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A CHECKLIST OF THE ANGIOSPERMS OF TAL CHHAPAR WILDLIFE SANCTUARY, RAJASTHAN, INDIA

ANSHU KAREL* and DILIP GENA
Department of Botany, S.P.C.Govt. College, Ajmer
***Corresponding Author's Email: anshkarel@gmail.com**

Tal Chhapar Wildlife Sanctuary (TCWS), located in the arid zone region of the largest state of the country, Rajasthan comprises of 102 species of Angiosperms. It contains 83 dicot and 19 monocot species that include 16 trees, 16 shrubs and 48 herbs. Fabaceae with 10 species and Poaceae with 13 species occupy the first position in dicots and monocots, respectively. *Acacia* and *Cyperus* with 04 species each have been found to be the largest genera represented while 48 genera are represented by solitary species. The present study enumerates all species of flowering plants occurring in the sanctuary area with their correct name along with first citation, vernacular names and habit. The paper also briefly deals with the basic geographical location, climate, type of vegetation and ecological framework of TCWS.

The outcome of the work is based on extensive field survey of the area conducted during 2021–2023 and study of previous literature.

Keywords: Angiosperms, Checklist, Flora, Rajasthan, Tal Chhapar Wildlife Sanctuary.

Introduction

The Tal Chhapar sanctuary is situated in the Sujangarh tehsil of Churu district in the north eastern part of Rajasthan. This district experiences mostly arid conditions and lies in the desert tract known as 'Thar'.

Churu district covers an area of 6.94 square km. and has a population of 2,039,547 as per census of 2011. The geographical location is latitude 27°42' N and longitude 74°20' E and about 286.6 meters from mean sea level. The sanctuary lies on Nokha-Sujangarh state highways at a distance of 85 km. from Churu, 160 km. from Bikaner and 200 km. from Jaipur. The word "Tal" means plains. Tal Chhapar sanctuary is almost flat plains embodied with shallow low-lying areas, has open grasslands with *Acacia* trees strewed giving it an appearance of the Savannahs. Small seasonal water ponds are formed during the rainy season in the shallow low-lying areas.

The sanctuary is home to one of the most graceful antelopes which we come across in India, *Antilope cervicapra* L., commonly known as the black buck.

A variety of migratory birds flock to this sanctuary every year. Over 2000 black bucks are found in the saline flat land of Tal Chhapar sanctuary. It is being observed that the population of black bucks increasing, which may lead to ecosystem imbalance. The TCWS is facing several drawbacks such as degradation of forest area, human interference, and lack of proper facilities for the animals and the menace of poaching.

Climatically, Sujangarh tehsil is not categorized as a true desert (Stein 1942), but it is an arid region with erratic and insufficient precipitation. The area witnesses three distinct seasonal variations: winter (November–February), summer (April–June) and warm rainy (July–September). The maximum

temperature during summers reaches up to 48.5°C and in winters the minimum temperature falls to -1°C. The average annual rainfall of this region is 363 mm. The rainy season is of a short duration. Water is a limiting factor in this region. The sanctuary also has a network of artificial water supply system.

Natural vegetation in this area has been classified as Northern Tropical Thorn Forest (6B) and sub-classified as Desert Thorn Forest (6B/C1)[1]. The entire area is a typical grass land interspersed with shrubs and trees.

Rajasthan is the largest state of India occupying an area of about 3,42,239 sq.km. however, its Recorded Forest Area (RFA) is about 32,863 sq.km. As per Forest Survey of India, State of Forest report 2021 (ISFR 2021), it is 9.60 % of the geographical area of Rajasthan and about 4.23 % of forest area of India. According to Rajasthan Forest Statistics 2017, with the aim of safeguarding biodiversity, 26 sanctuaries and 03 national parks have been declared in the state. TCWS was declared as a wildlife sanctuary in 1962. Total area of this black buck sanctuary spans 7.1977 sq.km., which lies on both sides of Chhapar-Sujangarh road. It is surrounded by Gopalpura, Tal Chhapar town, Charwas, Soorwas, Dewani and Rampura villages (Fig.1.).

