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Caralluma fimbriata- An Important Medicinal Plant: A Review of Its Traditional Uses, Phytochemistry and Pharmacological Properties

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Abstract : Medicinal herbs are moving from fringe to mainstream use with a greater number of people seeking remedies and health approaches free from side effects caused by synthetic chemicals. India officially recognizes over 3000 plants for their medicinal value. It is generally estimated that over 6000 plants in India are in use in traditional, folk and herbal medicine. This article aims to provide a comprehensive review on the phytochemical and pharmacological aspects of Caralluma fimbriata. It is obtained from forests throughout greater parts of India, it is widely used in traditional medicinal system of India has been reported to possess anti-obesity, antioxidant, and anticancer activity. It is known as a rich source of tannins, flavonoids, phenols and glycosides. The innumerable medicinal properties and therapeutic uses of Caralluma fimbriata as well as its phytochemical investigations prove its importance as a valuable medicinal plant.
Keywords *Caralluma fimbriata,* Pharmacological activities, Phytochemistry, Traditional uses.

Introduction

Over the last few years, researchers have aimed at identifying and validating plant-derived substances for the treatment of various diseases. Interestingly it is estimated that more than 25% of the modern medicines are directly or indirectly derived from plants. It is worth mentioning that Indian medicinal plants are considered as a vast source of several pharmacologically principles and compounds that are commonly used as home remedies against multiple ailments [1]. For many of the medicinal plants of current interest, a primary focus of research to date has been in the areas of phytochemistry, pharmacognosy, and horticulture. In the area of phytochemistry, medicinal plants have been characterized for their possible bioactive compounds, which have been separated and subjected to detailed structural analysis. Research in the pharmacognosy of medicinal plants has also involved assays of bio-activity, identification of potential modes of action, and target sites for active phytomedicinal compounds. Horticultural research on medicinal plants has focused on developing the capacity for optimal growth in cultivation. This has been especially pertinent as many medicinal plants are still harvested in the wild, and conditions for growth in cultivation have not been optimized. Wild harvesting of medicinal plants can be problematic in terms of biodiversity loss, potential variation in medicinal plant quality, and occasionally, improper plant identification with potential tragic consequences [2].Indian traditional medicine is based on various systems including Ayurveda, Siddha, Unani and Homoeopathy. The evaluation of these drugs is primarily based on phytochemical, pharmacological and allied approaches including various instrumental techniques such chromatography, microscopy and others. With the emerging worldwide interest in adopting and studying

traditional systems and exploiting their potential based on different health care systems, the evaluation of the rich heritage of traditional medicine is essential [3, 40-56]. In this regard, one such plant is *Caralluma fimbriata.*

Caralluma fimbriata, also known as *Caralluma ascendens*, belongs to the family Asclepiadaceae. In western India it is also called Ranshabar, Makadshenguli, Kullimudayan, and Shindulamakadi [4].

Taxonomic Classification

Kingdom	-	*Plantae*
unranked	-	*Angiosperms*
unranked	-	*Eudicots*
unranked		*Asterids*
Order	-	*Gentianales*
Family	-	*Asclepiadaceae*
Genus	-	*Caralluma*
Species	-	*Fimbriata*

Vernacular names

English	*Caralluma*
Kannad	*Maakada singi, mangana kodu*
Marathi	*Makad Shing*
Tamil	*Kullee Mooliyan, Kallimudayan*
Telegu	*Kaarallamu, Kundelu kommulu*
Sanskrit	*Yugmaphallottama*

Geographical Source

Caralluma fimbriata is a tender succulent that is found in the wilds of Africa, the CanaryIslands, Arabia, southern Europe, Ceylon, and Afghanistan [2,3]. The *Caralluma* genus ofcacti is included among those listed as edible, because the daily diets of numerous nativesof India over many centuries include this edible, wild, succulent cacti [1,4,5]. Daily consumption is largely due to the fact that the *Caralluma* genus grows ubiquitously in that area. *Caralluma fimbriata* is the most prevalent of the genus, as it grows wild in urban centers, is planted as a roadside shrub, and is commonly used as a boundary-marker ingardens. This so-called vegetable is eaten daily in several different forms - cooked as aregular vegetable, placed in preserve like chutneys and pickles, and sometimes eaten raw.

