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RESEARCH COMMUNICATION

Cinnamomum macrophyllum Miq. (Lauraceae): A new distributional record for the Indian mainland

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Abstract

Genus *Cinnamomum* Schaeffer (Lauraceae) is represented by 35 species and 3 varieties in India; of which 22 taxa are endemic and 13 are exclusively confined to the Western Ghats. *Cinnamomum macrophyllum* Miq. a taxon of Indonesian origin was reported from the Nicobar Islands in the Indian boundaries. Present study reported the occurrence of *C. macrophyllum* Miq. from Bhimashankar Wildlife Sanctuary in the Northern-Western-Ghats, a new addition to the flora of Indian mainland. Detailed morphological description and measurements were recorded using fresh plant specimens. An identification key and comparison of characters with allied species, viz., *C. burmannii* (Nees & T. Nees) Blume and *C. verum* J. Presl. is provided for the distinction between the taxa. The possible International Union for Conservation of Nature (IUCN) conservation status and geographical distribution is provided.

Keywords: *Cinnamomum macrophyllum;* Lauraceae; least concern; Maharashtra; new record; Northern-Western-Ghats

Introduction

The genus *Cinnamomum* Schaeffer (Lauraceae) was first described in 1760, based on *Cinnamomum verum* J. Presl. as its type representative species (1). The taxa of this genus are characterised by aromatic, trinerved, leaves, paniculate inflorescences, flowers with 9 stamens and fruits seated on cupules (2). Traditionally the genus was considered to comprise around 350 species in the world, that were naturally distributed across the tropical and subtropical regions of Asia, South America, Australia and the Pacific (2–8). Recent phylogenetic and taxonomic revision have transferred the American species of *Cinnamomum* to the genus *Aiouea* Aubl. (9). Consequently, the Old World *Cinnamomum* Schaeffer nom. cons. now contains 227 accepted species distributed mainly in Asia, South-East Asia and Australia (10).

In a review of the genus *Cinnamomum* total of 45 taxa (43 species and 2 infraspecific taxa) were recorded to occur in India including 24 endemic taxa of which 13 were exclusively confined to the Western Ghats (5). In a recent taxonomic work this number is reduced to 35 species and 3 varieties because of 23 non-confirmed taxa due to lack of sufficient literature or specimens (4). These taxa included 22 taxa endemic to India. The taxa of this genus prefer evergreen to semi-evergreen, moist, tropical hilly forest habitats with altitudinal range from 125–2500 m above sea level (4). Economically, *Cinnamomum* is well known as the source of the spice "Cinnamon" and several species produce camphor and other essential oils such as cinnamaldehyde, eugenol and safrole (11–13). The bark, twigs and leaves of different species are also widely used as spices and flavouring agents (4).

During a field exploration in the Northern Western Ghats, Maharashtra, India, in 2010, an interesting specimen of *Cinnamomum* from the Bhimashankar Wildlife Sanctuary in Pune district was collected. The specimen was in vegetative state but did not match with any reported taxa of the genus from this region (14, 15). The visits in the sanctuary and surroundings resulted in the recording of the same taxon in 2 sacred groves. However, no flowering and fruiting was observed and the identity of species remained unconfirmed. The species was not mentioned in previous work on floristic diversity of Bhimashankar Wildlife Sanctuary because of lack of flowering state (16). The prolonged observations in natural population of species for about 15 years period failed to record the reproductive state. Interestingly, the original protologue of this species is based on vegetative characters and flowering characters are lacking (3, 4, 17). After critical examination of the collected specimens and a thorough review of relevant literature and comparison with herbarium specimens including collections from Indonesia (Vriese, W H. de (s.n.), Digital image K000778686) and specimens at Central National Herbarium (CAL), Botanical Survey of India, Kolkata, the identity of collected specimens was confirmed as *Cinnamomum macrophyllum* Miq. (10).

The present collection of *C. macrophyllum* Miq. from Bhimashankar Wildlife Sanctuary, in Northern Western Ghats of Maharashtra state, highlights the further range expansion of this species on the mainland of India.

Materials and Methods

Study area

The Bhimashankar Wildlife Sanctuary is situated in the Northern Western Ghats, Maharashtra along the crestline of Sahyadri, spreading over 130.78 km^2 between 19.0226361–19.2305555 N & 73.4827777–73.6308333 E. The elevation ranges between 340–1208 m above mean sea level. The vegetation is divided into evergreen, semi-evergreen and moist deciduous forests.

Field work and herbarium

The specimens were collected during the field surveys for documentation of floristic diversity of the sanctuary during 2010–2012. Voucher specimens were prepared and processed using standard techniques (18). The specimens were deposited in BJB (Balasaheb Jadhav Botany Department Herbarium). The identification was confirmed based on observed morphological characters of young branches and leaf characteristic and comparison with the original protologue (3), available literatures as well as with the herbarium specimens available at CAL and Kew which are mentioned below under subheading specimen examined (1–10, 14, 15, 17).

