

A Review of Phytochemical and Pharmacological Analysis of Poaceae Family Plants

Kinjal Damor¹, Riya Kadia², Nainesh Modi³

¹Master of Botany, Department of Botany, USSC, Gujarat University, Ahmedabad, Gujarat, India

²Research Scholar, Department of Botany, USSC, Gujarat University, Ahmedabad, Gujarat, India

³Professor, Department of Botany, USSC, Gujarat University, Ahmedabad, Gujarat, India

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ABSTRACT

The Poaceae family has 12,000 species of plants and approximately 800 genera. Around 1291 Poaceae family plant species are found in India. Grasses have been utilized since ancient times for nourishment, medicine, ornamental purposes, handcrafts, ceremonies, etc. Some common medicinal grasses like *Aristida setacea* L., *Chrysopogon aciculatus* (Retz.) Trin., *Chrysopogon zizanioides* (L.) Roberty, *Cynodon dactylon* (L.) pers, *Dactyloctenium aegyptium* (L.) Willd, *Digitaria bicornis* (Lam.), and *Echinochloa colona* (L.) Link, *Eragrostis amabilis* (L.) Wight & Aen. ex Nees, *Eragrostis coarctata* (L.), *Eulaliopsis binata* (Retz.), *Hackelochloa granularis* (L.) Kuntze, *Imperata cylindrica* (L.) P. Beauv., *Leersia hexandra* (Sw.), *Oplismenus compositus* (L.) P. Beauv., have been extensively used in India. Phytochemicals possess important pharmacological activities like antioxidant, anti-inflammatory, cancer prevention, hormone regulation, immune system support, cardiovascular health, and brain health. Pharmacological activities are important for disease treatment and prevention, drug discovery and development, veterinary medicine, etc. Certain grass species are being used as an ethno-medicine. Number of phytochemical compounds are present which are having excellent pharmacological activity. *Saccharum spontaneum* L. also used as an ethnomedicine to treat various kinds of disease like microbial infections, gynecological issues, piles, sexual weakness, and burning sensations. Various phytochemicals are reported from *Saccharum spontaneum* L. leaves, like alkaloids, phenolic compounds, coumarins, and quinones. This plant has been recorded to have numerous pharmacological activities, such as CNS depressant, antipsychotic, antibacterial, antifungal, cytotoxic, antioxidant, anti-inflammatory, and anti-diarrheal. *Eulaliopsis binata*

(Retz.) used to treat digestion problems, skin diseases, wound healing, and bronchitis. This plant has a number of phytochemical components, including alkaloids, triterpenoids, glycosides, phenolic acids, essential oils, etc. Also, this plant species has antioxidant, anti-bacterial, and anti-lithiasis activities. *Cynodon dactylon* (L.) pers. is also used as a folk treatment for cancer, epilepsy, snakebites, bronchitis, leucoderma, asthma, tumors, and eye disorders. Also this plant contains phytochemicals including terpenoids, resins, phytosterols, reducing sugars, volatile oils, and fixed oils. It has numerous pharmacological activities, including anti-diabetic, anticancer, antimicrobial, antiviral, anti-tumor, anti-infertility, antioxidant, and anti-inflammatory activity.

Keywords: *Saccharum spontaneum* L., *Eulaliopsis binata* (Retz.), *Cynodon dactylon* (L.) pers, ethnomedicinal uses, phytochemical compounds, pharmacological activity

