

Discovery of a new *Myristica* swamp in the Northern Western Ghats of India.

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Abstract: *Myristica* swamps are one of the world's unique freshwater ecosystems. In recent years there has been an increase in the number of reports about their distribution along the western Ghats. In the current paper, we report a new distribution record for the occurrence of *Myristica* Swamp from the northern part of the western Ghats of Maharashtra. The *Myristica* swamp is located within the Bhalandeshwar Sacred Grove of Kumbhal Bagwadi, Dodamarg Maharashtra, India. This forms a second report from the state of Maharashtra. Frequent field visits were made to study and document the floral assemblage and biodiversity in the swamp from, November 2023 to January 2024. The swamp is dominated by *Myristica magnifica* Bedd. The swamp is a part of a sacred grove and it is protected by Villagers due to religious beliefs. The discovery of this swamp points towards the possibility of the occurrence of more swamps in this region. Hence there is a need for a systematic survey for documenting swamps in the different areas.

Keywords: Endemic flora, Northern Western Ghats, Traditional knowledge, Threatened Wetland Ecosystem.

Myristica swamps represent highly important yet one of the threatened freshwater ecosystems of the world. As the name suggests, the plants of the family Myristicaceae dominate the swamps. The high watershed value of these swamps supports many rare, endemic flora and fauna (Chandran et al. 2010). They are also denoted as living fossils due to the primitive nature of *Myristica* plants (Roby et al. 2013). With an evolutionary origin of about 140 million years, the swamps are valuable for evolutionary studies (Chandran et al. 1999; Dharmapalan and Asokhan 2013).

Krishnamoorthy (1960) for the first time, shed light on the occurrence of this unique ecosystem from the south Western Ghats of Kerala, India. Since then, their occurrence has also been studied and reported in the states of Karnataka, Goa, and Maharashtra (Gadgil & Chandran 1989; Santhakumaran et al. 1995; Jose et al. 2014; Sreedharan and Indulkar 2018). The *Myristica* swamp reported from Bambarde-Hewale of Maharashtra forms the first record of the presence of such an ecosystem in the state and the northernmost record in the Western Ghats (Sreedharan and Indulkar 2018).

The literature survey indicates that the swamps show restricted distribution along the Western Ghats of India in small fragmented areas. In the present communication, we are reporting a new site occurrence of *Myristica* swamps from Maharashtra state, India. Pravin Desai runs a homestay and conducts wildlife trails in the different parts of Dodamarg Tilarī Bioregion in Dodamarg Taluka of Sindhudurg District of Maharashtra. During his regular birding trail to Bhalandeshwar sacred grove, while searching for Brown Wood-owls (*Strix leptogrammica*) he observed a huge tree of *Myristica magnifica* Bedd. which led to him discovering the *Myristica* swamp. This was subsequently followed by our visits to the swamp for further studies.

We estimated the area of the sacred grove and the area of the swamp within the sacred grove using Garmin GPS 72s by walking around the grove and swamp. We measured all trees in the swamp with ≥ 30 cm girth at breast height by using a measuring tape, and height by using a Leica geosystem D1 distometer. For *Myristica magnifica*, an obligate swamp specialist, we recorded the height and girth of all individuals. For individuals who were less than 1.3 cm in height, their girth was recorded (ocular estimation). Tree seedlings (GBH < 10 cm) were enumerated from the sample plots to determine the regeneration status of tree species in the *Myristica* swamps. Additionally, we have created a checklist for other woody plant species to understand the species diversity and identify the associated species in the area.

The *Myristica* swamp is located in the Bhalandeshwar sacred grove at Kumbraī Bagwadi (Fig. 1). The swamp is dominated by *Myristica magnifica*, which has prominent stilt roots Image 1. The area of the grove and swamp is 8200 m² and 770 m² respectively. A total of 39 plant species were documented (Table 1). We recorded 70 individuals of *Myristica magnifica*, out of which 19 are with a girth of ≥ 30 cm and 51 individuals with a girth of < 30 cm. Given that

51 out of 70 individuals were < 30 cm indicates regeneration of the *Myristica magnifica*. The size class plot for girth and height is given in Fig. 2 and 3 respectively. The rank abundance curve shows that the swamp species exhibit low species evenness, with *Myristica magnifica* being the dominant species in the swamp (Fig. 4). The undergrowth in the swamp is dominated by the fern *Bolbitis presiliana* Ching and *Pandanus furcatus* Roxb (Image 1).

