

Phytochemical and pharmacological Potential of Kair (*Capparis Decidua*)

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Abstract

Capparis decidua (Forsk.) is belonging to family Capparidaceae, yet important medicinal plant of Indian Medicinal Plants. In the traditional system of medicine, the bark has been shown to be useful in the treatment of coughs, asthma and inflammation; roots used in fever and buds in the treatment of boils. In Unani, leaves act as appetizer, helps in cardiac troubles, fruits used in biliousness. The plant is reported to contain Phytochemicals including alkaloids, terpenoids, glycosides and some fatty acids. In Unani, leaves act as appetizer, helps in cardiac troubles, used in biliousness; alveolaris and pyorrhea; Root bark is used as anthelmintic and purgative. The plant have significant pharmacological activities like hypercholesterolemic, anti-inflammatory and analgesic, antidiabeti, antimicrobial, antiplaque, antihypertensive, antihelmintic & purgativ activities. The review analyses phytochemical and pharmacological potential of medicinal plant (kair).

Keywords: *Capparis decidua*, traditional system of medicine, alkaloids, Phytochemical, Pharmacology.

Introduction

The genus *Capparis* comprises 250 species including shrubs, trees and woody climbers. *Capparis decidua* (Forsk.) Edgew commonly known as karel, karer, karil, karu etc, is a densely branching shrub or small tree of the Thar Desert [1]. It is also found in the subtropical and tropical zones and other arid regions in southern Asia with a mass of slender, 4-5 m high, or occasionally a small tree with many green vine-like apparently leafless branches, hanging in bundles (Fig 1). The bark turns into whitish-grey colour with age, but most of the branches and twigs are a glossy dark green in colour. Small,



Fig. 1: The plant *Capparis decidua* with stem, fruits and flowers

light brown spines occur in pairs on the twigs at each node. Leaves are very minute (2 mm long), with a very short life span on young shoots, so that the plant looks leafless most of the time. The new flush of leaves appears in November-January. Flowers are pink in colour, red-veined, in small groups along the leafless shoots, in the axils of the spines. Red conspicuous flowers appear in March to April and August-September and ripe by May and October. Fruit are small many-seeded ovoid or sub-globulous, slightly mucronate pink berry of the size and shape of a cherry, becomes blackish when dry. The generic name is derived from the Arabic 'kappar', the name for *Capparis spinosa*.

It coppices well and produces root suckers freely. It is extremely drought-resistant and tolerates some frost. This is a useful plant in its marginal habitat. Its spicy fruits are used for preparing vegetables, curry and fine pickles and can attract helpful insectivores; the plant also is used in folk medicine and herbalism. *Capparis decidua* can be used in landscape gardening, afforestation and reforestation in semi desert and desert areas; it provides assistance against soil erosion [2, 3].

This species is common in dry tropical Africa, especially in the Sahel, where it sometimes constitutes lines of small trees in Wadi beds, as in Mauritania for instance. In West Africa, the area of distribution is identical to that of *Cadaba arinose*; its southern limit corresponds to the northern loop of the Senegal River. In the Republic of Niger it reaches the Konadougou. Its area includes Tibesti (West Chad), much of the Sudan (except the extreme South) the Arabian Peninsula, Jordan, India, Pakistan, Iran, the Mascarene Islands and Natal. It is tolerant to prolonged drought and an interesting plant by reason of its excellent adaptation to arid conditions [4].

Vernacular name: The plant name is available in the following languages

English : *Caper*

Hindi : Karel, karer, karil, karu, kurel, kurrel, lete, satari, karer

Arabic : Hanbag, margh, sodab, tundub

Kannada: Chippuri, karira, kareera, kareuppina gida, kiruli, nispatley gida, kari uppina gida

