



Role of Insects in Maintaining the Thar Desert Ecosystem in Rajasthan

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ABSTRACT: The Rajasthan state is divided into different climate zones from a western arid desert to a humid region of the south-eastern plateau that represents significant insect diversity. The present review aims to provide baseline information of vegetation, insect diversity, rainfall and the role of these factors in maintaining the Thar desert ecosystem. The Aravali Ranges form the chief topographical feature of Rajasthan extending from Gujarat in a north-easterly direction to near Delhi. There is little doubt that Western Rajasthan was occupied largely by a sea during the Jurassic Cretaceous Eocene. It is not clear when this area was uplifted into dryland but it may have been sometime in the upper tertiary, after Miocene when the Himalayas became a prominent feature in the North. Desert conditions must have gradually set in well after man appeared in Pleistocene. Therefore we are left with a conclusion that Thar or Rajputana desert is at least 2 Millenia old. The geological conditions led to the formation of this desert, but there are certain features which have led to the maintenance of desert and other factors which have caused expansion of the desert. In this present review the various factors are related to develop a common understanding. The desert has a large number of plants of economic importance and medicinal use, Forty-five plant species are considered to be rare and/or endangered. The insect biodiversity of Thar region was studied through review of papers which were available in open access

Study Area- Thar Desert

Rajasthan is a northwestern state of India having an area of approx 3,42,200 km square, geographically situated from 23.3 - 30.12N to 69.30 - 78.17E. The line of Cancer traverses through the southernmost region of the state (Banswara), hence it is dominated by subtropical climatic conditions. Aravallis divide the state separating the fertile plains from the Thar Desert.

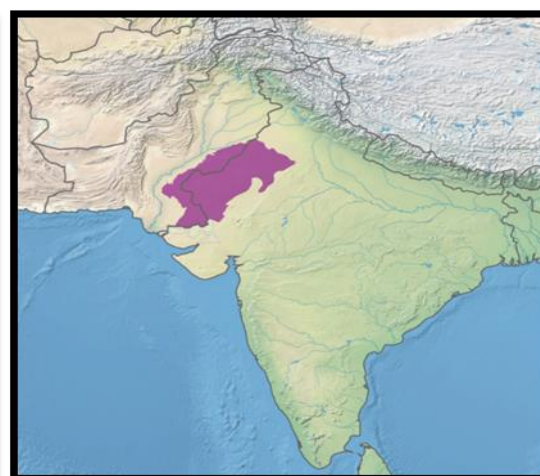
Biodiversity of Thar

Thar desert is peculiar in both the vegetation and the faunal endemism. It has a great range of faunal endemism (6.5). The insects inhabiting the Thar Desert mostly belong to the following groups:- Carabid, Scarabid and Lygaeid Beetles, Acrididae (Grasshopper and Locust), Wasp and wild bees, mud daubers, spiders etc. these insects pass the hot afternoon at the base of dry bushes. They are also capable of entering a period of dormancy during which they eat little and they're also capable of hibernating as eggs, larvae or Pupa buried deep in the soil. In Thar desert annuals and perennials form the wild vegetation. The annuals pass adverse season as seeds. Perennials are characterized by succulent or narrow needle like leaves

When rainfall is normal the common crops cultivated in the village are 'Mot' (*Phaseolus*), 'Guar' (*Cyamopsis*) and 'Bajri' (*Pennisetum*). Rainfall in Rajasthan occurs during the months of July, August and may extend up to September. The period between October and June is generally dry and hot or dry and cold. Insects which are active during monsoon season, increase enormously in numbers and undergo dormancy in the winter. If any insect species is to survive in the desert and environment it must adapt in such a way to withstand the adverse period of October to June and it must also have mechanism to save itself from heat, Rapid transpiration and predators

Insect Fauna of Rajasthan

The most common group of insects found in Thar region are grasshoppers, bugs belonging to Lygaeidae, Cicadidae, various families of beetles like Scarabaeidae (Chaffer Beetles) Copriidae (dung beetles), Tenebrionidae and Carabidae (ground beetles), moths belonging to Noctuidae, Arctiidae, Sphingidae, Pieridae and bees (Apidae). A few species of termites occur as subterranean insects in the desert area. **The desert insect fauna is peculiar in many ways for instance :**



The desert locust which is a serious pest and breeds in the monsoon season in India and undertakes long migratory flights at the onset of drought reaching to more favourable tracks Baluchistan, Arabia, Persia etc these flights are similar to those of certain migratory birds.

