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"Pharmacological And Ethnomedicinal Significance of *Cyperus Rotundus Linn*"

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ABSTRACT:

Herbal therapy, one of humanity's oldest healing practices, continues to thrive, especially within traditional medicine systems such as Ayurveda, Unani, and Siddha.Cyperus rotundus, commonly known as nutgrass or purple nutsedge, is a resilient plant native to Asia and Africa, noted both for its medicinal uses and its invasive growth. Nutgrass is valued in South Asian traditional medicine for its therapeutic effects, while the World Health Organization (WHO) reports that about 80% of the global population still relies primarily on traditional treatments, with plant-based remedies forming a core part of health systems worldwide. The extensive spread of C. rotundus from Asia to the Americas highlights its adaptability, making it both a vital medicinal plant and a persistent weed in agriculture. It propagates primarily through tubers and rhizomes, allowing it to adapt to diverse environments, and environmental factors like temperature and daylight play significant roles in its growth and tuber development.Its bioactive compounds, including alkaloids, flavonoids, tannins, and essential oils like cyperene and camphene, are the source of its medicinal properties. These compounds give nutgrass anti-inflammatory, analgesic, antibacterial, and cytoprotective effects. In traditional medicine, it is used to address digestive issues, respiratory problems, skin disorders, infections, and conditions such as malaria, fever, and kidney stones. Nutgrass is also valued for its benefits to menstrual health, its astringent qualities, and its role in wound healing and managing certain psychiatric disorders.

Key words- *C. rotundus*, Anti-inflammatory, Traditional Medicine,WHO

INTRODUCTION: -

The earliest known method of healing, herbal therapy, has long been a mainstay of medical practice. Plant-based medicines were used to cure a variety of illnesses by many ancient societies, and this practice is still widely used today. The most popular type of healthcare in the world even now is herbal medicine, which offers natural cures and therapies that are still prized for their therapeutic effects and cultural importance.[1] *Cyperus rotundus Linn*,a member of the *Cyperaceae* family, is often referred to as mustaka in Urdu, muthaghas in Bengali, motha in Hindi, and nutgrass in English. The "world's worst weed" is a common moniker given how invasive it is. *Cyperus rotundus*, which is widely found in India and Pakistan, is a tenacious and problematic plant in many areas because it grows well in a variety of conditions, especially warm ones.[2] *Cyperus rotundus* has been dubbed the "world's worst weed" due to its extensive presence in 92 nations. It may flourish in a variety of climates, including temperate, tropical, and subtropical ones, because to its ability to adapt to warm conditions. Because of its adaptability and capacity to thrive in a variety of temperatures, it is an important invasive plant, particularly in agricultural areas where it affects productivity by competing with crops.[3] There is disagreement over *Cyperus rotundus*'s origins; some claim that it originated in the Indian subcontinent, while others place it in the northern and eastern parts of Australia. Its extensive prevalence throughout the Old World's tropical and subtropical regions, especially in Africa and Eurasia, has been proven by recent investigations. Its wide geographic distribution highlights both its adaptability and invasiveness.[4]

All people and animals depend on plants for their survival since they provide food, oxygen, and the basis for medical interventions. Herbal medicine continues to be an essential part of traditional treatment systems like Ayurveda, Siddha, Naturopathy, Unani, and Homeopathy, because to the widespread appreciation of plants for their therapeutic qualities. Because they are effective and have few adverse effects, several medicinal herbs are employed today for therapeutic purposes. The need to market these medicinal compounds, both in their pure and crude forms, is increasing despite their widespread use. Known for its wide spectrum of therapeutic effects, *Cyperus rotundus* is one of the most prominent medicinal plants with great healing potential. [5,6]

Cyperus rotundus is a historically noteworthy plant that is referenced in the 100 A.D. Charaka Samhita, an ancient Indian Ayurvedic treatise. This plant is valued commercially in India, especially in the Balaghat District, and is regarded as one of the native medicinal plants. Its acceptance in conventional

medical systems such as Ayurveda emphasizes both its ongoing therapeutic value and its historical significance in contemporary herbal therapies.[7,8] Siddha medicine has a long history, dating back more than 10,000 years. In places where it coexists with traditional medicine, it is an essential component of the healthcare system. With an emphasis on the harmony of body, mind, and spirit, this age-old healing technique promotes a holistic approach to health. Siddha practitioners cure a wide range of illnesses and promote well-being by using a variety of herbal treatments, dietary recommendations, and lifestyle routines. This shows how relevant Siddha is to modern healthcare.[9]

