An Appraisal of Halophytes of District Nagaur, Rajasthan-An Overview

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ABSTRACT: The vegetation in deserts is a unique blend of perennial grasses, hardy shrubs and scattered small trees. These perennial systems are the lifeline of desert and sustains high human and livestock, even during drought or near famine situations. Of these, shrubs are dominant in hot arid ecosystem and adapted in harsh climate of arid and hyper arid region. The shrubs have a resilient role in resisting erosion and desertification because of their ability to withstand biotic pressure, conserve soil, moisture and improve soil productivity. These are primary source of fuel and fodder for the rural masses in the areas with low tree cover and have the potential to provide products useful to the local people as well as industry. Masses in these areas depend on shrubs for fuel, food, fodder and various other economic products like gum, dyes, medicines, etc.

KEYWORDS-halophytes,desert,drought,food,fodder,medicines,economic,products,shrubs,thorns

I.INTRODUCTION

The term ‘Rajasthan’ was first coined by James Tod, the 19th century British annalist as ‘the collective and classical denomination of that portion of India which is the "abode of [Rajput] princes”' (Kothiyal 2016:3).[1] The colonial construct carried over to independent India, giving us the boundaries of the modern state of Rajasthan. However, its contours do not coincide with a natural geographic region with unambiguous physical boundaries. Three-quarters of the state is the Thar Desert, which forms part of the South Asian desertscape that moves through Pakistani Sindh, Punjab and Balochistan. The remaining one quarter of the state consists of the gently rolling Aravalli range that undulates north and northeast into the plains of the Yamuna and the Chenab rivers, and connects to the Malwa plateau in the southeast.

A direct result of this colonial misconstruction has been the general perception of Rajasthan as a harsh terrain peopled by doughty, battle-scarred Rajput clans. This is more a product of historical fallacy and political circumstance than facts of actual geography or human settlement. Today, the anthropology of Rajasthan is increasingly being studied within the parameters of mobility and migration, and the long-standing yet fluid occupational and cultural patterns set in a landscape that is neither barren nor unrelentingly inimical. The 19th century Rajput-centric paradigm of a chivalric ruling order standing firm in a hostile, sterile desert is no longer the base model for understanding the cultural, political or social development of the Thar region. Instead, the region is seen as part of an interconnected south Asian desertscape, peopled by a vast range of itinerant and settled castes and communities, who have optimised the landscape, the biotic resources, and the locational advantages to their benefit. The purpose of this essay is to examine one aspect of the biotic resources, namely the vegetation, in greater detail.[2,3]

Within the Thar, there are four sectors on the basis of rainfall and edaphic characteristics (Sharma and Mehra 2009:3).

- The Luni basin, comprising Pali, Jalore, the south-eastern part of Barmer, the eastern part of Jodhpur, the western part of Ajmer, Sirohi and the southern part of Nagaur
- The northern drainage zone, comprising Sikar, Jhunjhunu and northern Nagaur
- The agriculturally rich district of Sri Ganganagar and Hanumangarh adjoining Punjab and Haryana
- The true desert of marusthali, consisting of Jaisalmer, northern Barmer, and the western parts of Jodhpur, Bikaner and Churu districts

Water, or the lack of it, defines the Thar. Seasonal rain comes at the tail end of the monsoons and from occasional western disturbances in winter. The amount of precipitation varies 100 to 400 mm annually, the average being 250 m.[3] High daytime temperatures, high evaporation levels and low groundwater recharge make this a water deficient region. There is only one natural drainage system of the river Luni, and a few seasonal lakes and reservoirs. The fairly recent Indira Gandhi Canal in the north, operative since 1983, has revived agriculture in the Hanumangarh and Ganganagar districts.

The region was not always desolate. If mythology and local legends are to be believed, it was once a well-watered land of rivers and green fields. Historically, Harappan settlements once existed in the area, presumably on the banks of watercourses. The desertification of the Thar is attributed to geological shifts leading to altered flow and silting up of rivers, and the gradual development of sandy plains and salt marshes. Sometime during 2000 to 1500 BCE, the Indus river system may have shifted to the west and the Ghaggar ceased to be a major river and terminated in the desert. Some geological studies suggest that the Ghaggar was once the main drainage system, with the Sutlej and the Yamuna as its tributaries (Kothiyal 2016:30–31).

The geological shift also led to a shift from farming to pastoral activities. Forests were cut down for fuel and fodder beyond their regenerative power, while livestock grazing depleted much of the natural vegetation cover over the centuries. M.M. Bhandari summarises the devastating propensities of grazing herds with a Marwari proverb: *'Oont chhode akaro*, *bakre chhode kankro'*. The camel will eat everything but the *aakado* (*Caliotropis procera*) but the goat will leave only pebbles (Bhandari 1978:7).[,5]

For the last two millennia, settlements have grown around sources of water and their names reflect this. *Ser* or *sar* means water tank or pond. So we have Napaser, Bachaser, Sadosar, Rawatsar, Bhimsar, Dhisar etc. The source of water could be a well or tank, usually with brackish water. *Mer* means a hill, which usually indicated a stronghold on a strategically higher location such as Jaisalmer, Barmer or Ajmer.

