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Medicinal and food value of *Capparis*—a harsh terrain plant

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Capparis is a dominating genus of the family Capparidaceae. *Capparis* spp. 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. 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. Whole plant or parts are used for curing asthma, rheumatism, diabetes, paralysis, toothache, as antihelmintic, antiallergic, snakebite antidote, etc. Out of the many *Capparis* species, a few are of specific interest for curing particular ailments, like tuberculosis, cancer, rheumatism or diabetes, which still requires extensive study. Simultaneously, it will be valuable to evaluate utility potential of flowers/fruits in cancer patients due to high titre of spermidin containing alkaloids, which are implicated in tumorogenesis. The review highlights medicinal importance of the *Capparis* products and unnoticed threatened status in their respective niches for sustainable use and long lasting conservation. Being harsh terrain species, plant needs to be considered for strategic planning for greening deserts hilltops.

Key words: Medicinal plant s, Food value, *Capparis* sp., Harsh terrain plant

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About 45,000 angiosperm plants, largely having both medicinal and nutritional value, are playing pivotal role in shaping modern human and keeping society sustainable[1]. 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. Out of 95,000 wild plants recognized for various uses, 7,500 plants are used in medicine, 3,900 as edible, 500 for fiber, 400 as fodder and 300 as source of biopesticides. But the optimum commercial exploitation is still limited. The paper provides information on *Capparis*, growing from Himalayan belt to that of Rajasthan to southern plateau of the country. This may draw scientific focus for strategic planning to optimize judicious, sustainable use, and long lasting conservation.

Morphology and distribution

Many species of *Capparis* are reported from India and different parts of the world. *Capparis aphylla* syn *C.decidua (Gudhapatra*, *Korira, Karer*,) is either a bush or small tree distributed throughout India and Pakistan[2]. Its branches are leafless with pair of spines, which are green, straight, and glabrous. Leaves are found on very young shoots. Flowers either red or sometime yellow are found on short lateral shoots. Fruits are small, berry slightly beaked green and red on ripening. *Capparis spinosa* (L.) (*Kebera*) is either creeper or bush, distributed throughout North & eastern Himalaya, sandy regions of Rajasthan, salty ranges of Maharashtra, Karnataka, Andhra Pradesh and Pakistan[2]. The species has round, ovate leaves with two spines at base, flowers auxiliary and solitary on thick peduncles. The drought tolerance capacity of leaves is demonstrated[3]. *C. sepiaria* Linn. (*Kakada-mimni*, *Kanthari*) is also widely distributed in India, Pakistan, Myanmar and Srilanka[2]. It is climbing shrub with curved thorns, elliptical leaves and simple flowers, fruits are in clusters, pisiform and black. *C. grandis* Linn. F. growing on hard soil and in arid zone (*Dhuti/Gunti*), is found in Rajasthan, Gujarat, Maharashtra, Karnataka and Pakistan[2]. It is a perennial shrub with simple leaves, petioles with spines or bristle like stipules, flowers are white and bracteates, and fruits are berry with many seeds. *C. horrida* Linn. (*Ahimsara, karambha*, *Aranda*, *Gitoran*) is distributed throughout India, Bangladesh

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and some parts of Pakistan[4]. The species is 4 -8 m long, branched, stellate, tomentose or glabrescent with elliptical or lanceolate or ovate leaf apex, mucoranate and recurved thorns. Flowers are in serial clusters on fresh shoots; fruits are berry and globose having many seeds. *C. moonii* (L.) Wight (*Rudanti*) frequently found in Konkan area grows vigorously in hot climate[5]. It is a woody climber with glabrous branches, recurved thorns, simple oblong leaves comparatively bigger with leathery texture, shining dorsal surface and pale ventral side, bigger flower in diameter on long stout pedicels. Fruits are sub-globose or ovoid. Fruits comprise of many seed of large size. *C. brevispinosa* DC. is a weed. *C. rotundifolia* Rottl is reported from Ratngiri in Maharastra while *C. masaiki* L. is of Chinese origin[6-8]. *C. cartilaginea* L., *C. tomentosa* L., *C. heyneana* L., *C. fascicularis* L. and *C. flexuosa* L. have been also evaluated for medicinal value[9-12].

