

## Pharmacognostic Investigation of Carissa Carandaslinn: A Review

### Running Title: Carissa carandasLinn: A Review

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#### ABSTRACT

Carissa carandas Linn is a member of Apocynaceae family and has climbing shrub having small berry shaped fruits & lovely jasmin like flowers. It is widely distributed throughout subtropical and topical regions of India, Indonesia, Sri Lanka, etc. It is known as Bengal Currant or Christ's thorn, keronda, Jasmin flower Carissa. It has medicinal value due to presence of alkaloids, flavonoids, cardiac glycosides, triterpenoids in its various parts. Pharmacologically it has anti-cancer, anti-convulsant, antioxidant, analgesic, anti-inflammatory, anthelmintic, cardiovascular, antidiabetic, antipyretic, hepatoprotective, neuropharmacological, antimicrobial activities as per information available in various reference books and published literature. The plant is been used as traditionally over thousands of years with great demand in the international market. The review has been written with the aim & objective to provide detail information of plant and its phytoconstituents and their pharmacological uses in clinical research to promote safe and effective herbal treatments to cure various diseases.

**Key Points-** Carissa carandas, Morphology, Microscopy, Phytochemicals, Pharmacological Nature

#### I. INTRODUCTION

Carissa carandas (Karonda) is a member of Apocynaceae family which consists of 300 genera and 1000 species. There are about 30 species in genus Carissa being native of tropics and subtropics.<sup>5</sup> a spiny treelet that grows up to 5m tall and is native to India and cultivated in Taiwan, India, Indonesia, Malaysia, Burma, Sri Lanka, Thailand, and the Pacific Islands.<sup>1</sup> In India is found in Jharkhand, Bihar, Rajasthan, Maharashtra. It is a non-traditional fruit crop which thrives well as a

rained crop. Once established, the plant hardly needs any care and gives yield with minimum management.<sup>3</sup> Its fruits, which can be eaten raw, are also made into jelly, or used for pies. The stems are up to 5cm long and show numerous spines, which are woody, simple or forked. The leaves are decussate, simple, and exstipulate. Different phytochemicals such as carotenoids, alkaloids, saponins, triterpenes and steroidal compounds have already been reported. The whole plant usually used as anthelmintics and antidiarrheal and stem of plant is used to reinforce tendons, fruits are used in skin infections and leaves are remedy for fevers and syphilitic pain. Alcoholic extract of root material reduces the blood pressure and aqueous extract of roots exhibited various pharmacological activities like histamine releasing, anthelmintic, and spasmolytic and cardio tonic. Chemical constituents such as carisone, carindone, carinol, lignin, oderoside H and 2-acetylphenol have been reported from roots of Karonda plant. Triterpenes, tannins and carissic acid are reported from the leaves of this plant.<sup>2</sup> Consumption of various types of fruit provides excellent health benefits because they are a good source of phytochemicals that are good for preventing diseases.<sup>4</sup> the species has been used as a traditional medicinal plant over thousands of years in the Ayurvedic, Unani, and Homoeopathic system of medicine. Traditionally, whole plant and its parts were used in the treatment of various ailments. Its fruits are eaten to treat liver dysfunction, to break fever, to counteract the putrefaction of blood while roots are used to improve digestion. Fruits are very rich source of iron and vitamin C, therefore ethnomedical the fruits are used for curing anemia. as an astringent, antiscorbutic used as a remedy for biliousness. Its leaf decoction is used against fever, diarrhea, and ear ache, whereas roots serve as a stomachic, vermifuge, remedy for itches, and insect repellent.<sup>6</sup>

The antioxidant compounds like flavones, phenolic acids, polyphenols and flavonoid may scavenge these free radicals such as peroxide, hydro peroxide produced through the metabolism. Thus, it inhibits the oxidative mechanism that leads to degenerative diseases.<sup>8</sup> The alcoholic extract of the roots of *C. carandas* had been reported to possess cardiotoxic activity and antihypertensive activity. The ripe fruit is cooling and acidic; used to treat sore throat, mouth ulcer and skin disorders, Equal quantity of fresh leaves, fruits and roots bark is grounded and

taken once a day with water for eight days for the permanent cure of piles. Ethanolic extract of the plant root has been reported for histamine releasing activity used to assess the intensity of snake poisoning.<sup>9</sup>

