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***Correspondence**

Saba Sahar
Email:
sabasahar787@gmail.com

A Review on Caralluma Species: The Medicinally Important Plants

Saba Sahar[1]*, Mirza Imran Shahzad[1], Umm E Habiba[1]

[1]Department of Biochemistry & Molecular Biology, IBBB, The Islamia University of Bahawalpur - Pakistan.

Abstract:

Plants have been used by Humans since prehistoric times for many purposes. Humans are dependent on plants not only for nutrition purposes but also for the treatment of different diseases. *Caralluma* species belong to therapeutic plants and are used to cure different diseases like diabetes and cancer. It is mainly used as a vegetable in most parts of the world, some species has limited flowering instead their stems show the spiky projections. They are mainly found in the dry regions of the world as in India, Pakistan, Saudia Arabia etc. All parts of the plant are rich in phytochemicals. The *Caralluma* plants mostly contains a known antitumor drug i.e. pregnane glycoside. Being an edible plant, *Caralluma* spp are considereded safe to use and non-toxic to humans and other animals. There are many pharmaceutical benefits of this plant. Their single plant has the potential to treat many diseases, many research works are conducted to find out their medicinal importance and chemical composition using different in vitro and in vivo studies. Basically, they possess anticancer, anti-proliferative, anti-inflammatory, immune-suppressant, anxiologic, nootropic and appetite suppressant properties. Thus *Caralluma* spp can be regarded as therapeutic agent because of their chemical constituents.

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INTRODUCTION

Caralluma belongs to the family Asclepiadacea and contains about 200 genera & 2500 species. *Caralluma* is widely found in dry areas of the world as in Spain, Africa, Middle East, Saudi Arabia, Pakistan and India. It is planted as a border marker in gardens and as a wayside shrub in India. *Caralluma* has extreme importance in medicine field as it possess anti-inflammatory, anti-tumor activity, and anti-ulcer properties (Mahmood *et al.*, 2010; Moni *et al.*, 2023). Plants as a traditional medicine are being used for the treatment of different diseases all over the world (Aernan *et al.*, 2024; Aernan *et al.*, 2023; Ashraf *et al.*, 2020). Ayurvedic, Unani, and Chinese are some examples of traditional medicines. The use of plants as medicinal drug is famous because of their limited side effects as they contain natural constituents (Ashraf and Iqbal, 2022; Aslam and Ahmad, 2016; Iqbal and Ashraf, 2018). WHO defines medicinal plant as "any plant containing chemical substances which are precursors of chemo-pharmaceutical semi-synthetic, new drug or can be used for therapeutic purposes" (Jain *et al.*, 2019). The Guinea-Bissau traditional medicinal systems use the plants for medicinal purpose. Different research studies are performed in different ethnic groups, namely Fulani and Bijagó. These studies were carried to focus on the botanical or pharmacological analysis and reported about ninety eight species with different pharmaceuticals activities (Frazão-Moreira, 2016). Traditionally, Indian herbal medicines are called as Ayurveda and It has a long list of variety of medicines obtained from plants (Anand *et al.*, 2019). Magical and religious issues are common in Indian cultures. Among these issues, a number of ritualistic prayers and practices are performed in which different plants are used to influence the supernatural powers. Mostly *Ocimum sanctum* L., *Ficus religiosa* L., *Ficus benghalensis* L., *Musa paradisiaca* L., and *Nelumbo nucifera* Gaertn. are used in these prayers and practices (Thakur *et al.*, 2021). Traditional Chinese Medicine (TCM) is one of the main living traditions that has played an important role in treatment of different diseases. By different formulations as powders, syrups etc. medicines are being synthesized by using plant extracts (Anand *et al.*, 2019). *Ficus carica* (Fig) is considered as a mythical tree and their leaves are considered sign of Buddha and it is holy for Behrman and Zoroaster followers. Fig was a sign of eternality in China, and a symbol of devotion in Egypt. It represented a synagogue that acknowledged Jesus, and as a result, it was left without fruit (Adelazadeh and Fakhri, 2015). In short, the studies have proven that humans have nutritional, medicinal as well as spiritual relationship with plants.

Caralluma species have been used as emergency foods in semi-arid areas of world including Pakistan for centuries (Mahmood *et al.*, 2010; Moni *et al.*, 2023). Some *Caralluma* species are discussed below.

• *C. dalzielii* known as the mosque stalk is a cactus like plant with 5-merous flower and up to 1m height is used for many therapeutic purposes. Mostly its aerial parts and sometimes whole plant is being used in the treatment of infertility both in males and females. Its use against snake bite, diabetes, leprosy, rheumatoid arthritis and scorpion bites and severe pains in the epigastrium (Ugwah-Oguejiofor *et al.*, 2019).

• *C. sarkariae* is a succulent type and wild medicinal plant. In India, it is found in dry areas of Nagamalai hills, Tamil Nadu and Madurai district. *C. sarkariae* has a limited population size. *C. sarkariae* possess antipyretic, anti-ulcer, carminative, anti-diabetic, febrifugal, anti-nociceptive and antioxidant properties. Indian tribal and hunters are well aware of the hunger suppressing properties of this plant (Sreelatha *et al.*, 2009).

• *C. europaea* used as traditional medicine for the treatment of ulcer, inflammation, bacterial infections and diabetes,. Its aerial parts are being used as a powder mixed with honey or milk or as juice. The literature shows that *C. europaea* possess pharmacological activities as anti-nociceptive, antiulcer, anti-hyperglycemic, antioxidant, and cytotoxic activities (Amrati *et al.*,

2021). Numerous Mediterranean nations, such as Morocco, Jordan, Algeria, Libya, Spain, Egypt, Tunisia, and Italy, are home to this leafless wild succulent plant (Amrati *et al.*, 2021).

• *C. attenuate* (Wight) is a fleshy, perennial herb that grows erect. It grows to a height of one to three feet. Roots are fibrous (Kiranmayee Pamidimukkala, 2015). It possess the antihyperglycemic activity thus can be used against diabetes (Kumar *et al.*, 2013).

• *C. edulis* is a succulent type herb, often known as chunga, Settu or Pippu in Pakistan. It grows 15-45 cm long (Gillani *et al.*, 2024). It possess the anti-nociceptive, anti-obesity,anti-inflammatory properties (Minhas *et al.*, 2018; Sundas Firdoos *et al.*, 2017).

• *C. stalagmifera*, commonly known as dark purple *Caralluma*. The flowers are small, star shaped, dark purple with purplish yellow end. The leaves are small, narrow and triangular or tooth-like, stalk-less. The inflorescence is axillary and typically has one flower, but can occasionally have two. Flowers are bisexual, having fleshy corollas that are wheel shaped. It possesses anti-inflammatory activity (Jesudass *et al.*, 2025; Veerabhadraiah *et al.*, 2024).