I. INTRODUCTION

Poaceae (Gramineae), or the grass family, is one of the most significant monocotyledonous flowering plant family (Gebashe *et al.*, 2019). Poaceae is the world's fourth biggest plant family. This family consists of 800 genera and 12,000 species and is divided into 12 subfamilies and 54 tribes. In India around 1291 plant species of the Poaceae family are reported, and in Gujarat almost 284 plant species of Poaceae family are found (Gavali *et al.*, 2004). The Poaceae family contains cereal crop species, bamboos, and important weed species (Soreng *et al.*, 2015). Grassland covers 20% of the world's vegetation (Edwards *et al.*, 2010). Plants of the Poaceae family are typically beneficial to both humans and animals as green herbage, dried fodder, and cereal crops. These family plants are being utilized in traditional medicine to treat diseases like indigestion, intestinal parasites, menorrhagia, dysmenorrhea, colds, cuts, and teething pain (Hutching *et al.*, 1996). Several drugs have been developed based on various botanical compounds of ethno-medicinal plants, including digitoxin from *Digitalis pupurea* L. (cardiac tonic), cocaine from

Erythroxylum coca Lam., and quinine (antimalarial drug) from *Cinchona calisaya* Wedd., atropine from *Atropa belladonna* L. (anticholinergic), and codeine and morphine (analgesic) from *Papaver somniferum* L. (Anand *et al.* 2019).

Biologically active and naturally occurring chemical compounds are called phytochemicals. They are present in plants and provide human health advantages as nutrients and therapeutic compounds (Hasler *et al.*, 1999). They protect plants from disease and damage. While also enhancing their color, fragrance, and flavor (Gibson *et al.*, 1998). Many parts of plants, including the bark, leaves, fruits, flowers, and roots, have been found to have significant medicinal benefits because they contain a variety of bioactive compounds (Rutuba *et al.*, 2021). Over 4,500 phytochemicals have been recorded and divided based on their protective roles. Approximately 350 phytochemicals are among them that have been studied in detail (Dipak Koche *et al.*, 2010). There are many different sources of phytochemicals, including whole grains, fruits, vegetables, nuts, and herbs. Carotenoids, polyphenols, isoprenoids, phytosterols, saponins, and certain polysaccharides are a few

important phytochemicals. These phytochemicals show strong antioxidant, antimicrobial, antidiarrheal, anthelmintic, anti-allergic, anti-spasmodic, and antiviral properties (Sharma *et al.*, 2018; Jaeger *et al.*, 2016). Also, they improve gap junction communication, increase immunity, control gene transcription, and provide defense against prostate and lung cancers (Rowles *et al.*, 2020; Jiang *et al.*, 2018; Cooperstone *et al.*, 2016; Vallverdu-Coll *et al.*, 2015; Yuan *et al.*, 2015).

Pharmacological activity refers to the ability of a drug and chemical compounds to interact with biological systems or living organisms and cause specific effect (Rang *et al.*, 2011). Plant have kinds of pharmacological activity like Antioxidants, antibacterial, antiulcer, anti-inflammatory, anti-stress, and anti-diabetic are qualities that plants have (Kadia *et al.*, 2023). Pharmacological activities are important for drug discovery and development, dose optimization, side effect management, personalized medicine, and also use in therapeutic effectiveness (Goodman *et al.*, 1970).

II. REVIEW LITERATURE

❖ Plant description, Traditional uses, phytochemical and pharmacological activity of selected ethno-medicinal plants:

1. *Saccharum spontaneum* L.

❖ Taxonomical Classifications :

- **Kingdom:** Plantae
- **Division:** Tracheophyta
- **Class:** Liliopsida
- **Order:** Poales
- **Family:** Poaceae
- **Genus:** *Saccharum*
- **Species:** *spontaneum* L.



Fig: *Saccharum spontaneum* L.

(<https://alchetron.com/Saccharum-spontaneum>)

❖ Vernacular names:

Bengali: Kans, **Hindi:** kasa, **Odia:** Kasatandi, **English:** Thatch grass, **Assamese:** Khagor (Hussain *et al.* 2014).

