

REVIEW ON ETHNOBOTANICAL STUDIES OF NUTRACEUTICAL PLANT: *CAPPARIS SPINOSA* L. (CAPER)

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ABSTRACT

Objective: *Capparis spinosa* L. (Caper) is a perennial spiny bush that bears rounded, fleshy leaves and big white to pinkish-white flowers. It is native to the Mediterranean region and growing wild on walls or in rocky coastal areas throughout India. Even though it has been used in traditional Indian system of medicines for various human diseases, the summation of its medicinal properties is lacking. Hence, the present review focused to provide collective information regarding the medicinal value of *C. spinosa*.

Methods: Literatures were collected from online resources like Scopus, Sciencedirect etc., related to the pharmacological activities of *Capparis spinosa* and the available information were summarized and given in the review.

Results: *C. spinosa* has anthelmintic, cytotoxic, anti-inflammatory, antiarthritic, antioxidant, antibacterial, antifungal, antiviral, cardiovascular, chondroprotective, antidiabetic, hypolipidemic, antiallergic and antihistaminic, immunomodulatory, anticarcinogenic, and antihepatotoxic activity. The phytochemicals identified in this plant were lipids, alkaloids, glucocapperin, and polyphenols.

Conclusion: This review attempts to encompass the available literature on *C. spinosa* with respect to its pharmacognostic characters, chemical constituents, nutritional characters, various pharmacological activities, traditional uses, and modern use.

Keywords: *Capparis spinosa* L., Caper, Medicinal properties, Nutritional value, Phytochemicals.

INTRODUCTION

Capparis is a name coined by Theophrastus (4th century BC) and endorsed by Dioscorides (1st century AD). It seems to have come into wide use after the spread of the Arab culture in the middle ages. The genus *Capparis* was created by Linnaeus with the description of *Capparis spinosa* L. and other *Capparis* species [1]. The synonym of this species is *Capparis rupestris* Sm. and common name of this species is caper. It is called in different names in different languages such as English (Caper, Caperberry, Caperbush), Hindi (Kiari, Kobra), Sanskrit (Ahimsra, Kanthari, Kantaka, Tiksnagandha), Urdu (Kabar), Kannada (Mullukattari), Marathi (Kabar), Telugu (Kokilakshmu), Punjabi (Kabarra), and in Tamil (Marattimokku) [2]. The collective information on medicinal properties of *C. spinosa* was presented in this review article.

PLANT DESCRIPTION

C. spinosa is a perennial spiny bush, commonly known as caper that bears rounded, fleshy leaves and big-white to pinkish-white flowers (Fig. 1). Roots are deep tap roots, woody stems; foliages are evergreen, orbicular to elliptic, base rounded and apex mucronate, alternate. Flowers are complete, sweetly fragrant, showy, with four sepals, and four white to pinkish-white petals, many long violet-colored stamens, with a single stigma. Capers are the small buds picked when they are very young, even before they have bloomed. If the caper is not picked, it will soon become a flower. This flower produces a fruit caper berry. Caper berries are the mature fruits of the caper bush. They are of same size and green olive in color, with a delicate fruity flavor [3].

The bush is native to the Mediterranean region, growing wild on walls or in rocky coastal areas throughout India. It grows in Afghanistan, West Asia, Europe, North Africa, and Australia. In India, it grows from Punjab and Rajasthan to the Deccan Peninsular. A prostrate, glabrescent,

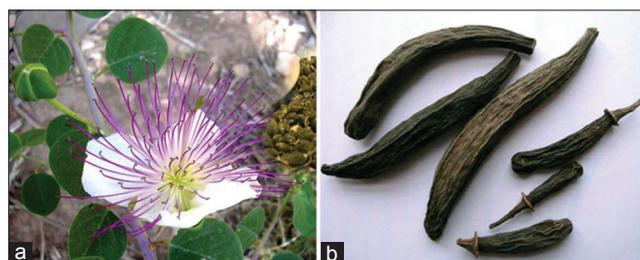


Fig. 1: Morphology of (a) *Capparis spinosa* plant and (b) caper berries

polymorph Shrub or Climber armed with divaricated light yellow thorns, occurring commonly in the dry rocky area [4]. The presence of various chemical constituents in different parts of *C. spinosa* was reported (Table 1).

TRADITIONAL USES

C. spinosa L. was used in ancient Greece as a carminative. The first recorded use of *C. spinosa* for medicinal purposes is in 2000 BC by the Sumerians. The ancient Greeks and Romans also used the plant for various medicinal purposes. In Iranian medicine, fruit and the root of the plant were used in gout and also as diuretics, astringents, and tonic. Capers (flower buds), caper berries (fruits), leaves, roots, and seeds of this plant are used medicinally [5].

