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Review Article

Pharmaceutical Potentials and Formulation Perspectives of Corallocarpus Epigaeus: A Compehensive Review

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A B S T R A C T

Corallocarpusepigaeus, popularly referred to as Akasa Garudan Kizhangu, is a lesser-known but important medicinal plant from the Cucurbitaceae family. In Siddha medicine and local healing traditions, the tuber has long been valued for treating digestive discomfort, reducing swelling, and clearing toxin-related ailments. Scientific investigations have revealed that the plant contains several biologically active groups of chemicals, including cucurbitacins, flavonoids, triterpenoids, alkaloids, and various glycosides. These compounds contribute to the plant's antioxidant effects and its ability to fight inflammation, microbes, and liver-related issues. Although traditional practices highlight its therapeutic value, modern pharmaceutical research on C. epigaeus is still in its early stages. Only limited studies are available on how to extract its active molecules efficiently, how the plant behaves during preformulation and stability testing, or how to convert it into reliable dosage forms. Because of these gaps, the development of standardized herbal medicines from this plant remains a challenge. This review brings together the currently available information on the plant's botanical features, chemical composition, and biological activities. It also outlines the formulation difficulties that must be addressed. Future research may benefit from exploring advanced nano–drug delivery technologies—such as nanoemulsions, nanosponges, and phytosomes—which can improve solubility, stability, and site-specific delivery of the plant's active constituents. Stronger collaboration between traditional medicine, phytochemistry, and pharmaceutical sciences could help transform Corallocarpusepigaeus into a dependable herbal therapeutic.

Keywords: Corallocarpusepigaeus, Akasa Garudan Kizhangu, Phytochemistry, Herbal Formulation, Nanoemulsion, Cucurbitacins, Pharmaceutics.

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INTRODUCTION

Herbal medicines remain integral to global healthcare systems, particularly in regions where traditional systems such as Siddha, Ayurveda, and folk healing practices dominate. Corallocarpusepigaeus, traditionally known as Akasa Garudan Kizhangu, is a tuber-bearing medicinal plant recognized for its long-standing therapeutic applications. Recent scientific interest has accelerated due to its phytochemical richness and broad pharmacological potential.

The plant's rise in modern phytopharmaceutical discussions is largely attributed to the presence of cucurbitacins, triterpenoids, flavonoids, phenolics, sterols, and glycosides. These compounds align closely with clinically relevant bioactivities, suggesting strong translational potential. However, despite its popularity in

traditional healing systems, significant scientific gaps remain in extraction standardization, toxicological validation, formulation science, and mechanistic pharmacology.

Figure 1: Plant of Corallocarpus Epigaeus

BOTANICAL DESCRIPTION

Corallocarpusepigaeus is a perennial climbing herb common in dry regions of South India. Its tuberous root is the primary medicinal component, characterized by a thick, fleshy structure containing bitter, aromatic compounds. The leaves are simple, ovate to lobed, and palmately veined, while flowers are unisexual and yellowish white.

Ecologically, the species prefers rocky or sandy soils with minimal organic matter, thriving in semi-arid climates. Its distribution includes Tamil Nadu, Karnataka, Kerala, Andhra Pradesh, and some parts of Sri Lanka. Due to low seed viability and slow tuber development, large-scale cultivation remains challenging, necessitating alternative propagation techniques such as tissue culture.

Taxonomic Classification

Table 1**: Taxonomic Classification**

Rank	Taxonomic Group
Kingdom	Plantae
Subkingdom	Tracheobionta (Vascular plants)
Superdivision	Spermatophyta (Seed plants)
Division	Magnoliophyta (Angiosperms / Flowering plants)
Class	Magnoliopsida (Dicotyledons)
Subclass	Dilleniidae
Order	Cucurbitales
Family	Cucurbitaceae (Gourd family)
Genus	Corallocarpus
Species	Corallocarpusepigaeus (Rottl.) C.B.Clarke

Figure 2: Corallocarpus Epigaeus Plant Along With Its Root

Root/tuber

- Large, aromatic, brownish tuber.
- Contains bitter compounds used therapeutically.
- Primary storage organ for phytochemicals.

Stem

- Slender, creeping or climbing.
- Soft, pale green, with slight hairiness.

Leaves

- Simple, alternate, ovate or shallow-lobed.
- Coarse texture; palmately veined.

Flowers

- Unisexual; monoecious plant.
- Male flowers in clusters; female flowers solitary.
- Yellowish-white with 5 lobes.

Fruit

- Small berry, initially green, turning orange-red.
- Contains mucilaginous pulp with seeds.

