

Research Article

A revisionary study on *Cinnamomum* species in central western ghats, Karnataka

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ABSTRACT

Present research high light the *Cinnamomum* 's of Karnataka with emphasis on distribution, taxonomic identification, status in Central Western Ghats, Karnataka. The floristic survey undertaken in central part of Western Ghats, Karnataka, it comprises ten districts of the state (from North Belgaum to South Chamarajnaraga). Eight species have been collected, identified and prepared vocher specimens and deposited in Herbarium, Botanical Garden, UAS, Bangalore, the identified species like *Cinnamomum heyneanum* Nees *C.macrocarpum* Hooker f., *C.malabratrum* (Burm f.) Bl., *C. sulphuratum* Nees, *C.travancoricum* Gamble, *C. verum* J.S.Presl, *C.walaiwarens* Kosterm. and *C.wightii* Meissn.. All these species identified based on morphological characters and considered ecology of the species. Among eight species seven species belongs various categories of endangered status. Distributional maps were prepared for each species by using Erdas Imagin 9 software. The latitude, longitude and altitude data's were collected during field surveys were used for preparation of maps. Among eight species two species such as *Cinnamomum travancoricum* Gamble, and *C.walaiwarens* Kosterm. are considered as Critically Endangered species like *Cinnamomum heyneanum* Nees, *C.wightii* Meissn. are belongs to Endangered category. Species like *C.sulphuratum* Nees, *C.walaiwarens* Kosterm. and *C.wightii* Meissn. are facing sever threat due to unwise exploitation, conversion of forest land to estates, mining operations, roads, etc. Eight species have been reported from Karnataka, among eight species 6 species have been belongs various IUCN categories and shows poor germination in natural as well as nursery conditions, hence it indicates it need further studies on germination by forestry researchers and use some advanced techniques like scarification, stratification and application of growth harmones may induce the germination.

Keywords: Cinnamomum, Central Western Ghats, Karnataka

INTRODUCTION

Cinnamomum species are very popular spices commonly used in the Indian dietary in the name of Dalchini. The genus *Cinnamomum* Shaeffer belongs to the family Lauraceae, which has some 32 genera and 200-250 species. A Willis (1973) state that there are some 250 species of *Cinnamomum* throughout the world, but it has some controversies from different phytogeographers/botanists. Bailey recorded more than 50 species in Manuals of cultivated plants, while Kostermans (1964) lists 462 binomials, some of which, of course, are synonyms. *Cinnamomum* species are evergreen trees and shrubs found in south-eastern and eastern Asia, through Malesia to Australia and Pacific. There are twenty-six species of *Cinnamomum* reported by J.D. Hooker in Flora of British India there are thirteen species recorded from south India by Kostermans (1983) and eleven species recorded from J.S. Gamble in Flora of the Presidency of Madras and six species found wild in Karnataka (Saldanha, 1984 & 1976), such as *Cinnamomum travancoricum* Gamble, *C.riparium* Gamble, *C.sulphuratum* Nees, *C.malabratrum* (Burm.f.) Blume, *C.verum* J.S.Presl and *C.wightii* Meissn. Species such as *Cinnamomum malabratrum* (Burm.f.) Blume, *C.heyneanum* Nees, *C.macrocarpum* Hooker f., *C.travancoricum* Gamble, *C. sulphuratum* Nees are endemic

