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## **A Medicinal Potency of *Capparis decidua*–A Harsh Terrain Plant**

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### **ABSTRACT**

*Capparis decidua* is a dominating genus of the family Capparidaceae, yet important medicinal plant of Indian Medicinal Plants. *Capparis* sp. are xerophytic, growing in a broad range of climatic conditions, such as dry deserts to cooler terrains of mountain either as shrubs, trees or creepers. 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 pyorrhoea; 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 and purgativ activities. The female flowers of some of the *Capparis* species are used as vegetable and fruits are used in pickle production because of their high nutritive ingredients like proteins, carbohydrate, minerals and vitamins. The review highlights medicinal importance of the plant *Capparis decidua* and unnoticed threatened status in their respective niches for sustainable use and long lasting conservation.

**Key words:** *Capparis decidua*, traditional system of medicine, alkaloids, phytochemical, pharmacology

### **INTRODUCTION**

Medicinal plants continue to be an important therapeutic aid for alleviating the ailments of human kind. The search for eternal health and longevity and for remedies to relieve pain and discomfort drove early man to explore his immediate natural surroundings and led to the use of many plants, animal products and minerals, etc. and the development of a variety of therapeutic agents (Joseph and Raj, 2010). About 45,000 angiosperm plants, largely having both medicinal and nutritional value, are playing pivotal role in shaping modern human and keeping society sustainable (Myers *et al.*, 2000). Specific plant knowledge may provide insight for strategic consumption and sustainable use. The alternate medicine system is now gaining momentum with the knowledge of active principles identified from plant species. *Capparis decidua* (Forsk.) commonly known as karel, karer, karil, karu etc. is a densely branching shrub or small tree of the Thar Desert (Kaul, 1963). The generic name is derived from the Arabic kapar, 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



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

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 (Ghosh, 1977; Gupta and Prakash, 1975). 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).

#### PLANT DESCRIPTION

It is a small much branched tree or shrub of arid regions in Africa, Middle East and southern Asia, including the Thar desert. It bears a mass of slender, leafless branches, the small caducous leaves being found only on young shoots. It rarely exceeds a height of 5 m (15 feet). The scientific classification of *C. decidua* is given in the Table 1.

**Bark:** The bark turns into whitish-grey colour with age, but most of the branches and twigs are a glossy dark green in colour. Small, light brown spines occur in pairs on the twigs at each node.

**Leaves:** 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:** 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.

**Fruits:** Fruits are small many-seeded ovoid or sub-globulous, slightly mucronate pink berry of the size and shape of a cherry, becomes blackish when dry.

#### NATURAL HABITAT

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

Table 1: Scientific classification of *Capparis decidua*

Scientific classification	
Kingdom	Plantae
(unranked)	Angiosperms
(unranked)	Eudicots
(unranked)	Rosids
Order	Brassicales
Family	Capparaceae
Genus	<i>Capparis</i>
Species	<i>decidua</i>

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 (Pandey and Rokad, 1992).

#### TRADITIONAL USES OF VARIOUS PARTS

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 (Kirtikar and Basu, 1993; Sharma, 2003; Chopra *et al.*, 1999). In Sudan, *C. decidua* is used in swellings, jaundice and infection of joints.

Barks, leaves and roots of *C. decidua* have been claimed to relieve variety of ailments such as toothache, cough, asthma, intermittent fever and rheumatism (Dhar *et al.*, 1972). The powdered fruit of *C. decidua* is used in anti-diabetic formulations (Yadav *et al.*, 1997a, b), while the bark of its leafless shrub is used for the treatment of asthma, cough, inflammation and acute pain (Ahmad *et al.*, 1992).

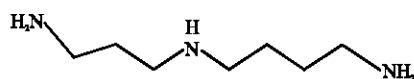
#### PHYTOCONSTITUENTS OF PLANT

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:

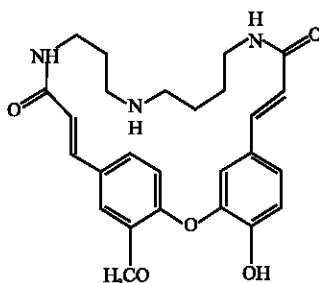
**Root bark:** Two sterols, one diterpene alcohol, two aliphatic constituents and one diterpenic ester were reported from *C. decidua* root barks.  $\beta$ -Sitosterol was isolated from the roots by extracting with ethanol and chromatographing the alcoholic extract on neutral alumina with the eluents benzene, ether, chloroform and methanol successively. The structures of the sterols were established as 24- $\beta$ -methylcholest-7-ene-22-one-3  $\beta$ -ol and 24- $\beta$ -methylcholest-9 (11)-ene-22-one-3 $\beta$ -ol. The structure of diterpene a lcohol 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 (Rai, 1987). From the root bark, spermidine

