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REVIEW ARTICLE

A Critical Review on Karamarda (*Carissa carandas* Linn.)

Sunil Kumar *[1], Pallavi Gupta[2], Virupaksha Gupta K.L[3]

[1] *Lecturer, Dept of Dravya Guna, Gaur Brahman Ayurveda Medical College, Rohtak, Haryana, India*
[2] *Lecturer, Dept of Basic Principles, Gaur Brahman Ayurveda Medical College, Rohtak. Haryana, India*
[3] *Reader, Dept of Rasa Shastra & Bhaishajya Kalpana, Gaur Brahman Ayurveda Medical College, Rohtak ,Haryana, India*

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ABSTRACT

Herbal drugs are being used as well as recommended nowadays for all major health ailments. *Karamarda* is one such herb which is native and common throughout much of India. It is a widely used medicinal plant by tribes throughout India and popular in various indigenous systems of medicine like Ayurveda, Unani and Homoeopathy. All parts of the plant are used in traditional medicine. It is commonly known as "karanda." It contains several phyto-chemical constituents belonging to terpenoid category. It has a good nutritional value and is useful in multiple illnesses such as diarrhea, intestinal worms, skin ailments etc, various pharmacological activities have also been reported such as Anti microbial, Anti inflammatory, Antipyretic, Anti viral, Anti convulsant, Cardiotonic etc.

Key words: *Karamarda*, Karanda, Traditional medicine.

INTRODUCTION

Karamarda (*Carissa carandas* Linn.) is a common herb of Apocynaceae family found throughout India mainly in the semi-arid regions. It is commonly used as a condiment or additive to Indian pickles and spices. It is a very hard, drought-tolerant plant that thrives well in a wide range of soils [1,2]. Traditionally the plant has been used in the treatment of scabies, intestinal worms, pruritus, biliousness etc. The notable biological activities reported are analgesic, anti inflammatory, anti pyretic, cardiotonic and histamine releasing [3,4]. Additionally it has shown wide range of evidences for its, hepato-protective, free radical scavenging, antirheumatic, antibacterial, antiviral and anticonvulsant activity.

Taxonomical Classification

Kingdom: Plantae
Divison: Magnoliophyta
Class: Magnoliopsida
Order: Gentianales
Family: Apocynaceae
Genus: Carissa
Species: C.carandas

Synonyms: *Krishanapaakaphalam, Sushenaa, Karamardikaa, Vaneshudraa, Sheeraphenaa, saamlapushpaa.*

Vernacular names:
Sanskrit: Karmard, Sushena **Hindi**: *Karamarda*, **English:** Cranberry Bengal currant, Christ's thorn, Corinda tree, Karanda, **Tamil:** Kalakai, Kalakkay **Telugu:** Vakkay, Peddakalavi, **Kannada**: Karjige, Karekayi **Gujarati:** Karamdaa **Marathi**: Karvinda, Karavanda **Bengali**: Karamcha, **Urdu**: *Karamarda*, **Oriya:** Kerendokuli **Malayalam:** Karakka

BOTANICAL DESCRIPTION

Habit: A large thorny evergreen shrub; **Height:** 2-3m; **Bark** - light grey, **Branches:** These are numerous, rigid and spreading, with 2 straight, simple or forked thorns, up to 5 centimeters in length on the axils and nodes. Branchlets are usually with thin stout sharp spines. **Leaves**: opposite, simple; exstipulate; petioles short; laminae elliptic or broadly elliptic or obovate, the bases obtuse to rounded, the margins entire, tips acute, often shortly mucronate, unicostate, reticulate, the surfaces glabrous, glaucous, coriaceous. **Inflorescences:** in axillary corymbose