to Western Ghats. One species *C.camphor* found in cultivated form and some of these are belongs to endangered category. These six species are distributed in Coastal and Malnadu areas of Karnataka. Very few exploratory works have been done on *Cinnamomum* species regarding identification and ecology by Kostermann (1983) and Manilal, K.S & Shylaja (1986). Pascal and Ramesh (1987), Pascal (1986) and Saldanha (1976 & 1984) have mentioned *Cinnamomum* species in their works, but these studies are inadequate to understand the ecology, taxonomic identification of *Cinnamomum* species. Some recent studies reported new species from India such as taxonomic significance of morphological studies by Yang et al. (2022), Remya Krishnan et al. (2020), *Cinnamomum mathewianum* a new species reported from Kerala by Remya Krishnan et al. (2014). A taxonomic revisionary study by Soh Wuu-Kuang (2011). Some of the studies other than taxonomy like Pharmacological and phytochemical studies of *C.wightii* by Laloo et al (2012), Diego et al (2021) and Javad et al (2021), a review on aroma profile of *Cinnamomums* of North and North east India by Akanksha Rani et al. (2017), Leaf architectural characteristics of *Cinnamomum cebuense* by Edgardo P. Lillo et al. (2020) Among the species *Cinnamomum verum* J.S.Presl is very important species it is used as spice in the name of

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'dalchini'. Due to the improper identification all these *Cinnamomum* species are sale and used under the name 'dalchini'. Few of the above mentioned species are sold in the same name of 'dalchini' (*Cinnamomum verum*) in the local markets. The other species of *Cinnamomum* are also important but when compare to *C.verum* J.S.Presl these are have lower quality. As has been pointed out by Burkill (1966), all the species are aromatic, the aromas depending on different substances and mixtures of them. Some have Cinnamaldehyde, the chief of these being the true Cinnamon, some have Eugenol and smell like cloves, some have Safrole and smell like Sassafras, and some contain camphor. Besides these four chemical components, they contain many other aromatic components, which are of importance as they give, or mar, the delicacy of the scent.

Cinnamomum cassia and other species of *Cinnamomum* partially meet the world spice requirement, even today *Cinnamomum* along with *Cassia* occupy an important position in the world trade. According to the ITC estimates (1991-92), the total world trade in *Cinnamomum* and *Cassia* is around 35 million dollars (about Rs 1,220 million), and the world demand for both these spices is growing. India export *Cinnamomum* to American zone, Australia and Oceanic zone, EEC, East Asia. As per recent report India export more than 565 tones of *Cinnamomum* per every year and earned 3,139 thousand rupees. So the identification, ecology and conservation of *Cinnamomum* is very important. Main problem is all six species morphologically looks same and have aromatic odour. It needs thorough studies like ecological habitat, morphological studies like leaf structure (size, nerves pattern and blade), bark morphology and odour, branching pattern, flowers, fruits of each species.

METHODOLOGY

Study area

The study area situated between North latitude $11^{\circ} 36'$ & $16^{\circ} 53'$ and E' longitude between $73^{\circ} 58'$ & $77^{\circ} 47'$ and spread in ten districts viz. Belgaum, North Canara, Shimoga, Udupi, Chikmagalur, South Canara, Hassan, Kodagu, Chamaraja nagar and Mysore. And an area of about 28,601sq. Km. It covers almost all types of vegetations like evergreen, shola, semi-evergreen, moist deciduous, dry deciduous, scrubby thorn forests and grasslands. It has high species richness, diversity and endemism, it is considered as one of the hot spot of the world.

Demarcation of the study area: The study area demarcated through using topo sheets and software package Erdas imagine 9. The study area comprises ten districts and this area situated in south-west of India and some districts like Belgaum, Shimoga, Hassan, Chikmagalur and Mysore are partly covered under Western Ghats (Figure 1).