Fig .1 Plant of *cyperus rotundus linn.*

Historical and Contemporary Significance of *Cyperus rotundus linn.*: -

According to estimates from the World Health Organization (WHO), around 80% of people worldwide receive their medical care mostly from traditional medicines. Plant extracts or active chemicals derived from higher plants were used in around 25% of all prescriptions filled in community pharmacies between 1959 and 1980, demonstrating the importance of plant-based medications even in developed nations like the USA.[10] About 4.5 billion of the 7.5 billion people on the planet receive their primary medical care from traditional medicines. Approximately 0.93 billion people in India, which accounts for 17.84% of the world's population, still rely mostly on traditional medicine for their medical needs. [11,12] 'Rotundus' means "round," alluding to the tuber of the plant, while 'Cyperus' is an ancient Greek genus name. Over 5,000 species and roughly 104 genera make up the 'Cyperaceae' family worldwide, though this estimate fluctuates according on one's taxonomic perspective. With around 2,000 species, 'Carex'is the biggest genus in this family. 'Cyperus' is next, with roughly 550 species. Usually growing 10 to 75 cm tall, '*Cyperus rotundus*'is a perennial herb that is widely distributed over the plains of India. It thrives as a weed in gardens, waste areas, and by the sides of roads from sea level to an elevation of 1,800 meters [13] 'C. rotundus' was one of several starchy, tuberous sedges that Pliocene hominins may have eaten. Human dental calculus at the Al Khiday archaeological complex in central Sudan has been found to include biomarkers and tiny remnants of 'C. rotundus'. The evidence ranges from as early as 6700 BC to the Meroitic pre-Islamic Kingdom period, which occurred between 300 and 400 AD. [14]

***Synonyms:* [15,21]**

The various synonyms are Ambhoda, Ambudhara,Banya,Bhadrakshi, Bhadramusta,Gundra, Gunja, Meghaksha, Musta,Varahi, Varida, Varidhara, Kuru, Kurubilwa, Kurubinda, Pindamustaka, Pithara, Prachya, Purnakostha, Rajakaseruka, Sugandhi.

***Scientific name:* [22]**

Chloro*cyperus rotundus* (L.) Palla,
Cyperus olivaris Targioni Tozzetti,
Cyperus purpurovariegatus Boeckeler,
Cyperus stoloniferumpallidus Boeckeler,
Cyperus tetrastachyos Desf.,
Cyperus tuberosus Roxb,
Pycreus rotundus (L.) Hayek

Table 1. Taxonomic Classification of *Cyperus rotundus* [23,24]

Kingdom	Plantae
Sub kingdom	Tracheobionta
Superdivision	Spermatophyta

Division	Magnoliophyta
Class	Liliopsida
Subclass	Commelinidae
Order	Cyperales
Family	Cyperaceae
Genus	Cyperus.L
Species	*Cyperus rotundus*. L
Habitat	Weed found all over India

Indian Common Names [25,26]

- Marathi : Bimbal, Nagarmotha, Motha
- Hindi : Motha, Mutha
- English : Nut Grass
- Sanskrit : Bhadramusta,Granthi
- Gujarati : Motha
- Tamil : Korai
- Telugu : Tungagaddi
- Canarese : Koranarigadde, Tungegaddo
- Urdu : Saad kufi.