***Corresponding Author:** Dr. Sunil Kumar**, Email:** drsuniltomarmuz@gmail.com

cymes; bracts linear. **Flowers**: Flowers are fragrant (jasmine-like fragrance.), white or pale rose-colored, clustered in twos or threes ebracteolate, pedicellate, bisexual, actinomorphic, pentamerous, hypogynous. Calyx-segments are very slender, pointed and hairy, synsepalous 5-partite, the lobes lanceolate, pubescent. **Corolla**: synpetalous, 5-lobed, salverform, the lobes oblong lanceolate, pubescent, the tube cylindrical, dilated at the throat, pubescent, white. **Androecium**: polyandrous, apically appendaged, basifixed, introrse, dehiscence longitudinal. **Gynoecium**: 1, ovary ellipsoid 2-carpelled, syncarpous, 2-loculed, the placentation axile, the ovules 2 in each locules, the style filiform the stigma minutely bifid. **Fruit**: Fruit is a drupe, broadly ovoid/ellipsoid, 1.5 to 2.5 centimeters long, bluntly pointed, and blackish or reddish-purple when ripe, and containing 2 to 4 small, flat seeds. Pulp is reddish-purple and sour. Karonda's ripeness depends on its end use. If intended for use as a vegetable, the fruits should be plucked while still unripe. This is apparent by the fruit's greenish white color. When fully ripe, these fruits are selected for canning, preserving and pickling. Some of the fruits grow dark red when fully ripe; others grow dark purple. **Seeds**: oblongoid, concave endosperm fleshy. **Flowering and fruiting periods**: October – January – June. **Varieties**: Formerly there were believed to be 2 distinct varieties: *C. carandas* var. *amara*–with oval, dark-purple, red-fleshed fruits, of acid flavor; and var. dulcis–round, maroon, with pink flesh and sweet-subacid flavor. However, David Sturrock, a Florida horticulturist who took a special interest in the karanda, observed these and other variations throughout seedling populations [5].

Fig 1: Flowers of Carissa carandus

Fig 2: Fruits of Carissa carandus

Distribution:

Karamarda is one of the many berry-like fruits believed to originate near the Himalayas, though some botanists place the fruit's origin to Java. Its natural range extends from Nepal to Afghanistan and encompasses several parts of India throughout that stretch. It is attributed all over warm regions of India and Sri Lanka. It grows naturally in the Himalayas at elevations of 300 to 1800 meters, in the Siwalik Hills (part of India), and in Nepal and Afghanistan. It is also distributed throughout the drier sandy or rocky soils of India, wild or cultivated from Punjab to Srilanka.

Soil: The plant grows vigorously in Florida on sand or limestone. In India, it grows wild on the poorest and rockiest soils and is grown as a hedge plant in dry, sandy or rocky soils. It is most fruitful on deep, fertile, well-drained soil but if the soil is too wet, there will be excessive vegetative growth and lower fruit production.

Propagation and Cultivation

Karamarda is a drought tolerant plant; it thrives well throughout the tropical and subtropical climates. Heavy rainfall and waterlogged conditions are not desirable. It can be grown on a wide range of soils including saline and sodic soils. [6] The plant grows successfully in marginal and waste lands.

Vegetative methods: The plants are commonly raised from seeds. Air-layering and stem (hard wood) cuttings are feasible but not very common. Fresh seeds are sown in nursery during August – September. One- year old seedlings are transplanted. Air- layering is very successful in *Karamarda*. It can be performed in the beginning of the monsoon. Rooted layers can be separated 3 months after layering but can also be multiplied by hard wood cuttings and air-layering with the aid of growth regulators. Cuttings from a fruiting tree do not root well, although those from young

nursery plants root successfully. Two types are commonly grown, one with dark purple to almost black fruits, and the other with pink and white attractive fruits. The plants once established, are very hardy and thrive without irrigation and much care, but require manuring regularly. They start bearing fruits two years after transplanting.[7]It was found that tender tip cuttings could be rooted under constant mist; also that the karanda can be grafted onto self-seedlings. It has proved to be a good rootstock for carissa.

Manuring and fertilization:

Karamarda plants grown as protective hedge are hardly manured or fertilized. Manuring, however used as 10-15 kg well-rotten farmyard manure or compost/plant and should be applied before flowering.

Irrigation:

Water requirement of *Karamarda* is very low. Irrigation after planting and manuring is essential. Plantation once established does not need much water.

Storage: The fruits ripen from July to September in north India. *Karamarda* fruits mature 100-110 days after fruit set. At this stage fruits develop their natural color. Fruits ripen after this stage, taking about 120 days (after fruit set) when they become soft and attain dark purple/maroon/ red colour. After packing of fruits, they are kept in shade. Fruits harvested at maturity, can be stored for a weak at room temperature. Fruits can be preserved / stored for 6 months in SO_2 solution (2,000ppm).