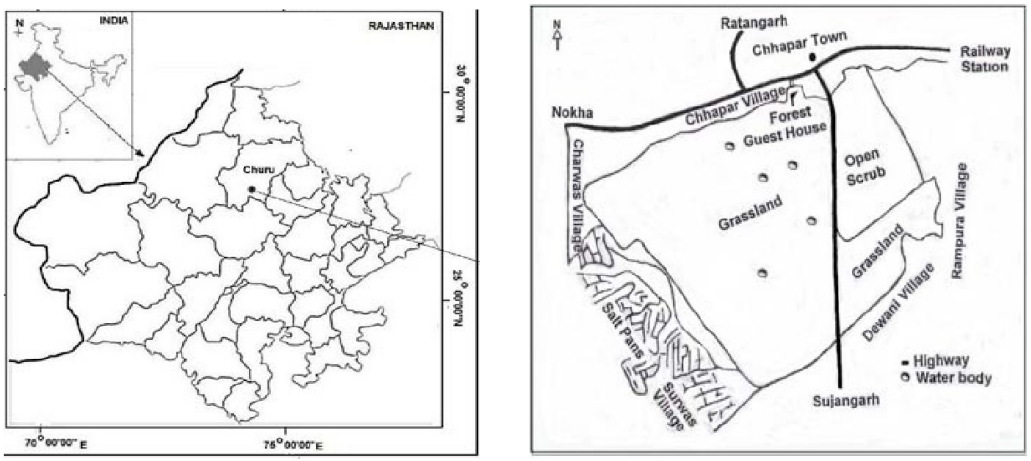

Figure 1. Location of Tal Chhapar Wildlife Sanctuary in Rajasthan. Source: Das S, Dookia S, Das K and Dutta SK (2013), Ecological observations on the Indian Spiny-tailed Lizard Saarahardwickii (Gray, 1827) (Reptilia: Squamata: Agamidae) in Tal Chhapar Wildlife Sanctuary, Rajasthan, India. *Journal of Threatened Taxa, 5*, 3516-3526.

As the sanctuary is surrounded by several villages from all sides, anthropogenic pressure is imposed on the forest resulting in rapid depletion of plant diversity. The Rio de Janeiro Convention on Biological Diversity in 1992 led to inquisitiveness to look into the cause of rapid depletion of biodiversity and procure methods of conservation. The Tal Chhapar Wildlife Sanctuary (TCWS) was selected for its proper documentation and assessment. As a result, traditional knowledge will also be conserved. Hence, in the present study the whole sanctuary area has been selected to document its entire native plant diversity of angiosperm flora, and cultivated and invasive species.

Material and methods

During 2021 to 2023 Tal Chhapar Wildlife Sanctuary was thoroughly explored in summer, monsoon and winter seasons to collect and document the plant diversity. Plants were randomly collected from all habitats, following standard herbarium techniques[2,3]. All collected plant materials have been deposited in the Botany department of S.P.C. Govt. College, Ajmer in the form of herbarium specimens for

record. All species have been correctly identified with the help of flora and published work.

The correct nomenclature has been provided by consultation of regional[4-9] and national[10-13] floras, literature[14-18] and different websites like IPNI, The Plant List, Wikipedia, Tropicos, etc. In the present study the species have been assigned family and genus as per recent taxonomic treatments and have been arranged alphabetically for the sake of convenience. Each species name has been mentioned with first citation.