Phytochemistry

Various biochemical compounds, alkaloids, phenols, sterols or glycosides present in *Capparis sp.* (Fig. 1) might be medicinally important and/or nutritionally valuable (Table 1). Moreover, compound isothiocynate universally present could be considered as an indicator of the phylogenetic relationship with other crucifers[13,14]. The specific application of a conjugate of isothiocynate, like 2-hydroxy ethyl glucosinolate from *C. masaikai* has to be explored[8]. It warrants studies to establish link, if any, with sweat protein[8]. Another alkaloid, l-stachyhydrin obtained from seeds, roots bark, flowers, fruits husk and dry fruits of C. *moonii* and C.*tomentosa* exhibited anti-tuberculosis property in *in vivo*[15-20]. The role of this compound has been assigned in increasing blood coagulation, thus shortening bleeding time and blood loss[7]. *C. spinosa* aerial part extract is being used as constituent of multi herbal formulation used in the treatment of liver disorder[21-23]. The cappers preparation has been found as chemo preventive for papillomogenesis[24]. It is demonstrated that *p*-methoxy benzoic acid (33% w/w) from *C.spinosa* posses significant *in-vivo* antihepatotoxicity induced by carban tetrachloride and paracetamol as well as thioacetamide and galacotosamine induced toxicity in isolated rat hepatocyte[25]. The carbon tetrachloride induced liver cell toxicity was significantly checked by the aqueous extract[25]. β-sitosterol, present in whole plant or leaf extract of *C. sepiaria*, fruits of *C. moonii*, flower and seed of *C. aphylla* requires specific evaluation for biological and/or medicinal relevance[13,16,26]. Absence of n-triacontane in *C. aphylla* seed should be also looked for its physiochemical importance[15]. Betulin identified from whole plant and leaf extracts of *C.sepiaria*, could not be demonstrated for any medicinal or biological value[27.] Presence of spermidine alkaloids like capparidisine, capparisine or capparisinine in root bark of *C. aphylla* reminds for careful use of *Capparis* plant parts in dietary or medicinal supplements[28]. Spermidine, spermine, putrescine and cadavarine grouped into polyamines considered to be new class of plant growth regulator, besides regulating plants growth and development even in adverse conditions are also implicated in animal tumor promotion[29,30]. Therefore, it will be imperative to have a critical examination of this aspect precisely in those populations using *Capparis* fruit/ flower in diet and/or in medicine on regular basis. This kind of study is urgently needed for proper management of cancer patients before popularizing this family of plants for wide spread medical practices[21,22,23]. Recently, a compound cappamensin A (1) (2H-1, 4-benzoxazin-3 (4H)-one, 6-methoxy-2-methyl-4-carbaldehyde) isolated from the roots of *C. sikkimensis* sub sp. Formosana displayed significant *in vitro* antitumor activity in various human cell lines[31]. This further suggests that *Capparis species* roots might have chemical compound with anticancer properties as well, which requires standardization.

Immediate attention is required in few fatty acids and glucosides reported from *Capparis species,* such as E-octadec-7-en-5-4 noic acid (1) isolated from *C zeylanica* root, β-sitosterylglucoside-6'-octadecanoate and 3-methyl-2butenyl-B-glucoside from *C.spinosa*[32,33]. Compounds like (6S)-hydroxy-3-oxo-α-ionol glucosides, corchoionoside C (6S, 9S-roseoside) and a prenyl glucoside isolated from mature fruits of *C. spinosa* still warrant detailed studies for their role in nutrition and/or medicine[34]. Methanol extract of *C. spinosa* aerial parts yielded new flavonoids quercetin 3-O-[6-a-L-rhamnosyl-6-B-D-glucosyl]-B-D-glucoside (1) in addition to rutin, quercetin 3-O-glucoside and quercetin 3-O-glucoside-7-O-rhamnoside demands critical evaluation for their utility[35]. *C.spinosa* and *C.ovata* var. *canescens* seeds, rich in palmitic, oleic and linoleic acid and in protein indicates scope for its food value[36]. A new variety *C. yco* Mert. recorded with high protein and oil content, requires attention for cultivation and full exploitation in food industries[37]. Presence of two glucose