#### PLANT DESCRIPTION

**Synonyms-** Karvada, Bengal Currant or Christ's thorn, Jasmin flower Carissa

**Botanical Name-***C. carandas* Linn (*C. Carandas*)

**Family-** Apocynacea



Fig.1 *C. Carandas* Plant Fig. 2 *C. Carandas* Flowers



Fig. 3 *C. Carandas* Fruits

*C. carandas* is a small shrub herb, the word “herb” has been derived from the Latin word, “herba” and an old French word “herbe”. Now days, herb refers to any part of the plant like fruit, seed, stem, bark, flower, leaf, stigma or a root, as well as a non-woody plant. (Fig1) Earlier, the term

“herb” was only applied to non-woody plants, including those that come from trees and shrubs.<sup>15</sup> Major characteristic features of this family are that almost all species are known to produce milky sap.<sup>16</sup>

Taxonomy of <i>C. Carandas</i> Linn.	
Kingdom	Plant
Class	Angiospermae
Order	Gentianellas
Family	Apocynaceae
Genus	Carissa
Species	caranda
Scientific Name	Carissa carandas

Table I Taxonomy of *C. Carandas*

Some of the important cultivated *Carissa* species are *C. carandas* L. includes: *Carissa grandiflora* DC, *Carissa bispinosa* Desf., *Carissa spinarum* DC, *Carissa ovata*, *Carissa edulis* Vahl., *Carissa inermis* Vahl. Syn., *Carissa macrophylla*, *Carissa paucinervis* D.C., and *C. spinarum* L. Syn., *Carissa diffusa*, *C. carandas* and *C. spinarum* are native to India, while *C. grandiflora* is native to South Africa.<sup>6</sup> It grows from sea level to 6000 feet and requirement is fully exposure to sun. Karunda may bloom and fruit off throughout the year. For use unripe fruits are collected from mid-May to mid-July. Ripening season is August to September<sup>4</sup>.

#### Organoleptic Study of *C. carandas*

**Leaves-** Simple Green, opposite, oblong-oval or oblong-lanceolate, subacute at the base, obtuse at the apex, glabrous and thin with reticulate venation.

**Flowers-** Jasmin like white, Pinkish white regular and bisexual flowers having pleasant fragrance (Fig.2).

**Fruit-** Cluster of 3 to 10 is oblong, broad-ovoid or round, has fairly thin but tough skin, sour sweet taste, purplish-red turning dark-purple or nearly black and shiny when ripe (Fig. 3).

**Bark-** Light gray, scaly; branch lets usually alternate, with thin stout sharp horizontal glabrous spines 2.5-3.8 cm long at their base having short fractures.

**Roots-** Considerably long, often irregularly bent, woody and cylindrical, rusty or yellowish-brown in color, 1–1.5 cm thick having smooth surface & hard fracture.

**Stem-** Dark Green Color cylindrical shaped smooth surface with internode.

#### Cultivation & Collection

It is commonly grown from seeds. It grows well in arid climate at higher temperature. The plant growth gets much affected with heavy

rainfall and even waterlogged regions. The climate with high frost and snowfall temperature is not recommended for the fruit development. The plant is grown very well on a wide variety of soil types, such as sandy loams, laterite, alluvial sand and calcareous soil. Sometimes it grows very well in stony and rocky surface with less fertile soils. Alluvial sandy loamy soil with proper drainage provides higher yield and optimum growth of the plant. It requires optimum range of pH from 5 to 8 for their better growth. The air-layering was performed in between June and July. After air-layering, the plants were removed in September and planted in polythene bags. They were ready for planting after 6-7 months of this process. Before planting, the levelling of soil must be required to remove all the older plants from the field. The planting should be done in the month of June-July. The pits must be filled with equal proportion of farmyard manure. For the proper establishment of the plant, watering is done immediately after the planting. The regular irrigation is required at a regular time interval for the better nourishment. It requires balanced proportion of fertilizer including nitrogen, phosphorus and potash. Nitrogen level should maintain to maintain iron contain in leaves; nitrogen level must be maintained in the range of 0.99 to 0.37%.<sup>3</sup> Initially, the branches and stems of the plants were tender and weak, so they required support for their growth. Unwanted stems and branches should be trained and pruned to give a definite shape and enhance the growth of the trunk. Training of the plant should be done only in the initial two years. The plant start bearing flowers in December–March, and the fruit gets matured in the month of April–June. The maturity of fruits can be analyzed on the basis of colour change. Harvesting can be done for 3-4 times as all the fruits cannot get matured at one time. The fruits are then stored for 3-4 days under room temperature.<sup>18</sup>