Chemical Constituents:

Root contains a number of volatile principles including 2-acetyl phenol [8],[9] with an odor similar to that of Piper betel leaf, salicylic acid, and an alkaloid. Study has reported carissone, carindone, carinol, lignin, oderoside H, digitoxigenin, glucose, D-digitalose and 2-acetylphenol from root materials. Certain studies have led to isolation of a mixture of sesqui terpenes , namely carissone and carindone as a novel type of C31 terpenoid [10-12]. **Stem bark** contain alkaloids. **Leaves** have yielded triterpenes, tannins, ursolic acid and carissic acid [13,14]. Study of fresh leaves isolated four pentacyclic triterpenoids including a new constituent, carissin (3beta-hydroxy-27-E-feruloyloxyurs-12-en-28-oic acid), and two previously unreported compounds.**Volatile oil of fresh flowers** yields myrcene, limonene, camphene, carene, dipentene, farnesol, nerolidol, dihydrojasmone, α-terpeneol, citronellal, β-ionone, nerylacetate, linalol and geranyl acetate .**Fruits** yield a mixture of volatile principles - 2-phenyl ethanol, linalool, ß-caryophyllene, iso amyl alcohol, benzyl acetate, lupeol, oxalic, tartaric, citric, malic, malonic and glycolic acids, glycine, alaline, phenyl alaline, cerine, glucose, galactose and a novel triterpenic alcohol (carissol -an epimer of α-amyrin). Study of **volatile flavor constituents of fruits** growing in Cuba yielded 150 compounds in the aroma concentrate; the major constituents were isoamyl alcohol, isobutanol and beta-caryophyllene. **Seeds** yield fatty acids, viz., palmitic, stearic, oleic, arachidic, linoleic acids. Enzymatic mild hydrolysis of polar glycoside from the plant yielded oderoside H, digitoxigenin and the sugars D-glucose and D digitalose. Moreover, *C.congesta* contains crude protein 13%, polyphenols 7.8%, and fixed oil 5.3 % hydrocarbons 58 % and free acid 31.4 %. Higher gross hest values of this species indicate that it can be used as fuel source. **Essential oil** from C.*congesta* was found to contain coumarin [15].

Pharmacognosy

Stem bark occurs in small and thin, flat or slightly curved pieces, rough due to longitudinal striations; external surface brownish grey, internal surface grey and smooth, light in weight; .Microscopically mature bark shows a wide zone of stratified cork having lenticels at a few places. Secondary cortex is composed of thin walled, tubular, parenchymatous cells having groups of stone cells. Cortical fibres are in singles or in groups of 2-3, a few stone cells attached with cortical fibres. Prismatic crystals of calcium oxalate are found scattered in cortical cells and phloem parenchyma. Starch grains are simple and compound having 2-3 components, found scattered in cortical and phloem parenchyma cells. Powdered drug is greyish brown; shows single and groups of stone cells, prismatic crystals of calcium oxalate, simple and compound starch grains.

Nutritional value of *Karamarda*:

Components	Composition according to the book "Minor Fruit Crops of India"	Composition according to "National Bureau of Plant Genetic Resources" per 100g of edible fruit [16]
Moisture	91%	
Protein	1.1%	0.39-1.1g
Fat	2.9%	2.5-4.63g
Minerals	0.6%	

Sugar	0.51-0.94%;,	
Fiber	1.5%	0.62-1.81g
Carbohydrate	2.9%	0.51-2.9g
Calcium	0.021%	21mg
Phosporous	0.028%	
Calorific Value		42.5kcal

Physical constants:

Foreign matter – Not more than2 %; Total ash - Not more than 12%; Acid insoluble ash - Not more than 3%; Alcohol soluble extractive - Not less than 4%; Water soluble extractive - Not less than 8%.

