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Caralluma fimbriata: An Edible Wild Plant and it's pharmacological review:-

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ABSTRACT:-

Many different herbal treatments have been used in various medical traditions to treat and control a range of health issues. Medicinal plants not only offer main ingredients for therapeutic purposes but also serve as an important resource for discovering new therapeutic targets. Caroliuma is a genus that has been utilized in traditional medicine. This paper thoroughly examined the pharmacological activity of Caralluma fimbriata , the quantity of species, Caralluma has properties and biological activities such as a antiobesity anti inflammatory antibacterial antifungal analgesic antioxidant hypolipidemic antidiabetic anticancer antirehumatic antimicrobial antimalarial antihypertension skin infection.It is employed as a traditional remedy for conditions such as diabetes, paralysis, leprosy, arthritis, and swelling. The presence of various chemical groups within the genus could be responsible for these bioactivities. Caralluma consists of pregnane-glycosides, flavones, megastigmane-glycosides, pregnane-steroids, and aromatic-volatile compounds. This study aims to establish a link between traditional uses and scientific research on Caralluma by examining the fragmented literature on ethnobotany, phytochemistry, pharmacology, and toxicity. However, the research mentioned here shows its beneficial impacts on improving health.

Key world: - Caralluma fimbriata, therapeutic targets, utilized, traditional medicine bioactivities, Glycosides, flavones, phytochemistry, Toxicity.

Caralluma fimbriata diagram

1.INTRODUCTION :-

Food was mostly obtained from natural or forest resources in nomadic societies [1]. Plants are the primary source of food, bioactive components, and are essential for survival and environmental conservation [2]. Likewise, medicinal plants are a true gift from nature to humans, assisting them in their quest for better health. Natural foods and their byproducts have been identified and used as the primary source of medicinal drugs since prehistoric times. They continue to provide effective bioactive chemicals that can be used directly as medicines. According to current estimations, the plant kingdom contains over 250,000 species.

Around 10% of medicinal plants have been studied or identified to cure various ailments [3]. As a result, there is an urgent need to discover more hidden components in the plant kingdom. In contrast to traditional medicine, many plants and herb-based therapies have a long history of use in the prevention and treatment of many illnesses [4]. The World Health Organization defines herbal, phyto, or botanical medicine as the use of herbs, herbal materials, herbal preparations, finished herbal products containing active plant components, or combinations thereof as pharmaceuticals [5]. These medicinal herbs are extensively dispersed throughout plant sources and have a broad therapeutic utility. applications [6]. The worth of such plants or herbs lies in their secondary metabolites, which are nonnutritive but can exert certain physiological actions in humans against different types of infectious diseases and metabolic disorders [7]. Various plant species throughout the world

have been studied for their therapeutic properties, and bioactivity dif- fers from plant to plant, as they pose diverse physiological impacts on the human body [8]. Medicinal plants play an important role in public health, particularly in underdevel- oped countries owing to their better affordability and lower toxicity [9]. The extensive use of plants with therapeutic properties does not lead to intoxication, whereas overutiliza- tion of allopathic medicines has been associated with adverse effects. Drug residues may lead to the growth of drug-resistant microorganisms that are difficult to treat; hence, the globe is looking for safer alternatives [6].

