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FUTURE PROSPECTS FOR THE CRITICALLY ENDANGERED MEDICINALLY IMPORTANT SPECIES, CANARIUM STRICTUM ROXB. A REVIEW

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Abstract

An increase in the consumption of flora, in the name of medicine and timber, critically affects biodiversity, thereby drawing a multitude of indigenous plants to be endangered. Canarium strictum Roxb. is an indigenous and endemic plant species of Eastern and Western Ghats. It is a large, resinous tree species, commercially harvested for dammar, throughout South and South East Asia. Due to its overexploitation and the loss of habitat, it was found to be an endangered species and, therefore, required urgent attention for its conservation. Its traditional medicinal and spiritual importance helps yield references that make us understand its links with the culture and tradition of our country. This study was undertaken to bring about awareness among the harvesters and environmentalists, to take voluntary measures for the conservation of such red-listed plants, so that they remain available to the generations to come.

Keywords: *Canarium strictum, Conservation, Black Dammar, Resin.*

Introduction

The Forest Genetic Resources (FGR) refers to the genetic variations within and among species of actual and potential importance [1]. Worldwide, forests are no longer considered only reservoirs of timber, fuel, etc., because there are innumerable plant species there, that are more valuable to human societies [2]. India has some of the world's most biodiverse hotspots. This has become a difficult task since the sustenance requirement of each species differs considerably. Besides, different variables are considered as prerequisites for conservation of a species, for example the size of the protected area. In addition to size, conditions and connectivity to maintain even the most sensitive species with the prevalent ecological processes are an essential foundation of any conservation strategy. In current scenario, the discipline of biodiversity science and its taxonomy itself attained the status of an endangered field. Biodiversity inventorying and monitoring provide fundamental and essential biological information used by many applied biodiversity science disciplines [3].Biodiversity must be seen in the light of holding ethical value. Man holds great responsibility towards preserving and conserving other organisms. This study concerns about *Canarium strictum* Roxb. (Burseraceae)- A Red-listed medicinal evergreen tree species [4] that is highly appreciated for its aromatic resin. It is also known as Black Dammar or Dhoopa. It occurs in the tropical moist

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evergreen and moist mixed deciduous forests. In India, it is restricted to Sikkim, Arunachal Pradesh, Assam, Meghalaya, Orissa, Maharashtra, Karnataka, Kerala, and Tamil Nadu up to an altitude of 1600 m and in the Andaman Islands [5]. As a result of overexploitation, the species is now placed on the IUCN red list as vulnerable to nearly threatened in the regions of Kerala, Karnataka and Tamil Nadu and hence deserves our high concern. However, there is very little information available on the nature, extent, or patterns of *C. strictum* harvest and trade in the NBR or of the impacts of tapping *C. strictum* populations but still a systematic research and conservation strategy is required to save the species from local extinction. Hence, an attempt has been made here to bring such drugs under the lime lights that can prove to be a blessing to the human race.

Taxonomic classification

Kingdom	: Plantae
Subkingdom	: Tracheobionta
Superdivision	: Spermatophyta
Division	: Magnoliophyta
Class	: Magnoliopsida
Subclass	: Rosidae
Order	: Sapindales
Family	: Burseraceae
Genus	: *Canarium*
Species	: Canarium strictum Roxb.

Botanical Description

Canarium strictum is a gigantic tree with a spherical crown having a clean bole of 30-35 meters length (Fig.1)**.** Based on technical inputs of conservation groups and forest agencies it has been observed that populations in the Eastern and Western Ghats are very different in their phenological behavior [6]. It is poly-gamodioecious tree species and noted to be very rarely gregarious. Leaves are compound, imparipinnate, alternate, spiral, clustered at twig ends, rachis is ferruginous pubescent; leaflets 3-9 pair with odd one at apex, increasing in size towards apex; petiolule is 0.3-0.7 cm long; It shows with lamina 5-15 x 2.5-7 cm usually oblong, sometimes ovate, apex acuminate, base asymmetric-rounded; margin serrate or serrulate, coriaceous, rusty tomentose or pubescent beneath and glabrous above; secondary nerves are strong with 11-18 pairs; tertiary nerves are weakly percurrent.

Fig.1. *Canarium strictum*: A complete tree and fruits

Flowers are bisexual or polygamous, in shortly branched axillary panicles, about 1 cm long, yellow to dull white, shortly stalked and mildly fragrant. [5]. *Flowering* occurs from February to April and fruits start maturing from November to January. *Fruits* are drupe, 2.5 to 5.0 cm long, pointed at ends, mesocarp fleshy, stone hard, aromatic and seeds trigonous, usually 3- celled with three seeds. The ripen fruits/drupes are collected by lopping the small branches, the fleshy mesocarp is removed with a sharp knife, and seeds are dried under proper shade [7].