Vernacular Name[27,31]

- Assam : Mutha, Somad Koophee
- Bengali : Nagarmotha
- Malayalam : Muttanna, Muthanga
- Punjabi : Mutha, Motha
- Sinhalese : Kalanduru
- Arabic : Saad, Soadekufi,
- Burma : Vomonniu
- Persian : Mushkzenezamin
- Bombay : Barikmoth
- Mundari : Batha-bijir
- Santali : Tandisura
- French : Souchet rond
- German : Knolliges Zypergras
- Italian : Zigolo infestante
- Japanese : Hamasuge
- Korean : Hyangbuja
- Portuguese : Alho-bravo
- Spanish : Castañuela
- Swedish : Nötag
- Chinese : Xiangfu, Suo cao, Xiang fu zi

Classification CYPERUS ROTUNDUS [32]

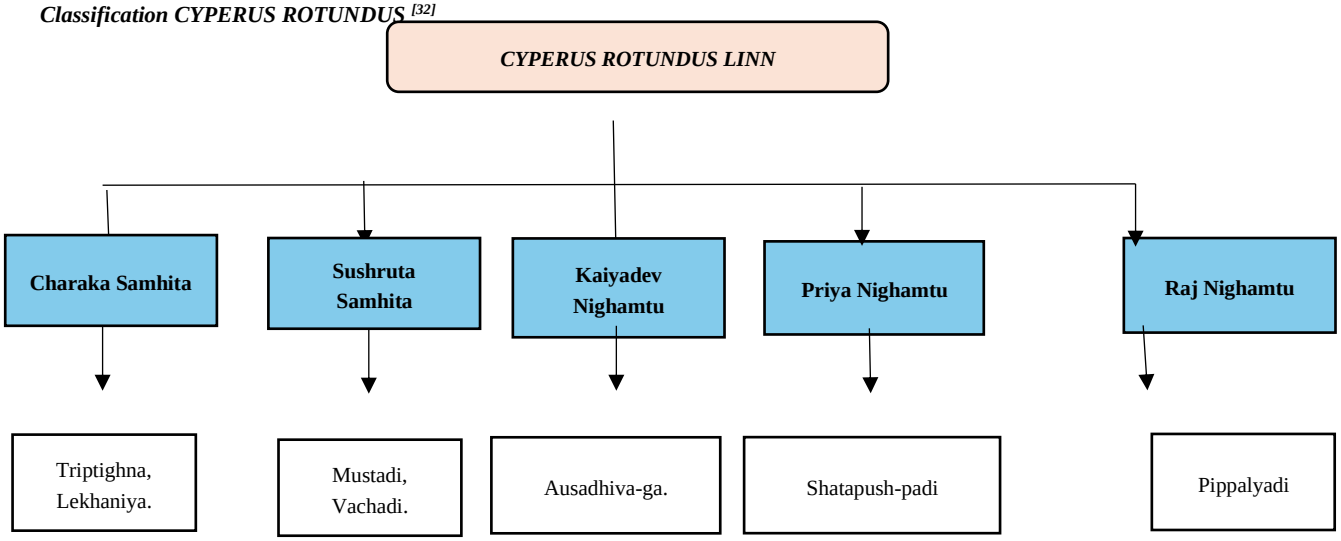


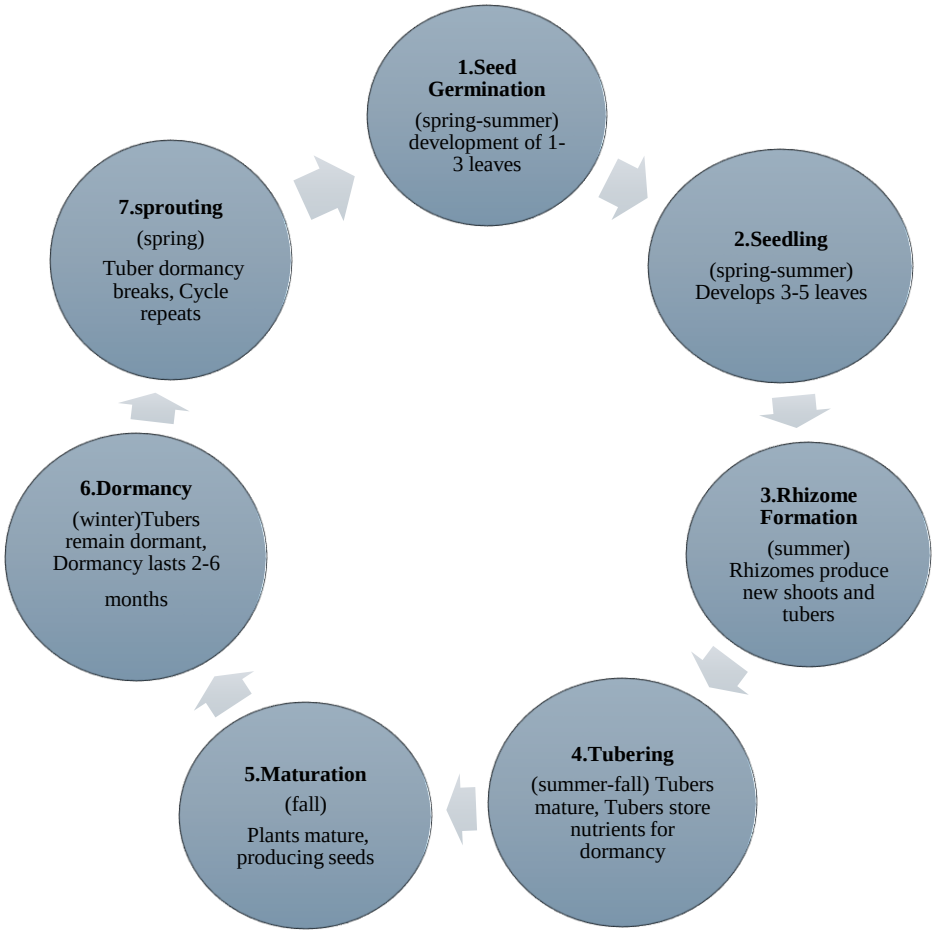
Table 2. Global Distribution and Habitat of *Cyperus rotundus*[33,38]

Continent	Nation
Eastern Asia	China, Japan, Korea, India, Nepal, Pakistan, SriLanka, Myanmar, Thailand, Vietnam, Indonesia, Malaysia, Philippines.
Africa	Algeria, Egypt, Libya, Morocco, Tunisia, Western Sahara, Chad, Djibouti, Eritrea, Ethiopia, Somalia, Sudan, Kenya, Tanzania, Uganda, Burundi, Equatorial, Guinea, Gabon, Rwanda, Democratic Republic of Congo, Benin, Burkina Faso, Cote D'Ivoire, Ghana, Guinea, Mali, Mauritania, Niger, Nigeria, Senegal, Sierra Leone, Togo, Angola, Malawi, Mozambique, Zambia, Zimbabwe, Botswana, Namibia, South Africa, Swaziland
Middle Asia	Kazakhstan, Kyrgyzstan, Turkmenistan, Uzbekistan
Western Asia	Afghanistan, Iran, Iraq, Saudi Arabia, Yemen, Palestine, Lebanon, Syria, Turkey
Europe	ustria, Switzerland, Albania, Bulgaria, Croatia, Greece, Romania, Serbia, Slovenia, France, Portugal, Spain
