

## Durva (Cynodon Dactylon): A Systemic Review on Pharmacological Aspects & Its Therapeutic Activities

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### ABSTRACT

Cynodondactylon(L)pers, Family-(poeace/ Graminae), is a perennial herb found I various region of India. It has different names in different Indian Languages such as Durva (Marathi), Durba,(Gujrati), Garichgaddi(Telugu),Arukampillu(Tamil),shatapar va(Sanskrit) etc.CynodonDactylon occupies a key Position in ethno medicinal Practices and traditional System of medicine. It has vast medicinal value and it use in the treatment of various diseases in the form of its powder, Paste or Juice. Cynodondactylon contained flavonoid, alkaloids, glycosides carbohydrates minerals carotenoids terpenoids, triterpenoids steroids, saponins,tannins, resins, phytosterols reducing sugars, proteins, volatile oils and fixed oils. Previous studies show that cynodontdactylon possessed central nervous, cardiovascular,antidiabetic, gastrointestinal, antioxidant, immunological, antiallergic,anti-inflammatory, antipyretic, analgesic, anticancer, dermatological, diuretic, protective, antimicrobial, antiparasiticinsecticidal and repellent.This review attempts to encompass the available literature on cynodondactylon with respect to its pharmacognostic characters, traditional uses chemical constituents summary of its various pharmacognostic and pharmacological activities and a brief review on patents associated with it.

**KEYWORDS:** Cynodondactylon, Durva, traditional uses, pharmacology, pharmacognostic characters, medicinal plants, chemical constituents.

### I. INTRODUCTION

India has tremendous wealth of medicinal plants and its resources which are of different kind they grow in different climatic and ecological conditions. In ancient time India was not so advanced in therapeutic values of medicinal plants.

The earliest mention of the use of medicinal plant is found in Ring-Veda (4500-1600B.C).According to an estimation of the World Health Organization, about 80 percent of the world's population uses herbs to fulfil its primary healthcare needs. More then 35,000 plants in traditional and ethno medicinal practices. Among numerous species of plants growing in India, Durva or taxonomically the Cynodondactylon occupies a key position in ethno medicinal practices and traditional medical knowledge system of ayurveda, Unani, Nepalese, and Chinese.

There are hundreds of significant drugs and biologically active compounds developed from the traditional medicinal plants. Plants showed wide range of pharmacological activities including antimicrobial, anti-inflammatory, analgesic antipyretic and many other pharmacological effect.

Decoctions of root are used in secondary syphilis and irritation of urinary organs.The plant is astringent, sweet, cooling, haemostatic, depurative, vulnerary, constipating, diuretic and tonic and is useful in depurative, vulnerary, constipating, diuretic and tonic and is useful in impaired conditions of pitta and kapha, hyperdipsia, burning sensation, haemoptysis, haematuria, haemorrhages, wounds, Leprosy, diarrhoea, dysentery, conjunctivitis, vomiting etc.The plant is a folk remedy for snake bites, gout, and rheumatic affections. Three varieties namely nildurva with bliish or greenish stem, shvetadurva with whitish stem and branches and gandadurva with nodulose stem are mentioned is BhavaprakashNighantu. C.dactylon is fond in warm climates all over the world between 45° south and north latitudes.

Cynodondactylon occurs on almost all soil types especially in fertile soil. E.g. loamy soil. It is common in disturbed areas such as gardens, roadsides, overgrazed, trampled areas, uncultivated lands, localities with high levels of nitrogen, and is

often found is moist sites along rivers. It is suitable for cultivation under dry land conditions. It is widely distributed in southern African countries, in biomes such as grassland, Savanna, Nama-Karoo and Fynbos.

It can be a serious weed, rapidly invading cultivated lands, and it is difficult to eradicate. Animals such as white rhino, reedbuck, impala and many other wild animals graze it. As a result, these animals aid in the dispersal of this grass which is essentially wind-pollinated. After fire, new shoots and leaves sprout quickly as they are nourished by ample underground reserves.

