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Caption: Stripe-backed Weasel *Mustela strigifrons*. Medium—digital, Software—procreate, Device—iPad + Apple pencil © Dhanush Shetty.



## A look over on the scented tree of India (*Santalum album*)

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Sandalwood tree is the pride of India. It is also quoted as ‘Queen of essential oils and ‘Dollar earning parasite’ (Rao et al. 2007). Among the 3,000 timber species in the Indian sub-continent, this tree has been present throughout Indian history. Starting from the Indian rulers, invaders and even the colonial powers have systematically focused on this tree species. Indians have systematically researched this species and there was a need for a dedicated monograph on this species. Now, the book titled “Sandalwood: Silviculture, Conservation and Applications” under review is important literature concerning the East Indian Sandalwood tree compiled by Thammineni Pullaiah, Sudhir Chandra Das, Vishwas A. Bapat, Mallappa Kumara Swamy, Vaddi Damodar Reddy, and Kondragunta Sri Rama Murthy. More than 10 authors apart from the editors have contributed to this book which contains 15 chapters covering the scientific to economic aspects of the *Santalum album*. At the very outlook, I believe that this book is written to enlighten the next generation of researchers on the *Santalum album*.

The first chapter reflects the significance of the Sandalwood tree and even the new readers can comprehend it. Overall, chapters one, two and three are introducing the tree species with new information, including a narration on the historical use of sandalwood in India, Australia, and Hawaii. It indicates the need for documenting sandalwood usage in other countries. Chapter 3 is a treatise, the authors narrate the complete story of *Santalum* and other members of the genus *Santalum*. The relevant photographs or figures make it easy for the readers to corroborate with the content. Chapter 4 is unique in all sense. It is well-known that sandalwood is used for carving deity idols and wooden sculptures yet, exclusive documentation on Sandalwood carving was missing to date in the scientific literature. Though there is a dearth of technical details, the authors have made due justification in their narration which is

### Sandalwood: Silviculture, Conservation and Applications

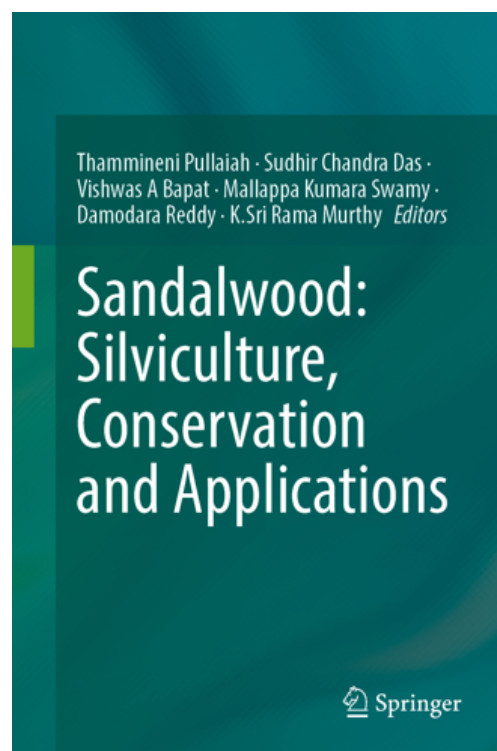
-- Pullaiah, T., S.C. Das, V.A. Bapat, M.K. Swamy, V.D. Reddy & K.S.R. Murthy

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commendable.

The next chapter deals with the medicinal property of sandalwood and its oil. Giving reference to the phytochemical property of sandalwood oil mostly, the authors also highlight the ethnobotanical use of this tree. The peculiarity in this chapter will be the adulterants that are substitute in the place of the sandalwood oil apart from the synthetic prepared oil. Some of the alternate plant-derived oil which are used as a substitute is copaiba (*Copaifera langsdorfi*) oil, Amyris (*Amyris balsamifera*) oil and Atlas cedar (*Cedrus atlantica*). There are adulterants not only for the oil but also for the sandalwood. For instance, species like *Osyris lanceolata* and *Erythroxylum monogynum* are the most common adulterant and chapter six narrates the means and methods to identify these adulterants. Even wood from other genera of *Santalum* is commonly used as an adulterant. Among the 18 species of the genus *Santalum*, the *Santalum album* fetches high prices because of the superior oil quality. Technically, the  $\alpha$ -santalol and  $\beta$ -santalol content in the *Santalum album* ranges from 45–50% and 15–20% respectively, whereas these values are lower in other *Santalum* members (Kumar et al. 2011). For instance, the  $\alpha$ -santalol and  $\beta$ -santalol content in the *Santalum spicatum* is <20 % and <5 %, approximately. Apart from this aspect, chapter six describes the wood properties of *Santalum album*. These authors have done a commendable job in describing the Sandalwood properties and also highlighting the research gaps about the wood property of the *Santalum album*.