• *C. umbellata* is found in the desert parts of Chittoor District in Andhra Pradesh, India. It is thick, erect, leafless, branched and succulent perennial herb (Babu *et al.*, 2013). It possess anti-inflammatory, anti-bacterial, antifungal and hepatoprotective properties thus is considered as natural pharmacy (Ahmad *et al.*, 2014; Bellamakondi *et al.*, 2017).

• *C. penicillata* is a succulent shrub with erect stems that bend downwards as they age. It can reach height of 1.3-2 m and spreads 0.6-1 m. The stems are 20-60 mm thick and branch randomly, with a succulent texture. The small flowers are densely grouped in umbels of 30-50, originally terminal but laterally displaced by fresh stem growth. It possess antimicrobial and antioxidant activity (Albaser, 2024).

• *C. dolichocarpa* is a succulent plant. Its flower is about 2 cm in diameter with five broadly ovate, acute lobes (Thulin and Al-Hawshabi, 2022). No data is found on its medicinal properties yet.

• *C. flava* is a perennial shrub commonly found on hillside and wadis in the UAE. Here it is both used for food and traditional medicines. It possess the anti-ulcer and antioxidant properties thus used to combat different diseases related to it (Al-Naqeb, 2017; Karthishwaran *et al.*, 2018).

• *C. cicatricosa,* often known as the milkweed family because to its milky latex. *C. cicatricosa* is an angular and succulent plant that grows naturally in the Arabian and western Peninsula. In Yemen, it is found in Manakha, Taiz, Milhan, Maaber and mountainous areas. It possess hepato-protective properties (Al-Mehdar *et al.*, 2015).

• *C. tuberculata* is succulent, erect, leafless and tiny herb that ranges in height from 45cm to 1m. Angular stem is leafless and contains tiny flowers. Stem is angular, succulent and is about 15 cm tall. The notches has soft spines.. Branches are 8 to 13 mm broad. The fruit has a smooth, pointed apex and is long, slender, and upright. Flowers are dark brown, black, maroon and yellow in color (Ali *et al.*, 2022; Mudrikah *et al.*, 2021). *C. tuberculata* has high fiber content which is crucial for lowering cholesterol but contains low fats and energy (Khan *et al.*, 2019).

C. fimbriata is an edible plant that possess cactus like leaves and succulent shrub (Vyshali *et al.*, 2023). The plant has an upright, branching, 20–30 cm height, and a green stem with four angles that is tapered to the tips but lacks leaves. The stems are small and are roughly of equal thickness, not always attenuate, occasionally reddish distally, with rounded angles. It has tiny leaves that emerge only on young branches and fall off rapidly. Thus stem shows the spiky projection. Flowers rather small about 2cm in diameter, more or less pendulous, hairy , having tiny purple petals with golden and hairy edges, they can bloom alone or in clusters at the tips of branches on small stalks. *C.*

fimbriata have restricted flowering seasons. The flowers bloom freely during the heavy rains and sparingly in the hot weather (Anwar *et al.*, 2022; Gravely and Mayuranathan, 1931). For the purpose of controlling body weight, *C. fimbriata* extract has been made available as capsules under the brand name GENASLIM (Sreelatha *et al.*, 2009).

Phytochemical Constituents

Medicinal plants are used widely as they are less expensive than synthetic medicine and they contain no side effects, very effective and easily available. For above reasons in Africa, Asia, and Southern America Medicinal plants are utilized extensively (Awuchi, 2019). Plants synthesize a large number of organic chemicals for their defense purpose, for attracting pollinators etc. These compounds are not essential for plant growth and are classified as secondary metabolites or phytochemicals. Plants possess medicinal properties due to these secondary metabolites or phytochemicals. These phytochemicals are limited to certain taxa and are produced during specific time period of their growth (Tiwari and Rana, 2015).

The medicinal importance of *Caralluma* genus lies in its chemical constituents. The various uses of *Caralluma* plants in traditional medicine have led to the phytochemical and biological analyses of their components. Saponins, Pregnane glycosides, triterpenes, megastigmane glycosides and flavone glycosides are the main phytochemical components of *Caralluma* (Al-Mahweety *et al.*, 2020). The presence of pregnane glycoside makes *Caralluma* species to be used as an anticancer and antitumor drugs(Mahmood *et al.*, 2010). Comprehensive biochemical analyses led to the identification and purification of the diverse range of the phytochemical constituents from different parts of the *Caralluma* genus as listed below in Table 1.

Table 1. Chemical Constituents of Different Extracts of *Caralluma* spp.

Extract types and solvents Used	Plant parts	Region	Chemical Constituents Reported	Reference
Dry and wet extract (Petroleum ether, EtOH, and aqueous)	Whole plant of *C. fimbriata*	Chitradurga district, India	alkaloids, tannins, flavonoids, and phenols	(Vyshali *et al.*, 2023)
Aqueous	Bark of plant *C. fimbriata*	Sangamner tehsil, India	Alkaloids, Steroid, Saponins, Caumarin, Protein, flavonoids, Carbohydrates, phytosterols and Diterpenes	(Padwal *et al.*, 2016)
Aqueous	Leaves of plant *C. fimbriata*	kovilpatti, Tiruchirappalli district, Tamilnadu , India.	Gums and mucilage, Alkaloids , amino acids, Flavonoids , proteins, Carbohydrates ,phenolic compounds, Glycosides ,tannins, Saponins , Sterols ,Oils and fats	(Packialakshmi and Naziya, 2014)
Aqueous, EtOAC, EtOH & MtOH	Whole plants of *C. fimbriata*	Medicinal garden, J.J College of Arts and Science, Pudukkottai, Tamil Nadu, India	Alkaloids, Glycosides , Flavonoids , Saponins , Phenolic Compounds ,Quinone	(Priya *et al.*, 2011)
EtOAC extract and MEtOH extract	Whole plant (stem, leaves and roots) of *C. fimbriata*	Tamilnadu, India.	cardiac glycoside flavonoid, saponins, tannins and terpenoid (in both the extracts) alkaloids only in EtOAC extract	(Devi and Dhamotharan, 2016)