The local communities worship the deity Bhalandeshwar, who is believed to be an avatar of Lord Shiva and they have been performing religious rituals since the 16th century. According to the elders, the land was awarded as jagir during the reign of the Adilshahi Dynasty. The spring that emerges at the temple, serves as a source of drinking water for local people. The swamps offer various ecological services, like groundwater recharge, carbon sequestration, natural barriers against floods, habitat, and food for many aquatic and aerial fauna. The fruits of *Myristica* are important food plants for threatened hornbills (Gopal et al. 2021). The occurrence and discovery of this second swamp in the northern Western Ghats of Maharashtra strongly point toward the possibility of more swamps in this region. Hence, a systematic survey is needed to document swamps in the different areas. Religious beliefs and sustainable use of the water from swamps have been the important reasons for protecting this swamp for several decades.

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Table 1. Checklist of plants documented in the *Myristica* swamp of Bhalandeshwar

Sr.no	Species Name	Family	Habit	IUCN status
1	<i>Actephila excelsa</i> (Dalzell) Müll.Arg.	Phyllanthaceae	Small tree	Least Concern
2	<i>Allophylus cobbe</i> (L.) Forsyth f.	Sapindaceae	Liana	NA

3	<i>Anamirta cocculus</i> (L.) Wight & Arn.	Menispermaceae	Liana	NA
4	<i>Antidesma nigricans</i> Tul.	Phyllanthaceae	Shrub	NA
5	<i>Aporosa cardiosperma</i> (Gaertn.) Merr.	Phyllanthaceae	Tree	Vulnerable
6	<i>Artocarpus hirsutus</i> Lam.	Moraceae	Tree	Least Concern
7	<i>Bolbitis presiliana</i> Ching.	Dryopteridaceae	Tree	Least Concern
8	<i>Bridelia retusa</i> (L.) A.Juss.	Phyllanthaceae	Tree	Least Concern
9	<i>Bridelia scandens</i>	Phyllanthaceae	Scandent shrubs	Least Concern
10	<i>Calophyllum apetalum</i> Willd.	Calophyllaceae	Tree	Vulnerable/ Endemic
11	<i>Capparis spp</i>	Capparaceae	Climber	NA
12	<i>Carallia brachiata</i> (Lour.) Merr.	Rhizophoraceae	Tree	Least Concern
13	<i>Caryota urens</i> L.	Arecaceae	Tree	Least Concern
14	<i>Cleodendron sp.</i>	Lamiaceae	Shrub	NA
15	<i>Combretum sp.</i>	Combretaceae	Herb	NA
16	<i>Diospyros thwaitesii</i> (Hiern) Bedd.	Ebenaceae	Tree	Vulnerable
17	<i>Dracaena elliptica</i> Thunb. & Dalm.	Asparagaceae	Herb	Least Concern
18	<i>Ficus hispida</i> L.f.	Moraceae	Tree	Least Concern
19	<i>Ficus nervosa</i> Roth	Moraceae	Tree	Least Concern
20	<i>Garcinia indica</i> (Thouars) Choisy	Clusiaceae	Tree	Vulnerable
21	<i>Gymnosporia rothiana</i> (Walp.) M.A.Lawson	Celastraceae	Shrub	NA
22	<i>Holigarna arnottiana</i> Hook.f.	Anacardiaceae	Tree	Endemic
23	<i>Ipomoea campanulata</i> L.	Convolvulaceae	Climber	NA

24	<i>Ixora nigricans</i> R.Br. ex Wight & Arn.	Rubiaceae	Small tree	NA
25	<i>Ixora brachiata</i> Rox.	Rubiaceae	Tree	NA
26	<i>Lagenandra toxicaria</i> Dalzell	Araceae	Herb	Least Concern
27	<i>Leea indica</i> (Burm.f.) Merr.	Vitaceae	Small tree	Least Concern
28	<i>Lophopetalum wightianum</i> Arn.	Celastraceae	Tree	Least Concern
29	<i>Macaranga peltata</i> (Roxb.) Müll.Arg.	Euphorbiaceae	Tree	NA
30	<i>Machilus glaucescens</i> (Nees) Wight	Lauraceae	Tree	NA
31	<i>Myristica magnifica</i> Bedd.	Myristicaceae	Tree	Endangered/ Endemic
32	<i>Nothopegia castaneifolia</i> (Roth) Ding Hou	Anacardiaceae	Tree	Critically Endangered / Endemic
33	<i>Pandanus furcatus</i> Roxb	Pandanaceae	Shrub	NA
34	<i>Pothos scandens</i> L	Araceae	Climber	NA
35	<i>Premna coriacea</i> C.B.Clarke	Lamiaceae	Climber	NA
36	<i>Pterospermum acerifolium</i> (L.) Willd.	Malvaceae	Tree	Least Concern
37	<i>Sterculia guttata</i> Roxb	Malvaceae	Tree	NA
38	<i>Tabernaemontana alternifolia</i> L.	Apocynaceae	Tree	NA
39	<i>Tetrastigma</i> sp.	Vitaceae	Climber	NA