Economic importance

Canarium strictum exudates a resin called as 'Sambrani' or 'Dammar' which has medicinal as well as commercial uses. Its usage among tribal and folk people for medicinal purposes in different parts of India has been explored through ethnobotanical studies. It is also used in Siddha system of medicine. It finds its usage in incense and varnish industries [8] and also used as a substitute for burgundy pitch in making medicinal plasters.

Resin: The species is rich sources for Sambrani which is used to cure various bronchial ailments. The resin powder is given orally to cure rheumatism, fever, cough, asthma, epilepsy, chronic skin disorders, syphilis, and hernia and also helps to improve complexion [8].

Timber: The wood of *Canarium strictum* is grayish-white with a pinkish cast to the heartwood and used for making boards for ceiling, flooring and partitions from well seasoned timber. It is also used for packing cases and for cheap utility furnitures. The wood has good glue holding capacity and used for plywood tea-boxes [9].

Seed: The seed kernel is edible and its oil is used in confectionery.

Threats and Status of the Population

Although the status of this species is critical, it was found that there was a reduction of 20% of its population in the last 10 years. Habitat fragmentation and landscape changes (eg: Kolli Hills, Eastern Ghats), pollinator limitation (eg: Kolli Hills, Eastern Ghats), seed dispersal limitation (Kolli Hills, Eastern Ghats and Silent Valley, Western Ghats) [6], exploitation for resin and wood and other human activities contributed in the declination of the population of the species. Several authors have expressed concerns that populations are disappearing in the wild due to unsustainable tapping practices [8] due to which the species falls under the category of vulnerable in South India [4]. Therefore, efforts may be taken up for cultivation of this species so as to meet all of the demands of the trade industry or local needs for subsistence and to save the species from extinction [10].

Regeneration and Viability

Regeneration or adequate protection of areas from clearance and degradation could allow it to make a fast recovery. Seeds of a *Canarium strictum* fall close to the tree and germinate easily. Artificially it could be propagated by directly sowing the 24 hour water soaked and drained seeds in properly shaded mother beds at a depth of 1.5 to 2.0 cm vertically to keep micropyle upward. Germination is epigeal; it starts after three weeks of sowing and continues up to 120 days especially when sowing is done during winter months. 95% germination was observed on sand substratum. Transplanting is done in the polythene bags when seedlings attain 3-leaves stage. Initial growth of the seedlings is very fast and they become ready for plantation after about two months of transplanting. It can be successfully raised by direct sowing in fields at the onset of monsoon rains [7]. *Canarium strictum* shows high rate of germination under controlled conditions, thus establishing nursery at the study site can aid in achieving high seed to seedling ratio [6].

Harvesting and Resin Collection Methods

Wide variation in the harvesting pattern and resin collection has been observed and three modes of resin collection have been documented for *Canarium strictum* [11].

The first type involves the collection of resin formed naturally through fissures on the tree. The second type of resin collection involves making incisions to promote resin flow (Fig. 3). This method is largely employed by harvesters. They make incisions with curved iron knives and collect the resin exuding from the incisions. The third type of resin-collection strategy involves setting a low fire at the base of the tree followed by incisions and resin collection.

Fig. 3. Use of fire and incision for resin collection

Value addition of Black Dammer was done depending on the quality/grades of resin. The lowest quality resin is dust like and mixed with pieces of bark and earth; after a minor amount of cleaning this is mixed with other ingredients and used for prayer fires as frankincense. The middle grade resin is used to make agarbatti and incense cones. The finely powdered resin is mixed with oils and the bark of *Persea macarantha* or *Litsea spp* [12] which forms the dough. These are dried in the shade and packed as incense sticks, used widely in India.

Markets for Dhoopa in India

Since Dammar collection is not allowed in Tamil Nadu, the data availability for this product is restricted to market data in Kerala. Over the 2004- 2008 period, about 150 tons of Black Dammar was sold through auctions in Kerala. The higher domestic prices for Dammar have resulted in the nearby industry complexes for matches and fireworks reporting a lesser demand (down by 50%) for Dammar during the last 2-3 years. The incense or agarbatti industry reportedly produces about 4,200 million sticks annually (20 percent of this production is in the organized sector) and is estimated to use about 1,100 – 1,200 tons of gum Dammar as the binding agent in the production. Quality conscious or high value agarbatti-makers prefer Indian Dammar due to its high quality and smell [10]. The boat-building and maintenance industry in Kerala use gum Dammar in the wooden parts of the boats and in caulking, to increase the water-resistant properties. The estimated use of Dammar gum by this industry in Kerala is about 50-60 tons per year. Thus, the domestic share of Dammar use is high (nearly 60%) in the incense industry – including agarbatti, loban/jos sticks, etc. – and is estimated to be 18,000 million tons annually (ITC Data). The Virudhnagar producers are the major procurers of Dammar from the Indian trade and the importers; smaller use sectors depend on the Virudhnagar manufacturers to procure Dammar [11].

