

# *Sterculia urens Roxb.: Bridging Tribal Livelihoods and Industrial Innovation*

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**Abstract:** *Sterculia urens*, the Karaya gum tree, boasts a remarkable versatility. Not only is its natural gum exudate cost-effective and environmentally friendly, but it also finds applications in pharmaceuticals, cosmetics, and food processing. Additionally, this tree holds a rich history in traditional medicine, serving as a trusted remedy for various ailments in tribal communities. However, the widespread commercial use of *Sterculia urens* has resulted in a decline in its natural populations. This concerning trend has led to its classification as endangered in parts of India. This highlights the urgent need for conservation strategies and sustainable management practices to ensure the long-term viability of this valuable plant.

## INTRODUCTION

Plants serve as indispensable resources in human life, providing essentials such as food, shelter, pharmaceuticals, and livelihood. *Sterculia urens* Roxb., a member of the Malvaceae (Sterculioideae) family, previously classified under Sterculiaceae, exemplifies this botanical significance. Its common names include gulu, kadaya, karaya, among others, reflecting its widespread use and cultural importance. The family Sterculiaceae encompasses approximately 50–72 genera and 1200–1500 species, predominantly found in tropical and subtropical regions. Notably, it includes economically significant products like chocolate, cocoa, cola, and karaya gum, which are vital in global commerce.

*Sterculia urens* thrives in diverse habitats across Asia, including the Indian subcontinent, Burma, and Sri Lanka, favoring dry forest environments with low water availability and varying temperatures. This deciduous tree grows in challenging terrains such as desert zones, exposed ridges, and rocky slopes, demonstrating resilience to extreme conditions.

The gum exudate of *Sterculia urens* holds substantial commercial value, known as Indian tragacanth or

karaya gum, prized for its superior qualities and historical use as a substitute for gum tragacanth in various applications. Its phytochemical properties distinguish it, despite past adulteration practices due to cost considerations.

However, despite its economic and cultural importance, *Sterculia urens* faces conservation challenges due to overexploitation for its valuable gum and habitat degradation. This has led to its classification as an endangered species in parts of India, necessitating urgent conservation efforts.

This review aims to highlight *Sterculia urens*' multifaceted significance, encompassing its commercial value, ethnobotanical applications, and conservation status. By exploring its industrial uses, traditional uses by tribal communities, and current challenges in conservation, this study underscores the importance of sustainable management practices to ensure the continued existence and utilization of this valuable botanical resource.

## Botanical Features of *Sterculia urens*

*Sterculia urens*, a medium-sized tree reaching heights of 15–20 meters, is characterized by its dense, bushy growth habit (Goldstein, 1954). The tree exhibits distinctive botanical features that contribute to its identification and ecological adaptation.

- **Stem and Bark:** The stem bark of *Sterculia urens* varies in color from grayish-white to red and possesses a shiny appearance, adding to its visual appeal and ecological resilience.
- **Chromosome Number:** It is a diploid plant with a chromosome number of 40 (Darlington and Wylie, 1956), indicating its genetic makeup and reproductive characteristics.
- **Leaves:** The leaves are notable for their palmately compound structure, consisting of five lobes (pentalobed), each attached to a long petiole.

These leaves are large, typically ranging from 20 to 30 centimeters in diameter. They are densely clustered towards the ends of branches, contributing to the tree's lush foliage.

- **Leaf Surface:** The lower surface of the leaves is covered with short, thick tangled hairs, imparting a tomentose texture. In contrast, the upper surface is smooth and typically lacks such hair cover, enhancing its exposure to sunlight and facilitating photosynthesis.

These botanical characteristics not only aid in the identification of *Sterculia urens* but also reflect its adaptation to specific environmental conditions, particularly in dry and semi-arid regions where it thrives. The tree's structural attributes, including its bark coloration, leaf morphology, and chromosomal constitution, contribute to its ecological role and utilization in various industrial and traditional applications. Understanding these features is crucial for effective conservation and sustainable management practices aimed at preserving this valuable plant species.

#### Gum Exudates of *Sterculia urens*

Gum exudates play a crucial role in the defense and wound healing mechanisms of superior plants, including *Sterculia urens*. Known commonly as karaya gum, *Sterculia* gum is renowned for its abundance, affordability, and diverse industrial applications.

- **Source and Production:** Karaya gum primarily originates from the stems and roots of *Sterculia urens*. It is secreted from ducts located within the pith and cortex of young stems, highlighting these regions as the main production sites (Kuruwanshi, 2017).
- **Properties:** The sap of *Sterculia urens* serves as the source of karaya gum, notable for its adhesive properties. This characteristic makes it valuable in various industrial applications where adhesion and cohesion are essential attributes (Upadhyay,).
- **Industrial Applications:** Karaya gum is widely utilized due to its superior properties in various industries such as pharmaceuticals, cosmetics, food processing, and textiles. Its natural origin, along with its non-hazardous nature and ease of recovery, positions it favorably against synthetic alternatives (Kuruwanshi, 2017).

- **Cultural and Economic Significance:** Beyond its industrial applications, karaya gum holds cultural significance, especially among indigenous communities who have historically utilized it for medicinal purposes. Its economic importance is underscored by its substantial value in international trade markets.
- **Conservation Challenges:** Despite its commercial viability, *Sterculia urens* faces conservation challenges due to overexploitation for its valuable gum. Sustainable harvesting practices and conservation efforts are essential to ensure the long-term survival of this species in its natural habitats.

