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A preliminary report on reptilian diversity of the arid region of Bikaner district

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Abstract

Reptiles are a diverse group of cold-blooded vertebrates, encompassing various species such as snakes, lizards, turtles, and crocodiles. These remarkable creatures have adapted to a wide range of habitats across the globe, from deserts to rainforests and even oceans. We have been studying the reptilian diversity of Bikaner region for more than a decade and the present article provides baseline data for further monitoring of them. We have observed 11 species of Lizards, 14 species of snakes and two species of testudines during our survey. Some of these have been introduced with the transportation and are trying to establish their population here. Three venomous snakes of economic importance are Saw-scaled Viper, Asian Cobra and Common Krait. Krait and viper species are most responsible for the deaths due to snake bites. From an ecological perspective, reptiles play vital roles both as predator and prey in ecosystems, contributing to the balance of this delicate environment. Reptiles play vital roles in the ecosystems and help in maintaining intricate equilibrium. However, due to climate change, habitat loss and anthropogenic activities, many reptile species in the Thar are facing significant threats. It is crucial that conservation efforts are increased to safeguard these unique species and preserve Rajasthan's rich biodiversity for future generations.

Keywords: Thar Desert, Reptiles, lizards, snakes, threats, biodiversity

Introduction

Reptiles are a diverse group of cold-blooded vertebrates that have scaly skin and lay eggs. They are found in almost every corner of the world. Reptiles are cold-blooded animals that don't have the ability to regulate their body temperature. This unique habit makes them undergo torpor during extreme winters in the desert environment. Rajasthan is known as Desert state of India and it is also the biggest state of India with total area of 3,42,239 km² (Sivaperuman, *et. al.*, 2009) [16]. Thar Desert covers approximate 62% of the total area of Rajasthan state. In Rajasthan, 13 districts are part of Desert, but four major districts that have 100 percent deserts conditions are Jaisalmer, Barmer, Bikaner and Jodhpur districts. Bikaner is the fourth Thar Desert district having total area of 270 km². Thar Desert is one of the smallest Desert in the world with maximum temperature ranging from 45-50 °C and the annual rainfall is as meager as 23-25 cm. In Rajasthan state less than 2% of total Desert area is Protected Area. Reptilian fauna is significantly known from the Thar desert and out of total 456 reptilian species found in India; the 63 reptile species are found in Rajasthan. As many as 20 species of lizards (Gaur *et al.*, 2013) [6] and 34 species of snakes (Bhatnagar *et al.*, 2013) [3] have been reported from this state. Desert is a unique habitat which suits both lizards and reptiles and hence 54 Squamata species (Sharma & Gaur, 2005) [13] make it a reptile rich habitat. Snakes have developed various physiological and behavioral adaptations to survive in hot and dry conditions. Rajasthan, known for its diverse wildlife and desert landscapes, is also home to a wide variety of snake species. Some of the most commonly found snakes in Rajasthan include the Indian cobra, Russell's viper, saw-scaled viper, common krait, and rat snakes. These reptiles play a crucial role in maintaining the ecological balance by controlling rodent populations and contributing to the biodiversity of the region. The reptiles consist of four living clades: Crocodylia, Sphenodontidae, Squamata and Testudines. Squamata includes snakes, lizards and tuataras. In Bikaner district, reptilian population is restricted to snake, lizard and testudines.

Snakes can be defined as exothermic (poikilothermic), secretive, nocturnal, carnivorous, vertebrates belonging to the suborder Ophidia of Order Squamata of Class Reptilia. Total number of 34 snake species found in Rajasthan only 6 are venomous and only three are found in Bikaner viz., Saw-scaled viper, Common Krait and Indian cobra. Snakes are divided into two groups venomous and nonvenomous. Venomous snakes are further divided into two categories, depending upon the type of venom they carry: Neurotoxic and Haemotoxic. Bikaner, which is one part of desert triangle, is quite rich in reptilian diversity because of typical desert like conditions. Its ecology is also changing like any other district of the Thar desert and its biodiversity is increasing but at the cost of desert adapted species (Idris *et al.*, 2009) [8]. Lizards are the most prominent species found in desert area is the Indian spiny-tailed lizard, also known as the *Saara hardwickii*. Lizards have adapted well to the harsh desert conditions by burrowing underground to escape extreme temperatures and emerging during cooler parts of the day to hunt for insects and vegetation. They are known for their distinctive spiny tails and colorful markings which help camouflage them amongst the sandy area. Lizards in Bikaner play an important role in controlling insect populations, making them as Key stone species in desert ecosystem.