Ecological Impacts among Tapping Strategies

The quality of resin is determined by the frequency of tapping which is an indicator of sustainable harvest. Disappearance of tenure systems due to increased commercial demand for resin, habitat loss due to forest encroachment, lack of economic incentives for high-grade resin, increased populations of harvesters, and the breakdown of traditional knowledge and beliefs resulted in increase of tapping frequencies. Heavy tapping of *Canarium strictum* significantly increases the adult mortality and decreases the reproductive output because of low fruiting to flowering ratio and increase in the production of non-viable seeds. A decrease in the reproductive output and population size of *Canarium strictum* could have impacts on the other organisms such as pollinators and frugivores. *Canarium strictum* are vital to sustain different faunal populations such as Hornbills and Imperial pigeons [12, 13]. Ecological surveys revealed decreased sizes of *Canarium strictum* populations which could lead to still smaller populations over the long term. [14] found higher mortality of *Canarium strictum* seedlings planted from seeds collected from smaller groves than those collected from larger groves and it has been found that, seedling fitness decreases as the grove area reduced which could be due to inbreeding among the fewer individuals and accumulation of lethal characters in the smaller groves.

The Sörenson similary index and Coles association coefficient were computed to analyse the similarity between forest types and association between *Canarium strictum* individual in the Pacchaimalai hills of the eastern ghats of Tamil Nadu, South India. It has been found that *Canarium strictum* has significant chi-square values with *Aglaia lawii* and *Artocarpus heterophyllus* and high Coles value with *Sygygium cumini, Streblus taxoides* and *Dicliptera cuneata* [15].The significance can be attributed to the favourable conditions, provided by the species for the germination and growth of the plants [16].

Antimicrobial activity report

The preliminary phytochemical screening of compound A and compound B from the *Canarium strictum* showed the presence of triterpenoid. It was investigated for antimicrobial activity by using cup plate method and diffusion agar method. The results showed that compound A and compound B possess broad-spectrum antimicrobial activity at concentration of 100µg/ml. The inhibitory effect of each compound is very close and identical in magnitude for Gram- positive, Gram-negative bacteria and fungi [17].

Discussion

Literature search has shown that this plant has immense medicinal and economic uses in different systems of medicine in India as well as throughout the world. Though it has wide medicinal and economic properties, it is now rarely available and has been categorized as an endangered plant, that need an awareness about its uses in general public as well as its difficulty in natural reproduction.

In many parts of the country, indigenous knowledge related to availability and uses of medicinal plants has not been thoroughly catalogued and are eroding under the increasing emphasis on western medicinal systems promoted by the government under the social welfare and health care programmes. An urgent need for a comprehensive analysis and documentation of the indigenous knowledge is a basic need. The reluctant attitude of the inhabitants may put end to cease the trend of passing such knowledge from generation to generation. Use of ayurvedic medicines resulting in the indiscriminate and ruthless collection of this species in recent times which led to acute scarcity of the plant and is listed out as vulnerable and rare in the Foundation for Revitalization of Local Health Traditions red list of medicinal plants [10].

Conservation and propagation of *Canarium strictum* is of utmost importance as populations seem to be declining. Thus a thorough study of the population and ecology of the

tree across the Western Ghats is also required. One of the study revealed that female trees yield more resin in comparison to male trees, therefore the cultivation of female trees should be promoted so as to fetch local markets with better economic returns and cultivation of the species on the large scale will have a direct impact of the livelihood of the tribal's [11]. Research related to its habitat, germination and seedling mortality in the wild need to be undertaken. The species also requires necessary attention and concern regarding its population status, sustainable harvesting techniques, markets and trade links through a multiprolonged approach to address the issues for conservation aspects. Future research assessing the impacts of different tapping methods and intensities on reproductive output is required. The livelihood aspects also need special attention to know what portion of income/employment and subsistence needs of various communities are met by *Canarium strictum*. Once we allow the loss of species the death of entire ecosystems cannot be far behind. If we continue to tolerate unlimited destruction of our rarest plants, efforts to preserve biological diversity and a healthy environment will inevitably fail. The status of land tenure and the methods of harvesting resin can be documented in detail to arrive at a sustainable model that takes into consideration both indigenous systems and modern science, therefore this species needs a special concern in order to make it available to the nature and mankind. Therefore the plant needed immediate attention to sort out alternative means of its conservation. All these efforts need to continue and be expanded to keep our natural heritage alive.

