsar Site, with 30 species of mammals, 112 bird species, 20 reptiles, and 22 important plant species.The Lal Suhanra Biosphere Reserve and National Park is a UNESCO declared biosphere reserve, which covers 65,791 hectares (254.02 sq mi)

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the Cholistan region of the Greater Thar Desert. The natural vegetation of this dry area is classified as northwestern thorn scrub forest occurring in small clumps scattered more or less openly. Density and size of patches increase from west to east following the increase in rainfall. The natural vegetation of the Thar Desert is composed of these tree, shrub, and herb species:

Trees and shrubs: *Vachellia jacquemontii*, *Balanites roxburghii*, *Ziziphus zizyphus*, *Ziziphus nummularia*, *Calotropis procera*, *Suaeda fruticosa*, *Crotalaria burhia*, *Aerva javanica*, *Clerodendrum multiflorum*, *Leptadenia pyrotechnica*, *Lycium barbarum*, *Grewia tenax*, *Commiphora mukul*, *Euphorbia caducifolia*, *Euphorbia neriifolia*, *Cordia sinensis*, *Maytenus emarginata*, *Capparis decidua*, *Mimosa hamata*

Herbs and grasses: *Ochthochloa compressa*, *Dactyloctenium scindicum*, *Cenchrus biflorus*, *Cenchrus setiger*, *Lasiurus scindicus*, *Cynodon dactylon*, *Panicum turgidum*, *Panicum antidotale*, *Dichanthium annulatum*, *Sporobolus marginatus*, *Saccharum spontaneum*, *Cenchrus ciliaris*, *Desmostachya bipinnata*, *Eragrostis* species, *Ergamopagan* species, *Phragmites* species, *Tribulus terrestris*, *Typha* species, *Sorghum halepense*, *Citrullus colocynthis*

The endemic floral species include *Calligonum polygonoides*, *Prosopis cineraria*, *Acacia nilotica*, *Tamarix aphylla*, and *Cenchrus biflorus*. [3,4]

The Thar is one of the most heavily populated desert areas in the world with the main occupations of its inhabitants being agriculture and animal husbandry. Agricultural production is mainly from kharif crops, which are grown in the summer season and seeded in June and July. These are then harvested in September and October and include bajra, pulses such as guar, jowar (*Sorghum vulgare*), maize (*zea mays*), sesame and groundnuts. The Thar region of Rajasthan is a major opium production and consumption area. *P. cineraria* wood is reported to contain high calorific value and provide high-quality fuel wood. The lopped branches are good as fencing material. Its roots also encourage nitrogen fixation, which produces higher crop yields.Desert safaris on camels have become increasingly popular around Jaisalmer. Domestic and international tourists frequent the desert seeking adventure on camels for one to several days. This ecotourism industry ranges from cheaper backpacker treks to plush Arabian night-style campsites replete with banquets and cultural performances. During the treks, tourists are able to view the fragile and beautiful ecosystem of the Thar Desert. This form of tourism provides income to many operators and camel owners in Jaisalmer, as well as employment for many camel trekkers in the desert villages nearby. People from various parts of the world come to see the Pushkar ka Mela (Pushkar Fair) and oases.

II. DISCUSSION AND RESULTS

The vegetation is unsurprisingly influenced by the extreme climate. The sparse vegetation consists of plants adapted to growing in dry conditions, known as xerophilous plants. These include several kinds of grass and scrub-type vegetation of low trees of *Acacia*, *Prosopis*, *Tamarix*, and *Zizyphus*. These trees have small leaves with a thick waxy surface to reduce evapotranspiration and save water in hot and dry environments.