Results and Discussion

After the study of the collections and survey of literature 102 species of native and introduced plants have been included here, out of which 83 species under 59 genera and 32 families belong to dicots and 19 species under 12 genera and 04 families to monocots (Fig.2.). These species include 16 trees, 16 shrubs, 48 herbs and 04 climbers, including a parasitic one, 13 grasses, 04 sedges and 01 aquatic plant (Fig.3). Among different families in dicots, Fabaceae occupies the highest position with 10 species and 5 genera followed by Asteraceae (09 sp. and 08 genera), Amaranthaceae (08 sp. and 05 genera), Solanaceae (06 sp. and 04 genera) and Zygophyllaceae (06 sp. and 04 genera) and so on (Fig. 4). While in monocots the largest family is Poaceae having 13 species under 09 genera followed by Cyperaceae (04 sp. and 01 genus), and so on (Fig. 5). In Fig. 6, the 09 dominant families of both dicots and monocots have been included based on number of species. *Acacia*sp.(04 sp.), *Cyperus* sp. (04 sp.) has been found as the largest genus among all groups followed by *Cenchrus* (03 sp.) and *Cleome* (03 sp.) Fig.7. On the otherhand, 15 families and 48 genera are represented by a solitary species. The sanctuary has ornamental and cultivated species as it is surrounded by agricultural fields and villages. Also, several plantations by the forest department of non-native ornamentals near rest houses and along roadsides have been observed.

Detailed studies on biodiversity[19,20], ecological analysis[21-23] and micro-climatic variables[24], water quality[25] in Tal Chhapar Wildlife Sanctuary have been done recently.

Future strategies on conservation of fauna and ecosystem have also been carried out[26,27]. An ecosystem is defined by three main attributes i.e., structure, composition and function and the most important component of any ecosystem is the species it contains.

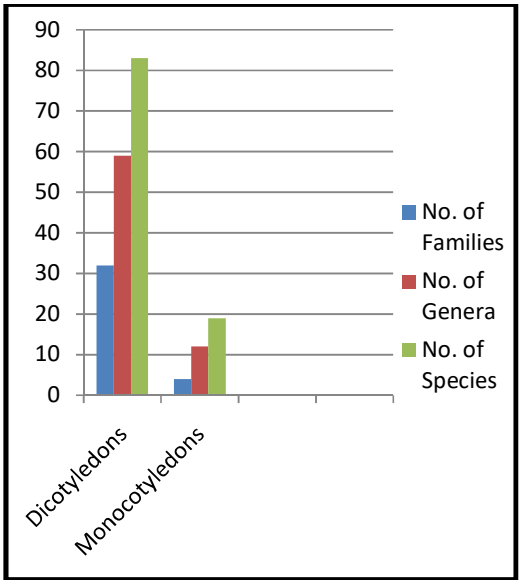

Figure 2.: Floristic analysis of plants of Tal Chhapar Wildlife Sanctuary.

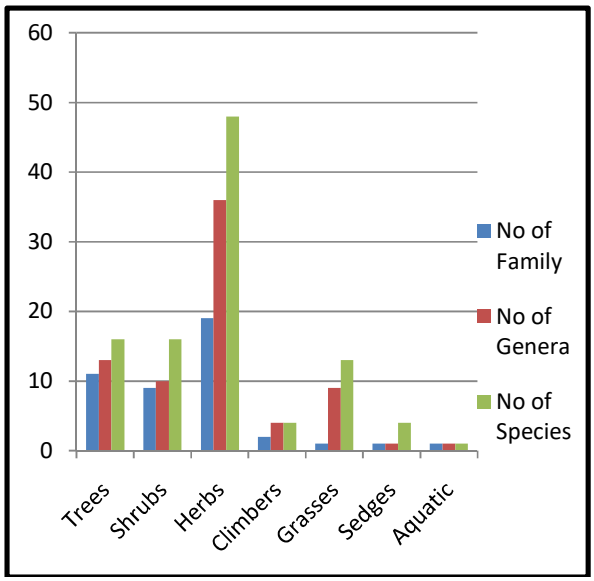

Figure 3.: Different life forms.