EtOH-water extract	Aerial parts of *C. fimbriata*	Parma, Italy	Slimaluma, pregnane glycosides (at least 25 % by weight)	(EFSA Panel on Dietetic Products and Allergies, 2010)
Dried extract	Whole plants of *C. edulis*	Pakistan	Alkaloids, flavonoids, glycosides, phenol, saponins, tannins and terpenoids.	(Sundas Firdoos *et al.*, 2017)
EtOH extract	Whole plants of *C. attenuata*	Ghatkesar, Andhra Pradesh, India	Tannins, triterpenoids, steroids, carbohydrates, flavonoids, resins,	(Kumar *et al.*, 2013)
EtOH extract	Aerial parts of *C. europaea*	Ourika-Valley, High Atlas of Morocco	tannins, flavonoïds, terpenes and steroids	(Dra *et al.*, 2019)
Dried extract (Petroleum ether, EtOAC, Chloroform, MEtOH.)	Whole plants of *C. stalagmifera*	Medikonda village from Jogulamba Gadwal District,India	Alkaloids, flavonoids, saponins, steroids, phenols, tannins and glycosides	(Veerabhadraiah *et al.*, 2024)
Dried	Stems of *C. edulis*	Cholistan desert of Bahawalpur, Pakistan.	Glycosides, alkaloids, terpenoids saponins, phenols quinones, flavonoids, carbohydrates, terpenes and , tannins	(Akram *et al.*, 2023)
EtOH	Stems of *C. indica*	Kathattipatti (Palaiyapatti North) Thanjavur, Tamil Nadu, India	1-Octadecanol, 1,2 Benzenedicarboxylic acid, 3-Octadecene, diethyl ester (CAS) Ethyl phthalate, diethyl ester (CAS) di-n-Hexyl phthalate,	(Gnanashree and Sirajudeen, 2018)
Aqueous	Aerial part of *C. dalzielii*	Tureta, Sokoto State, Nigeria	Phenols, flavonoids, cardiac glycosides tannins, glycosides saponins, steroids and carbohydrates	(Ugwah-Oguejiofor *et al.*, 2023)
80 % aqueous-MtOH	aerial part of *C. quadrangula*	Northwestern region of Saudi Arabia around the city of Tabuk.	tannins, saponins, phenols, alkaloids, flavonoids,	(Bhat *et al.*, 2019)
Exudate gel	Stem of *C. retrospiciens*	Rijal-Almaa region, Asir province, SaudiArabia	Sorbic acid Rhodopsin 1-Heptatriacotano, arbohydrates, alkaloids, flavonoids, tannins, steroids,andsaponinsl	(Makeen *et al.*, 2020)
Dried (MtOH, hydro-MtOH) and aqueous	Whole plant of *C. umbellate*	Tirupati, Andhra Pradesh, India	Saponins, carbohydrates, flavonoids,sterols, glycosides, phenols and triterpenoids	(Bellamakondi *et al.*, 2017)
Dried (EtOH, MtOH, water and EtOAC)	Aerial parts of *C. bhupenderiana*	Vallnadu, Tamil Nadu, India	Saponins, phlobatannins, flavonoids, phytosteroids, carbohydrates, terpenoids, tannins, cardiac glycosides, alkaloids, quinones, phenols, alkaloids,	(Pachipala *et al.*, 2022)
Hydro-alocholic	Aerial parts of *C. europaea*	Middle Atlas Mountains, Imouzzer, Morocco	holosides,flavonoids, coumarins, catechic tannins, mucilages triterpene saponins and oses (alkaloids and quinones were not present)	(Amrati *et al.*, 2020)
Dried (chloroform, *n*-hexane, mEtOH, EtOAC)	Whole plant of *C. tuberculata*	mountain area of Mago, Razagram, Toormang, Dir, Khyber Pakhtun khwa Pakistan	amino acid, steroids, reducing sugars, terpenoids, beta cyanin and tannins	(Rauf *et al.*, 2013)
Dried (*n*-Hexane, Chloroform, and	Stems of *C. quadrangula*	Sana'a, Yemen	Stigmasterol, Glochidonol and 3,14 dihydroxy-14-pregn-5-en-20-one	(Al-Mahweety *et al.*, 2020)

EtOH)				
Dried extract (*n*-Hexane, Chloroform, and MtOH)	Stems and roots of *C. lasiantha*	Gooty, District Anantapur, India	stigmasterol, an Active Immunomodulatory Agent	(Sireesha Malladi *et al.*, 2017)

Medicinal Importance

Caralluma genus is used for the treatment of many diseases as in the treatment of Cancers, Tumor, Gastric Ulcers, Rheumatism, Diabetes, Leprosy, Antiseptics and Disinfectants etc. Its phytochemical constituent as in *C. fimbriata* often act individually, additively or synergistically in improvement of health, these constituents are found in different parts of the plant (Mahmood *et al.*, 2010; Packialakshmi and Naziya, 2014). The *Caralluma* flowers can be used topically for cuts and wounds, and the juice from the stem is administered to ill patients to hasten the healing process for burns, skin irritations, and sunburns (Al-Mahweety *et al.*, 2020). The medicinal importance of *Caralluma* species is explained in Table 2.

Appetite Suppressent Activity to Treat Obesity

C. fimbriata extract can reduce the body weight and lipid profile level by the administration of extract at a dose of 100 mg/kg/day. *Caralluma* extract blocks the synthesis of the two enzymes Malonyl co-enzyme A and Acetyl co-enzyme A which are involved in the synthesis of fats. *C. fimbriata* comprises of megastigmane glycosides, flavone, pregnane glycoside and various esters. Their pregnane glycosides constituent possess the appetite suppressing properties. Experiments showed that the administration of extract for 60 days decreases the food intake, body weight, hip circumference, body fat and body mass index. It suppresses the synthesis of neuropeptide-Y in the hypothalamus and ghrelin in the stomach thus helps to reduce obesity (Pawade and Shinde, 2018).

C. fimbriata is regarded safe to use because it contains natural constituents. However some mild side effects may occur including gastritis, constipation, abdominal distention and flatulence. All these symptoms end up within a week (Anwar *et al.*, 2022). In clinical experiment mEtOH extract from the *C. fimbriata* at a dose 500mg twice a day for three months was administered to Diabetic patients and the result showed a significant increase in blood leptin level. Before performing the clinical trials the acute and sub-acute toxicity was assessed using animal models Mice and the drug was found safe for clinical study. It showed that *C. fimbriata* extract (CFE) can be used in the treatment of obesity and its associated symptoms (Riazurrehman *et al.*, 2020). Non-protein coding small nucleolar (sno) RNAs cause the deletion of paternally region of chromosome 15q11.2 q13, which is the reason of the hyperphagic phenotype of Prader–Willi syndrome (PWS). From 6 weeks of age the strains (Snord116del (SNO) and wild-type mice) received a daily treatment (dose per weight) of standardized CFE powdered extract. After 9 weeks chronic CFE treatment (33 mg or 100 mg kg−1 day−1) , the 14-week-old Snord116del (SNO) and wild-type mice (n = 72) were alternated through intra-peritoneal injections of (a) isotonic saline; (b) 400 mg/kg of 2 deoxyglucose (glucose deprivation); (c) 100 mg kg beta-mercaptoacetate (MA), fatty acid signaling; and (d) SB242084 (a selective 5HT2cR antagonist), with five days gap between each treatment. The result shows that with CFE the food intake decreases but stimulated during co-administration with SB242084. Thus in short it explains the role of 5-HT2cR in CFE-induced appetite suppression noteworthy disturbances in

stimulatory feeding in the model of snord116del mice (Griggs *et al.*, 2018).