**SYNONYMS**

Cynodactylon (L)  
 Pears. Cynodactylon var. affinis (Caro & E, A. Sanchez) Romero Zarco, Cynodactylon subsp. Arcuatus (J. Presl) Kern & Henty, Cynodactylon var. arcuatus (J. Presl) J. Kern ex Henty, Cynodactylon var. aridus J. R. Harlan & de Wet. Cynodactylon var. biflorus Merino, Cynodactylon var. coursii (A. Camus) J. R. Harlan & de Wet, Cynodactylon var. dactylon, Cynodactylon var. densus Hurcombe, Cynodactylon var. elegans Rendle, Cynodactylon subsp. Glabratus (Steud). A. Chev., Cynodactylon var. intermedius (Rang. & Tadul.) C.E.C. Fisch, Cynodactylon var. Longiglumis Caro & E. A. Sanchez, Cynodactylon F. major (Beck) Soo, Cynodactylon var. maritimus (Kunth) Hack, Cynodactylon subsp. Nipponicus (Ohwi) T. Koyama, Cynodactylon var.

**COMMON NAME :**

**Afrikaans:** Gewonekweek, Kweekgras  
**Arabic:** Thaiel, Najeel, Echrish, Tohma  
**Chinese:** Go ya gen  
**English:** Bhama grass, Bermuda grass, common couch, Devils grass, giant Bermuda

Grass, Green couch, Hariali grass, Indian couch, Quick grass.

**French:** Chiendent pie-de-poule, Cynodactyle, Grandchiendent.

**German:** Bermudagrass, Hundezahngras

**India:** Dhub, Doob

**Italian:** Grammina

**Portuguese:** Capim-Bermuda

**Spanish:** Gramastrera, zacate de Bermuda

**Swedish:** Hundtandsgras

**TAXONOMICAL CLASSIFICATIONS:**



**Fig. a.** Cynodactylon

**Kingdom:** Plantae  
**Subkingdom:** Tracheobionta  
**Super division:** Spermatophyta  
**Division:** Magnoliophyta  
**Class:** Liliopsida  
**Subclass:** Commelinidae  
**Order:** Cyperales  
**Family:** Poaceae  
**Genus:** Cynodon  
**Species:** Cynodactylon

**TYPES OF CYNODON DACTYLON**

Type name	Type	Profile
Midland Hardie	Coastal + Winter hardy	Tall, leafy Sterile, pH < 5
Guymon	Established by seeding	Dense tillering, good
Winter hardiness Wrangler	Seeded Variety	Good forage yield, Average winter hardiness
Greenfield	Established by sprigging	Good cold tolerance, dense Sod, good stand capacity
Tifton 44	Coastal + winter hardy	Leafy, tall, better yield, Good stand

Midland stand	Hay type	Cold tolerant, average Forage quality
Quick stand	Winter hardy	Used for turf, erosion Control, very dense sod
World feeder	Moderate winter hardy	Inferior forage yield.

### CHEMICAL CONSTITUENTS

The chemical constituents present in *Cynodondactylon* are –  $\beta$ - sitosterol,  $\beta$ - carotene, vitamin C, palmitic acid, triterpenoids, arundoin, friedelin, selenium, alkaloids- ergonovine and ergonovinine, Ferulic, syringic, p- coumaric, vanilic, p hydroxybenzoic and ohydroxyphenyl acetic acids, Cyanogenic hyperoside, Cyanogenic glucoside- triglochinin, furfural, furfural alcohol, phenyl acetaldehyde, acetic acid,

phytol,  $\beta$ - ionone; mono and oligosaccharides, lignin (whole plant); hydrocarbons (tritriacontane) esters, eicosanoic and docosanoic acids, free alcohol, free aldehydes (hexadecanal) and free acids (hexadecanoic acid) (surface cuticular wax); flavone – apigenin, luteolin, flavone glycosides – orientin (8-C- $\beta$ -D-glycosylluteolin), vitexin (8-C- $\beta$ -D-glycosylapigenin), iso –orientin (6-C- $\beta$ -D-glycosylluteolin) and iso- vitexin (6-C- $\beta$ -D-glycosylapigenin) (aerial parts).

### MICROSCOPIC CHARACTERS



fig.b. *Cynodondactylon*

*Cynodondactylon* (L) Pers has following microscopic characters:

#### Root

Mature root shows piliferous layer (bearing hairs) composed of a single layer of thin-walled, radially elongated to cubical cells. Hypodermis consists of 1 or 2 layers of thin-walled, tangentially elongated cells. Cortex is differentiated into two zones (i) thin walled, polygonal and lignified sclerenchymatous zone and (ii) 4 to 6 layered parenchymatous zone containing elongated cells. Endodermis consists of single

layered tangentially elongated cells. Pericycle consists of one or two layered thin-walled sclerenchymatous cells. Vascular bundles comprise xylem and phloem arranged in a ring form. Pith region is centrally located. It is composed of oval and thick-walled parenchymatous cells containing numerous simple or angular starch grains having diameter of about 4 to 16  $\mu$ .