Phytochemical Profile

- Phytochemical[1]investigations consistently reveal the presence of **cucurbitacins A, B, and E—potent triterpenoids exhibiting cytotoxic and anti-inflammatory actions**. These compounds are structurally similar to bioactive molecules used in oncology, giving the plant unique value in anticancerresearch.
- Flavonoids such as quercetin, kaempferol, and rutin contribute to antioxidant and hepatoprotective actions. Triterpenoids and sterols support membrane

stabilization and enzyme modulation. Alkaloids and phenolics add antimicrobial and anti inflammatory breadth to the pharmacological profile.

Ethnomedicinal Importance[2]

- Traditional medicinal systems, particularly Siddha, use the tuber for:
- Improving digestion and reducing flatulence
- Managing inflammatory conditions
- Relieving abdominal discomfort
- Supporting detoxification and liver health.
- Treating fever and skin disorders .
- Topical pain relief through medicated oil preparations.
- These ethnobotanical uses provide the rationale for exploring its pharmacological mechanisms and developing standardized formulations.

Pharmacological Activities[12]

1. **Anti-inflammatory[7]:**

Anti-inflammatory[3] effects are primarily mediated by cucurbitacin-induced suppression of NF-κB, COX-2, and TNF-α signaling. In-vitro assays demonstrate potent inhibition of pro-inflammatory cytokines and reactive oxygen species.

2. **Anticancer:**

Anticancer[8] activity appears through apoptosis induction, mitochondrial membrane disruption, and cell cycle arrest at G2/M. Extracts show selective cytotoxicity toward breast (MCF-7), liver (HepG2), and cervical (HeLa) cancer cell lines.

3. **Antidiabetic:**

Antidiabetic potential arises from improved insulin sensitivity, enhanced glucose uptake, and pancreatic β-cell protection. In-vivo studies show significant glycemic reduction in alloxan-induced diabetic models.

4. **Hepatoprotective**:

Hepatoprotective action is supported by reduced ALT, AST, and ALP levels, enhanced hepatic antioxidant enzymes, and protection against CCl_4-induced liver injury.

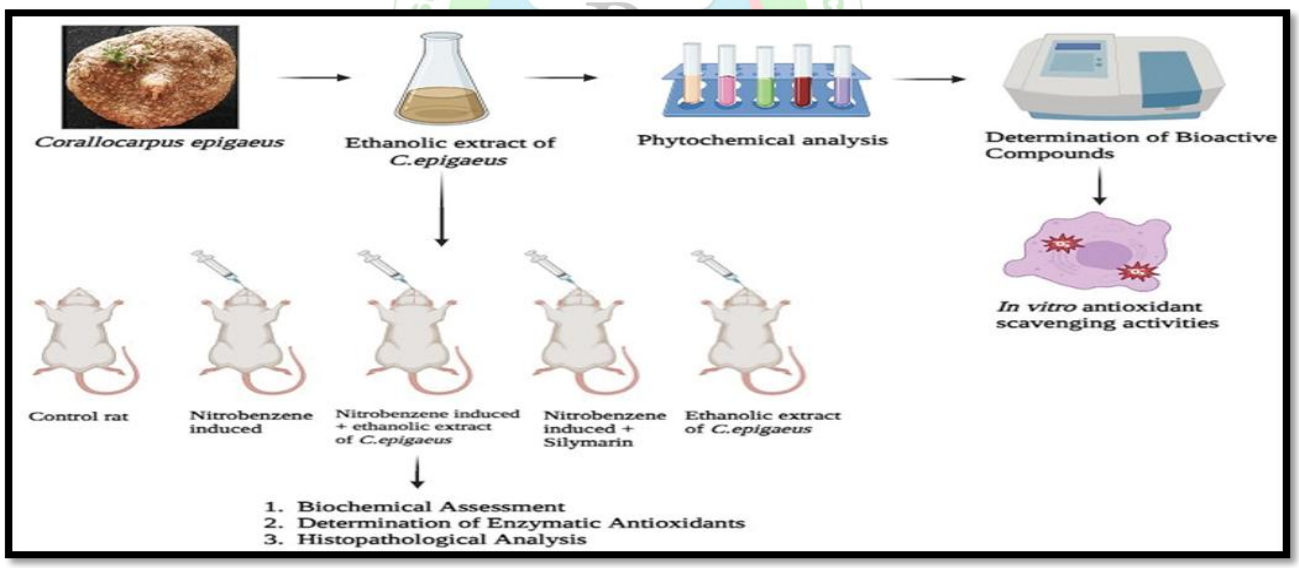

Figure 3: This image shows the Hepatoprotective effects of ethanolic extract of *Corallocarpusepigaeus* roots on nitrobenzene-induced liver injury in Wistar rats

PREFORMULATION STUDIES

Preformulation[4] characterization is essential for developing modern formulations:

Solubility characteristics

Cucurbitacins are hydrophobic → require lipid-based or surfactant-based systems.

