

Synopsis proposal of Ph.D on
**Morphoanatomical traits based assessment of leaf cohorts in
genus *Prosopis* across Sambhar lake region**

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Introduction

Soil salinization is a severe and major problem that inhibits the plant productivity. About 20% of the irrigated soils in the world are affected by the salinity (Reginato et al., 2013). In arid and semi-arid region salinity is a major problem. In these regions soil has major salt content. Many salt tolerant plants species develop in saline area for example *Suaeda fruticosa*, *Portulaca oleracea*, *Prosopis juliflora*, *Prosopis cineraria*, *Calotropis procera*, *Cassia italica*, *Acacia jacquemonti*, *Boerhavia diffusa* etc. In saline soil high pH conditions inhibits the plant growth. Extreme saline conditions are found due to low rainfall and high temperature and high wind velocity, which cause evaporation (Kasera and Mohammed, 2010). Salinity causes ionic imbalance which related with compilation of Na^+ and Cl^- in the cell (Zhao et al., 2020). Soil salinization is a major problem in the Sambhar lake. In the western area of India Sambhar lake is located which is the largest inland saline depressions (Jhajhria, 2020). Sambhar lake is situated approximately 60 km west of Jaipur city at latitude $26^{\circ}58''$ N and longitude $75^{\circ}5''$ E on the east of the Aravalli mountain range (Kajale et al., 2020). Sambhar lake is spread across three cities i.e. Jaipur, Nagaur and Ajmer of Rajasthan State. The lake bed varies from 359.96 to 364.77 m (1181 to 1196.76 ft) above the mean sea level (MSL) covering an area of approximately 190 – 230 sq. km (Jhajhria, 2020). Mean temperature of Sambhar area is around 23°C with minimum temperature of $8-10^{\circ}\text{C}$ in winter and maximum temperature of $40-45^{\circ}\text{C}$ in summer with annual rainfall ranges from 550 – 600mm. The vegetation of the lake area includes *Acacia nilotica*, *Acacia senegal*, *Salvadora persica*, *Azadirachta indica*, *Prosopis cineraria*, *Prosopis juliflora* etc. *Prosopis* is the major vegetation found in the areas surrounding the lake. *Prosopis* is in abundance due to its capacity to tolerate the saline condition (Mathur, 2021).

Prosopis includes several important arboreal and shrub-like species present in extreme salinity areas (Reginato et al., 2013). Salts especially sodium chloride and sulphates, affects plant growth by modifying their morphological, anatomical and physiological attributes. Such growth impairment may be due to ionic imbalances and osmotic effects affecting plant metabolism. Processes such as seed germination, seedling growth, flowering and fruiting are adversely affected by salinity, which ultimately causes reduces economic yield and simultaneously quality of production. Extreme salt concentration increases the need for naturally adapted salt tolerant plants, which provides information for investigating the adaptation mechanisms used to tolerate high salinity that may help

plant breeder to evolve salt tolerant plant varieties (El-Lamey, 2015). Few plant species are found in catchment area where sodium chloride concentration is more than their theoretical tolerance although high concentrations of calcium, potassium or sulfate are found as supplementary ions which reduce the toxic effects of sodium and chloride, hence enabling plants to exist (Kasera and Mohammed, 2010). *Prosopis* is termed as poor man's fuel wood, since it is the only fast growing fuel wood which is able to grow in different range of soils which may include sites like degraded lands, eroded lands, riverbeds and salty soil. *Prosopis* is one of the most tolerant species for high salt concentration soil, alkaline soil and able to grow in waterlogged sites (Basavaraja et al., 2007). The leaves of the *Prosopis* are bipinnate compound and arrangement is alternate. Leaflets of the *Prosopis* are dorsiventral and 10–20 pairs (approximate) with oblong shape, blunt apex, entire margin, reticulate venation, round base, glabrous surface, petiolate and the petiole which is 2.5–3 cm long. Size of the leaf may vary from 1.6-2.0 cm in length and 0.2-0.4 cm in breadth. The leaves are green in color and odorless with less palatable taste (Robertson et al., 2010). *Prosopis* which has evergreen appearance produce two well defined cohorts of leaves. The First cohort appears in the spring [February-March], these leaves declines moderately and senescences in summer [June-July], whereas second cohort develops during monsoon [June-July] and senescences in winter [December-January] (Shirke et al., 2018). So far, there is limited information available about the mechanism by which seasonal variation control stomatal traits and anatomical features of leaf cohorts in *Prosopis* plants across Sambhar lake area. Therefore, understanding the stomatal traits and anatomy of leaf cohorts in genus *Prosopis* towards seasonal variation across Sambhar lake region is needed to be explored.

Objectives

The objectives of the proposed work are following:

- I. Survey, collection and taxonomy of genus *Prosopis* in Sambhar lake region.
- II. Analysis of stomatal traits of leaf cohorts in *Prosopis* that developed during spring and monsoon in Sambhar lake region.
- III. Evaluation of anatomical attributes of leaf cohorts in *Prosopis* that developed during spring and monsoon in Sambhar lake region.

Methodology

The aim of this study to elucidate the morphoanatomical attributes of leaf cohorts in genus *Prosopis* across Sambhar lake region. The methods used in the present study are divided into following sections as given below-

- Vegetation survey of genus *Prosopis* (species and relative abundance) across Sambhar lake area
- Collection of the plant samples from the Sambhar lake area that produced in different seasons (spring and monsoon).
- Authentication of plants from authentic herbarium viz., BSI center or NBRI Lucknow.
- Leaf morphological analysis (leaf area, leaf thickness, midrib, vein density), flowering traits, fruit/pod shape and size, seed number and size.
- Microscopic study of the leaves stomatal traits (stomatal density, index and size) and epidermal cell density.
- Leaf anatomical analysis (cuticle layer, spongy parenchyma, palisade parenchyma, vascular bundles, xylem and phloem).

Significant outcome of the research work

- This study will help to explain phenotypic diversity of leaf cohorts in genus *Prosopis* that developed during spring and monsoon across Sambhar lake area.
- This study will help to understand the regulation of stomatal traits and vascular tissue in leaf cohorts, and thus regulating adaptation and survival of *Prosopis* in spring and monsoon.
- This study will help to explain the phenological plasticity of leaf cohorts of *Prosopis* that developed in spring and monsoon across Sambhar lake region.
- This study will help to understand the regulation of stomatal and vein densities in leaf cohorts of *Prosopis* plants that produced in spring and monsoon across Sambhar lake area.

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