The whole plant is used in rheumatism [14]. Roots are used as diuretic, astringent, and tonic [20]. The bark of the root has a bitter taste and used as an appetizer, astringent, tonic, anti-diarrheal, and to treat hemorrhoids and spleen disease [21]. The bark is also used for gout and rheumatism, as an expectorant, and for chest diseases [22]. Infusion

Table 1: Major chemical constituents of *Capparis spinosa*

Serial number	Plant part	Chemical constituents	References
1	Fruits	Flavonoids, indoles, and phenolic acids	[6,7]
		Sitosterylglucoside-6'-octadecanoate, 3-methyl-2-butenyl-glucoside	[8]
		P-hydroxybenzoic acid; 5-(hydroxymethyl)furfural; bis(5-formylfurfuryl)ether; daucosterol;	[9]
		α -D-fructofuranosides methyl; uracil, and stachydrine	
		Capparaside(4-hydroxy-5-methylfuran-3-carboxylic acid)	[10]
		(6S)-hydroxy-3-oxo- α -ionolglucosides, corchoinoside C(6S, 9S)-roseoside, prenyl glucosides,	[11]
		cappariloside A, stachydrine, an adenosine nucleoside, hypoxanthine, β -sitosterol, vanillic acid,	
		P-hydroxybenzoic acid, protocatechuic acid, daucosterol, uracil, butanedioic acid, and uridine	
		P-hydroxybenzoic acid, 5-(hydroxymethyl)furfural bis(5-for- mylfurfuryl)ether, daucosterol,	[12]
		α -D-fructofuranosides methyl, uracil, and stachydrine	
		β -sitosterol, vanillic acid, P-hydroxybenzoic acid, protocatechuic acid, daucosterol, uracil,	[13]
		butanedioic acid, and uridine	
		Al, P, S, K, Ca, Cl, Ti, Mn, Fe, Ni, Cu, Zn, Br, Rb, Sr, Y, and Pb	[14]
		Carbohydrates, fats, dietary fibers, sugar, protein, and Vitamin C	[15]
2	Seeds	Isopropyl isothiocyanate, methyl isothiocyanate, butyl isothiocyanate, 3-P-menthene, 2-butenyl	[16]
		isothiocyanate and 3-methylthio-1-hexanol, palmitic, stearic, oleic, linoleic and linolenic acid	
		Lectin HIV-1 reverse transcriptase inhibition potential	[17]
		Al, Ca, Cu, Fe, K, Mg, Na, P, and Zn	[18]
		Cholesterol, brassicasterol, campesterol, campestanol, stigmasterol, B-sitosterol, Δ 5 avenasterol,	[19]
		Δ 5,24 stigmastadienol, Δ 7 stigmastenol, and Δ 7 avenasterol	

Table 2: Biological activities reported on *Capparis spinosa*

Serial number	Parts studied	Biological activity	References
1	Alcoholic and aqueous extracts of <i>Capparis spinosa</i>	Anthelmintic activity	[32]
2	Aqueous extract of flower buds of <i>Capparis spinosa</i>	Cytotoxic activity	[33]
	A novel dimeric 62 kDa lectin from <i>Capparis spinosa</i> seeds		[34]
	Aqueous extract of leaf of <i>Capparis spinosa</i>		[35]
	<i>Capparis spinosa</i> seeds		[36]
	<i>Capparis spinosa</i> root bark		[37,38]
	Chloroform fractions of <i>Capparis spinosa</i>		[39]
	Aqueous and methanolic crude extracts and secondary metabolites extracts (polyphenolic, rutin, and alkaloids) of mature fruit of <i>Capparis spinosa</i>		[40]
3	Extract of <i>Capparis spinosa</i>	Anti-inflammatory activity	[17,41,42]
	Flavonoids from <i>Capparis spinosa</i> fruits		[7]
4	Aqueous extract of <i>Capparis spinosa</i> fruits		[6]
	Ethanol and water fractions of <i>Capparis spinosa</i> fruits	Antiarthritic activity	[9,12]
5	Ethyl acetate extract of aerial part and root of <i>Capparis spinosa</i>	Antioxidant activity	[14]
	Methanol and ethyl acetate extracts of <i>Capparis spinosa</i>		[43]
6	<i>Capparis spinosa</i> leaves		[44]
	Petroleum ether, water, butanol, methanol and hexane crude extracts of the aerial parts of <i>Capparis spinosa</i>	Antibacterial activity	[16]
	Crude extracts fractions and essential oils of <i>Capparis spinosa</i>		[45]
	<i>Capparis spinosa</i> extract		[46]
	Petroleum ether, methanol, hexane, butanol and aqueous extracts of the whole aerial parts of <i>Capparis spinosa</i>		[47]
	Ethanol and petroleum ether extracts of <i>Capparis spinosa</i>		[4]
	Ethanol extract of <i>Capparis spinosa</i>	Antifungal activity	[48]
8	Methanolic extract of buds of <i>Capparis spinosa</i>	Antiviral activity	[49]
	9	Aqueous extract of <i>Capparis spinosa</i>	Cardiovascular activity
Aqueous extract of roots, leaves, stems, flowers, fruits, and kernels of <i>Capparis spinosa</i>			[51]
10	Leaf and flowers of <i>Capparis spinosa</i>		[52]
	Aqueous extract of fruits, leaf of <i>Capparis spinosa</i>	Respiratory activity	[53]
11	Lyophilized methanolic extract of flowering buds of <i>Capparis spinosa</i>	Chondroprotective activity	[54]
12	<i>Capparis spinosa</i> fruit extract	Antidiabetic activity	[15,55,56]
13	Aqueous extract of <i>Capparis spinosa</i>	Hypolipidemic activity	[57]
14	Lyophilized methanolic extract of flowering bud of <i>Capparis spinosa</i>	Antiallergic and	[58]
		antihistaminic activity	
15	Methanolic extract of <i>Capparis spinosa</i> buds	Immunomodulatory activity	[49]
16	Essential oil and aqueous infusion of leaf and flower buds of <i>Capparis spinosa</i>	Anticarcinogenic activity	[59]
17	P-methoxybenzoic acid from the methanolic soluble fraction of the aqueous extract of <i>Capparis spinosa</i>	Antihepatotoxic activity	[60,61]
	Ethanol extract of root bark of <i>Capparis spinosa</i>		[62]
	Aqueous extract of <i>Capparis spinosa</i>		[63]