Detailed elaboration of floral diversity in Thar desert:-

The vegetation of the desert remains crucial to the survival of the nomadic pastoral and agricultural communities, providing them with food, fodder, fuel, traditional medicines and a host of other derivatives.[5,6]

Name: **Khejri**/jhand/sangri

Scientific name: *Prosopis cineraria*

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Figs. 1a & 1b. Khejri (Source: 1a, Arna Jharna; 1b, Wikimedia Commons)

Features

- Medium sized, deciduous
- Small leaves, thorny branches
- Deep root system penetrating up to 30 metres
- Tiny yellow flowers in spikes
- Bunches of slender fruit pods

Uses/Significance to Community

- State tree of Rajasthan
- Pods gathered as vegetable when green
- Provides timber
- Range of traditional medicine
- Fodder for livestock

Name: **Rohira**/luar/desert teak

Scientific name: *Tecomella undulata*

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Figs. 2a–2c. Rohira (photographs by Malini Saigal)

Features

- Small to medium deciduous tree
- Trumpet-shaped flowers in red, yellow or orange clusters
- Seed pods are long and thin, gently curved

Uses/Significance to Community

- State flower of Rajasthan
- Excellent wood used to make furniture, tools and printing blocks
- Traditional medicine[7,8]

Name: **Kumatiyo**/gum arabic

Scientific name: *Acacia senegal*

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Figs. 3a–3c. Kumatiyo (Source: 3a, Arna Jharna; 3b & 3c, Wikimedia Commons)

Features

- Small deciduous tree
- Shiny dark red spines in sets of three, with one thorn hooked like a parrot's beak
- Creamy white flowers in cylindrical spikes
- Flat brown seed pods, gently curved or straight

Uses/Significance to Community

- Source of the true gum arabic, once used in the printing industry as an adhesive
- Also used in processed food
- Seeds collected when green to make a traditional Marwari vegetable dish

Name: **Hingot**/hingoto/hingua/hingorni/desert date[9,10]

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Scientific name: *Balanites roxburghii*

Fig. 4. Hingot (Source: Wikimedia Commons)

Features

- Small tree or deciduous bush with thin branches
- Small leaves
- Long green thorns
- Egg-shaped woody fruit

Uses/Significance to Community

- Seeds, fruit, leaves and bark have medicinal and detergent use
- Fruit is a natural dewormer eaten by pigs, porcupines, ruminants and jackals

Name: **Jaal**/peelu/dhalu/toothbrush/mustard tree[11,12]

Scientific name: *Salvadora persica*

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Figs. 5a–5c. Jaal (Source: Wikimedia Commons, 5a & 5b are photographs by J.M. Garg)

Features

- Resilient tree with evergreen foliage of fleshy leaves
- Knobbly trunk
- Tiny white flowers in branching clusters
- Small translucent berries in red or cream

Uses/Significance to Community

- Many traditional medicines
- Small creatures like rodents and birds nest in the trunk

Name: **Kharo jaal**/bada peelu [13,14]

Scientific name: *Salvadora oleoides*

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Figs. 6a & 6b. Khaaro Jaal (Source: Wikimedia Commons, photograph by J.M. Garg)

Features

- Small evergreen tree
- Dense canopy of green leaves
- Branches may droop down to ground
- Trunk more gnarled than peelu

Uses/Significance to Community

- Small creatures like rodents and birds nest in the trunk

Name: **Neem**

Scientific name: *Azadirachta indica*

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Figs. 7a & 7b. Neem (Source: 7a, Arna Jharna; 7b, Wikimedia Commons, photograph by J.M. Garg)

Features

- Semi evergreen, medium to large, grows to 15 metres
- Not native to region but well adapted to it
- Honey-scented flowers

Uses/Significance to Community

- All parts have many medicinal uses
- Timber used for planking

Name: **Ber**/Indian jujube[15,16]

Scientific name: *Zizyphus mauritiana*

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Figs. 8a–8c. Ber (photographs by Malini Saigal)

Features

- Short hardy tree with evergreen canopy
- Spines in pairs with one hooked
- Variable leaf sizes from medium to small
- Pale greenish flowers in small clusters
- Fruit is round or oblong

Uses/Significance to Community

- Rich in Vitamin C, the fruit provides a commercial crop, fodder for livestock and food for wild animals
- Shellac is made from the resin on ber leaves
- Bark and fruit yield a dye and tanning material
- Roots, bark and fruit are used in traditional medicine
- Wood is used for farm implements, beams, oilseed crushers
- Wood makes fuel and high-grade charcoal [17,18]

