

Cultivation and Potentials of Cyperaceae Family

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Introduction: Sedges belong to the Cyperaceae family while grasses belong Poaceae family (Christenhusz and Byng, 2016). Sedges are the third largest family among monocots which is made up of 106 genera and 5387 species (Govaerts et al., 2007). It is tracked from genius name *Cyperus*, emanate from the Greek “Kupeiros” meaning sedge. They appear mainly in moist temperate to wet tropical regions of the world. Earlier, Cyperaceae and Poaceae have been sighted as connected plant families (Csilla et al., 2021) and are allied with the Juncaceae and Thurniaceae families (Csilla et al., 2021). Sedges differ from grasses by having triangular and solid stems while grasses have hollow stems except at their nodes. The leaves of sedges are arranged spirally in three ranks while grasses have their leaves arranged alternately in two ranks (Mills, 2018). The leaf sheath is closed with an achene fruit in sedges but the grasses have their leaf sheath open and their fruit type is called caryopsis (grain). Plants species of family Cyperaceae primarily grow in water bodies, wet places, and some species are found in sandy soil and rocky areas (Maitreya, 2015).

Plant Description: The inflorescence in cyperaceae consist of many spikelets. The Spikelet of a central axis, the rachilla to which are inclined to an over lapping order of scale like bractlets and the Perianth may unnoticeable flowers envelop by the distichously or spirally place glumes on spikelets. The indehiscent fruits are nuts or achenes. Sedges show up alike to grasses, rushes are round, and grasses are hollow right up from the ground (Mishra and Chauhan, 2013). Sedges are in the Cyperaceae family and they have no nodes. Sedges are primarily grass-like herbs with linear leaves and parallel venation. Plants have minute inconspicuous flowers enclosed by the distichously or spirally arranged glumes on spikelets. The indehiscent fruits are nut or achenes. The culms are hard and they have triangular design stems which give them edges. They have three grade leaves which are

grouped spirally in three vertical planes along the stems and are mainly perennial and select moist to wet environments. Their leaves blades may be wrapped and the base of each leaf is restricted around the stem. Sedges exhibit only floral stems and their wind-pollinated flowers lean to be inconspicuous. Their indehiscent fruits are nuts or achenes and are surrounded by a single scale. Majority of sedges exist in sunny, moist to wet habitats and grow in ditches, canal banks, under stories of diverse types of forest, both temperate and tropical. Grasses are in Poaceae (Graminae) family. The stems of grasses or sedge are cylindrical and shield in nodes (swollen joints). Grasses have round stems and are hollows with nodes along the stems. They are annuals or perennials, their leaf blades are flat and their leaf sheaths are open, the leaves of grasses is said to be two ranked meaning they increase both vegetative and floral stems are wind-pollinated flowers, their fruits are seeds and are shielded by two papery scales. They grow in ever-accelerating tufts, the new shoots they dispatch out are known as tillers. The fibrous roots of grasses can measure 182.88cm thereby permitting them to take in water and mineral and stabilizing both the plants and soil. Rushes are in Juncaceae family, they are spherical but alike to sedge in that they have hard culms and non-appearance of nodes, they have zero to a few leaves along their stems. Their flowers have six tepals that make them aspire star-shaped (Mishra et al., 2016).

The Culum diameter and leaf breath of cyperaceae are controlled about halfway ahead the organ. Culum length is controlled from the base of the plant to the lowest involucre bract at base of inflorescence. The spikelets are mainly and clearly identified units with diverse modified bracts (glumes) each subtending a bisexual or unisexual flower. A leaf like bract and a two-keeled modified bract are posing at the junction of the spikelets and inflorescence branch. The flower normally has three stamen that projects for the spikelets when pollen is being liberated.

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Scientific Classification

Kingdom	Plantae
Phylum	Charophyta
Class	Equiseropsida
Sub-class	Magnolidae
Order	Poales
Family	Cyperaceae

(Govaerts *et al.*, 2003)

Common plants in this family include the following Cotton-grass (*Eriophorum angustifolium*), Spike-rush (*Eleocharis palustris*), Sawgrass (*Cladium mariscus*), Purple Nut sedge (*Cyperus rotundus*), white star sedge (*Rhynchospora colorata*), Yellow Nut sedge (*Cyperus esculentus*) etc.