To give specific examples,

(1) Consumed daily as a vegetable in the Kolli Hills of South India;

(2) Used in pickles and chutney in the arid regions ofAndhra Pradesh; and

(3) In Western India, *Caralluma fimbriata* is accepted as a famine food - suppressing appetite and quenching thirst. Legend has it those hunting tribe's chewed chunks of the *Caralluma* cactus to suppress hunger and thirst when on a long hunt.

Most importantly to determine safety, there are no adverse event reports on the Indian Sub-continent over the centuries of use.

(4) *Caralluma fimbriata* is listed as a vegetable in The Wealth of India, the Indian Health Ministry's comprehensive compilation on medicinal plants.

(5) Key phytochemical ingredients include pregnane glycosides [6,7], flavone glycosides [8], megastigmane glycosides [8], bitter principles, saponins, various flavonoids [9], etc.

The edible cactus flourishes in the states of Andhra Pradesh, Karnataka, and Tamil Nadu of India as a roadside shrub and is planted as a boundary marker in gardens. Indian tribal people have included the cactus in their diet for many centuries. Among Indian tribal populations C. fimbriata is known as a famine food and thirst quencher when its green follicles are boiled and salted [10].

Morphology

Caralluma, a cactus plant belongs to family Asclepiadaceae is a succulent, perennial herb, grow to a height of 1 to 10 ft and grow in different regions of India. The members of genus Caralluma are erect and fleshy. They have quadrangular stem, devoid of leaves and small flowers in several varieties of dark colour. The species of Caralluma found in India are edible and form a part of traditional medical system of country [15].



Traditional uses

C.fimbriata has been in use since centuries in India.

It is commonly used as a vegetable in several regions of India. It is eaten raw or cooked with spices, it is also used in pickles day's hunt. The cactus is used among the labor class in South India to suppress appetite and enhance endurance.

In the Kolli hills of South India, *C.fimbriata* is a vegetable used daily. In the arid regions of Andhra Pradesh, *C.fimbriata* is used in pickles and chutneys.

In Western India, *C.fimbriata*is well known as a faminefood, appetite suppressant and thirst quencher. The green folliclesareeaten, boiled and salted.

In Kerala, South India,*C. fimbriata*is used as a vegetable and appetite suppressant among tribal populations-It also finds use today as an appetite suppressant and famine food during times of famine, in the semi-arid regions of India.

Wealth of India, the Indian Health Ministry's comprehensive compilation on medicinal plants, lists Caralluma fimbriata as a vegetable, used in Curries, pickles or raw eaten.

Ayurvedic preparation

Phytochemistry

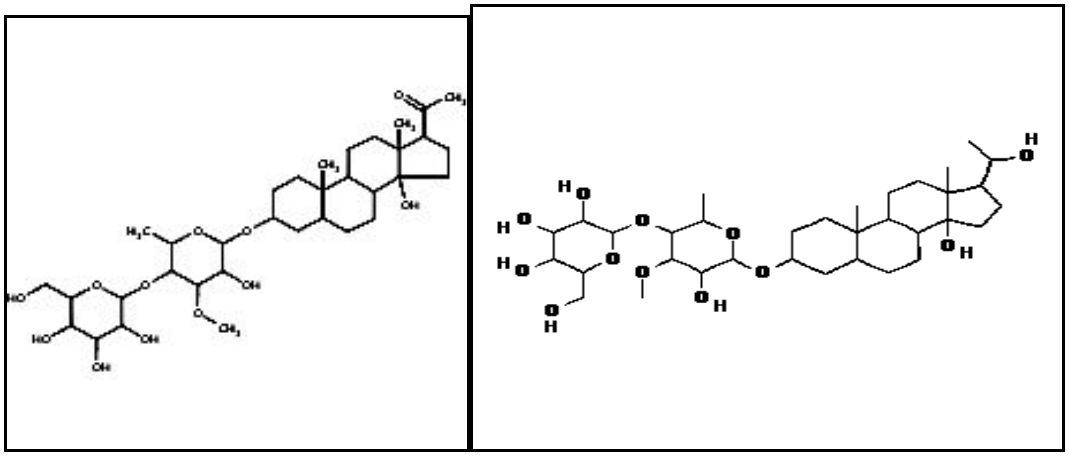
Species of caralluma have pregnane glycosides (23), stogmasterol and other further constituents (24) which are well known for the array of biological activities and pocess antimicrobial, antidiabetic, antioxidant etc. Saponins and flavonoids (25) and predominantly found in Caralluma show in great interest because of the wide range of immune stimulating activities.