Nowadays, obesity possesses serious threat to global health, society, and economy. The experiment was performed on 83 men and women, aged between 20 -50 years. Daily supplementation of a *C. fimbriata* extract (CFE) or placebo was given for 16 weeks. Gastrointenstinal functions, Plasma cardiometabolic (insulin, glucose, lipid profile) and satiety (neuropeptideY, leptin, ghrelin) biomarkers, diet history and body composition were assessed after 4, 8, 12 and 16 weeks at baseline. The result showed that the leptin and ghrelin concentration in (CFE) group remains constant, but leptin level increased in placebo group. However there was a reduction in calorie intake and waist circumference in (CFE) group. Thus *C. fimbriata* extract (CFE) can be used to reduce weight. CFE showed mild side effects such as minor gastrointestinal symptoms (loose stools, bloating in only 4 participants) and rashes (Rao *et al.*, 2021). In the experiment the oral administration of aqueous extract obtained from aerial parts of *C. dalzielii* to mice and rats resulted in reduction of body weight and appetite suppression. Hence it may be used as an anti-obesity drug. The aerial parts of *C. dalzielii* were collected from North-west Nigeria. It is safe to use however long term used may affect the liver and cause mild liver toxicity (Sreelatha *et al.*, 2009).

Table 2. Medicinal Importance of *Caralluma* spp.

Type of extract	Part of plant	Material and method	Medicinal Importance	Reference
Alcoholic extract	Aerial part of *C. fimbriata*	Body weight, serum lipid and hormonal (leptin) profiles, fat pads, and liver weight were analyzed in Diet-Induced Obesity (DIO) rats. Anti-atherosclerotic effects were measured by histology	Possess antiobesogenic and anti-atherosclerotic properties.	(Kamalakkannan *et al.*, 2010)
aqueous fraction of MtOH	Aerial part of *C. fimbriata*	MTT Assay for Cell Viability, Immuno-fluorescent Assays for Cyclin D1, Indirect Immuno-fluorescent Assay	Possess anti-adipogenic property in the mouse-derived 3T3-L1 pre-adipocyte cell line	(Kamalakkannan *et al.*, 2011)
Dry	Aerial parts of *C. fimbriata*	Daily supplementation to overweight adults aged between 20 to 50 years	Can help to reduce weight	(Rao *et al.*, 2021)
MtOH	Whole plant of *C. fimbriata*	Oral administration of daily dose for three months and ELISA assay on blood serum	Can be used in the treatment of obesity	(Riazurrehman *et al.*, 2020)
Dried	Whole plant of *C. edulis*	varying doses of the plant extract in Hyperlipidemia induced mice for 2 weeks	Shows anti-hyper-lipidemic effect	(Ashfaq *et al.*, 2017)
Dried	Aerial parts of *C. arabica*	Oral administration of extract at the doses of 200 and 400mg/kg in gastric ulcer models induced by phenylbutazone	Shows Anti-gastric Ulcer and Cytoprotective Properties	(Zakaria *et al.*, 2002)
EtOH	Aerial part of *C. europaea*	Oral administration of extract at a dose of 250 mg/kg and 500 mg/kg body weight	anti-hyperglycemic activity	(Dra *et al.*, 2019)

Dried (MtOH)	Whole plants of *C. quadrangula*	Oral administration of *C. quadrangula* extract of 50,100,200 mg/kg dose in STZ-induced diabetic rats	anti-hyperglycemic activity	(Abdel-Sattar *et al.*, 2017)
EtOH	whole plants of *C. attenuata*	Oral administration of *C. attenuata* extract at dose 100 and 250 mg/kg	Anti-hyperglycemic activity	(Kumar *et al.*, 2013)
EtOH	Leaves of *C. fimbriata*	α-amylase and α-glucosidase inhibitory assay with acarbose as control	Anti-hyperglycemic activity.	(Shenai Ashwini and Roy Anitha, 2017)
MtOH	Whole plant of *C. fimbriata*	Oral administration of plant extract on streptatozocin induced diabetic albino rats for different time periods up to 21 days	Hepato-protective and anti-diabetic effect on streptatozocin induced diabetic albino rats	(Latha *et al.*, 2014)
Dried	Whole plant of *C. tuberculata*	Administration of extract of dose 100 and 200 mg/kg body weight in alloxan-induced diabetic mice	Show significant anti-diabetic effectiveness	(Batool *et al.*, 2024)
Dried	Aerial parts of *C. fimbriata*	Daily administration for 14 days to Male albino mice (18 - 22 g)	Possess significant nootropic and anxiolytic activity in mice	(Rajendran *et al.*, 2014)
Dried	Whole plant of *C. pauciflora* & *C. gracilis*	In vitro study of inhibitory effect on α-glucosidase, α-amylase and pancreatic lipase	Used as Anti-diabetic drugs	(Mopuri *et al.*, 2022)
EtOH	Leaves of *C. fimbriata*	α amylase and α glycosidase inhibit or assay with acarbose as control	Anti-hyperglycemic activity	(Shenai Ashwini and Roy Anitha, 2017)
Dried	Aerial part of *C. umbellata*	α amylase and pancreatic lipase inhibition	Possess antidiabetic property	(Bellamakondi *et al.*, 2014)
MtOH, chloroform, EtOAC, *n*-hexane and aqueous	*C. fimbriata*	MTT assay on MCF-7 cell lines	chloroform and aqueous extracts possess very potent anticancer activity against MCF-7 cell lines	(ABBAS *et al.*, 2023)
EtOAC and MEtOH	Whole plant (stem, leaves and roots) of *C. fimbriata*	(FRAP) Assay , FRAP Assay, FTC method, and The ABTS scavenging assay	Used as antioxidant and anticancer drugs	(Devi and Dhamotharan, 2016)
MtOH	Whole plant of *C. fimbriata*	Cytotoxicity Assay on L6 muscle cell line, Anticancer assay on A-549 Lung cancer cell line (MTT Assay)	Possess anticancer properties against A549 lung cancer cell line. lesser toxicity on L6 muscle cell line	(Dhayalan *et al.*, 2014)
EtOH extract	Leaves of *C. fimbriata*	MTT assay on The COLO 320 cells	Cytotoxic Effect of *C. fimbriata* against Human Colon Cancer Cells	(Ashwini *et al.*, 2017)
Dried	aerial part of	MTT assay on MCF-7 human breast	Possess anticancer	(Khasawneh *et al.*,