North America	United States of America (USA), Mexico
Southern America	Brazil, Bolivia, Colombia, Ecuador, Peru, Argentina
Caucasus	Armenia, Azerbaijan, Russian Federation
Pacific	Marshall Islands, Micronesia, Northern Mariana Islands

Life cycle

Cyperus rotundus, is a plant that may regenerate itself vigorously in the spring and is propagated mostly by rhizomes or tubers. This species usually produces seeds that are not viable when temperatures rise in temperate zones, meaning that the plant's ability to reproduce depends more on its vegetative structures than on the germination of seeds. *Cyperus rotundus* can effectively colonize and stay in its habitat thanks to this vegetative reproduction technique, especially in places where the conditions might not be conducive to seed development.[39,40] Temperature and average day length have a significant impact on *Cyperus rotundus* growth and development. The output of dry matter and tuber size are significantly influenced by these environmental factors. Longer days promote photosynthesis and energy buildup, which raises biomass and increases the size of tubers. The metabolic activities of plants are also impacted by temperature; whereas extremes can impede development, ideal temperatures encourage robust growth. When combined, these elements are essential for *Cyperus rotundus*'s successful growth, especially in agricultural environments where its expansion may affect crop yields. [41]

Fig 2. Life Cycle and Growth Patterns of (Cyperus rotundus Linn)