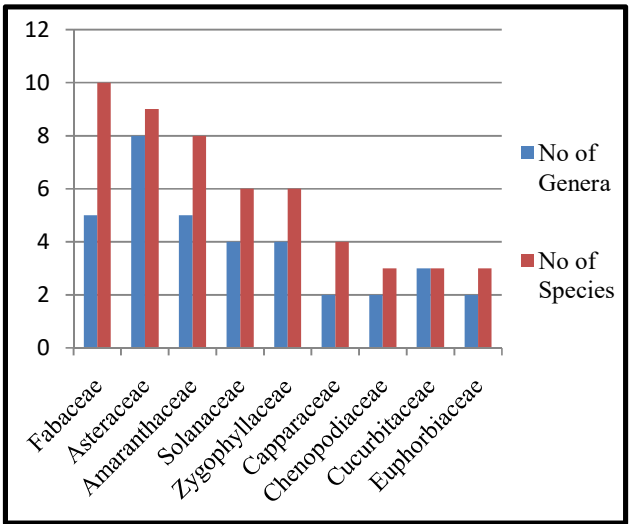

Figure 4.: Largest families in dicots.

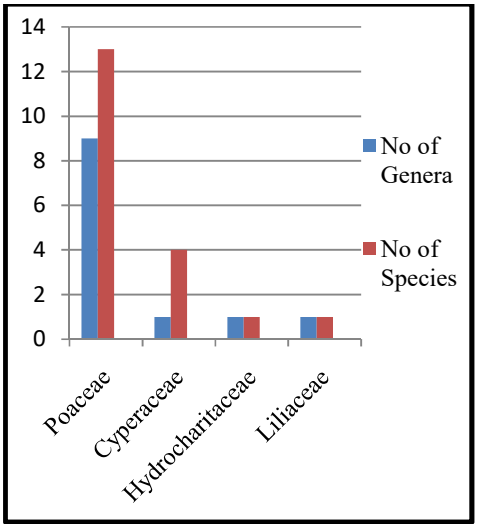

Figure 5.: Largest families in monocots.

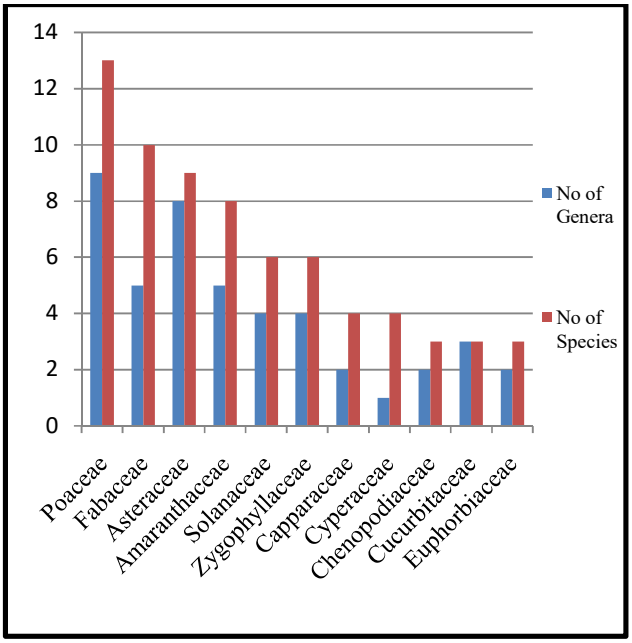

Figure 6.: Largest families with their genera and species in dicots and monocots.

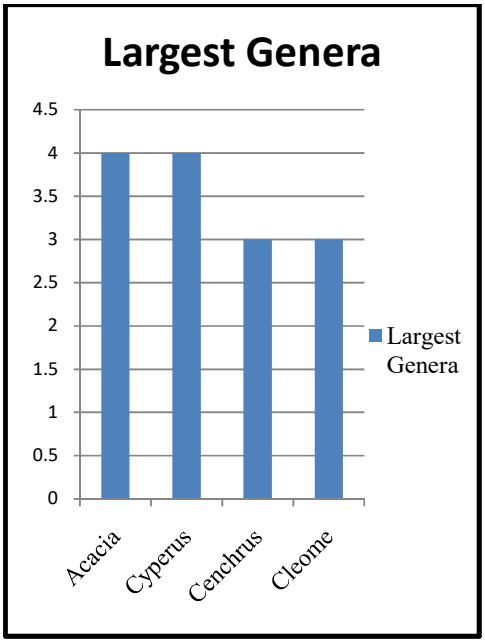

Figure 7.: Largest genera.

