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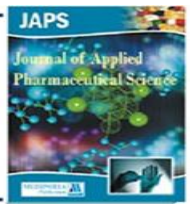

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Pharmacognostical Potential of *Capparis decidua* Edgew.

P. D. Verma, R.D. Dangar, K. N. Shah, D. M. Gandhi and B. N. Suhagia

P.D. Verma, R.D. Dangar
B.N. Suhagia
L. M. College of Pharmacy, Ahmedabad, India.

K.N. Shah
B. K. Modi Government Pharmacy College, Rajkot, India.

D.M. Gandhi
Institute of Pharmacy, Nirma University, Ahmedabad, India.

For Correspondence
Ms. Preeti D. Verma
L. M. College of Pharmacy, Post Box No: 4011, Navrangpura, Ahmedabad-380009 Gujarat, India

ABSTRACT

Capparis decidua (Family, Capparidaceae) is commonly known as 'Kair'. It is distributed throughout the arid regions of India and other countries. Kair is a caducous plant, so in the foliage condition mainly stem and fruits are common. It is also known as *Capparis aphylla*. Since the plant is xerophytic, it is generally found in dessert area and is highly draught resistant plant which can survive for long. Tribal people prepare pickle from the fruits of Kair. Some of the communities use Kair fruits as vegetables and food additives. The plant is used traditionally as anti-inflammatory, laxative, anti-diabetic, anthelmintic, antibacterial, astringent, digestive, diaphoretic and anodyne. It is reported to possess beneficial effects in various ailments, like rheumatism, asthma, diabetes, liver disorders, hypercholesterolemia, hypertension and microbial infections. Studies have revealed the presence of various phytoconstituents especially spermidine alkaloids, glucosinolates and other glycosides, β-sitosterol, rutin, l-stachydrine, hydrocarbons and terpenolides. The present review is an attempt to highlight the traditional uses, pharmacognostical, phytochemical and pharmacological reports on *Capparis decidua.*

Keywords: *Capparis decidua,* Xerophytic**,** Caducous, Pickle.

INTRODUCTION

There are thousands of medicinal plants used in various traditional systems existing in India, which possess enormous potential of offering direct therapeutic effect individually or in combination. Medicinal plants have also become a growing part of modern medicine. More than 70% of the drugs listed in Ayurvedic and traditional literatures like 'Charaka Samhita' and 'Sushruta Samhita' are of herbal origin (Shrishailappa et al., 2001). *Capparis decidua* Edgew. (Syn. *Capparis aphylla* Roth.) (Nadkarni, 1954; Kirtikar & Basu, 1933a) belonging to the family Capparidaceae, is a glabrous, highly branched, spiny, almost leafless shrub or small tree growing wildly in dry, open wastelands throughout the arid and semi arid zones of India and different parts of the world (Patel, 1971). Different parts of the plant especially root bark and fruits have been used traditionally to cure various ailments. Its fruits and flower buds are edible and are used in pickles since long time. Root bark in the form of powder or infusion is used in rheumatism, gout, dropsy, intermittent fever, etc. (Nadkarni, 1954). It is also used as an analgesic, laxative, anthelmintic and diaphoretic. It is considered to be good in cough, asthma, ulcers, boils, piles and all inflammations. Externally, the infusion of plant is used in boils, eruptions and swelling in joints, and internally, as an antidote to poisons. Tender branches and leaves of the plant relieve toothache when chewed (Kirtikar & Basu, 1933a). The fruits are astringent and useful in cardiac troubles and biliousness (Anonymous, 1950; Longman, 1994).

Fig. 1 The Plant of *Capparis decidua* with Flowers and Fruits.

VERNACULAR NAMES

Arabic : Hanbag, Kiabara, Margh, Sodab, Tundub
Bengali : Karil
Bihari : Kari
Deccan : Karyal
English : Caper berry, Caper bush, Caper plant
Gujarati : Kerdo, Kair, Kera, Kerda
Hindi : Kabra, Kachra, Karer, Karil, Karu, Kurrel, Pinju, Teent, Tent, Tenti.
Kannada : Chippuri, Karira, Kariuppi-gidda, Niovate-gidda, Nispatigay, Nispatige
Konkani : Kiral
Kutchi : Davra
Malyalam : Karimulli, Karimullu
Marathi : Karil, Ker, Nepati, Nevati
Persian : Bergesodab, Kebir, Kurake, Sodab
Punjabi : Delha (fruit), Karia, Karil, Karin, Karis, Kerin, Kirra, Pinju, Tenti
Sanskrit : Apatra, Chakrak, Granthil, Gudhpatra, Kantaki, Karaka, Karira, Kataphala, Katutiktaka, Krakar, Krakaripatra, Krakatha, Krishashakha, Marubhuruh, Mrduphala, Nigudhpatra, Nispatrak, Nispatrika, Shaakpushpa, Shatakunta, Shonapushpa, Suphal, Tikshnakantaka, Teekshnakantaki, Teekshnasar, Ushnasundara, Vidahika, Vishvakpatra
Sindhi : Dorakiram, Kirab, Kiral, Kirid, Kirrur
Tamil : Karyal, Kulaladandai, Sengam, Sirakkali
Telugu : Enugadanta, Kariramu, Mumudatu
Urdu : Titali
Rajasthani : Kair, Kareal, Kerro, Taint