**Microscopical (Histochemical) of different parts of *C. carandas***

Plant Part	Microscopic study	Powder study
<b>Leaves</b>	Presence of wavy-walled epidermal cells with thin cuticle, containing anisocytic stomata. Covering and glandular trichomes are present. Upper epidermis consists of single layered parenchymatous cells, followed by bilayer radially elongated palisade cells. These cells are surrounded by 3-4 layers of spongy parenchyma and lower epidermal cells. Mid-rib consists of upper epidermis, followed by single layer of parenchymatous hypodermis. Presence of collenchyma below hypodermis. Collenchyma cells are surrounded by chlorenchymatous cells. Bicolateral vascular bundles are followed by calcium oxalate crystals and starch grains.	Colour: greenish-brown; it shows pericyclic fibers, calcium oxalate crystals, glandular trichome and xylem vessels
<b>Bark</b>	A wide zone of stratified cork is seen, with lenticels; secondary cortex is composed of thin-walled, elongated, parenchymatous cells containing stone cells; cortical fibers are present in single or sometimes in groups of 2-3; Presence of secondary phloem containing calcium oxalate crystals, and starch grains are scattered in cortical cells and phloem parenchyma	Colour: greyish-brown; it shows stone cells, calcium oxalate crystals and starch grains (simple or compound)
<b>Root</b>	Presence of stratified cork consists of lignified tangentially elongated cells; secondary cortex is composed of 1 or 2 layers of thinwalled cells which are very narrow in size; secondary phloem composed of several cavities, found just beneath the secondary cortex in a ray pattern; stone cells are found scattered in phloem regions; phloem rays are uni or biserriate containing calcium oxalate prism; cambium is not prominent; and secondary xylem consists of xylem vessels, fibers, tracheid and even xylem parenchym	Colour: yellowish-brown; it shows stratified cork, lignified xylem fibres, stone cells, calcium oxalate and starch grains (simple, round to oval)
<b>Stem</b>	Presence of single-layered epidermal cells, surrounded by hypodermis and cortex. The cortex is composed of 4- to 5-layered parenchyma cells. Lignified fibers are scattered in the cortical region. Non-lignified pericyclic fibers are seen in the bicollateral vascular bundles. Pith is present at the center of the section	Lignified fibers, xylem vessel, starch grains, calcium oxalate crystals and epidermal cells

Table IIMicroscopical of different parts of *C. carandas*

**Physiochemical analysis-**

Parameter	Range
Total Ash	20 % w/w
Acid insoluble Ash	18 % w/w
Water Soluble Ash	16 % w/w
Alcohol Soluble Extractive	1.2 % w/w

Water Soluble Extractive	2.0 % w/w
Loss on Drying	14%

Table III Physicochemical Parameters of *C. carandas*

### Phytochemical study of *C. carandas*

Ethanollic and aqueous extracts of *C. carandas* from apocynaceae demonstrate 1,1-diphenyl-2-picrylhydrazyl (DPPH) radicals have scavenging activity<sup>1</sup>. DPPH free radical scavenging and % inhibition of linoleic acid peroxidation.<sup>2,9</sup> The antioxidant activities of various extracts from different organs of *C. carandas* were screened for by using ferric thiocyanate (FTC) and thiobarbituric (TBA) methods. All the extracts showed strong antioxidant activities as compared to BHT (a commercial antioxidant) towards the autooxidation of linoleic acids.<sup>1</sup> It had the highest antioxidant activity and possessed total anthocyanin content at 81.00 mg cyanidin-3-glucoside/100g, total phenolic content at 216.53 mg GAE/100g, FRAP at 259.11 mmol FeSO<sub>4</sub> /g, and DPPH at 78.28% scavenging effect.<sup>10</sup>

The sesquiterpene glucoside and (6S,7R,8R)-7a-[β-glucopyranosyl) were isolated from the stem of *Carissa carandas*. In the co-chromatography comparison with authentic markers, rf values, colors, ultra violet and mass spectrum analyses. The major compound in the extract was tentative identified as apigenin 6-C-rhamnosil-7-O-rhamnoside. The minor components found in the extract are Pelargonidin 3-O-glucoside, Chrysoeriol 7-O-glycoside and Quercetin 3-O-methyl-7-O-glucoside.<sup>1</sup>

roots extract was also reported to contain volatile principles including 2-acetyl phenol, lignan, carinol, sesquiterpenes (carissone, carindone), lupeol, β-sitosterol, 16β-hydroxybetulinic acid, α-amyryn and β-sitosterol glycoside, and des-Nmethylnoracronycine, an acridone alkaloid.<sup>6</sup>