❖ Description:

Saccharum spontaneum L. is a perennial grass that grows in stools or continuous canebrakes, commonly having rapid rhizome tillering, and has thin stems that are 100-200 cm tall with deep roots and rhizomes. The leaves have a rounded base, serrated edges, and the apex is acuminate, involute, and glaucous. Ligules are elliptical and membrane-bound. Panicles have a thick, smooth, white coating. Internodes are typically long, and nodes are always thicker than internodes. The stems can stay green, grey, ivory, or white, firm but extremely pithy and hollow in the center. Long, smooth white spikes are produced by plants (Saxena *et al.*, 1996).

❖ Distribution:

Saccharum spontaneum L. originated in South Asia (Sureshkumar *et al.*, 2009; Govindaraj *et al.*, 2016; Karthigeyan *et al.*, 2020). It is common in tropical countries in America, Africa, Asia, Pakistan, Bangladesh, Sri Lanka, India, Nepal, and tropical Australia (Saltonstall *et al.*, 2021).

❖ Medicinal uses:

Ayurveda claims that *Saccharum spontaneum* L. is a vital medicinal plant in India's ancient medical system. Tribal communities in Andhra Pradesh and Tamil Nadu have traditionally utilized *Saccharum spontaneum* L. to cure obesity, vesicles calculi, burning feeling, biliousness, galactagogue, and

strangling (Ghani, A., 1998; Kritikar *et al.*, 2005; Mall *et al.*, 2022). The stems can cure several conditions such as menorrhagia, dysentery, hemorrhoids, agalactia, phthisis, real and vesicolcalculi dyspepsia, burning feeling, mental disease, and mental problems (Sureshkumar *et al.*, 2009). Roots are utilized as a diuretic, galactagogue, and treatment for urinary tract infections (Lapuz *et al.*, 2016). Padalia, H., & Chanda, 2015 reported that, Roots are useful for treating gynaecological problems, respiratory problems, piles, and burning sensations. According to the Ayurveda and Siddha traditions, this plant has aphrodisiac, purgative, tonic, diuretic, astringent, and scorching qualities. It also helps in sexual weakness, piles, gynecological issues, vomiting, mental health issues, stomach diseases, dyspnea, anemia, and obesity (Hussain *et al.*, 2014). Leaves have diuretic and cathartic properties (Khalid *et al.*, 2011; Kodali *et al.*, 2016). Anemia, dyspnea, vomiting, mental disorders, stomach issues, and obesity that are treated by the aerial parts. Rural residents utilize the fresh juice of the stem of this plant to treat mental illnesses and disturbances (Rajkumar *et al.*, 2024). Anemia, dyspnea, vomiting, mental disorders, and stomach issues can all be treated with the whole plant.

❖ **Phytochemicals:**

Phytochemical study of *Saccharum spontaneum* L. root extract indicates the plant's phytochemical compositions, including secondary metabolites (Fatima *et al.*, 2018). The root extract of this plant has excellent antioxidant and free radical scavenging properties. Quinones, terpenes, alkaloids, phenolic compounds, coumarins, saponins, tannins, steroids, proteins, and carbohydrates are some important phytoconstituents found in the plants. Root has good antioxidant activity, which also considered as medicinal property to prevent disease, improve good health and increase longevity (Sathya *et al.*, 2012). Quinones, terpenes, alkaloids, phenolic compounds, coumarins, saponins, tannins, steroids, proteins, and carbohydrates are some of the significant

phytoconstituents found in the plant's leaves (Chandel *et al.*, 2009).

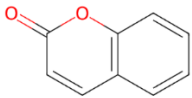
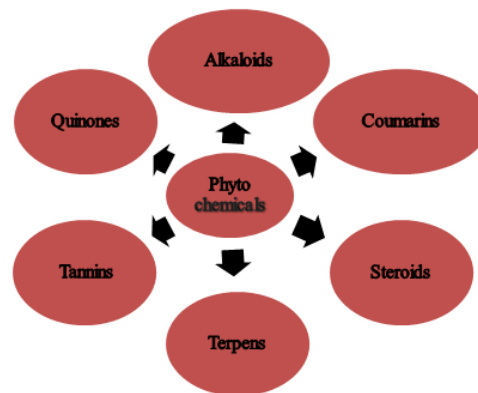
List of compounds	Molecular formula	structure	References
Quinones	$C_6H_4O_2$		(Chandel <i>et al.</i> 2009)
Coumarins	$C_{19}H_{18}O_5$		(Chandel <i>et al.</i> 2009)

Table.1 List of phytochemical compounds of *Saccharum spontaneum* L.