Malayalam : Karimulli, karimullu

Marathi : Karil, ker, nevati

Persian : Bergesodab

Sanskrit : patra, granthila, granthila, gudhapatra, kantaki, karaka, karira, karira, karira, karirah, karirah, kataphala, krakara, krakatha, mriduphala, nigudhapatra, nishpatra, nishpatrika, maruruhi, krishashakha, mar vidahika, marubharuha, shakapushpa, shatakunta, shonapushpa, suphala, tikshnakantaka, tikshnasara, ushnasundara, vishvakpatra, ubhuruha

Tamil : Kulaladondai, sengam, senkam, sirakkali, sirakkali, sengam, kulalatontai, cattiputpam, cattiracoputpam, inaikaravi, cinaikaravicceti, ciracukkilam, cirakakoli, cirakatantai, cirakkoli, cirakkoli, ciratci, cutakkini, kariram, kelal, kentikam, kuraram, marupurukam 2, palaccaka, vayacca, vayaccam, venu

Talugu : Kariramu

Tibetan : Karira, karira, rgyasnal, rgya sneu (p& d), uboka (d), upotaka (p), upota kila

Urd : Titali, ab karir, kachia phal

Rajasthan : *Kair, Dhalu*

Fruit : *Laddu*

Rajasthan : *Ker* (Jaisalmer district)

Synonym : *Capparis aphylla Roth*

The fruits of *C. decidua* (green berries) are used in food preparations like pickles due to the belief that it has antidiabetic action. In the traditional system of medicine, the bark has been shown to be useful in the treatment of coughs, asthma and inflammation; roots used in fever and buds in the treatment of boils. In Unani, leaves act as appetizer, helps in cardiac troubles, fruits used in biliousness; Shoots along with shoots of *Peganum harmala* used as anti fertility drug; Ground stem and leaves used in alveolaris and pyorrhea; Root bark is used as anthelmintic and purgative; Wood coal used in

muscular injuries [5-7]. In Sudan, *C. decidua* is used in swellings, jaundice and infection of joints.

Phytoconstituents of Plant

The plant is found to reveal the presence of a number of alkaloids, terpenoids, glycosides and some fatty acids. The different phytoconstituents of different plant parts are as follows:

Root bark: Two sterols, one diterpene alcohol, two aliphatic constituents and one diterpenic ester were reported from *C. decidua* root barks. β -Sitosterol was isolated from the roots by extracting with ethanol and chromatographing the alcoholic extract on neutral alumina with the eluents benzene, ether, chloroform and methanol successively. The structures of the sterols were established as 24- β -methylcholest-7-ene-22-one-3 β -ol and 24- β -methylcholest-9 (11)-ene-22-one-3 α -ol. The structure of diterpene alcohol was identified as 3-methyl-7-hydroxymethylene-10-(12, 16, 16-trimethylcyclohex-11-enyl) - dec-9-ene-5-one-8-ol. Butyl-3-oxoeicosanoate and 25-oxooctosan- 1, 20-diol were the aliphatic constituents.

The diterpenic ester was identified as 9-(11, 15, 15-trimethylcyclohex-11-ene-13-one-yl)-one-6-hydroxymethylene-7-one-yl, 4'-Me heptanoate [8]. From the root bark, spermidine alkaloids (Fig. 2) like Isocodonocarpine (Fig. 3) [9], Capparisine (Fig. 4) [10- 12], Capparadisine (Fig. 5) [13,] were isolated. Six oxygenated heterocyclic constituents capparisterpenolide (3-carboxy-6, 17-dihydroxy-7, 11, 15, 19- tetramethyleicos-13-ene-d-lactone) and deciduaterpenolides (Fig. 6) (d-lactone derivatives of 1, 3, 3-trimethyl- 1, 4-cyclohexadien-6-one) A, B, C, D and E from alcoholic extract of root bark [14]. The root bark also contains alkaloids [15], 14-N-acetyl isocodonocarpine (Fig. 7), 15-N-acetyl capparisine (Fig. 8), Cadabcine (Fig. 9) [16], Stachydrine (Fig. 10), Rutin (Fig. 11), capparisine (Fig. 12) [17] and codonocarpine (Fig. 13).