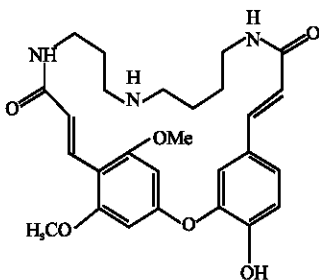
alkaloids (Structure: 2) like Isocodonocarpine (Structure: 3) (Ahmad *et al.*, 1989), Capparisinine (Structure: 4) (Dahot, 1993; Ahmad *et al.*, 1985, 1987a), Capparadisine (Structure: 5) (Ahmad *et al.*, 1992) were isolated. Six oxygenated heterocyclic constituents capparisesesterpenolide (3-carboxy-6, 17-dihydroxy-7, 11, 15, 19-tetramethyleicos-13-ene-d-lactone) and decduaterpenolides (Structure: 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 have been identified (Gupta and Ali, 1997). The root bark also contains alkaloids, 14-N-acetyl isocodonocarpine (Structure: 7), 15-N-acetyl capparisine (Structure: 8), Cadabicine (Structure: 9) (Ahmad *et al.*, 1987b), Stachydrine (Structure: 10), Rutin (Structure: 11), capparisine (Structure: 12) (Gand and Juneja, 1970) and codonocarpine (Structure: 13).