In conclusion, the gum exudates of *Sterculia urens*, particularly karaya gum, exemplify a natural resource of significant economic, industrial, and cultural value. Understanding its source, properties, and applications is crucial for sustainable management and conservation efforts aimed at preserving this valuable botanical resource for future generations.

#### Industrial Potential of *Sterculia urens* Roxb.

*Sterculia urens* Roxb., commonly known as the Karaya Gum tree, holds substantial industrial potential owing to its versatile applications across various sectors. This review highlights its significant economic value, historical usage by tribal communities, and its expanding role in contemporary commercial markets.

#### Historical and Cultural Significance

*Sterculia urens* has been integral to traditional practices among tribal communities, serving both as a livelihood resource and for personal consumption since ancient times. Its gum exudate, known as Karaya gum, has played a crucial role in indigenous medicine and cultural practices, reflecting its deep-rooted importance in local traditions.

#### Commercial Applications

Karaya gum is a prominent natural resource with a diverse range of industrial applications, contributing significantly to the global market. It is valued for its adhesive properties, making it indispensable in sectors such as



Fig no.1

- **Pharmaceuticals:** Used as an ingredient in tablets, dental impression materials, and wound dressings due to its bioadhesive and mucoadhesive properties.
- **Cosmetics:** Included in products like creams, lotions, and dental products for its thickening and emulsifying capabilities.
- **Food Industry:** Employed as a stabilizer, thickener, and texturizer in various food products, including dairy, bakery, and confectionery items.
- **Textiles and Paper Industry:** Enhances the quality of textiles and paper products by imparting strength and improving moisture retention.

#### Market Demand and Economic Impact

The commercialization of Karaya gum has been a significant source of income for India, reflecting its high demand and market value globally. Its natural origin, coupled with properties that surpass synthetic alternatives in terms of safety and effectiveness, continues to drive its popularity across diverse industrial sectors.

#### Conservation Challenges and Sustainable Management

Despite its economic importance, *Sterculia urens* faces challenges related to habitat loss and overexploitation. Sustainable harvesting practices and conservation initiatives are crucial to safeguarding its natural populations and ensuring long-term availability.

#### Future Prospects

The future of *Sterculia urens* lies in balancing its economic potential with sustainable conservation

efforts. Research into improved cultivation techniques, efficient gum extraction methods, and broader market diversification could further enhance its industrial value while preserving biodiversity.

#### Pharmacological Properties of *Sterculia urens*

*Sterculia urens*, recognized for its traditional medicinal uses, possesses diverse pharmacological properties that validate its therapeutic potential and support its historical applications.

##### 1. Anti-inflammatory Activity:

*Sterculia urens* exhibits significant anti-inflammatory effects, attributed to bioactive compounds such as flavonoids. These properties are beneficial in managing inflammatory conditions like arthritis and various skin disorders. The plant's extracts, including the gum, contribute to reducing inflammation and associated symptoms.

##### 2. Antioxidant Potential:

Phytochemicals present in *Sterculia urens* demonstrate strong antioxidant activity. They act by scavenging free radicals, thereby protecting cells from oxidative damage. This antioxidant capacity plays a crucial role in preventing chronic diseases and delaying the aging process.

##### 3. Gastrointestinal Benefits:

Karaya gum from *Sterculia urens* is known for its demulcent and laxative properties. It effectively soothes and protects mucous membranes, making it beneficial in the treatment of constipation and other digestive disorders. Additionally, decoctions from the bark help alleviate conditions like diarrhea and dysentery, highlighting its gastroprotective effects.

##### 4. Wound Healing Properties:

Traditionally used for wound healing, *Sterculia urens* promotes tissue repair and antimicrobial activity. Karaya gum accelerates the formation of granulation tissue, facilitating faster wound closure and reducing the risk of infections. Its application supports the natural healing process of cuts, burns, and other skin injuries.

##### 5. Respiratory Support:

In Ayurvedic medicine, *Sterculia urens* is prescribed for respiratory ailments such as cough and asthma. Its expectorant properties help in expelling mucus from

the respiratory tract, while bronchodilator effects improve lung function and ease breathing. These properties contribute to managing respiratory symptoms effectively.

### CONCLUSION

*Sterculia urens* Roxb, commonly known as the Karaya Gum tree, holds significant medicinal value across diverse agroecological regions of India. Its gum exudate serves as a versatile therapeutic agent, offering remedies for a wide range of health issues, from gastrointestinal disorders to skin ailments. The widespread use of *Sterculia urens* in traditional medicine highlights its importance as a valuable resource in healthcare practices. The traditional knowledge surrounding *Sterculia urens* provides a foundation for its continued utilization in addressing various health concerns. This botanical resource not only supports local communities in managing health conditions but also offers potential applications in modern pharmaceutical formulations. Ongoing research into its pharmacological properties and bioactive compounds presents promising opportunities for its integration into contemporary healthcare solutions.

Embracing and further exploring the medicinal potential of *Sterculia urens* can contribute significantly to the development of effective and accessible healthcare options, particularly in regions where access to conventional medicine may be limited. By harnessing its traditional uses and expanding scientific understanding, *Sterculia urens* stands poised to continue benefiting both traditional and modern healthcare systems alike.

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