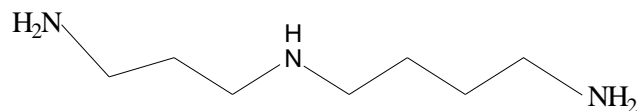


Fig. 2: Spermidine alkaloid

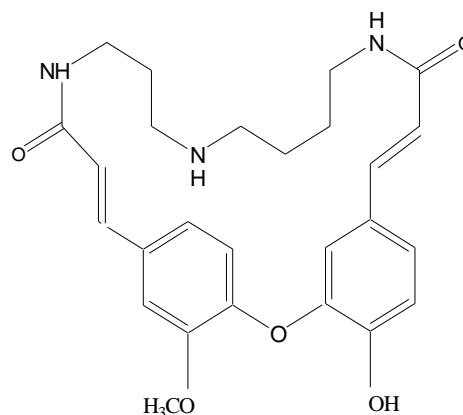


Fig. 3: Isocodonocarpine

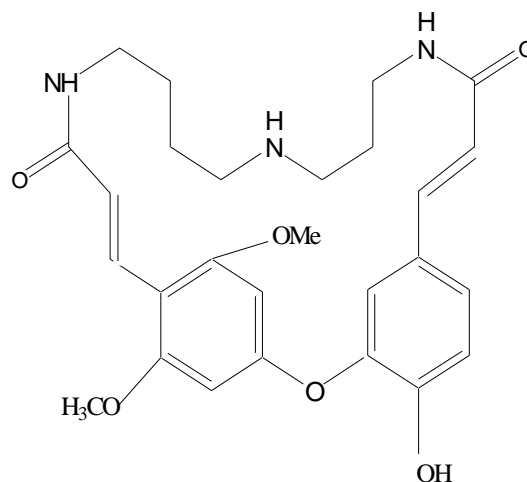


Fig. 4: Capparisine

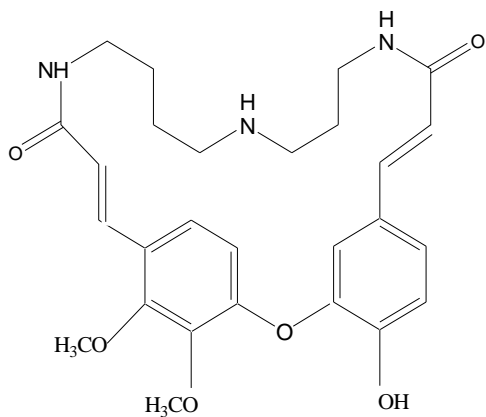


Fig. 5: Capparidisine

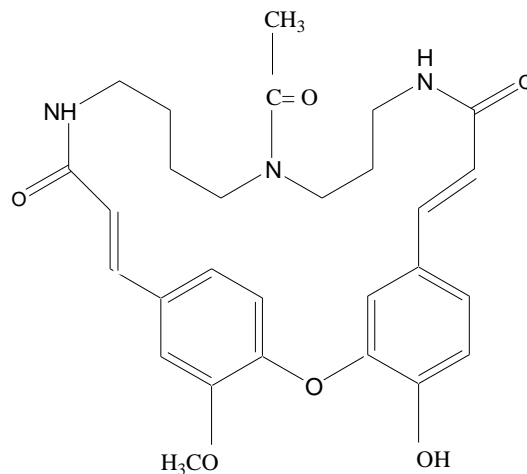


Fig. 8: 15- N- acetyl capparisine

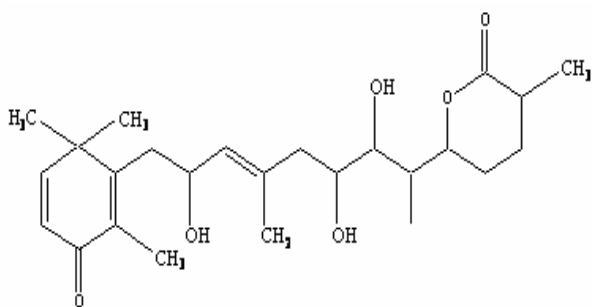


Fig. 6: Decidua terpenolide A

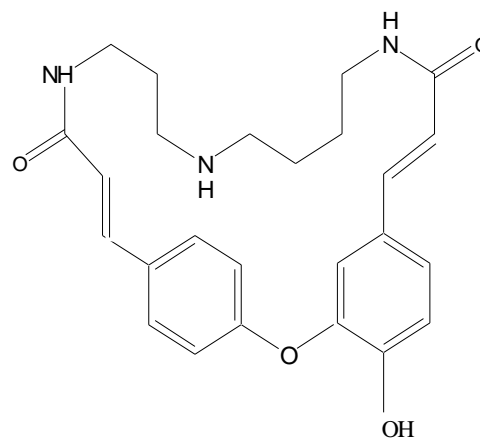


Fig. 9: Cadabicine

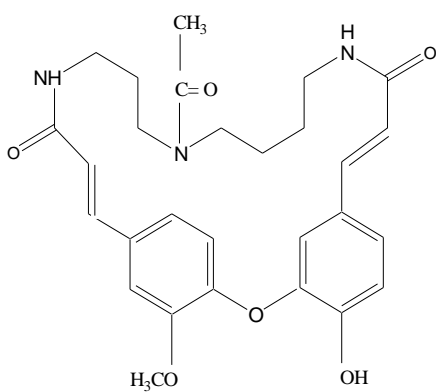


Fig. 7: 14-N- acetyl codonocarpine

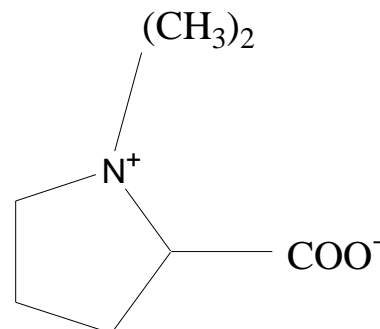


Fig. 10: Stachydrine

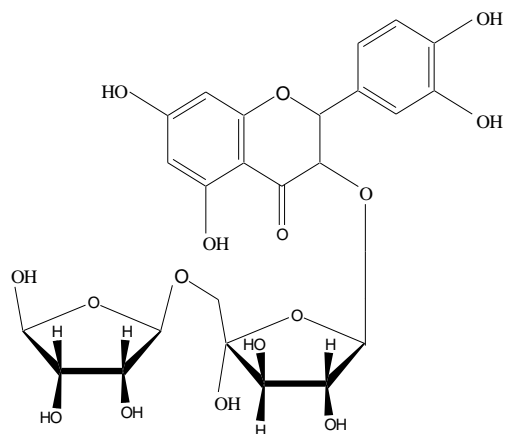


Fig. 11: Rutin

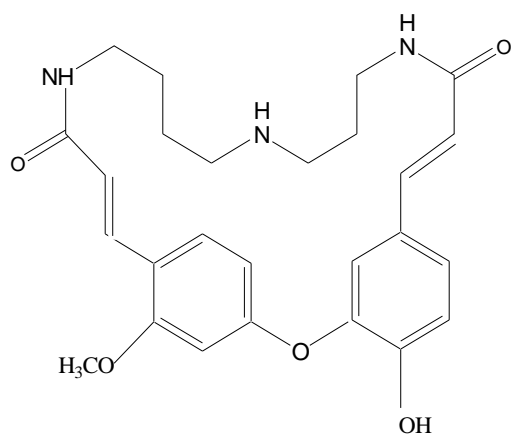


Fig. 12: Capparisine

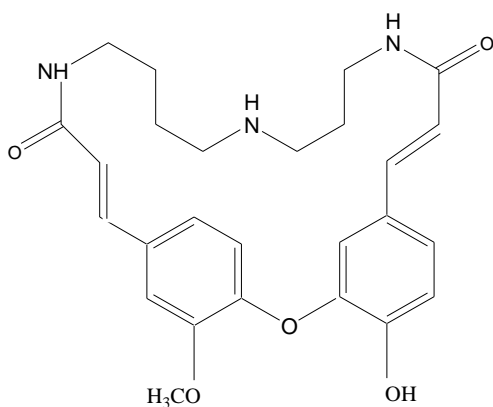


Fig. 13: Codonocarpine

Root: Colorless, crystalline and hygroscopic alkaloids Capparine (M. P. 236⁰C, C₁₅H₃₅N₃O₆.2H₂O), Cappariline (M. P. 188⁰C, C₁₅H₃₅N₃O₆.5H₂O) and Capparinine (M. P. 