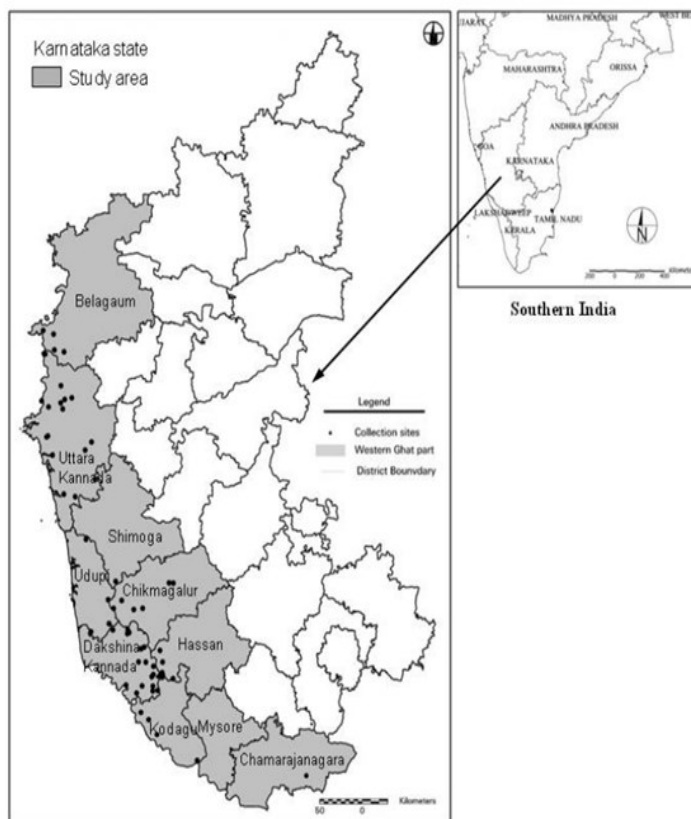


Figure 1. Map showing study area

Collection, Identification & preparation of herbarium specimens: Conducted field trips approximately twice in a season to undertake survey, collection, documentation to understand ecology and phenological status of the *Cinnamomum* species. Covered all the districts of the state along the Western Ghats.

The plant specimens collected were identified with the help of regional floras like Flora of Karnataka (Saldahna, 1984), Flora of Hassan district, Karnataka (Saldahna & Nicolson, 1976)), Flora of South Kanara (Gopalkrishna Bhat, 2014) and original literature of Kosterman (1978), and Pascal and Ramesh (1987).

The *Cinnamomum* species data were collected during vegetation studies of Western Ghats. 20x20 m. quadrats were laid randomly across the different types of forests at different altitudes and analyse the density and frequency of the species. Understand the species status through referring IUCN website (<https://www.iucnredlist.org/species>).

Preparation of distribution maps: Distribution maps were prepared for nine species viz. *Cinnamomum heyneanum* Nees, *C.macrocarpum* Hooker f., *C.malabattrum* (Burm.f.) Blume, *C.sulphuratum* Nees, *C.travancoricum* Gamble, *C.verum* J.S.Presl, *C.walaiwarens* Kosterm., *C.wightii* Meissn. and *Cinnamomum* species. Maps were prepared with the help of GPS data using ERDAS and Arc coverage software programmes. GPS data were entered in Excel Programme later was converted into database file, these files were presented in Arc and ERDAS programme, finally these maps were converted into JPEG format.

RESULTS AND DISCUSSION

Collected plant species were identified through above mentioned floras based on vegetative and reproductive characters, like bark thickness, odour and leaves character such as nerve pattern, leaf size and lamina. Flower characters like perianth, stamens, ovary, style and stigma. These identified species were treated with 5% formaldehyde solutions, and prepared herbarium sheets by wet method, minimum one-two herbarium sheets were prepared for each location for each species, and each herbarium sheet contains information like date of collection, latitude, longitude, altitude, location (village), collectors and voucher number. The voucher specimens were deposited in the Herbarium, Botanical garden, UAS, GKVK, Bangalore. The voucher specimens compared with Herbarium at CES, IISc, Bangalore and Herbarium, Botanical garden, UAS, GKVK, Bangalore for authentication.

Total eight species have been identified (Figure 2) and prepared herbarium specimens. Key characters upon which species can be distinguished along with habit, habitat and distributional of the eight species were given below.

1. *Cinnamomum heyneanum* Nees, Pl. Asiat. Rar. 2: 76. 1831.

Small tree, Evergreen forests at lower altitude and near streams. Flowers few, axillary. Leaves linear-lanceolate. India (Karnataka (Dakshina Kannada and Kerala), Endemic.