Conclusions

Canarium strictum an indigenous and endemic plant of the Eastern and Western Ghats, reputed for its medicinal properties, timber and resin is at the verge of extinction. Though conservation is an affordable measure as the regeneration capacity of the plant is promising, therefore Forest Departments, Conservationists and Physicians dedicated for medicinal plant studies along with NGO's, should take voluntary measures for the conservation and propagation of such red-listed species, preventing it from extinction in the near future.

References

[1] National Research Council (NRC), **Managing global genetic resources: Forest trees, National** Academy Press, Washington, DC, 1991.

[2] T. Panayatou, P.S. Aston, **Not by Timber Alone: Economics and Ecology for Sustaining Tropical Forests**, Island Press, Washington, DC and Covelo, CA, 1992.

[3] H.A. Mooney, J. Lubchenco, R. Dirzo, O.E. Sala, *Biodiversity and ecosystem functioning*. In **Global Biodiversity Assessment** (Eds. H. A. Mooney & R. T. Watson), Cambridge: Cambridge University Press, 2000, pp. 327–453.

[4] K. Ravikumar, D.K. Ved, **Illustrated field guide - 100 Red Listed Medicinal Plants of Conservation Concern in Southern India**, Foundation for Revitalisation of Local Health Traditions (FRLHT)**,** 2000, Bangalore, India

[5] http://www.envis.frlht.org. (accesed on 22/02/2012).

[6] C. Kunhikannan, B. Nagarajan, V. Sivakumar, N. Venkatasubramanian, **Species recovery in few rare, endangered and threatened plants of Silent Valley and Kolli Hills,** Final Report FRLHT-IFGTB Project, 2004, p. 47.

[7] N.S. Bisht, S.P. Ahlawat, U.V. Singh, *Nursery techniques of local tree species*, **Information Bulletin No. 9,** State Forest Research Institute, Itangagar, 2001**.**

[8] J. Augustine, P.G. Krishnan, *Status of the black dammar tree (Canarium strictum Roxb) in Periyar Tiger Reserve, Kerala and the uses of black dammar*, **Indian Forester, 132**(10), 2006, pp. 1329–1335.

[9] CSIR, **The wealth of India: a dictionary of Indian raw materials and industrial products, Raw materials** (revised edition), Council of Scientific and Industrial Research, India, New Delhi, (Wealth India RM ed. 2), 3, 1992, pp.185–186.

[10] S. Molur, S. Walker, **Report on Conservation Assessment and Management Plan Workshop for selected species of the medicinal plants of southern India,** 16-18 January 1997, Bangalore, pp.72-73.

[11] A. Varghese, T. Ticktin, *Regional variations in Non Timber Forest Produce Harvest strategies, trade and Ecological Impacts: The case of Black Dammer (Canarium Strictum, Roxb) Use and Conservation in the Nilgiri Biosphere Reserve*, **Ecology and Society,** 13(2), 2008, 11.

[12] R. Kannan, Burning out the black dammar, *Canarium strictum* Roxb., **Bombay Journal of Natural History, 91**(1), 1992, p.159.

[13] T. Ganesh, P. Davidar, *Dispersal modes of tree species in the wet forests of southern Western Ghats,* **Current Science, 80**(3), 2001, pp. 394–399.

[14] B. Tambat, G. Rajnikanth, G. Ravikanth, R. Uma Shankar, K.N. Ganeshaiah, C.G. Kushalappa, *Seedling mortality in two vulnerable tree species in the sacred groves of Western Ghats, South India*, **Current Science, 88**(3), 2005, pp. 350-352.

[15] S. Soosairaj, S. John Britto, B.Balaguru, D. Natarajan, N. Nagamurugan, *Habitat similarity and species distribution analysis in tropical forests of Eastern Ghats, Tamilnadu*, **Tropical Ecology, 46**(2), 2005, pp.183–191

[16] K. Zaal, *Plant species associations in alpine-subnival vegetation patches in the Central Caucasus*, **Journal of Vegetation Science, 4**, 1993. pp. 297–302.

[17] P. B. Suruse, N.J. Duragkar, U.D. Shivhare, S.B. Bodele, *Study of Antimicrobial Activity of Canarium strictum Gum Resin*, **Research Journal of Pharmacognosy and Phytochemistry, 2**(6), 2010, pp. 435-437.

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