Recent advances in nutraceuticals and functional foods research have proved that bioactive components in our diet have an important therapeutic role in the treatment of human maladies. Dietary scientists place a high value on iso- lating nutraceutical bioactive components from food sources [10]. Nutraceuticals, in contrast to traditional diets, are foods or part of food that combine nutritional and pharma- cological effects. Hence, nutraceuticals contain any natural component with a nutritional value that has a positive effect on the human body, which are available in the form of pow- der/pill/dietary supplements or products containing concen-trated food derivatives-nutrients. They are typically found in the most common functional foods. Some molecules, micro- nutrients, and macronutrients including alkaloids, polyphe- nols, terpenoids, some vitamins (A, B6, B12, C, D, and E), folate, and some trace elements like zinc, iron, selenium, and magnesium are present in these products that are believed to be responsible for the therapeutic effects [11]. Caralluma species are gaining more interest among nutra- ceutical companies owing to the presence of various phyto- chemicals with antioxidative potential [12]Caralluma species have been widely utilized to treat different conditions such as diabetes, rheumatism, leprosy, paralysis, malaria, and inflammation. Numerous active chemicals have been sourced from various Caralluma species. Hence, researchers are striving to create nutraceuticals from natural substances and their byproducts that can help improve human health without causing any unwanted effects [13].Commitment to a healthy vegan diet and regular exercise Adopting a lifestyle akin to that of our ancestors could potentially be beneficial.preventing and handling the escalating threat of MS. Within plant-based foods, numerous native varieties are commonly found.Wild plants that can be eaten are still not receiving enough attention from food scientists.Scientists, dietitians, and manufacturers. Therefore, it is necessary to focus on tapping into these underused plant resources to tackle these issues Disorders related to one's way of living. Regrettably, there is still no well.Studies that are well-defined are carried out in order to promote the use.Of traditionally recognized wild edible plants as a nutritional resource.Treatment and healing. Intentionally, many investigations into .the nutritional value of wild edible plants is being studied.To increase public awareness about their usage [2]

C. fimbriata is one such underappreciated plant with significant nutritional and nutraceutical potential. From now on, this evaluation has been intended to gather the most current research on C. fimbriata to capture the interest of experts in food and nutrition,food scientists, nutritionists, and healthcare professionals about its use in nutrition and as a natural supplement for home, industrial, and medical purposes. The main goal was to highlight the overlooked medicinal plant, which is thoroughly explored in this study, including its actions, possible mechanisms,and its potential role in managing and preventing metabolic disorders. This study focuses on various species and their key active compounds that have been shown to target metabolic syndromes, thereby creating new opportunities for treatments and therapies [3]. Therefore, this study aims to gather the most up-to-date research on C. fimbriata over the past ten years to draw attention from experts in food and nutrition departments about its recommended dietary use. To achieve this, research articles from

2012 and beyond were collected through sophisticated search techniques on Google Scholar, ScienceDirect, and Scopus using the following keywords: "Caralluma fimbriata" OR "Caralluma adscendens" OR "Choong" AND "Metabolic Syndrome"OR "Diabetes" OR "Hyperlipidemia" OR "hypertension"

2 GENUS: CARALLUMA

The genus Caralluma is part of the Asclepiadoideae subfamily and is found across a wide range of regions including Asia (countries like Afghanistan, India, Iran, Pakistan, and Sri Lanka), Africa, the Arabian Peninsula, the Canary Islands, and Southeast Europe. [14 ,15] The name "Caralluma" comes from the Arabic term "qarh al-luhum," which translates to "wound in the flesh or abscess." [16] Historically, Caralluma has been considered synonymous with Boucerosia, though they differ in their floral structures. [16] These plants are typically tall, either creeping or scrambling, succulent herbs with tetragonal branches. [17] In the past, certain Indian succulent plants with long flowers were grouped under the genus Caralluma by R. Brown. [18] In 1834, Wight and Arnott [19] reclassified the genus Caralluma into two new categories: Hutchinia and Boucerosia. Boucerosia was identified by its plants with flowers at the end of umbels and a global distribution across the Arabian, Indian, and Mediterranean regions. Hutchinia, on the other hand, was known for its underground succulent species and a few erect species with flowers at the end of umbels. Both categories were later merged back into the genus Caralluma by Brown in 1892. However, there was ongoing debate about including similar succulents in the same genus. In 1895, Schumann [20] further divided the genus into three subgenera: Boucerosia, Lacruma, and Eucaralluma (Caralluma). Gilbert [21] redefined the Caralluma genus into four subgenera: Boucerosia, Caralluma, Desmidorchis, and Urmalcala. Plowes [21] expanded the Caralluma genus to 17 genera, with only four (Apteranthus, Boucerosia, Caralluma, and Caudanthera) found in India. Within India, Caralluma species are categorized into three subgenera: Boucerosia, Desmidorchis, and Urmalcala. [22] In terms of traditional medicine, Caralluma plants are used for treating diabetes and rheumatism in both folkloric and traditional medical systems. Tribes also consider some species as a food source during famines and as part of their traditional medicinal practices. In India and Pakistan, Caralluma species have been relied upon as emergency food sources for several centuries. The genus Caralluma is known to contain a variety of bioactive compounds, including pregnane glycosides, stigmasterol, and other phytochemicals, which suggest a wide range of biological activities. Currently, Caralluma is gaining attention for its potential health benefits.

