Assessment of Morphological Parameters and Soil Microbial Dynamics in Different Growing Conditions of *Saraca asoca*

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Article DOI Link: https://zenodo.org/uploads/19659747

DOI: 10.5281/zenodo.19659747

Abstract

Saraca asoca, an evergreen medicinal tree of the Fabaceae family, was studied across four habitats in Sirsi Taluka—Betta land, areca nut plantation, urban garden, and natural forest. Morphological traits varied widely: tree height ranged from 2.43–9 m, GBH from 22–87 cm, bark thickness 0.2–1.45 cm, bark color from greyish-brown to brownish-gray and blaze from pinkish-red to pale orange. Leaves measured 13.7–26.2 cm in length and 3.5–6.2 cm in width, with leaflet shapes mostly lanceolate (65%) and oblanceolate (35%). Diversity was highest in natural forests, followed by Betta land, plantations, and lowest in urban gardens. Soil microbial analysis revealed bacterial and fungal populations were richest in natural forests, moderate in Betta land and plantations, and lowest in urban gardens. Overall, morphological variation and microbial diversity were strongly correlated, decreasing from natural forests to urban gardens.

Keywords: *Saraca asoca*; Western Ghats; Microbial flora; Medicinal tree

Introduction

Saraca asoca (Roxb.) Wild, a small perennial evergreen important medicinal tree from the family Fabaceae (sub family – Caesalpiniaceae), locally known as the Ashoka tree or Seeta Ashoka (Upadhya et al., 2010). The species is native to the central regions of the Deccan Plateau and the mid-altitudinal zones of the Western Ghats in India, as well as Sri Lanka. Ashoka trees have been reported to exhibit notable morphological variation within the Maharashtra region. Soil is one of the most valuable natural resources, harboring diverse assemblages of living organisms. Microorganisms within the soil play a dominant role in decomposition processes and in the cycling of nutrients. The relationship

between microbial diversity and soil functionality was well known. Healthy soil serves as a critical habitat, influencing the germination, growth, chemical composition, and overall development of plant species (Bardgett and Shine,1999). Hence, this study was carried out to understand morphological variation and, soil microbial diversity under different growing conditions of *S. asoca* in Sirsi Region

Materials and Methods

The study was conducted across four distinct growing habitats *viz.*, Natural forest, Betta land (privately owned forest land), Areca nut plantation, Urban area (gardens) in Sirsi region of Uttara Kannada district, Karnataka, India to evaluate the morphological parameters and soil microbial dynamics associated with *S. asoca* tree.

Total five individual *S. asoca* were selected from each habitat type for morphological assessment. Following morphological parameters growth parameter (Girth at Breast Height - GBH), bark parameters (bark thickness, colour and blaze colour), leaf parameters (leaf length and width and leaflets shape), presence or absence of fruit and flowers during the study period were carried out as per standard method (Deepika, 2016).

Assessment of Microbial Dynamics

Three composite soil samples were collected from each habitat and bulked into one, yielding fifteen samples across five sites. Microbial assessment was done using the spread plate technique: Martin's Rose Bengal Agar (MRBA) for fungi and Nutrient Agar (NA) for bacteria. After incubation, plates with 30–300 colonies were selected for counting, and results were expressed as Colony Forming Units (CFU) per gram of soil (Bagyaraj et al., 2011).

$$\text{No.of Microbe per mL/gram of Soil} = \frac{N0.\ of\ colonies}{weight\ of\ the\ soil\ in\ grams} \times \text{Dilution Factor}$$

Results and Discussion

The qualitative morphological characters of *S. asoca* were presented in table 1 and the qualitative parameters were discussed in running text in this section.