Some insects hibernate in egg stage as in case of some grasshoppers like phadka (*Hieroglyphus nigrorepletus*) lays eggs under the soil sometimes in October and the eggs remain dormant till next monsoon. Some insect burrow in the soil like cricket, beetles and ants. Most of them store food in the burrows for use during unfavourable period. Grasshoppers and beetle hibernate as adults in base of thickly growing Xerophytic bushes and feed very little during dormancy. The unfavorable period is passed as Pupa in shelter places as in red hairy caterpillar (*Amsacta moorei*), which is the serious pest of kharif crop in Rajasthan desert, it burrows deep into the soil and hibernate there till outbreak of monsoon next year. As there are strong winds in the desert, many insects have reduced wings as in crickets, beetles and mantids. If the wings are well developed from flight the insect likely to be blown away by winds, the death of local locust swarms which are carried by such winds to sea is well known.

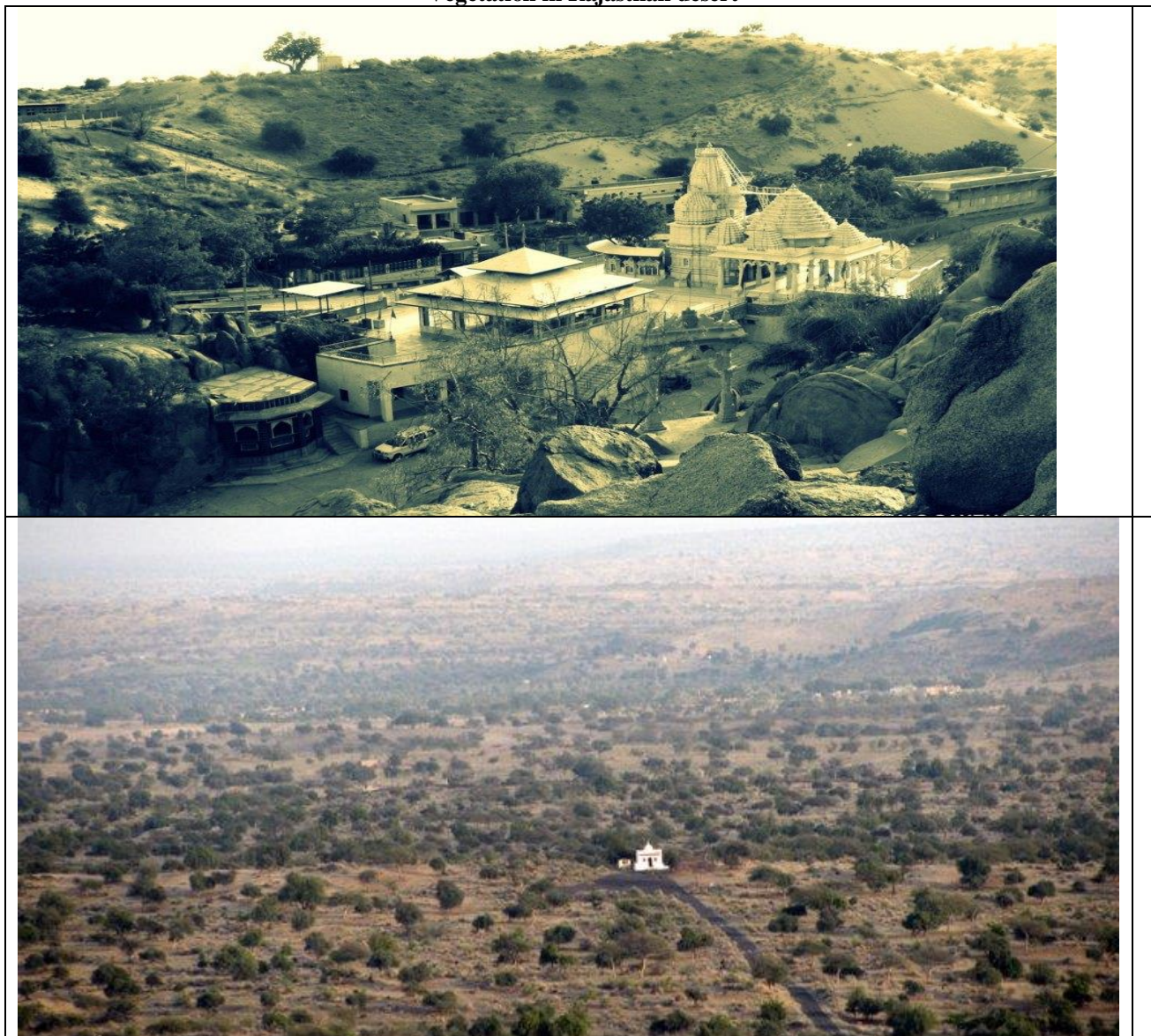
The colour of desert insect generally resembles the ground on which they live, in general their upper surface is sandy with little pigmentation. In desert insects colour also changes in some species according to the type of vegetation on which they pass their life, for instance the colour of solitary hoppers of desert locust (*Schistocerca gregaria*) is deep green if it thrives on green cultivation of bajari on the other hand it becomes Ashy grey if it lives on 'both' (*Aerua tomentosa*), this adaptation in colour is possibly to defend the insects against the enemies which Prey on them or is due to some physiological changes resulting from the desert habitat. Some desert beetles, crickets, moths etc avoid hot surface of the soil by coming out at night, others by rising from time to time on their wings into the air and some by climbing on plant. For instance it is well known that the locust, hoppers congregate themselves on bushes at mid day during summer. A Table of insect fauna of the Rajasthan is arranged by studying online research publications. There were 76 open access research papers from researchgate, Google Scholar were browsed using previously published literature, from 1995 a consolidated database of insect fauna was prepared, which is appended below