3 C. fimbriata: A Nutritious and Medicinal Wild Plant

The recommendation of numerous native medicinal plants by the World Health Organization (WHO) is based on their widespread availability, low cost, and minimal side effects. The first recorded cultivation of C. fimbriata was in Britain in 1830 [23]. However, governments and farming organizations often overlook or excessively focus on the growth of these wild plants.

Moreover, due to overuse by the pharmaceutical sector, agriculture, mining, and the practice of cutting down trees for fodder, these plants are rapidly declining and could face extinction soon [24]. To satisfy the demands of the global food and health supplement industries, innovative approaches are needed to halt this alarming decrease.

C. adscendens var. fimbriata, also known as C. fimbriata, is locally referred to as "Choong" or "Choonga," and "Kalli moolian" or "Karallamu" in Pakistan and India, respectively [25]. It is a hardy shrub found along roadsides, characterized by cactus-like leaves and is a well-known ingredient in Ayurvedic medicine. This plant typically reaches heights of 20-30 cm, stands upright, and has branches that split into four-angled green stems that taper to the ends. Its leaves are tiny, appearing only on the young branches and quickly falling off,

leaving behind spiny remains. Flowers appear either singly or in clusters at the tips of branches on short stalks. These flowers are about 2 cm in diameter, featuring small purple petals with golden and hairy borders [26]. The plant is increasingly popular for its natural bioactive compounds, which are being explored for their potential health benefits, including weight management [27].

C. fimbriata is a wild edible and medicinal plant that thrives in arid regions and is considered a "famine food" by tribal communities in India. It is traditionally consumed as a pickle or a vegetable [28]. With careful selection and adjustments to the climate, this wild plant could be cultivated on a large scale

[29] The history of its use in long periods of hunting is told by hunting tribes in the form of chewed pieces or pieces of C. fimbriata to suppress hunger and thirst. No side effects have been reported after the use of C. fimbriata in the Indian region [30]. It contains glycosides that are known to suppress hunger and increase energy. This plant has been studied for its antihyperglycemic and lipid-lowering properties, as well as hepatoprotective and antioxidant activities, which produced significant results [31, 23]. It is also used to treat pain, fever and inflammation. This plant is eaten by the tribes of central India for the treatment of severe disease [24]. It also stimulates the central nervous system and its medicinal benefits can be attributed to the group of family glycosides that are abundant in them [25]. Flavon glycosides, family glycosides, saponins, triterpenoids and other flavonoids are important phytochemical compounds of C. fimbriata that have been studied for various pathological conditions and spasm diseases. Pregnant glycosides are secondary metabolites of C. fimbriata, which are steroidal compounds related to various sugars [26]. They are associated with altered lipid metabolism and inhibition of fatty acid synthesis [31, 27]. It also affects the hypothalamus and cortisol, which produces a feeling of satiety, thereby reducing hunger, and may be largely responsible for suppressing appetite [28]. This results in no side effects in comparison to interested entrepreneurs [29].

C. fimbriata extract (CFE) is available in many countries, including Australia and New Zealand [30]. CFE is generally recognized as safe (GRAS) for use as a food ingredient to combat a major global health problem (eg, obesity) [31]. For example, GenaSlim is a CFE approved brand for weight loss programs. The use of CFE as a therapeutic intervention in Ayurvedic medicine is well known [32]. CFE can also be used as a natural antioxidant [33]. Other medicinal uses of CFE reported in the literature include analgesic, antipyretic, anthelmintic, antirheumatic, anti-inflammatory, analgesic and antioxidant effects [25]. Therefore, CFE can act as an appetite suppressant, safe and effective leading to weight loss, blood sugar and lipid reduction [34]. In addition, it has been used to fight malaria, hyperglycemia, ulcers, cancer and other diseases. Future research on drugs and nutrients should focus on this important phytochemical pregnancy glycoside [31]. It is known to have lipid lowering, antioxidant, hepatoprotective, anti-obesity and anti-cancer properties with minimal side effects [23].