Material and Methods

Study Area

The Thar Desert, of which Bikaner district forms a part, is believed to have been bed of a sea in the pre-historic periods of Jurassic, Cretaceous and Eocene. It is surmised that the area was converted into a dry land during upper Tertiary. Many centuries after the marsh had completely dried up; vegetation began to spring up resulting in clusters of shrubs and trees. Bikaner region of Thar Desert was our main study area where field-work was carried for reptilian studies. Bikaner is one of the 13 districts of Rajasthan state, which are part of Thar Desert (Fig. 1). The district is located between 27°11' and 29°03' N latitude and 71°54' and 74°12' E longitude. The district can be classified into two natural divisions – (i) north and western Desert and (ii) south and eastern semi-Desert. The greater part of district is covered with stable and shifting sand dunes. The average elevation in and around Bikaner city is 228 to 235 m above mean sea level.

The area is normally devoid of significant drainage except for a few ephemeral rivulets. The seasonal nallahs normally develop in rugged topography in the upland, which normally vanish in the low-lying areas. The principal sources of water are dug wells and at places tankas. Kanwar Sen Lift Canal and the Bichwal reservoir are prominent surface water bodies in the area. The canal and underground water are main sources of domestic supply of water in Bikaner city.

Flora

The vegetation of Bikaner district falls under the broad natural division of tropical thorn forest (Champion & Seth, 1968). Like any other Desert area, Bikaner witness extremely low and erratic rainfall, extremes of temperatures and high evapo-transpiration rate. In low-lying areas of dunes, where the moisture accumulates to some extent during rains, a few scattered stunted trees can be observed. Jorbir, Bichhwal and Gajner are important protected areas where patches of good vegetation can be observed. Besides, there are a few common property resources, locally known as 'Gauchars' and 'Orans',

which still are the strongholds of biodiversity in the Desert ecosystem. The vegetation of this area is composed of annuals and few perennial shrubs. Two major vegetation types are (i) Psammophytic scrub Desert and (ii) Mixed xeromorphic woodland (Gupta and Saxena, 1972) [7]. The psammophytic scrub vegetation, sustained by subterranean water, constitutes the perennials. The former vegetation type includes *Calligonum polygonoides* and *Panicum turgidum* as the most common community on the sand dunes and undulating and inter-dunal plains. While the latter type includes *Prosopis cineraria*, *Ziziphus nummularia* and *Capparis decidua* community covering the flat degraded older alluvial plain and flat inter-dunal plains (Arora, 1992) [2]. The saline depression and saline inter-dunal areas are dominated by halophytic scrub vegetation like *Sporobolus marginatus* and *Eleusine compressa*.

The common ephemerals are *Indigofera cordifolia*, *Cenchrus biflorus*, *Tribulus alatus*, *Tribulus terrestris*, *Limeum indicum*, *Euphorbia granulata*, *Aristida funiculata* and *Farsetia hamiltonii*. Certain other plant species like, *Crotalaria burhia*, *Aerva persica*, *Cyperus arenarius* and *Leptadenia pyrotechnica* are found on sand dunes. The very crest of sand dunes is often colonized by *Lasiurus indicus*, *Citullus colocynthis* with its typical habit is codominant on such dunes but *Calotropis procera* occur occasionally.

Among the trees, *Prosopis cineraria*, *Ziziphus nummularia* are dominant while *Acacia arabica*, *Salvadora persica*, *Albizia lebbek*, *Dalbergia sisoo*, *Prosopis juliflora*, *Acacia tortilis*, *Leucaena leucocephala*, *Parkinsonia aculata* are also found in this area of arid zone.

