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## The Spice Tree of India: *Cinnamomum tamala*

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**ABSTRACT**

Tejpat or tamala (*Cinnamomum tamala*) is an evergreen multi-valued tree spice having immense medicinal value. The leaves and bark are primarily utilized in culinary purpose from ancient times. It is a major constituent in traditional Ayurvedic medicinal preparations for dioarrhea, vomiting, nausea, colic and cardiac ailments because of its carminative, anti-flatulent, diuretic, and hypolipidemic properties. It is also used as a bark adulterant for *Cinnamomum zeylanicum*. The peculiar aroma makes it an excellent flavouring agent. The high commercial demand for the species has paved way to over exploitation from its natural range. This blind exploitation is a matter of concern due to its diminishing population for this habitat specific species. Seed propagation is not adequate because of its poor germination. Therefore, there is a need to raise high quality planting materials in large to fulfill the increasing industrial demand and sustainable harvesting practices for the conservation of the species both *in situ* and *ex situ*.

**Key Words:**

conservation, medicinal value, *Tejpat*, utilization

## INTRODUCTION

Medicinal plants are gaining importance day by day. More than 25 % of modern medicines are directly or indirectly derived from plant resources (Majumder and Paridhavi 2013). Compared to other herbal plants, trees with medicinal values are having less relevance in cultivation and conservation. *Tejpat* (*Cinnamomum tamala* T. Nees and Ebrum) belonging to family Lauraceae which is commonly known as *Tejpat*, Malabar leaf or Indian bay leaf is an important aromatic medicinal tree spice species with multiple benefits. Its one among the high value Medicinal and Aromatic (MAP) species. *C. tamala* is illegally exploited in its natural pockets for household as well as commercial purpose as its demand is increasing. Commercial plantations of tejpat are very scarce. This creates pressure on wild populations. As the seeds are recalcitrant in nature, besides

producing large number of seeds, this species fails to establish in fields. Hence it poses difficulty in successful propagation and conservation of *C. tamala*. Thus it's the need of hour to produce quality planting materials for mass multiplication of the species. Moreover, as MAP cultivation is an emerging self employment sector there is huge potential for this spice tree. There is very little information available on population status, propagation and conservation aspect as most of the studies have focused on the pharmaceutical aspects and chemical constituents of Tejpata.

**DISTRIBUTION**

The genus Cinnamomum has about 270 tropical tree and shrub species, of which 20 species occur in India only (Anon. 1950). *C. tamala* is an important species occurring in the transitional shady moist habitats in evergreen broadleaf forests of India (Arunachal Pradesh, Uttaranchal, Himachal Pradesh, Assam, Meghalaya, Mizoram, Sikkim, West Bengal); Bangladesh; Bhutan; Myanmar; Nepal; Thailand within altitude of 300-2400 m (IUCN 2019). The tree also grows well in primary and secondary evergreen forest and open vegetations over granite.

**PHENOLOGY**

It's a medium sized monoecious evergreen tropical tree of (Sharma and Nautiyal 2011). This species attains a height between 6 and 20 m high with a girth of 150 cm. Leaves are three-nerved from the base, lanceolate, and glabrous; opposite, alternately placed, and short stalked. Its bark produces mucilage. Flowers are bisexual and flowering time starts from March to May pollinated usually by honeybees (Sharma and Nautiyal 2011). The tree bears during June to October with dark purple coloured single seeded fruits (Chauhan 2006; Sharma et al. 2009). The tree is long lived up to 100 years, and continues bearing even at old age (Lamichhane and Karna 2009).

