## Synopsis of Thesis

# STATUS OF ENDEMIC AND THREATENED ANGIOSPERMS OF GUJARAT

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सत्यं शिवं सुन्दरम्

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# CHAPTER I - INTRODUCTION

Endemism denotes confinement of biological taxa to a restricted area which may range from a small habitat to biogeographical region, usually isolated by geographical or temporal barriers (Gaston, 1991; Anderson, 1994; Beck, *et al.* 2007; Young, 2007). Such species are known as endemic as against those which are widely distributed are called cosmopolitan. Endemic floristic elements of a country or geographical region throw light on the biogeography of the area, centres of speciation, areas of extinction, vicariance and adaptive evolution of the flora occurring in the area (Richardson, 1978; Ahmedullah, 2000).

Endemism indicates the importance and uniqueness of the flora of a region or area. Studies on endemism provide an insight into the centres of diversity and highlight the indigenous nature of its biological diversity and it also provides important clues to the pattern of taxic distribution and the process of speciation. Endemism is a significant factor in diversity assessment and conservation. Reduction and fragmentation of wild population and habitats are occurring at rapid and accelerating rate. These have resulted in small isolated populations (endemic plants) that are at risk of extinction for an increasing number of taxa. For such populations, more intensive management becomes necessary for their survival. Jain & Sastry (1980) states "if endemic species are eliminated from our country it will mean they will be eliminated from the world, will be lost to science, will be struck off the roles of biological resources of this earth". Hence, in conservation efforts priority should be given for endemics. So it is very essential that threatened taxa should be repeatedly searched for in their type localities for correct assessment of their status and proper management and conservation.

The **study site**, Gujarat state, is located on the west coast of India and lies between 20°02' and 24°41' North latitudes, and 68°08' and 74°23' East longitudes covering a land area of 196,024 sq. km. Gujarat comprises 33 districts, of which Kachchh is the largest holding 23 percent, while the Dangs is the smallest holding less than one percent of its total geographical area.

Endemic and threatened plants represent a small but important part of the flora of Gujarat. They are very susceptible to the effects of environmental change, because they occur in small populations or at scattered localities and are often confined to unique and localized habitats. The causes of such environmental change are biotic activities such as land clearing, cutting, lopping, overgrazing, the development of man-made forests (monoculture) and industrial pollution. The result of all such activities will be the dwindling of number of certain habitat-specific, wild plants because of change in their habitats. It is therefore urgently required to make an inventory of all such endemic and threatened plant species and to initiate measures to conserve the specific habitats and consequently the species occupying such habitats.

## Review of earlier works

The flora of Gujarat has been extensively studied by Thaker, Cooke, Shah, Bole and Pathak, Jani, etc. however, they have given distribution of the sites studied by them, but the status of the species have been designated very abruptly using general terms like Rare, Very Rare, Extremely Rare, Occasional, Uncommon, Common, Not Common and Threatened, and not proper assessments have been carried out.

Also, the information on habitat was lacking in most of the species. Some of the species are indicative of improper/lack of systematic surveys, such as *Wrightia dolichocarpa* which is widely spread all across Gujarat, but owing to lack of key characters the plant has been stated as very rare, that too after a period of three decades. No precise localities has been stated for some plants like *Cansjera rheedii* from Pavagadh (Oza, 1962), *Polygala irregularis* from Ahmedabad (Saxton and Sedgwick, 1918) and *Tephrosia collina* from Kachchh (Raghavan, *et al.* 1981).

Studies on endemism and their conservation have received petite attention in Gujarat, and except for a few publications, there is little information on this subject. From the available literature it was determined that information on endemics in Gujarat was altogether lacking. An acute need was therefore felt to assess the present situation, locate important lacunae and stimulate studies on as large a scale as possible on threatened plants.

To provide all relevant information on such plant species of Gujarat, the present study was hence undertaken with the following objectives:

- Analyse the status of Indian endemics occurring in Gujarat.
- Evaluate the status of all angiosperm taxa found in Gujarat as per BSI/IUCN Red List.
- Distributional pattern of threatened indigenous and endemic species.
- IUCN Red List assessment of some endemic and threatened plant species of Gujarat.
- *In-situ* and *Ex-situ* conservation of endemic and threatened species of Gujarat.
- Awareness of endemic and threatened plants of Gujarat.

## CHAPTER II - METHODOLOGY

Status of endemic plants from the study area was analysed by reviewing all past PhD thesis, floras, research articles, reports and from available floristic works. Preliminary field excursions were also carried out in the study area, focussing on sites mentioned by past workers.

A computerized database was generated incorporating details on their distribution, life-form type, habitat, phenology and local names. Consulting the published literature, unpublished research reports and PhD dissertations pertained to the flora of Gujarat; a comprehensive checklist of angiosperms of Gujarat has been prepared.

Field surveys were organized in various geographic zones of Gujarat in order to get field data. Plants were identified using regional, national and international floras. This checklist is further processed through the following steps in order to construct taxonomically rich and accurate database.