It is listed as a vegetable in the Compendium of Medicinal Plants of the Ministry of Health of India [25]. In Indian Materia Medica, it is also classified as hunger, hunger drink and thirst [35]. Its aerial parts are used as a cooking vegetable and cooked with meat in winter [24]. For decades, tribal communities in India have used

this plant as a form of traditional medicine. CFE is readily available and easy to consume despite its bitter taste. Its safety and toxicity characteristics carefully examined [30].

4 C. fimbriata's Nutritional and Phytochemical Profile

C. fimbriata contains approximately 45% water, 9% ash, 4.8% fat, 0.67% dietary fiber, 0.66% protein, 40% carbohydrates, and 207 kcal per 100 grams, making it a nutrient-dense food source, rich in iron, manganese, zinc, and copper [36]. A separate study found slightly different nutritional values, with higher percentages of fats, ash, sugars, and calories, ranging from 8% to 554 kcal per 100 grams, respectively [20]. The analysis of the amino acid profile (mg/100 g dry weight) of the plant's aerial parts showed aspartic acid at 21.6%, negligible glutamic acid, alanine at 120.72 mg, methionine at 22.56 mg, tyrosine at 130.08 mg, lysine at 316.56 mg, threonine at negligible levels, proline at 483.8 mg, isoleucine at 1578.24 mg, phenylalanine at 141.58 mg, tryptophan at 157.36 mg, glycine at 108.29 mg, arginine at 51.58 mg, histidine at 84.48 mg, and valine at 342.95 mg. Additionally, the plant's composition includes 82% moisture, 5.6% lipids, 55.4% carbohydrates, 3.5% protein, 27.5% total free amino acids, 15.3% crude fiber, and 2.1% ash. These findings were reported in [27]. Table 1 provides an overview of the phytochemicals found in C. fimbriata, along with their reported bioactive properties from various studies. Future research is anticipated to explore the plant's bioactive peptides and genetic variations [37, 38].

The extraction of CFE using various techniques, along with the identification of bioactive non-nutrient compounds in C. fimbriata, as detailed in Table 2, revealed significant amounts of steroids, coumarin, phytosterols, flavonoids, and alkaloids, with moderate levels of diterpenes and saponins. The absence of anthocyanins, phenols, tannins, phlobatannins, and cardinal glycosides was noted. Similarly, the presence of steroids, coumarin, proteins, carbohydrates, diterpenes, phytosterols, flavonoids, saponins, and alkaloids was confirmed, along with the high concentration of minerals and elemental compounds [28]. Another study investigated the phytochemical components, total phenolics, and flavonoid contents of the whole plant CFE through various in vitro assays, including Soxhlet's extraction, 2,2-diphenyl-1-picrylhydrazyl (DPPH) assay, nitric oxide (NO) scavenging assay, and ferric reducing antioxidant power (FRAP) assay. The plant's ethanolic extract was found to contain 80.08 ± 0.629 mg of total phenolics and 70.88 ± 1.170 mg of total flavonoids, demonstrating higher antioxidant activity compared to other extracts in DPPH, NO, and FRAP tests [8]. Furthermore, a study examined the phytochemical profile of CFE using various solvents (aqueous, ethanolic, methanolic, and ethyl acetate). The methanolic extract showed the highest concentration of alkaloids, flavonoids, glycosides, phenolic compounds, saponins, and quinones. The primary fatty acids identified were oleic acid (21.08%) and n-hexadecanoic acid (44.23%) [61]. Another study reported that C. fimbriata contained total free phenolics at 13.56 mg/100 g, with antinu- tritional compounds, specifically tannins (112 mg/100g), And Moreover, oxalates (125 mg/100 g) were observed [2]. Chemical studies on plant compounds showed that 1.3% of CFE contained polyphenols and 12% were made up of pregnane glycosides. The existing information indicates that C. fimbriata could influence eating habits, likely through both peripheral and brain-related pathways [55].

4.1 Plant description:

Caralluma Adscendens is a medicinally important succulent cactus plant. It belongs to the Apocynaceae family and is a flowering plant genus. Caralluma adscendens, synonym caralluma fimbriata, was illustrated in 1832.