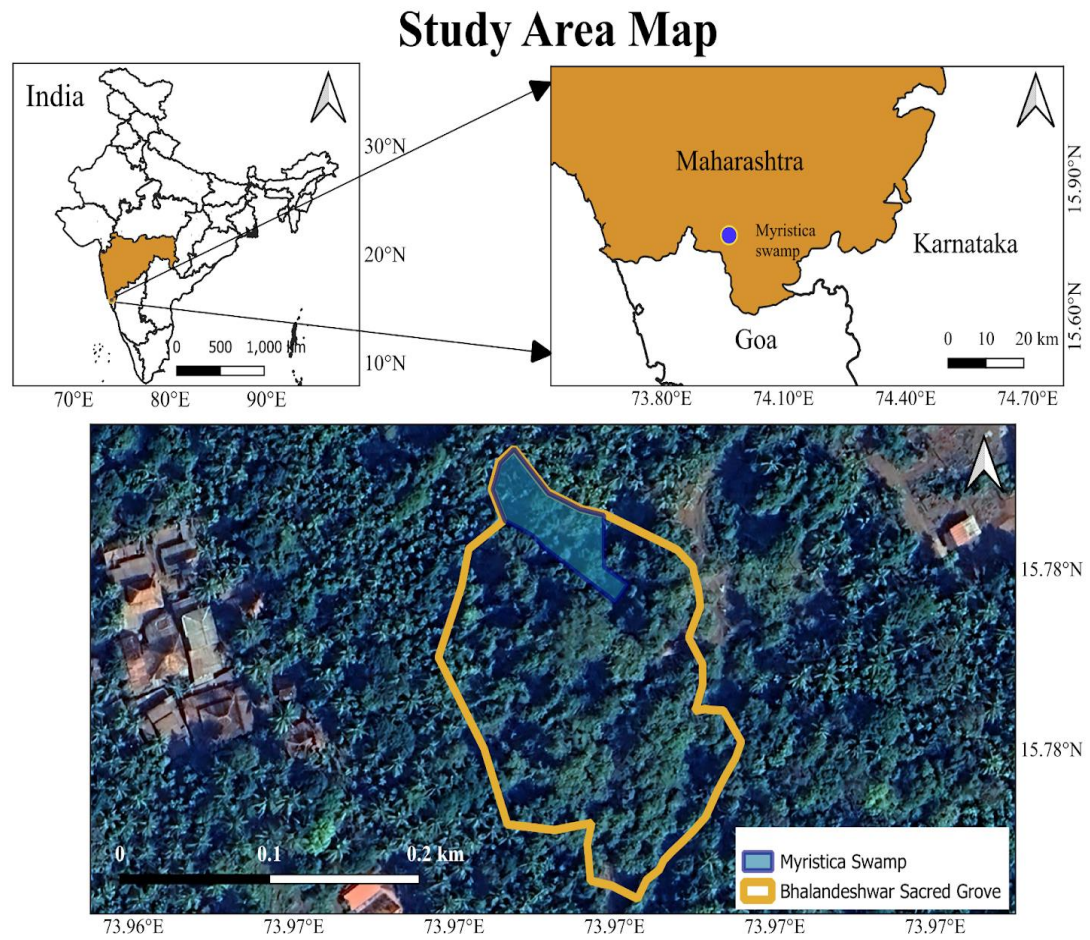


Figure 1. Map showing the location of Bhalandeshwar Sacred Grove and Myristica Swamp as on December 16, 2023.

