



Flora and Fauna: As A State Symbol of Rajasthan, India

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Abstract

Flora and fauna (important biotic component of the ecosystem), are confined to particular physiographic regions of the land and dependent on the climate of the physiographic region. Rajasthan (North West situated), is the largest state of India, has arid and semi-arid climate which is the habitat of varieties of flora and fauna. Rajasthan is also a habitat of some threatened species of flora and fauna. Due to climate change and anthropogenic pressures, a natural habitat of flora and fauna are being declined that lead to loss of biodiversity. In order to conserve biodiversity, Rajasthan State has declared some flora (*Gazella bennettii* and *Ardeotis nigriceps*) and fauna (*Tecomella undulate* and *Prosopis cineraria* L.) as a state symbol to maintain and promote their population.

Keywords

Biodiversity, Conservation, Flora and Fauna.

INTRODUCTION

Rajasthan is the largest state of India with respect to area, covering 10.4% geographical area of India. It is situated in 23° 04' to 30° 11' N and 69° 29' to 78° 17' E, northwest of India [1]. On the basis of physiographic, the state has been divided into four regions such as western desert, Aravalli hills, southern plateau and eastern plateau. Out of these four physiographic regions, western region (Thar Desert) is the largest region (70%) of Rajasthan with

barren hills and sandy plains [2 & 3]. Due to these physiographical regions, Rajasthan has a wide range of climate namely semi-arid to arid [4]. Average annual rain fall varies from 150 mm in the Thar Desert to 1000 mm southern plateau and annual temperature ranges between 0°C to 55°C [5 & 6]. The Aravalli mountain (One of oldest folded mountain chains of the world), is lying in mid of the state from southwest to northeast with a distance of more than 550 km. This mountain divides the state into two

parts and is responsible for the climatic and physiographic pattern of Rajasthan [7].

Despite of wide range of climate, Rajasthan state has a diversity of flora and fauna in their natural habitat. 2500 species of plants, 450 species of birds, 50 species of mammals, 20 species of reptiles and 14 species of amphibians besides numerous species of insects, butterflies, microflora and fauna [8]. Major Forests of Rajasthan are tropical dry deciduous forest and tropical thorn forest in the east-south region. The western region of Rajasthan is devoid of forest due to its hot arid condition. However, Rajasthan possess 10.4% of Indian land mass but only 4.25 % of total Indian forest and 9.59 % forest of total geographical area are found in Rajasthan [9].

Rajasthan has 5 national parks, 25 Sanctuaries and 2 Conservation Reserves which contribute 2.80% of the geographical area of the state and devoted to conserve biodiversity. Keoladeo National Park (World Heritage Site) has international importance for its rich avifauna and for migratory Siberian Crane (*Grus leucogeranus*). Apart from Keoladeo national park, Sambhar Lake is another Ramsar site of India in the State.

The state has a rich tradition to conserve nature. Vishnoi culture of western Rajasthan has religious faith to protect flora (Khejri) and fauna (Indian gazelle and black buck) in the desert. Similar to other states of India, Rajasthan has also declared some flora and fauna as a state symbol to conserve them because of their significance in the ecosystem and human benefit. This review provides valuable information about Rajasthan state symbol fauna and flora.

***Tecomella undulata* (Rohida)**

Tecomella undulata is a deciduous or nearly evergreen tree, belongs to family bignoniaceae of angiosperm (Figure 1A). It is monotypic genus, distributed to arid zone of Arabia, South East Pakistan and western India [10]. In India, a natural habitat of *T. undulata* is Thar Desert of Rajasthan since 40% geographical regions of Rajasthan is covered by the Thar Desert. Due to its arid zone habitat and significance as a source of good quality of timber, it is popularly known as “Desert Teak” and “Marwar Teak”. In different regions of India, it is named differently such as in Hindi it is called “Rohida”. Botanically it is a medium-sized tree (6-10 m in height) with branched stems and branched are drooping. Flowers are bisexual, inodorous and large, with red-orange yellow colored corolla [11]. Rajasthan Government has declared it as Rajasthan state flower in 1882.