(Nadkarni, 1954; Krishnadas, 1938; Chaube, 1932; Lakshmandas, 1951; Vaidya, 1995; Kirtikar & Basu, 1933a; Sharma, 2005; Charaka & Drdhabala, 1949; Chunekar & Pandey, 1999).

AYURVEDIC PROPERTIES AND ACTIONS

Rasa : Katu, Tikta
Guna : Laghu
Virya : Usna
Vipaka : Katu
Karma : Kaphvatahara, Sothhara, Drishtihitkara, bhedana (Gupta & Sharma, 2007; Sharma, 2005; Krishnadas, 1938)

TAXONOMICAL CLASSIFICATION

According to the botanical scheme of Engler, the plant is classified as follows:

Kingdom : Plantae
Division : Phanerogamae
Subdivision : Angiospermae
Class : Dicotyledonae
Subclass : Polypetalae
Order : Thalamiflorae
Suborder : Parietales
Family : Capparidaceae
Genus : *Capparis*
Species : *decidua*
(Metcalfe & Chalk, 1950)

HABIT AND HABITAT

Capparis decidua is a widely spreading, densely branched, glabrous shrub or occasionally a small tree of up to 5 m height (Anonymous, 1950). It grows abundantly in dry, arid and exposed habitat like wastelands, ditches, drying ponds, cultivated lands, road sides and surrounding plains of hills as it is tolerant to prolonged drought due to its excellent adaptation to arid conditions (Pandey & Rokad, 1992).

OCCURRENCE AND DISTRIBUTION

It is of a common occurrence in dry places in Sind, Baluchistan, Western Rajputana, Deccan Peninsula, Egypt, Socotra, Arabia, Tropical Africa, Central India, Punjab, Gujarat, Tinnevelly and Pakistan. On most occasions, *Capparis decidua* is found to be growing with *Zizyphus mauritiana* (Chavan & Oza, 1966; Kirtikar & Basu, 1933b).

BOTANICAL DESCRIPTION

Root

It shows tap root system. Initially, a single primary root develops which gives rise to secondary branches. After 1 year, numerous secondary roots develop but primary root continues to dominate. In case of mature plants, the roots can penetrate up to 4 meters (Singh & Singh, 2011).

Stem

The plant is much branched; each branch is slender, smooth, terete and spinous. Mature branches are leafless as leaves are present only on young shoots. Small, sharp, straight, light brown spines occur in pair at each node of twig. Most twigs and branches are glossy and dark green in colour, but with age, bark develops which is whitish gray (Kirtikar & Basu, 1933a).

Leaves

Caducous (with very short life span), present only on young shoots. Leaves are simple, linear-oblong, acute, pointed and very small, about 4 to 12 mm long and 1 to 3 mm broad. They are either sessile or with very short petiole. New leaves appear in Nov-Jan (Anonymous, 1950; Longman O, 1994; Singh & Singh, 2011).

Inflorescence

Corymb with many flowers arising from old branches or from short lateral shoots, in the axils of the spines.

Flowers

New shoots bear fewer flowers, while profuse flowering occurs on old shoots (Singh & Singh, 2011).

Sepals: The outer sepals are pubescent with ciliate margins and sub-valvate aestivation. The lower sepals are saccate and acuminate, while the upper sepals are smaller in size, concave and ovate-oblong. The inner sepals are elliptic, acute and having floccose margin.

Petals: Pink, red-veined, narrow-oblong

Gynophore: About 12 mm long

Androecium: Stamens 8, inserted at the base of gynophores

Pedicel: Slender and about 12 mm in length (Kirtikar & Basu, 1933a).

Flowering season

Feb-July. But peak flowering occurs in the summer (Mahmood et al., 2011).

Fruits

Small, globular, glabrous, fleshy berry, beaked at the apex, resembling a cherry in shape and size. Fresh berries are green, which turn pink on ripening and blackish on drying.