Specimen examined: Dakshina Kannada: Kukke Subramanya, date: 28-02-06, *Haleshi 18* (UASB!)

IUCN Status: Endangered (EN)

2. *Cinnamomum macrocarpum* Hooker f., Fl. Brit. India 5: 133. 1886.

Tree, Evergreen forests and coffee estates. Bark and leaves with clove-aniseed smell. Panicles long-peduncled, but comparatively few-flowered, up to 5 in. long in all, the flowers elongate, with the thickened perianth up to 0.5 in long. Fruit cup obconical, not ribbed.

South India (Karnataka (Kodagu)) and Myanmar. Specimen examined: Kodagu: Koothi, date: 06-06-06, *Haleshi 20* (UASB!)

IUCN Status: Vulnerable (VU)

3. *Cinnamomum malabattrum* (Burm.f.) Bl., Bijdr. 568. 1826.

Tree, Evergreen forests. All districts of Western Ghats. Leaves drying yellowish-tomentose; Flowers many, in terminal and axillary panicles. Perianth lobes ovate-acute in fruit, thinly coriaceous, persistent.

India (Karnataka (Kodagu, Mysore, Chamarajnaraga, Dakshina Kannada, Hassan, Chikmagalur, Udupi, Uttarakannada, Shimoga and Belagavi) and Kerala) endemic.

Specimen examined: Shimoga: Agumbe, date: 27-06-06, *Haleshi 22* (UASB!)

IUCN Status: Least Concern (LC)

4. *Cinnamomum sulphuratum* Nees, Pl. Asiat. Rar. 2: 74. 1831.

Small tree, High mountain regions of Talacauvery and Koothi of Kodagu district. Leaves drying greenish, minutely pubescent or glabrous beneath; 12-28 cm long, elliptic to oblong-lanceolate inflorescence pubescent; Perianth lobes oblong in fruit, partly or completely deciduous. Flowers many, in terminal and axillary panicles.

South India (Karnataka (Kodagu, Dakshina Kannada) and Kerala), E. Himalaya to Assam.

Specimen examined: Chikmagalur: Kagodu, date: 04-01-06, *Haleshi 01* (UASB!)

IUCN Status: Vulnerable (VU)

5. *Cinnamomum travancoricum* Gamble

Small tree. High mountain regions of Talacauvery and Koothi village of Kodagu district. Young leaves sericeous underneath, leaves ovate, acute or acuminate at apex, acute at base, to 7.5x3.5 cm, 3-ribbed at about 0.4cm above the base, tawny villous beneath when young, basal lateral nerves not reaching the leaf tip. Panicle fulvous-tomentose. Flowers 0.2 in. long, fulvous tomentose, often reduced to threes, the filaments villous. Berry oblong 1.5 cm long.

India (Karnataka (Kodagu), Kerala: near Poonmudi)

Specimen examined: Kagodu; Choudlu near Koothi, date: 01-07-06, *Haleshi 08* (UASB!)

IUCN Status: Critically Endangered (CR)

6. *Cinnamomum verum* J.S.Presl

Small tree, Evergreen forests at lower altitude, with aromatic bark and leaves. Young leaves glabrous or sparingly tomentellous underneath, basal lateral nerves not reaching the leaf tip, oblong, ovate or ovate-oblong to subovate-elliptic or elliptic. Fruit with deep cuplike, conspicuously ribbed cup.

Srilanka and India (South)

Specimen examined: Dakshina Kannada; Kukkesubramanya and Shimoga; Jog falls, date: 01-07-06, *Haleshi 28* (UASB!)

IUCN Status: Least Concern (LC)

7. *Cinnamomum walaiwarens* Kosterm.

Small tree. High mountain regions of Talacauvery. Young leaves sericeous underneath, basal lateral nerves not reaching the leaf tip, oblong, acumen to 1.5 cm long.