To concern with its phytochemical importance, different parts of the plant are rich of many phytochemicals such as undulatin, lapachol, tecomelloside, stigmasterol. Other phytochemicals such as ecomin (glycoside) from bark, lapachol and veratric acid from heart wood, rutin and quercetin from flower have been isolated and found to be beneficial for human health [12]. Due to the presence of these phytochemicals of pharmaceutical importance, the plant is used for human health in the treatment of leucoderma, syphilis, typhoid fever, diabetes, and eczema [13]. Plant extract also possesses anticancer, antibacterial, antifungal and anti-termite properties [14 & 15]. In Unani medicine system, decoction and extract of bark powder are used in treating jaundice, enlarged spleen, anemia, intestinal worms [16]. In Ayurveda, *T. undulata* is used in many formulations of hepatoprotection by different names Rohitakarishtha, Rakta Rohitaka, Rohitakadya churna, Rohitaka ghrita and Rohitaka Lauha [17].

Apart from its medicinal significance, *T. undulata* has played a crucial role in conservation of environment in arid zones as it stabilizes shifting sand dunes in the desert. Due to its drought and fire resistant properties, it is also useful in forestation and provides shelter to wildlife in the desert. Its lateral roots on top soil, prevent soil erosion. It is a common agro forestry tree species in the Thar Desert of Rajasthan, due to its higher survival rates even in extreme drought conditions [13].

***Prosopis cineraria* L. (Khejri)**

Prosopis cineraria L. Druce is a small to moderate size, thorny and irregular branched tree of family Fabaceae which is one of the most important families for human diet as it includes a variety of pulses (Figure 1B). It is an indigenous species of Thar Desert of Pakistan and north western India. The genus *Prosopis* has 44 species which are distributed in less rain fall arid and semiarid zones of Africa and Asia (Oman, Afghanistan, India, and Pakistan) [18] (Jinu, U., 2017). In India it is distributed in arid zones of western India such as Rajasthan, Gujarat, Punjab, Haryana, Uttar Pradesh and Tamil Nadu. In Rajasthan, it is found mainly in western districts such as Jodhpur, Jaisalmer, Barmer and Bikaner. It is an important plant in Indian traditional medicine system and in different regions, it is commonly known by different names such as *khejri* (Hindi), *jand*, *jandi* (Urdu), *shami* (Sanskrit) and *khijdi* (Rajasthani) [19]. Medicinally, almost all parts of the plant are important that is why it is also called as “Kalpataru” (a wish granting tree).

Rajasthan Government has declared it as a state tree in 1983 due to its significance as nutritious supplementary food, fodder, fuel, timber, medicine and gum. Due to its slow-growing nature, extremely abiotic stress tolerant nature as it flourish in a wide range of temperature ($\sim 1^{\circ}\text{C}$ in winter and $\sim 50^{\circ}\text{C}$ in summer) and highly saline soil, it is also called as “King of dessert” [20]. It has also agricultural importance as its root rhizosphere accumulates organic carbon and nitrogen from the soil that increase the fertility of soil in arid regions of Rajasthan [21].

It is rich of various bioactive phytochemicals such as flavonoids, phenolic compounds, alkaloids diketones, spicigerin, stigmaterol, octasanol, hentriacontane and prosogerin A, B, C and D, β -sitosterol, diketones, spicigerin, stigmaterol, octasanol, hentriacontane hentriacontane, rutin, gallic acid, patulitrin, luteolin and spicigerin [19 & 22]. Because of the presence of these phytochemicals, various parts of the plant such as root, stem bark, leaves and fruit pod are used to cure various human health problems such as skin diseases, piles, worms, vertigo and dyspnoea, protection from miscarriage, eye diseases, snake bite, asthma, bronchitis, leucoderma, leprosy, muscle tremors, piles and toothache [23 & 24].

***Gazella bennettii* (Chinkara)**

Gazella bennettii (Chinkara) is a swift and agile wild animal, declared by Rajasthan Government as a State animal in 1982 (Figure 1C). Chinkara is commonly known as Indian gazelle, primarily found in north western region of India. About 70-80% of global Indian gazelle are found in western Rajasthan due to its arid habitat [25]. Although, it has wide range of habitat from dry deciduous forest to open woodland but more preferably they are found in water deficit regions of arid zones such as sand dunes of the Thar Desert as they can resist water deficit for long period and maintain water by vegetation and metabolic process [26].