Flavonoids → moderately soluble in polar solvents

Glycosides → water soluble

Partition coefficient

High lipophilicity implies good membrane permeability but poor aqueous solubility.

pH stability

Active compounds are more stable in acidic to neutral pH conditions.

Organoleptic properties

Odor: aromatic

Taste: bitter

Color: yellow to brown

These properties influence excipient selection and taste-masking strategies.

Extraction Techniques

- Suitable methods for extracting phytochemicals include:
- Maceration for heat-sensitive compounds
- Soxhlet extraction for efficient extraction of lipophilic cucurbitacins
- Ultrasonic-assisted extraction for faster yield
- Supercritical CO_2 extraction for solvent-free extracts suitable for phytopharmaceuticals

Pharmaceutical Formulation Approaches

- The poor aqueous solubility of cucurbitacins necessitates advanced delivery strategies. Nanoemulsions improve dispersibility, enhance intestinal absorption, and provide sustained release. Phytosomes increase membrane permeability by phospholipid complexation.

- Solid lipid nanoparticles (SLN) and nanostructured lipid carriers[5] (NLC) stabilize thermolabile compounds and improve oral bioavailability. Hydrogel-based systems offer targeted transdermal and wound-healing applications.

- Standard preformulation studies reveal high lipophilicity, moderate instability under alkaline conditions, and sensitivity to oxidative degradation. This supports the need for antioxidant stabilizers, encapsulation matrices, and pH-controlled formulations.

- Modern pharmaceutics suggests the plant is ideal for lipid-based systems (SEDDS, SNEDDS), polymeric nanoparticles (PLGA, chitosan), and mucoadhesive delivery technologies.

Drug Delivery Opportunities

- Lipid-based systems (NLC, SLN, SEDDS)
- Transdermal patches
- Nano-gels
- Mucoadhesive systems
- Standardized dry extract capsules
- Phytochemical-enriched fractions

Quality Control and Standardization

Quality parameters required for publication-grade herbal pharmaceutics:

- Pharmacognostic Evaluation
- Microscopic and macroscopic analysis: Tuber morphology and powder characteristics
- Physicochemical Parameters: Ash values, Extractive values, Moisture content
- Chromatography & Spectroscopy: HPTLC fingerprinting for cucurbitacins, HPLC for quantification, FTIR for functional groups, UV spectrophotometry for phenolic content, GC-MS for volatile constituents
- Standardization ensures batch-to-batch consistency and regulatory acceptance.

Toxicity [6] and Safety Evaluation

1. Acute toxicity
   - Limited studies; high-dose safety unknown.
2. Chronic toxicity
   - Not studied.
3. Suggested safety guidelines
   - Avoid in pregnancy
   - Avoid high doses
   - Standardize before clinical use

Stability and Shelf-Life Considerations

Stability issues include:

- Sensitivity to heat and oxidation
- pH-dependent degradation
- Light-induced decomposition
- Stability testing should comply with ICH Q1A–Q1F guidelines, including:
- Accelerated stability
- Long-term stability
- Stress degradation studies
- Suitable packaging: amber bottles, airtight containers, or foil strips for tablets.

Future Research Opportunities

- Standardization initiatives require validated chromatographic markers, including cucurbitacin E and quercetin. Establishing pharmacopeial monographs would strengthen quality control frameworks.
- Clinical research must examine dose–response relationships, pharmacokinetics (ADME), and therapeutic outcomes in humans. Early-phase clinical trials could target inflammatory disorders, liver ailments, and metabolic syndromes.
- Nanotechnology-based formulations present the strongest commercial potential due to their ability to address solubility, permeability, and stability challenges inherent in plant extracts.

CONCLUSION

Corallocarpusepigaeus is a promising but scientifically underreported medicinal plant with significant potential for pharmaceutical applications. Traditional systems attribute digestive, detoxifying, anti-inflammatory, antimicrobial, and analgesic properties to the tuberous root. The phytochemical richness, especially cucurbitacins and triterpenoids, supports its pharmacological relevance. However, the absence of standardized extracts, mechanistic pharmacology, toxicological profiling, and formulation development studiescreates a major research gap. Considering its broad pharmacological spectrum and bioactive phytochemicals, the plant represents an excellent candidate fornovel dosage form development, value-added herbal formulations, nano-phytomedicine research, and integrative therapeutic application.

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