Order	Family	Scientific Name
	Acridiidae	<i>Acrida exallata</i>
		<i>Schistocerca gregaria</i>
		<i>Locusta</i>
		<i>Oedaleus</i>
		<i>Sphingonolus</i>
		<i>Hieroglyphus nigrorepletus</i>
		<i>Chrotogonus</i>
		<i>Cyrtacanthacris latrica</i>
		<i>Catantops</i>
		<i>Orthacanthacris</i>
	<i>Poecilocercus pictus</i>	
	Gryllacridae	<i>Schizodactylus monstrosus</i>
	Mantidae	<i>Hierodula sp</i>



		<i>Mantis sp.</i>
	Tettigoniidae	<i>Conocephalus sp</i>
COLEOPTERA	Aphodidae	<i>Aphodus sp</i>
	Buprestidae	<i>Julodis</i>
	Cetoniidae	<i>Oxytelonia versicolor</i>
		<i>Chiloloba acuta</i>
	Coccinellidae	<i>Epilachna</i>
		<i>Coccinella septempunctata</i>
	Carabidae	<i>Anthia sexguttata</i>
	Chrysomelidae	<i>Aulacophora foveicollis</i>
	Curculionidae/Meloidae	<i>Xanthochelus faunus</i>
	Scarabaeidae	<i>Scarabaeus</i>
		<i>Trox</i>
	Tenebrionidae	<i>Adesmia</i>
		<i>Blaps</i>
		<i>Pimelia indica</i>
		<i>Rhytinota impolita</i>
		<i>Arthrodes</i>
		<i>Opatroides vicinus</i>
	Belostomatidae	<i>Belostoma</i>
	Cicadidae	<i>Cicada</i>
RHYNCHOTA	Coreidae	<i>Homocercus</i>
	Lygaeidae	<i>Lygaeus</i>
	Pentatomidae	<i>Bagrada cruciferarum</i>
		<i>Nezara graminea</i>
		<i>Aspongopus</i>
	Pyrrhocoridae	<i>Dysdercus cingulatus</i>
LEPIDOPTERA	Arctiidae	<i>Utetheisa pulchella</i>
	Noctuidae	<i>Speiredonia retorta</i>
	Nymphalidae	<i>Precis orithya</i>
	Danaidae	<i>Danais</i>
HYMENOPTERA	Apidae	<i>Xylocopa fenestrata</i>
	Mutillidae	<i>Mutilla durga</i>
	Megachilidae	<i>Megachile vigilans</i>
	Vespidae	<i>Polistes hebraeus</i>
ISOPTERA	Termitidae	<i>Hodotermes macrocephalus</i>
		<i>Heterotermes</i>
		<i>Microtermes</i>