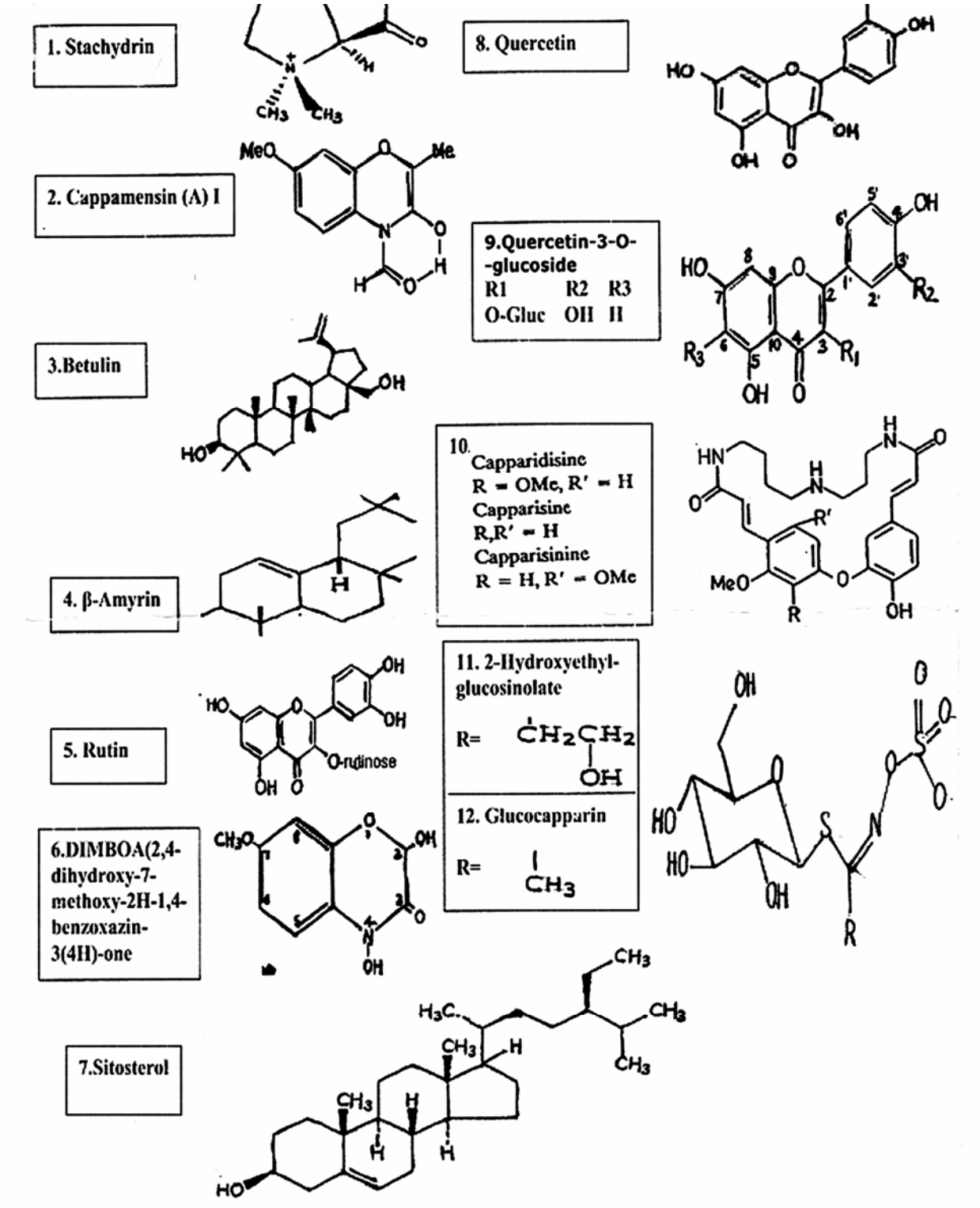

Fig. 1—Important compounds isolated from *Capparis*

containing compounds, cappariloside A & B & 1H-indol-3 aceto-3 acetonitril glycosides in mature fruit of *C. spinosa* suggest nutritional richness of the cappers and can be examined for food supplements for diabetic patients[38]. Presence of natural sweet protein (mabinlins) has not been examined for developing diet for diabetic patients[8]. Significance of these chemicals in various herbal preparations can further galvanize the market. Literature survey shows that the chemical compounds isolated from *Capparis* sps have not been systematically examined for their biological properties. Furthermore, reported antituberculosis and antitumour properties of *Capparis* preparation may provide new respite in dreaded disease control without any any side effects.