Indian gazelles are morphologically characterized by a sandy, yellowish and red colored fur and straight horns to defend the resources. Female horns are smaller and thinner than male Indian gazelle [26]. During danger, they alarm their members by beat their fore foot on the ground and emit a sneeze-like hiss through the nose, therefore, they are locally called as Chinkara (the sneezer) [27]. They are herbivore and nocturnal feeder. They fulfill their water requirement from vegetations such as grasses, leaves and fruits are the major diet for them. Although, many predators such as Golden jackals, Bengal tigers, Indian wolves, Asiatic cheetahs and

Indian leopards are victimized but human are most fatal for them. Hunting and poaching for skin, meat and occasionally for horns are the main cause of species reduction of Indian Gazelle [28 & 29].

International Union for Conservation of Nature (IUCN) has categorized *G. bennettii* in the least concern species whereas Wildlife (Protection) Act, India 1972 grouped in Schedule 1 [30]. These biodiversity conservation authorities protect *G. bennettii* that reserve 80% in India, 9% in Iran and 5% in Pakistan. In Rajasthan, they are mainly found in western arid regions such as Jodhpur, Jaisalmer, Barmer and Bikaner. Although 25 Sanctuaries and 3 National Parks are recognized in Rajasthan, most of the *G. bennettii* is found in Vishnoi community of Jodhpur in terms of density [31].

***Ardeotis nigriceps* (The Great Indian Bustard)**

Ardeotis nigriceps (The Great Indian Bustard), belongs to avian family Otididae, is an obligate grassland and open-nesting bird (Figure 1D). The Great Indian Bustard (a state bird of Rajasthan, declared in 1983) is nomadic in wide range of grass land and is omnivorous. Fruits, cereals, insects, and reptiles are their diet [32]. Morphologically, it is a magnificent, tall, long-necked and long-legged bird which found in arid and semi-arid (dry) grasslands and scrubs containing scattered bushes and some cultivation such as Thar Desert of Rajasthan, Gujarat, Maharashtra, Karnataka, Madhya Pradesh and Sindh of Pakistan. Earlier they were abundant in grassland habitat but their population has been declined 90% in the last few decades and declared as an endangered species by International Union for Conservation of Nature (IUCN) [33 & 34]. Habitat loss by industrialization and conversion into agriculture land by anthropogenic pressure are the main causes of their population declination. Later, their population keeps decreasing and reached from 1260 to 300 species in 2010 due to habitat loss which is now mainly confined to western Rajasthan regions such as Jaisalmer, Barmer and Bikaner [35 & 36]. In 2011, ICUN has declared them as a critically endangered bird. In Rajasthan, Desert National Park and Tal Chhapar Wildlife Sanctuary are two important protected areas to conserve their population in the world where largest numbers (70-75 individuals) of Great Indian Bustard are protected there.

Wildlife Protection Act, India 1972 has listed this bird in Schedule-I whereas Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) has categorized it in Appendix-I to prevent its international trade and killings. The Bombay Natural History Society (Indian organization for conservation

and biodiversity research) has focused on the causes of decline and has recommended conserving them by starting 'Project Bustard' like other flora conservation projects [37]. After a decade, Rajasthan

State Government has launched "Project Great Indian Bustard" to conserve the remaining population of critically endangered Great Indian Bustard in Desert National Park, Rajasthan [9].



(A)



(B)



(C)



(D)

Figure 1 (A) *Tecomella undulata* (Rohida), (B) *Prosopis cineraria* L. (Khejri), (C) *Gazella bennettii* (Chinkara) and (D) *Ardeotis nigriceps* (The Great Indian Bustard).

CONCLUSION

Thus, the present communication provides valuable information of threatened flora and fauna of the State Rajasthan and their promising conservation by representing them as a state symbol that lead to conserve global biodiversity.

REFERENCES

1. Pingale, S. M., Khare, D., Jat, M. K., & Adamowski, J. (2014). Spatial and temporal trends of mean and extreme rainfall and temperature for the 33 urban

centers of the arid and semi-arid state of Rajasthan, India. *Atmospheric Research*, 138, 73-90.