	C. arabica	cancer cell line	activity	2014)
aqueous	Stems of *C. fimbriata*	proliferation assay using MTT on bone marrow cells and ELISA assay using standard lactoferrin capsule and OVA	anti-inflammatory and immunosuppressive agent	(Gupta and Shinde, 2016)
EtOH	Bark of *C. fimbriata*	RNA Isolation and q - PCR Analysis of Raw 264 macrophage cell lines	anti-inflammatory activity is shown by the extract	(Krishnaa *et al.*, 2018)
MtOH	whole plant part of *C. sarkariae*	carrageenan induced paw oedema method	Possess anti-inflammatory activity	(Danya, 2017)
10% EtOH	Aerial parts of *C. penicillata*	Fresh egg albumin paw oedema Cotton pellet implantation	Anti-inflammatory and gastric protection	(Albaser, 2024)
Dried	aerial part of *C. arabica*	FRAP Assay, ABTS Assay, DPPH Assay and ß-Carotene Bleaching Assay	Shows antioxidant property	(Khasawneh *et al.*, 2014)
Dried	Stems of *C. tuberculata*	Free radical scavenging activity of extracts by FRAP, ABTS and DPPH assays	Possess antioxidant activity	(Noreen S, 2018)
EtOH	Stems of *C. indica*	total antioxidant assay, iron reducing power activity and nitric oxide scavenging activity	Shows good antioxidant activity	(Vadivu and Velavan, 2018)
Aquoes MtOH	roots & stems of *C. umbellata*	*In Vitro* antioxidant assay	Possess antioxidant activity	(Jyoti *et al.*, 2015)
DCM, MtOH & water	Fruits of *C. penicillata*	Modified agar diffusion method, DPPH assay on FL-cell line	Possess antimicrobial and antioxidant activity	(Albaser, 2024)
80 % aqueous-MtOH	aerial part of *C. quadrangula*	scavenging of DPPH radicals and ABTS radicals and Anti-hemolytic assay	Possess antioxidant activity can be used in treatment of cancer and blood diseases	(Ouassou *et al.*, 2021)
Dreid	Whole plant of *C. pauciflora*	MTT assay on AGS cancer cell lines by silver nanoparticles	Used to treat gastric cancer	(Navaneethan *et al.*, 2024)
Aqueous	Stem of *C. subulata*	methylene blue (MB) dye degradation and antibacterial activity tests by silver nanoparticles	Possess antibacterial and antifungal activity	(Alamier *et al.*, 2023)
Dried	Stems of *C. edulis*	Administration of *C. edulis* extract at different doses of 100, 300 and 500 mg/Kg	Shows anti-obesity, antihypertensive, anti-atherosclerotic and antioxidant potential.	(Akram *et al.*, 2023)
aqueous	aerial parts of *C. dalzielii*	Administration of *C. dalzielii* extract at varying dosage ranging from 250, 500 and 1000 mg/kg p.o in max electroshock (MES) model chicks, and induced seizures mice (caused by strychnine (STN) and pentylenetetrazole)	possesses anticonvulsant activity can be used to treat epilepsy and convulsions	(Ugwah-Oguejiofor *et al.*, 2023)

MtOH EtOAC DCM *n*-hexane	Whole plant *C. edulis*	Antibacterial assay, Antivrial assay, Antipyretic assay, Antidiabetic and Anti-inflammatory assays, HPLC PDA analysis	Different extracts have different pharamacological activities. *C. edulis* is a rich source of pharmacological agents.	(Sundas Firdoos *et al.*, 2017)
Dried	Whole plant of *C. edulis*	Administration of *C.edulis* extract at dose 10, 30 and 100 mg/kg after acetic acid induced writhing and before hot plate test, tail immersion test.	Anti-nociceptive Effect on Peripheral and Central Pain Pathways	(Sundas Firdoos *et al.*, 2017)
Dried	Mature plants of *C. tuberculata*	*In Vitro* assay against fungus and Antibacterial susceptibility assay:	Possess antibacterial and antifungal activity	(Ahmad *et al.*, 2014)
Dried	Stems and roots of *C. umbellata*	Antibacterial susceptibility assay	Used as antibacterial drugs	(Babu *et al.*, 2013)
MEtOH Hot aqueous	Leaves of *C. penicillata*	*In Vitro* Antibacterial susceptibility assay	Possess antibacterial, antioxidant properties	(Albaser, 2024)
aqueous extract	Stem of *C. europaea*	daily administration of extract at the doses of 250mg/kg body weight for 14 days in on CCL4 induced hepatic damage in Wistar rats	Shows hepatoprotective effect in rats	(Ouassou *et al.*, 2021)
exudate gel	Stem of *C. retrospiciens*	*In vitro* Antibacterial susceptibility assay	Shows antibacterial activity	(Makeen *et al.*, 2020)
Dried extract(chloroform, acetone, and EtOAC)	Whole parts of *C. deflersiana*	bipyridine-ferric reducing antioxidant capacity assay, as well as the antibacterial activity using the agar diffusion method	Possess antioxidant and antimicrobial activity	(Almaqtari and Mubarak, 2024)
MtOH	Leaves of *C. flava*	oral administration of extract to EtOH induced gastric ulcer rats in a dosage of 3g/kg for 2 weeks	Possess the antiulcer property	(Al-Naqeb, 2017)
Aqueous	Aerial parts of *C. dalzielii*	oral administration of extract at dose 100, 200 and 400 mg/kg in in Wistar rats	Shows antidiarrheal and antioxidant activity	(Ugwah-Oguejiofor *et al.*, 2022)
Dried extract	Whole plant of *C. edulis*	administration of extract at varying dosage ranges upto 1000 mg/kg against carrageenan-induced hind paw edema	anti-inflammatory activity	(Minhas *et al.*, 2018)
Dried (mEtOH, hydro-mEtOH) and aqueous	Whole plant of *C. umbellata*	DPPH, cell based hepatoprotective study using BRL3A cells, ABTS, nitric oxide, and lipid peroxidation models	possess hepatoprotective activity	(Bellamakondi *et al.*, 2017)