In the recent past, workers have enlisted 78 and 139 plant species respectively[28-29], from the study site. In the present study 102 plant species were documented from the area and the vegetation was found to be well represented by diverse groups of plants (Table 1). With more field trips conducted and different herbaria consulted in the present study, a number of species have been added as well as some were not found Though the findings are quite encouraging, some species viz. *Zaleya govindia* (Buch. - Ham. Ex G.Don) N.C. Nair and *Heliotropium ellipticum* Ledebour.

Heliotropium curassavicum L. documented[28,29] from the area were not recorded in the present study. This led to further investigation as to fill in the gaps, if any, in the research work. In the area

maximum species richness was observed in the grass family Poaceae followed by herbs Asteraceae and Amaranthaceae

The dominance of grasses can be explained by the fact that the area consists of largely of perennial grasses, as similar pattern of dominance was recorded[30] in grasslands of northeast India.

Table 1: Plant species recorded in Tal Chhapar Wildlife Sanctuary

S. No.	Botanical name	Family	Local name	Habit
1.	*Abutilon indicum* L.	Malvaceae	Kanghi	Shrub
2.	*Acacia jacquemontii* Benth.	Fabaceae	Bu-banvali	Shrub
3.	*Acacia nilotica* (L.) Del. sub sp. *indica* (Benth.) Brenan	Fabaceae	Banwal	Tree
4.	*Acacia senegal* (L.) Willd.	Fabaceae	Kumbat	Tree
5.	*Acacia tortilis* (Forsk.) Hayne.	Fabaceae	Israeli babul	Tree
6.	*Achyranthes aspera* L.	Amaranthaceae	Chirchita	Herb
7.	*Aerva persica* (Burm.f.) Merr.	Amaranthaceae	Bui	Herb
8.	*Aerva pseudotomentosa* Blatt	Amaranthaceae	Bui	Herb
9.	*Amaranthus lividus* L.	Amaranthaceae	Shandalio	Herb
10.	*Amaranthus viridis* L.	Amaranthaceae	Junglicholai	Herb
11.	*Argemone mexicana* L	Papaveraceae	Satayanasi	Herb
12.	*Aristida adscensionis* L.	Poaceae	Lamp, Lampro	Grass
13.	*Azadirachta indica* A. Juss.	Meliaceae	Neem	Tree
14.	*Balanites aegyptiaca* (Linn.) Del.	Zygophyllaceae	Hingota	Tree
15.	*Balanites roxburghii* Planch	Zygophyllaceae	Ingoriyo	Tree
16.	*Blumea* sp.	Asteraceae	-	Herb
17.	*Boerhavia diffusa* L.	Nyctaginaceae	Chinawari	Herb
18.	*Boerhavia elegans* Choisy	Nyctaginaceae	Punarnabajaati	Shrub
19.	*Calligonum polygonoides* Linn.	Polygonaceae	Phog	Tree
20.	*Capparis decidua* (Forsk.) Edgew.	Capparaceae	Ker	Tree
21.	*Calotropis procera* (Ait.) R. Br	Asclepiadaceae	Aakado	Shrub
22.	*Celosia argentea* L.	Amaranthaceae	Imarti	Herb
23.	*Cenchrus biflorus* Roxb.	Poaceae	Bhurat	Grass
24.	*Cenchrus ciliaris* L.	Poaceae	Dhaman	Grass
25.	*Cenchrus setigerus* Vahl.	Poaceae	Dhaman	Grass
26.	*Chloris* sp.	Poaceae	Choto- Arnio	Grass
27.	*Citrullus* colocynthis (Linn.) Schrad.	Cucurbitaceae	Tumba	Climber
28.	*Cleome gracilis* Edgew. Herb	Capparaceae	Bangra, hul-hul	Herb
29.	*Cleome gynandra* L.	Capparaceae	Safed Bagro	Herb
30.	*Cleome viscosa* L.	Capparaceae	Bagro	Herb
31.	*Corchorus depressus* (Linn.) Stocks	Tiliaceae	Cham-gash	Herb
32.	*Corchorus tridens* L.	Tiliaceae	Kagnasha	Herb
33.	*Cressa cretica* L.	Convolvulaceae	Rudravanti	Herb
34.	*Crotalaria burhia* Buch-Ham. ex Benth.	Fabaceae	Shinio	Herb
35.	*Cucumis callosus* (Rottl.) Cogn.	Cucurbitaceae	Kachri	Climber
36.	*Crotalaria medicaginae* Lamk.	Fabaceae	Gugario	Herb
37.	*Croton bonplandianum* Baill.	Euphorbiaceae	Ban tulsi	Herb
38.	*Cuscuta* reflexa Roxb	Cuscutaceae	Amar bel	Parasitic Climber
39.	*Cyperus rotundus* L.	Cyperaceae	Motha	Sedge
40.	*Cyperus* arenarius Retz.	Cyperaceae	Jucchabari	Sedge
41.	*Cyperus* niveus Retz.	Cyperaceae	Motha	Sedge
42.	*Cyperus triceps* Rottb.	Cyperaceae	Nagarmotha	Sedge
43.	*Dactyloctenium sindicum* Boiss.	Poaceae	Tantia	Grass
44.	*Datura innoxia* Mill.	Solanaceae	Dhatura	Herb
45.	*Datura stramonium* L.	Solanaceae	Dhatura	Herb
46.	*Desmostachya bipinnata* (L.) Stapf	Poaceae	Dab	Grass