**PROPAGATION AND HARVESTING**

There is limited information on physiology, morphology, propagation, micropropagation and conservation aspects of the species (Babu *et al.*, 2003; Sharma et al. 2009; Sharma and Nautiyal, 2011; Deb et al. 2014). Propagation can be done by using seeds, cuttings and layering including micropropagation (Babu et al. 2003). As the seeds are recalcitrant, it could not be stored for more than four days even at room temperature or low temperature (4°C). The seeds are desiccation sensitive as they lose viability below 80 % moisture. The species tree usually propagated through seed and its freshly harvested seeds were reported with high germination (72 %) but in the seeds beds under partial shade (Deb et al. 2012). Seeds are sown in nursery beds during the months of March and April and can be transplanted in the fields after 30-45 days of sowing keeping a planting geometry of 3.0-3.5 m between the plants. Shade is necessary in the early stages of growth up to 8-9 years. Manuring is not necessary and less care is needed except removal of undergrowth (Anon. 1950). Harvest of leaves is done when the trees reach 10 years onwards during winters (Chauhan 2006). Leaves can be collected every year and alternate years from aged and weak ones. Plantation establishment of the species has been unsuccessful due to lack of assessment of survival rate and huge mortality (Paudel and Acharya 2018).

Harvests are generally made in dry weather from October to March. Handpicking is preferred over mechanical methods to reduce damage (Lamichhane and Karna 2009). For marketing, small branches with leaves are sun dried for 3-4 days, tied up into bundles and processed (Kumanan *et al.*, 2010). Timely collection of leaves is essential, as early and late collection will deteriorate the quality of the essential oil (Lamichhane and Karna 2009). On an average, a tree of Cinnamomum tree can produce 10-20 kg of dry leaves annually with 0.2-0.4 % oil yield.

**PEST AND DISEASES**

Not many diseases are reported in the species except rust caused by *Aecidium cinnamomi* (Goswami and Bhattacharjee 1973), leaf blight caused by *Glomerella cingulata* (Khan and Hussain 1985), leaf spot caused by *Colletotrichum gloeo-sporioides* and *Pestalotia furierea* (Ciferri 1926; Ciferri and Fragoso 1927; Roy et al. 1976), stripe canker caused by *Phytopthora cinnamomi* (Rands 1922), pink disease caused by *Corticium salmonicolor* (Weiss 2002), brown root rot caused by *Phellinus iamaensis*, grey blight disease caused by *Pestalotia palmarum* (Karunakaran et al. 1993). The grey leaf spot and leaf blight can be managed using Tilt 250 EC (Propicnazole) @ 0.1 % alone or combination with MOP @ 50 g/plant (Wadud et al. 2017).

**ETHNOMEDICINAL VALUES AND OTHER USES**

*Cinnamomum tamala* is a multipurpose tree species used as food, fodder, medicine, and timber (Nautiyal and Kaechele 2007). It has been used for many centuries in traditional East-West systems of medicine (Sudan et al. 2013) mainly in Indian traditional medicine system in various Ayurvedic formulations such as Sudarshan choorna, Aswagandharishtam and Chandraprabhavati (Gaur 2008; Kotteswari et al. 2018). In Ayurveda, it is used to treat anorexia, bladder disorders, dry mouth, coryza, nausea and spermatorhea (Kapoor 2000). This species is known to contain various active principles of therapeutic value and used against a number of diseases (Preety and Sharma 2016). Leaves and bark possess qualities like aromatic, astringent, stimulant and carminative and thus are used for curing malaria, rheumatism, skin problems, cardiac problems, dental problems, diarrhoea, nausea, colic, ophthalmia and vomiting (Khomdram and Khomdram 2016; Preety and Sharma 2016). Children are administered with crushed seeds mixed in honey against cough and dysentery (Edwards 1993). Dried leaves and bark are used against fever, anemia and body odor (Majumder and Paridhavi 2013). Because of its aroma, the leaves are kept in clothes and also chewed to conceal bad breath (Shah and Panchal 2010). It is also believed that this plant improves mood, refreshes and offers emotional health and reduces fatigue (Skok 1998). It is also used as ethnoveterinary medicine to treat broken bones, sore neck, sore yolk and tetanus (Pande et al. 2007). Many reports also mentioned ill effect of the species like irritation to skin and mucous membranes when used in high doses over sensitive or damaged skin, upper gastrointestinal tract bleeding after using dried leaves and asthma (Lemiere *et al.*, 1996; Kumar and Sharma 2012).

