Hyphaene dichotoma (Wight) Furtado (Indian Doum Palm/Ravan Tad): A Review

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ABSTRACT

Hyphaene dichotoma (Wight) Furtado, commonly known as the Indian Doum Palm or Ravan Tad, is one of the most distinctive members of the family Arecaceae due to its unique dichotomous branching pattern, a rare morphological characteristic among palms. Although the species is believed to have originated in East Africa and the Arabian Peninsula, it has become naturalized in several parts of the Indian subcontinent, particularly along the western coastal belt and isolated inland locations. The species possesses considerable ecological, economic, cultural, and evolutionary significance. Its leaves are traditionally utilized for weaving mats, baskets, hats, and handicrafts, while the fruits are edible and the seeds are employed for ornamental purposes. Despite its importance, *H. dichotoma* is experiencing a continuous decline owing to habitat destruction, urbanization, road expansion, climate change, and poor natural regeneration. Field observations in Dhule district (Maharashtra) revealed the presence of a solitary surviving male tree, with no female individual in the vicinity, thereby preventing sexual reproduction and threatening local extinction. The absence of natural recruitment highlights the urgent need for both *in situ* and *ex situ* conservation strategies, including germplasm conservation, tissue culture, assisted pollination, and reintroduction programmes. Recent germination experiments and conservation initiatives undertaken by researchers, including seed propagation studies and nationwide seed distribution programmes, represent promising steps toward safeguarding this rare palm. This review synthesizes available information on the taxonomy, distribution, morphology, reproductive biology, ecological importance, conservation status, and future management strategies of *Hyphaene dichotoma* in India, with particular emphasis on its conservation in Maharashtra.

Keywords: *Hyphaene dichotoma*, Indian Doum Palm, Ravan Tad, Arecaceae, dichotomous branching, biodiversity conservation, endangered palms.

INTRODUCTION

India is recognized as one of the world's megadiverse countries, harbouring nearly 8% of the global biodiversity and supporting an extraordinary wealth of plant, animal, and microbial diversity (Singh & Dash, 2014). However, rapid urbanization, industrialization, habitat fragmentation, climate change, and anthropogenic disturbances have accelerated the decline of numerous native and introduced plant species, placing several taxa at risk of extinction (Raven et al., 2020; CBD, 2022). Among these, rare palms constitute an important yet often overlooked component of tropical biodiversity because of their ecological, economic, and evolutionary significance.

Hyphaene dichotoma (Wight) Furtado, popularly known as Ravan Tad or the Indian Doum Palm, is one of the most remarkable palm species belonging to the family Arecaceae. Unlike the majority of palms that develop a solitary, unbranched stem, *H. dichotoma* exhibits true dichotomous branching, wherein the main trunk divides into two equal branches that repeatedly bifurcate during growth (Dransfield et al., 2008). This exceptional

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growth pattern is extremely rare among monocotyledonous plants and has attracted considerable interest from botanists studying plant morphology, evolution, and developmental biology.

Although the genus *Hyphaene* is primarily distributed in Africa and parts of the Arabian Peninsula, *H. dichotoma* has become established in several coastal regions of India, particularly in Gujarat, Maharashtra, Goa, and adjoining areas (Govaerts & Dransfield, 2005). Historical evidence suggests that Portuguese traders may have introduced the species to western India during the fifteenth and sixteenth centuries through maritime trade routes from Mozambique, East Africa, and Oman, where the seeds were transported for their oil-rich endosperm and associated economic uses (Johnson, 1998). Over time, the species adapted to India's tropical coastal climate and became naturalized in suitable habitats.

The Indian Doum Palm possesses considerable ecological and socio-economic value. Its edible fruits contribute to local food resources, while the leaves are widely utilized in traditional cottage industries for manufacturing mats, baskets, hats, ropes, and various handicrafts. The hard seeds are also employed in the preparation of decorative articles and handicrafts, providing supplementary income to rural communities (Johnson, 1998). Beyond its economic importance, the species serves as a valuable genetic resource for studies on palm evolution and developmental morphology due to its unique branching architecture.