#### Stem

The stem is oval in outline with a little depression on one side. It shows presence of cells arranged in single layer. Hypodermis is made up of

1 or 2 layers of sclerenchymatous cells. Cortex consists of 3 to 5 layers of round to oval thin walled parenchymatous cells. Endodermis shows presence of pericycle which is made up of continuous ring of 2 to 5 layers of sclerenchymatous fibers.

Vascular bundles are collateral, closed and scattered throughout the ground mass of parenchyma, each surrounded by sclerenchymatous sheath. Medullary rays are found to have narrow lumen and pointed tips. Starch grains may be of either simple or compound type. These are present in cortex and ground tissue, measuring 4 to 16  $\mu$  in diameter.

### Leaf

Lamina of the leaf is characterized by nearly square to oval epidermis having irregularly outer wall. The bulliform cells present on the dorsal side which are grouped together and lie at the bottom of a well-defined groove in between the veins; these are thin walled and lack chlorophyll that extend deep into the mesophyll.

The mesophyll is not differentiated into palisade and spongy parenchyma. It is observed that the mesophyll is broken by 1 or 2 thin-walled colourless cells which extend from bundle sheath to the thin walled parenchymatous cells near upper and lower epidermis. Vascular bundles are arranged in a row except that the median bundle is larger. Bundle sheath is single and consists of thin-walled isodiametric parenchyma cell containing chloroplast.

### TEST FOR IDENTITY AND PURITY

#### (A) Thin Layer Chromatography (TLC)

TLC of alcoholic extract of the drug is performed on Silica gel 'G' plate using toluene:ethyl acetate in 90:10 ratios. It shows five spots in the visible light at Rf. 0.1 (green), 0.40 (yellow), 0.45 (green), 0.51 (yellow) and 0.57 (green). On exposure to iodine vapour six spots appear at Rf. 0.22, 0.40, 0.45, 0.51, 0.57 and 0.64 (all yellow in colour). On spraying with 5% methanolic-sulphuric acid reagent and heating the plate at 105°C for ten minutes six spots appear at Rf. 0.22, 0.40, 0.45, 0.51 (all grey), 0.57 (green) and 0.64 (grey).

#### (B) Purity and strength

The following qualitative characteristics are described for the purity test of *C. dactylon*:

**Foreign matter:** Not more than 2%

**Total ash:** Not more than 9%

**Acid insoluble ash:** Not more than 4.5%

**Alcohol soluble extractive value:** Not less than 3%

**Water soluble extractive value:** Not less than 9.5%

### PHARMACOGNOSTIC STUDIES

#### The Photosynthetic activity

The photosynthetic activity of chloroplasts isolated from *C. dactylon* has been investigated by Chen T. M. et al where isolated chloroplasts were assayed for photophosphorylation and electron transport activity. It was found that, during cyclic electron flow with phenazine methosulfate, the chloroplasts actively synthesized adenosine triphosphate. It was concluded that, the high photosynthetic capacity of leaves of *C.*

#### Fluorescence analysis of roots

Namdeo and Deore performed the fluorescence analysis of root samples obtained from *C. dactylon*. The physicochemical properties such as loss on drying, total ash value, acid insoluble ash, water soluble ash value and extractive values of *Cynodactylon* were estimated. This detailed microscopy study revealed the presence of wide cortex, wide circular metaxylem and parenchymatous cells loaded with starch grain and intact epidermis. Researchers concluded that carbohydrates, flavonoids, phenols and tannins were found to be present in *Cynodactylon*.

#### Study on biotypes

The study of growth response of biotypes of *C. dactylon* to trichloroacetic acid (TCA) and 2, 2-dichloropropionic acid (dalapon), both formulated as the sodium salt, has revealed that the tetraploid biotypes were more resistant than the triploid, and that biotypes of the same chromosome number showed different responses to these herbicides. Development of *C. dactylon* was studied on one-node rhizome fragments, planted at successive dates for one year. Authors found no relationship between flowering and rhizome formation. The water-soluble sugar content of rhizomes was high in November-December, decreased in late winter, rose again in spring, and decreased in late summer. Percent germination of rhizome buds fluctuated greatly during the year, but researchers never observed the complete dormancy.

#### Study on released phenolic acids

In a study, the release of phenolic acids from *C. dactylon* was investigated with help of sequential sodium hydroxide treatment in relation



to biodegradation of cell types. Sections of solvent-extracted leaf blades were treated sequentially with increasing concentrations of sodium hydroxide.