❖ **Pharmacological activities:**

1) **Antioxidant activity:**

The antioxidant activity of *Saccharum spontaneum* L. was investigated using the 1,1-diphenyl-2-picrylhydrazyl (DPPH) free radical scavenging assay, which employed dosages ranging from 100 to 500 µg/ml. It showed a remarkable ability to scavenge 500 µg/ml of DPPH radical. According to this, *S. spontaneum* is utilized to treat a range of diseases as

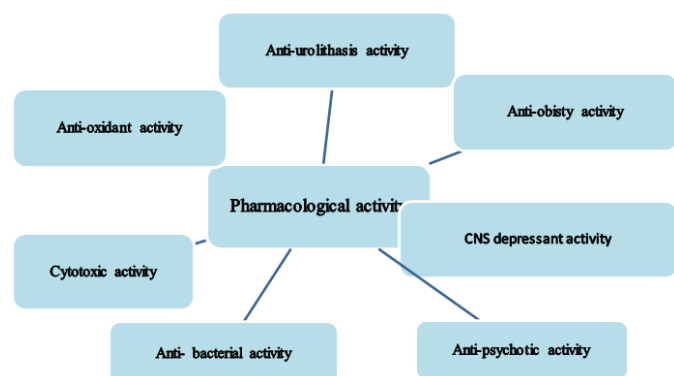
an efficient antioxidant and free radical scavenger (Ripa *et al.*, 2009).

2) *Antifungal activity:*

Saccharum spontaneum L. flower extract (500 µg/disc) showed antifungal activity against *Saccharomyces cerevisiae*, *Aspergillus niger*, and *Candida albicans*. All the fungi under investigation, *Aspergillus niger* showed the biggest zone of resistance (Ripa *et al.*, 2009).

3) *CNS depressant activity:*

The effects on rats were examined for the purpose determining the effect of aqueous, ethanolic, and chloroform extracts on locomotor activity at 1000 mg/kg. These extract all decreased movement, including the drug's central nervous system depressive action. Additionally, methanol extract significantly reduced locomotor activity. This extract's CNS depressive action was stronger at 400 mg/kg than it was at 200 mg/kg (Vhuiyan *et al.*, 2008).



2. *Eulaliopsis binata* (Retz.):

❖ Taxonomical Classifications :

- **Kingdom:** Plantae
- **Division:** Angiosperm
- **Class:** Monocots
- **Order:** Poales
- **Family:** Poaceae
- **Genus:** *Eulaliopsis*
- **Species:** *binata* (Retz.)



Fig: *Eulaliopsis binata* (Retz.)

(<https://mail.flowersofindia.net/catalog/slides/Sabai%20Grass.html>)

❖ Vernacular names:

Common name: Sabai grass, **Hindi:** Bhabar Ghas, **Nepali:** Babiyo.

❖ Description:

Sabai grass is a perennial clump-flowering grass with 30-80 cm long leaf blades and flowering stalks that reach 2-3 feet tall. The leaves are largely basal, reaching up to 60 cm in length and 2-3 mm in width, hairless, hard, almost upright, folded, or convolute. Flower racemes are 2-4 cm in length and are rusty and hairy. In India, this species is the second most significant raw material for the paper. It is widely grown in marginal uplands in West Bengal and Orissa for raw materials. Sabai grass is sometimes found at heights between 150 to 2600 meters in the Himalayas and northern India. Flowering occurs from April to July (Saxena *et al.*, 1996).