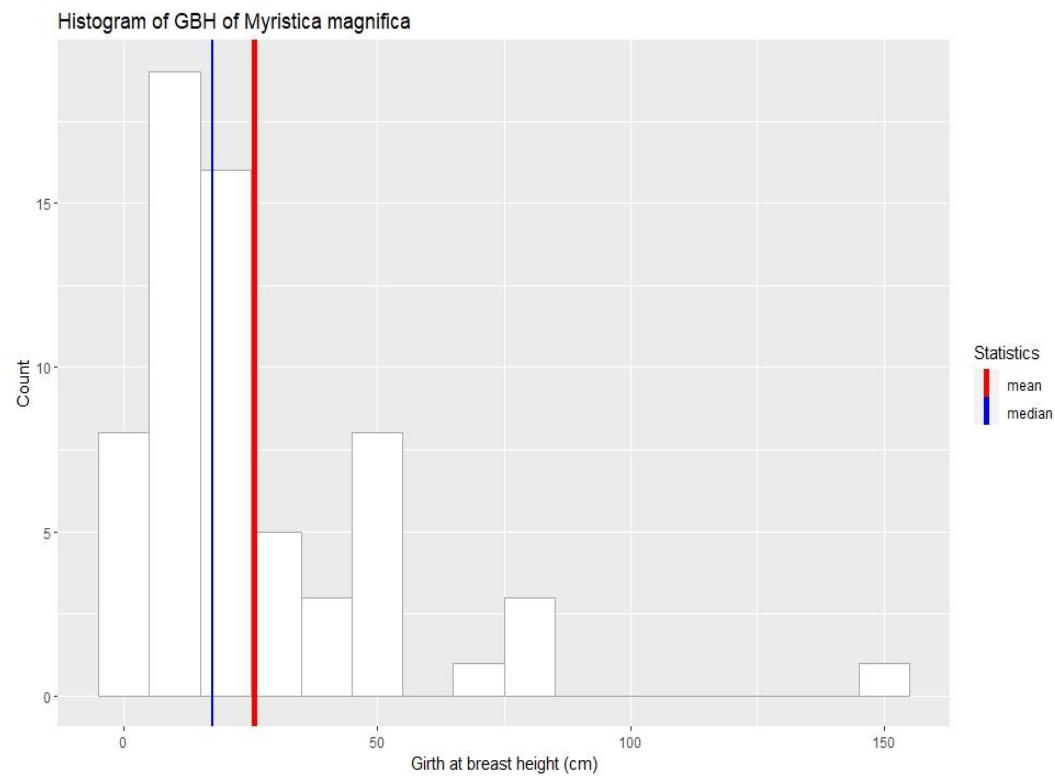


Figure 2. Histogram of girth at breast height of *Myristica magnifica* individuals that were > 1.3 cm in height.