Study of biodegradation of cell types was performed by scanning electron microscopy and for the purpose of histochemical analysis of lignin (after treatment with sodium hydroxide), light microscopy technique was implemented. Treatment with 0.1 M sodium hydroxide for 1 h did not show significant changes from untreated sections. However, researchers found that, the continuous treatment for 24 h released 86% of the ferulic acid, 65% of the dimers, and 50% of the p-coumaric acid.

#### Cell wall biodegradability study

Hartley and Akin studied the cell walls of *C. dactylon* for their lignification and wall biodegradability by using the technique of microspectrophotometry. This study proved that, the sclerenchyma walls which were indigestible to rumen microorganisms gave positive tests with acid phloroglucinol reagent for lignin. Parenchyma walls, which were either digested or partially digested, showed much lower absorbance values in the ultraviolet region and gave negative tests with acid phloroglucinol but positive tests with diazotized sulphanic acid (upper and lower internodes) and chlorine-sulphite (lower internodes) reagents.

### PHARMACOLOGICAL ACTIVITY

#### CNS Activity

Pal Dilip Kumar, worked on the, Evaluation of the CNS activities of aerial parts of *Cynodondactylon* (L.) Pers. in mice. The dried extracts of aerial parts of *Cynodondactylon* (L.) Pers. (Graminae) was evaluated for CNS activities in mice. The ethanolic extract of aerial parts of *C. dactylon* (EECD) was found to cause significant depression in general behavioral profiles in mice. EECD significantly potentiated the sleeping time in mice induced by standard hypnotics viz. pentobarbitone sodium, diazepam and meprobamate in a dose dependent manner.

#### Anti-diabetic activity

It has been attested numerous times that *C. dactylon* holds hypoglycaemic properties that help efficiently handle sugar level in the blood and reduce fatigue. The juice of this plant mixed along with neem juice is very good for the health as it assures to maintain the blood sugar level. The anti-diabetic effect lowered hyperglycaemia, by 70% ethyl extract of roots and stems of *C. dactylon*. It

was found that in diabetes, a joint combination of 10 mg/kg of xylazine and 60 mg/kg of ketamine exhibited an anti-diabetic effect. To treat the mice, 50 mg/kg and 100 mg/kg of this extract were used and both the administered amount of extracts had a substantial decreasing effect on the blood sugar level.

The first dose impact was seen to be more effective on the mice, as its effect was just like insulin. Moreover, the diabetic rats faced prominent decreased levels of cholesterol, glucose, urea, triglyceride, high-density lipoprotein and low-density lipoprotein due to the effect of non-polysaccharide and aqueous extract of *C. dactylon*. The effect of 250 mg/kg, 500 mg/kg and 1000 mg/kg of the aqueous extract was examined in the rats having diabetes. The investigation concluded that the dose of 500 mg/kg given orally was more effective. In normal rats, it lowered sugar level in the blood by 31%, after 4 hr of the administration. Diabetic rats given streptozotocin were treated for the anti-diabetic effect with the ethanolic concoction of root stalks of *C. dactylon*. The examination disclosed that 500 mg/kg of the extract, which showed anti-hyperglycaemic activity, was prominently analogous to tolbutamide drug, which is meant to be a standard.

#### Diuretic activity

An investigation on aqueous extract of the root stalk of *C. dactylon* showed diuretic activity in albino rats. Oral administration of the aqueous extract of root stalk of *C. dactylon* at a dose of 100, 250, 500 and 750 mg/kg body weight shows diuretic activity with increased excretion of sodium, potassium, and chloride ions and results were comparable to furosemide.

#### Anti-inflammatory activity

*Cynodondactylon* is one of the 10 auspicious herbs that constitute the group *Dasapushpam* in Ayurveda. Traditionally *Cynodondactylon* L. is used against many chronic inflammatory diseases in India. The present finding was to evaluate the protective effect of *Cynodondactylon* against rats with adjuvant-induced arthritis. Arthritis was induced by intradermal injection of complete Freund's adjuvant into the right hind paw produce inflammation of the joint. A significant increase in the levels of inflammatory mediators, myeloperoxidase, nitrite, C-reactive protein, ceruloplasmin was observed. This was associated with oxidative stress with a marked reduction in the activity of catalase, superoxide dismutase, glutathione peroxidase and

the levels of glutathione, vitamins C and E and an increase in the lipid peroxidation as indicated by the higher levels of thiobarbituric acid reactive substances. Cynodondactylon (20mg/kg) body weight was orally administered to arthritic rats after adjuvant injection produced a significant attenuation in the inflammatory response, oxidative stress and ameliorated the arthritic changes to near normal conditions. Hence, findings clearly indicate that Cynodondactylon extract has a promising protective role against arthritis.