AYURVEDIC PROPERTIES

***Rasa* (Taste) -** *Amla*(Sour), *Tikta* (Bitter)
***Guna* (Quality) –** *Guru* (heavy)
***Veerya* (Potency) –** *Ushna* (Hot)
***Vipaka* (Post digestive effect) -** *Amla* (Sour)
***Doshaghnata* (Disease pacifying effect) -** *Vatashamaka* (Pacifies vata)
***Rogaghnata* –** *Trishna* (Thirst), *Aruchi* (Tastelessness), *Agnimandya*,(Indigestion) *Prashitada* (Dental diseases), *Vatavikara* (Diseases of vata), *Yakridvikara* (Diseases of liver), *Visphota* (Boils), *Vishavikara* (Diseases due to poisoning)
***Karma* -** *Ruchya*(Enhances taste), *Deepana*(Improves digestion), *Sara* (laxative), *Bhedana* (purgative), *Vamaka* (Emetic), *Mootrajanana* (diuretic), *Vishaghna* (Combats poisoning)
***Doses* –** Juice – 10- 20 ml.

It enhances taste, increases *pitta, kapha* and *rakta*, mitigates thirst, *vata*, ripe fruit is light sweet and mitigates *kapha* and *rakta*. [17] It is said to be of 2 types. Big and small ones, Bigger ones are the routine ones which are very sour where as the smaller ones are the wild varieties which are sweet. Properties of ripened and unripe fruits differ. Unripe fruits are appetizers and cause burning sensation, where as the ripened ones pacifies the 3 *doshas* and combats tastelessness and poisoning. [18]

Uses

Root: The roots are anthelmintic, stomachic, antiscorbutic and are useful in stomach disorders such as acidity, flatulence. It is useful in intestinal worms, scabies, diabetic ulcer , pruritus, gonorrhea, pyrexia, indigestion, chronic ulcer ,biliousness, urinary disorders and acts as insect repellent. [19] Root is used as plaster in the Konkan to keep off flies by the folklore practitioners.

Stem bark: In Ayurveda, stem bark is used for obstinate skin diseases.

Leaves: Leaf decoction of *Karamarda* is used against fever, diarrhoea, earache, soreness of the mouth and throat, and syphilitic pains. Decoction of leaves is given at the commencement of remittent fever.

Fruit: The unripe fruit is bitter, sour, astringent, thermogenic, constipating, appetizer, antipyretic mucolytic and useful in polydypsia, anorexia, diarrhea, diseases of brain intermittent fevers and haematemesis. The ripe fruit is sweet, cooling, appetizing, antiscorbutic and is useful in bilious complaints, expectorant anorexia, burning sensation, scabies, pruritus and other skin diseases, it is useful for cure of anaemia, acts as Antidote for poisons It is said to be carminative .In traditional medicine the fruit is used to improve female libido and to remove worms from the intestinal tract. The fruits have anti-microbial and antifungal properties and its juice is used to clean old wounds which have become infected. The juice can be applied to the skin to relieve any skin problems. Traditionally *Karamarda* has been used to treat insanity. [20]

Various plant parts: are reported to be used in dropsy, anasarca, madness, rheumatism, hemiplegia, epilepsy, convulsions, postnatal complaints, sores and bite of rabid jackal or dog.[21] A concoction pounded with horse wine, lime juice and camphor, is used as a remedy for itches. It is used by tribal healers of Western Ghat region of Karnataka as hepatoprotective and antihyperglycemic. In Bangladesh, plant parts are used for treatment of malaria, dysentery, and diabetes. Juice of fresh plant is used for wounds that refuse to heal. The fruits have an analgesic action as well as an anti- inflammatory one.

Traditional Medicinal Uses:

Traditional healers of Chattisgarh have expertise in treatment of different types of cancer with *Karamarda*. They use its different plant parts to dress the cancerous wounds and to kill the maggots. To prepare the *Karamarda* decoction, its roots, flowers, spines, leaves and fruits are mixed in equal proportion and crushed to make an aqueous paste. This paste is applied at very initial stages. This paste is boiled in water and when half quantity of water remains, the boiling is stopped and lukewarm decoction is used to wash the

cancerous wounds. The healers claim that this decoction is having immense potential to heal the wound and make it infection free. It acts in more promising ways than Neem (Azadirachta indica) plant parts. Many healers boil the aqueous paste in Mustard seed oil and when all watery contents evaporate, the boiling is stopped and special oil is used for wound dressing [22].