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Name: **Googal**/mukul myrhh

Scientific name: *Commiphora wightii*

Figs. 9a & 9b. Googal (9a, photograph by Malini Saigal; 9b, Arna Jharna)

Features

- A low stout thorny shrub, sometimes a tree
- Small, scanty leaves
- Shiny, peeling bark
- Small red flowers
- Exudes a resin called 'Indian bedellium' or 'gum googal' in the cold season

Uses/Significance

- Most valuable medical plant
- The resin releases a myrhh-like fragrance when burned and is used as incense
- In the Red Data list of endangered plants [19,20]

Name: **Kankera**/red spike-thorn

Scientific name: *Maytelus senegalesis*

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Fig. 10. Kankera (Source: Wikimedia Commons, photograph by Aldonix)

Features

- Small deciduous crooked tree or bush
- Branches with solitary long spines, often leaf and flower bearing
- Tiny white scented flowers in bunches
- Tiny dark red fruit

Name: **Dhau**/dhawra/gum ghati/button tree

Scientific name: *Anogeissus latifolia*

Fig. 11. Dhau (Source: Wikimedia Commons, photograph by Lalithamba)

Features

- Tall, slender deciduous tree growing upto 24 metres
- Clusters of tiny flowers
- Tiny spiky red fruits
- A honey-coloured resin called *gum ghati* is tapped from its trunk

Uses/Significance to Community

- The resin is used as binding agent in foods, drugs and skincare products
- The leaves and bark are used for dyeing and tanning

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- Tussar silkworms are reared on its leaves
- The timber is used in construction, and for charcoal and fuelwood

Name: **Badh**/Indian banyan/east Indian fig tree[21]

Scientific name: *Ficus bengalensis*

Figs. 12a & 12b. Badh (Source: Wikimedia Commons; 12a by N. Aditya Madhav, 12b by J.M. Garg)

Features

- Spreading, almost evergreen tree with prop roots. Can grow to astonishing sizes in height and width
- Not a species of the arid region, but grown all over India
- Glossy oval leaves
- Fruit are red round figs

Uses/Significance to Community

- The fruit and the shady environs of the branches sustain bats, monkeys and birds
- Leaves and twigs are excellent fodder
- Bark, leaves, latex and root fibres have medicinal uses
- Worshipped by Hindus as the consort of the pipal tree

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Name: **Pipal**/sacred fig

Scientific name: *Ficus religiosa*

Features

- Large deciduous tree, up to 27 metres high
- Sinewed trunk
- Heart-shaped leaves with prominent pointed tips
- New leaves are very colourful in shades of rust and yellow
- Fruit is round, in pairs, and changes from unripe yellow-green to deep red-black when ripe
- Not an arid species, but cultivated across India

Uses/Significance to Community

- Most sacred of Indian trees. Often there is a shrine at the base
- Root, latex, bark, fruits and new shoots are used as medicines
- Fruits eaten by birds, and leaves are fodder for buffaloes and elephants

Name: **Shisham**/chirhol

Scientific name: *Dalbergia sissoo*

Fig. 13. Shisham (Source: Arna Jharna)

Features

- Middle-sized deciduous tree
- Oval leaves with pointed tips
- Small flowers in creamy clusters
- Long flat fruit pods
- Not an arid species but adapts to dry conditions

Uses/Significance to Community

- The best quality timber
- The wood ‘raspings’ and bark are used for medicine

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- Leaves are used for fodder
- Often planted as a windbreak to prevent erosion

Name: **Sargado**/bitter drumstick[20]

Scientific name: *Moringa concanesis*

Figs. 14a & 14b, Sargado/bitter drumstick (photographs by Malini Saigal)

Features

- Similar to the soajna or drumstick
- Small tree with feathery leaves
- Enormous roots to anchor in the sandy soil
- Clusters of fragrant cream flowers
- Long striated fruit pods