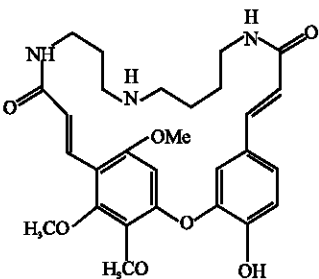
Structure 2: Spermidine alkaloid



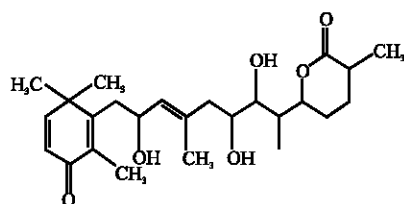
Structure 3: Isocodonocarpine



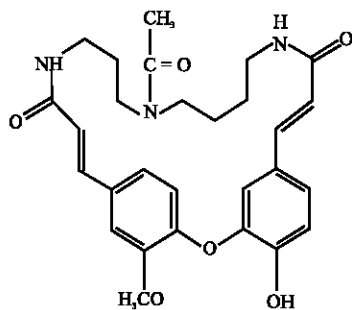
Structure 4: Capparisinine



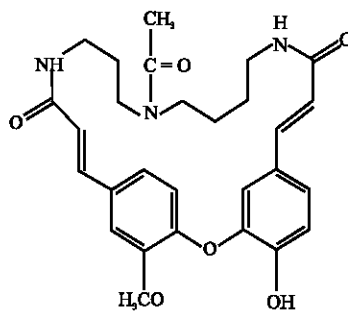
Structure 5: Capparadisine



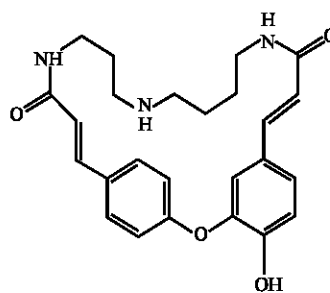
Structure 6: Decidua terpenolide A



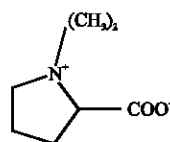
Structure 7: 14-N- acetylcodonocarpine



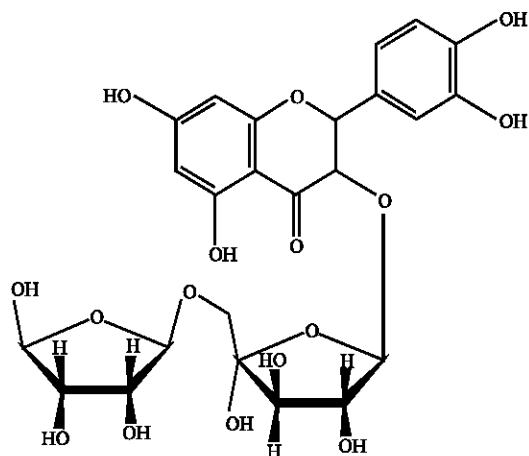
Structure 8: 15- N- acetyl capparisine



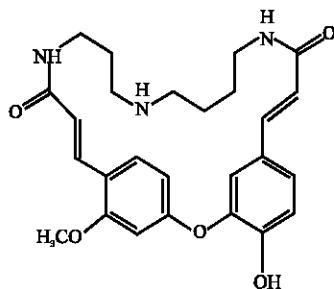
Structure 9: Cadabicine



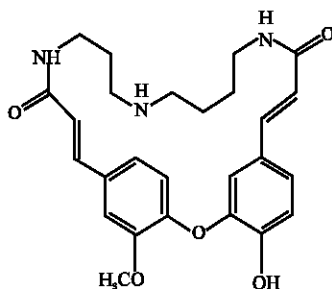
Structure 10: Stachydrine



Structure 11: Rutin



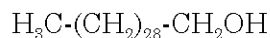
Structure 12: Capparisine



Structure 13: Codonocarpine

**Root:** Colorless, crystalline and hygroscopic alkaloids Capparine (M. P. 2360C, C<sub>15</sub>H<sub>35</sub>N<sub>3</sub>O<sub>6</sub>·2H<sub>2</sub>O), Cappariline (M. P. 1880C, C<sub>15</sub>H<sub>35</sub>N<sub>3</sub>O<sub>6</sub>·5H<sub>2</sub>O) 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 (Ahmad *et al.*, 1992).

**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 (Gupta and Ali, 1997). The stem contains two alkaloids n-triacontanol (structure. 14), 2-carboxy-1, 1-dimethylpyrrolidine (stachydrine).

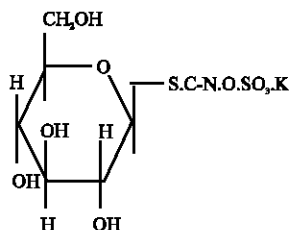


Structure 14: n-Triacontanol

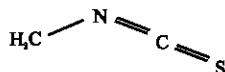
Water soluble stachydrine (2-Carboxy-1, 1-dimethyl Pyrrolidine) alkaloid was isolated from the fruit pulp, fruit husk, flowers and root bark.

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

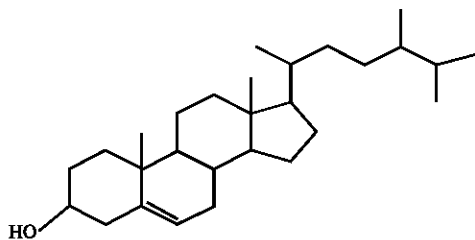
Unaponifiable fraction of fruit husk and seeds contained N-pentacosane,  $\beta$ -Sitosterol (Structure: 17) (Ahmad *et al.*, 1987a) and  $\beta$ -Carotene (Structure: 18).



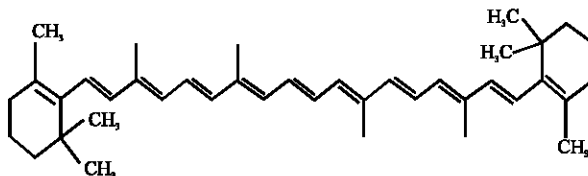
Structure 15: Glucocapparin



Structure 16: Methyl isothiocyanate



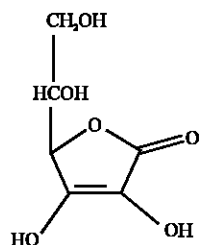
Structure 17:  $\beta$ -Sitosterol



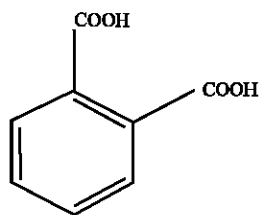
Structure 18:  $\beta$ -Carotene

**Flowers:** Flowers contain the hydrocarbons Nonacosane and Triacontane. Flowers and fruit husk contain ascorbic acid (Structure: 19) and phthalic acid (Structure: 20) (Ahmad *et al.*, 1987b).





Structure 19: Ascorbic acid



Structure 20: Phthalic acid

### MEDICINAL POTENCY OF *CAPPARIS DECIDUA*

**Antidiabetic activity:** Fruits possess antidiabetic activity. *Capparis 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. *Capparis decidua* powder is used against alloxan induced oxidative stress and diabetes in rats (Agarwal and Chavan, 1988; Yadav *et al.*, 1997a).

**Antiatherosclerotic activity:** In a study by Vyas and Purohit the Ethanolic extract of fruit was found to have antiatherosclerotic activity in cholesterol fed rabbits (Ghulam, 2002).

**Antihypertensive activity:** The hypotensive activity of *C. decidua* ethanol extract at a dose of 1-30 mg kg<sup>-1</sup> 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 1 mg mL<sup>-1</sup> 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 (Behl *et al.*, 1996).

**Anthelmintic and purgative activity:** The aqueous extracts of roots of *C. decidua* are found to have purgative activity (Gaind *et al.*, 1969a) while the alcoholic extract of the fruit pulp and root bark possess anthelmintic activity (Gaind *et al.*, 1969a; Mali *et al.*, 2004).