There are 2500 species in 200 genera. Caralluma (family Asclepiadaceae) is a genus of succulent plants with 50 different species. 30-60(- 100) cm tall; stem basally up to 2 cm in diameter, concavely 4-angled, at apex tapering to a pointy tip, reddish spotted; tubercles blunt, projecting, spreading horizontally or vertically; latex present. Simple, tiny, and primitive leaves. Flowers 1-2 together, axillary, scattered, bisexual, 5-merous, regular, drooping, with foetid odour; pedicel 1-4 mm long; sepals triangular, 2-3 mm long, acute. (Bader A, Bingtao Li etal.2003)

Synonym: Caralluma fimbriata,

Common Name: Ranshbar, Maked Shenguli, Shindala Makadi,

Toxonomy	Caralluma adscendens
Domain	Eukargota
Kingdom	Plantae
Sub kingdom	Viridiplantage
Phylum	Magnoliophyta
Subphylum	Spermatophytin
Infraphylum	Angiospemde
Class	Magnoliopsida
Subclass	Limiidae
Super order	Gentiananae
Order	Gentianales
Family	Asclepiadaceae
Specific epithet	Adscendens

Table 1. Taxonomic Classification of Caralluma adscendens. (Bingtao Li etal.2003)

4.2 Composition of phytochemicals:

Across India, this species is present in both deciduous and mountainous regions. The cells of this plant often hold a high concentration of triterpene compounds in their latex, along with various alkaloids such as Indole alkaloids, Phenanthrene, Indozolidine, Glycosides, Saponin, and Tannins. Many of its species are utilized in traditional medicine within their native countries. The genus contains a variety of compounds including Pregnane glycosides, flavonoid glycosides, flavones, megastigmane glycosides, pregnane steroids, steroidal glycosides, both saturated and unsaturated hydrocarbons, aromatic and nonaromatic volatile compounds, and -sit sterols. (Deepak Prashar, D.S.Srivastav et al.1997)

Table 2. Phytochemical Constituents of Caralluma adscendens (Deepak Prashar, Kunert O et al.2008

Sr.no	Phytochemical Constituents	Inference
1	Steroids	Present
2	Anthocynin	Absent
3	Caumarin	Present
4	Protein	Present
5	Amino Acid	Absent
6	Carbohydrates	Present
7	Diterpenes	Present
8	Phytosterol	Present
9	Phenol	Absent
10	Flavonoids	Present
11	Tnnins	Absent
12	Phobatannin	Absent
13	Cardinal glycosides	Absent
14	Saponin	Present

5 Pharmacology:

Different forms of caralluma are used to treat rheumatism, diabetes, leprosy, antipyretic and anthelmintic action, tumors, fungal infections, snake bites, scorpion bites, and ant nociceptive activity. In India's traditional medicinal system, antibacterial, antifungal, analgesic, anti-inflammatory, mutagenic, ant hyperpolipidemic, hyperglycemic, antioxidant, antibacterial, and antifungal properties have been proven. (Anon P, Bader A et.al.2005)

a)Anti-obesity activity

Excessive buildup of body fat, which can pose health risks, is referred to as One with [39]. Between 1960 and 2000, the percentage of adults aged 20 and over in the United States who were obese rose from 15% to 30%, as reported by the National Health and Nutrition Examination Survey [40]. Treatments for obesity encompass lipase inhibitors, medications that boost the central nervous system, and thermogenesis, but these treatments have been associated with negative side effects [41]. Natural remedies like the genus Caralluma are traditionally used to curb appetite and aid in weight loss. Certain Caralluma varieties have demonstrated properties that help prevent obesity, such as C. fimbriata and C. tuberculata. These plants work by blocking the production of two key enzymes - malonyl coenzyme A and acetyl coenzyme A - crucial for the formation of fat molecules. The primary compound in the plant, known as pregnane glycoside, is believed to be the cause of this anti-obesity effect [42].

b) Anti- fungal activity

Fungi are dependent on other organisms, such as animals, for their carbon and energy. They can contaminate food and have harmful effects on humans [42]. There are 40 medicinal plants with antifungal properties and fewer side effects. The genus Caralluma includes several species with proven antifungal activity, which are traditionally used. C. tuberculata effectively suppresses mycelial growth and demonstrates strong anti-alternaria alternate action in in vitro tests. This results in a significant decrease in the number of mycelials (92.8%) as well as their dimensions, including width (67.6%) and length (23.3%) [43].The antifungal properties were assessed using the standard cup-plate method 10-12 after the extract was prepared with the appropriate solvent. The efficacy of Aspergillus niger and Cladosporium was compared to that of miconazole nitrate (M. Mcown et al., 1999).