Name: **Lasura**/risalla/Indian cherry

Scientific name: *Cordia myxa*

Fig. 15. Lasura (photograph by Chiranjit Parmar, source: Fruitipedia, encyclopaedia of the edible fruits of the world, initiated, coordinated and edited by Dr Chiranjit Parmar)

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Features

- Hardy, middle-sized deciduous tree
- Broadly oval leaves
- Round yellow fruit with smooth skin and sticky pulp
- In dry areas, grows around depressions and water margins

Uses/Significance to Community

- Fruit and leaves have multiple medicinal uses
- Fruit is eaten as vegetable and pickled
- Leaves used as fodder
- Wood is light but usable for boats and farming tools[18,19]

Name: **Imli**/tamarind

Scientific name: *Tamarindus indica*

Fig. 16. Imli (Source: Wikimedia Commons)

Features

- Large deciduous tree
- Compound leaves with pairs of leaflets
- Yellow three-petal flowers
- Fruit are green bean-like pods that ripen to brown, with a soft downy texture
- Cultivated across India

Uses/Significance to Community

- The tart fruit is used in cooking and has many medicinal properties
- Imli seeds provide an oil varnish
- The bark is used in tanning and dyeing

Shrubs

Name: **Kair**/ker/kareel

Scientific name: *Capparis decidua*

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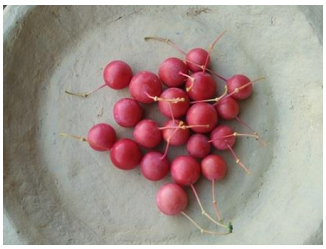

Figs. 17a–17d. Kair (Source: Arna Jharna)

Features

- Spiny bush or small tree, deciduous
- Dense clump of leafless branches
- Tiny leaves, shed quickly in less than a month
- Bright red/orange flowers twice a year
- Round dark pink fruit

Uses/Significance to Community

- The flowers and fruit are pickled or cooked as a vegetable dish

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- Is a sand binder that stabilises sand dunes
- Used in traditional medicines

Name: **Aakado**/aakra/giant milkweed

Scientific name: *Caliotropis procera*

.

Figs. 18a–18c. Aakado (Source: 18a & b, Arna Jharna; 18c, photograph by Malini Saigal)

Features

- A large bush with big fleshy leaves
- Small pink/purple flowers in clusters
- Ubiquitous in dry sandy areas and along roads and highways

Uses/Significance to Community

- All parts of the plant are poisonous
- The aakra flower is sacred to Hindus and is offered in prayers to Shiva

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Name: **Kheemp**/broom brush

Scientific name: *Leptadenia pyrotechnica* [17,18]

Figs. 19a–19c. Kheemp (19a, photograph by Malini Saigal; 19b, Wikimedia Commons; 19c, Arna Jharna)

Features

- Grows up to two and a half metres
- Wiry stems and leaves
- Tiny star-shaped flowers

Uses/Significance to Community

- A sand binder
- The dried stems are used for thatching and to make brooms
- Fruit is collected and cooked as a vegetable dish
- Traditional medicine for sheep

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Name: **Phog**

Scientific name: *Calligonum polygonides*

Features

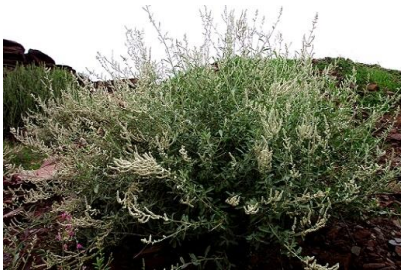
- Small shrub that grows up to one or two metres

Uses/Significance to Community

- Edible flowers called *phogalo*
- Provides fodder
- Its charcoal is used to melt iron

Name: **Bui**/desert cotton

Scientific name: *Aerva javanica*



Figs. 20a–20c. Bui (20a, Arna Jharna; 20b & 20c, photographs by Malini Saigal)

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Features

- Most common desert bush
- Produces thick white inflorescence
- Grows up to a metre high

Uses/Significance to Community

- A sand binder
- The fluffy flowers are used as filling for bedding
- Anti-inflammatory in traditional medicine
- Fodder for goats