Despite its importance, populations of *H. dichotoma* have declined substantially throughout its distribution range because of habitat degradation, infrastructure development, overexploitation, limited natural regeneration, and changing climatic conditions (IUCN, 2024). The species has consequently been recognized as a conservation priority in several regions. A particularly alarming situation exists in Dhule district of Maharashtra, where field investigations have documented the survival of a single mature male tree near Methi village along the Songir–Dondaicha State Highway. The absence of female individuals in the surrounding landscape prevents pollination and seed production, effectively eliminating natural regeneration in this isolated population. Furthermore, nearly half of the surviving tree has undergone severe dieback, indicating an increased risk of local extinction.

The persistence of such isolated populations demands immediate conservation interventions. Conventional propagation is constrained by the absence of viable seeds, making alternative approaches such as tissue culture, germplasm conservation, assisted propagation, and the introduction of female plants essential for long-term species recovery. Recent conservation initiatives, including seed germination experiments, ex situ propagation, and nationwide seed distribution programmes organized by the Botanical Survey of India during national botanical events, have demonstrated promising avenues for restoring populations of this unique palm.

The present review aims to compile and critically evaluate available information on the taxonomy, morphology, distribution, reproductive biology, ecological significance, conservation status, and management strategies of *Hyphaene dichotoma*. Particular emphasis is given to its occurrence in Maharashtra, recent field observations from Dhule district, and future prospects for conservation through integrated scientific and community-based approaches.

Taxonomy and Botanical Description

Taxonomic Classification

Hyphaene dichotoma (Wight) Furtado belongs to the family Arecaceae (Palmae), one of the most economically important families of monocotyledonous flowering plants. The genus *Hyphaene* comprises approximately 8–10 species distributed mainly in Africa and the Arabian Peninsula, with *H. dichotoma* representing the only naturally established species in the Indian subcontinent (Dransfield et al., 2008; Govaerts & Dransfield, 2005).

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Taxonomic hierarchy

Taxonomic Rank	Classification
Kingdom	Plantae
Division	Magnoliophyta
Class	Liliopsida (Monocotyledons)
Order	Arecales
Family	Arecaceae
Tribe	Borasseae
Genus	*Hyphaene* Gaertn.
Species	*Hyphaene dichotoma* (Wight) Furtado

Synonyms: *Hyphaene indica* Becc.; *Borassus dichotomus* Wight (earlier classification)

Common Names

Hyphaene dichotoma (Wight) Furtado is known by different vernacular names across its distribution range, reflecting its cultural and regional significance. In English, it is commonly referred to as the Indian Doum Palm or simply the Doum Palm, highlighting its close relationship with the African doum palms of the genus *Hyphaene*. In Maharashtra, the species is popularly known as Ravan Tad or Ravan Tal, names inspired by its distinctive dichotomously branched trunk, which resembles multiple heads or branching forms associated with the legendary figure Ravana in Indian mythology. In Hindi, it is generally known as Doum Palm, while in Gujarati it is also widely called Ravan Tad. These vernacular names not only facilitate local identification but also reflect the historical, ecological, and cultural importance of this unique palm among different communities in India (Dransfield et al., 2008; Johnson, 1998).

The species is distinguished from all other Indian palms by its unique dichotomously branched trunk, a characteristic found only in a few palm species worldwide (Dransfield et al., 2008).

Botanical Description

Hyphaene dichotoma is a slow-growing, perennial palm attaining a height of 8–15 m under favourable environmental conditions. The trunk is stout, cylindrical and greyish-brown with persistent leaf scars. Unlike typical palms that possess an unbranched stem, the trunk divides equally into two branches at a certain height, and each branch continues to bifurcate repeatedly, producing a characteristic candelabra-like crown (Johnson, 1998).

The leaves are large, fan-shaped (costapalmate), bluish-green to greyish-green, measuring 1–2 m in diameter. The petiole is robust, armed with sharp marginal teeth, and terminates in a broad leaf blade divided into numerous rigid segments. These leaves are highly durable and traditionally used in weaving handicrafts and household articles.