In *Cyperus rotundus*, the extension of tuber shoots towards light may result in the development of basal bulbs, leading to the growth of additional tubers and shoot rhizomes. The plant can multiply and take up more space because to this adaption. The plant usually finishes its life cycle by the end of the summer, with a flowering stem appearing in late spring. It takes *Cyperus rotundus* a remarkable amount of time to attain maturity, typically 3 to 6 weeks. The subterranean tubers and rhizomes of the plant survive and grow again the next spring when the above-ground portions of the plant die off as autumn approaches. This quick cycle of growth and regeneration helps explain why it persists as a weed in a variety of settings [42] 'Apical dominance' is a mechanism commonly seen in the rhizomes of *Cyperus rotundus* that prevents the formation of other tubers while one is actively growing. Auxins and other hormones are released by the dominant tuber to limit the creation of lateral tubers, allowing it to devote resources more efficiently to its own growth. By concentrating energy on the most active tuber and optimizing growth, this mechanism gives the plant a competitive edge in its surroundings. The plant uses this tactic to help spread and establish itself in a variety of settings in addition to ensuring its survival. [43,44]

Botanical description

The slender, upright perennial sedge *Cyperus rotundus*, sometimes called nutgrass, spreads by a fibrous root structure. Initially covered in scaly, modified leaves, the subterranean structures, called rhizomes, are white and mushy; but, as they age, they turn brown and woody. A rhizome may inflate into a tiny, spherical structure known as a 'Basal bulb' once it reaches the surface, from which new roots, shoots, and other rhizomes grow. Nutgrass rhizomes also produce tubers, which house starch as a food source and can produce new rhizomes or whole plants. This method of reproduction improves its capacity to spread and establish itself in a variety of settings.[45] In length, the tubers range from 1 to 3.5 cm. Initially luscious and white, they eventually take on a hard, brown feel. The scientific term "rotundus," meaning "round," reflects the tubers' rounded form.[46] The smooth, upright stems of nutgrass (*Cyperus rotundus*) are triangular in cross-section and usually grow to a height of 30 to 40 cm. The leaves are grouped in threes down the stem and emerge from the base of the plant. They have sharp tips, a grooved upper surface, and are dark green, smooth, and lustrous. With a length of 20 to 30 cm and a width of 0.2 to 1 cm, the leaves are long and slender. This plant bears its blooms at the ends of its stems in clusters called inflorescences. Reddish-brown to purple spikelets on three to nine stalks of various lengths make up each inflorescence. Nutgrass's alternate name, purple nutsedge, comes from its coloring. Ten to forty blooms, each with no petals and encased in dry, oval, membrane bracts called glumes, are found within each spikelet, which is around 3.5 cm long. The fruit of the nutgrass is dry, single-seeded, brown to black, and up to two millimeters longIt has a network of gray lines [47,50]