Fauna

There is no doubt that this desert district is decorated with a large number of species and the region is recognized for richness of reptilian, avian and mammalian fauna. The Thar supports 66 mammalian species, out of these 33 species have Palaearctic affinities, 30 have Oriental affinity and rest 3 are endemic to region. Small mammal fauna of Thar has the great complex with the west (Ellerman, 1961) [5]. There are three main habitat types in Bikaner viz. Sandy, Ruderal and croplands. On the sand dune slopes commonly found rodents are *Gerbillus gleadowi* and *Meriones hurrianae*. Around the hummocks of the bushes, in the inter-dunal plains where grass cover is thick, the Indian gazelle (*Gazella gazella benneti*) occur in fair abundance. Among carnivores, Indian fox (*Vulpes bengalensis*), Desert fox (*Vulpes vulpes*), mongoose (*Herpestes* spp.), Desert cat (*Felis silvestris*), and Desert hare (*Lepus nigrocollis*) are also found in and around Bikaner city. The insectivores, namely the hedgehogs (*Hemiechinus collaris* and *H. microus*) and shrews (*Suncus murinus*) are quite common in scrubland and ruderal habitats respectively. The Pholidote, Indian Pangolin (*Manis crassicaudata*), though never observed in the region, was killed by villagers in Nokha tehsil because of its strange body structure. Blackbuck (*Antelope cervicapra*) is quite common is and around Bishnoi Dhanis and villages. *Funambulus pennanti*, *Gerbillus gleadowi*, *G. nanus*, *Meriones hurrianae*, *Tatera indica*, *Rattus rattus* are other common rodents of the region. Many mesic rodent species have recently invaded Bikaner district. *B. bengalensis* has been reported from the Bikaner city and more aggressive *Nesokia indica* has been observed in Lunkaransar tehsil. Prakash (1961) [10] reported the bats, *Rhinolophus lepidus* and *Rhinopoma hardwickei* from fuller's

earth in Bikaner. We have recently observed a colony of *Pteropus giganteus* roosting in Bikaner. The Jackal, *Canis aureus* is quite common in Gajner Sanctuary while Indian Porcupine, *Hystrix indica* is quite abundant in grasslands of Nal. Prolific breeder, Wild boar, *Sus scrofa* has extended its range and is quite common in Gajner Sanctuary and Jorbeer Conservation Reserve.

Among eight species of amphibians found in the Thar Desert, only four have been observed in Bikaner. *Euphlyctic cyanophlyctis* is very common in Sagar, Darbari and Gajner water bodies; *Heplobatrachus tigerinus*, *Bufo melanostictus* and *B. stomaticus* are other amphibian species reported from this region.

The avian fauna of the region is quite spectacular and our checklist for the district is 192 species. Jorbeer area, on the outskirts of city, attracts seven species of vultures. Egyptian vulture (*Nephron percnopterus*), Eurasian Griffon (*Gyps fulvus*), Himalayan Griffon (*Gyps himalayensis*), White-backed vulture (*Gyps bengalensis*) Long-billed vulture (*Gyps indicus*), Redheaded vulture (*Sarcogyps calvus*) and Cinereous vulture (*Aegyptius monachus*) had been observed here during winters. Many mesic species of birds like Baya (*Ploceus philippinus*), pied crested cuckoo (*Clamator jacobinus*) Black-crowned night heron (*Nycticorax nycticorax*) and white-browed fantail (*Rhipidura aureola*) have appeared in the region, indicating ecological transformation. The endangered and state bird of Rajasthan, Godavan (*Ardeotis nigriceps*) has been observed near Nokhdaiya village and (Singh *et al.*, 2010) [15]. Indian Peafowl, *Pavo cristatus* inhabits piedmont zones and village complexes. Stoliczka's Bush-chat or white-browed Bush-chat, *Saxicola macrorhyncha* is the only endemic bird of the area.

Data Collection

We have been working on the vertebrate diversity of Bikaner and adjoining desert districts from last two decades and the present study is our observations and photographic evidences collected during our studies. This primary data was recorded from various localities, in which number of species present were recorded. As most of reptiles are nocturnal and have secretive life style, we conducted night surveys as well. The species of reptiles observed were identified using field guides of Whitaker and Captain (2008) [18] and Sharma (2002) [12]. The nomenclature of Aengals *et al.*, (2018) [1] has been followed in this communication. The species identification, type of species (venomous or non-venomous), whether a key stone species, its role in the ecosystem were also recorded in

the field diary. In addition to this secondary data was also collected from newspapers, social media and interacting with local farmers and laborers. The observations and the collected data were recorded in the field data sheet. These data were collected from all eight tehsils of the Bikaner district. We also intensively surveyed the Conservation Reserves and Protected areas like Gajner, Jorbeer, Lunkaransar and Kodamdesar.

