

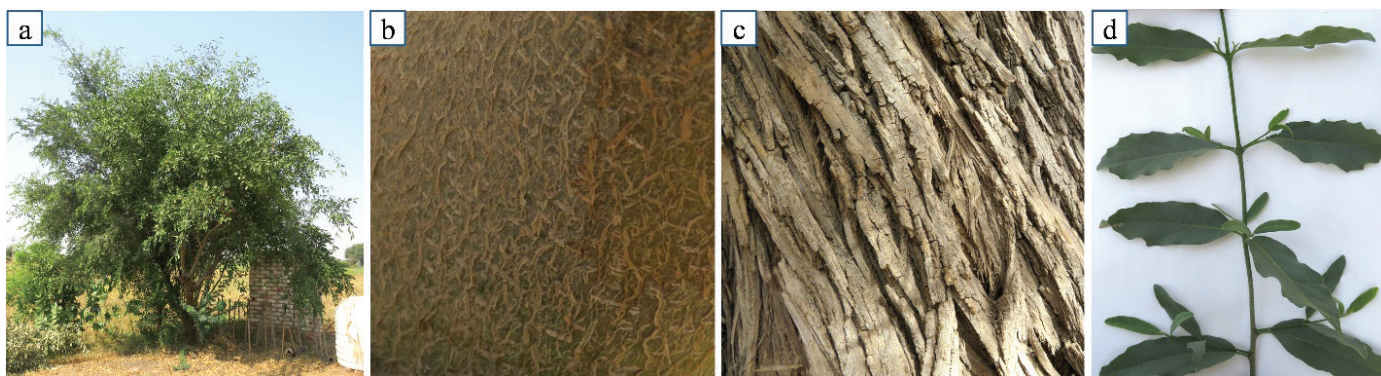
Gundi (*Cordia gharaf*): An Un-tapped Arid Fruit for Commercial Promotion

Gundi (*Cordia gharaf*) is a highly valuable arid-zone fruit species. Despite its immense potential as a source of high-quality fruits for rural income and as fodder for livestock nutrition, it remains largely underexploited. This multipurpose species thrives during peak of the summer, bearing fruits and lush green foliage even under the harsh environmental conditions of arid and semi-arid regions. The gundi tree has a deep and robust taproot system and exhibits several adaptive traits such as waxy leaves, dense hairiness, and remarkable tolerance to salinity, extreme heat, and prolonged drought. These traits not only enhance its resilience to climate stressors but also establish its vital role in dryland ecosystems. Given its multiple benefits, gundi has emerged as a promising candidate for domestication and commercial cultivation, particularly in water-scarce and degraded landscapes. Despite its utility, this species has received limited research attention. In response, ICAR-CIAH, Bikaner, has initiated efforts for its horticultural development and genetic conservation. Significant gaps remain in areas such as genetic variability utilization, varietal orchard development, production models, and value-added product commercialization. Advancing scientific research on gundi could unlock new socio-economic and environmental opportunities.

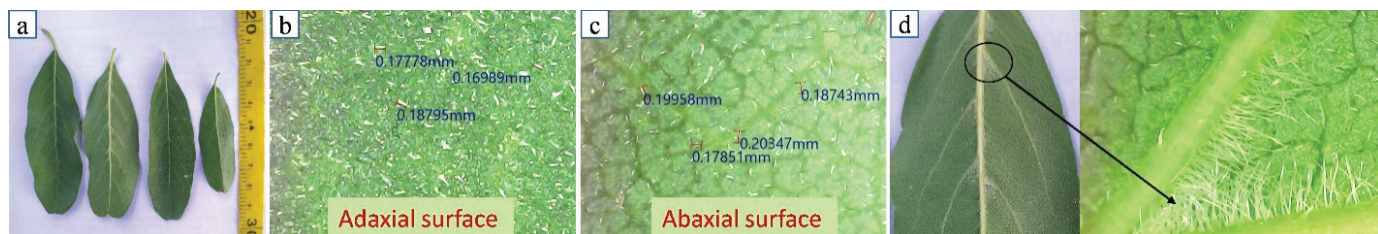
THE genus *Cordia* belongs to the family Boraginaceae, which comprises 250–300 species of trees and shrubs found across tropical and subtropical regions. *Cordia gharaf* (Forssk) Ehrenb. ex Asch., is an underutilized multipurpose fruit species within this genus. It holds great potential as a source of food, fodder, fiber, wood, and traditional medicine. Commonly known as *gundi* in Hindi and Punjabi, it is also referred to as *laghusleshamataka* (Sanskrit), *gondani* (Marathi), *cadusalle* (Kannada), *narivirayan*, *verasham*, *veri* (Malayalam), *chinnabotuku*, *chinnavirigi* (Telugu), *narville*, *sirnaruvuli*, *narivirian* (Tamil), and in English as grey-leaved saucer berry or grey-leaved cordia.