#### Anti-arrhythmic activity

Ischemia is a state where a body tissue in which it abstained from blood flow for a little moment. In contrast, reperfusion is damage caused to the body tissue due to the flow of blood returning to the ischemia region. Ventricular tachycardia is a state of the heart. The lower chambers, the ventricles beat in an increased speed, whereas, ventricular fibrillation is a fatal phenomenon of the heart, where it beats in a hasty speed and can lead to a heart attack. The probability of the anti-arrhythmic effect of extracts of *C. dactylon* was testified on the isolated heart of rat induced with ischemia and reperfusion. Then the rat hearts were exposed to ischemia and reperfusion regionally for 30 min respectively with the *C. dactylon*'s rhizomes' hydro-alcoholic extracts in the fraction of 25 µg/ml, 50 µg/ml, 100 µg/ml and 200 µg/ml.

The hydro-alcoholic extract yielded insight deduction in the numbers, time period and the incidence of ventricular tachycardia respectively at first two doses; also it lowered the aggregate number of the ventricular beats through ischemia when treated with all the doses respectively except 200 µg/ml. Through reperfusion, the frequency of ventricular tachycardia occurrence reduced to 13% and 33% from 100%, when treated with the first two doses respectively. Apart from this, it was seen that it reduced the chance of ventricular fibrillation with the same rate at the same given concentrations. It was observed that *C. dactylon* also helped in reducing up the bleeding time and clotting time, too, while testing its haemostasis property on albino rats.

#### Immunomodulatory activity

The protein fraction of *C. dactylon* showed significant immunomodulatory activity in healthy Swiss albino mice. The protein fraction was administered by intra peritoneal route and immunomodulatory activity was assessed by

testing humoral and cellular immune responses to the antigenic challenges with sheep RBCs and by neutrophil adhesion test. A significant increase in the test parameters viz., neutrophil test, haemagglutinating antibody titer and delayed type hypersensitivity response was observed. An investigation showed that the daily treatment of 70 µl of ethyl acetate fraction of *C. dactylon* polyphenols significantly prevent the immunosuppression caused by pyrogallol in Balb/c mice. Fresh juice of *C. dactylon* of 1.46% (w/w) solid content had a phenolic content of  $47 \pm 0.33$  mg/kg GAE. At doses equivalent to 50, 100 and 200mg total solids/kg body weight the juice protected human DNA against doxorubicin-induced DNA damage as demonstrated in DNA spectral studies, where the ratio of absorbance of DNA at 260 and 280nm in samples pre-treated with the juice was 1.66, 1.53 and 1.63 respectively, while it was 1.37 for DNA treated with doxorubicin only. Oral administration of the juice at 250 and 500 mg/kg in Balb/c mice increased humoral antibody response upon antigen challenge, as evidenced by a dose-dependent, statistically significant increase in antibody titer in the haemagglutination antibody assay and plaque forming cell assay.

#### Anti-ulcer activity

In research, to study the anti-ulcer property of *C. dactylon*, rats were induced to have gastro-intestinal ulcers by feeding them indomethacin. The standard drug, famotidine, was used as a reference to the anti-ulcer effect. To study the anti-ulcer effect, 50% of *C. dactylon*'s ethanolic extract was referred orally in the dosage of 300 mg/kg and 600 mg/kg, 30 min before feeding them with indomethacin. Both the dosage, 300 mg/kg and 600 mg/kg, showed a shielding effect on the ulcers, induced by the indomethacin by 54.74%. *C. dactylon*'s gastro-protective activity was examined against gastric mucosa damage, induced by indomethacin and alcohol. They were grouped as indomethacin-induced rat section and alcohol-induced rat section. The reference group, standard group and test group of both the induced sections were administered with ulcerogens, 25 mg/kg of ranitidine and 300 mg/kg of juice triturate of *C. dactylon* respectively, before exposing them to ulcerogens. The rats were then dissected after 4 hr of their ulcerogenic exposure. In the dissection procedure, numbers of how many ulcers were found with their sizes and indexes were penned down. The section of rats induced with alcohol and their anti-ulcer property was observed most significantly in the test group, given the juice

triturate of *C. dactylon*, contrary to the reference and standard group. Though, in the section of rats induced with indomethacin, the standard group pre-treated with ranitidine gave better results. A substantial deduction of ulcer index was also observed against ulcers induced by aspirin and ethanol and pylorus ligation of rats, treating them with the extracts of *C. dactylon*. It also further showed a gastro-protective outcome on examining the stomach of the rats histopathologically.