India (S. Tamil Nadu, Karnataka; Kodagu district)

Specimen examined: Kodagu; Talacauvery, date: 02-06-06, *Haleshi 19* (UASB!)

IUCN Status: Critically Endangered (CR)

8. *Cinnamomum wightii* Meissn.

A stout, small tree. Hill tops regions of Koothi village, Kodagu district. Leaves less than 15 cm long, ovate, leaves glaucous-white and minutely pubescent beneath; peduncle fulvous-tomentose; pedicel thick, much shorter than perianth, 0.25 in. long. Berries supported by a truncate cup; these berries are frequently diseased and become globose.

South India (Karnataka and Tamilnadu)

Specimen examined: Kodagu; Koothi, date: 17-02-06, *Haleshi 35* (UASB!)

IUCN Status: Endangered (EN)



Figure 2. 1. *C. macrocarpum* 2 *C. malabatrium*, 3 *C. sulphuratum*, 4 *C. travancoricum*, 5 A flower of *C. travancoricum*, 6 *C. verum*, 7 A flower of *C. verum*, 8 *C. wightii*, 9 A leaf of *C. wightii*, 10 *C. walaiwarens*, 11 A leaf of *C. walaiwarens*

The density of *Cinnamomum* species varies across the species, the general pattern of distribution of *Cinnamomum* species is less towards windward side of Western Ghats (coastal area) and very less on the eastern leeward side. But the populations were seen in higher density along higher and mid Ghat regions, indicating that *Cinnamomum* species requires cool and high rainfall region. *Cinnamomum malabatrium* (Burm.f.) Bl. is the most common species found extensively in the area followed by *Cinnamomum macrocarpum* Hooker f., it is rare in Uttara Kannada, Belagum, Udupi, Dakshina Kannada and Chamarajnagara districts and common in Somwarpet, Pushpagiri of Kodagu and Shimoga districts. *Cinnamomum verum* J.S.Presl occasionally seen in lower altitudes of Kukkesubramanya of Dakshina Kannada district and rarely seen near Jogfalls of Shimoga district in the middle of Western Ghats and sometimes found in cultivated form. *C. sulphuratum* Nees is found rarely in the higher altitudes of Talacauvery and Koothi of Kodagu district. *C. walaiwarens* Kosterm. And *C. wightii* Meissn. rarely seen in higher altitudes and high rainfall areas of

Talacauvery, Koothi (Somwarpet) and Virajpet of Kodagu district. *C. heyneanum* Nees very rarely found in evergreen forests of Kukke Subramanya (Dakshina Kannada) and Agumbe (Shimoga) it is usually found near streams and rivers in lower altitudes, the type specimen collected from Kodagu district after long gap the rare species was collected. *C. travancoricum* Gamble frequently found in the forests and borders of Coffee and Cardamom estates of Kodagu district.

The distributional maps were prepared for all 8 species (Figure 3a & 3b) and these maps depict almost accurate points of *Cinnamomum* occurrence in Western Ghats of Karnataka. The map shows a typical distribution pattern of *C. malabatrium* (Burm.f.) Bl. in Central Western Ghats. *C. malabatrium* (Burm.f.) Bl. and *C. macrocarpum* Hooker f. shows more richness than other species. *C. sulphuratum* Nees, *C. wightii* Meissn., *C. travancoricum* Gamble, *C. walaiwarens* Kosterm. and *C. heyneanum* Nees shows rare occurrence in borders of Dakshina Kannada and Kodagu district respectively and it is endemic to Karnataka.