Dried (EtOH, MtOH, water, EtOAC)	Aerial parts of *C. bhupenderiana*	Free radical scavenging activity employing DPPH	Shows antioxidant and DNA damaging inhibitory activity	(Pachipala *et al.*, 2022)
aqueous	Aerial parts of *C. dalzielii*	Oral administration of extract at dose 100, 200 and 400 mg/kg in female Wistar rats	Useful in the treatment of infertility and support traditional use	(Ugwah-Oguejiofor *et al.*, 2020)
flower concentrate (FC) gel	flowers of *C. retrospiciens*	Antibacterial susceptibility assay through Agar well diffusion technique	Shows antibacterial activity	(Alqahtani *et al.*, 2020)
MtOH	Whole aerial part of *C. retrospiciens*	MTT assay against human breast adenocarcinoma cell line (MCF-7)	Used in the treatment of breast cancer as possess methyl b-lilacinobioside	(Alallah *et al.*, 2018)
Hydro-ethanol	Aerial parts of *C. europaea*	FRAP and DPPH Assay, Antiproliferative Activity against human breast cancer cell lines, MDA-MB-231 and MCF-7	Show antioxidant and antiproliferative activities.	(Amrati *et al.*, 2020)
Aqueous (MtOH, EtOH, and EtOAC)	Aerial parts of *C. deflersiana*	MIC, ABTS,FRAP and DPPH radical scavenging assay,	Possess specific antioxidant and antimicrobial components	(BinMowyna and Alsayadi, 2020)
Aqueous	Stems of *C. russeliana*	Administration of Caralluma russeliana stem extract in induced diabetic male Wistar rats (caused by streptozotocin)	Can be used in the treatment of diabetes	(Zari and Al-Thebaiti, 2018)
EtOH	Whole plant of *C. flava*	*In Vitro* hydroxyl radical and nitric oxide radical scavenging assays, ABTS, DPPH assays	Shows antioxidant and free-radical-scavenging activity	(Karthishwaran *et al.*, 2018)
Dried (*n*-hexane, EtOAC, MtOH, chloroform)	Whole plant of *C. tuberculata*	DPPH radical scavenging assay and Phytotoxicity assay	MtOH extract Shows significant antioxidant and phytotoxic property than others	(Rauf *et al.*, 2013)
10% EtOH	aerial parts of *C. penicillata*	Administration of *C. penicillata* extract in Adult male guineas pigs	possesses anti-inflammatory and antiulcerogenic properties	(Albaser *et al.*, 2014)
Dried extract (*n*-hexane, chloro form, and MtOH)	Roots and stems of *C. lasiantha*	In vitro screening of antibacterial activity by agar well diffusion method	Possess antibacterial activity	(Malladi *et al.*, 2017b)
MtOH	Stem of *C. cicatricose*	Oral Administration of *C. cicatricose* extract (0.5, 1 and 1.5 g/kg b.w.) in carbon tetrachloride-induced liver damaged rabbits	Possess natural hepatoprotective agent	(Al-Mehdar *et al.*, 2015)
pregnane glycoside arabincoside B (AR-B) in	aerial parts of *C. arabica*	Histopathological evaluation, SOD, NO, and MDA tests ,evaluation of Gene expression of VEGF and Caspase-3	Enhanced wound healing process	(Ali *et al.*, 2024b)

EtOH				
Dried (Hexane, MtOH, DCM, EtOAC MtOH-aqueous	Stems of *C. europaea*	α-Glucosidase Inhibition Assay, administration of extract in Streptozotocin Induced diabetic Swiss albino mice and Wister rats	Possess significant anti-hyperglycemic activity	(Ouassou *et al.*, 2018)
Dried	whole plant of *C. umbellata*	Evaluation of extract's (pregnane glycoside Carumbelloside-III) anti-inflammatory activity by Egg white-induced rat paw oedema test in albino rats	Possess anti-inflammatory activity	(Ramanjaneyulu *et al.*, 2016)
95% EtOH	The aerial parts of *C. arabica*	Evaluation of extract's (Arabincoside B) anti-apoptotic effect in the lipopolysaccharide (LPS) mice model	Can be used to alleviate Acute lung injury in its early stage, act as anti-pneumonitis	(El-Shiekh *et al.*, 2023)

Controversial Results

Seven interventional trials on *C. fimbriata* supplementation for weight loss or appetite regulation were included in this analysis and showed mild to moderate adverse effects. Such studies reported that neither metabolic nor appetite parameters improved with supplementation of CFE. Thus it is doubtful whether *C. fimbriata* should be taken as a weight reduction supplement or as an appetite suppressant (Jayawardena *et al.*, 2021).

However, a scientific opinion was given that there was no enough evidence that showed the cause and effect relationship between consuming *C. fimbriata* EtOH water extract and decrease in waist circumference, which in turn improved the negative health effects linked to an excess of abdominal fat (EFSA Panel on Dietetic Products and Allergies, 2010).

Antihyperglycemic Activity

The MtOH extract obtained from the aerial parts of *C. europaea* possess anti-hyperglycemic activity. The MtOH extract inhibited the diabetogenic effect in mice treated with alloxan, it also decreased blood glucose level and protected the islets of langerhans against alloxan (Dra *et al.*, 2019). *C. attenuata* contains a flavonoidal glycoside, luteolin-4'-O neohesperidoside which possesses the anti-inflammatory activity. Research showed that it also possesses the anti-hyperglycemic activity (Kiranmayee Pamidimukkala, 2015).

C. edulis MtOH extract contains highest terpenoids, flavonoid, alkaloids and phenolic contents. In the sub-acute diabetic animal model (Sundas Firdoos *et al.*, 2017), *Caralluma* extract demonstrated anti-diabetic activity at dose of about 200 mg/kg, but no substantial anti-diabetic impact was seen in the acute diabetic model (Khan *et al.*, 2022). The experiment showed that the aqueous extract from stems of *C. russeliana* in streptozotocin induced diabetic male Wistar rats resulted in decrease in hyperglycemia (Zari and Al-Thebaiti, 2018). The Administration of dried extract from Whole plant of *C. tuberculata* at a dose of 100 and 200 mg/kg body weight in diabetic mice (caused by alloxan) shows significant anti-diabetic effectiveness (Batool *et al.*, 2024). Oral administration of MtOH extract from whole plant of *C. fimbriata* plant on

streptatozocin induced diabetic albino rats for different time periods up to 21 days reported hepato-protective and anti-diabetic effects (Latha *et al.*, 2014).