❖ Distribution:

Eulaliopsis binata (Retz.) is originated from North America. It is grown in several Asian countries, including China, Nepal, India, Pakistan, Bhutan, Myanmar, Thailand, Malaysia and the Philippines (Sankara Rao *et al.*, 2019).

❖ Medicinal uses:

There is minimal information available on the indigenous medicinal uses of this plant. Root pest along with black paper are being use by the tribes to cure various diseases. These plant extracts have been utilized in various traditional medical systems, and used directly to promote wound healing (Sahal *et al.*,

2014). Bronchitis can be treated using a mixture of whole plant paste with honey. Also used in herbal treatment to improve digestion. It could help to relieve symptoms of digestive disorders and improve overall digestive function. For reducing body temperature during summer, a mixture of root and black pepper seed powder is taken. It can be used in Ayurvedic remedies to boost energy and improve longevity (Sahu *et al.*, 2010). Additionally, the whole

plant is used for the treatment of skin diseases (Sinha *et al.*, 2023).

❖ Phytochemicals:

Eulaliopsis binata (Retz.) phytochemical composition contributes to its medicinal characteristics and possible therapeutic benefits. This plant contains many compounds, like alkaloids, flavonoids, triterpenoids, saponins, phenolic compound, sterols, carbohydrates, glycosides, and essential oil (Kumar *et al.*, 2018).

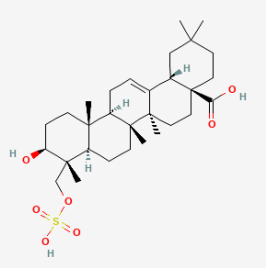
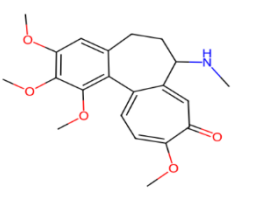
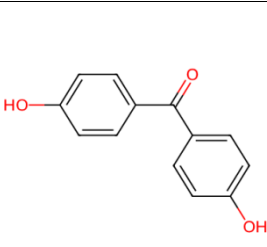
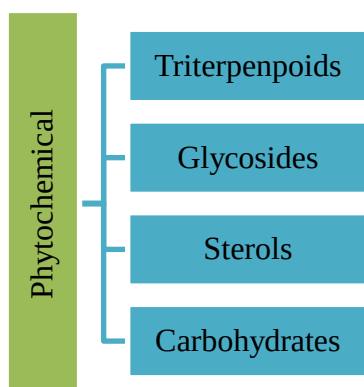
List of compounds	Molecular formula	structure	References
Triterpenoids	$C_{30}H_{48}$		https://pubchem.ncbi.nlm.nih.gov/compound/451674
Alkaloids	$C_{21}H_{25}NO_5$		https://www.chemspider.com/Chemical-Structure.2730.html
Sterols	$C_{13}H_{10}O_3$		https://www.chemspider.com/search

Table.2 List of phytochemical compounds of *Eulaliopsis binata* (Retz.)



❖ Pharmacological activities:

Eulaliopsis binata (Retz.) has many phytoconstituents that are responsible for the pharmacological activity (Kumar *et al.*, 2018).

1. *Anti-inflammatory activity:*

Extracts of *Eulaliopsis binata* (Retz.) have shown potential anti-inflammatory effects. These activities may benefit inflammation-related disorders, including

arthritis and inflammatory bowel disorders (Kumar *et al.*, 2018).