The word *jangal* came to be used for the lands around Bikaner, to denote 'a region where the sky is generally clear, and water is scarce, and land abounds in *Shami*, *Karira*, *Peelu* and *Kankero*'[,7]

II.DISCUSSION

A halophyte is a salt-tolerant plant that grows in soil or waters of high salinity, coming into contact with saline water through its roots or by salt spray, such as in saline semi-deserts, mangrove swamps, marshes and sloughs and seashores. The word derives from Ancient Greek ἅλας (halas) 'salt' and φυτόν (phyton) 'plant'. Halophytes have different anatomy, physiology and biochemistry than glycophytes.[1] An example of a halophyte is the salt marsh grass *Spartina alterniflora* (smooth cordgrass). Relatively few plant species are halophytes—perhaps only 2% of all plant species. Information about many of the earth's halophytes can be found in the ehaloph database.

The large majority of plant species are glycophytes, which are not salt-tolerant and are damaged fairly easily by high salinity.[2]

Classification

Halophytes can be classified in many ways. According to Stocker (1933), it is mainly of 3 kinds by habitat, viz.

1. Aqua-halines (aquatic plants)
   - *Emerged Halophytes* (most of the stem remains above the water level)
   - *Hydro-halophytes* (whole or almost whole plant remains under water)
2. Terrestro-halines (terrestrial plants)
   - *Hygro-halophytes* (grow on swamp lands)
   - *Mesohalophytes* (grow on non-swamp, non-dry lands)
   - *Xero-halophytes* (grow on dry or mostly dry lands)
3. Aero-halines (epiphytes and aerophytes)

Again, according to Iversen (1936), these plants are classified with respect to the salinity of the soil on which they grow.[3]

1. Oligo-halophytes (amount of NaCl in the soil is 0.01 to 0.1%)
2. Meso-halophytes (amount of NaCl in the soil is 0.1 to 1%)

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3. Euhalophytes (amount of NaCl in the soil is >1%)

For comparison, seawater has a salinity of about 3.5%. See water salinity for other reference levels.[9,10]

Habitats of halophytes

Major habitats where halophytes flourish include mangrove swamps, sand and cliff shorelines in the tropics, salt deserts and semi-deserts, the Sargasso Sea, mudflats and salt marshes, kelp forests and beds, salt lakes and salt steppes of the Pannonian region, wash fringes, isolated inland saline grasslands, and in places where people have brought about salination.[4]

One quantitative measure of salt tolerance (halotolerance) is the total dissolved solids in irrigation water that a plant can tolerate. Seawater typically contains 40 grams per litre (g/L) of dissolved salts (mostly sodium chloride). Beans and rice can tolerate about 1–3 g/L, and are considered glycophytes (as are most crop plants). At the other extreme, *Salicornia bigelovii* (dwarf glasswort) grows well at 70 g/L of dissolved solids, and is a promising halophyte for use as a crop.[5] Plants such as barley (*Hordeum vulgare*) and the date palm (*Phoenix dactylifera*) can tolerate about 5 g/L, and can be considered as marginal halophytes.[2]

Adaptation to saline environments by halophytes may take the form of salt tolerance or salt avoidance. Plants that avoid the effects of high salt even though they live in a saline environment may be referred to as facultative halophytes rather than 'true', or obligatory, halophytes.

Pneumatophores of Grey mangrove

For example, a short-lived plant species that completes its reproductive life cycle during periods (such as a rainy season) when the salt concentration is low would be avoiding salt rather than tolerating it. Or a plant species may maintain a 'normal' internal salt concentration by excreting excess salts through its leaves, by way of salt glands, or by concentrating salts salt bladders in leaves that later die and drop off.[1]

In an effort to improve agricultural production in regions where crops are exposed to salinity, research is focused on improving understanding of the various mechanisms whereby plants respond to salinity stress, so that more robust crop halophytes may be developed. Adaptive responses to salinity stress have been identified at molecular, cellular, metabolic, and physiological levels.[6]

III.RESULTS AND CONCLUSIONS

Some halophytes are in Nagaur are:

Taxon	Common name(s)	Habitat type	Tolerance type
Anemopsis californica	*yerba mansa*, lizard tail	Hygro	
Atriplex	saltbush, orache, orach	Xero	
Attalea speciosa	Babassu	Meso	
Panicum virgatum	Switchgrass	Meso, Xero	
Salicornia bigelovii	dwarf glasswort, pickleweed	Hygro	Eu (seawater)
Spartina alterniflora	smooth cordgrass	Emerged, Hygro	Eu (seawater)

Tetragonia tetragonoides	warrigal greens, *kōkihi*, sea spinach	Hygro	Eu (seawater)
Dunaliella	(a green alga)	Hydro	Eu (seawater)
Sesuvium portulacastrum	sea purslane, shoreline purslane	Hygro	Eu (seawater)
Suaeda	Seep-weeds	Hygro	Eu (seawater)
Halimione portulacoides	sea purslane	Hygro	Eu (seawater)
Sarcocornia fruticosa	Saltworts		

Uses

Biofuel

Some halophytes are being studied for use as "3rd-generation" biofuel precursors. Halophytes such as *Salicornia bigelovii* can be grown in harsh environments and typically do not compete with food crops for resources, making them promising sources of biodiesel or bioalcohol.[5][7][8]

Phytoremediation[10,11]

Halophytes like *Suaeda salsa* can store salt ions and rare-earth elements absorbed from soils in their tissues.[9] Halophytes can therefore be used in Phytoremediation measures to adjust salinity levels of surrounding soils.[10] These measures aim to allow glycophytes to survive in previously uninhabitable areas through an environmentally safe, and cost effective process.[11] A higher concentration of halophyte plants in one area leads to higher salt uptake and lower soil salinity levels.[9]

Different species of halophytes have different absorption capabilities.[10] Three different halophyte species (*Atriplex patula, Atriplex hortensis,* and *Atriplex canescans)* have been found to rehabilitate soils contaminated with road salt over varying lengths of time.[11]

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