**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 (Yadav *et al.*, 1977b).

**Antimicrobial activities:** *C. decidua* extracts and active components have shown better bactericidal potential in comparison to antibiotics as it is proved by significantly very high growth inhibition obtained in various bioassays at a very low concentration (Upadhyay *et al.*, 2010). Petroleum ether, chloroform and methanolic extracts of *Capparis decidua* showed inhibitory activity against *Bacillus subtilis* and *Aspergillus niger* (Iqbal *et al.*, 2008).

**Root bark:** The alcoholic extract of root bark possesses significant antibacterial and antifungal activities (Mali *et al.*, 2004; Gaind *et al.*, 1969b). 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.

**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 (Juneja *et al.*, 1970). It was found to inhibit cell cultures of *Vibrio cholerae*, *V. ogava*, *V. inaba* and *V. eltor* (Gaind *et al.*, 1972).

**Antiplatelet activity:** *Capparis decidua* fruit and flower extract have potent activity in preventing plaque formation (Rathee *et al.*, 2010).

**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 1 mg mL<sup>-1</sup>, 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 (Rashid *et al.*, 1989).

**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 (Goyal and Grewal, 2003).

**Hepatoprotective activity:** The hepatotoxicity produced by administration of carbon tetra chloride in paraffin oil (1:9 v/v) at a dose of 0.2 mL kg<sup>-1</sup> for 10 days, was found to be inhibited by simultaneous oral administration of aqueous and methanolic extracts of *C. decidua* stems (200, 400 mg kg<sup>-1</sup> b.wt.) for 10 days, with evidence of decreased level of serum aspartate amino transferase, alanine amino transferase, alkaline phosphatase and bilirubin (Ali *et al.*, 2009).

**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<sup>-1</sup> b.wt. was given to rabbits (Purohit and Vyas, 2005, 2006; Sharma *et al.*, 1991). The various parts of *C. decidua* are used in food preparations like pickles due to the belief that it has hypolipidaemic action. The extracts of *C. deciduas* prove to have a hypolipidemic potential (Chahlia, 2009).

Table 2: The nutritive value of various parts of *C. decidua*

Plant parts	Nutritive value
Seed	Oil (20%) (Rai and Rai, 1987)
Flower	Oil (14%) Sugar (1.7%) Protein (806%) $\beta$ -Carotene (Mishra <i>et al.</i> , 2007)
Fruit	Pickles (Siugh, 2000)

## FOOD AND NUTRITIVE VALUE

*Capparis decidua* has considerable nutritional value. Flowers and fruits of *C. decidua* are extensively used in diet as vegetable and pickle in Rajasthan and Haryana (Singh, 2000; Musa and Attila, 1999; Ozacus, 1999). The nutritive value of various parts of this plant is given in the Table 2. The ripened fruits are rich in carbohydrate (71%), protein (15-18%), fats (5%) and crude fiber (1%) including Ca (20%), P (360%), Zn (4%), Fe (6%), Mn (2%). *C. decidua* was found to be the richest source of  $\beta$ -carotene (Chaturvedi and Nagar, 2001). The presence of  $\beta$ -carotene (14%) is sufficient to meet the requirement of vitamin A. Fruit is a rich source of vitamin C (Chauhan *et al.*, 1986; Duhan *et al.*, 1992). The presence of oil content in seed and flower along with sugar and protein substantiate the nutritional value (Rai and Rai, 1987).

## NEED OF CONSERVATION

Due to the xerophytic nature and usefulness in sustenance for humanity, *Capparis decidua* is suggested for the preservation. *Capparis decidua* checks the sand dune formation and soil erosion in addition to medicinal and food logistics. The tendency of high networking of root system of *Capparis decidua* apparently facilitates the weathering of stone/rocks and soil formation. Therefore, there is a need to exploit plant species for afforestation in the hot dry to cold deserts regions.

## CONCLUSION

The concept of food as medicine is a central theme in dietetic and nutritional sciences. In recent years, ethnobotanical and traditional uses of natural compounds, especially of plant origin received much attention as they are well tested for their efficacy and generally believed to be safe for human use. They obviously deserve scrutiny on modern scientific lines such as physiochemical characterization, biological evaluation, toxicity studies, investigation of molecular mechanism of action(s) of isolated phytoprinciple and their clinical trials. These are necessary classical approaches in search of new lead molecule for management of various diseases. From ancient days to now a day, medicinal plants are a potential and useful for the treatment of several diseases and disorders. Main reason behind of that is medicinal plants is not having any side effects. One of the common medicinal plants is *Capparis decidua*; it has been used in various Asian traditional medicines. We concluded that *Capparis decidua* is a potential herbal in the world. Further studies are required to find many more activities of this plant.

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