Biological activity

Extracts of different parts of *Capparis* show biological activity against large number of pathogens[7]. Antifungal, antibacterial, antiamoebic and antiworm activities of some active principles isolated from *C. decidua* have been demonstrated[2,26,39]. Anthelmintic properties were found to be more prominent in aqueous extract than alcoholic extract[39]. Whereas, alcoholic extracts of husk of fruits, seeds and flower were demonstrated to be antibacterial but not antifungal[40,41.] A stem volatile product from *C. decidua* showed antifungal and antibacterial activity[40]. The change in responses of capper preparations due to change in preparatory condition suggests the possibility of specific modification of biomolecules thereby eliciting different action on different organisms[19,39,40,42-44]. For instance, *C. moonii* fruit powder preparation did not exhibit antituberculosis or bacteriostatic activity, and had no effect on growth in *Solmonella typhi* and *Vibrio aeruginosa*, whereas it had slight inhibitory effect on *Staphyllococcus aureus* and marked effect *on Shigella flexneri* [19,42,43]. Antitubercular property of *C. cartilaginea* ethanol extract could be a considered as a very specific property[44]. Distilled C. *decidua* stem extract inhibited 50% colony size of *Staphylococcus aureus, E. coli, Pseudomonas aeruginosa, Aspergillus fumigatum* Fres., *Aspergillus flavus* Link, *Aspergillus niger* van Tiegh., *Penicillium* sp, *Candida albicans, Cladosporium* sp[45]. *C. spinosa* had strong antibacterial activity against both Gram positive and Gram negative bacteria as well as moderate antifungal activity, whereas *C. spinosa* completely prevented growth of *Microsporum canis* Bodin and *Trichophyton* violaceum Sabouraud[46,47]. *C. tomentosa* preparation showed antimicrobial activity against *Staphylococcus aureus*, *Streptococcus pyogenes, E. coli* and *Pseudomonas aerugenosa*[48]. *Capparis* formulations have a potential to control large number of human and animal diseases. Further studies are required to evaluate the potency of cappers compound in controlling viral infections as well. Antiviral activity of methanol extract of *C. apylla* Roth stem bark and *C. longispina* Hook. f. & Thomsonethanol extract was quiet prominent[7]. More clinical trials are required to evaluate its *in vivo* efficacy. Medicinal uses of *Capparis* are also mentioned in ancient books like *Shushrut, Dhanwantri, Nighantu, Kshem Kutulhan* and *Madanpal*[49]. The medicinal activities of preparations made from different parts of *Capparis* sps have been evaluated (Table 2). *C. decidua* has been reported to cure asthma, cough, gout, ear infection, rheumatism and ulcer[50]. Bark pout of *C. decidua* and *C. cartilagenea* were found effective as antihelmintic, constipative and purgative[26,39, 44]. *In-vitro* antioxidative and *in-vivo* photoprotective effects of a lyophilized extract of *C. spinosa* L. have also been observed[51]. *C. spinosa* stem bark has been found to be effective in paralysis and toothache[52]. *C. decidua* powder could be effective in diabetes and hypercholesterolemia [53,54]. Root bark is suggested to be useful in diuretic, paralysis, enlarging spleen and tubercular gland in rheumatism, expectorant and analgesic[52]. *C. spinosa* L. exhibited potent antihyperglycaemic activity and effectively prevented chemically induced pappillomagenesis in mouse skin[24,55]. *C. decidua* ethanol and *C. spinosa* aqueous extracts reduced carrageen induced oedema in rats[56]. *C.spinosa* showed antihepatic and antihepatotoxic activities[23,25]. Seeds of *C. moonii* are used in cough, weakness due to tuberculosis, while *C. zeylanica* stem and leaf are used as spasmolyte.

