CRITERION III – RESEARCH, INNOVATIONS AND EXTENSION

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Red Sanders: Silviculture and Conservation

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Introduction

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T. Pullaiah and M. Anuradha

Abstract

Pterocarpus santalinus L.f., popularly known as red sanders, belonging to the family Fabaceae, is endemic to the southern parts of Eastern Ghats. IUCN has listed this plant as endangered. The plant has superlative characteristics in its wood and has many medicinal properties. This plant has attracted the attention of both foresters and layman because of its illegal harvesting and law and order problem. In this chapter the plant is introduced to the reader for its importance and restricted distribution.

Keywords

Red sanders · Red sandalwood · *Pterocarpus santalinus* · Endangered tree

1.1 Introduction

The astonishing gifts of forests to the well-being of humankind are from time immemorial. Forest wealth plays a vivacious role in providing green growth opportunities, food production, mitigation of climate change and primary medical needs. The immense onus of forests in supporting and balancing ecosystems, recycling of natural resources and conservation of biodiversity is uncontestable. In 1990 the world had 4.128 million hectares of forest, and this area declined to 3.999 million hectares by the year 2015 (Global forest resources assessment 2015). Half of these forests are in tropical regions. India ranking sixth, among the

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Chemistry of Red Sanders

4

T. Pullaiah, V. Damodara Reddy, Umalatha, and B. S. Rashmi

Abstract

Plants are commendable source of metabolites with therapeutic properties from time immemorial. *Pterocarpus santalinus*, an endemic Indian plant, is having an array of phytochemicals with a plethora of applications in medicine and industries. Phytochemical investigations and bioprospecting of leaf, stem, bark, and heartwood of *P. santalinus*, by employing various extraction methods, revealed the presence of different groups of metabolites like triterpenoids, alkaloids, flavonoids, phenols, saponins, glycosides, sterols, tannins, and more specific metabolites like pterocarpol; pterocarptriol; santalins A, B, and Y; isopterocarpalone; pterocarpodiolones; β-eudesmol; and cryptomeridiol of high medicinal value with significant applications in pharma, cosmetics, liquor, and textile industries. Here different classes of metabolites found in various parts of *Pterocarpus santalinus* are discussed, and a comprehensive review is presented.

Keywords

Phytochemicals · Santalin · Pterocarpol · Flavonoids · Glycosides · Phenols

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Propagation of Red Sanders: An Overview

8

M. Anuradha, B. K. Indu, and S. Balasubramanya

Abstract

Pterocarpus santalinus L.f., the pride of Andhra Pradesh, India, is despoiled intentionally many times in want of its wood, which is one of the finest luxury woods of the globe. The commensurate replenishment and sustainable utilization is the only left alternative to preserve this precious species. This chapter emphasizes various natural propagation methods, problems associated with conventional propagation, biotechnological tools to resolve them, and scope of future research.

Keywords

In vitro propagation · Micropropagation · Recalcitrance · Morphogenesis · Regeneration · Acclimatization · Multiple shoots · In vitro rooting

8.1 Introduction

India, 1 of the 12 mega biodiversity countries in the world, abodes many rare, endemic, endangered, and threatened plant species. *Pterocarpus santalinus*, commonly called as red sanders, is one such precious tree which is over-exploited due to multitudinous reasons, and there is a fast depletion of the wild resources and placed in Red List by

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Pests and Diseases of *Pterocarpus santalinus*

10

Umalatha and M. Anuradha

Abstract

The host of benefits forests provide are indispensable, and the flora and fauna of the forests are vulnerable to multiple threats. Apart from some abiotic factors such as fire, wind, storms, and climate change, there are many biotic factors like insects and diseases, which can have a devastating impact on the forest landscape. Man-made forests in general and particularly trees are susceptible to pests and diseases. Red sanders, a species with high timber value, is also affected; however the information on disease and pests is scanty. The tree is introduced in many geographical locations, and plantations are successfully maintained in various climatic zones. For sustainable utilization and to meet the global demand, the red sanders cultivation needs to be encouraged. For achieving healthy and resilient plantations, it is imperative to have a pest and disease management in place. In this chapter infections and infestations reported in red sanders are reviewed.

Keywords

Red sanders · Fungal infestation · Nematode infestation · Termite infestation · Heart wood borer

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Genetic Diversity and Conservation of *Pterocarpus santalinus* L.f. Through Molecular Approaches

13

B. K. Indu, Sudipta Kumar Mohonty, Savithri Bhat, Mallappa Kumara Swamy, and M. Anuradha

Abstract

The research and development of molecular tools in recent years has significantly influenced the tree improvement and conservation. Molecular markers, such as restriction fragment length polymorphism, random amplified polymorphic DNAs, amplified fragment length polymorphism, inter simple sequence repeat, single strand conformation polymorphism, single sequence repeats are indispensable in identifying elite lines, studying genetic diversity and phylogenetic relationships and utilizing genetic resources for crop improvement. The advancements in these DNA-based marker technologies along with high-throughput sequencing platforms have further geared plant biotechnology and have a unique role in selection of plants with desired characters. Genetic diversity though contributes to adaptability and sometimes hampers the morphological selection of plants particularly tree species. There are certain features which are expressed only after several years of juvenile growth. *Pterocarpus santalinus*, commonly known as 'red sanders', is one such tree which has elite and nonelite types. This is an endemic and endangered medicinally and commercially valued tree species with wavy grained wood and

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Trade, Commerce and Socio-economic Status of Red Sanders

14

S. Balasubramanya, B. K. Indu, and M. Anuradha

Abstract

Pterocarpus santalinus, popularly known as red sanders, is much talked about species, in view of its economic importance, status, trade and smuggling activities which rammed the tree into the vulnerable status. Due to its endemic nature, slow growth, restricted commercial cultivation activities and high demand promoting to illegal felling, the population dynamics is imbalanced. To protect, conserve and promote sustainable utilization, there is a dire need for proper understanding of trade, commerce, socio-economic status and restoration efforts, and these are discussed in this chapter.

Keywords

Red sanders · *Pterocarpus santalinus* · Trade · Commerce · Smuggling · Restoration · Vulnerability

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Tree Improvement in Red Sanders

15

B. K. Indu, R. Kavyashree, S. Balasubramanya, and M. Anuradha

Abstract

Red sanders (*Pterocarpus santalinus*) is acclaimed for its fabulous timber character and is highly adored for its red-coloured dye santalin and opulent heartwood. This highly prized endangered and endemic tree lured illicit international trade and is controlled by ruthless mafia. The tree has typically two different qualities which determine their value, one has wavy grain wood texture impregnated with intense scarlet red santalin principles and the other with straight grained texture with relatively light colour. Because of this mixed population of elite and non-elite genotypes, red sanders deserves tree improvement programs for its sustainable utilization. Any tree improvement program can be successful with the availability of information on phenology, reproduction biology, genetic and molecular status and breeding techniques. In this review various methods practiced for improvement, limitations and future scope is discussed.

Keywords

Red sanders · Tree improvement · Phenology · Santalin · Plus tree selection

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