2. **Antimicrobial activity:**

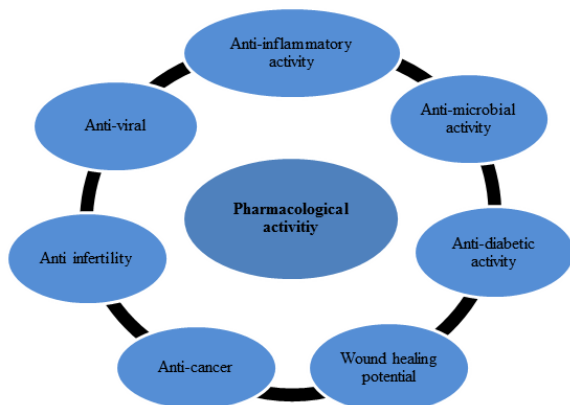
Eulaliopsis binata (Retz.) extracts have antibacterial activity against certain bacteria and fungi. The results show its potential value in fighting microbial disease (Kumar *et al.*, 2018).

3. **Anti-diabetic activity:**

Eulaliopsis binata (Retz.) extracts have anti-diabetic effects by regulating glucose metabolism and enhancing insulin sensitivity, according to preliminary research (Kumar *et al.*, 2018).

4. **Wound healing potential:**

Eulaliopsis binata (Retz.) high phenolic content makes it suitable for treating skin problems, wounds, and burns (Kumar *et al.*, 2018).



3. *Cynodon dactylon* (L.) pers:

❖ **Taxonomical Classifications:**

- **Kingdom:** Plantae
- **Division:** Angiosperm
- **Class:** Monocots
- **Order:** Poales
- **Family:** Poaceae
- **Genus:** *Cynodon*
- **Species:** *dactylon* (L.)



Fig : *Cynodon dactylon* (L.) pers

(<https://www.teline.fr/en/photos/poaceae/cynodon-dactylon>)

❖ **Vernacular names:**

Hindi: Doobh, **English:** Bermunda grass, **Bengali:** Durva, **Gujarati:** Drow, **Kannada:** Garike, **Marathi:** Harali, **Punjabi:** Dubda, **Tamil:** Arugam pullu, **Telugu:** Goriya gaddi.

❖ **Description:**

Cynodon dactylon (L.) pers is the perennial creeping herb with wiry, slim stems that are light green in color and have a coarse texture. Consisting of three primary parts: leaves, stems, and roots. Fibrous, cylindrical, and up to 4 mm thick, the root resembles small hairs. Cream-coloured roots emerge from the main roots. It grows swiftly, and when nodes of its roots touch the ground, they spread out rapidly, creating a dense mat. The stem is horizontal, willowy, jointed, yellowish-green, and up to 1 mm thick. Its leaves are also extremely smooth. The leaves are delicate, glucose green, sharp, narrowly linear or lanceolate, and size 2-10 cm x 1.25-3 mm. Spikes 2-6 radiate from a thin, purple or green, ascending pseuduncle. Spike of inflorescences 2-5 cm long, 3-6 in spiral, spikelets of flowers with a single perfect floret, lanceolate, sharp glumes that are 2 mm long with the lowest glume being smaller than the upper lemmas, 3 nerves, 2-8 mm long, acute, pubescent, or scabrous on the nerves. Yellow anthers measure 1.3 mm in length and purple fashion. Ovoid, Yellow-reddish seeds that are around 1.5 mm long (Saxena *et al.*, 1996; Asthana *et al.*, 2012; Das *et al.*, 2013).

❖ **Distribution:**

Africa is considered to be the birthplace of *C. dactylon* (L.) pers, which is now found around the world in

tropical and subtropical areas, including Asia, North, Central and South America (Elvin-Lewis, M. 2005).