*C. tamala* is a major non-timber forest product cultivated commercially for its leaves and barks in most parts of India and Nepal and traded as a spice (Khanal et al. 2021). It is an ethno-botanically important species in India (Edwards 1993; Chang and Cheng 2002). The leaves taste like clove with a light pepper like odour (Grover et al. 2002). Its dried leaves are widely used in culinary preparations throughout the world since ancient times (Chakravarty and Das 2010; Sudan et al. 2013). It is also used as a bark adulterant for *Cinnamomum zeylanicum* while in Kashmir valley; it is substitute for betel leaves. Bark oil of the tree is a powerful germicide, fungicide and an excellent insect repellent but usually used as valuable flavoring ingredient (Dutta 2007). Main component in volatile oil of the species is eugenol including eugeniol, α-pinene, camphene, myrcene, limonenep-cymene, methyl eugenol and eugenol acetate (Kumar and Sharma 2012; table 1) which is extensively used for flavoring liquors, confectionaries, soaps, detergents, perfumes, toothpastes, cosmetics and industrial fragrance preparations (Jantan and Goh 1990; Rema et al. 2005; Sharma and Nautiyal 2011; Hossain et al. 2012; Sankaran et al. 2015). The leaf oil is also used as a preservative in pineapple juice (Kapoor et al. 2008) while, leaf extract are used in green dyeing procedures as a clarifier with emblic myrobalans (Tiwari and Talreja 2020).

**PHYTOCHEMICAL PROPERTIES**

The potential of phytochemicals present in *Cinnamomum tamala* are immense. The leaf oil contains a variety of constituents including eugenol and cinnamaldehyde, which is a local mucous and dermal membrane irritant. The essential oils from leaf contain furano sesquiterpenoids like furanogermenone, furanodienone, furanodiene, sabinene, germacrene D, β- caryophyllene, curcumenol, curzerenone and curzerene (Kirtikar and Basu 2005). Numerous studies are available on phytochemical properties of the species (table 2; Majumder and Paridhavi 2013) like lipid lowering activity and free radical scavenging effect (Al-Mamun et al. 2011; Chunekar 2013), reno-protective properties (Ullah et al. 2013), immunosuppressive properties (Chaurasia et al. 2010), antifungal activity against *Aspergillus niger*, *Aspergillus fumigatus*, *Rhizopus stolonifera*, *Candida albicans* and *Penicillium spp*. (Pandey et al. 2012) and gastro-protective activity (Eswaran et al. 2010) including antidiarrhoeal properties (Semwal et al. 1999). This tree possesses nimaticidal and insecticidal properties including mosquito larvicidal property and as anti-termite agent (Gambhire et al. 2009; Tiwari and Talreja 2020).

**Table 1.** Composition of *Cinnamomum tamala* volatile oil

| Constituents | % | Constituents | (%) |
|---|---|---|---|
| α-Thujene | 0.02 | Cis-verbenol | < 0.01 |
| α -pinene | 0.07 | Borneol | 0.1 |
| β-pinene | 0.03 | Terpinene-4ol | 0.1 |
| 6-Methyl-5heptene-2-one | < 0.01 | m-cymen-8-ol | < 0.01 |
| Myrcene | 0.02 | p-cymen-8-ol | 0.08 |
| α -phellandrene | 0.4 | a-terpineol | 0.5 |
| 3-carene | 0.02 | Trans-piperitol | < 0.01 |
| p-cymene | 0.6 | Iso-dihydrocarveol | 0.03 |
| Limonene | < 0.01 | (z)-cinnamaldehyde | < 0.01 |
| 1,8-cineole | 0.4 | p-cumic aldehyde | 0.03 |
| p-mentha-2,4(8)-diene | < 0.01 | Carvone | < 0.01 |
| Terpinolene | 0.03 | Chavicol | < 0.01 |
| p-cymenene | < 0.01 | (e)-cinnamaldehyde | 0.5 |
| Linalool | 0.04 | Anethol | 0.2 |
| Trans-pinocarveol | < 0.01 | p-cymen-7-ol | < 0.01 |
| Camphor | < 0.01 | Thymol | 0.2 |
| b-terpineol acetate | < 0.01 | Carvacrol | < 0.01 |
| Eugenol | 66.1 | 3-methoxyacetophenone | 0.1 |
| b-elemene | 0.3 | a-elemene | 0.06 |
| Vanillaldehyde | -0.2 | a-cubebene | 0.06 |
| α-gurjunene | 0.1 | Alloaromadendrene | 0.5 |
| Menthyleugenol | 1.3 | Ethyl vanillin | < 0.01 |
| (E)- b-caryophyllene | 1.9 | g -muurolene | 0.6 |
| Sesquiterpene | 0.2 | d-germacrene | 0.5 |
| Aromadendrene | 1.5 | β-Eudesmene (β-elinene) | < 0.01 |
| α-guaiene | 0.1 | Mixture of sesquiterpens | 0.4 |
| α -humulene | 0.4 | Viridiflorene | 2.9 |
| Elemicin | < 0.01 | ϒ -cadinene | 0.1-0.2 |
| Trans-nerolidol + sesquiterpenoid | 0.2 | Sesquiterpenoid | 0.2 |
| Spathulenol | 4.8 | Eugenolacetate | 0.1 |