This succulent Cactus contain glycosides, hydrocarbons, Saponins as major phytoconstituents and reported for various biological activities such as rheumatism, diabetes, leprosy, antinociceptive, antipyretic, anti-helminthetic, antiobesity activities. [16-22].

The phytochemistry of the genus Caralluma is characterized by many pregnane glycosides. Other chemical constituents include flavones glycosides, megastigmane glycosides, saponins and several flavonoids. The appetite suppressing properties of C. fimbriata could be attributed to the pregnane glycosides, which are present in the plant species belonging to the Apocynaceae family. Eleven pregnane glycosides have been isolated from the plant extract with four (compounds 10–13) containing a novel genin. [40].

The attraction of Pharmaceutical companies, Researchers for elucidation of bioefficacies and provide knowledge for the advancement of phytomedicine.

The key phytochemical constituents of the herb are pregnane glycosides, flavone glycosides, megastigmane glycosides, and saponins. Some of the active components present in this plant are Caratuberside A, Caratuberside B, Bouceroside I-X, Tomenkogenin, Sitosteroletc [38].



Caratuberside A Caratuberside B

Pharmacological activities

A standardized extract of *Caralluma fimbriata* is commercially available (SlimalumaTM, Gencor Pacific Group)

Appetite suppression

It was stated that pregnane glycosides may suppress appetite; it is thought that the pregnane glycosides amplify the signalling of energy sensing function in the hypothalamus[10].

Another hypothesis is that C. fimbriata may down-regulate ghrelin synthesis in the stomach and neuropeptide-Y in the hypothalamus, resulting in appetite suppression [40].

There is limited research conducted into the effect of C. fimbriata on appetite in humans. A human trial conducted on the appetite suppressing effects of C. fimbriata in Indian adults found that the extract (1 g/day) appears to suppress appetite and reduce waist circumference in overweight individuals (n=50) with a BMI greater than 25 kg/m2 over a two month period compared to the placebo group [10].

It was also found that hunger levels of participants reduced by 20 % following the administration period, which may account for an 8 % decline in energy intake of the experimental group. Appetite sensations including ‘hunger’, ‘thoughts of food’, ‘urge to eat’ and ‘fullness of stomach’ were assessed by the visual analogue scales method and dietary intake wasassessed via a modified food frequency questionnaire. The food frequency questionnaire indicated that the appetite suppressing effect caused a decrease in energy and fat intake and also a decline in the consumption of less desirable food [10]

Antiobesity activities

The evaluation of the extract of *C. fimbriata* (CFE)for appetite suppressing, and antiobesogenic properties in the DIO rat model has been conducted.Resultsdemonstrate that CFE has pronounced dose-

dependent appetite suppressant and antiobesogenic effects in this model. These effects were reflected in the feed intake, body weight, liver weight, fat pad mass, and serum lipid profiles of the rats in our various treatment groups. The hyperleptinaemia and implicit leptin resistance characteristics of obesity were abolished by CFE. Fifty mg/kg/day of CFE appears to be the optimal dose for preventing CA diet-induced changes in body weight, hormones, fat pads, and liver. Kidney and liver function data were assayed at all probe points. Slight negative changes inliver and kidney function induced by the cafeteria diet were reduced by CFE in a dose-dependent manner and approached normal values at the intermediate dose level. [**35**].

A standardized extract of the plant Caralluma fimbriata is widely used in the management of obesity but its mode of action is not yet clarified. The study conducted for investigating the ability of Caralluma fimbriata extract (CFE) to modify pre-adipocyte cell division and resulted in the development of hyper-plastic obesity. Mouse 3T3-L1 pre-adipocyte cell line samples were treated with different concentrations of an extract of CFE standardized against its pregnane glycoside content. Plain medium formed the negative control and hydroxyurea was the positive control. The cells were counted at 12-hour intervals, and their viability tested using the MTT assay. The treated cells were subjected to direct and indirect immunofluorescent assays for cyclin D1. CFE inhibited 3T3-L1 cell growth in a dose and duration-dependent manner, with results comparable to those produced by hydroxyurea. The viability of CFE-treated cells was reduced. Direct and indirect immunofluorescent assays demonstrated that CFE inhibits import of cyclin D1into the nucleus. CFE appears to inhibit pre-adipocyte cell division by interfering with a mechanism preceding the import of cyclin D1-CDk4/6 complex into the nucleus during the early G1 phase of the cell cycle, suggesting that CFE has the potential to inhibit hyperplas-tic obesity. [**42**].