Fruiting season

Green fruits start appearing in Mar-April, second flush of fruit occur in May-July. Maximum mature fruits appear just before onset of the monsoon. Numerous seeds are embedded in the pulp of fruit (Longman O, 1994; Singh & Singh, 2011).

CHEMICAL CONSTITUENTS

Various phytoconstituents have been identified and isolated from different parts of *Capparis decidua* which includes alkaloids, glycosides, terpenoids, sterols, flavanoids, phenols and fatty acids. The root of *C. decidua* is found to contain sitosterol and a spermidine alkaloid, isocodonocarpine (Rathee et al., 2010; Chahlia, 2009). Three crystalline, colourless and hygroscopic alkaloids, Capparine, Cappariline, Capparinine, are also isolated from the roots **(**Chahlia, 2009**)**.

The spermidine alkaloids, Isocodonocarpine, Capparidisine and Capparisinine have been isolated from dried root bark and their structures are elucidated by Mass, U.V., I.R. and N.M.R. Spectroscopy (Ahmad et al., 1985; Ahmad et al., 1987; Ahmad et al., 1989). Two new naturally occurring acetals are isolated from the root bark and characterized, in the form of N-acetylated spermidine alkaloids, 14-N-acetylisocodonocarpine, 15-N-acetylcapparisine (Ahmad et al., 1992). Root bark also contains Capparisine, Codonocarpine, and Cadabacine, Rutin l-Stachydrine, β-sitosterol (Rathee et al., 2010; Mishra et al., 2007; Anonymous, 2000) and 6-oxygenated heterocyclic constituents, like Capparisesterpenolide and Decidua terpenolides A, B, C, D and E (Chahlia, 2009).

Aerial parts (flower, fruit, stem and seed) contain n-triacontane, n-triacontanol, n-pentacosane, 6-(1-hydroxy-non-3-enyl) tetrahydropyran-2-one, 2-carboxy-1-dimethylpyrrolidine, β-sitosterol, β-carotene, Glucosinolates, Ascorbic acid, proteins, carbohydrates, Calcium, Potassium, Phosphorous, Zinc, Iron and Manganese (Rathee et al., 2010). The quantity of β-sitosterol in the stem is found to be 0.044% by TLC densitometric method using HPTLC **(**Rathee et al., 2010**)**.

Flower buds contain Capric acid and a glucoside which, on boiling with sulphuric acid, yields isodulcite and a colouring matter similar to quercetin (Nadkarni, 1954). In flowers, hydrocarbons, like Nonacosane, n-pentacosane and n-triacontane, triacontanol, β-sitosterol and glycosides are present (Mishra et al., 2007; Chahlia, 2009). Flowers and Seeds also contain wax, which is a mixture of hydrocarbon and ketones having C-28 to C-32 with Nitrogen and Sulphur oils (Mishra et al., 2007). Fruits from Hissar (Haryana) contain, on dry basis, moisture – 65, total carbohydrate – 71, proteins – 17, fat – 5, crude fibre – 1, ash 6%, Phosphorus – 360, Calcium – 210, Iron – 6, Zinc – 4, Manganese – 2, β-carotene – 21, ascorbic acid – 119, phytic acid – 68 and oxalic acid 0.1 mg/100g (Anonymous, 2000). These constituents are responsible for the nutritive value of the fruit. Fruit husk is also found to contain β-carotene and pthalic acid (Mishra et al., 2007). In seeds, an isothiocyanate glucoside, named Glucocapparin, hydrocarbons, n-pentacosane, n-triacontanol and β-sitosterol are identified (Sharma, 2005, Mishra et al., 2007**)**.