The heart of this book is chapter seven which deals with the silviculture of the *Santalum album*. The information in this chapter will be helpful not only forester but also to any individual growing this tree species. With the relaxations on sandalwood tree cultivation, there is increasing interest in growing sandalwood trees even among small farmers. Moreover, the projected increase in the market price of sandalwood can further motivate or lure farmers into sandal cultivation. Chapters seven, eight, and nine are written by a single author who has done extraordinary work. There are relevant photographs that make these chapters more informative and relevant for the readers. "Agroforestry is a collective name for land-use systems and technologies where woody perennials (trees, shrubs, palms, bamboos etc.) are deliberately used on the same land management unit as crops and/or animals, in some form of spatial arrangement or temporal sequence. In agroforestry systems, there are both ecological and economic interactions between the different components" (Kumar & Nair 2006). A good agroforestry system will ensure that the competition

for space and nutrients between woody perennials and crops is minimum. In this context, imagine *Santalum album* a hemiparasite which always competes for space and nutrients with its adjacent plants and trees. Therefore, presuming *Santalum album* as a suitable tree for agroforestry: can be a bit unrealistic. Chapter eight titled "Cultivation of Sandalwood Under Agro-Forestry System" provides enough insights and management of this tree under agroforestry.

Being one of the highly valued trees, it is one of the highly traded both legally as well as illegally. This is the subject matter for chapters 10 and 11. Both chapters extensively narrate the production and trade network of the *Santalum album*, exclusively the illegal trade network and its implications on the natural population of this tree species. And the subsequent chapters 12, 13, and 14 gives insight into the biotechnology and tissue culture techniques for sustainable use and conservation of this tree. Chapter 14 advocates that rigid legislations are not the only means for conservation for this species and this is happening today as many states are relaxing the legislation to promote private cultivation of *Santalum album*. Largely, the book serves as a reference for the cultivation/growing of this priced tree species.

The language of this book is simple, readable and understandable by its intended audience group. The editors have attempted to do justice for the topic taken for which they have reviewed all papers on *Santalum album* and also cited papers about other sandal species to bring in analogy, perfectly. It would be slipshod in writing this review if we are not pointing out the lacunae.

The editors have not given a prelude nor a foreword detailing the content of the books. There are some errors and content organization issues. As we have always felt that the repetition of information and content is inevitable in an edited book, particularly while describing a single species. For instance, the line "Kautilya's Arthashastra (320 BC) considered Sandalwood as one of the important forest products to increase the royal revenue" in chapter 2 is repeated in the same chapter (page 14 and 15). This is one example that indicates that the editors need to revamp this book in its next edition.

However, there are some major issues that the editors have to address in their next edition. For instance, mentioning *Santalum album* as 'most valued South India tree' is not appropriate in our opinion. More importantly, it is not the most valued wood from southern India. It is one of the most valued wood in line with Red Sanders (*Pterocarpus santalinus*). Similarly, in Chapter 2, the author mentions other trees species as Chanda which is due to the local misconception and

the author have acknowledged it rather than critiquing this misconception. The exact verbatim is as follows “There are at least three kinds of sandal, namely, White Sandal (*Santalum album*) called as “Sweta Chandana”, Red Sandal (*Pterocarpus santalinus*) called as “Rakta Chandana”, and Sandal Ku-chandana (*Adenanthera pavonina*). I would urge the editors to look into this issue and address it with proper reference.

I strongly urge the editor to reconsider the inclusion of chapter 15 which deals with the success stories of Sandalwood. Overall the chapter narrates the experiences of farmers and other sandalwood tree growers. Considering this book as a monograph of sandalwood, the case studies narrated here are from secondary sources mostly. I feel that the author could have at least made a comparative assessment of

different sandalwood growers and come out with some significant inferences. Still, this book is an irreplaceable scientific contribution and must be reading material for forestry graduates and researchers interested in this tree with an economic value.

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