Enzyme Inhibitory Activity

The EtOH extract of leaves of *C. fimbriata* at various doses ranging from 1–1000 g/mL were analyzed to check α-amylase and α-glucosidase inhibitory effect using acarbose as control. The results showed the max α-amylase inhibitory effect at 1000 g/mL dose with an IC_{50} value of 41.75 g/mL was 77.37% ± 3.23% and α-glucosidase inhibitory effect at 1000 g/mL with an IC_{50} value of 66.71 g/mL was 83.05% ± 1.69%. This research work confirmed the anti-hyperglycemic activity of EtOH extract of *C. fimbriata* leaves (Shenai Ashwini and Roy Anitha, 2017). The diethyl fraction of dried extracts of *C. pauciflora* and *C. gracilis* possessed the antidiabetic properties as they inhibited the key enzymes (α -glucosidase, α-amylase and pancreatic lipase) of diabetes type 2. Thus these two plants can be useful in the treatment of diabetes (Mopuri *et al.*, 2022). Dried extract from stems of *C. europaea* possessed significant anti-hyperglycemic activity. The administration of extract inhibited the α-glucosidase in Streptozotocin Induced diabetic Swiss albino mice and Wister rats (Sireesha Malladi *et al.*, 2017). Dried extract from aerial parts of *C. umbellata* inhibited the α amylase and pancreatic lipase production, thus showing antidiabetic property (Bellamakondi *et al.*, 2014).

Anti-Cancer Activity

Research showed that MtOH extract of *C. fimbriata* possesses anticancer activity against lung cancer cell line A-549. This *in vitro* assay reported the effects of *C. fimbriata* on cell viability, growth inhibition and cell morphology. The result reported that MtOH extract up to 100µg/ml had less toxicity and thus the doses for anti-proliferative activity were set at that range. The anti-proliferative activity showed decrease in cell viability and increase in growth inhibition using cytotoxicity assay and MTT assay (Dhayalan *et al.*, 2014). The most widespread cancer in females is breast cancer and it is an invasive form of cancer in developing countries. Out of aqueous, MtOH, chloroform, *n*-hexane and EtOAC extracts of *C. fimbriata*, only chloroform and aqueous extracts exerted potent anticancer activity against MCF-7 cell lines (ABBAS *et al.*, 2023).

Colon cancer is a clinically common and highly malignant tumor of the digestive tract of humans. It is one of the leading global causes of death in male and female by cancer. The EtOH extract of *C. fimbriata* leaves showed good anti-proliferative activity against COLO 320 cells. The extract showed an inhibitory concentration (IC_{50}) of 233.87 µg (Ashwini *et al.*, 2017). The presence of methyl b-lilacinobioside in chloroform extract from aerial parts of *C.retrospiciens* against human breast adenocarcinoma cell line (MCF-7) by MTT assay reported highest toxicity (IC_{50} of 175µg/ml). So, it can be used to treat breast cancer (Alallah *et al.*, 2018). Another study conducted by MTT assay using EtOAC extract from aerial parts of *C. arabica* showed the strongest cytotoxic effect (IC_{50} = 87.55 µg/mL) against MCF-7 breast cancer cell line (Khasawneh *et al.*, 2014).

Immuno-Suppressant and Anti-Inflammatory Activity

Aqueous extract from the stem of the *C. fimbriata* possesses anti-inflammatory and immunosuppressive activity. The same experiment measured the *in vitro* production of B cells using ELISA against specific protein antigens (lactoferrin and Ovalbumin, OVA) and also determined the *in vitro* synthesis of T cells using immature bone marrow cells of mice treated with Concanavalin and incomplete freunds adjuvant (IFA). The results showed the protein concentration of about 10 µl, 0.698 mg/ml and also showed the increase in overall cellular (protein) content with or without IFA but at high dose of CFE there was a dramatic decline in the bone marrow cell production. Thus it was shown that *C. fimbriata* enhances the B cells response and suppresses T cell responses,

so can be used as immunosuppressant (Gupta and Shinde, 2016).

The dried extract of *C. lasiantha* also possesses active immune-modulatory activity (Malladi *et al.*, 2017a). The EtOH extract from the bark of *C. fimbriata* possess the anti-inflammatory activity. Inflammation is characterized by restricted rise in the quantity of white blood cells as well as a number of intricate mediating factors. Prostaglandins are ubiquitous molecules that signal and regulate inflammation-related responses of cells and tissues. In colonic adenomas, cardiovascular diseases, Alzheimer's disease and cancer their biosynthesis was reported. However in that experiment anti-inflammatory effect of CFE was examined on RAW 264 Macrophage cell lines. Nitrous oxide (NO) is a chemical that is known to contribute in inflammation. Additionally, the iNOS gene expression was also investigated in this study. The result showed that the level of NO is lowered by increasing the concentration of CFE in RAW 264 Macrophage cell lines (Krishnaa *et al.*, 2018).

The MtOH extract from whole plant of *C. sarkariae* at the dose of 150mg/kg by weight reported anti-inflammatory effect in the research conducted by carrageenan induced paw oedema method (Danya, 2017). The dried extract from whole plant of *C. edulis* at different doses as 100, 300 and 1000 mg/kg by weight against carrageenan-induced hind paw edema showed anti-inflammatory activity (Minhas *et al.*, 2018). Dried extract from whole plant of *C. umbellate* due to presence of pregnane glycoside Carumbelloside-III shows anti-inflammatory activity in albino rats by rat paw oedema test caused by Egg white (Ramanjaneyulu *et al.*, 2016).

Antioxidant Activity

Extracts of *C. fimbriata* can be used as antioxidant and anticancer drugs. The experiment was conducted through FRAP Assay, TRAP Assay, FTC method and ABTS scavenging assay. The results showed that the EtOAC extract and MtOH extract possess antioxidant and anticancer properties (Devi and Dhamotharan, 2016). The dried extract from stems of *C. tuberculata* by free radical scavenging activity of extracts by FRAP, DPPH and ABTS assays showed antioxidant activity (Noreen S, 2018). The EtOH extract from stems of *C. indica* also showed antioxidant through NO scavenging activity, antioxidant assay and iron reducing power activity (Vadivu and Velavan, 2018). *In vitro* study of aqueous MtOH extract from roots & stems of *C. umbellata* also showed antioxidant activity (Jyoti *et al.*, 2015).

Extract obtained from the fruits of *C. penicillata* showed antioxidant activity by modified agar diffusion method and DPPH assay on FL cell line (Albaser, 2024). In the other research work dried extract from whole parts of *C. deflersiana* by bipyridine-ferric reducing antioxidant capacity assay reported that EtOAC extract exhibited the highest total antioxidant activity of 370µg Ascorbic equivalent ASA/mg($p<0.05$) (Almaqtari and Mubarak, 2024). Oral administration of extract from aerial parts of *C. dalzielii* at dose 100, 200 and 400 mg/kg body weight Wistar rats also showed antioxidant activity (Ugwah-Oguejiofor *et al.*, 2022). EtOH extract from whole plant of *C. flava* also reported antioxidant property by *in vitro* hydroxyl radical and NO radical scavenging assays, ABTS and DPPH assays (Karthishwaran *et al.*, 2018).