The species is dioecious, with male and female flowers borne on separate trees. Male inflorescences are slender and densely packed with numerous small yellowish flowers, whereas female inflorescences are comparatively thicker and produce fewer but larger flowers. Pollination occurs primarily through wind and insects (Corner, 1966).

The fruit is nearly spherical to ovoid, measuring 5–8 cm in diameter, with a fibrous mesocarp surrounding a

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hard endocarp containing one or more seeds. The fruits are edible and consumed locally in several countries. The hard seeds are used for ornamental crafts and jewellery (Johnson, 1998).

Fig. 1: A tree located near Methi village in Dhule district, Maharashtra, India.

Fig. 2. Fruit and seed *of H. dichotoma*

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Distribution and Biogeography

The genus *Hyphaene* is native to tropical and subtropical Africa and parts of the Arabian Peninsula. Species of the genus occur in countries including Mozambique, Tanzania, Kenya, Sudan, Ethiopia, Egypt, Namibia, Botswana, South Africa, Oman, and Yemen (Govaerts & Dransfield, 2005). The genus generally inhabits dry savannahs, riverbanks, coastal plains, and semi-arid ecosystems where groundwater is available.

Historical records suggest that *Hyphaene dichotoma* was introduced into western India during the fifteenth and sixteenth centuries through Portuguese maritime trade from East Africa and Mozambique. Seeds were transported because the oily endosperm served as fuel for ship lamps and possessed commercial value. Some of these seeds were intentionally planted or accidentally dispersed along the western coast, where the warm tropical climate facilitated successful establishment (Johnson, 1998).

At present, the species occurs sporadically along India's western coastal belt, including Gujarat, Maharashtra, Goa and parts of coastal Karnataka. Small populations have also been reported from Diu, Daman, Vasai, Mumbai, Alibag and nearby coastal habitats (Reddy, 1991).

In Maharashtra, *H. dichotoma* is extremely rare. One of the most significant inland occurrences has been documented from Methi village along the Songir–Dondaicha State Highway in Dhule district. This tree has also been recorded in *Flora of Dhule and Nandurbar District*, indicating that it represents an introduced but historically important component of the regional flora (Patil, 2010).

Recent field observations revealed that nearly half of this solitary tree has dried, leaving only a partially living crown. Since no female tree exists in the surrounding area, natural seed production has ceased, placing the local population at imminent risk of extinction (Dhale, personal field observations, 2024–2026).

The restricted distribution, fragmented populations, habitat degradation, and lack of regeneration collectively justify urgent conservation efforts for the species in India.

Morphological and Reproductive Biology

Hyphaene dichotoma possesses one of the most remarkable architectural patterns among monocotyledonous plants. The most distinguishing feature is true dichotomous branching, where the apical meristem divides equally into two growing points. This process is repeated several times throughout the life of the tree, producing a symmetrical branching canopy that resembles a candelabrum (Dransfield et al., 2008). Such branching is extremely uncommon in palms and has considerable significance in studies of plant developmental biology.

The trunk is robust with persistent leaf scars, while the crown bears numerous fan-shaped leaves arranged spirally. The thick cuticle and leathery texture of the leaves help reduce water loss, enabling survival under semi-arid and coastal conditions.

The species is dioecious, meaning male and female flowers occur on separate individuals. Male trees produce numerous branched inflorescences bearing small pollen-producing flowers, whereas female trees bear larger flowers that develop into fruits following successful pollination (Corner, 1966).

The reproductive biology of *H. dichotoma* presents a major conservation challenge in isolated populations. Field investigations conducted in Dhule district by author confirmed that the surviving tree bears only male inflorescences. No female individual has been located within the surrounding landscape, preventing pollination, fruit development, and seed formation. Consequently, natural regeneration has completely ceased in this population.

Although tissue culture offers a promising method for vegetative multiplication, regenerated plants are expected to retain the genetic constitution and sex of the donor plant. Therefore, propagating tissues from the existing male tree alone would produce only male plants, failing to restore reproductive populations. Long-

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term conservation therefore requires identification, introduction, and establishment of female trees from other regions to ensure successful cross-pollination and sustainable seed production (George et al., 2008).