Ecology and geographic distribution

Gundi has a wide natural distribution, extending from West Africa across the Middle East to India and Sri Lanka, reaching as far south as South Africa. In India, it occurs in diverse climatic regions, including Punjab, Haryana, Delhi, Andhra Pradesh, Karnataka, Tamil Nadu, and Kerala, with a significant presence in the arid and semi-arid areas of Gujarat, Rajasthan, and Maharashtra. This hardy species thrives in the Thar Desert, dry savannas, grasslands, bushlands, dry deciduous forests, open woodlands, and along riverbanks. It typically grows in sandy, rocky, or saline soils, showcasing its remarkable adaptability to challenging environments.



(a) Gundi tree, (b) bark of young, and (c) mature (d) trees, and syyleptic shoot emergence



(a) Leaves of *Gundi*, (b) leaf morphology, pubescence on the abaxial, (c) abaxial leaf surfaces, and (d) hair tufts in vein axils on the abaxial surface

Although *gundi* prefers sunny locations with moist, well-drained soil, it is exceptionally resilient. It can tolerate periodic waterlogging, extended droughts, and saline conditions. This adaptability makes it a highly versatile species across a wide range of ecological conditions.

Botanical description

Tree: *Gundi* is a fast-growing shrub or small tree, either single or multi-stemmed, typically reaching a height of 5–6 meters, though it can sometimes grow up to 10 meters. It has an almost round and sparse canopy. The young bark is smooth and grey-white, which later becomes brownish-grey, rough, and deeply furrowed longitudinally. The tree exhibits a high tendency for sylleptic shoot induction, resulting in the development of numerous branches. Young branches and shoots are tomentose (covered with dense, short hairs) and display a drooping habit.

Leaf: The leaves are 6 to 10 cm long and 2.5 to 4.1 cm wide, with a thickness of 0.18 to 0.22 mm. It is light green to grey-green in colour, simple in structure, and arranged more or less oppositely. The leaf shape ranges from elliptic-oblong to cuneate/oblong or oblanceolate, with entire margins. The base is attenuate to cuneate, while the apex is usually obtuse to rounded, and occasionally notched. The leaf is exstipulate, rough to the touch, and densely pubescent on both surfaces, with tufts of long, soft hairs in the axils between the midrib and the main lateral veins on the underside. The petioles are 4 to 14 mm long and 0.9 to 1.1 mm in diameter.

Flower: The flower is borne in terminal and axillary cymes, each measuring approximately 7.5×6.1 mm. The flower is bisexual, white or cream in colour, sweetly scented, and typically tetramerous.

The calyx is tubular-campanulate (bell-shaped), measuring 3.5 to 4.1 mm in length, and shallowly lobed with 3 to 5 (occasionally 6) obtuse lobes. It is slightly pubescent on the outside and densely pubescent on the inside, and becomes accrescent as the flower matures.

The corolla is whitish or cream-coloured, with a tube about 4 mm long and 4 (occasionally 5) reflexed lobes, each 3.1 to 3.5 mm long and 1.1 to 1.2 mm wide. The lobes are epipetalous.

There are 4 (occasionally 5) stamens, with filaments measuring approximately 2 to 4 mm in length. The anthers are dorsifixed, about 1.0 to 1.2 mm long and 0.5 to 0.6 mm wide.

The pistil measures 5 to 6 mm in length and consists of a style 2.1 to 3.5 mm long, an ovary 1.5 to 2.0 mm long and 1.1 to 1.3 mm wide, and a branched stigma.

Fruit: The fruit is a drupe, measuring 10–12 mm in length, 10–15 mm in diameter, and weighing between 0.8 and 1.4 g. It usually contains a single seed. The fruit is ovoid or narrowly ovoid in shape, tapering towards the apex and longitudinally striate. Both mature and immature fruits display tiny white or light-coloured dots—most likely lenticels—embedded in the persistent calyx cup. The calyx has a toothed edge, and the fruit terminates in a pointed beak. When mature, the fruit is orange-red, turning reddish-brown upon drying. The exocarp and mesocarp have a gummy texture and are edible.

