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Title – **Ecology and Conservation of *Diospyros crumenata* (Ebenaceae), a Critically Endangered Tree of the Western Ghats biodiversity hotspot**

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Societal Impact statement

The extinction of species is considered the greatest threat to biodiversity. A recent global tree assessment report has revealed that one-third of tree species are at risk of extinction, indicating an alarming extinction crisis regarding trees that must be addressed immediately. *Diospyros crumenata* is a rare tree linked to indigenous people and many wildlife in the forest. Losing trees like *D. crumenata* will have far-reaching impacts on people and the planet, so conserving these endangered tree species is essential. Its fruit is edible and has a higher nutritive value than commonly cultivated fruits so that the fruit can be commercialised for consumption.

Abstract

Diospyros crumenata is an IUCN- critically endangered tree species that belongs to the Ebenaceae family and is found in the Western Ghats region. There is limited information about this tree in floristic literature and herbaria, so we conducted extensive forest trips to the Western Ghats to locate its population and study its ecology. Unfortunately, this threatened tree is facing severe threats in its natural habitats. We aimed to understand this species' ecological, reproductive, and genetic constraints in its natural habitat. Unfortunately, this tree is facing severe threats in its natural habitats, and there is the possibility of the species becoming extinct in the near future. Immediate conservation measures such as restoration are needed to prevent the extinction of this species. The fruits produced by this tree are edible and mainly consumed by wildlife and indigenous people. The lion-tailed macaque, *Macaca silenus*, which is also endangered and endemic to the Western Ghats, depends on this fruit as its food source. Preliminary studies indicate this fruit has higher nutritive value than other commonly cultivated fruits.

Keywords

Diospyros crumenata, IUCN critically endangered, Western Ghats, Biodiversity hotspot, Conservation.

Introduction

Extinctions are the biggest threat to biodiversity. Plant extinctions are relatively faster and endanger other organisms, ecosystems, and human well-being. About two plant species vanish yearly, 500 times faster than the natural extinction rate (Humphreys et al., 2019). Most plant extinctions occur in high-diversity tropical regions. The Western Ghats, India, is a biodiversity hotspot (Myers et al., 2000) and a world heritage site in the tropics with high floristic diversity and endemism. With a latitudinal extent of 12° (8°N–20°N) and an elevation range of 300–2700 m, the Western Ghats occupy an area of around 160,000 km² (Das et al., 2006). In less than 6% of the country's total land area, the Western Ghats are home to more than 30% of all plant species. Four thousand flowering plant species are thought to exist in the Western Ghats, of which fifteen hundred are endemic (Nair et al., 1986). This region is also home to many lesser-known and underutilised wild edible plants.

The *Diospyros crumenata* Thwaites, belonging to the Ebenaceae family, is an IUCN-critically endangered and dioecious tree native to the Western Ghats. Locally referred to as Karimaram, this tree can grow up to 25 meters tall and be found in evergreen and semi-evergreen forests. The timber of this tree is used for making agricultural tools and household articles. The fruits of this tree are edible and are mainly consumed by indigenous people and wildlife. In tropical regions, there are around 900 species belonging to the *Diospyros* genus. Within the Western Ghats' wet evergreen forests are 23 species from this genus (Gamble, 1957; Cooke, 1958; Kostermans, 1978).

Materials and methods

Rareness is often associated with the ecology and biology of a species. To know the factors contributing to a species' rarity, one must fully understand the distribution, population structure, and diversity of the species, as well as an analysis of the climatic and edaphic conditions in its native habitats.

These studies will help to understand the population's ecological, biological, and genetic parameters leading to causes of rarity and will help to develop strategies for effective conservation, population management, and resourcebased sustainable utilisation of these species in the long run. Limited information on *D. crumenata* is available in floristic literature and herbaria, so we conducted extensive forest surveys in the Western Ghats region from June 2021 to July 2023 to locate existing populations and study the ecology of this endangered species. Forest trackers and indigenous people assisted us in locating this rare species and gathering information. We located populations of *D. crumenata* in Vazhachal/Poringalkuth (in Vazhachal Forest Range/Vazhachal Division), Chakkapara, and Vellani Mala (in Pattikad Forest Range in Thrissur Division). Information on each population, including GPS coordinates, number of mature individuals, area of occupancy, extent of occurrence, natural regeneration, and habitat threats, was collected from each site. The fruits were collected for nutritive analysis, and seeds were collected for the ex-situ conservation of the species.

Results

The *D. crumenata* plant blooms from October to November, with mature fruits appearing from March to April. However, mainly due to climate change, irregularities in flowering and fruiting patterns have been observed in recent years. The fruits, known as karimbudan or Karivalypazham in the local language, are safe for consumption and commonly eaten by indigenous people and wildlife. Every fruit has eight seeds, but they become nonviable within two weeks of being harvested because they are recalcitrant. However, storing them in controlled seed banking conditions (20°C; 40% RH) has increased longevity. The fruits are typically consumed before they reach maturity, and any fallen fruits are prone to fungal infections (Jose et al., 2023). The fruits are principally consumed by the Endangered lion-tailed macaque *Macaca silenus*, which is endemic to the Western Ghats. Conserving this tree is crucial for protecting this primate species. It has been noted that wild fruits have a higher concentration of nutrients and minerals compared to commonly cultivated fruits (Valvi & Rathod, 2011). Therefore, it is essential to conduct additional research to identify the exact nutritional composition of fully matured *D. crumenata* fruits.

Based on population surveys and ecological studies, it has been found that *D. criminal* is currently dealing with various threats in its natural habitat. These threats have led to a decrease in its population and caused concerns about the possibility of the species becoming extinct soon. It was observed that the populations in Vellani Mala are susceptible to forest fires, while the construction activities for the Powerhouse in Poringalkuth have caused habitat degradation. Furthermore, developing the State Highway in Vazhachal (Chalaky-Malakkapara) may threaten some trees at the forest edges.

Scientists have estimated that the rate of species extinction is rapidly increasing, as high as 1,000-10,000 times the natural extinction rate (Ricketts et al., 2005; Thuiller, 2007). If this trend continues, we could lose up to 30-50% of all species by the middle of this century. (Myers, 1980). It is crucial to prioritise conserving and managing biological diversity to achieve sustainable development. *D. crumenata* is an endangered tree species that needs

urgent conservation. Ex-situ conservation is preferred since the species faces many constraints in its natural habitat. We have collected seeds for seedling development in the nursery. We are planning reintroduction methods for the conservation of this species. Considering the fruits' ecological, conservational, and edible value, conservation biological studies of the species have been initiated.

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