Threat assessment

Possible IUCN threat status is estimated based on the GeoCAT mapping involving previous locations of Indonesian Islands and newly added locations of Nicobar Islands and North Western Ghats (19). The area of occupancy (AOO) based on by-default defined cell width of 2 km per location point.

Results

The results of the present study revealed that, *C. macrophyllum* is being first time recorded from Indian mainland, in the Northern Western Ghats. Its probable threat status as per IUCN guidelines is predicted. The detail results are presented below.

Taxonomic treatment

Diagnosis - *Cinnamomum macrophyllum* Miq. is morphologically allied to *C. burmannii* (Nees & T. Nees) Blume but differs in having large elliptic-lanceolate leaves, young branchlets fine puberulous at apex and lateral veins of accessories forming nearly squarish loops. It is not a morpho-variable of *C. verum* Presl. Therefore, the differences between these 3 species are given below (Key and Table 1).

Key

1. Leaves with strong areolate reticulation on both surfaces by minor nervules. 2

1. Leaves without strong areolate reticulation by minor nervules . . . . . *C. verum*

2. Leaves smaller, 9–14 × 3–5 cm; young branchlets glabrous at apex, terminal buds tomentellous sericeous, accessory veins reach up to 2/3 of leaf length; lateral veins of accessories forming large oblique loops . . . . . *C. burmannii*

2. Leaves larger, 18–35 × 6.5–9.5 cm; young branchlets fine puberulous at apex, terminal buds pilose, accessory veins reaching to > 3/4 of leaf length; lateral veins of accessories forming nearly straight, large squarish loops . . . . . *C. macrophyllum*

Cinnamomum macrophyllum Miq. Ann. Mus. Bot. Lugduno-Batavi 1:269. 1864; Kosterm. in Reinwardtia 8:52, 1970; Gangopadhyay Bull. Bot. Surv. India 48(1–4):154, 2006. Vern. Name (Marathi): *Mothe Tamalpatra.*

Evergreen tree, up to 20 m in height (ca. 3–15 m), branchlets slender, terete below, smooth, blackish-brown, glabrous, compressed above, sparsely puberulous at extreme apex (below the buds). Buds ovate, lanceolate, acute at apex. Leaves opposite at apex, sub-opposite below, typically glossy, greenish-brown, glabrous above; paler, minutely appressed puberulous beneath, elliptic-lanceolate ca. 18–35 cm to 6.5–9.5 cm., equally or sub-equally acute to cuneate at base; entire margin, flat with acuminate apex. Three-veined, accessories incomplete, slender, veins faint above, raised and prominent beneath. Lateral veins of accessories forming distinct nearly straight squarish loops along marginal veins, prominent, tertiary veins distinctly scalariform, sometimes forked, prominent on both surfaces, minor nervules areolate-reticulate more prominent above. Petiole ca. 12–14 mm × 1.5–1.9 mm flat and shallow channelled above terete beneath. Leaves strongly aromatic of specific cinnamon aroma. Flowers and fruits not seen (Fig. 1A).

Table 1. Comparison of the characters between allied species

Characters	*Cinnamomum macrophyllum* Miq.	*Cinnamomum burmannii* (Nees & T. Nees) Blume	*Cinnamomum verum* J. Presl
Habit	Tree, 20 m tall	Trees, 14 m tall	Trees, 5–20 m tall
Stem	Young branches, blackish brown, puberulous at apex, terminal bud ovate-lanceolate, acute at apex, densely pilose.	Young branches, angled, brown, glabrous, terminal bud ovate, tomentellous to sericeous.	Young branches angled, reddish-brown, sparsely minutely puberulous. Terminal buds ovate, acuminate at apex, sparsely pilose or tomentellous.
Leaves	Large, elliptic-lanceolate, 18–35 × 6.8–10 cm	Small, ovate-oblong to lanceolate, 9–14 × 3–5 cm	Small to medium, broadly ovate-oblong-elliptic-lanceolate, 4–13 × 2.2–6.8 cm
Venation	Three veined some distance ca. 1.5–2.5 cm above from base. Accessories incomplete, slender and faint above, prominent beneath, reaching > 3/4 length of the leaf, not reaching base of acumen. Lateral veins of accessories forming distant more or less straight squarish loops along marginal veins, prominent. Minor nervules areolate-reticulate, prominent above.	Three veined from base. Accessories incomplete, reach up to 2/3 of the leaf length. Lateral veins of accessories forming large oblique loops along margin. Miner nervules faint to prominent, areolate-reticulate to reticulate on both surfaces.	3–5 veined from base, less prominent, accessories prominent, incomplete, not reaching leaf tip. Accessory veins reaching to acumen base. Lateral veins of accessories forming prominent oblique loops along margin. Minor nervules areolate-reticulate, faint above, prominent or faint beneath.
Leaf surface	Often glabrous above and minutely appressed puberulous beneath.	Glabrous, non-glossy above, scattered puberulous on veins beneath.	Glabrous, glossy to non-glossy above, sub glaucous to glaucous beneath.
Leaf apex	Acuminate	Shortly acuminate	Obtuse - acute - shortly acuminate
Base	Acute to cuneate	Acute	Truncate or subcordate or rounded
Petiole	Ca. 12–24 mm long	5–12 mm long	15–18 mm long
Flowers	Not seen	Greenish-white ca. 5 mm long	Cupular companulate, Yellowish-green or greenish-white, ca. 1.2 cm long
Pedicels		4–6 mm long	Angular, 14–18 cm long
Fruits		Ellipsoid, ca. 8 × 5 mm long	Ellipsoid or oblong-ovoid, ca. 16 mm long