2. Roy, A. D. (2015). Trend detection in temperature and rainfall over Rajasthan during the last century. *Asian Journal of Research in Social Sciences and Humanities*, 5(2), 12-26.
3. Pradhan, R. K., Sharma, D., Panda, S. K., Dubey, S. K., & Sharma, A. (2018). Changes of precipitation regime and its indices over Rajasthan state of India: impact of climate change scenarios experiments. *Climate Dynamics*, 1-16.

4. Rathore, M. S. (2004). *State level analysis of drought policies and impacts in Rajasthan, India* (Vol. 93). IWMI.
5. Mundetia, N., & Sharma, D. (2015). Analysis of rainfall and drought in Rajasthan State, India. *Global NEST J*, 17(1), 12-21.
6. Laskar, S. I. (2016). India Meteorological Department. *Proceedings of the Indian National Science Academy*, 82(3), 1021-1037.
7. Dutta, D., Kundu, A., Patel, N. R., Saha, S. K., & Siddiqui, A. R. (2015). Assessment of agricultural drought in Rajasthan (India) using remote sensing derived Vegetation Condition Index (VCI) and Standardized Precipitation Index (SPI). *The Egyptian Journal of Remote Sensing and Space Science*, 18(1), 53-63.
8. Johnson, M. F., Karanth, K. K., & Weinthal, E. (2018). Compensation as a Policy for Mitigating Human-wildlife Conflict Around Four Protected Areas in Rajasthan, India. *Conservation and Society*, 16(3), 305-319.
9. Forest department of Rajasthan, Government of Rajasthan. 2018 <http://fmdss.forest.rajasthan.gov.in/>
10. Negi, R. S., Sharma, M. K., Sharma, K. C., Kshetrapal, S., Kothari, S. L., & Trivedi, P. C. (2011). Genetic diversity and variations in the endangered tree (*Tecomella undulata*) in Rajasthan. *Ind J Fund Appl Life Sci*, 1(1), 50-8.
11. Kumar, P., Bangarwa, K. S., & Johar, V. (2017). Phenology behaviour and reproductive biology of *Tecomella undulata*. *Ecology, Environment and Conservation*, 23 (3), 413-417.
12. Azam, M. M., & Ghanim, A. (2000). Flavones from leaves of *Tecomella undulata* (Bignoniaceae). *Biochem Syst Ecol*, 28(8), 803-804.
13. Kumawat, R., Sharma, S., & Kumar, S. (2012). An overview for various aspects of multifaceted, health care *tecomella undulata* seem plant. *Acta Pol Pharm*, 69(5), 993-6.
14. Khatri, A., Garg, A., & Agrawal, S. S. (2009). Evaluation of hepatoprotective activity of aerial parts of *Tephrosia purpurea* L. and stem bark of *Tecomella undulata*. *Journal of ethnopharmacology*, 122(1), 1-5.
15. Choudhary, G. P. (2014). Phytochemistry and pharmacological activity of *Tecoma undulata*: an overview. *Mintage Journal of Pharmaceutical and Medical Sciences*, 20-23.
16. Khare, C. P. (2004). *Indian herbal remedies: rational Western therapy, ayurvedic, and other traditional usage, Botany*. Springer science & business media.
17. Jain, M., Kapadia, R., Jadeja, R. N., Thounaojam, M. C., Devkar, R. V., & Mishra, S. H. (2012). Hepatoprotective potential of *Tecomella undulata* stem bark is partially due to the presence of betulinic acid. *Journal of ethnopharmacology*, 143(1), 194-200.
18. Jinu, U., Gomathi, M., Saiqa, I., Geetha, N., Benelli, G., & Venkatachalam, P. (2017). Green engineered biomolecule-capped silver and copper nanohybrids using *Prosopis cineraria* leaf extract: enhanced antibacterial activity against microbial pathogens of public health relevance and cytotoxicity on human breast cancer cells (MCF-7). *Microbial pathogenesis*, 105, 86-95.
19. Ukani, M. D., Limbani, N. B., & Mehta, N. K. (2000). A Review on the Ayurvedic Herb *Prosopis cineraria* (L) Druce. *Ancient science of life*, 20(1-2), 58.