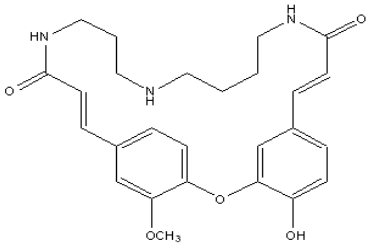

Fig. 2 Isocodonocarpine

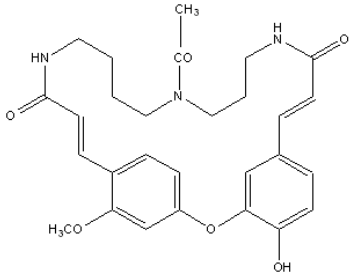

Fig. 3 15-N-acetylcapparisine

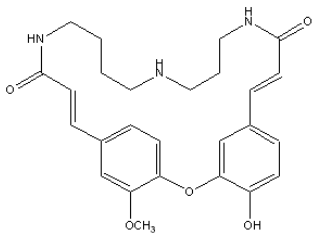

Fig. 4 Codonocarpine

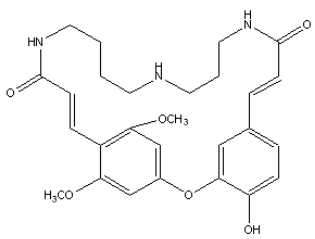

Fig.5 Capparisinine

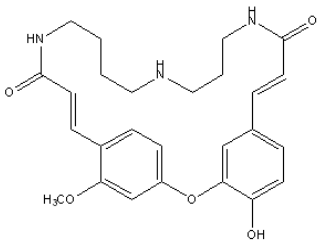

Fig. 6 Capparisine

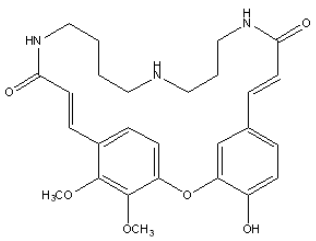

Fig.7 Capparisidine

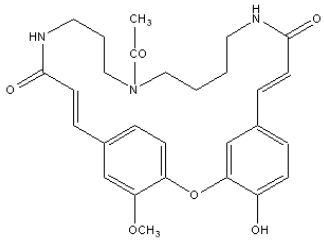

Fig.8 14-N-acetylisocodonocarpine

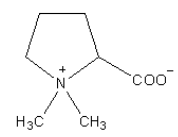

Fig.9 l-Stachydrine

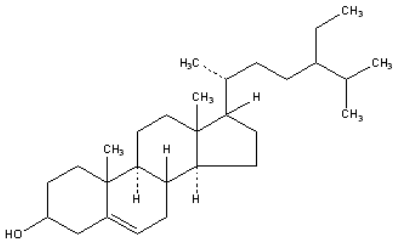

Fig.10 β-Sitosterol

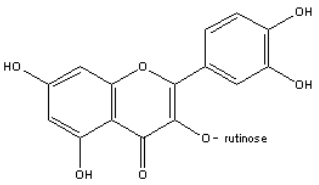

Fig. 11 Rutin

Chemical Constituents of *Capparis decidua*

TRADITIONAL PROPERTIES AND USES

The plant and its parts are widely used by traditional healers and tribal people for curing variety of ailments. The medicinal uses of *C. decidua* are also mentioned in ancient books. By Kavirajas, the plant is regarded as acrid, laxative, counter-irritant and stimulant. They often prescribe it in heart diseases, colic pains, scurvy and phthisis (Nadkarni, 1954). The plant is used in flatulence, anorexia, respiratory disorders, skin diseases, in general weakness and also as anthelmintic and diuretic (Vaidya BG, 1995; Sharma PV, 2005). Infusion of plant is used externally for eruptions, boils, joint diseases and internally in cough and as an antidote in case of poisoning. Juice of fresh plant is used to kill worms in ear. It is also considered as a good substitute of senega (Nadkarni, 1954; Shastri 1957). Crushed bark of the plant is applied as poultice for treatment of wounds (Marwat et al., 2011).

Roots are considered to be sudorific, thermogenic, expectorant, carminative, digestive, stimulant, antibacterial, aphrodisiac, anodyne, anthelmintic and useful in arthritis, dyspepsia, constipation, lumbago, odontalgia, amenorrhoea and dysmenorrhoea (Longman O, 1994). In traditional system of medicine, root bark is known to be astringent, alterative, acrid, diaphoretic, alexeteric. Powder or infusion of root bark is used in gout, rheumatism, cough, dropsy, palsy, asthma, intestinal worms and intermittent fever. The powder is applied externally on malignant ulcer (Nadkarni, 1954; Chunekar & Pandey, 1999; Anonymous, 1950).

A paste of coal obtained after burning the wood is applied to muscular injuries (Gupta & Sharma, 2007). Fresh leaves and young shoots, when chewed, give immediate relief in toothache (Shastri, 1951). Their paste is used as plaster on blisters and swellings (Vaidya BG, 1995). In Pakistan, powder of tender branches is mixed with wheat flour and fed to animals to relieve pain (Marwat et al., 2011).