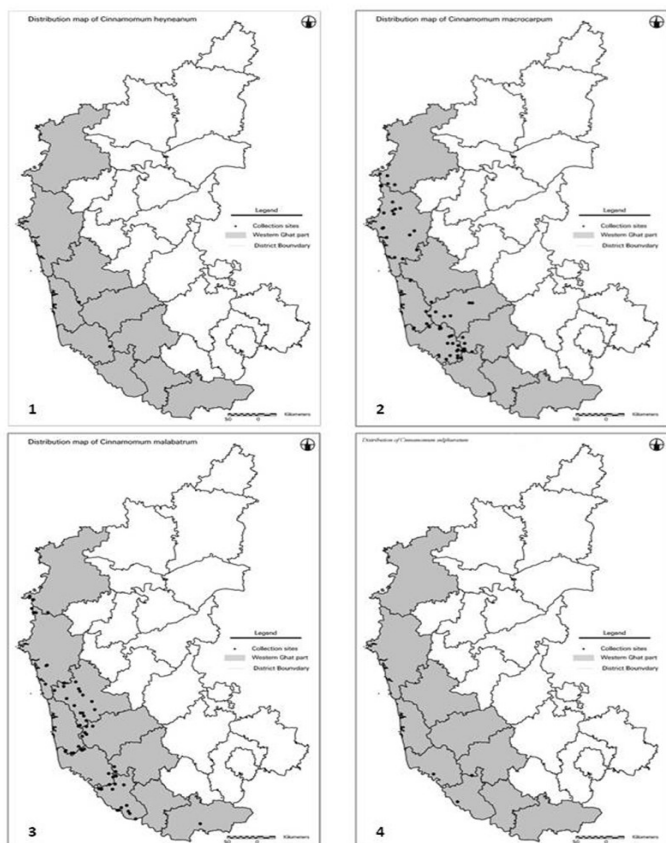


Figure 3a. Maps showing distribution of *Cinnamomum* species in Central Western Ghats, Karnataka, 1 *C. heyneanum*, 2 *C. macrocarpum*, 3 *C. malabattrum*, 4 *C. sul-*

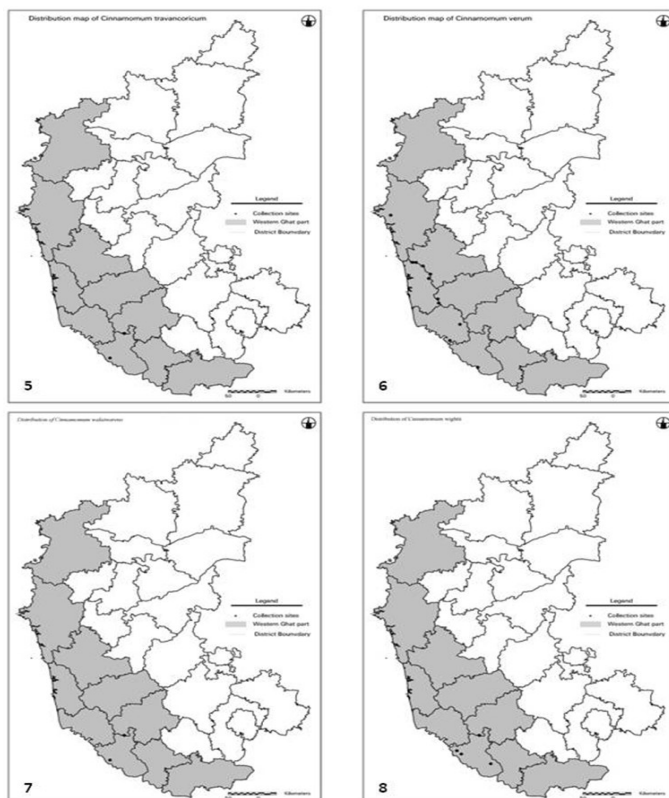


Figure 3b. Maps showing distribution of *Cinnamomum* species in Central Western Ghats, Karnataka, 5 *C. travancoricum*, 6 *C. verum*, 7 *C. walaiwarens*, 8 *C. wightii*

Regeneration status

Regenerations of *Cinnamomum* species were observed in the natural conditions, its showing very poor, but few of the species like *Cinnamomum malabattrum* (Burm.f.) Blume, and *C. verum* J.S.Presl have shown some of the germinations in the natural conditions, but the species such as *Cinnamomum wightii*, *C. travancoricum*, *C. walaiwarens*, *C. sulphuratum*, *C. heyneanum* and *C. macrocarpum* have no germination observed in the forest areas as well as in the nursery. The fresh seeds were collected and used for the study and a standard nursery procedure was used to raise the seedlings.