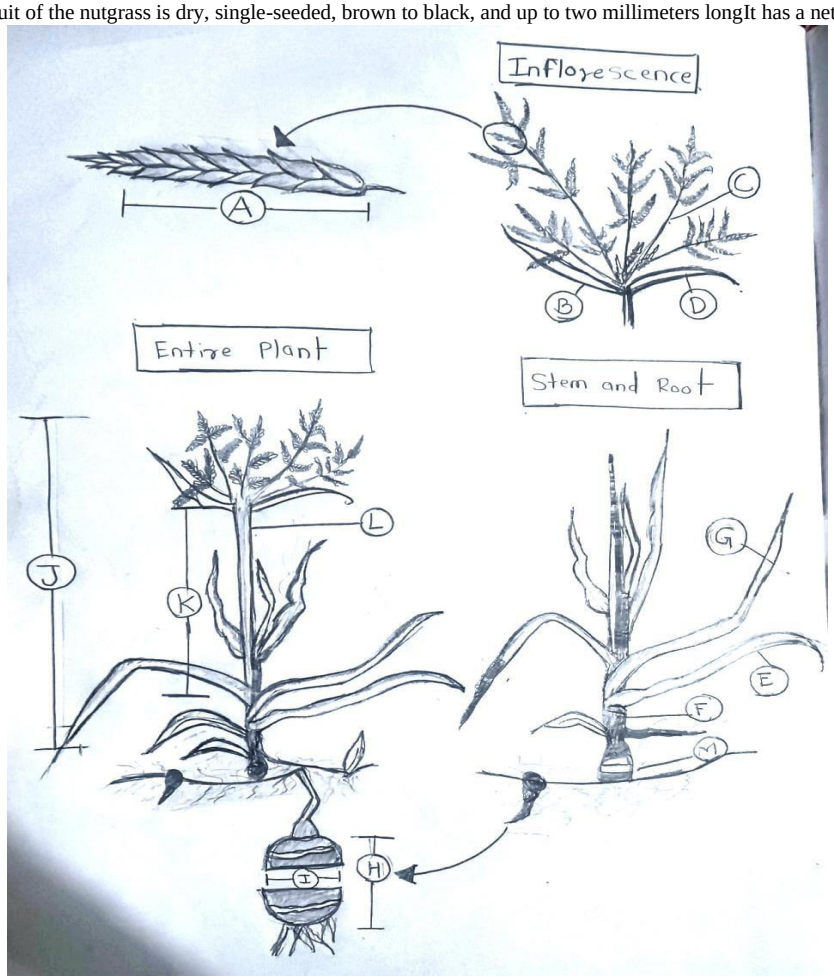


fig 3. Purple nutsedge showing the quantitative characters measured

(A- longest spikelet for a seed , **B**-Bract width involucre ,**C**-lengthiest rachis, **D**-Bract lengthiest, **E**-largest leaf per stalk, **F**-Girth of the fascicles **, G**-Length, longest leaf per stalk involucral,**H**-Length of the fully developed tube, **I**-Size of the mature tube, **J** -Height of shoots at maturity, **K** -Length of culm, **L**-Culm, **M**-Basal bulb diameter)

Table 3. Important formulations of ayurvedic [51,52,53]

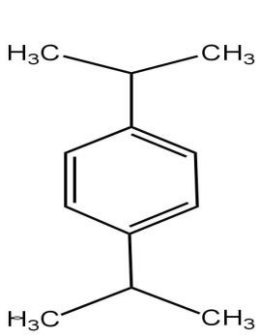
Formulations	Plant Parts used	Therapeutic Uses	Reference
Ardrakakhandawaleha	Rhizome	Itching, swelling, regurgitation, anorexia, asthma, coughing, and epistaxis.	[54]
Ashokarista	Rhizome	Health of menstruation, reproduction, digestion, and bleeding	[55]
Kutajashtaka kvatha	Rhizome, tubers	gastrointestinal problems (bloating, diarrhea), skin conditions including eczema and acne,health of the mouth (bad breath, gum inflammation),breathing issues (asthma, bronchitis),Warmth	[56]
Mustakadi Kwatha	Rhizome	gastrointestinal problems (bloating, diarrhea), breathing issues (asthma, bronchitis), The fever,skin conditions including eczema and acne,Health of the mouth (bad breath, gum inflammation)	[57]
Mustakarishta	Rhizomes	digestive disorders (bloating, diarrhea), respiratory troubles (asthma, bronchitis), Feverconditions of the skin (eczema, acne), oral health (bad breath, inflamed gums)	[58]
Shadangapaneeya	Tubers	Anorexia, diarrhea, fever, and other conditions. Additionally, it can aid with hunger stimulation, thirst reduction, and bodily detoxification.	[59]
Vatsakadi churna	Dried Rhizome	Diarrhea,Dysentery , Indigestion , Flatulence ,Abdominal pain, Respiratory issues (bronchitis, asthma).	[60]
Stanyashodhana kashaya	Rhizome	problems with women's reproductive systems (infertility, irregular menstruation), care after giving birth, symptoms associated with menopause, digestive issues, assistance with lactation	[61]

Physicochemical Properties[62]

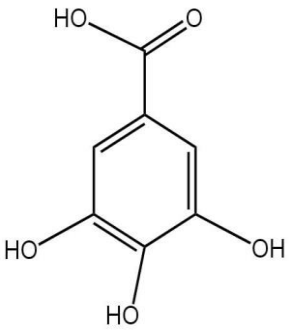
The physical and chemical characteristics of *Cyperus rotundus* Acid soluble Ash content (w/w %) 3.00, extractive alcohol soluble (w/w %) Line-spread and adhesive strength at 50°C, 9.068 26.73 percent amylose, 5.9–6.35 percent total ash, and 20°C viscosity Content of white starch: 24.1; water-soluble ash: 1.10; water-soluble extract: 16.36.