c) Anti-inflammatory activity:

Caralluma fimbriata extract has been examined for its anti-inflammatory effects. Its ability to reduce inflammation was tested using a carrageenan-induced paw edema model, revealing that mice treated with the extract and standard indomethacin showed significantly reduced inflammation compared to the positive control group. The extract reduced carrageenan-induced paw swelling in a dose-dependent manner. By the second hour, normal control group rats had a paw volume of 0.2148 ± 0.0122 ml (Donald P, Joshi DR et al. 2009).

d) Analgesic activity:

The analgesic properties of Caralluma fimbriata were evaluated using Eddy's hot plate method. The results indicated that animals treated with the extract and Pentazocin experienced longer latency periods for jumping and paw licking compared to the control group. The maximum analgesic effect was observed at 60, 90, and 120 minutes for doses of 100 and 200 mg/kg (Tambe DA et al. 2010).

e) Antibacterial activity:

Caralluma adscendens and 15 other medicinal plants were assessed for their antibacterial properties and physicochemical characteristics. The methanol extract of C. adscendens was tested against four pathogenic bacteria, including E. coli, Proteus vulgaris, Klebsiella pneumoniae, and Staphylococcus aureus, with MIC values measured. C. adscendens showed antibacterial activity against K. pneumoniae and S. aureus comparable to other bacteria. Its aqueous and ethanolic extracts were tested against five bacterial strains (E. coli, P. vulgaris, Pseudomonas aeruginosa, S. aureus, and Salmonella typhi), revealing both antibacterial and antifungal effects (Gowri S, K. Dash et al. 2003).

f) Antioxidant Activity:

Extracts from C. adscendens var. fimbriata were tested for antioxidant or free radical scavenging activities against both synthetic and natural radicals. Different assays, such as trolox equivalent antioxidant capacity and ferric reducing antioxidant power, were used to measure total antioxidant activity against various radicals including 2,2-diphenyl-1-picrylhydrazyl, OH, and NO. The antioxidant capability was linked to the total phenolic and flavonoid content. Methanol and water extracts, rich in flavonoids and phenols, exhibited higher antioxidant activity compared to other extracts. These findings suggest that the extracts could be viable

alternatives to synthetic antioxidants in nutraceutical and food products. The antioxidant and hypolipidemic activites of various extracts of C. adscendens Roxb. were examined by Tatiya et al. (Maheshu V et al., 2014).

g) Hypolipidemic Activity:

Different animal models were used to examine the hypolipidemic effects of the aqueous extract of C. adscendens var. fimbriata in rats with hyperlipidemia (induced by triton and methimazole). Noorulhuda et al. studied the anthelmintic activity of different extracts of C. adscendens var. fimbriata against Pheretima posthuma (Annelida) and Ascaridia galli (nematode), and discovered that the aqueous extract exhibited significant activity compared to other extracts. Gowri and Chinaware's findings showed that the ethanol extract of C. adscendens displayed substantial antimutagenic activity against tested strains (Tatiya AU, Thorat Sheela S, etal., 2019).

2. Types of Caralluma plant activities, their distribution across the globe, and the specific active compounds responsible for these activities (Table No.1).

2.1 Antidiabetic Properties

A variety of treatments exist for managing blood sugar levels, but many have been associated with side effects. Plants offer fewer negative effects, are an affordable option for diabetes treatment, and are widely used [44]. Among the genus Caralluma, several species are recognized for their antidiabetic properties. For instance, Caralluma fimbriata, C. edulis, C. attenuates, and others have been scientifically validated. An ethanol extract from C. tuberculata has been found to significantly decrease G-6-Pase activity in rat liver cells. Additionally, the plant extract reduces the levels of sugar [45]. The role of various compounds, such as pregnane glycosides, in boosting insulin P production [46], and quercetin in enhancing glucose uptake, leading to the movement of glucose transporter 4 and the reduction of sugar synthesis by decreasing essential gluconeogenesis enzymes [47], is explained. Rutin, another compound, stimulates insulin secretion and helps in the restoration of glycogen stores. Different species of Caralluma plants exhibit these properties [48].