C. separia seed and *C. zeylanica* fruit have been considered as antidote to snakebite[57-59]. Herbal adjuvant to antisnake venom (ASV) can reduce the dose and mitigate the dose demands[60]. Though herbal antidotes seem to be less expensive, requires precise standardization. Bark and leaf of *C. grandis* cure swelling eruptions while *C. heyneana* Wall. leaves reduces rheumatic joints pain[57]. *C. sepiaria* roots are also used in earache and mumps, while stem bark and root are used in curing dropsy gout[2]. *C. zeylanica* root bark was used in small pox and swelling of testicles[2]. Anticancer activity of various herbal products and capper compounds are assayed[31.61]. Standardizations

Table1—Chemical compounds in *Capparis* sp

Name of *Capparis* sp	Plant parts	Compounds present
Capparis decidua (Forsk.) Edgeo. Syn *Capparis aphyla* Roth.	Seeds	Isothiocynate, Glucoside, Glucocapparin, n-pentacosane, n-tricontanol[13,15,26]
	Root bark	β- sitosterol, L- stachyhydine, Capparidisin, Capparisin, Capparissinin[28]
	Seed & Flower	Wax (mixture of Hydrocarbon & Ketone with C-28 to C-32 with N and S oils[71]
	Flower	n-pentacosane, n-triacontane , triacontanol β-sitosterol[15]
	Fruit husk	β-carotene,Phthalic acid[15]
Capparis spinosa Linn.	Whole plant	Polyprenols, Cappaprenols-12, 13, 14-sopreneunit, p-methoxy benzoic acid[25,83]
	Leaf & Fruit	Isothiocynate[14]
	Flower	β-sitosterylglucoside-6'-octadecanoate, 3-methyl-2-butenyl-β-glucoside[33]
	Mature fruit	(6S)-hydroxy-3-oxo-α-ionol glucosides corchoionoside C ((6S,9S)-roseoside), prenyl glucoside, Cappariloside A & B, 1H-indol-3 aceto-3 acetonitril-glycosides[34,38]
	Aerial part	rutin, quercetin 3-O-glucoside, quercetin-3-O-glucoside-7-O-rhamnoside, quercetin 3-O-[6-α-L-rhamnosyl-6-β-D-glucosyl]-β- D-glucoside[35]
	Seed	Palmitic, oleic acid, linoleic acid[36]
Capparis moonii Wight	Fruit	β-sitosterol, Stachyhydrin, Rutin[16]
Capparis sepiaria Linn.	Leaf	α, β-amyrin, Taraxasterol, Erythrodiol, β-sitosterol, Betulin, Triterpin alcohol[27]
	Whole plant	n-octacosanol, α, β-amyrin, β-sitosterol and glucoside Betulin-28 acetate[27]
Capparis coriaceae	Leaf	Dolichol polyprenols[84]
Capparis species	Leaf	Poly isoprenoids alcohol
Capparis mosaikai Linn.	Seed	2-Hydroxyethyl glucosinolate, mabinlins[8]
Capparis tomentosa Lam.	Root bark	Stachyhydrin[16]
Capparis zeylanica Linn.	Root	E-octadec-7-en-5-4 noic acid[32]
Capparis sikkimensis Kurz	Root	2H-1,4-benzoxazin-3(4H)-one, 6-methoxy-2-methyl-4-carbaldehyde[31]
Capparis ovata M. Biers.	Seed	Palmitic, oleic acid, linoleic acid[36]

Table 2—Medicinal uses of plant parts of different *Capparis* sp.

Name of *Capparis* sp	Plant parts	Uses
Capparis decidua	Powder	Asthma, cough, gout, rheumatism, analgesic diaphoretic, alexeterie, hypoglycemic & antidiabetic agent, in lowering oxidative stress in diabetes[26,53]
	Bark pout	Anthelmintic ,constipative, purgative,
	Root bark	Diuretic, paralysis, enlarge spleen and tubercular gland in rheumatism, expectorant, analgesic reduction of triglycerides, lipids, phospholipid in plasma[52, 65]
Capparis cartilagenea	Bark pout	Anthelmintic, constipative, purgative[44]
	Ethanolic extract	Reduction in blood press & heart rate[64]
	Aqueous extract	Inhibition of non epinephrine paralysis and toothache[52]
Capparis spinosa	Stem bark	Antihyperglycaemic activity, Liv-52, anti- hepatic activity, hepatotoxic activity[22-24,55,85]
	Aqueous extract	Lipid lowering activity[64]
	Flowering bud	Antiallergic & antihistaminic[63]
Capparis moonii	Seed	Cough spitting[57]
Capparis zeylanica	Stem, Leaf	Spasmolyte[57]
	Fruit	Antidote to snakebite
Capparis separia	Seed	Antidote to snakebite[57]
	Root	Earache & mumps
	Stem, root bark	Curing dropsy gout, aphthae[62]
Capparis grandis	Bark, Leaf	Cure swelling eruptions[57]
Capparis heyneana	Leaf	Rheumatic joints pain [57]