Chemical analysis of stem showed the presence of sesquiterpene glucoside. The leaves were reported to contain triterpenoid constitutes as well as tannins, and a new isomer of ursolic acid namely carissic acid, triterpene carandinol, betulinic acid, β-sitosterol-3-O-β-d-glucopyranoside, oleanolic acid, ursolic acid, and 4-hydroxybenzoic acid. Fruits of *C. carandas* have been reported to contain carisol, epimer of α-amyryn, linalool, β-caryophyllene, carissone, carissic acid, carindone, ursolic acid, carinol, ascorbic acid, lupeol and β-sitosterol. isolated the volatile flavor constituents of the karanda fruits; isoamyl alcohol, isobutanol, and β-caryophyllene

being the major constituent.<sup>6</sup> tacyclic oleanane triterpenes, oleanolic acid, bamyryn, methyl oleanolate and ursane triterpene, ursolic acid, had been isolated mostly from the roots of *C. carandas*.<sup>11</sup> lupeol and oleanolic acid exhibited potential anti-inflammatory activities. Carandinol was isolated from the leaves of *C. carandas*, along with three known triterpenoid acids, ursolic acid, oleanolic acid, and betulinic acid, and its structure as 3b,21a-dihydroxyisohopane was deduced by exhaustive spectroscopic analyses.<sup>11</sup> Steroid β-Sitosterol found *C. carandas*.<sup>11</sup>

Other Chemical constituents also found various part of *C. carandas*

**Roots:** Lupeol, 16b-Hydroxybetulinic acid, Lupa-12,20(29)-dien-3b,28-diol, α-Amyryn, Oleanolic acid, Carindone, Carinol.<sup>18</sup>

**Fruits** -Carissol, Rutin, Epicatechin, Kaempferol, Caffeic acid, Chlorogenic acid.<sup>18</sup>

**Leaves**-Carissic acid, Carissic acid methyl ester, Carissic acid monoacetate, Carandinol, Betulinic acid.<sup>18</sup>

**Flowers**- Farnesol, Camphene, Menthol, p-Cymene, α-Terpeneol, Piperitone, Citronellal, Linalool, Neryl acetate, Geranyl acetate, β-Ionon.<sup>18</sup>

**Seeds**-Eicosanoic acid, Hexadecanoic acid, Octadecanoic acid.<sup>18</sup>

### Pharmacological Activities-

#### Anti-Oxidant Activity-

Anti-oxidant properties were seen in various parts of *C. carandas* and determined by using ferric thiocyanate (FTC) and thiobarbituric (TBA) methods.<sup>1</sup> Scavengers' activities show Ethanollic and aqueous extracts of *C. carandas* to show the presence of 1,1-diphenyl-2-picrylhydrazyl (DPPH) radicals,<sup>1</sup> phenolics and flavonoids contents shows DPPH free radical scavenging and % inhibition of linoleic acid peroxidation of sample extracts was determined<sup>2</sup>

#### Antidiabetic activity

Extracts *C. carandas* L. of concentration levels of 500 and 100 mg/kg significantly reduced glucose level of blood of alloxan induced diabetic rats at 4, 8, and 24 h.<sup>5</sup> The methanol extract and its ethyl acetate soluble fraction have significantly lowered the elevated blood glucose levels at dose level of 400 mg/kg per oral after 24 h. as compared to diabetic control group.<sup>6,9</sup>



### Cardiotonic and Blood pressure

The alcoholic extract of the root of *C. carandas* L. has been possess cardiotonic activity by decreasing the blood pressure in normal anaesthetized cats due to Presence of new cardioactive substance; glucosides of odoroside H.<sup>1</sup>The terpenoid carindone besides carissone, lupeol, ursolic acid and its methyl ester shows pharmacological activity of the extract showed an increase in free histamine in the guinea pig lung and a pronounced decrease in blood pressure at 1 mg/kg dose which lasted for 4-5 h.<sup>1</sup>*C. carandas* extract decreased the blood pressure of arteries, in mice. Significant reduction in activation of histaminergic and muscarinic receptors.<sup>5</sup>

### Anti-convulsant activity:

Anti-convulsant effect of *C. carandas* roots extract at dose levels of 0.1, 0.2 and 0.4 g/kg was investigated on chemically and electrically based seizures. The extract at concentration of 0.2 and 0.4 g/kg significantly reduced the duration of seizures induced by electric shock in mice.<sup>5,6</sup>

### Adaptogenic activity:

A triterpenoid (lanostane) isolated from *C. carandas* fruit extract (ethanolic) shows adaptogenic activity against immune suppression induced by cyclophosphamide, swimming endurance, and anoxia stress tolerance model.<sup>5</sup>

**Anti-microbial activity-** The ethanolic extract of *C. carandas* shows powerful antibacterial activity against various strains of bacteria including *B. subtilis*, *E. coli*, *S. aureus*, *S. faecalis*, *P. aeruginosa* and *S. typhimurium*.<sup>5</sup>