Seed germination in *H. dichotoma* is generally slow because of the hard seed coat and prolonged dormancy. Recent germination experiments undertaken in Maharashtra using seeds collected from different regions have shown encouraging results, providing opportunities for ex situ conservation and future reintroduction programmes.

Conservation Status (IUCN)

Hyphaene dichotoma (Wight) Furtado is regarded as a species of conservation concern because of its fragmented distribution, declining populations, habitat degradation, and poor natural regeneration. According to the International Union for Conservation of Nature (IUCN), the species has been assessed as Near Threatened (NT), indicating that it is close to qualifying for a threatened category in the near future if the factors responsible for its decline continue to operate (IUCN, 2024). The principal threats include habitat loss due to urbanization, road expansion, agricultural intensification, industrial development, climate change, and anthropogenic disturbances. In addition, the slow growth rate, dioecious nature, and dependence on the coexistence of male and female individuals for successful seed production further increase its vulnerability.

In India, *H. dichotoma* occurs in small, isolated populations, particularly along the western coastal regions and a few inland localities. One of the most critical populations is represented by a solitary mature tree located near Methi village in Dhule district, Maharashtra. Field observations conducted by author during 2024–2026 revealed that this surviving individual is a male tree, producing only staminate inflorescences. The absence of nearby female trees has completely prevented pollination, fruit formation, and natural regeneration. Moreover, nearly half of the tree has undergone severe dieback, emphasizing the imminent risk of local extinction. Such isolated populations are highly susceptible to stochastic events, diseases, and environmental stresses, making immediate conservation intervention imperative.

Conservation of *H. dichotoma* requires an integrated strategy involving both in situ and ex situ approaches. In situ conservation should focus on protecting existing mature trees through legal safeguards, habitat restoration, and declaration of significant specimens as Biodiversity Heritage Trees under the Biological Diversity Act, 2002. Ex situ measures should include seed banking, germplasm conservation, nursery development, tissue culture, and assisted propagation programmes. Since vegetative propagation through tissue culture from the existing male tree is likely to produce only male progeny, identifying and introducing female plants from other regions is essential for restoring viable breeding populations. Public awareness, community participation, and collaboration among the Forest Department, Botanical Survey of India (BSI), botanical gardens, universities, and research institutions are equally important for ensuring the long-term survival of this unique palm.

Ecological and Economic Importance

Hyphaene dichotoma is a multipurpose palm that possesses significant ecological, economic, and socio-cultural value. Ecologically, the species contributes to the stability of dry tropical and coastal ecosystems by protecting soil from erosion, improving microclimatic conditions, and providing habitat and shelter for numerous birds, insects, and other wildlife. The large fan-shaped leaves create shade and support local biodiversity, while the extensive root system helps stabilize sandy and alluvial soils in semi-arid and coastal environments. As one of the few naturally branching palms, *H. dichotoma* also represents an important genetic resource for studies on palm evolution, developmental biology, and plant architecture (Dransfield et al., 2008).

Economically, the species has long been valued for its diverse traditional uses. The mature leaves are strong, durable, and flexible, making them suitable for manufacturing mats, baskets, hats, brooms, ropes, fans, bags, and a variety of handicraft products. These products contribute to the livelihoods of rural artisans and support small-scale cottage industries in many regions. The fibrous leaf material is also used for roof thatching and fencing in some traditional communities.

The fruits of *H. dichotoma* are edible and contain a sweet fibrous pulp that is consumed fresh or processed in

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certain regions. The hard seeds are polished and carved into attractive beads, buttons, rosaries, toys, and decorative articles. Historically, the oily endosperm of the seeds was used as a source of fuel for lamps, particularly during maritime trade between East Africa and the Indian subcontinent. The trunk and petioles are occasionally utilized as construction materials for temporary structures, agricultural implements, and fencing.

Beyond its direct economic value, *H. dichotoma* has considerable cultural and educational importance. Its unusual dichotomous branching habit makes it a prominent attraction in botanical gardens, educational institutions, and biodiversity parks, where it serves as a valuable specimen for teaching plant morphology and evolution. Furthermore, the species has become a symbol of biodiversity conservation in western India, emphasizing the urgent need to preserve rare and threatened plant species before they disappear from their natural habitats.