Results

Bikaner located in the northwestern region of Rajasthan is renowned for its numerous conservation areas that protect the diverse flora and fauna unique to this region. Along with these conservation areas, gauchars, orans and other common property resources serve as crucial habitats for various endangered species such as the Spiny tailed lizard, Desert monitor, Desert Fox, GIB, vultures and snakes. Bikaner, is home to a diverse range of snake species, both venomous and non-venomous. Some of the venomous snakes pose a significant threat to humans and can cause serious harm if bitten. On the other hand, non-venomous snakes such as the rat snake, Glossy-bellied racer, Red spotted royal snake and black-headed royal snake are the most commonly found non-venomous species.

The Thar is a great repository for reptilian species, which have been classified in three categories viz., those with western affinities, those which are eastern elements and third those which are endemic to region. Lizards *Stenodactylus orientalis* and *Cyrtodactylus khhensis* are endemic to Thar (Sharma, 1974) [11]. Indian Cobra (*Naja naja*), Saw scaled viper (*Echenis carinatus*) and Indian krait (*Bungarus caeruleus*) are three venomous snakes of the area. The sand boa (*Eryx johnii*), Dhaman (*Ptyas mucosa*) Diadem snake (*Sphalerosophis* spp.) and blind snake (*Typhlops braminus*) are other common snakes of Bikaner region (Table 1 & Plate 1). Spiny tailed lizard (*Saara hardwickii*), locally known as "Sanda", is quite common on Gajner Road, Husangsar, Jorbeer and in Nokha Tehsil. Desert monitor (*Varanus griseus*) and the Indian monitor (*V. bengalensis*) are quite common in the district (Table 2 & Plate 2). *Stenodactylus orientalis*, *Mabuya macularia*, *Ophiomorus tridactylus* are other important lizards of the region. In addition to these, two testudines are also found here, which are Indian soft-shelled turtle and Star tortoise (Table 3).

As many as 14 snake species, 11 lizard species and 2 testudines make this small area of 30,248 sq/km quite rich in reptilian diversity.

Table 1: List of snakes found in Bikaner

S. No.	Name of snake	Scientific Name	IUCN status	Category (Venomous or nonvenomous)	Abundance status
Family: Typhlopidae					
1	Brahminy Worm Snake	<i>Indotyphlops braminus</i>	LC (Least Concern)	Nonvenomous	C
Family: Erycidae					
2	Common Sand Boa	<i>Eryx conicus</i>	LC (Least Concern)	Non venomous	R
3	Red Sand Boa	<i>Eryx johnii</i>	NT (Near Threatened)	Nonvenomous	C
Family: Viperidae					
4	Saw-scaled Viper	<i>Echis carinatus</i>	LC (Least Concern)	Venomous	VC
Family: Lamprophiidae					
5	Afro Asian Sand Snake	<i>Psammophis schokari</i>	LC (Least Concern)	Venomous	R
Family: Elapidae					
6	Common Indian Krait	<i>Bungarus caeruleus</i>	LC (Least Concern)	Venomous	VR
7	Spectacled Cobra	<i>Naja naja</i>	LC (Least Concern)	Venomous	C