The green berries and flower buds of *C. decidua* are edible and commonly pickled or used in preparation of vegetable and curry due to the folkloric belief that they have hypoglycemic effect in diabetes (Nadkarni, 1954; Marwat et al., 2011). The vegetable prepared from fruits in ghee is also believed to be good for eyes (Vaidya BG, 1995). The fruits are astringent used as laxative and cathartic in chronic constipation. They are also useful in biliousness, cardiac troubles, halitosis and vitiated conditions of Pitta (Anonymous, 1950; Longman O, 1994). In folk medicine, mixture of equal quantity of fruit powder and sugar is prescribed in rheumatism. They are given in diarrhoea in cattle and goats (Marwat et al., 2011). In Rajputana and Sudan, the plant is fed to camels and goats as fodder (Nadkarni, 1954). The dried plant is also used for fuel purpose.

PHARMACOLOGICAL ACTIVITIES OF DIFFERENT PLANT PARTS

Isocodonocarpine found in roots of plant was found to be responsible for Antiinflammatory and anti-asthmatic activity (Ahmad et al., 1992). Anthelmintic and purgative properties were found to be more prominent in aqueous extract than alcoholic extract of root (Gaind et al., 1969). Alcoholic extract of fruit pulp and root bark possess anthelmintic and antimicrobial activities (Hundiwale et al., 2005). β-Sitosterol isolated from the root bark has been examined for possible anti-inflammatory activity in acute and chronic inflammatory models. β-sitosterol exerted statistically significant and dose-dependent anti-inflammatory activity in

carageenan-induced rat paw oedema, which was similar to Indomethacin. Topical application of β-Sitosterol significantly inhibited ear inflammation induced by multiple applications of tetradecanoylphorbol-13-acetate in mice. β-Sitosterol significantly inhibited adjuvant-induced rat paw oedema. The results suggested that β-Sitosterol exerts anti-inflammatory activity, at least in part through inhibition of cyclooxygenase and 5-lipoxygenase pathways (Perianayagam, 2008).

Hepatoprotective activity of aqueous and methanolic extract of *C. decidua* stem against CCl_4-induced hepatotoxicity in rats have been demonstrated and have been found to be comparable to Silymarin (Ali et al., 2009).

Anti-oxidant and β-cell regeneration effect of stem extract in streptozotocin-induced diabetic rat have been evaluated. Methanolic extract and active fraction from stem part significantly reduced blood glucose levels in diabetic rats. Extract exerted rapid protective effects against lipid peroxidation by scavenging of free radicals thereby reducing risk of diabetic complications (Dangi & Mishra, 2011).

Studies have shown that fruits have antidiabetic (Yadav et al., 1997), hypolipidaemic (Purohit & Vyas, 2005), anti-atherosclerotic (Purohit & Vyas, 2006) and anti-hypertensive (Ghulam S, 2002) activities. 50% ethanolic fruit extract showed hypolipidemic effect in cholesterol fed rabbits, by significant reduction of serum cholesterol, serum triglycerides and LDL and increase HDL ratio and excretion of cholesterol (Sharma et al., 1991). Seeds have been shown to possess antibacterial activity against *Vibrio cholera, Vibrio ettor and Vibrio inaba* (Gaind et al., 1972).

Flavonoid fractions obtained from different parts of *C. decidua* (root, stem and flowers) have been studied for their anti-microbial activity using disc diffusion assay, against two Gram negative bacteria (*Escherichia coli* and *Proteus mirabilis*), one Gram positive bacteria (*Staphylococcus aureus*) and a fungi (*Candida albicans*). The plant exhibited broad spectrum activity (Sharma & Kumar, 2009). Three different alcoholic extracts obtained from bark, flower and fruit have been shown to have hypolipidaemic activities in rats. The alcoholic extracts restored the elevated levels of serum lipids to normal and showed significant decrease in levels of total cholesterol, triglycerides, LDL and VLDL cholesterol (Chahlia, 2009). Alcoholic extract of husk of fruits, seeds and flowers were demonstrated to be antibacterial (Gaind et al., 1969).

CONCLUSION

Because of its xerophytic nature, *Capparis decidua* has wide and cheap availability. Besides, its usefulness in numerous ailments is also mentioned in Ayurvedic and traditional literatures and scientific investigation of its therapeutic worth is found in the literature. Pharmacological and clinical data of *Capparis decidua* are also available in order to support its traditional and folklore uses. This may provide benefit to common man and even tribal people by the use of easily available cheaper plant as a medicine and food. Some pharmacological and phytochemical investigations are carried out, but more scientific validation for those investigations is still required. Pharmacological reports are found regarding the use of root and root bark of *Capparis decidua*, but these findings are not supported by international community related to plant conservation and forestation. Furthermore, pharmacognostical data also needs to be generated for knowing the identity, purity and quality of the plant, which are not available still today in the literature.

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