Table 3—Nutritive value of plant parts

Name of *Capparis* sp	Plant parts	Nutritional value
Capparis spinosa	Fruit	Alkaloids (0.74%), glucosides (0.083%), reducing sugar (32.9%), fats (3.75%), resins (23.75%), titratable acid (14.1%), ascorbic acid (135.5 %)[28]
	Leaf	Alkaloids (0.02%), reducing sugar (1.68%) fat (0.71%), resins (2.2%), ascorbic acid (70.8%)
	Bud	Antioxidants/flavoring agent[51,74]
	Flower/ buds	Pickels[66]
Capparis decidua	Seed	Oil (20%)[71]
	Flower	Oil (14%), sugar (1.7%), protein (8.6%), β-carotene,
	Fruit	Pickels[45]
Capparis ovata	Flower/ buds	Pickels[66]
Capparis mosaikai	Seed	mabinlins (Sweet proteins)[8]
Capparis yco	Seed	Protein, oil content[37]

of *Capparis* products may provide new impetus to cancer management. *C. sepiaria* has been evaluated for the treatment of aphthae and *C. spinosa* L. flower buds for antiallergic and antihistaminic potency[62,63]. Ethanol extract of *C. cartilaginea* causes reduction in blood pressure and heart rate[44]. Aqueous extract of *C. spinosa* exhibited a potent lipid lowering activity in both normal and hyperglycemic condition[64]. *C. decidua* preparation showed a significant reduction in plasma triglycerides, total lipids and phospholipids concentration in human plasma[65].

Food and nutritive value

Capparis has considerable nutritional value. Buds of *C. spinosa* & *C. ovata*, flowers and *C. decidua* fruits are extensively used in diet as vegetable and pickle in Rajasthan and Haryana[45,66,67]. However, only few species have been examined for their nutritive value (Table 3). 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%). The presence of β-carotene (14 %) is sufficient to meet the requirement of vitamin A. *C. decidua* was found to be richest source of β-carotene[68]. Fruit is a rich source of vitamin C[69,70]. The presence of oil content in seed and flower along with sugar and protein substantiate the nutritional value[71]. *C. spinosa* fruits contents of alkaloids, glucosides, reducing sugar, fats, resins, titratable acid and ascorbic acid leaf contents alkaloids of reducing sugar, fat, resins and ascorbic acid justify its use as an important diet supplement[28]. *C. spinosa* buds are rich source of antioxidant[46]. However, some doubts have been raised against its full potential of replenishing the dietary minerals requirements of a consumer due to certain specific compounds. There is possibility of alteration in assimilation pattern of minerals by the human body due to the presence of phytic acid or phytates in *Capparis*, probably that hinders the absorption of divalents in human digestive system[72]. *Capparis* species utility has been advocated in food processing industry as a flavouring material from the flower buds or young fruits[73]. This exalts the nutritional value of the flowering buds, which are widely used as a source of flavour[74]. *Capparis* having large potential as food supplement and medicinally important, extensive study is required for optimizing its cultivation potentials.