Name: **Thhor**/danda thor/leafless spurge

Scientific name: *Euphorbia caducifolia*

Figs. 21a & 21b. Thhor (21a, photograph by Malini Saigal; 21b, Arna Jharna)

Features

- Multi-stemmed succulent that grow to a large circumference
- Small red or green flowers

Uses/Significance to Community

- It creates a mini protected zone within its stems where rodents, small animals and a host of plants prosper in shade and safety

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Name: **Baonli**

Scientific name: *Acacia jacquemontii*

Fig. 22. Baonli (photograph by Vishal Pratap Singh Deo)

Features

- Hardy shrub with multiple shoots
- Up to two metres tall

Uses/Significance to Community[19,20]

- Sand binder
- Used in traditional medicine
- Provides fodder and fuelwood

Name: **Sinniya**/senna/swarna patri

Scientific name: *Cassia augustiflora*

Fig. 23. Sinniya (photograph by Yashaswini Chandra)

Features

- Small perennial shrub
- Yellow flowers

Uses/Significance to Community

- Leaves and seed used in medicine as laxative and blood purifier

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Name: **Tulsi**/holy basil/ sweet basil

Scientific name: *Ocimum tenuiflorum*

Fig. 24. Tulsi (Source: Wikimedia Commons)

Features

- Small aromatic shrub
- Green and purple leaves, small purplish flowers

Uses/Significance to Community

- Seeds and leaves used in traditional medicine to cure bronchitis, stress, acne and leucoderma
- Significant in Hindu rituals

Name: **Dhatura**/thorn apple/devil's trumpet

Scientific name: *Datura stramonium*

Fig. 25. Dhatura (Source: Arna Jharna)

Features

- Foul-smelling bush
- Up to two metres tall
- Bell-shaped white-violet flowers
- Highly toxic plant

Uses/Significance to Community

- Traditional medicine for asthma, as an analgesic and as an anaesthetic

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Name: **Kaner**/desert rose

Scientific name: *Nerium indicum*

Figs. 26a & 26b. Kaner (Source: Wikimedia Commons)

Features

- Tall evergreen shrub that rises up to five metres
- Pale to bright pink scented flowers

Uses/Significance to Community

- Traditional medicine for malaria, ulcers, piles, skin diseases
- Also used to induce abortions

III. CONCLUSIONS

Thar desert or the Great Indian desert is one of the most important tourist destinations of Rajasthan. One can see the true Rajasthani culture in the desert. The folk song and dance of Rajasthan can be experienced in the desert. Jaisalmer also known as the "The Golden City" is one of the major attractions in the desert. It is located in the heart of the desert. It is known as the golden city because of the golden color sand dunes present in the city. Jaisalmer is famous for the sand dunes and the fort which is the second oldest fort in Rajasthan built in 1156 AD. The desert festival of Jaisalmer is the most important cultural and colorful event of Rajasthan. It is held in the month of February every year. The main attraction of the festival is the camel race, folk dance, music and most important is the Rajasthani cuisine. Jaisalmer is well connected by rail,road and air. Another important city is the Bikaner. Some of the important tourist places are Junagarh Fort, Lakshmi Nivas Palace, Laxmikanth temple and the international Camel Festival held

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in the month of January every year. One should experience the beautiful sunset, the sand dunes and the Rajasthani cuisine. Known as Gateway to Thar, Jodhpur is another important place in Rajasthan to visit and enjoy the palaces and forts. One must enjoy the Camel and Jeep safari on the dunes.

Desert National Park is located between Jaisalmer and Barmer. The Desert National Park consists of fossils of animals and plants of 180 million years old.It is home to some of the most exotic animals and birds like the Great Indian Bustard, desert fox, Bengal fox, Chinkara, Falcons, Short toed eagles, migratory birds. With a fragile ecosystem and rough sand dunes, rocks and compact salt lakes bottom, the Desert National Park is a must visit place in the thar desert. The best time to visit is November to January. The endangered Indian bustard is the major attraction in the park.[21]

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