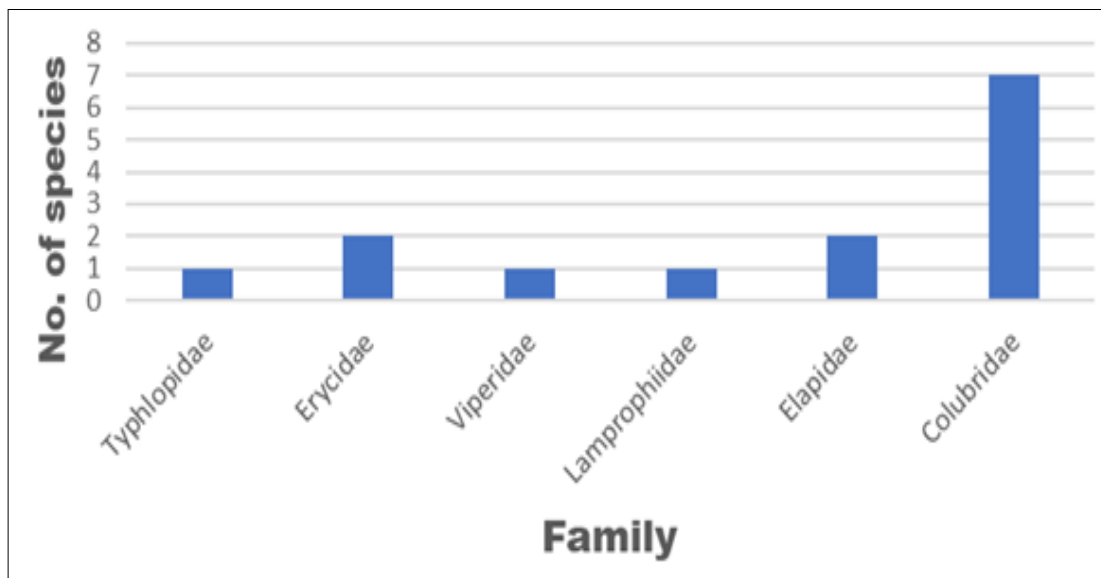


Fig 1: Family wise distribution of serpents species

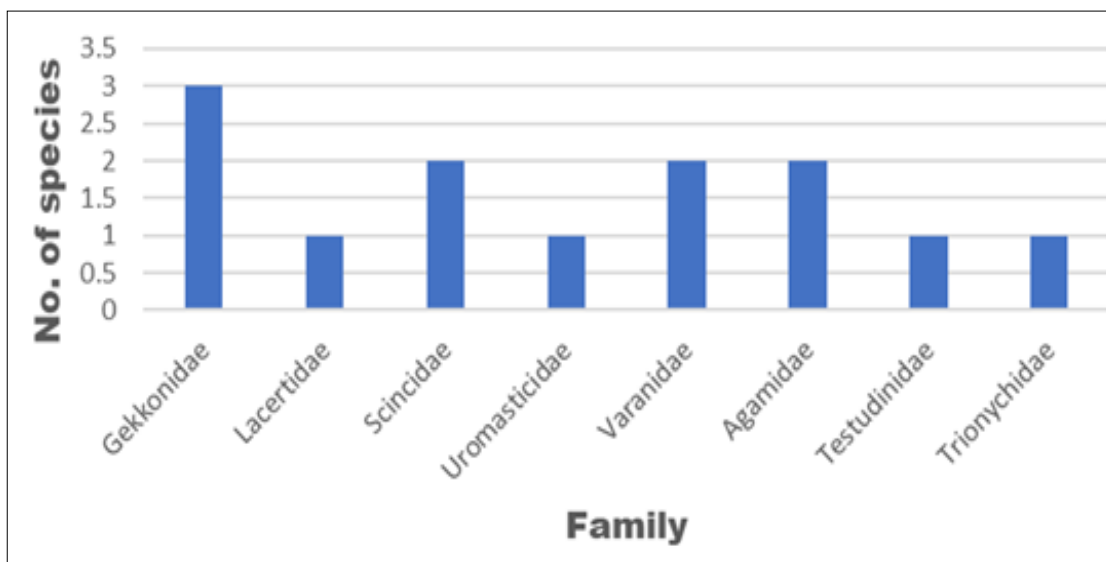


Fig 2: Family wise distribution of sauria and testudine species

Table 2: List of lizards found in Bikaner

S.No.	Name	Scientific Name	IUCN Status	Food & feeding	Abundance status
Family: Gekkonidae					
1	Sind Day Gecko	<i>Crossobamon oreintalis</i>	NT (Near Threatened)	Carnivorous & Herbivorous	VR
2	Asian house gecko	<i>Hemidactylus frenatus</i>	LC (Least Concern)	Carnivorous	VC
3	Bark Gecko	<i>Hemidactylus leschenaultii</i>	LC (Least Concern)	Carnivorous	C
Family: Lacertidae					
4	Indian Fringe-fingered Agama	<i>Acanthodactylus cantoris</i>	EN (Endangered)	Carnivorous	C
Family: Scincidae					
5	Yellow-bellied Mole Skink	<i>Eurylepis taeniolatus</i>	LC (Least Concern)	Carnivorous	C
6	Eastern Sand Swimmer	<i>Ophiomorus raithmai</i>	LC (Least Concern)	Carnivorous	R
Family: Uromastixidae					
7	Spiny-tailed lizard	<i>Saara hardwickii</i>	VU (Vulnerable)	Omnivorous	VC
Family: Varanidae					
8	Bengal Monitor	<i>Varanus bengalensis</i>	NT (Near Threatened)	Carnivorous & Scavenger	VC
9	Desert Monitor	<i>Varanus griseus</i>	LC (Least Concern)	Carnivorous & Scavenger	VR
Family: Agamidae					
10	Brilliant Ground Agama	<i>Trapelus agilis</i>	LC (Least Concern)	Carnivorous	C
11	Indian garden lizard	<i>Calotes versicolor</i>	LC (Least Concern)	Carnivorous	VC

Table 3: List of test dines found in Bikaner

S. No.	Name	Scientific Name	IUCN Status	Food & feeding	Abundance Status
Family: Testudinidae					
1	Indian Soft-shelled Turtle	<i>Nilssonia gangetica</i>	EN (Endangered)	Omnivorous	R
Family: Trionychidae					
2	Star Shell Turtle	<i>Geochelone elegans</i>	VU (Vulnerable)	Herbivorous	R

Discussions

Bikaner is very rich in reptilian diversity and out of 54 squamata species found in the Thar desert as many as 25 species, which constitute 46.29%, are found in Bikaner district. Out of big four venomous species, three are found here. Most of the snake bite cases reported in the Govt. PBM hospital are those of saw-scaled viper (Solanki, 2015). *Bungarus caeruleus*, though not very common but is responsible for many deaths particularly in the monsoon season. "Sawan" is the month of fairs in Bikaner region and thousands of people move on foot from villages to the pilgrimages. They are served food on the way and sleep in tents during night and hence the chances of encountering the snakes increase manifold. Out of 20 species of the lizards found in the Thar desert (Gaur *et al.