Phytochemistry

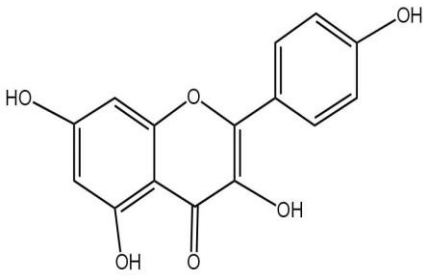
The worst weed in the world, *C. rotundus*, has yielded several phytochemical substances [63]and some of these substances are utilized in China, India, Latin America, and other places because they have therapeutic qualities.[64-66]Numerous substances, such as alkaloids, flavonoids, tannins, starch, glycosides, furochromones, monoterpenes, sesquiterpenes, sitosterol, and fatty oils, have been identified through phytochemical research on *Cyperus rotundus*. Essential fatty acids including linolenic, myristic, and stearic acids are present in these oils together with a neutral waxy molecule called glycerol. The plant's biological activity and possible therapeutic uses are influenced by its varied phytochemical profile.[67-70] The main substances that were separated from the essential oil and the C. rotundus rhizome extracts are: Calcium, Camphene, Copaene, Cyperene, Cyperenone, Cyperol, Cyperolone, Alpha-cyperone, Alpha-rotunol, Beta-cyperone, Beta-pinene, Betarotunol, and Beta-selinene. The cyclorotundone Dpoxyguaiene, D-copadiene, and D-fructose and D-glycerol[71] alkaloids; rotundine A, rotundine B, rotundine C, flavonoids; luteolin 3′-methyl ether, luteolin 7,3′-dimethyl ether, luteolin 5,3′-dimethyl ether, luteolin 7-glucuronide, luteolin 4′-glucoside, orientin, quercetin, quercetin 3-rutinoside, kaempferol, triterpenoid; n-tritriacontan-16-one, n-pentadecanyl-9-octadecenoate, n-tetradecanyl-n-octadec-9, 12-dienoate, khellin, visnagin, ammiol, khellol-β-D-glucopyranoside, phenylpropanoids; isoaragoside, chionoside A, pungenin, salidroside, helioside C, phenolic acids; gallic acid, chlorogenic acid, caffeic acid, p-coumaric acid, loganic acid, ferulic acid, ellagic acid, iridoides, benzodihydrofurans.[72]