The toxic effect of *C. tomentosa* feeding to sheep, calves, Nubian goat has been reported[75]. Daily single or repeated feeding of *C. tomentosa* dried leaf or stem to sheep and Zebu calves caused death[75]. *C. heyneane* flowers preparation were found to be laxative[57]. Ethanol extract of *C. moonii* aerial parts induce depression in central nervous system[76]. *C. spinosa* may cause allergic contact dermatitis in human due to presence of high concentration of isothiocynate in preparations, if remains for prolong contact with inflamed skin[70]. Lectins and toxins in the plant diet of *Phlebotomus papatasi* can kill leishmania (parasite) major promastigotes (vector) in the sandfly[77]. *C. spinosa* extract agglutinated the parasite and killed it in their vector[77]. These toxicity factors could be relevant for evaluation before formulation of the various products for human use. The hypnotic activity of some of the active principles of *Capparis* is demonstrated. Stachychlor, a non hygroscopic, odourless and a bitter compound present in almost all species of *Capparis* possess hypnotic activity[13]. It is suggested that *C. Zeylanica* root bark preparation can be used for sedative purpose[2]. This further shows the wide spectrum of utility potency of *Capparis*. Hence,

it is worthwhile to initiate steps for cultivation and preservation of plant species.

Due to xerophytic nature and usefulness in sustenance for humanity, *Capparis* species are suggested for the preservation. *Capparis* 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* 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

Phytomedicines exert their effect through additive or synergistic action at single or multiple targets due to their low side effects[78,79,80]. Ethanol extract of *C. tomentosa* had impressive antibacterial and antifungal properties, which could lead to the discovery of new antibiotics[81]. The isolation of bioactive compounds by guided fractionation of the aerial parts of *Capparis* may replenish the decreasing effectiveness of many antibiotics in use. *Capparis* sp. seems to have tremendous scope to provide different therapeutic compounds as analgesic, antiinflammatory and biochemicals to treat cardiac, renal, skin and central nervous system problems. Fruits, flowers and leaves rich in nutrients, minerals, and vitamins can be used as dietary supplements. *C. masaikai* contains a sweet protein called mabinlins, which is to be examined further in the all *Capparis* species[8]. The plant genetic engineering could provide great opportunity to exploit sweet protein production, which can open new vistas for nutritionist and medical practitioners especially in case of coronary and diabetic diseases. Extensive physiological characterization is lacking in medicinal plants so as to exploit for quantity and quality production of desired products. Although, active principles have been identified/characterized in general, the pathway for biosynthesis and regulation of specific desired compounds is still unclear. The level of various chemicals produced in different species could be characterized by using molecular marker like RFLP/RAPD, which may help in selection of desired traits for biotechnological approaches to modify quality and quantity of active gradients in *Capparis* sp. and in others.

Uncontrolled grazing and uprooting/mechanical damage have caused poor fruits quality. Poor seed germination and biotic interference have caused depletion of *Capparis*. Some of the *Capparis* sps. are threatened which includes species like *C. cinevea* from Manipur, *C. diversifolia* Wight & Arn. in Kerala, *C. fusifera* Dunn in Tamil Nadu, *C. pachyphyla* from Arunachal Pradesh, *C. rhudii* from Goa, Daman and Diu, Karnataka, Kerala and Tamil Nadu and *C. shevaroyensis* Sunder from Tamil Nadu[82]. Therefore, *Capparis* depletion rate should be checked by immediate conservation and propagation by modern techniques. The optimization of plant growth before cultivation of *Capparis* in specific area is very pertinent. This plant is harvested in wild, where condition for growth has not been optimized. Wild harvesting of medicinal plants hampers the quality of plant as well as biodiversity. Regulation of phyto-medicinal use through specific legislation is essential to protect the plant biodiversity with people participation. Some more genus of Capparidaceae family has been evaluated for medicinal value. *Crateava nurvala* Buch.-Ham. (*Barun*) is used as a laxative, diuretic, in calculus and snakebite[52]. Roots and leaves of *Cadava farinosa* Forsk. (*Kadamba*) are prescribed in urine obstruction and leaves as poultice for sores. *Cadaba trifolia* (Roxb.) Wight & Arn. (*Balya*) root and leaves are anthelmintic[52]. *Gyandropsis gynandra* (Linn.) Briq. (*Karalia*) root decoction in given in fever; leaves in rubifacient, rheumatism and seed as anthelmintic[57]. Since, the species of this family has a wider application in medicine because of chemical biodiversity, there is a need to tap its multifaceted utility, without which it is likely to be threatened as in case of *Cleome burmoni* in Kerala & Tamil Nadu, and *Cleome gynandra* in Rajasthan[82].

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