Habitat

Semi evergreen forests, between ca. 890–1000 m above sea level in cool and moist places along the streams. It grows in association with *Garcinia talbotii* Raizada ex Santapau; *Ancistrocladus heyneanus* Wall. ex J. Graham.; *Myristica malabarica* Lam.; *Cinnamomum virens* R.T. Baker; *Mangifera indica* L.; *Macaranga peltata* (Roxb.) Mull.-Arg. and *Memecylon umbellatum* Burm. f.

Distribution

Indonesia; Islands viz., Batjan, Obi, Halmaheira, Morotai and Ceram from Indonesia (Maluku). India; Andaman and Nicobar Islands, now from Indian mainland- Bhimashankar, Pune District, Maharashtra.

Specimens examined

INDIA, Nicobar Islands, Kamorta Island, February 1875, S. Kurz, 383654 (CAL Ster.); Nicobar, March 1897, R L Heinig s.n., (CAL Ster.); Maharashtra, Pune District, Bhimashankar, 19.07719 N 73.53920 E, 880 m, August 2010, S S Rahangdale, 1950 (BJB); Bhatti, 19.14902 N 73.54744 E, 980 m, October 2010, M R Bhise, 23713(BJB); Bhimshankar, August 2011, S R Rahangdale 24504 (BJB); Bhatti, January 2019, S R Rahangdale, 24912 (BJB); Ahupe, 19.18226N 73.57971E, 960 m, May 2024, S S Rahangdale, 24998 (BJB) (Fig. 1B) Vriese, W H de (s.n.), Digital image K000778686(K) (10).

IUCN Status

Least Concern (LC), based on Extent of Occurrence (EOO) of 95584 km^2 and AOO of 28 km^2(20). The 'GeoCAT' online application was used for status analysis considering the previous and present new locations. By inclusion of the present locations the revised EOO is estimated to 1977013.6 km^2 and the AOO is 44.0 km^2 giving the status of endangered (EN) to the taxon (Fig. 1C). Final IUCN assessment requires assigning the taxon and due process by the authorities.