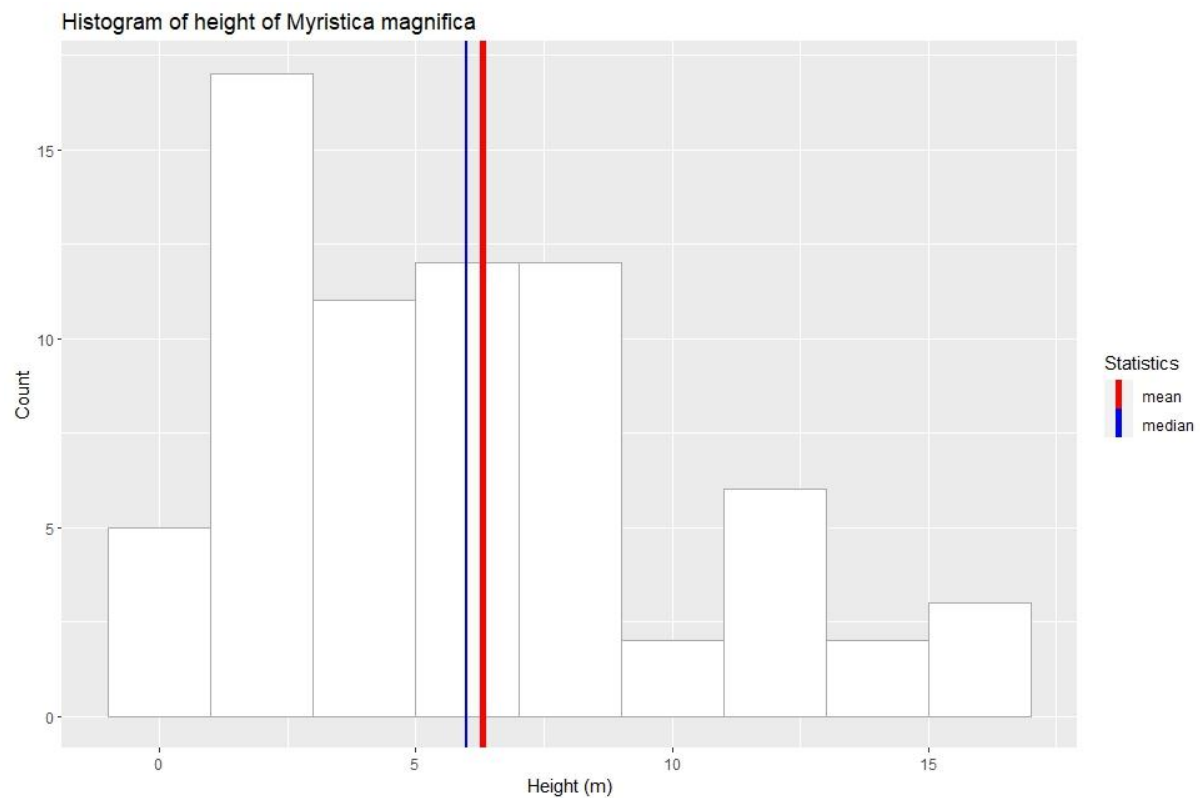


Figure 3. Histogram showing *Myristica magnifica* tree height distributions in the swamp. There is a greater representation of saplings indicating the regeneration of trees in the swamp.

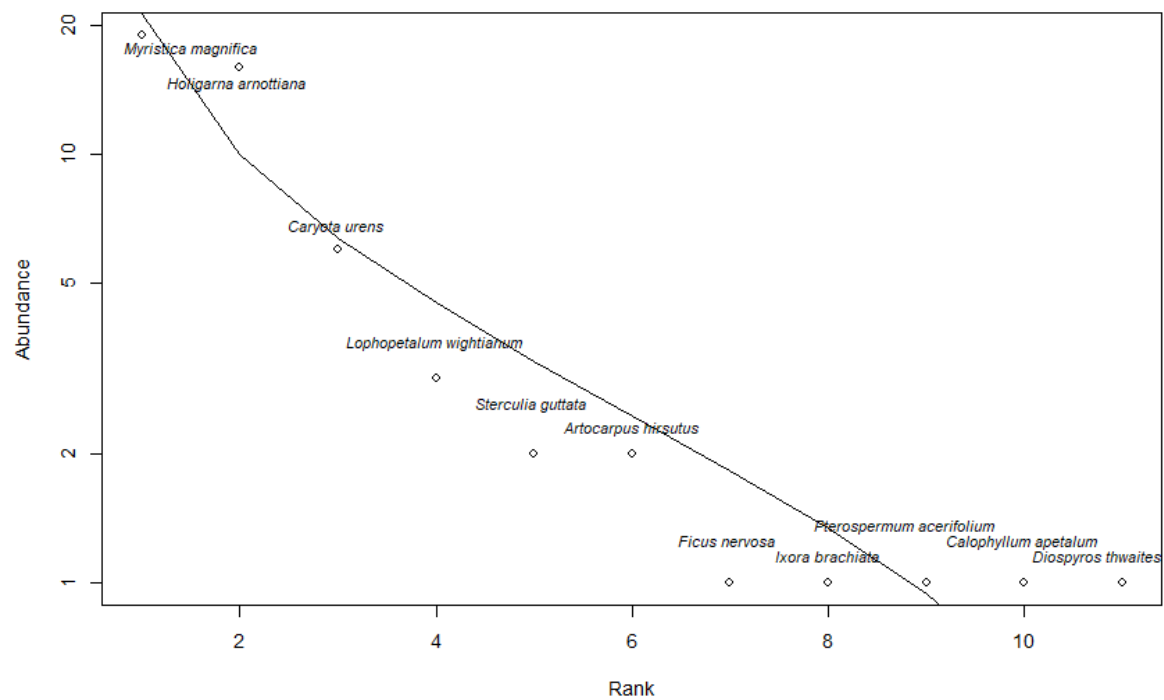


Figure 4. Rank abundance curve for all individual woody plant tree species in the *Myristica* swamp. Only those individuals with ≥ 30 cm girth at breast height were included in this plot.



Image 1. A) *Myristica magnifica* with undergrowth of fern, *Bolbitis presiliana*, and edge vegetation B) Water inundation in the swamp and Stilt roots of *Myristica magnifica* C) Source of water for the swamp D) God idol being worshiped in the sacred grove.

Author Contributions

Pravin Desai discovered the swamp and assisted with fieldwork; Vishal Sadekar conducted the field survey and wrote the manuscript; Shital Desai assisted with fieldwork and wrote the manuscript. All authors contributed critically to the drafts and gave final approval for publication.