Recent conservation initiatives have further highlighted its national significance. The Botanical Survey of India and collaborating organizations have distributed seeds of *H. dichotoma* during national botanical events, including the National Botany Fest at the Statue of Unity, Gujarat, to encourage ex situ conservation and wider cultivation. In Maharashtra, ongoing seed germination experiments and propagation studies conducted by author aim to develop effective restoration strategies and establish new populations of this rare palm. These efforts are expected to play an important role in ensuring the long-term conservation and sustainable utilization of this unique species.

Historical Introduction into India

The origin of *Hyphaene dichotoma* (Wight) Furtado has long attracted the attention of botanists and biogeographers because of its disjunct distribution between Africa and the Indian subcontinent. The genus *Hyphaene* is primarily native to tropical Africa and parts of the Arabian Peninsula, where several species occur naturally in arid and semi-arid landscapes, river valleys, and coastal ecosystems (Dransfield et al., 2008; Govaerts & Dransfield, 2005). In contrast, the occurrence of *H. dichotoma* in India is widely regarded as the result of historical introduction rather than natural dispersal.

Historical records suggest that the species was introduced into western India during the fifteenth and sixteenth centuries through Portuguese maritime trade routes linking East Africa, Mozambique, Oman, and the western coast of India (Johnson, 1998). During this period, Portuguese sailors frequently transported seeds of the Doum Palm because of their economic utility. The seeds contain a hard, oil-rich endosperm, which was traditionally used as a source of fuel for ship lamps, while the fruits served as a supplementary food source during long sea voyages. Some seeds were intentionally planted near ports and settlements, whereas others were accidentally dispersed during maritime activities.

Following their introduction, the species gradually became established along suitable coastal habitats of western India, particularly in Gujarat, Daman, Diu, Maharashtra, Goa, and parts of coastal Karnataka. The warm tropical climate, sandy soils, and humid coastal environment provided favourable conditions for seed germination and establishment. Consequently, *H. dichotoma* became naturalized in several coastal localities and is now regarded as an introduced but well-established component of India's palm flora (Corner, 1966).

Despite its long history in India, the species has never become widespread. Instead, it survives in scattered and isolated populations, many of which are now threatened by habitat loss and declining regeneration. Its restricted distribution and unique evolutionary characteristics make it an important subject for studies on plant migration, historical biogeography, and the influence of ancient maritime trade on the dispersal of economically valuable plant species. The presence of *H. dichotoma* in India therefore represents not only a remarkable botanical phenomenon but also an important chapter in the history of Indo-African cultural and commercial interactions.

Status in Maharashtra and Dhule District

In Maharashtra, *Hyphaene dichotoma* (Wight) Furtado is an exceptionally rare palm with a highly restricted and fragmented distribution, occurring only in a few isolated localities, primarily along the western coastal

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belt, while inland populations are extremely scarce. One of the most significant inland occurrences is located at Methi village along the Songir–Dondaicha State Highway in Dhule district, where the species has been officially documented in *Flora of Dhule and Nandurbar District* (Patil, 2010) and earlier reported by Reddy (1991), indicating its long-standing presence in the region despite geographical isolation from coastal populations. This solitary tree represents an invaluable component of Maharashtra's botanical heritage and an important element of the floristic diversity of the Khandesh region. However, recent field investigations conducted by author (2024–2026) revealed that nearly half of the tree has dried due to age and environmental stress, while the surviving portion bears only male (staminate) inflorescences. The absence of female trees in the surrounding area has completely prevented pollination, fruit production, and natural regeneration, rendering the Dhule population functionally extinct from a reproductive perspective. To address this critical conservation issue, Author has initiated seed germination and propagation experiments using seeds collected from different parts of India with the objective of developing nursery stock and restoring viable populations in Maharashtra. Simultaneously, efforts are being made to locate and introduce female plants from other regions to facilitate cross-pollination and sustainable seed production. Considering its extreme rarity, historical significance, and imminent threat of local extinction, the Methi tree warrants immediate declaration as a Biodiversity Heritage Tree under the Biological Diversity Act, 2002, which would ensure legal protection, scientific monitoring, habitat management, and coordinated conservation efforts involving the Maharashtra Forest Department, Botanical Survey of India, universities, botanical gardens, local communities, and conservation organizations.