| | | | |
|---|---|---|---|
| Caryophyllene oxide | 4.8 | α-cadinene | 0.07 |
| Globulol + sesquiterpenoid | 1.6 | α -calacorene | 0.1 |
| Viridiflorol | 0.6 | Hexahydrofarnesyl acetone | 0.04 |
| Guaiol | 0.5 | Farnesyl acetone | 0.03 |
| 4-Allyl-2,6-dimethoxy phenol | 0.2 | a-cadinol | 0.6 |
| 10-epi- g -Eudesmol | 0.3 | Coniferol | 0.2 |
| d –Cadinol (torreyol) | 0.2 | | |

**Table 2.** Pharmacological activity of Cinnamomum tamala

| Property | Plant parts | Reference |
|---|---|---|
| Antidiabetic | Bark, leaves | Bisht and Sisodia 2011; Palanisamy et al. 2011 |
| Antibacterial | Stem-bark, leaves | Prabu et al. 2006; Jamiuddin et al. 2013 |
| Antioxidant | Whole plant | Shahwar et al. 2010; Palanisamy et al. 2011 |
| Anti-ulcer | Leaves | Lima et al. 2010 |
| Antimicrobial | Leaves | Mohan et al. 2012 |
| Cytotoxic | Leaves | Jamiuddin et al. 2013 |
| Anti-inflammatory | Leaves | Gambhire et al. 2009; Thamizhselvam et al. 2012 |
| Acaricidal | Leaves, bark | Manjunatha et al. 2001 |
| Anti-fungal | Fruits, leaves | Srivastava et al. 2011; Singh et al. 2013 |
| Anti-hyperlipidemic | Leaves | Dhulasavant et al. 2011 |
| Analgesic | Leaves | Thamizhselvam et al. 2012 |
| Antipyretic | Leaves | Thamizhselvam et al. 2012 |
| Anti-diarrhoeal | Leaves | Rao et al. 2008 |
| Anti-aflatoxigenic | Leaves | Srivastava et al. 2011 |
| Lipid lowering | Leaves | Al-Mamun et al. 2011 |
| Gastroprotective | Leaves | Eswaran et al. 2010 |

## CONSERVATION

Conservation efforts done so far in *C. tamala* have not been succeeded due to lack of standard agro-techniques and absence of proper information on seed germination behaviour (Sharma et al. 2009). The species is listed as Least Concerned Category IUCN Red List (IUCN 2021). The species was reported vulnerable in Uttarakhand, Himachal Pradesh, Arunachal Pradesh and Meghalaya while, endangered in Jammu and Kashmir (Ved et al. 2003). Deforestation or habitat destruction and indiscriminate exploitation has caused its natural population to decline drastically and therefore both *in situ* and *ex situ* conservation approach is recommended for this species (Samant et al. 2001; Ved et al. 2003; Sharma et al. 2009).

## CONCLUSION

*C. tamala* is a multipurpose tree with declining population in the wild which requires urgent conservation approaches with sustainable harvest practices. Propagation methods should be developed for economically viable mass multiplication techniques. There should be proper documentation of its population. Therefore, there is a need to raise high quality planting materials quickly to fulfill the increasing industrial demand and sustainable harvesting practices for the conservation of the species both *in situ* and

*ex situ*. Research should be done focusing on areas like product diversification, micropropagation and conservation aspects.

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