### Hypoglycaemic activity

The hypoglycaemic potential of ethanolic extract of *C. dactylon* has been studied by Singh and co-workers; by its oral administration of 250, 500 and 750 mg/kg body weight of the extracts to normal as well as Streptozocin-induced diabetic rats. The dose of 500 mg/kg body weight was identified as the most effective dose as it lowered the blood glucose levels of normal by 42.12% and of diabetic by 43.42% during fasting blood sugar (FBG) and glucose tolerance test respectively. The study proved that, the ethanolic extract of *C. dactylon* had high antidiabetic potential along with good hypolipidemic profile.

### Effect on nephrolithiasis

Mousa-Al-Reza Hajzadeh et al. investigated the effect of hydroalcoholic extract of *C. dactylon* on experimentally induced nephrolithiasis in a rat model. Urinary biochemical and other variables were measured during the course of study along with the examination of crystal luria and renal histology. Beneficial effect of *Cynodon* extract was seen in kidney tissues where reduced levels of Calcium oxalate deposition have been noticed especially in medullary and papillary sections from treated rats.

### Anticonvulsant activity

In a study, it was reported that, the *C. dactylon* imparts protective action against convulsions induced by chemo convulsive agents in mice. The amount of GABA, which is most likely to be involved in seizure activity, was increased significantly in mice brain after six week treatment. Results revealed that the extracts of *C. dactylon* showed a significant anticonvulsive property by altering the level of catecholamine and brain amino acids in mice.

### Anticancer activity

An investigation conducted by Albert-baskar and Ignacimuthu revealed the anticancer activity of *C. dactylon*; where in-vivo

chemoprotective property of plant extract of *C. dactylon* was found to be antiproliferative and antioxidative at lower concentrations and induced apoptotic cell death in COLO 320 DM cells. Researchers found that, the treatment with methanolic extract of *C. dactylon* increased the levels of antioxidant enzymes and reduced the number of dysplastic crypts in DMH-induced colon of albino rats. This investigation proved the anticancer potential of methanolic extract of *C. dactylon*.

### Hepatoprotective activity

Singh SK. et. al., studied the Protective effect of *Cynodon dactylon* against STZ induced hepatic injury in rats. The present study was designed to investigate the hepatoprotective effect of aqueous extract of *Cynodon dactylon*, widely used in India as a traditional treatment for diabetes mellitus. Male Albino Wister rats (180-220 g) were administered with streptozotocin (STZ, 50 mg/kg) intraperitoneally to induce experimental diabetes. Alkaline phosphatase (ALKP), serum glutamate oxaloacetate transaminase (SGOT), serum glutamate pyruvate transaminase (SGPT), creatinine (CRTN) and total protein (TP), urine sugar (US) and total haemoglobin (Hb) were estimated at the beginning and after 14 days of treatment. Daily oral administration of aqueous extract of *Cynodon dactylon* suspended in distilled water at 500 mg/kg dose almost normalized various biochemical parameters. This suggests that *Cynodon dactylon* can be used as a hepatoprotective agent.

### Cardiovascular activity

In a research study, it was found that the rhizome part of *C. dactylon* existed in use to cure heart failure in traditional medicine. It wielded a sturdy protective upshot on heart failure patients, by accompanying positive action of muscle contraction and refining the heart's functions. Further to examine the normal heart contractility and the cardio-related functions, the after-effects of *C. dactylon*'s rhizome's hydro-alcoholic excerpts were testified. When administered to the rats, the extracts headed to insightful improvement in heart functions, which was verified with the help of reduced right ventricular end-diastolic pressure and raised mean arterial pressure. The extract also showed that it helped reduce congestion, of the lung and the heart.

The potential haemostatic activity of *C. dactylon* was premeditated in albino rats of both the control and test group. The control group's

bleeding time was generally noted to be  $160.5 \pm 8.3$  second and the clotting time was marked at  $507.6 \pm 18.2$  second. The haemostatic effect of *C. dactylon* in, the test group was observed to be decreasing both the bleeding and clotting time to  $96.8 \pm 10.3$  second and  $319.3 \pm 27.1$  second, respectively.