The germination studies shown after one week the seeds were started germination and by 15 days all seeds were germinated in two species. The germination studies show that *Cinnamomum malabattrum* (Burm.f.) Bl. and *C. verum* J.S.Presl (Figure 4) has shown good response but there are no germination found in other species of *Cinnamomum*s.

Among eight species only two species have shown good response but other six species do not show any response and all these six species were falls under various endangered categories, it need further studies like reproductive biology such as seed setting, dormancy. Several studies have been recommended and highlight the enhancing the germination of forest tree seeds, they used some techniques like scarification (mechanical and chemical), stratification (chilling), storage conditions (temperature, moisture and substratum) and applied plant hormones (Gibberelins, Abscisic acid, Ethylene and Auxins), all these hormones reduce the dormancy period and help to germination of seeds, ethylene affect on radical growth (Iralu et al., 2019). Non germinated seeds have may be long dormancy period it prevent germination, it recommends that using of modern nursery techniques such as paper towel methods, different combinations of nursery mixtures will give good results.

CONCLUSION

Eight species have been identified and herbarium specimens were prepared for all visited locations, these voucher specimens deposited in Herbarium, Botanical Garden, University of Agricultural Sciences, GKVK campus, Bangalore. These voucher specimens useful for future research regarding *Cinnamomum* species. Morphological studies were made for Bark, Leaves, flowers and fruits. These characters are recorded and compared with each other to see the variation among the *Cinnamomum*'s. Present research highlight the *Cinnamomum*'s of Karnataka with emphasis on distribution, taxonomic identification, status, and conservation status. This data is expected to benefit to forest management, conservation and further research on phytochemistry, as *Cinnamomum*'s are the economically very important species used in various pharmaceutical and other industries, because of its high exploitation and destructive collection, some of the *Cinnamomum*'s are listed in various RET category.

The species such as *C.walaiwarens* Kosterm. and *C.wightii* Meissn. represented by a few individuals in the Kodagu district, this indicates the status of the species, many species are affected by debarking and collection of buds and almost lost the regeneration ability and warrants immediate protection and conservation measures. Species such as *C. riparium* collected by earlier botanists could not be located during present study.

Total eight species have been recorded and their distribution maps were given. The regeneration studies that are carried out for some species and simple methodology to raise the seedlings are developed that are useful for mass cultivation. All *Cinnamomum* species are very good medicinal plants, every part of the plants-bark, wood, leaves, buds, flowers, fruits and roots finds some uses and medicinal properties, so it needs to be conservation and propagation.



Figure 4. Showing germination studies of *C. verum* J.S Presi and *C. malabatum* (Burm. f) Blume

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REFERENCES

- Akanksha Rani, Chitra Pande, Geeta Tewari and Kiran Patni (2017). A review on aroma profile of *Cinnamomum* species in North and North East India. *World Journal of Pharmaceutical Research* 6 (11); 200-221.
- Burkill, I.H., 1966 A dictionary of the Economic Products of the Malaya Peninsula Vol.1, A-H; p 1-1240.
- Diego P.de Oliveira, Mauro M. Teixeira (2021). Medicinal plants and their potential use in the treatment of rheumatic diseases. In *Inflammation and Natural Products* Eds. Sreeraj Gopi, Augustine Amalraj, Ajaikumar Kunnumakkara, Sabu Thomas. Academic Press.
- Edgardo P. Lillo, Inocencio E. Buot JR., Archiebald B. Malaki, Steve Michael T. Alcazar, Raamah Rosales, John Lou B. Diaz, Bernardo R. Redoblado, Glory Grace G. Gealon (2020). Leaf architectural characteristics of *Cinnamomum cebuense* Kosterm. (Lauraceae) distributed in different geographical locations, taxonomic identification and conservation concerns. *BIODIVERSITAS* 21 (1); 246-251.