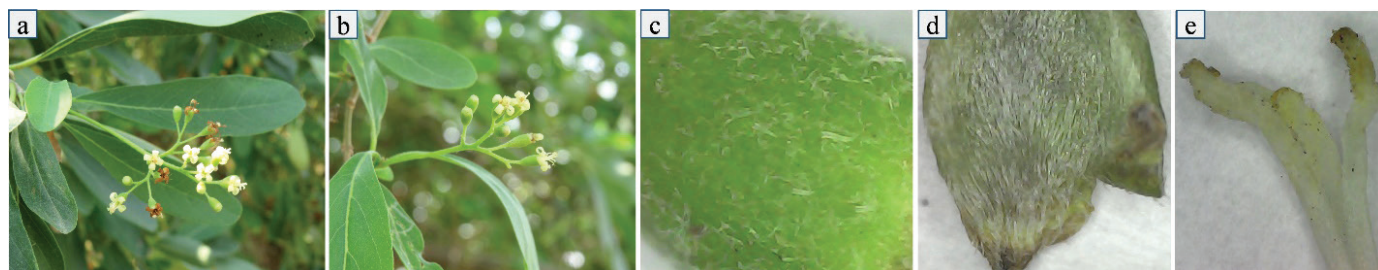
Seed: The seed is generally rigid and abrasive, with a yellowish cream colour.

Flowering and fruiting phenology

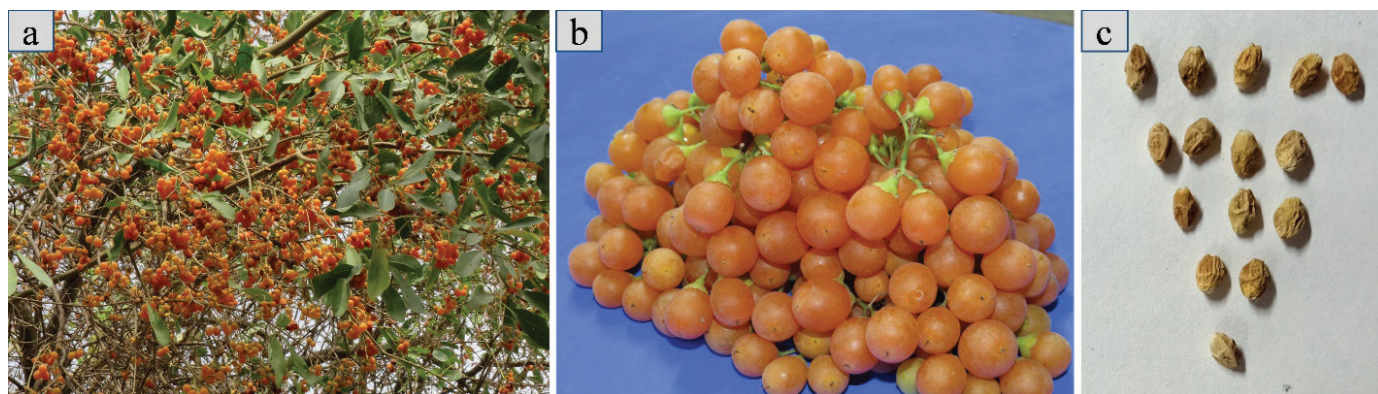
In the hot arid region, the flowering and fruiting phenology of *Gundi* follows a distinct bimodal pattern. The primary flowering season occurs from February to April, with peak blooming in March. This is followed by fruit maturation during the summer months, from April to June. A secondary flowering phase takes place between August and October, peaking in September. The fruit from this cycle mature during the winter months, from October to December.

Nutraceutical value and uses

Underutilized fruits are often considered rich sources of nutrient and antioxidant. In addition to their nutritional



(a) Terminal and (b) axillary (c) cymes; pubescence on the outer (d) and inner surfaces of the tubular calyx; and (e) branched stigma of *Gundi*.



(a) Profuse fruiting on *Gundi* tree, and (b, c) harvested fruits and seed

and therapeutic benefits, their resilience in poor soil and harsh climatic conditions makes them ideal candidates for meeting future food security challenges. *Gundi* is well known for its medicinal properties, with various parts of the plant traditionally used across cultures to treat a wide range of ailments, including gastrointestinal issue, respiratory disorder, fever, headaches, eye infection, joint inflammation, swelling, dental pain, parasitic infection, and skin disease. These traditional uses underscore the plant's significance in folk medicine.