❖ Medicinal uses:

Cynodon dactylon (L.) pers. is used to treat many different kinds of disorders. This plant juice has been reported to possess wound healing properties. It is directly used on cuts, abrasions, and wounds to encourage healing and protect against infections. Traditionally it has been applied to decrease inflammation. Its leaves are used to make poultices that are applied to irritated regions to reduce swelling and irritation (Nagori and Solanki, 2011). Cancer, epilepsy, bronchitis, anasarca, calculus, dropsy, hemorrhage, urogenital disorders, cough, sores, cramps, cystitis, dysentery, leucoderma, hypertension, hysteria, asthma, tumors, measles, rubella, warts, wounds, and eye disorders are some of the diseases for which it is used as a traditional remedy (Khatun *et al.*, 2020). It is used to treat digestive issues like dysentery

and diarrhea. The digestive tract is thought to be relieved by its juice. Urinary issues are also relieved with it. It is believed to include diuretics, qualities that encourage urine flow, and it can help in the treatment of ailments including kidney stones and urinary tract infections (Nagori and Solanki, 2011; Bheram *et al.*, 2021).

❖ Phytochemicals:

Cynodon dactylon (L.) pers. plants contain minerals including magnesium, phosphorus, calcium, salt, and potassium, as well as crude proteins and carbohydrates. In addition, it includes triterpenoids, alkaloids, glycosides, flavonoids, and β -sitosterol. This plant includes chemical components such as ethyl ester, d-mannose, hydroquinone, and hexadecanoic acid. Analysis of several *Cynodon dactylon* (L.) pers plant sections has revealed the presence of minerals, terpenoids, vitamins C, palmitic acid, alkaloids, etc (Abhishek *et al.*, 2012; Parihar *et al.*, 2021).

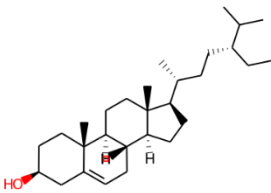
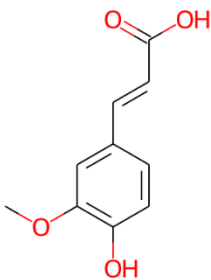
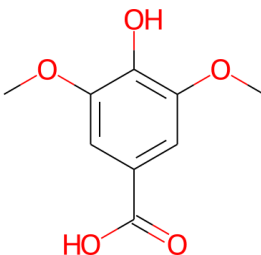
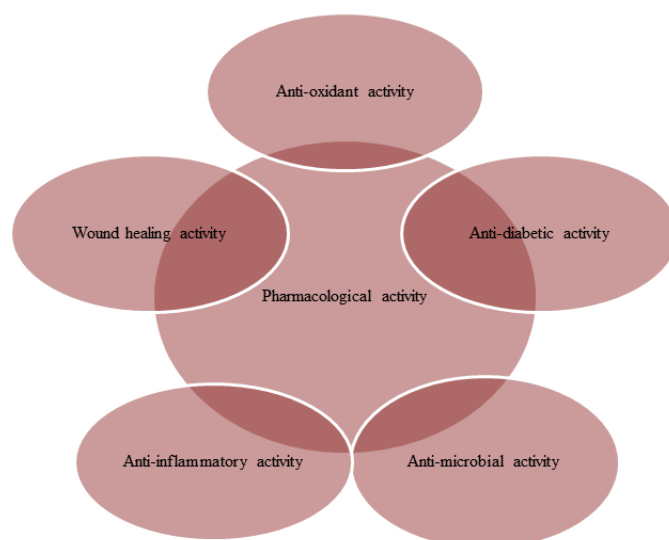
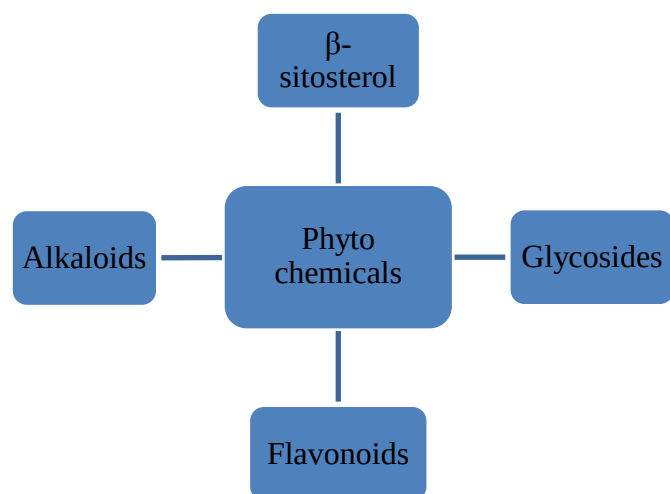
List of compounds	Molecular formula	structure	References
β -sitosterol	$C_{29}H_{50}O$		ISBN:9788171360536
Ferulic acid	$C_{10}H_{10}O_4$		ISBN:9780387706375
Syringic acid	$C_9H_{10}O_5$		ISBN:9780387706375