#### **Dermatological activity**

The potential *C. dactylon* to heal dermatological wounds categorized in the wound by excision and wound by incision was studied in albino rats. They were treated with the *C. dactylon* gel made by its alcoholic and aqueous extract. It resulted in wound healing in the speedy rate in both wound by excision and incision. The potential of healing of both excision and incision wound was also evaluated in mice, by treating them with the flavonoid concentrate of *C. dactylon*. The flavonoid concentrate was smeared externally over the wound daily for a week. The protein and collagen escalation in the body with the reduction of the fat peroxides in granulation flesh proved the flavonoid potential helped enhance the process of healing.

#### **Antioxidant activity**

The antioxidant of *C. dactylon* evaluated in vitro by several assays like nitric oxide scavenging assay, DPPH radical scavenging activity, super-oxide anion radical scavenging assay, ferrous chelating ability, hydrogen peroxide scavenging activity, ABTS assay and hydroxyl radical scavenging assay, by taking a hydro-alcoholic extract of its aerial part. It was observed that the free radicals in a manner of concentrated dependence were scavenged in all the methods as mentioned above performed. Extreme inhibition in superoxide anion radical method was noted to be 93.33% and the antioxidant ability corresponding to the equal amount of ascorbic acid was noted to be 172.39 mg per gram of the aerial extract.

#### **Anti-nephrolithiasis activity**

Aqueous-ethanolic concentrate of *C. dactylon* showed that it could shrink the stones of calcium oxalate present in the rodent kidney by 40% to 55% individually. It helped in kidney stone expulsion beneficially and also employed in humans. It was evaluated that the impact of the excerpts of this plant has a protective and therapeutic consequence in tentatively initiated nephrolithiasis. Rats empirically induced with nephrolithiasis were studied for the anti-nephrolithiasis effect of *C. dactylon*'s hydro-alcoholic extract on them. Regular inspection of

renal histology, crystalluria, biochemical present in urine and other mutable compounds, was thoroughly carried out.

#### **Anti-diarrheal activity**

In an investigation hexane, dichloromethane, ethyl acetate and methanol extracts of *C. dactylon* whole plant were tested for anti-diarrheal activity on castor oil induced diarrhea, gastro intestinal motility by charcoal meal and entero pooling models in albino rats. Methanolic extract exhibited considerable reduction in inhibition of castor oil induced diarrhea and also showed a significant decrease in gastrointestinal motility by charcoal meal and decreased weight on intestinal contents in enter pooling models. These results indicate that the plant possess good anti-diarrheal activity.

#### **Bronchodilatory activity**

The bronchodilatory effect of *C. dactylon* was investigated by in vitro and in vivo models. Acetylcholine (Ach)-induced bronchospasm was conducted in guinea pig while isolated rat tracheal strip was suspended in organ bath to measure the concentration response curve using multichannel data acquisition system. The chloroform extract of *C. dactylon* (CECD) protected against Ach-induced bronchospasm in guinea pigs, similar to atropine. In the in-vitro studies, CECD relaxed carbachol (CCh) and high  $K^+$  -induced contraction of rat tracheal strip, similar to atropine and verapamil, suggesting antimuscarinic and calcium channel blocking (CCB) activities, which were confirmed by right ward shifting of CCh and  $Ca^{+2}$  concentration response curve (CRC). The phosphodiesterase (PDE) inhibitory activity was confirmed by potentiation of isoprenaline-induced inhibitory response, similar to papaverine. Densitometry analyses led to the identification of scopoletin as an active ingredient. It significantly inhibited high  $K^+$ , and  $Ca^{+2}$  induced contractile response, similar to verapamil.

The phosphodiesterase inhibitory activity was confirmed by direct evidence of potentiation of isoprenaline-induced inhibitory response, similar to papaverine. The results revealed that the bronchodilator activity of CECD was partly due to presence of scopoletin, and mediated possibly through CCB and PDE inhibition.

#### **Reproductive activity**

The effect of administration of aqueous extract of entire plant of *C. dactylon* for thirty days on reproductive hormones and reproductive organ



weight of female was studied in Wistar rats. Administration of the extract produced significant increase ( $p < 0.001$ ) in the serum estradiol concentration whereas, follicle stimulating and luteinizing hormones were significantly ( $p < 0.001$ ) reduced. Furthermore, a significant increase ( $p < 0.001$ ) in the weight of the uterus and significant decrease in the weight of the ovaries ( $p < 0.001$ ) was observed in the treated group when compared to the control group. In addition, the estrous cycle was found to be irregular and disturbed.