Reproductive Constraints and Tissue Culture Prospects

The long-term survival of *Hyphaene dichotoma* is severely constrained by its dioecious reproductive system, in which male and female flowers are borne on separate individuals. Successful sexual reproduction depends on the presence of both sexes within pollination distance; however, many surviving populations in India are highly fragmented and consist of only a few individuals. The most critical example is the solitary tree at Methi village in Dhule district, Maharashtra, where field investigations by author (2024–2026) confirmed the presence of only a male tree bearing staminate inflorescences. The complete absence of female plants has prevented pollination, fruit set, and seed production, resulting in the total failure of natural regeneration. Besides reproductive isolation, the species is further threatened by habitat degradation, aging populations, slow growth, poor seed availability, and anthropogenic disturbances, all of which contribute to its declining population. Tissue culture and other in vitro propagation techniques provide promising alternatives for rapid multiplication and ex situ conservation of this rare palm. Micropropagation can facilitate the production of large numbers of disease-free planting materials and support germplasm conservation. However, since tissue-cultured plants are genetically identical to the donor plant, propagation from the existing male tree would produce only male progeny, thereby failing to restore sexually reproducing populations. Therefore, successful long-term conservation requires the identification and introduction of female plants from other populations, establishment of breeding populations, assisted pollination, seed banking, and integration of tissue culture with conventional propagation methods.

CONSERVATION STRATEGIES

The conservation of *Hyphaene dichotoma* requires a comprehensive approach combining *in situ*, *ex situ*, and community-based conservation measures. Existing mature trees should be legally protected by declaring them Biodiversity Heritage Trees under the Biological Diversity Act, 2002, while their surrounding habitats should be safeguarded from urban expansion, road widening, grazing, and other anthropogenic disturbances. Regular monitoring, habitat restoration, and ecological assessments are essential for ensuring the survival of existing populations. Ex situ conservation should include seed collection, germplasm banking, nursery development, botanical garden cultivation, tissue culture, and reintroduction programmes. Identification and transplantation of female plants into areas containing male individuals would facilitate cross-pollination and restore natural seed production. Collaborative research involving the Botanical Survey of India, Forest Departments, agricultural universities, botanical gardens, and research institutions should focus on reproductive biology, pollination ecology, seed physiology, genetic diversity, and climate resilience. Public awareness programmes, biodiversity education, and participation of local communities and non-governmental organizations are equally important for promoting conservation. Distribution of seeds through national botanical programmes, such as

the National Botany Fest organized at the Statue of Unity, Gujarat, provides an effective model for expanding ex situ conservation efforts across India. Collectively, these integrated strategies will contribute significantly to the long-term survival and sustainable management of this unique palm species.

CONCLUSION

Hyphaene dichotoma (Wight) Furtado is one of the most distinctive palms of the family Arecaceae, recognized for its unique dichotomously branched trunk, ecological importance, economic utility, and remarkable evolutionary significance. Although believed to have been introduced into India through historical maritime trade, the species has become an important component of the country's botanical heritage. However, habitat degradation, urbanization, fragmentation, climate change, and reproductive limitations have caused a drastic decline in its natural populations. The solitary male tree surviving in Methi village of Dhule district represents one of the last known inland populations in Maharashtra and symbolizes the urgent need for scientific conservation. The absence of female plants has completely halted natural regeneration, making immediate intervention essential. Integrated conservation measures involving habitat protection, legal recognition as a Biodiversity Heritage Tree, ex situ propagation, tissue culture, seed banking, assisted breeding, and public participation are necessary to ensure the long-term survival of this rare species. With coordinated efforts from government agencies, research institutions, conservation organizations, and local communities, it is possible to prevent the extinction of *H. dichotoma* in Maharashtra and preserve this unique palm as an invaluable component of India's biological and cultural heritage for future generations.

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