- Viheno Iralu, Humayun Samir Ahmed Barbhuyan, Krishna Upadhaya (2019). Ecology of seed germination in threatened trees: a review. *Energ. Ecol. Environ.* <https://doi.org/10.1007/s40974-019-00121-w>
- Javad Sharifi-Rad, Abhijit Dey, Niranjana Koirala, Shabnum Shaheen, Nasreddine El Omari, Bahare Salehi, Tamar Golosvili, Nathália Cristina Cirone Silva, Abdelhakim Bouyahya, Sara Vitalini, Elena M. Varoni, Miquel Martorell, Anna Abdolshahi, Anca Oana Docea, Marcello Iriti, Daniela Calina, Francisco Les, Víctor López, and Constantín Caruntu. (2021). *Cinnamomum* Species: Bridging Phytochemistry Knowledge, Pharmacological Properties and Toxicological safety for Health Benefits.
- Kostermans, A.J.G.H (1983) THE SOUTH INDIAN SPECIES OF *CINNAMOMUM* SCHAEFFER (LAURACEAE), *Bull.Bot.Surv. India* 25(1-4); 90-133.
- Kostermans, A.J.G.H (1964) *Bibliographia Lauracearum*. Ministry of National Res., Djakarta.
- Laloo, D, A.N.Sahu, S.Hemalatha and D. Dubey (2012). Pharmacognostical and phytochemical evaluation of *Cinnamomum wigtii* Meissn. *Indian Journal of Natural Products and Resources* 3(1); 33-39.
- Manilal, K.S and Shylaja (1986) A NEW SPECIES OF *CINNAMOMUM* SCHAEFFER (LAURACEAE) FROM MALABAR, *Bull.Bot.Surv.India*, 28(1-4); 111-113.
- Pascal J.P (1986), Explonatory booklet on the forest map of South India (Sheet Belgaum-Dharwar-Panani-Shimoga, Mercara-Mysore) Travaux dela section scientifique et technique; t 23, French Insititute of Pondicherry, Pondicherry.
- Pascal J.P and Ramesh, B.R., 1987. A field key to the trees and lianas of the evergreen forests of the Western Ghats (Inida), 2nd ed.. Travaux dela section scientifique et technique; t 23, French Insititute of Pondicherry, Pondicherry, 238 p.
- Remya Krishnan, R.V, E.S. Santhoshkumar, P.M. Radhamany, G. Valsaladevi (2020). Taxonomic Significance of Floral Morphology in *Cinnamomum* Schaeffer (Lauraceae) From South India. *Journal of Scientific Research* 25(1); 144-50.
- Remya Krishnan R.V., E.S. Santhosh Kumar, Radhamany P.M., Valsaladevi G. and Jagadeesan R (2014). *Cinnamomum mathewianum* sp. nov. (Lauraceae): A new species from Kerala, India. *International Journal of Advanced Research*, 2 (7); 29-32.
- Saldanha, C.J and Dan H.Nicolson (1976) Flora of Hassan district Karnataka, India, *Amerind Publishing Co.Pvt. Ltd.*, New Delhi.
- Saldanha, C.J (1984) Flora of Karnataka, *Oxford and IBH publishing House* New Delhi, Vol-I
- Soh Wuu-Kuang (2011). Taxonomic revision of *Cinnamomum* (Lauraceae) in Borneo. *Blumea* 56: 241–264.
- Willis, J.C (1973) A Dictionary of the flowering plants and ferns. 8th edn. Revised by H.K.Airy Shaw. Cambridge.
- Yang, Zhi; Liu, Bing; Yang, Yang; Ferguson, David K. (2022). Phylogeny and taxonomy of *Cinnamomum* (Lauraceae). *Ecology and Evolution*. 12(10): 1-19. <https://www.iucnredlist.org/species>