Despite its extensive use in traditional medicine, scientific exploration of *Gundi's* pharmacological properties has only recently gained traction. Phytochemical studies have identified several bioactive compounds—such as flavonoid, glycoside, terpenoid, and phenolic acid—that contribute to its broad pharmacological effects. Research indicates that *Gundi* possesses antimicrobial, anti-inflammatory, antioxidant, anti-glycation, hepatoprotective, and anticancer properties.

The fruit is particularly popular during the summer and is consumed fresh when ripe. In Kenya, it is traditionally valued for its digestive benefits, with local communities continuing to use the fruit as a fast-acting digestive aid. It is widely used to treat malabsorption and is recognized for its effectiveness as a natural, stool-softening laxative. Additionally, a clear, edible gum obtained from the bark is sometimes used to adulterate gum arabic, which is derived from *Acacia senegal* and related species.

The root is boiled to prepare a decoction for malaria treatment. The bark, known for its astringent properties,

is used to make gargle solutions. The leaf, either alone or in combination with other medicinal plants, are used to treat fever. They also serve as valuable fodder for livestock such as goat, camel, sheep, and cattle. A strong fiber extracted from the inner bark is used for rope making. The heartwood is brown with a mild fragrance, while the sapwood is yellowish. The wood is hard and of high quality, commonly used for making construction materials.

Endangered status and conservation efforts

Despite its numerous uses, *Gundi* has been classified as endangered due to habitat loss and overharvesting, raising serious concerns about its survival in the wild. Conservation efforts are critical to safeguard this valuable plant. These include promoting sustainable harvesting practices, habitat restoration, and agroforestry systems where *Gundi* can be cultivated alongside other crops.

Raising awareness about its ecological importance and commercial potential is essential to ensure its long-term conservation and promote its widespread use in a sustainable manner. To protect *Gundi*, it is imperative to implement effective conservation strategies that balance its ecological role with its economic potential—ensuring that both its natural habitat and cultivated populations are preserved for future generations.

CONCLUSION

Gundi (*Cordia gharaf*) is a highly valued arid-zone fruit tree with impressive green foliage growth during the hottest periods of the year. This multipurpose species



Flowering and fruit developmental stages of *Gundi*

shows promise for diversified applications, climate-resilient plantations, and horticultural development. Systematic research and the establishment of commercial orchards could introduce a new fruit to consumers and enhance the economic utility of marginal landscapes through ecosystem services.

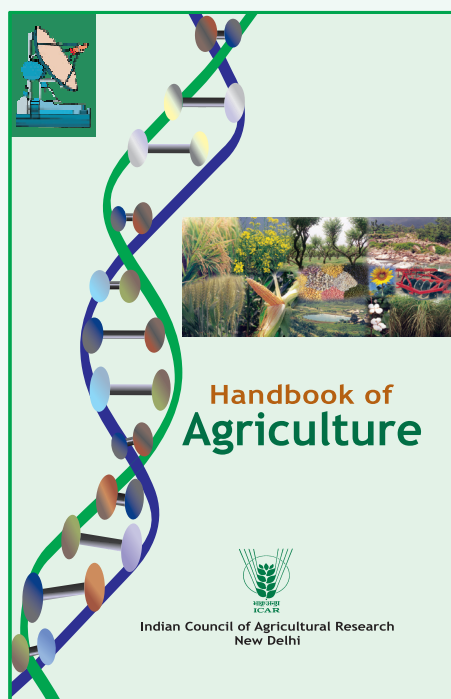
However, serious efforts are needed for the conservation and strategic utilization of *Gundi* germplasm, particularly in conjunction with its commercial promotion. Recognizing this potential, the ICAR-Central Institute for Arid Horticulture (CIAH), Bikaner, has initiated dedicated efforts to collect and evaluate *Gundi* diversity with the aim of identifying elite genotypes for conservation and commercial exploitation.

Furthermore, the development of viable practices for vegetative propagation, varietal improvement, planting models, canopy management, crop regulation, product diversification, and resilient farming approaches is a priority. These initiatives are crucial for enabling sustainable food and fodder production year-round using *Cordia* species and native crop diversity adapted to arid ecosystems.

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TECHNICAL SPECIFICATIONS

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