Paper reed (*Cyperus papyrus*): This is a herbaceous perennial plant that originated in Africa, It can advance to 4m to 5m high. It requires a fertile soil and it is adaptable in term of soil acidity. It grows at a soil pH of between 6.0 and 8.0 and permits annual temperature of 20°C to 30°C. It develops in wet, swampy areas around landscape ponds and rain gardens that admit constant moisture. It forms a grass-like clump of triangular green stems that rise up from thick, woody rhizomes. Each stem is topped by a dense cluster of thin, bright green, thread-like stems around 10 to 30cm in length. Greenish-brown flower clusters eventually appear at the ends of the rays, giving way to brown nut-like fruits. It is a source of papyrus paper, parts of it can be eaten and the highly buoyant stems can be made into boats. *C. papyrus* advance in full sun, in wet swamps and on lake margins amidst Africa. The flowering heads make standard nesting sites for many social species of birds. It is not a deep water plant and does not grow fully submerge in water Govaerts *et al.*, 2003).

Tiger Nut (*Cyperus esculentus*): This is a light green perennial sedge growing to about 1m in height with lonely stems growing from a tuber. The stems are triangular in partition and maintain slender leaves 3-10mm wide. The flowers of the plant are distinctive with a cluster of flat oval seeds fenced by four hanging leaf-like bracts positioned 90 degrees from each other. The plant foliage is very hard and fibrous and is often mistaken for a grass. Tiger nut planting is regularly done in flat soils. The separation between ridges is 60cm and seeds are planted manually. The planting distance between seeds may vary from 15 to 20cm and seedlings depth is 8cm (Coskuner *et al.*, 2002). It can be planted in any type of soil but they prefer well-drained sandy loam and majorly planted in the Northern part of the country. It is planted between April and May (Chukwuma *et al.*, 2010). The tubers develop about 6-8 weeks after seedlings emergence and grow quickly during July-August. The maturing is around 90-110 days (Toungos and Babayola, 2019). *Cyperus esculentus* cultivation requires a mild-climate. Low temperature, shade and light intensity can inhibit flowering. Tuber initiation is inhibited by high levels

of gibberellic acid. Flower initiation occurs under photoperiods of 12 to 14 hours per day. Harvest usually occurs when the leaves are scorched after 4 to 5 months of its planting. Immediately, after harvesting the tiger nut are washed with water in order to remove sand and small stones. Fruits are small single seeded achenes. The tubers, seeds and leaves of sedge are preferred food for many animal species residing in wet lands (Tande and Lipkin, 2003).

Nutsedge (*Cyperus rotundus*): This is a perennial plant that may reach a height of up to 40cm, the leaves sprout in ranks of three from the base of the plant around 5-20cm. The flower stems have a triangular cross-section. The flower is bisexual, reddish-brown to purple, and has three stamina and a three stigma pistol with the inflorescences having three to eight unequal spikes. The fruit is a three-angled achene (small, dry, not opening when ripe, one seeded). The root system of a young plant initially forms white, fleshy rhizomes. Some rhizome grow upward in the soil and then form a bulb- like structure from which new shoots and roots grow. Other rhizomes grow horizontally or downward and form dark reddish-brown tubers or chains of tubers. *C. rotundus* prefers dry condition, but will tolerate moist soils and often grows in wastelands and in crop fields (Govaerts *et al.*, 2003).

Cyperus helferi: This is an aquatic plant species that belongs to the family of *Cyperaceae*. It is a native to Thailand and it grows naturally in stream, rivers and other bodies of water with slow-moving or still water. It has narrow, grass-like leaves that can grow up to 30cm in length and 1-2mm in width. The leaves are bright green in colour and have a distinctive curling or twisting habit which gives the plant a unique and attractive appearance (Govaerts *et al.*, 2003).

Grassland sedge (*Carex divulsa*): This is a cool-season sedge, it tolerate full sun limited to full shade and a wide variety of soil conditions as well as heat and humidity. It grows in arching clumps spreading 60.96cm wide with sparkling green leaves and a tidy habit. It flourishes under landscape with dry shade (Govaerts *et al.*, 2003).