47.	*Dichanthium annulatum* (Forssk.)Stapf.	Poaceae	Karad	Grass
48.	*Digitaria* sp.	Poaceae	-	Grass
49.	*Echinops echinatus* Roxb.	Asteraceae	Unt-kantalo	Herb
50.	Eclipta alba (Linn.) Hassk.	Asteraceae	Jal Bhangro, Bhrangraj	Herb
51.	*Eragrostis* sp.	Poaceae	Chirioghaas	Grass
52.	*Euphorbia caducifolia*	Euphorbiaceae	Danda thor	Shrub
53.	*Euphorbia prostrata* Aiton.	Euphorbiaceae	Dudheli	Herb
54.	*Fagonia schweinfurthii* Hadidi	Zygophyllaceae	Dhamaso	Shrub
55.	*Farsetia hamiltonii* Royle.	Brassicaceae	Hiran chhabo	Herb
56.	*Ficus bengalensis* L.	Moraceae	Bar, Bargad	Tree
57.	*Ficus religiosa* L.	Moraceae	Peepal	Tree
58.	*Gisekia pharnaceoides* L.	Molluginaceae	Balukar sag	Herb
59.	*Gnaphalium* sp.	Asteraceae	-	Herb
60.	*Haloxylon salicornicum* (Moq.) Bunge ex Boiss.	Amaranthaceae	-	Shrub
61.	*Haloxylon* recurvum (Moq.) Bunge ex Bioss.	Amaranthaceae	Khar	Shrub
62.	*Heliotropium marifolium* Koen. ex Retz.	Boraginaceae	Choti-santari	Herb
63.	*Heliotropium ovalifolium* Forsk.	Boraginaceae	Kunden	Herb
64.	*Hydrilla verticillata* (Linn.) Royle	Hydrocharitaceae	Jalpadap	Aquatic herb
65.	*Indigofera linnaei* A.	Fabaceae	Bekario	Herb
66.	*Lasiurus scindicus* Henrard	Poaceae	Sevan	Grass
67.	*Leptadenia pyrotechnica* (Forssk.) Decne.	Asclepiadaceae	Khimp	Shrub
68.	*Lycium barbarum* L.	Solanaceae	Morali	Shrub
69.	*Mollugo* cerviana (Linn.) Seringe.	Molluginaceae	Chirimorio	Herb
70.	*Momordica balsamiana* L.	Cucurbitaceae	Jungli karela	Climber
71.	*Opuntia elatior* Mill.	Cactaceae	Hatha-thor	Shrub
72.	*Pedalium murex* L.	Pedaliaceae	Bada gokhroo	Herb
73.	*Portulaca pilosa* L.	Portulacaceae	Lunki	Herb
74.	*Prosopis juliflora* (Sw.) DC.	Fabaceae	Jungali kikar	Tree
75.	*Prosopis cineraria* (L.) Druce	Fabaceae	Khejari	Tree
76.	*Pulicaria crispa* Sch.-Bip.	Asteraceae	Haldwa	Herb
77.	*Pulicaria wightiana* (DC.) C.B.Clarke	Asteraceae	Sonela	Herb
78.	*Salsola baryosma* (Roem and Schult.)Dandy	Chenopodiaceae	Lani	Shrub
79.	*Salvadora persica* L.	Salvadoraceae	Pilu	Tree
80.	*Salvadora oleoides* Decne.	Salvadoraceae	Pilu	Tree
81.	*Solanum surattense* Burm. f.	Solanaceae	Bhurhingani	Herb
82.	*Solanum* nigrum L.	Solanaceae	Chirpoti, Makoi	Herb