2.2 Anticancer Research

Cancer is a widespread and remarkable disease, with several factors contributing to its development. These include the formation of a large number of unstable free radicals, which lead to tumor growth and tissue death, potentially resulting in cancer . Additionally, genetic factors and lifestyle choices play a significant role in cancer development [49], with various cancers arising from different causes such as smoking and alcoholism [50]. There are numerous treatment options for cancer, but they often come with severe side effects. Therefore, utilizing medicinal plants with fewer adverse effects for treating these conditions is beneficial. The genus Caralluma stands out as a potential source of curative treatments for certain cancers, including lung, breast, and colorectal cancer. Some species within this genus, like C. tuberculata, C. attenuates, and C. europaea, have been scientifically validated for their effectiveness. In a particular study, three pregnane glycosides were identified in the C. tuberculata plant. It was discovered that russelioside significantly reduced NF-KB function in breast cancer cells [51], indicating that the chemical components of the plant, specifically the pregnane glycosides, may play a role in the Caralluma genus's anti-cancer and anti-tumor capabilities [52].

2.3 Anti-Rheumatic

Rheumatoid arthritis is a long-term autoimmune disease characterized by the deterioration of joints and ongoing inflammation of the synovial membrane [53]. The causes of this condition are associated with elevated rates of death and illness. There are numerous treatment options available, each with its own set of side effects. However, natural remedies, particularly those from plants, tend to have fewer side effects but are still effective. The genus Caralluma has been found to have anti-inflammatory and pain-relieving properties. Specifically, carumbelloside-III and carumbelloside-IV have demonstrated significant anti-inflammatory effects. Further analysis revealed that carumbelloside-III (4) is the 20R isomer of the originally identified 1 (20S isomer) of russelioside B from C. russelliana. This led to further research on the anti-inflammatory capabilities of Russellioside B (1) [54].

2.4 Antimalarial

Malaria is a severe illness caused by the Plasmodium parasite, known for its high mortality rate. There are various antimalarial drugs available, with natural remedies being in high demand due to their preference among many. Caralluma has shown antimalarial activity, thanks to its active components such as flavonoids and pregnane glycosides. Flavonoids have a unique mechanism of action that blocks the entry of L-glutamine myoinositol into infected red blood cells [55] [56].

2.5 Antihypertensive

High blood pressure in the arteries, known as hypertension, is a chronic condition [57]. The use of synthetic drugs for hypertension treatment has led to several adverse effects, including dry cough, which is a common side effect of ACE inhibitors. Natural alternatives, like Caralluma, contain flavonoids that act as secondary metabolites. These compounds influence nitric oxide levels and enhance the function of endothelial cells, making them a promising treatment option for hypertension [58].

2.6 Antimicrobial

Pathogenic bacteria cause disease through rapid reproduction and tissue damage. Antibacterial drugs reduce microbial infections but can have severe side effects if misused [59] [60]. Medicinal plants, such as C. quadrangula, C. nilagiriana, and C. tuberculata, demonstrate antibacterial potential, primarily attributed to flavonoids rather than pregnane glycosides [61] [62] .

CONCLUSION :-

The Caralluma genus shows promise as a provider of medicinal plant compounds. An in-depth examination of existing research shows that only a select few species have been explored for their potential medicinal uses. Historically, herbal remedies have been the primary form of treatment before the advent of modern pharmaceuticals. It is believed that approximately 80% of people worldwide, particularly in rural areas of developing and underdeveloped nations, depend on medicinal plants for healthcare, as per estimates. The use of Caralluma in traditional medicine is widespread in India, with claims of its effectiveness in protecting the liver, reducing inflammation, fighting cancer, acting as an antioxidant, combating fungal infections, and aiding in wound healing. Caralluma fimbriata stands out for its high content of tannins, flavonoids, and glycosides,

which could have both medicinal and nutritional benefits. This research aims to explore the chemical and nutritional aspects of the plant, suggesting its potential as a dietary substitute and for large-scale cultivation.

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