



INTRODUCTION

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Nearly one third of earth's surface has been classified as arid lands, according to their soil types, vegetation and climate (Dregne, 1983; Dalsted & Myres, 1983). Arid lands can be subdivided into three categories: semiarid, arid and extremely arid (Hillel, 1982). Arid and semiarid areas in India are characterised by low but highly variable precipitation, high evaporation and extremes of temperature. Based on the above criteria, they are grouped into two major categories.

A : Hot arid region

B : Cold arid region

The hot arid region is further divided into two main zones; one as the north and another as the south. The first one i.e. north zone is in contiguous with the Thar desert and

includes, western parts of Rajasthan and Gujarat, south-east and north-east parts of Rajasthan and south-west parts of Punjab and Haryana. The second one i.e. South zone includes, Deccan and Coimbatore plateau of Karnataka, Andhrapradesh and Tamilnadu.(Bharucha & Meher-Homji, 1965; Das Gupta, 1977). The district of Kutch, the present area of investivation falls under the northern hot arid zone.

Kutch is an ancient land possessed of great antiquity, having its own geographical characteristics and topographic features resembling a Tortoise. It has been defined as

जल पायभनूपं स्यात् पुंसिक्च्छस्त्रमाविधः ॥

i.e. a marshy region, by Mallinath in Sanjeevani, his commentary on Amarkosh. The Sanskrit word 'irina' or the waste means a salty flat terrain. It is encircled by water, swampy marshes/or by low lying saline and sandy tract of Rann. It is mostly a plain country with low hillocks, undulated plains and sandy alluvial soils.

The area provides the fascinating study in the extremes. Due to overgrazing by livestock, activities of rodent pests, the pastures and the shrubs show severe degradation. The soils in these regions have also become poorer. In recent times arid and semiarid regions gained interest and importance, because of their large extent and the problems they pose. These semiarid regions have received little

attention of Geologists and Botanists in the past.

Hooker's Flora and British India (1875-1897) and Cooke's Flora of Bombay Presidency (1905) provide some information regarding arid and semiarid plant species. Blatter & Hallberg (1918-21) and Saxton & Sedgewick (1918) are the pioneers, who explored these regions, and published the Flora of Indian Desert and Flora of North Gujarat respectively. Later on, these semi-arid regions attracted the attention of few workers. Puri, Jain and associates (1959) have explored areas of west of Aravalli and published flora of Rajasthan. Bhandari (1978) explored the western region of Rajasthan and published Flora of the Indian Desert. At the same time, Sharma & Tiagi (1979) worked out areas of Rajasthan and published the Flora of north-east Rajasthan. Sindh (Pakistan) is also a bioclimatically identical and contiguous with northwestern semi-arid regions of India. Ali and his coworkers have also published the Flora of West Pakistan (1970-1984?) in number of fascicles.

The vegetation in arid region is chiefly dominated by thorny scrubs. Champion (1936) has included the vegetation of whole districts of Kutch under the thorny scrubs. Later, Champion & Seth (1965) reclassified the same under northern tropical thorn forest and commented that 'it represents the degraded

stage of thorny vegetation'. According to Meher-Homji (1972) the vegetation of Kutch can be classified as Prosopis cineraria - Capparis decidua and Zizyphus Sp - Salvadora Sp type. Jain (1965) classified the vegetation of the area under two main heads, on the basis of habitation.

I. Vegetation on rocky habitats

II. Vegetation on alluvial and saline habitat.

Kapadia (1954) has given a comprehensive account of phytogeography and grasses of the region.

One of the earliest reference on the botany of Kutch is a list of plants by Palin (1980). In the 1908, Blatter has also published another list of plants for the same region. Thaker (1926) has been a prominent worker on the flora of Kutch, who has given a detail account of useful plants of the area in the local language, Gujarati. Jain & Kanodia (1960), Jain & Deshpande (1960), Rao & Deshpande (1961) Bhandari (1965) published short accounts of vegetation, lists of plants emphasizing new records encountered in the area. Puri, Jain & Deshpande (1960) have described the phytogeography of area along with the list of plant species. Kanodia & Namda (1966) published a note on grasses and grasslands of Kutch. In recent years Rao (1970) has also prepared a list of 700 plant species from the area, on the authority of the earlier workers' reports. Rao & Sabnis (1977), Rao (1981) and Rao & Sabnis (1983) have in their

studies, dealt in greater depth, the vegetational aspects and new records encountered for the South-eastern Kutch.