83.	*Sporobolus marginatus* Hochst. ex A.Rich.	Poaceae	-	Grass
84.	*Sporobolus* coromandelianus (Retz.)Kunth	Poaceae	-	Grass
85.	*Striga angustifolia* (D.Don.) C.J.Saldanha	Orobanchaceae	Missa	Herb
86.	*Suaeda fruticosa* (L.) Forsk.	Chenopodiaceae	Lunaki	Shrub
87.	*Suaeda nudiflora* Thw.	Chenopodiaceae	Lunaki	Shrub
88.	*Tamarix dioica* Roxb.ex Roth	Tamaricaceae	Jhau	Tree
89.	*Tecomella undulata* (Sm.) Seem.	Bignoniaceae	Rohida	Tree
90.	*Tephrosia purpurea* (L.) Pers.	Fabaceae	Biyani	Herb
91.	*Trianthema portulacastrum* L.	Aizoaceae	Dhedosanto	Herb
92.	*Trianthema triquetra* Rottl. andWilld	Aizoaceae	Lunki	Herb
93.	*Tribulus terrestris* L.	Zygophyllaceae	Kanti	Herb
94.	*Tribulus pentandrus* Forsk.	Zygophyllaceae	Bhankhari	Herb
95.	*Urginea indica* (Roxb.) Kunth	Liliaceae	Jungalipyaz	Herb
96.	*Verbesina encelioides*(Cav.) Benth. and Hook. f. ex A. Gray	Asteraceae	Jungli Surajmukhi	Herb
97.	*Vernonia cinerea* (L.) Less.	Asteraceae	Sahadevi	Herb

98.	*Withania somnifera* (Linn.) Dunal	Solanaceae	Asgandh	Herb
99.	*Xanthium strumarium* L.	Asteraceae	Ghaghra	Herb
100.	*Ziziphus mauritiana* Lamk.	Rhamnaceae	Ber	Shrub
101.	*Ziziphus nummularia* (Burm. f.) Wight.and Arn.	Rhamnaceae	Jhad Bor	Shrub
102.	*Zygophyllum simplex* Linn.	Zygophyllaceae	Luni, Lunwo	Herb

Conclusion

The present study puts forth a detailed account of flora of Tal Chhapar Wildlife Sanctuary. It demonstrates a high level of phytodiversity, which includes plants that are important for food, fodder, and medicinal purposes. This region is characterized by dry climate, extremes in temperature, and average annual precipitation. The region under investigation is home to a wide variety of plant life, including species that thrive in xerophytic, mesophytic, halophytic, hydrophytic, and parasitic environments.

In addition to work done in the area earlier this will aid in supplementation of information about the plants in the sanctuary area. The research also communicates much about the extant plant communities of the sanctuary and their taxonomic position, which will aid future research on conservation and maintenance of balance in the sanctuary.

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