

Current and future prospects of guggul: A critically endangered medicinal plant

Conservation of *Commiphora wightii*, a critically endangered plant species, commonly known as Indian bdellium or guggul, is crucial due to its ecological and medicinal significance. This small deciduous tree species is native to India and plays a vital role in various ecosystems, and highly valued for its resin, which has been used for centuries in traditional Indian medicine, particularly in Ayurveda. Consequently, it has gained recognition worldwide, leading to high demand and excessive exploitation. The conservation of guggul is essential to ensure the species' long-term survival and maintain ecological balance.

COMMIPHORA *wightii*, commonly known as Indian Bdellium or Guggul, is a small to medium-sized tree belonging to the Burseraceae family. It is native to arid regions of India, particularly in the states of Rajasthan, Gujarat, and Maharashtra. The tree has a distinctive appearance with a gnarled and twisted trunk, small leaves, and thorny branches. It typically reaches 1-1.5 m high and thrives in hot and dry climates with well-drained soil. In *C. wightii*, leaf shedding typically occurs during the dry season, which is a natural response to conserve water and protect the plant from excessive water loss. This shedding of leaves allows the plant to enter a period of dormancy, conserving energy until favourable conditions return. It is worth noting that the exact timing and duration of leaf shedding can vary depending on factors such as climate, geographical location, and individual plant health. The resin is extracted from the bark of the tree and has a unique fragrance.

Guggul has been used in Ayurvedic medicine for its therapeutic properties, particularly in treating various ailments such as arthritis, obesity, and cholesterol-related disorders. The resin contains bioactive compounds called guggulsterones, which have shown anti-inflammatory, antioxidant, and cholesterol-lowering properties, among others. *C. wightii* is known to exhibit slow growth rates. Several factors can contribute to the slow growth of *Commiphora* plants like natural slow growth habits,

nutrient limitations, watering practices (Overwatering or inadequate watering), etc.

C. wightii has most recently been assessed for The IUCN Red List of Threatened Species in 2014. *C. wightii* is listed as 'Critically Endangered'. Several factors contribute to the vulnerability of *wightii* like habitat loss, overharvesting, climate change, etc. Sustainable harvesting practices, proper management, and cultivation initiatives are implemented to ensure the long-term availability of these valuable plants. By promoting sustainable practices, economic benefits can be derived while also supporting the conservation of *Commiphora* populations and their natural habitats. It is important to



Guggul plant and resin derived from its stem



Guggul Gum resin
antilipidemic (lipid lowering)
antioxidant & anti-inflammatory



Commiphora wightii: New growth, after leaf shed (dormant), flower, thorn and fruit

note that the collection of guggul resin should be done in a sustainable manner to avoid overharvesting and damaging trees. Local regulations and guidelines should be followed, and efforts should be made to promote responsible and eco-friendly practices in resin collection.

Secondary metabolites in guggul

C. wightii is known for its production of various secondary metabolites, including guggulsterones, which have been extensively studied for their pharmacological activities. The biosynthesis of secondary metabolites in *C. wightii* involves several key enzymatic steps. Although the specific details of the biosynthetic pathways in *C. wightii* have not been fully elucidated. There are two main types of guggulsterones: E-guggulsterone and Z-guggulsterone. These two compounds have slightly different structures and biological activities. E-guggulsterone is the most abundant and well-studied guggulsterone. It has been reported to have anti-inflammatory, antioxidant, and cholesterol-lowering properties. Z-guggulsterone, on the other hand, has been less extensively studied compared to E-guggulsterone. However, some research suggests that Z-guggulsterone may also have cholesterol-lowering effects. More research is needed to fully understand their mechanisms of action and evaluate their efficacy and safety.

Future conservation aspect

Conservation efforts for *C. wightii* are important due to its vulnerable status and the threats it faces in the wild. Here are some strategies and considerations for the conservation of *C. wightii*.

Protected areas: Establishing and effectively managing protected areas can help conserve the natural habitats where *C. wightii* occurs. Protected areas can provide legal protection, regulate human activities, and promote the conservation of the species and its associated biodiversity.

Habitat restoration: Implement habitat restoration initiatives in degraded areas where *C. wightii* once thrived. This can involve activities such as reforestation, erosion control, and restoration of arid and semi-arid habitats. Restoration efforts should focus on preserving suitable habitat conditions for the species and supporting natural regeneration.

Sustainable harvesting practices: Develop and promote sustainable harvesting practices for guggul resin derived from *C. wightii*. This includes establishing guidelines and regulations for resin collection, ensuring that it is harvested in a way that allows the species to regenerate and sustainably meet the demand. Collaboration with local communities and stakeholders is crucial to implement sustainable harvesting practices effectively.

In situ and Ex situ conservation: *In situ* conservation involves the protection and management of *C. wightii* populations in their natural habitats, while *ex situ* conservation involves the preservation of genetic material in controlled environments such as botanical gardens, seed banks, or tissue culture facilities. Both approaches can be complementary and contribute to the long-term

conservation of the species.

Research and monitoring: Conduct research on the ecology, biology, and population dynamics of *C. wightii* to improve our understanding of its conservation needs. Monitoring programs can track population trends, identify threats, and evaluate the effectiveness of conservation measures. This information can improve adaptive management strategies and conservation planning.

Community engagement and awareness: To involve local communities in conservation efforts by promoting their participation, understanding, and stewardship of *C. wightii*; Raise awareness about the ecological importance, cultural value, and potential economic benefits associated with the species; Engaging local communities as conservation partners can lead to more effective and sustainable conservation outcomes.

Tissue culture: It is a valuable tool for the conservation of *C. wightii*. Tissue culture also known as *in vitro* propagation or micropropagation, is a valuable tool for conserving rare and endangered plant species. It involves the aseptic culture of plant cells, tissues, or organs in a controlled laboratory environment, allowing for the production of genetically identical plants on a large scale. Tissue culture can contribute to the conservation of *C. wightii* by mass propagation, disease elimination, cryopreservation, clonal propagation, habitat restoration, and research and genetic studies. Also, tissue culture provides a platform for studying the biology, physiology, and genetics of *C. wightii*. It enables researchers to investigate the factors influencing plant growth, development, and responses to environmental stress. This knowledge can improve conservation strategies and aid in the development of effective management plans for endangered species. Overall, tissue culture plays a significant role in the conservation of *C. wightii* by providing a means to propagate, preserve, and restore their populations. It offers a valuable tool for maintaining genetic diversity, eliminating diseases, and contributing to the long-term survival of threatened plant species. At ICAR-DMAPR, Anand, Gujarat, a tissue culture method has been developed for the conservation and micropropagation of *C. wightii*.

SUMMARY

C. wightii is crucial for its medicinal value, making its conservation essential. Protecting this plant through tissue culture techniques can preserve its unique genetic traits and ensure sustainable availability. By doing so, we secure its role in traditional medicine and protect biodiversity and ecosystems. Introducing conservation measures and employing tissue culture methods is vital to safeguard *C. wightii*'s future, benefitting both human health and the environment.

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