Significance of Cyperaceae family: (1.) Environmental cleaning: The fast pace of industrialization and urbanization increased many environmental problem and liberated various kinds of pollutants into our natural system. These pollutants can be classified into four categories as nutrients, organic contaminants, xenobiotics and metals and metalloids (Marchand *et al.*, 2010). Aquatic ecosystem like wetlands are direct or indirect recipient of potentially toxic liquid and solid waste arising from domestic, agricultural and industrial activities (Hadad *et al.*, 2006., Valipour *et al.*, 2009). Sedges are useful indicators of environmental degradation, for example some species are being sensitive to pollution or to receding water levels, removal of sediments, water flood stabilization and flood control (Mishra *et al.*, 2015). Many plants advancing in and around wetlands (sedges) have a natural capacity to take up, gather or degrade organic and inorganic substances such as heavy metals (McIntyre, 2003).

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Soda *et al.* (2012); Yadaw *et al.*, (2012) reported that 65-90% parts sedge (*C. alternifolnes*) is used in ejecting heavy metal such as copper, nickel, chromate, zinc and cobalt. Cheng *et al.* (2002) equally reported that piling of aluminum and manganese is suppressed with umbrella sedge. *C. articulatus* and *C. exaltatus* is used to bio accumulation of nickel in good amounts to decontaminate soil affected by mine waste (Hussein and Manal, 2012; Mganga *et al.*, 2011). It has been documented that *C. rotundus* are able to endure salt stress (Mishra *et al.*, 2016). Chatterjee *et al.* (2011) observed that *C. rotundus* accumulate chromate, manganese, iron, copper, zinc and lead in some wetlands which emphasizes the importance of phytoremediation as a cost-effective tool for environmental cleaning. *C. helferi* is helpful i.e. aquarium ecosystems. It assists to oxygenate the water, remove excess nutrients and pollutants and equally provide shelter and spawning sites for fish and other aquatic organisms.

(2) Food value: Two species of sedges are considered as crop plants, namely tiger nut (*Cyperus esculentus*) and Chinese water chestnut (*Eleocharis dulcis*). The edible plant part is the underground tuber, which serve as a subsistence food (Macho, 2014). The tubers are majorly used to produce drinks or beverages (Udeozor, 2012). Chinese water chestnut (*Eleocharis dulcis*) which has crisp white flesh can be consumed uncooked or lightly boiled (Terri, 2008). The carbohydrates content in the tubers is about 90% by dry weight. Okorie and Nwanekezi (2014) stated that tiger nut is highly required by children and women suffering from malnutrition since the crop has high amounts of zinc, iron and vitamin C. Wild boars feed, in the tubers of *C. rotundus*, many species of sedges advance in grasslands, wasteland, wetlands and other habitats along with grass and hence form part of the diet of grazing cattle (Prasad and Singh, 2002). More than half of sedge species growing in wetlands bear a large crop of water-dispersed fruits and tubers which serve as food for insects, birds (especially passerines) and some mammals. Sedges (*C. vernacula*) assist as the foundation for terrestrial and aquatic food chains and are source of forage for butterfly, caterpillars, water fowl and a wide variety of mammals comprising rabbits, bears, ground squirrels etc. The tubers, seeds and leaves of sedges are chosen food for many animal species dwelling in wet-lands (Tande and Likpin, 2003). The tubers, seeds and leaves of sedges are chosen food for many animal species dwelling in wet-lands (Tande and Likpin, 2003). Ezech, Gordon and Niranjan (2014) disclosed that in roasted tiger nut oil, vanilla has been renowned and it has a good outcome and marketable quality because it enhances the overall aroma of oil. Tiger nut oil serve as a natural alternative source of vanilla or aromatic food flavouring and it comprises more than the adult protein needed for daily intake (Bosch *et al.*, 2005). The flour of tiger nut is used to make cakes and biscuits and the oil is used for cooking (Wise, 2009). Flour of roasted tiger nut is sometimes added to biscuits and other bakery. Belewu and Belewu (2007) and Ayeni (2022) noted that *C. esculentus* contain among others iron, zinc, and vitamin A and when consumed can fight the hidden hunger caused by

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deficiencies of these micronutrients in the populace which can be devastating (Iyagba, 2023). The products are used in making soap and starch extracts. It is used for the production of nougat, jam, beer and as flavouring agents in ice cream and in the preparation of kunu. It can be used naturally with salads on deep frying

(3) Ecological importance: Tall perennials with widespread rhizome arrangement (e.g. *Carex aquatilis*, *Cyperus iynghyei* and *C. utriculata*) that can grab water's edge materials are very suitable vegetation for erosion (Tande and Lipkin, 2003). The heavy root system of many other sedges such as *C. corymbosus*, *C. malaccensis*, etc acts as a good soil binder and hence prevent erosion, revegetation after natural disturbances and to amend and improve soil fertility (Simpson and Inglis, 2001). It can be planted as an accent plant, in small groups or in a sweep along a slope to avert erosion. It works well in a meadow, rain or rock garden, or any other area of the landscape where a ground cover is vital.