### Hepatoprotective activity

Extracts of *C. carandas* L. showed significant hepatoprotective activity at dose levels of 0.1, 0.2, and 0.4 g/kg be inhibiting the activities of serum marker enzymes (bilirubin and lipid peroxidase).<sup>5</sup> Oral consumption of ethanolic extract of the root of *V. carandas* showed hepatoprotective activity against CCl<sub>4</sub> and paracetamol induced hepatotoxicity by decreasing the activities of serum marker enzymes, bilirubin and lipid peroxidation and significant increase in the levels of uric acid.<sup>1</sup>

### Anti- Malarial activities

Invitro antimalarial activities of methanolic and aqueous extract of three different parts including leaf, stem, and fruit of the plant *C. carandas* were tested against *Plasmodium falciparum* 3D7 strain.<sup>5,9</sup>

### Analgesic, Antipyretic and anti-inflammatory activity

The ethanolic extracts of *C. carandas* were examined for anti-inflammatory and analgesic activities in experimental animals. *C. carandas* caused a dose dependent inhibition of swelling caused by carrageenin significantly in cotton pellet induced granuloma in rats.<sup>1</sup>

Antipyretic effect shows on using diseased albino rats. Maximum antipyretic effect was shown by the extracts at concentrations of 0.1 and 0.2g/Kg.<sup>5</sup>

Methanolic extract of *C. carandas* leaves reduced the edema induced by histamine, carrageenan and dextran in rat hind paw at the dose of 200 mg/kg b.w. It exhibited maximum inhibition of inflammation, i.e., 72.10 %, 71.80 and % 71.90 % at the end of 3 h. with histamine, carrageenan and dextran induced rat paw edema respectively. The methanolic extract of *C. carandas* leaves at the dose of 100 and 200 mg/kg p.o., showed significant reduction in yeast induced increased temperature in a dose depended approach and the effect also extended up to 4 h. after the drug administration.<sup>9</sup>

### Anthelmintic activities

Anthelmintic effects of petroleum ether, ethanolic and chloroform extracts of unripe fruits of *C. carandas* were examined using earthworms. Paralyzing & Death of worm are determined.<sup>5</sup>

### Neuropharmacological and diuretic activities

Evaluated methanolic extracts of *C. carandas* L. leaves for its neuropharmacological, and diuretic activities and reported significant neuropharmacological activity of the plant. While, diuretic activity of the extract was proved by the electrolyte loss ratio as that of the standard diuretic furosemide.<sup>6</sup>

Extract of *C. carandas* leaves exhibited dose-dependent and significant anti-nociceptive activity, and Methanolic decreased the number of writhing induced by intraperitoneal administration of acetic acid in acetic acid-induced gastric pain model in Swiss albino mice.<sup>6</sup>

### Anti-cancerous activity

The study showed significant antioxidant activity, and protection of cell death in MCF-7 cell line pretreated with *C. carandas*. The workers suggested the potential of this medicinal plant for future development of therapeutic drugs against breast cancer.<sup>6</sup>

### Traditional Uses of Carissa Carandas-

*C. carandas* has been used traditionally to cure various diseases including fever, malaria, headache, cough, leprosy, colds, myopathic spasms, and nervous disorders. Ripe fruits are used to prevent scurvy and to treat burning sensation, anorexia, pruritus, and skin diseases. The unripe

fruits are rich in ascorbic acid and iron, and are used to cure anemia. Root portion of this plant is used to reduce blood pressure, to cure stomach disorders, diabetes, intestinal worms, and to reduce blood pressure. Leaves are used in the treatment of fever, diarrhea, snake bite, and syphilitic pain.<sup>5</sup>

#### Ayurvedic formulations

The plant is used as ingredient in a number of ayurvedic formulations and preparations. Marmagutika used in the treatment of vital organs, like diseases related to heart, brain, urinary system. Hridayamahakashaya is employed in the treatment of heart disease. Kalkantaka rasa, 'juice' or 'essence' used for mental disease. Marichadivati used in the treatment of diseases of respiratory conditions and black pepper is the first ingredient of this medicine.<sup>9</sup>It is widely used medicinal plant by tribals throughout India and popular in various indigenous system of medicine like Unani, Ayurveda and Homoeopathy. Traditionally the plant has been used in the treatment of scabies, intestinal worms, diarrhea, intermittent fever and reputed for its aphrodisiac, antipyretic, appetizer, antiscorbutic, anthelmintic, and astringent and useful for cure of anemia. It contains a fair amount of Vitamin C and therefore is an antiscorbutic. Mature fruit is harvested for pickles.<sup>15</sup>

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