OTHER USES

In Asia, the ripe fruits are utilized in curries, tarts, puddings and chutney. Slightly under ripe fruits are made into jelly. Green, sour fruits are made into pickles in India. They are used for Natural Fencing and get benefit of fruits from third year. Mature fruit contains high amount of pectin and, therefore, besides being used for making pickle, it can be exploited for making jelly, jam, squash, syrup and chutney, which are of great demand in the international market. The fruit makes an excellent acid jelly for serving with fish and meats. Ripe fruits exude white latex when severed from the branch. The fruits have astringent properties and have been used for tanning and dying. The ripe fruit emits gummy latex when it is cooked, but yields a rich red juice which clears when it is cooled, so this is used as a refreshing cooling drink in hot weather. It is also sometimes substituted for apples to make an apple tart, with cloves and sugar to flavor the fruit. Usually the fruit is pickled before it gets ripened. The sweeter types may be eaten raw out-of hand but the more acid ones are best stewed with plenty of sugar. In Rajasthan *Karamarda* fruits are commonly cooked with green chillies to make a tasty dish taken with chapattis. A higher gross heat value of this species indicates its higher potential to be used as good fuel source.

PHARMACOLOGICAL ACTIVITIES

Antioxidant: The synergistic effects of the constituents in the chloroform extracts of the unripe fruits showed the best antioxidant activity.

Anticancer: Study of plant extracts was done on human ovarian carcinoma, Caov-3 and lung cancer cells, NCI. Chloroform extract from leaves showed good anticancer activity against Caov-3 while the n-hexane extract of the unripe fruit showed remarkable activity against the lung cancer cell line.

Anti-Inflammatory / Analgesic /Antipyretic: Study of ethanolic extract resulted in inhibition of stretching episodes and 16.05% inhibition in acetic acid induced writhing.

Anticonvulsant action: The ethanolic extract has powerful anticonvulsant action on electrically and chemically induced seizures by unknown mode of action [23].

Cardiotonic activity: The alcoholic extract of roots of *C.congesta* exhibited cardiotonic activity and prolonged blood pressure lowering effect. An atnorphous water-soluble polyglycoside possessing significant cardiac activity has been isolated. The cardiac activity of water-soluble fraction has been attributed to the presence of the glucosides of odoroside [24].

Antimicrobial action: The ethanolic extract has potent antibacterial action against different test bacteria like *B.subtillis, S.aureus, S.faecalis E.coli, P.aeruginosa* and *S.typhi murium.* Moreover ethanol extract has also showed considerable anticandidal action [25].

Antiviral action: The ethanolic extract possess potent antiviral activity against Sindbis virus (SINV) at 3 μg/ml, polio virus (POLIO), at 6 μg/ml HIV-1, and herpes simplex virus (HSV) at 12 μg/ml. [26]

Antidiabetic: Study showed a methanol extract and its ethyl acetate soluble fraction significantly lowered the elevated blood glucose levels by 48% and 64.5% respectively, at dose levels of 400 mg/kg.

Anti-Hyperlipidemic: Study of aqueous extract in egg yolk-induced hyperlipidemic rats showed a significant reduction in body weight, cholesterol, triglycerides, HDL, and LDL, with reduction in histopathologic changes in hyperlipidemic rats.

Other activities includes Free radicals scavenging and xanthine oxidase inhibitory activity,[27] Potential Hepatoprotective and Antioxidant activity, [28] Histamine releasing activity [29] and Antirheumatic property [30].

Toxicology

Plant extract caused vomiting, rhinorrhoea, diarrhea, tachypnea, exhaustion and death in conscious cats.

Formulations and Preparations

Marma gutika, Hridya mahakashaya, Kalkantaka rasa, Kshudrakarvanda yoga, Marichadi vati.

DISCUSSION & CONCLUSION

Karamarda (*Carissa carandus*) is potentially very useful drug with wide range of medicinal utility in various health ailments such as intestinal worms, indigestion, fever, diarrhoea, pruritis, scabies etc. Ayurveda advocates the use of *Karamarda* in diseases such as polydypsia, indigestion, various diseases of *vata* etc. Classically many therapeutic uses have been elaborated; few of them have been tested practically. Many works are attempted on the therapeutic utility of the drug such as anti

oxidant, analgesic, anti spasmodic activities. Its wide range of utility offers large scope for the researchers to explore and evaluate the pharmacological activities of the drug.

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