*, 2013) [6], 11 are being reported from Bikaner district alone and this constitute 55% of the total lizard species. Among snakes, 34 species have been reported from Thar and out of these as many as 14 are being reported from Bikaner. This constitutes 41.17% of the snake species found in the Thar. Among Suborder serpentes, Colubridae is the most represented family with seven species (Figure 1). Erycidae and Elapidae next in abundance with two genera each. Families Typhlopidae, Viperidae and Lamprophiidae are represented one genus each. Among snakes, common wolf snake has recently been sighted in an egg tray brought here from Ajmer. Otherwise, it is never seen

here. This clearly indicates that modern ways of fast transportation are helping these slow-moving creatures, expand their niches. Among Lizards, Gekkonidae is most represented family with three genera (Figure 2). Scincidae, Varanidae and Agamidae families are represented by two genera each. Lacertidae Uromastixidae are represented by one genus each. Among testudines, both Star tortoise and flap-shelled turtle are rare and this poor representation is because of absence of waterbodies and damp places in the district. Like any other habitat, we are losing biodiversity (particularly snake and lizard diversity) in this region of Thar desert because Climate change (Pimm, 2008) [9], Habitat loss, spurt in Anthropogenic activities, expanding agriculture fields and ecological transformation being brought by the mighty Indira Gandhi Nahar Pariyojana (IGNP) are all greatly altering the faunal diversity of the Thar desert (Singh & Prakash, 2004) [14]. The present study will provide the baseline data for future monitoring of these secluded creatures. Some of the reported lizard and snake species are key stone species of this fragile ecosystem and need urgent conservation measures. We must address the problem of human-snake conflict and spread awareness among masses for their conservation. These important components of food chain of desert ecosystem need urgent improved forecast and modelling for the conservation efforts to be successful.



Black-headed royal snake



Common wolf snake



Afro-Asian sand snake



Saw-scaled viper



Brahminy worm snake



Red sand boa

Plate 1: Some common snakes of Bikaner



Indian garden lizard



Asian house gecko



Brilliant ground agama



Desert monitor



Spiny-tailed lizard



Fringe-toed agama

Plate 2: Some common lizards of Bikaner

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