Table 1. Qualitative morphological characters of S. asoca in different growing habitat

Growth Parameters	Natural Population	Betta Land	Areca nut Plantation	Urban Area
Tree height (m)	3.00 - 9.00	3.20 - 6.51	2.43 - 4.57	6.00 - 3.00
Girth at Breast height (cm)	34.59 - 87.00	24.38 - 65.29	14.00 - 28.50	22.50 - 85.35

Bark thickness (cm)	0.40 - 1.40	0.40 - 1.20	0.20 - 0.40	0.20 – 1.00
Leaflet length (cm)	13.60 - 21.60	14.20 – 19.00	13.70 – 18.00	15.00 - 26.20
Leaflet length (cm)	3.90 - 5.50	3.90 - 6.20	3.5 - 4.9	4.20 - 5.80

Table 1 indicates higher growth parameters in the natural population for tree height, GBH, bark thickness, leaflet length, and leaflet width, followed by urban areas and Betta land. However, the Areca nut plantation containing *S. asoca* individuals showed poor growth parameters due to regular pruning activities carried out by farmers. The parameters recorded in the present study were consistent with those reported by Paranthaman et al. (2015) and other floras, which document comparable growth characteristics.

The qualitative traits of *S. asoca* - bark, blaze color, and leaflet shape—differ across habitats. Urban trees show varied bark shades from greyish-brown to brownish-gray, while natural forest samples are more uniform with greyish-brown bark. Areca nut plantation trees display lighter tones, such as whitish-grey and brown-white patches. Greater color variation in urban areas reflects diverse environmental influences, whereas consistent bark color in natural and Betta land forests indicates stable growth with minimal stress or disturbance.

Bark blaze varied noticeably among the different sources from reddish to yellowish (urban area), pinkish-red, reddish-pink, orange and pinkish-orange (natural). The Areca Nut Plantation displayed more uniform blaze tones dominated by orange and pale orange, whereas Betta land samples showed orange and pale pinkish blazes. The leaflet shape varies from lanceolate to oblanceolate in the study sites. The study indicates the variation in qualitative and quantitative growth parameters in the study area within the different growing habitats of Ashoka tree (Devan and Warrier, 2021).

Soil Microbial Population Assessment

The microbial counts recorded were represented in table 2. Among microbes, the ($78.47x10^5$ and $70.83x10^6$ cfu/ g of soil) followed by Betta land. The fungal diversity is highest in natural forest ($64.93x10^4$ and $57.63x10^5$ cfu/ g of soil) followed by Betta land and areca nut plantations. The study also indicated the lowest bacterial populations' $19.18x10^5$ and $24.49\ x10^6$ cfu/g of soil and fungi $24.79x10^4$ and $22.43x10^5$ cfu/g of soil microbial population in urban gardens. Morphological variations and microbial diversity are correlated with each other from natural forest to urban gardens. These variation among different habitat is

observed by the researchers (Bagyaraj et al., 2011).

Table 2. Soil microbial population in different growing conditions of S. asoca

Microbe	Dilutions	Natural forest*	Betta land*	Areca nut plantation*	Urban areas*
Bacteria	10^{-5}	78.47×10^{5}	44.68×10^{5}	31.67×10^{5}	19.18×10^{5}
	10^{-6}	70.83×10^{6}	32.12×10^{6}	29.39×10^{5}	24.49×10^{6}
Fungi	10^{-4}	64.93×10^{4}	36.50×10^{4}	23.97×10^{4}	24.79×10^{4}
	10^{-5}	57.63×10^{5}	29.78×10^{5}	24.84×10^{5}	22.43×10^{5}

** Values were indicated as cfu/ g of soil*

Conclusion

The morphometric study of *S. asoca* revealed site-specific variations influenced by plant physiology and habitat factors, with rainfall and temperature being key drivers. Microbial diversity was also high, linked to organic matter availability across habitats. Forest soils, enriched with leaf litter, supported greater bacterial density, highlighting the role of microbial activity in enhancing plant growth.

Acknowledgement

The authors duly acknowledge the support and facility provided by the Head of the Department of Forest Products and Utilization, Forest Biology and Tree Improvement and the Dean, College of Forestry, Sirsi.

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