236⁰C) were isolated from roots of *C. decidua* by extracting roots with ethanol and chromatographed on neutral alumina column with chloroform-methanol (90:10, 80:20, 50:50, 20:80) respectively [13].

Stem: The chromatographic separation of the aerial parts of *C. decidua* afforded one shikimate derivative, two acyclic terpenoids, four fatty acids, two sterols and two lupine terpenoids [14]. The stem contains two alkaloids n-triacontanol (Fig. 14), 2-carboxy-1, 1-dimethylpyrrolodine (stachydrine).

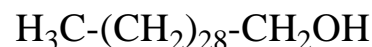


Fig. 14: n-Triacontanol

Water soluble stachydrine (2-Carboxy-1, 1-dimethyl Pyrrolidine) alkaloid was isolated from the fruit pulp, fruit husk, flowers and root bark.

Fruits and Seed: From the methanolic extract of the seeds, Glucocapparin (Fig. 15) and a highly antibacterial volatile compound, Methyl isothiocyanate (Fig. 16), were obtained. 5 glycosides were isolated from the flowers.

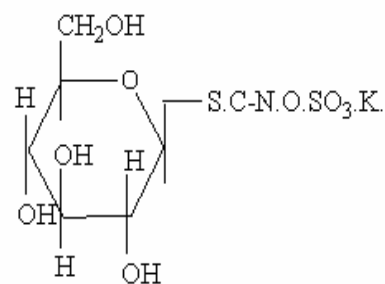


