



Original Article

***Prosopis cineraria* (L) Druce: A life line tree species of the Thar Desert in danger**

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Abstract

Prosopis cineraria is a very significant tree of the Thar Desert of India, contributing to ecological stability of the region and providing extensive support to human beings, livestock and the nutrient deficient soils. Since last one decade, problem of drying and mortality of this species has been noticed in some parts of the desert. Factors responsible for this drying phenomenon and research efforts undertaken by Arid Forest Research Institute, Jodhpur, India for various aspects related to the species has been discussed in the paper.

Keywords: *Khejari, Agroforestry, Fodder, Lopping, AFRI*

INTRODUCTION

Thar Desert of India, also known as Great Indian Desert, is considered to be seventh largest desert of the world having area of about two lakh square kilometers. In India, more than sixty percent of this desert lies in the state of Rajasthan. The life support systems in this region are constrained by bioclimatic and environmental limitations: low precipitation (100-400 mm, mean annual rainfall) high pre-monsoon temperatures (mean maximum of the hottest month: 45-47°C), high wind speed (average annual 8-10 km/h with figures up to 30-40 km/h in summers), high potential evapotranspiration with an annual total of 1500 to 2000 mm [1]. These conditions are most reminiscent of the Sahel of Africa [2]. Soils are generally sandy to sandy loam in texture with poor nutrient status and low water holding capacity. Important tree species of the region include *Acacia senegal*, *A. nilotica*, *A. tortilis*, *A. leucophloea*, *Azadirachta indica*, *Salvadora persica*, *S. oleoides*, *Prosopis cineraria*, *Tecomella undulata*, *Zizyphus* species and *Tamarix aphylla*. In the backdrop of scanty vegetation scenario, all the tree species are important in this region. But *Prosopis cineraria* (locally called Khejari) stands tall among all other tree species because of its multiple benefits and uses in the fragile desert ecosystem.

HISTORICAL BACKGROUND

In 1730 A.D, this tree came in to limelight when a brave lady (Amrita Devi) from Bishnoi clan of local Marwar region sacrificed her life along with her three daughters and 363 people for the sake of *P. cineraria* trees. Soldiers of the then local ruler, Maharaja Abhay Singh, wanted to cut Khejari trees for the construction of their king's palace. But the persons of Bishnoi clan under the leadership of Amrita Devi hugged the trees and faced axes of soldiers. After the incident, the ruler called back the soldiers and realized his mistake. At present, an annual fair in the memory of the 363 killed people, is held every year in the village Khejarli, where the massacre took place in 1730 A.D.

BRIEF DESCRIPTION ABOUT SPECIES

Khejari is a medium sized tree, called the king tree of Great Indian Desert because of the role played by it in conserving the ecosystem of arid and semi-arid region of the desert. It is a frost and drought resistant tree which can withstand temperature extremes, ranging from 45-48 degrees Celsius in the summer to less than 10 degrees Celsius in the winter. The tree is worshipped by a large number of people, mostly Bishnois, a great environmentalist community in the Thar Desert.

The importance of the medicinal value of this tree has been highlighted in ancient Ayurvedic (medical) literature. Wood is very high in energy value of about 5000 kcal/kg. An unlopped 30-35 years old tree produces about 4-5 kg of air dried pods in normal rainfall year, obtained during May-June months. Pods are brown to chocolate in colour on ripening and have a sweetish pulp. Unripe pods are also used as vegetable and after boiling can be stored for lean periods. Boiled and dried pods are the important constituents of this region's famous dishes "Triakuta" and "Panchakuta".

DISCUSSION AND CONCLUSION

Arid Forest Research Institute (AFRI), Jodhpur is an institute working in the field of forestry research, education and extension under the umbrella of Indian Council of Forestry Research and Education (ICFRE), in the Thar Desert. The institute has undertaken number of research projects related to this species in the past. Important studies are related to agroforestry systems, lopping regime, crude protein estimation, and causes of mortality of this important species in some districts of Thar region. Agricultural crop production in arid regions is very insecure due to variable and harsh climatic conditions. Agroforestry is one of the options and insurance against drought in such scenario. In this region, agroforestry systems include agrisilviculture, agrisilvopastoral, multipurpose tree systems and agrihorticulture (Figure-1). In the drier parts of Rajasthan, mostly in Jaisalmer district, agroforestry systems with *P.cineraria* and *Z.nummularia* have been developed in combination with run off farming practices under the name of Khadin farming. In this system, rain water is collected on an uncultivated catchment area where it is kept to percolate through small banks [1]. In other parts of Indian arid zone, *P.cineraria*, *T.undulata* and *Acacia nilotica* are the most preferred tree species of agricultural land. Depending upon rainfall, the approximate surface area of the main agroforestry models prevalent in the region is shown in Table1. Researchers studied long term effect of *P.cineraria* on the soil nutrient status [3]. They found a significant increase in organic matter, total N, P & K and more than two times higher dry matter yield of Pearl millet (*Pennisetum typhoides*) in fields with Khejari soil over non-Khejari soil. Kumar et al (1992) also recorded higher returns from Pearl millet (*Pennisetum typhoides*), Cluster bean (*Cyamopsis tetragonolobus*) and Cowpea (*Vigna sinensis*) in association with Khejari. Singh et al

(2007) from AFRI found that overall productivity of agricultural land and benefits increased when this tree species was grown with Mung bean (*Vigna radiata*) and Pearl millet. The yield of the annual agricultural crop increased when density of *P.cineraria* was appropriate or optimum. Another study related to assessment of 'Comparative productivity of *P.cineraria* and *Tecomella undulata* based agroforestry systems in degraded lands of Thar Desert' was conducted by the institute and Singh (2009) found *P.cineraria* more beneficial than *T.undulata* in improving soil conditions and increasing crop yield by 11.1 %. Thus this species was found more suitable for its integration in agricultural land.