Nootropic, Anxiolytic and Anti-Convulsant Property

The research experiment was performed by daily administration of dried extract of *C. fimbriata* (aerial parts) for 14 days onto male albino mice of weight between 18 - 22 g. The effect of CFE on memory and learning ability in mice using different behavior forms was analyzed. The results showed that CFE exhibited significant anxiolytic and nootropic effects in mice with no side-effects. Thus CFE can be used to reduce anxiety in humans and may be used in the treatment of Prader-Willi Syndrome also (Rajendran *et al.*, 2014). Administration of aqueous extracts from *C.*

dalzielii aerial parts at different doses in maximal electroshock (MES) model chicks, reported anticonvulsant activity, hence, can be used to treat epilepsy and convulsions (Ugwah-Oguejiofor *et al.*, 2023).

Antimicrobial and Antifungal Activity

Various solvent extracts from aerial section of *C. europaea* were found to have a variety of potentially active substances. These substances possess anti-inflammatory, antibacterial and antifungal activities. Thus *C. europaea* can be utilized as a substitute medications to combat nosocomial antibiotic-resistant microbes and inflammatory diseases (Amrati *et al.*, 2021). *C. retrospiciens* possess antifungal property against *Candida albicans*. The Exudate gel (EG) was extracted from the stem section of *C. retrospiciens*, collected from Saudi Arabia and it showed excellent antifungal activity against *Candida albicans*. The antifungal activity of EG was measured using agar well diffusion method (10). The extract obtained from the fruits of *C. penicillata* through modified agar diffusion method, DPPH assay on FL cell lines reported antimicrobial and antioxidant activity (Albaser, 2024). Dried extract from the whole parts of *C. deflersiana* by bipyridine-ferric reducing antioxidant capacity assay, as well as the antibacterial activity using the agar diffusion method reported antioxidant and antimicrobial activities (Almaqtari and Mubarak, 2024). Aqueous extract from the aerial parts of *C. deflersiana* through Ferric reducing antioxidant power assay (FRAP), diphenylpicryl hydrazine (DPPH)- radical scavenging assay, Minimum Inhibitory Concentration (MIC) assays and ABTS radical scavenging assays reported antimicrobial and antioxidant properties (BinMowyna and Alsayadi, 2020). In another research work the dried extract from mature plants of *C. tuberculata* was detected to possess antibacterial and antifungal activity through in-vitro assay against fungus and antibacterial susceptibility assay (Ahmad *et al.*, 2014).

Hepatoprotective and Cytoprotective Properties

Oral administration of mEtOH extract from stems of *C. cicatricose* (0.5, 1 and 1.5 g/kg by weight) in carbon tetrachloride-induced liver damaged rabbits showed reduction in liver damage as it contains natural hepatoprotective agents (Al-Mehdar *et al.*, 2015). Oral administration of dried extract from the aerial parts of *C. arabica* at varying dosage of 200 and 400mg/kg in models of gastric ulcer caused by phenylbutazone reported anti-gastric ulcer and cytoprotective action (Zakaria *et al.*, 2002).

Use in Nanotechnology

C. fimbriata extract was reported to play a role in the synthesis of pure Gd loaded ZnO nanostructures. It consists of simple single step and enhances photo-catalytic activity in the presence of both UV and solar irradiations. Furthermore, because of its great photosensitivity, affordability, and nontoxicity, ZnO has gained widespread acceptance as a viable option for photo-catalytic processes (Mishra *et al.*, 2016). The silver nanoparticles of 20.2 to 43nm in size synthesized from the *C. pauciflora* extract possess anticancer activity against gastric cell lines. Ag-CS NPs are a viable contender for contaminated water remediation as well as essential bioapplications because of their wide range of use in fields such as catalysis, biomedical engineering, electronics, biosensors, and adsorption. The issue of organic pollutants in water caused by industrial, agricultural, and domestic activities necessitates appropriate water shortage solutions. Nanoparticles (NPs) have been advocated for their unique physical and chemical advantages and applications (Alamier *et al.*, 2023). In one study, *C. tuberculata* was stimulated to produce in vitro callus cultures comprising of biomass and secondary metabolites by silver nanoparticles. The commercial synthesis of plant biomass and medicinally active metabolites in *C. tuberculata* was also achieved. Thus, it is possible to draw the conclusion that AgNPs can be successfully used to increase bioactive

antioxidants in callus cultures of the highly therapeutic but endangered *C. tuberculata* plant (Ali *et al.*, 2019). Plant cultures grown *in vitro* with favorable characteristics for therapeutic uses have become a reliable supply. This work attempts to characterize the antioxidant and hypoglycemic capabilities of *C. tuberculata* extract obtained from light stress and photosynthesized selenium nanoparticle (SeNP)-mediated in vitro callus cultures (Ali *et al.*, 2024a).

Non-Toxic Nature

C. fimbriata is safe to use and nontoxic to human health. For that a research was conducted to check the harmful effects of *C. fimbriata* extract (CFE). The administration of CFE for six months at varying dosage of 100, 300, and 1000mg/kg body weight in Sprague Dawley (SD) rats was examined .The result showed no deaths or toxicity at the highest dosage (Odendaal *et al.*, 2013). Dried extract from the aerial parts of *C. umbellate* inhibited α amylase and pancreatic lipase, thus showing antidiabetic property. The cytotoxicity test showed that the dose of extract ranging between 600 to >1000 µg/ml is safe to use (Bellamakondi *et al.*, 2014). In another study, acute toxicity of *C. edulis* was check through various doses on albino rats and it was found the plant was safe to us till 5000 mg/kg body weight. In short the *Caralluma spp* are marvel of nature like other medicinal plants (Sundas Firdoos *et al.*, 2017).

CONCLUSION

Caralluma genus is found in Saudi Arabia, Pakistan, India, Africa and other dry regions of the world consisting of about 2500 species. These species hold great promise as commonly available medicinal plants as they are natural and don't have any harmful effect. Their phytochemical constituents mainly pregnane glycosides and polyphenols make them suitable to be used as anticancer and antitumor drug. These phytochemicals are mainly found in the storage organs of the plants and are considered as a raw material for advanced research. These plants possess therapeutic potential against different diseases as Diabetes, Cancer, Bacterial infection etc. However there are many gaps in the study which needs to be fulfilled in order to make best use of natural resources for the welfare of mankind.

CONFLICT OF INTEREST

The authors declared no conflict of interest, financial or otherwise.

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