Vegetation in Rajasthan desert



The Vegetation amidst the desert

Before Independence, knowledge about the biodiversity of the Thar was only from contemporary administrative accounts, both Indian and colonial. The most well-known indigenous account of the region is provided by the 17th-century Diwan of Marwar, Munhot Nainsi, in his two books *Munhata Nainsi ri Khyat*, and *Marwar ra Parganan ri Vigat*. The former is a history of Marwar and the latter resembles a gazetteer—both are composite of contemporary information, observation, folklore and poetry. Many detailed studies have been undertaken post-Independence to map and identify plants of the Thar, record their growth patterns and prepare clear nomenclatures. In 1952, K. Biswas and R. Sheshagiri Rao noted the need for a proper phytogeographic survey of desert vegetation (Biswas and Rao 1953:411–421). They emphasised the study of autecology of plants, which is the life history of individual species occurring singularly or in association with other species in particular natural surroundings. In 1978, an excellent publication titled *Flora of the Indian Desert* by M.M. Bhandari consolidated all the previous research and listed 682 species belonging to 352 genera and 87 families of flowering plants. Of these, 69 species were labelled as ‘introduced’ while the rest as indigenous to the region (Bhandari 1978:16).

Forty-five plant species of Thar are considered to be rare and/or endangered. The desert has a large number of plants of economic importance and medicinal use. Another peculiarity of the vegetation of desert is that as a result of good monsoon and the resultant growth of luxuriant vegetation the surface of the sand is consolidated during that season but



thereafter with drying up of the soil moisture, it becomes loose. Sandstorms are of almost daily occurrence from April to June when it is particularly hot and dry so the vegetation of is particularly adapted to such extremes. Among the perennials most common are 'Booh' (*Aerua tometosa*), Kair (*Capparis*), Khejri (*Prosopis*) 'Lana' (*Haloxylon salicornicum*), 'phog' (*Calligonum polygonoides*) etc and among the animals most common plants are 'bekkar' (*Indigofera*) "Bharut" (*Cenchrus biflorus*)

The annual vegetation appears shortly after the commencement of rainy season and in the years of good rainfall normally cover practically the whole of available space. In fact sand is not visible except where there is a camel path or narrow tracks made by grazing cattle's, annuals wither soon when monsoon withdraw and dry condition prevails.

The main peculiarities of perennials are that they have deep roots and can thus draw water required for survival in hot and dry conditions of desert, the leaves are tough and leathery having thick cuticle and in some cases *Capparis* the leaves are reduced all together, these modifications reduce the loss of water due to transpiration. Some of the desert plants have succulent stems like in *Capparis* or *Calotropis*. Except for the few localised areas of shifting sand dunes which are without any vegetation the major part of Rajasthan desert maintains perennial vegetation. In monsoon season the growth of annuals is dependent on the amount of rainfall received. In fact the annual during the monsoon season are so plenty that this part of Thar Desert in Rajasthan is even described as semi desert

DISCUSSION

The role of faunal biodiversity in maintaining the desert is very well evident. Goats which are quite common particularly near the fringes of desert, Jodhpur area are allowed to graze wherever they like, leads to defoliation of all plant varieties their grazing causes death of vegetation in the same way as by locust. Therefore goats which are known to be a serious pest in several countries can also be considered to make an important contribution to the spread of desert. As already discussed the number of perennial plants found in the Thar Desert is sufficient in number but it's the growth of annuals that keeps the soil bound it shows that vegetation has a great role in keeping the soil bound.

Of the numerous pest found in Rajasthan, desert locust is one pest which can contribute to maintenance or spread of the desert, both in young and adult stage this pest destroys the annuals and perennials by devouring on leaves and even on strip the bark of host leaving only woody portions behind. This causes death of plants, the annuals are killed out right. Due to death of vegetation the soil becomes loose and their roots also ultimately decay with the strong winds soils get blown away resulting in shifting sand dunes.

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