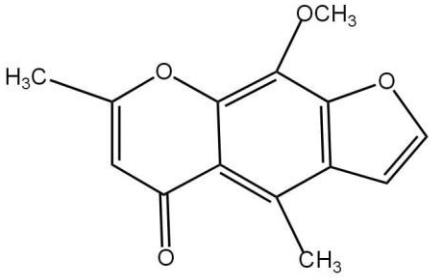
Cyperene



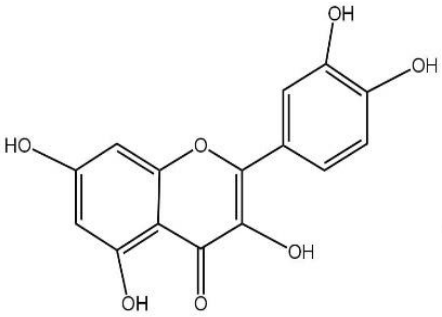
Gallic acid



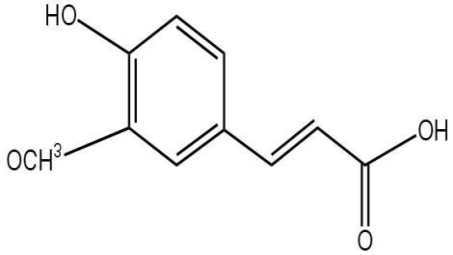
Kaempferol



Khellin



Quercetin



Ferulic acid

Medicinal uses

A plant that is frequently used in traditional medicine across the world to cure a range of illnesses is C. rotundus, usually referred to as nutgrass or purple nut sedge. Its potential therapeutic benefits, including as anti-inflammatory, analgesic, and antibacterial activities, have been acknowledged. The fact that C. rotundus is used in many cultures to treat ailments including skin, respiratory, and digestive illnesses demonstrates the importance of this plant in herbal medicines and the larger area of natural medicine. Its lengthy history of usage in traditional methods emphasizes the necessity of more scientific research into its potential medical benefits.[73] As a diaphoretic, analgesic, antiarthritic, diuretic, astringent, antispasmodic, antipyretic, antidiabetic, cytoprotective, anti-inflammatory, antimutagenic, and antimicrobial, the Ayurvedic medical system suggests utilizing the rhizomes of C. rotundus.[74] apoptotic and antioxidant, carminative, fragrant, emmenagogue, and antitussive.[75] Given its components, C. rotundus has many minerals, enzymes, and carbohydrates that stimulate different biochemical processes and facilitate digestion. This makes it a potentially effective indigestion remedy. Its nutritional composition may also aid in the treatment of psychiatric and metabolic disorders, promoting general health and wellbeing. Its varied actions highlight both its potential for wider therapeutic uses and its importance in conventional medicine.[76] Using its therapeutic qualities to assist a range of hematological problems, C. rotundus is also utilized to treat blood abnormalities. This reflects its function in improving blood health and includes applications for problems like anemia and other associated illnesses. It is a useful part of traditional medicine for treating blood-related conditions because of its many therapeutic advantages.[77] Traditional medicine uses a lot of C. rotundus to treat a lot of different ailments, including digestive problems including gas, diarrhea, colic, nausea, and vomiting. In addition, it works well for fever, kidney and bladder stones, and renal and vesical calculi. The

herb also treats respiratory conditions including bronchitis, infections of the intestines, cough, and malaria. Additionally, C. rotundus is known to help with wounds, amenorrhea (lack of menstruation), poor breastfeeding, the loss of memory, and skin problems. Additionally, food illness, bug stings, and dysmenorrhea (difficult menstruation) and dysuria (painful urination) can all be helped by it. This wide variety of medicinal applications demonstrates the important part C. rotundus plays in fostering health and wellbeing.[78] Conventional medicine uses C. rotundus to treat several ailments, such as intestinal parasites, diarrhea, flatulence, colic, nausea and vomiting, and dyspepsia. Moreover, it works effectively for bronchitis, fever, malaria, cough, and vesical calculi (stones in the kidneys and bladder), as well as urinary tenesmus (a sensation of incomplete urination). C. rotundus is also used to treat wounds, skin conditions, amenorrhea (absence of menstruation), dysmenorrhea (painful menstruation), and a lack of milk production. Menstrual difficulties, infertility, food poisoning, memory loss, insect bites, indigestion, dysuria (painful urination), and cervical cancer may all benefit from its use. Additionally, the aromatic oils that are derived from C. rotundus are used to make scented items and fragrances, augmenting its economic and medicinal value. [79,83]

Alternative and complementary medicinal uses

The cosmetic industry makes extensive use of the aromatic oil extracted from the rhizome of *Cyperus rotundus*, especially in scented goods and fragrances. Numerous rhizome preparations have a variety of medicinal uses, including as an antitussive, carminative, analgesic, and astringent. These extracts are useful for a variety of medical uses since they are also known for their litholytic (dissolving kidney stones), tonic, and emmenagogue (increasing menstrual flow) properties.[84]

conclusion

Cyperus rotundus Linn., commonly known as nutgrass or purple nutsedge, is both a globally invasive weed and a highly valued medicinal plant in traditional systems like Ayurveda and Siddha. Rich in bioactive compounds such as flavonoids, terpenoids, and essential oils, it is used to treat a wide range of ailments including digestive issues, respiratory conditions, menstrual disorders, and skin diseases. Despite its agricultural challenges, its extensive therapeutic potential and use in herbal medicine, cosmetics, and pharmaceuticals underscore its significant medicinal and economic value.

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