20. Krishnan, P. R., & Jindal, S. K. (2015). Khejri, the king of Indian Thar desert is under phenophase change. *Current Science*, 108(11), 1987-1990.
21. Kaur, R., Gonzales, W. L., Llambi, L. D., Soriano, P. J., Callaway, R. M., Rout, M. E., & Gallaher, T. J. (2012). Community impacts of *Prosopis juliflora* invasion: biogeographic and congeneric comparisons. *PLoS one*, 7(9), e44966.
22. Malik, A., & Kalidhar, S. B. (2007). Phytochemical examination of *Prosopis cineraria* L.(druce) leaves. *Indian Journal of Pharmaceutical Sciences*, 69(4), 576.
23. Sharma, N., Garg, V., & Paul, A. (2010). Antihyperglycemic, antihyperlipidemic and antioxidative potential of *Prosopis cineraria* bark. *Indian Journal of Clinical Biochemistry*, 25(2), 193-200.
24. Velmurugan, V., Arunachalam, G., & Ravichandran, V. (2010). Antibacterial activity of stem bark of *Prosopis cineraria* (Linn.) Druce. *Archives of Applied Science Research*, 2(4), 147-150.
25. Arshad, M. I., & Gill, A. H. (2010). Population status of Indian Chinkara in Cholistan Game Reserve, Punjab, Pakistan. *Russian journal of ecology*, 41(6), 524-530.
26. Dookia, S., Rawat, M., Jakher, G. R., & Dookia, B. R. (2009). Status of the Indian Gazelle (*Gazella bennettii* Sykes, 1831) in the Thar Desert of Rajasthan, India. In *Faunal Ecology and Conservation of the Great Indian Desert* (pp. 193-207). Springer, Berlin, Heidelberg.
27. Bohra, H. C., Goyal, S. P., Ghosh, P. K., & Prakash, I. (1992). Studies on ethology and eco-physiology of the antelopes of the Indian desert. *Annals of Arid Zone*, 31(2), 83-96.
28. Bagchi, S., Goyal, S. P., & Sankar, K. (2003). Prey abundance and prey selection by tigers (*Panthera tigris*) in a semi-arid, dry deciduous forest in western India. *Journal of Zoology*, 260(3), 285-290.
29. Saxena, A. K., Bisht, N. S., & Singh, C. J. (2008). The value of the indian gazelle (*gazella gazella*): A case study in Haryana, India. *Indian Forester*, 134(10), 1289-1295.
30. Sahajpal, V., Goyal, S. P., Thakar, M. K., & Jayapal, R. (2009). Microscopic hair characteristics of a few bovid species listed under Schedule-I of Wildlife (Protection) Act 1972 of India. *Forensic science international*, 189(1-3), 34-45.
31. Rahmani, A. R. (1990). Distribution, density, group size and conservation of the Indian gazelle or chinkara *Gazella bennetti* (Sykes 1831) in Rajasthan, India. *Biological Conservation*, 51(3), 177-189.
32. Rahmani, A. R. (1989). The Great Indian Bustard Final Report: Project Title Study of Ecology of Certain

- Endangered Species of Wildlife and their Habitats. *Bombay Natural History Society, Bombay*.
33. JHA, K. K. (2008). The Great Indian Bustard (*Ardeotis nigriceps*) on the verge of extinction. *Current Science*, 95(9), 1108.
34. List, I. R. (2010). The IUCN red list of threatened species. *Recuperado el*, 10.
35. Rahmani, A. R. (2006). Need to start project bustards. *Bombay Natural History Society, Mumbai*, 20.
36. Dutta, S., Rahmani, A. R., & Jhala, Y. V. (2011). Running out of time? The great Indian bustard *Ardeotis nigriceps*—status, viability, and conservation strategies. *European Journal of Wildlife Research*, 57(3), 615-625.
37. Rahmani, A. R. (1996). Strategies for long-term conservation of the Great Indian Bustard *Ardeotis nigriceps* in India. *Journal of the Bombay Natural History Society*, 93(3), 442-458.