Fig. 15: Glucocapparin

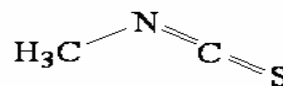


Fig. 16: Methyl isothiocyanate

Unsaponifiable fraction of fruit husk and seeds contained N-pentacosane, β -Sitosterol (Fig. 17) [16] and β -Carotene (Fig. 18).

Flowers: Flowers contain the hydrocarbons Nonacosane and Triacontane. Flowers and fruit husk contain ascorbic acid (Fig. 19) & phthalic acid (Fig. 20) [16].

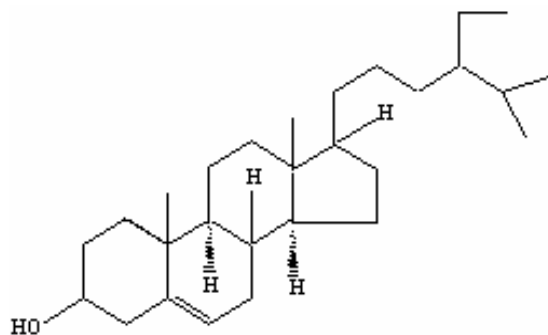


Fig. 17: β - Sitosterol

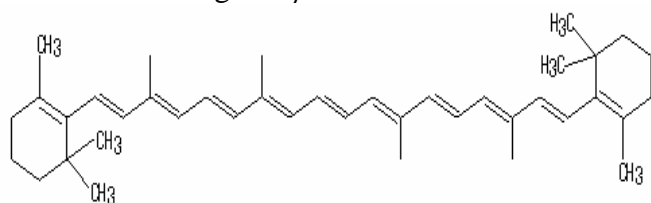


Fig. 18: β - Carotene

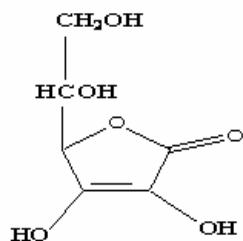


Fig. 19: Ascorbic acid

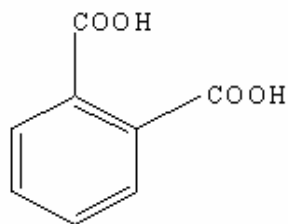


Fig. 20: Phthalic acid

Pharmacological Potential of Plant

Hypercholesterolemic activity: The extract of unripe fruits and shoots of *C. decidua* cause reduction in plasma triglycerides, total lipids and phospholipids; hence used as hypercholesterolemic. It appeared to operate through increased fecal excretion of cholesterol as well as bile acids [18].