of stem and root bark is used as antidiarrheal and febrifuge [22]. Fresh fruits are used in sciatica and dropsy. Dried and powdered fruit

combined with honey is used in colds, rheumatism, gout, sciatica, and backache [6]. As decoction, it is used for gastric pain and applied on

the body for the treatment of epilepsy. Seeds are used in feminine sterility and dysmenorrhea and to relieve a toothache [23]. Crushed seeds are used for ulcers, scrofula, and ganglions [24]. The crushed leaves are applied as a poultice on the front against the headache, on the face against the toothache [25]. The plant's decoction is said to clean eyes [26-30].

MEDICINAL USES

Various biological activities and medicinal properties of *C. spinosa* were scientifically proved (Table 2). *C. spinosa* is one of the several ingredients in Bonnisan, Digyton, Geriforte Aqua, Geriforte, Liv.52 drops, Geriforte Vet, Liv.52 Vet (Companion Care), Liv.52® (Himalayan Co. India) and Liv.52 Vet, Liv.52 DS [31].

NUTRACEUTICAL VALUE

C. spinosa is rich in nutrients and flavonoid compounds such as rutin and quercetin. The flower buds are stored in vinegar, brined and eaten as a pickle. They have long been used in recipes of salads, pasta, meat, sauces, and garnishes to add a pungent, spicy flavor and aroma to food. Capers are picked daily since the youngest flower buds have the highest quality. Capers are valued in proportion to the smallness of their size. Manual labor is required to gather floral buds must be picked early in the morning just as they reach the proper size.

After the buds are picked, they are usually sun dried, and then pickled in a vinegar brine. Capers are categorized and sold by their size, defined as follows, with the smallest sizes being the most valuable: Non-pareil (up to 7 mm), surfines (7 - 8 mm), capucines (8-9 mm), capotes (9 - 11 mm), fines (11 - 13 mm), and grusas (14+ mm) (Sher and Alyemini, 2010). The young fruits and tender branch tips can also be pickled and used as a condiment. The presence of reserve food materials was reported in various parts of *C. spinosa*.

The taste is slightly astringent and pungent, and they can be used as flavoring in many sauces and condiments; they can also be used as a garnish for meat and vegetable dishes. A similar finding was reported [64] that the salted and pickled caper bud is often used as a seasoning and garnish. Furthermore, he also reported that capers are a common ingredient in Mediterranean cuisine, especially Italian.

CONCLUSIONS

C. spinosa is a perennial spiny bush growing wild on walls or in rocky coastal areas throughout India. They have long been used as food in recipes of salads, pasta, meat, sauces, and garnishes to add a pungent, spicy flavor and aroma. This plant has many medicinal uses such as antirheumatism, diuretic, astringent, tonic, anti-diarrheal, febrifuge, gout, sciatica, epilepsy, feminine sterility, dysmenorrhea, toothache, headache, ulcers, scrofula, ganglions, expectorant, hemorrhoids, chest, and spleen disease. Various biological activities and medicinal properties of *C. spinosa* were scientifically proved. The present review is a collection all the available information on this medicinal plant and based on the literature and traditional uses; this plant could be developed as a nutraceutical plant since it has both nutritional and pharmaceutical potentials.

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