It has been evaluated that minor adverse events experienced in the experimental group included a dermatological rash and constipation. Therefore, C. fimbriata extract has received the Generally Recognized as Safe (GRAS) status for use as a nutraceutical for obesity treatment [14].

Anti – inflammatory activity

Anti inflammatory effect of the Caralluma fimbriata extract has been evaluated. The anti – inflammatory activity was screened by Carageenan induced paw edema model in which the animals treated with testing drug and standard indomethacin has significantly reduced the inflammation when compared with carageenan induced inflammatory positive control group animals. Incarageenan induced paw edema *Caralluma fimbriata* significantly inhibited the edema in a dose dependent manner. The paw volume in normal control group rats on 2nd hr was found to be 0.2148 0.0122 ml. The paw volume in rats pretreated with lower dose of *Caralluma fimbriata* (100 mg/kg/day), higher dose of *Caralluma fimbriata* (200 mg/kg/day) and indomethacin (10 mg/kg/day) at 2nd hr were found to be 0.191 0.0061 ml, 0.158 0.0042** ml and 0.1369 0.0054** ml. [**43**].

Analgesic activity

The analgesic effect of the Caralluma fimbriata extract is evaluated. In the evaluation of analgesic activity the model used was Eddy's hot plate method in which the animals treated with *Caralluma fimbriata* and standard Pentazocin has significantly increased the latency period of jumping & paw licking when compared with control group animals. *Caralluma fimbriata* showed maximum analgesic activity at 60, 90 min for 100 and 200mg/kg dose. The reaction time in normal control group at 60, 90 min were found to be 3.52±0.002, 4.08±0.161 Sec. The reaction time (paw licking / jumping response) in rats pretreated with a lower dose of *Caralluma fimbriata* (100mg/kg), higher dose of *Caralluma fimbriata* (200mg/kg/day) and Pentazocine (10 mg/kg) at 60, 90 min were found to be 9.26±0.851, 7.16 ± 0.193, 9.82 ± 0.894 and 8.60 ± 0.992, 9.12 ±0. 372, 14.12±3.182 respectively, when compared to control group rats. analgesic effect was more in 200 mg/kg compared to 100 mg/kg and reference drug pentazocine at 10 mg/kg dose significantly increased the reaction time at 90 minutes[**43**].

Anxiolytic activity

In the evaluation of anxiolytic activity, the animals were treatedwith the test drug and standard diazepam has significantly raised the time spent in open arm and a number of entries when compared with control group animals in elevated plus maze model. The classic anxiolytic benzodiazepine; diazepam has long been reported for its anxiolytic activity in rat with EPM. In this study significant effect was recorded with diazepam as it increased the number of entries in open arms and the time spent in open arms along with

a significant decrease in time spent in closed arms. *Caralluma fimbriata* at doses of 100 mg/kg, and 200 mg/kg showed significant anxiolytic activity by increasing the number of entries in open arms along with time spent in open arms and significant reduction in time spent in closed arms. The effect of *Caralluma fimbriata* (100, 200 mg/kg) on the number of entries in closed arms was insignificant. The anxiolytic activity shown at higher doses of *Caralluma fimbriata* (200 mg/kg) was comparable with Diazepam 2 mg/kg. p.o. [**43**].

Antiatherogenic activity

Antiatherosclerotic effects were measured by histology. CFE induced significant and dose-dependent inhibition of food intake, with dose-related prevention of gains in body weight, liver weight, and fat pad mass. Alterations in serum lipid profiles associated with weight gain were similarly inhibited, as were the typical increases in serum leptin levels.

Conclusion

Before the introduction of modern medicines, disease treatment was entirely managed by herbal remedies. It is estimated that about 80% of the world population residing in the vast rural areas of the developing and under developed countries still rely mainly on medicinal plants. It is quite obvious that the plant is widely used in traditional medicinal system of India and has been reported to possess hepatoprotective, anti-inflammatory, antiobesic, anticancer, antioxidant antifungal and also used to check wounds healing and antibacterial properties. It is known as a rich source of tannins, flavanoids and glycosides present in *Caralluma fimbriata* might be medicinally important and/or nutritionally valuable.

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