The peculiar geographical position, extreme climatic conditions, and dominance of xerophytic plant forms, make the study of the flora of this region all the more interesting. With a view to gather detail information regarding different vegetational types and diversities of plant forms, the area was divided into five zones, viz., north, east, south, west and central-zone. Visits to different zones during different seasons gave a comprehensive idea about the existing vegetational types and the seasonal changes.

The vegetational types encountered in different zones can be placed in the following categories:

Forest Vegetation

Aquatic Vegetation

Marshy & Sandy Saline vegetation

Agricultural crops and weeds

Vegetation along the road sides.

The existing forest vegetation can be natural or artificial. The natural vegetation is mainly represented by thorny scrubs and/or dry deciduous trees. The noteworthy forest in true sense are confined to the hills and hillocks in all the five zones. In the interior protected and comparatively moist areas of valleys in the northern, western and central

zones, prominence of dry deciduous plant species is noticed. The west zone is quite distinct from north and central zones in terms of availability of plant forms. The prominent constituents are Grewia tenax, Cordia gharaf, Cassia auriculiformis and Moringa oliefera in the west zone and Lannea coromandelica, Sterculia urens, Bauhinia racemosa and Maytenus emarginata in the north and central zones. The forests of the inner slopes are in better condition than outer sides, including surrounding areas, which depict sparse thorny vegetation. The prominent thorny species are Acacia arabica, Acacia nilotica Var. indica, Acacia leucophloea, Commiphora wightii and Zizyphus sp. in the west and parts of south zone. While, Prosopis chilensis, Prosopis cineraria, Acacia senegal, Balanites aegyptica and Euphorbia caducifolia in the north, east, south and central zones.

In addition, there are quite a few man-made forests called as Rakhals. These are either monocultures or mixed cultures, chiefly consisting of Prosopis cineraria, Prosopis chilensis, Salvadora persica and Tamarix articulata.

Aquatic vegetation of fresh-water bodies is represented by vegetation of ponds, tanks, puddles and rivers. Ponds, tanks and puddles show usual constituents, consisting of submerged as well as free floating and hygrophylous plant communities. In absence of any perennial river, rivers and rivulets

present in different zones, show presence of carpet vegetation on the exposed banks. The vegetation of these rivers do not show marked zonations and the vegetation disappears soon after the completion of monsoon. A mention may be made of Fragmatis karka and Scirpus tuberosus along with halophytic grasses.

The area is bounded by sandy saline or marshy situations of 100 km (approx.) in the north, stretches of 10-12 km in south and 5-10 km in the west zones. In the northern zone, Haloxylon recurvum, Suaeda nudiflora, Suaeda fruticosa, Cressa cretica and Halophytic grasses form mats. In southern and western zones in marshy situations Avicennia marina is most dominant along with Cyperus arvensis, Sericostema pauciflorum, Leptadenia pyrotechnica, Sesuvium portulacastrum and Juncus maritimus in the sandy saline situations.

All over the region, because of the non-availability of irrigation facilities and inferior quality of soils, agriculture as a whole is comparatively poor. Only in south, west and central zones, where meagre irrigation facilities are available, besides rainfed crops, other crops are also grown, such as Cotton, Wheat, Isabgol and Banana. While, open surroundings near human habitations, show scarce bushes of thorny species.

The regular visits during different seasons helped to locate about 20 plant species which are not commonly metwith in the adjoining areas of Gujarat and Rajsthan. Most of them are found to be localised to specific spots, having restricted distribution and that they are represented by small populations. These plant species are of ephemeral nature, which usually sprout up on the onset of monsoon and perish on or before conclusion of monsoon and winter.