Prosopis cineraria is extensively lopped for fodder by farmers in the arid and semi arid areas of Rajasthan state of India. Generally, complete lopping is practiced in the months of October-November. The collected dry fodder is locally called 'loong' and its annual production is around 1 to 1.5 tonnes per mature tree in a good rainfall year (Figure-2). The effect of different lopping intensities on the growth and fodder yield of this species was studied by the scientists of AFRI. It was found that lopping does not significantly affect the height of the tree. It was determined that complete lopping of the tree was detrimental in nature for better diameter growth. The study suggested to lop the trees moderately (approximately 2/3 of the crown length) and with a gap of one year between successive lopping for better fodder yield on a sustained basis (Kumar and Tewari, 2000).

Droughts and famines are recurring features of Thar Desert of Indian arid zone. Local population uses a number of wild plants as emergency food for its survival. Scientists from AFRI analyzed crude protein content in the bark of this species for the first time as 23.1 % (Rathore and Meena, 2004). This bark is a rich source of protein and is frequently mixed with wheat/pearl millet flour for food and consumption by human beings in the times of severe famines. Besides bark, seeds and leaves of *P.cineraria* are reported to contain 35.8 % and 23.2 % crude protein respectively (Rathore and Meena, 2004).

Since last one decade, the Khejari trees in some districts of arid region i.e. Churu, Nagaur, Sikar and Jhunjhunu started drying (Figure-3). Scientists from AFRI started investigations and found that the devastating problem of Khejari mortality has become severe with the cumulative effects of indiscriminate and successive lopping followed by a secondary infestation of four species of insect borers, viz., *Acanthophorus*

serraticornis (root borer), Aeolesthes holosericea, Derolus iranensis and Hypoeschrus indicus (shoot borers). The *A. serraticornis*, the rare giant long-horned beetle of Rajasthan, is considered to be the largest insect, with a maximum known body length of 16 centimeters (Figure-4). The larvae of this pest severely damage the root system of the Khejari trees. The scientists of AFRI also noted presence of six highly infective species of Fungi imperfectii viz., *Alternaria alternata*, *Colletitricum* sp, *Fusarium* sp, *Ganoderma lucidum*, *Phoma* sp and *Botryodiplodia theobromae* which cause the die-back disease in mature trees as a result of which the trees start dying from the top (Ahmed et al. 2004). Few field trials conducted by AFRI scientists in farmers' fields in the affected districts showed significant improvements in diseased tree recovery. The lopped portions/open wounds of lopped trees (for fodder) were treated with AFRI PASTE (one part Copper Carbonate, say ½ kg plus one part Red Lead, say ½ kg plus two parts raw Linseed Oil, 2 liter and 2 ml Monocrotophos). In addition to above shoot treatment, roots of the affected trees were also given treatment with a suspension containing Bavistine (0.1%) plus Chloropyriphos (0.1 %) plus Agromin (2ml/lit) @ 15 liter aqueous suspension per tree (Ahmed et al. 2004). Now it is proposed to undertake further studies on farmers' fields on large scale in affected districts.

Few abiotic factors in the arid region viz, Over exploitation of ground water by way of tube wells, low rain fall over the years, consequent low ground water charging and change in agricultural practices over the years by increased use of tractors and mechanized cultivating, resulting in harms to standing trees roots and seedlings; are also responsible for Khejari mortality (Ahmed et al. 2004). Previously camels or oxen were used for ploughing the fields and farmers took special care in protecting roots of trees and new saplings of *P.cineraria*. Now in the name of modernization and development, old practices have been discarded out, which is not good for overall health of fragile desert ecosystem.

The proportion of wasteland in arid zones is the highest in India and in Rajasthan state it is estimated to be around 30 % of the total land mass. Revegetation of these areas to meet ecological and social challenges needs proper management of inputs e.g. proper tillage operation, appropriate lopping practices of Khejari, appropriate grazing, appropriate tree density of Khejari in agricultural fields and application of biofertilizers for better yields. People's awareness and participation is a critical

factor for protecting this miracle tree species of Thar Desert. Extension departments of Agriculture & Forestry research institutes and Agriculture department of the state have to play a leading role in disseminating research findings related to this species to the masses.

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Table 1. Approximate surface areas of occurrence of the various agroforestry systems in Rajasthan state

Base system	Approx surface area (Km ²)	Percentage	Administrative Districts
<i>Prosopis cineraria</i>	196, 364	46.3	Barmer, Bikaner, Churu, Ganganagar, Jaisalmer, Jalore, Jodhpur, Jhunjhunu, Nagaur, Sikar
<i>Zizyphus nummularia</i>	116, 882	27.6	Barmer, Bikaner, Jodhpur, Jaisalmer
<i>Acacia nilotica</i>	49, 594	14.5	Ganganagar, Jodhpur, Nagaur, Pali
<i>Tecomella undulata</i>	28, 387	6.7	Barmer
<i>Acacia tortilis</i>	20, 634	4.9	Ganganagar

Source: Tewari and Singh, 2006

**Fig1.** A *Prosopis cineraria* based agroforestry system**Fig2.** A heap of *Prosopis cineraria* (loong) with lopped trees in the background



Fig3.A *Prosopis cineraria* tree with ailing and dying symptoms



Fig4. *Acanthophorus serraticornis* Beetle