#### **Analgesic activity**

50% each of 300 mg/kg and 600 mg/kg amount of *C. dactylon*'s ethanolic extract was made and taken to evaluate the analgesic impact on albino rats against pain, inflammation, oedema (induced with carrageenan), enzymes' activity and the formation of lipid peroxide and granuloma while practising inflammation experimentally. The extract was then administered orally for a week to albino rats. Substantially, it worked significantly in repressing oedema in the paw. It also helped reducing peroxide output, the elevated formation of granuloma and the elevated activity of enzymes during and causing inflammation. To study the analgesic effect of the extract, albino mice were induced muscle contortions with acetic acid. It was later observed that the extract profoundly helped in elevating the threshold of the pain in albino mice.

#### **Antiviral activity**

In vivo testing, black tiger shrimps were administered 1% to 2% extracts of *C. dactylon* orally in large quantity which displayed strong antiviral action in contrast to white spot syndrome virus and they have likewise been accounted for to have a high antiviral effect against white spot syndrome virus with zero mortality.

#### **Anti-Pyretic activity**

The analgesic and anti-pyretic activities of aqueous extract of *C. dactylon* at different doses was studied using hot plate, acetic acid induced writhing and yeast induced hyperthermia in rats. *C. dactylon* showed significant analgesic and anti-pyretic activities in all models studied. The antipyretic effect of aqueous extract of *C. dactylon* was studied in mice; it was found that at the dose of 600 mg/kg, the aqueous extract possessed significant decrease in rectal temperature of mice similar to that shown by paracetamol.

#### **Wound Healing activity**

The wound healing property of *druvagritha* was evaluated by incision and excision wound model in male Wistar rat promotes wound contraction and reduces the time for closure showing healing potential comparable to Framycetinsulphate 1% cream. Wounds dressed with *Azadirachta indica* and *C. dactylon* extract with honey formulations, as topical application of wounds significantly accelerate the rate of wound healing process. The most effective concentration of aqueous *C. dactylon* extracts was found to be 6.0%, for dead space, excision and incision wound models.

#### **Anti-microbial activity**

The extract of *C. dactylon*'s leaves was used to examine the in vitro anti-bacterial effects counter to micro-organisms like *Streptococcus pyogenes*, *Staphylococcus aureus* and *Escherichia coli*. The most effective concentration of the extract was 10% which worked efficiently as an anti-bacterial concoction. Micro-organisms like *Pseudomonas aeruginosa*, *Staphylococcus aureus*, *Candida albicans*, *Escherichia coli*, *Proteus mirabilis* and *Klebsiella pneumoniae* were taken to evaluate the anti-microbial effects on them with 50 to 400 mg per ml of *C. dactylon*'s aqueous extracts.

Two Gram-positive bacteria, namely *Staphylococcus aureus* and *Staphylococcus albus* and two gram-negative bacteria, *Pseudomonas aeruginosa* and *Escherichia coli* were studied for the anti-microbial effect of its hydro-alcoholic extracts by well agar diffusion and microdilution. It resulted effectively, showing that all the microbial strains were profoundly sensitive to the extract's action. In another study, bioactive compounds in nature in *C. dactylon*'s leaves were tested for its anti-microbial property counter to microbial pathogens like *Pseudomonas aeruginosa*, *Escherichia coli*, *Bacillus subtilis*, *Staphylococcus aureus*, *Streptococcus pyogenes*, *Klebsiella pneumoniae* and *Proteus mirabilis* by a method of the paper disc. The bio-active compounds were extracted using organic solvents of six different types, among which the most effective was the butanolic extract of the leaves and then followed by ethyl ester extract, methanol extract, petroleum ether extract and chloroform extract.

#### **TRADITIONAL USES**

Traditionally, the plant was used for the treatment of diarrhea, dysentery, wounds, hemorrhages and hyperdyspsia. Fresh juice of plant was used as demulcent, astringent and in the

treatment of dropsy, anasarca, catarrhal ophthalmia, secondary syphilis, chronic diarrhea and dysentery. The fresh expressed juice of the grass was used in hematuria, vomiting and as application in catarrhal ophthalmia, and also can be applied to cuts and wounds, and in chronic diarrhea and dysentery. Decoctions of root were used in vesical calculus and secondary syphilis, stoppage of bleeding from piles, and irritation of urinary organs.

## II. CONCLUSION

This review discuss the chemical constituent, taxonomical classification, types of cynodon dactylon, microscopic characters, test for identity and purity, pharmacognosy, pharmacological and therapeutic effects of Cynodon dactylon as promising herbal drug because of its safety and effectiveness.

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