The number of rare/restricted plant species metwith are distributed in Capparidaceae(1). Malvaceae(5), Zygophyllaceae(3), Geraniaceae(1), Fabaceae(2), Asteraceae(2), Boraginaceae(1), Convolvulaceae(2), Scrophulariaceae(1) and Verbenaceae(2), families.

The above mentioned taxa were further studied from morphological, cytological and seed germination view point. The populations representing above plant species, from different localities or habitations, were studied for their morphological details and variations. Wherever, necessary populations were also scrutinised for micromorphological, epidermal features. In addition, cytological data pertaining to n and $2n$ numbers, karyotype and meiotic abnormalities, have also been collected. The germination behaviour of seeds of these species was accessed under different treatments.

The detail study from the above mentioned aspects, should prove useful for better understanding of the reasons for their restricted distribution and adaptations, they resort to. In other words, an attempt has been made to understand the involved life strategies of these plants, for their survival in arid or semi-arid conditions.

Table 1 : Showing Taxa, Locality and Habitat

Taxa	Locality	Habitat
1 <u>Capparis cartilaginea</u> Decne.	i) Narayan Sarovar	Crevices of old pond walls
	ii) Tera	" "
2 <u>Abutilon pannosum</u> (Forst. f.) Schelect	i) Nalia	Elevated pond banks
	ii) Tera	In fallow fields
3 <u>Pavonia arabica</u> Hochst.ex. Steud.	i) Dinodhar	Exposed hilly slopes
	ii) Nakhtrana	Undergrowth of scrubs
4 <u>Pavonia zeylanica</u> (Linn.) Cav.	i) Dinodhar	Exposed hilly slopes
	ii) Nakhtrana	Undergrowth of scrubs
5 <u>Pavonia grewioides</u> Hochst.ex. Boiss.	i) Lariya	Outskirts of forest
6 <u>Senra incana</u> Cav.	i) Lariya	Outskirts of forest
	ii) Nadibaugh	Slopes of hillocks
	iii) Narayan Sarovar	Open areas along roadsides
7 <u>Tribulus rajasthanensis</u> Bhandari et Sharma	i) Nakhtrana	Sandy river beds
8 <u>Fagonia indica</u> Burm.f.	i) Nakhtrana	Fallow fields
var. <u>schweinfurthii</u> Hadidi	ii) Bhuji	Sandy river beds
9. <u>Zygophyllum simplex</u> Linn.	i) Narayan Sarovar	Sandy saline situations
10 <u>Monsonia senegalensis</u> Guill. & Perr.	i) Dinodhar	Undergrowth of scrubs
	ii) Khavda	Along roadsides
11 <u>Indigofera argentea</u> Burm.f.	i) Mandvi	Sandy soils of sea coast
12 <u>Indigofera caerulea</u> Roxb	i) Mandvi	Sandy soils of sea coast
13 <u>Launaea resedifolia</u> (Linn.) O. Kuntze	i) Dinodhar	Undergrowth of forests
	ii) Nakhtrana	"
14 <u>Helichrysum cutchicum</u> (C.B. Clarke) Rao et Deshpande	i) Nalia	Sandy gravelly soils
	ii) Nadibaugh	

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| 15. | <u>Heliotropium bacciferum</u>
Forsk.var. <u>suberosum</u> (Clarke)
Bhandari | i) | Khavda | Sandy saline
situations |
| 16 | <u>Ipomoea kostschyana</u>
Hochst.ex.choishy | i) | Anjar | Weed of fallow or
cultivated fields |
| 17. | <u>Seddera latifolia</u> Hochst
ex.Steud. | i) | Nakhtrana | Exposed slopes of
hillocks |
| 18. | <u>Schweinfurthia pterosperma</u>
A. Brain | i) | Khavda | Sandy saline situ-
ations |
| 19 | <u>Chascanum marrubifolium</u>
Fenzl ex. Walp | i) | Nakhtrana | Sandy gravelly soils |
| 20 | <u>Premna resinosa</u> | i) | Dinodhar | Exposed hilly slopes |