Depressant activity: Capparidisine a new alkaloid from *C. decidua* is reported to have dose dependant depressant effect on heart rate and coronary flow. Maximum fall in coronary flow was achieved at 1mg/ml, the contraction and heart rate increased at 2 ng dose and then a dose dependant fall was seen upto 128 and 32 ng, in force of contraction and heart rate respectively [19].

Anti-inflammatory and analgesic activity: Ethanolic extract of aerial parts exhibited anti-inflammatory and analgesic activity. Isocodonocarpine was found to be responsible for anti-inflammatory activity and anti asthmatic activity [20].

Antidiabetic activity: Fruits possess antidiabetic activity. *C. decidua* powder has hypoglycaemic activity, decreases lipid peroxidation and alters free radical scavenging enzymes such as superoxide dismutase and catalase in erythrocytes, liver, kidney and heart in aged alloxan induced diabetic rats. *C. decidua* powder is used against alloxan induced oxidative stress and diabetes in rats [21, 22].

Anthelmintic & Purgative activity: The aqueous extracts of roots of *C. decidua* are found to have purgative activity [23] while the alcoholic extract of the fruit pulp and root bark possess anthelmintic activity [23, 24].

Antimicrobial activities:

i) Root bark: The alcoholic extract of root bark possesses significant antibacterial and antifungal activities [24, 25]. The ethanolic extract from the root bark of *C. decidua* was tested for its anthelmintic and antimicrobial activities. The ethanolic extract was active against *Pseudomonas*

aeruginosa, *Staphylococcus aureus* and *Escherichia coli*, but was inactive against *Candida albicans*. None of the test concentrations exhibited comparable activity with the standard ampicillin trihydrate.

ii) Seeds: On studying the antibacterial activity of the seeds it was found that glucocapparin had no activity but its isothiocyanate aglycon had good antibacterial activity [26]. It was found to inhibit cell cultures of *Vibrio cholerae*, *V. ogava*, *V. inaba* and *V. eltor* [27].

Antiplatelet activity: *Capparis decidua* fruit and flower extract have potent activity in preventing plaque formation.

Hypolipidaemic activity: In a study the Ethanolic extract of different parts of *C. decidua* i.e., fruit, flower, shoot and bark were found to have antihyperlipidaemic activity in rabbits. The serum cholesterol level was reduced by 61%, 58%, 48% and 28% in *C. decidua* fruit, flower, shoot and bark after a dose of 500 mg/kg body weight was given to rabbits [29, 30].

Antiatherosclerotic activity: In a study by Vyas & Purohit the Ethanolic extract of fruit was found to have antiatherosclerotic activity in cholesterol fed rabbits. [31].

Antihypertensive activity: The hypotensive activity of *C. decidua* ethanol extract at a dose of 1-30 mg/kg exerted a dose dependent fall in blood pressure and heart rate in experimental animals. Whereas in guinea pig atria the extract caused a concentration dependent up to one mg/ml decrease in the force and rate of atria contractions. However, the extract displayed inhibition of nor-epinephrine or potassium induced contractions. Furthermore it inhibited the contraction at submaximal level with 1 mg extract produced with acetylcholine, histamine and histidine. All this clearly manifest that direct relaxation action of *C. decidua* extract on myocardium and blood vessels could be responsible for its hypotensive action. [32]

Rubifacient activity & vesicant activity: The shoots and young leaves have rubifacient and vesicant activity [80].

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