Each and every scientific name is looked for the correct orthography from the reliable International Plant Names Index database and corrected wherever required. Scientific names are checked for their validity and legitimacy. Also, basionyms and synonyms are provided.

Distribution data is updated based on the information gathered from the published literature. During these surveys various species were collected, processed and identified using relevant floras.

The Botanical Survey of India, Arid Zone Circle, Jodhpur; the Botanical Survey of India, Western Regional Center, Pune; Sardar Patel University, Vallabh Vidyanagar; Veer Narmad South Gujarat University, Surat; Government Science College, Gandhinagar; GUIDE, Kachchh; Sahjeevan, Bhuj; Junagadh Agriculture University, Junagadh; Anand Agricultural Univserity, Anand; B.K.M. science college, Valsad, and Waghai Botanical Garden, Dangs were visited for consulting relevant literature so as to update the distribution data of the enumerated species.

## CHAPTER III - STATUS OF INDIAN ENDEMICS OCCURRING IN GUJARAT

The critical field observation and review of literature on Flora of Gujarat reveals that there are 192 Indian endemics found in Gujarat, with dicots dominating with 137 taxa (71%), whereas monocots represented by 55 taxa (29%).

Seven species are exclusively endemic to Gujarat: *Helichrysum cutchicum*, *Ischaemum sayajiraoi*, *Rorippa cochlearioides*, *Solanum purpureilineatum*, *Spodiopogon aristatus*, *Tamarix kutchensis* and *Tephrosia jamnagarensis*. Top five families contribute 57% of the total Indian endemics reported from Gujarat; Fabaceae has the largest number (31), followed by Poaceae (27), Acanthaceae (20), Asteraceae (12) and Orchidaceae (10).

An analysis of the life-form types shows that endemic herbs (66%) dominate the study area, followed by shrubs (12%), trees (11%), climbers (6%), undershrubs (3%) and climbing shrubs (2%).

Analysis on the district-wise distribution of Indian endemics shows that the Dangs has maximum number of Indian endemics with 115 taxa, followed by Valsad (104), Narmada (71), Junagadh (63) and Panchmahal (57). The present study demonstrates that endemics are mostly concerted in southern Gujarat region; they are primarily herbaceous; while some of them are known with just a few additional collections.

## CHAPTER IV - STATUS OF ALL ANGIOSPERM TAXA FOUND IN GUJARAT AS PER BSI/IUCN RED LIST

In the recent studies, (Jani, 2014) documented 2555 species and infraspecific taxa recorded so far for the flora of Gujarat. But the present investigation showed the documentation of 2564 vascular taxa, because of the inclusion of 9 Indian endemics reported from Gujarat state. IUCN Red List status of all 2564 species and infraspecific taxa recorded so far for the flora of Gujarat has been documented in the present study. The results showed that 01 taxa is Extinct in Wild, 23 taxa fall under Threatened categories (04 Critically Endangered, 06 Endangered and 13 Vulnerable), 05 taxa are Near Threatened, 381 are Least Concern/Lower Risk, 8 are Data Deficient, while 2146 are still Not Evaluated. Departmental workshop with expert botanists of Gujarat and other states at the Department of Botany, The M.S. University of

Baroda, shortlisted 22 threatened taxa for Red List assessment. All the targeted plants were discussed by the experts present during the workshop.

### Distributional pattern of threatened indigenous and endemic species

Distribution of endemic and threatened plants found in Gujarat has been documented in the present study, with precise localities for most of the species. Extent of occurrence and area of occupancy have been calculated for some plant species during the present assessment.

## CHAPTER V - IUCN RED LIST ASSESSMENT

Threat assessment for some targeted plant species was carried out following the Guidelines for application of IUCN Red List criteria.

## CHAPTER VI - CONSERVATION PRACTICES AND AWARENESS ACTIVITIES

For *Ex-situ* conservation, seeds of various threatened plants were collected in the field and preserved at low temperature. Most of the plants like *Sterculia guttata, Hardwickia binata, Entada rheedii, Dolichandrone atrovirens* were grown in 1:1 (cocopeat: soil) and propagated in arboretum of The M. S. University of Baroda and Gujarat Forest Department Nurseries.

During the present field explorations, there has been observed a concentration of endemic and threatened plant species in sacred groves. Few refugia have been identified in different parts of Gujarat, having a good concentration of endemics and other species of rare occurrence. Identifying the still undisturbed forest patches as refugia for endemic and threatened flowering plants, can further be prioritized for conservation at regional and global scales.

### Awareness of endemic and threatened plants of Gujarat

To create awareness among the local people and tribals, the workshops were held in different areas of Gujarat. Booklets and posters were made to create awareness among the people and their importance for *In-situ* conservation. Also, awareness notes regarding some endemic and threatened plants of Gujarat were communicated through local newspapers and social media.

Date:

Place: Vadodara

**Signature of PhD student**

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