(4) Recycling nutrients: Sedge plants can successfully function under both aerobic and anaerobic conditions (rooted in wet soil). They play an essential role in cycling nutrients and create energy flow by pumping nutrients to organisms as they grow, die and supply detritus to other inhabitants of wetland ecosystems both plants and animals.

(5) Production of peat and peat soil: Tande *et al.* (2003) reported that sedge species are the main peat formers in marshy wetland environments. Anderson *et al.* (1996) stated that some sedges are calciphiles which like to grow in high pH, pollutants and sediments.

(6) Habitat for fauna diversity: Sedges are source of energy especially during feeding, breeding and nesting activities. For example, waterfowl, cranes and some other wandering birds rely on sedges. They are important link in various food chains and energy transfer chains while its fruits supply food to insects, birds and some mammals, its leaves are used as nesting materials by various birds (Mishra *et al.*, 2016). Sedge dominated wetlands are a good habitat for fish as they are used as spawning grounds, food sources and hiding place. Sedge has socioeconomic and ethnobotanical value and significantly contributes to the diversity and aesthetic values of wetlands.

(7) Paper industry: Cyperaceae species are used in ancient Egypt in making paper, its stems can be bundled together to make rafts. The stems and leaves of various sedges are used in basketry, to make hats and mats, for thatch and in various other fashions. Anon.2026)

(8) Medicinal uses: Cyperus plants are used in handling of the stomach and bowel upset as diuretic, digestant and lactodepurant purposes (Udari, 2018). Its extracts act as a selective drug for the treatment of bronchitis, blood disorders, menstrual irregularities, diarrhoea, dysentery and inflammatory disease (Peerzade *et al.*, 2015). Oleic acid is the most abundant fatty acid in tiger nut and has been involved in the reduction of heart diseases, diabetes and cancer (Lun and Theobald, 2006; Jones *et al.*, 2014). Tiger nut advances a healthy response to bloating and digestive

distress and its Vitamins C and E help to support body's immune response. Their antibacterial activity help against several human pathogens eg *Escherichia coli*, *staphylococcus* and *salmonella*. It also averts problems like premature ageing, blemishes, wrinkles and age spots. The amino acid in cyperaceae assist to keep blood sugar levels in a healthy range by enhancing insulin production and sensitivity. Chukwuma *et al.* (2010) revealed that tiger nut has a positive influence on activating blood circulation and preventing heart disease and cancer. The extract facilitates the biosynthesis of testosterone and prevents DNA damage in hepatocytes and against memory loss (Udefa *et al.*, 2020). The oil is a powerful antioxidant, averting the proliferation of free radicals in the skin tissues. It also assists in treating skin conditions such as eczema and psoriasis, it has a first-class ability to pierce into scalp and hair keeping them hydrated, nourished and protected (Lasekan, 2013), enhances normal menstruation and treat oral conditions such as mouth and gum ulcers.

(9) Other uses: Several other uses of cyperaceae are as:

- ornamentals examples *C. alternifolius* and *C. scripusgrossus*
- *C. stoloniferous* produces aromatic scented oil
- Important component in wetland , produces bulk food for aquatic animal (tubers and fruits),
- Plays important role in succession,
- Used in weaving of mats, baskets, screens and scandals because of their strong fibrous stem and leave (*C. togestes*). (Anon. 2026)

Conclusion: The *Cyperaceae* family plays an indispensable role in retaining ecological balance, supplying economic benefits and supporting human well-being. Cultivating these species can contribute to sustainable development, wetland restoration and biodiversity conservation. Addressing challenges posed by climate change and habitat destruction is essential for preserving the relevance of the *Cyperaceae* family.

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