Table.3 List of phytochemical compounds of *Cynodon dactylon* (L.) pers



❖ Pharmacological activities:

The numerous pharmacological activities of *Cynodon dactylon* (L.) pers are due to its abundance of bioactive chemicals (Asthana *et al.*, 2012; Ashokkumar *et al.*, 2013; Al-Snafi, A.E., 2016).

1. **Antioxidant activity:**

Phytochemicals with antioxidant qualities, such as flavonoids and phenolic compounds, are abundant in the grass. As reducing oxidative stress and protecting cells from injury, these antioxidants can aid in the body's defense against dangerous free radicals (Asthana *et al.*, 2012; Ashokkumar *et al.*, 2013; Al-Snafi, A.E., 2016).

2. **Anti-inflammatory activity:**

Extracts from *C. dactylon* have been shown to have anti-inflammatory properties that may help lessen inflammation caused by diseases including inflammatory bowel diseases, asthma, and arthritis (Asthana *et al.*, 2012; Ashokkumar *et al.*, 2013; Al-Snafi, A.E., 2016).

3. **Cardio protective effects:**

Research has explored the cardio protective effects of *C. dactylon*, including its ability to lower cholesterol levels, improve lipid metabolism, and protect against cardiovascular diseases. These effects may be due to its antioxidant and anti-inflammatory properties (Asthana *et al.*, 2012; Ashokkumar *et al.*, 2013; Al-Snafi, A.E., 2016).

III.DISCUSSION:

Plants are the source of several significant medications that have been transformed modern medicine during the last 50 years. These chemical compounds extracted from plant, and demonstrated their therapeutic effects on animals. The WHO supports the use of herbal pharmaceuticals in national health care systems as they are affordable, time-tested, and less harmful compared to synthetic drugs (Singh *et al.*, 1981). As a result, the investigation of pharmacological and physiologically active substances derived from natural sources, such as plant extracts, has shown several pharmaceutically significant medications that are essential for treating human diseases (Rastogi, R.M., 1990).

The plants of these family are generally used as a good source of food in India, which is full of carbohydrates. The fruit of plant *Triticum aestivum* L. is used to treat analgesic activity in Andhra Pradesh by direct smoke of fruit to the specific part. *Zea mays* L. stem Smoke inhaled directly to cure throat aid diseases in Andhra Pradesh (Murty & Rao, 2010). The plants like rice, wheat, sorghum, maize, sugarcane, etc., have high economic importance and high food values in many states of India like Gujarat, Punjab, Madhya Pradesh, Rajasthan etc. Farming of some species, like *Cynodon*, is specially done for the forage purpose. The bamboo

is used to make handicrafts and shoe pies in many states (Singh *et al.*, 2016).

IV. CONCLUSION:

The Poaceae family in addition to providing a major food source has great therapeutic value due to its rich phytochemical composition. Members of this family such as wheatgrass, barley, and lemongrass, have a wide range of medicinal qualities, including antioxidant, anti-inflammatory, antibacterial, anticancer, and neuroprotective benefits. These herbs are commonly used in traditional medicine to treat conditions such as diabetes, inflammation, infections, and liver disease. The pharmacological potential of the Poaceae family indicates its significance in the creation of natural treatments and medicinal agents, demonstrating the need for more study and continuous consumption of these beneficial plants.

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