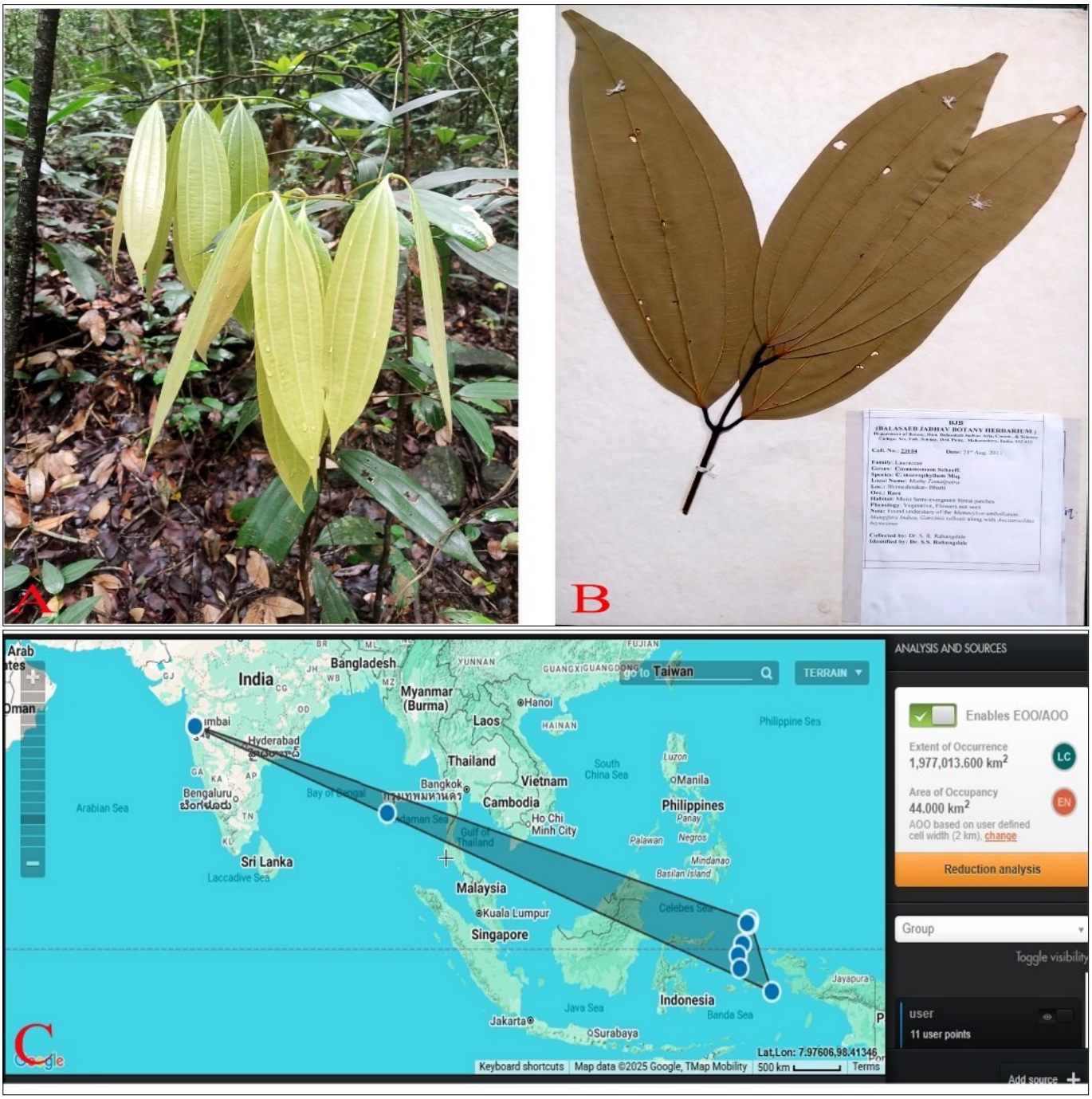

Fig. 1. *Cinnamomum macrophyllum* Miq.: A. Habit in the natural habitat; B. Herbarium specimen and C. The distributional map in GeoCAT including present locations.

Discussion

The present distribution status of the species in India is in 2 locations viz., Andaman & Nicobar Island and Bhimashankar in the Northern Western Ghats as present collection (4). These 2 locations represent 2 separate populations as there is no possibility of manual introduction or natural dispersal. Interestingly, the taxon was reported only based on vegetative characters and the reproductive characters were not observed as per the original protologue (3). Even the population of Nicobar and from the Indonesian Islands were also sterile (4, 17). All the descriptions and reports are based on the vegetative morphology only. The present population was under observation since, 2010 but the authors have not observed any flowering on the plants. Previous researchers stated that, "Of this species only sterile material is known. It is typified by the minute, coarse tomentum of the young branchlets and the lower leaf surface of young leaves (17). The specimen: Kostermans 1230 was collected from a tree of 20 m height and 20 cm diameter with rather hard wood; the leaves of this specimen vary between 4 × 14 and 6 × 25 cm and apparently represent the mature stage; all other specimens were collected from saplings (leaves up to 11 × 40 cm)". This statement indicates the nature of species having the largest leaves in the genus *Cinnamomum*. The present specimens are also of large leaves reaching to ca. 35cm in length. Thus, this is the first record of occurrence of *C. macrophyllum* from the Northern Western Ghats on Indian mainland.

It was reported to grow in lowland forests between 0–30 m altitude in Indonesian Islands and the forests were under threat of deforestation and habitat destruction for agriculture (19). The present locations are in the protected areas of wildlife sanctuary; therefore, the new population is protected from any threats. The primary estimation of threat assessment as per IUCN guidelines 3.1 places the species to EN category. Previous assessment was done in 2019 but the Criteria were not given (19). The taxon needs re-assessment in the light of present new populations and locations in India. The assessment requires prescribed process, which is beyond the scope of this study.

Conclusion

The present study confirms the occurrence of *Cinnamomum macrophyllum* Miq. documenting a new distributional range in the Northern Western Ghats. The IUCN conservation status of the species requires reassessment in light of the revised estimates of its EOO and AOO.

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Authors' contributions

SSR dealt with the taxonomic part along with preparation of manuscript. JJ has covered the herbarium references and confirmation of identity. SRR has taken exhaustive field works and collection of the information for present study. All authors read and approved the final manuscript.

Compliance with ethical standards

Conflict of interest: Authors do not have any conflict of interests to declare.

Ethical issues: None

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