Minireview Article

CYNODON DACTYLON PERS.: A REVIEW ON FORAGE CROP AND MEDICINAL HERB

ABSTRACT

Cynodon dactylon is a forage crop besides being a medicinal herb which has been holding a sacred position in our Indian culture. Its survival capacity in any ecological succession has forced it to exist as medicinal plant containing a broad spectrum of secondary metabolites like Cyanidin, Luteolin, apigenin having several therapeutic uses. The review paper is designed in coordination with data from Google, Pubmed, Science Direct and research articles to compile the various properties of the plant like its thriving capacity, chemical composition and therapeutic uses which could be used for mankind and environmental benefits.

Keywords: *Cynodon dactylon*, forage crop, medicinal herb, Cyanidin, Luteolin

1. INTRODUCTION

C. dactylon is a C_4 grass currently included in invasive plant list of Global Compedium of weeds [1], widely distributed in tropical and subtropical regions of the world. It is a sod-forming, fast-growing grass that spreads by seeds,

multiple stolons and rhizomes and colonizes rapidly new areas forming dense mats. It has strong potential to alter ecosystem functioning by altering hydrological cycles, fire regimes, nutrient cycles, biophysical dynamics, and community compositions [2]. Despite being categorised as an invasive plant, it has several medicinal applications and has attracted a huge amount of research especially in the field of pharmacology.

C. dactylon is one of the auspicious herbs of Ayurveda which constitutes the group 'Dasapushpam' [3]. It is a sacred plant in Indian culture next to *Ocimum* [4], mention of which has also been incorporated in early Graeco-Forman pharmacopeias due to its support to cattle rearing [5]. It belongs to Poaceae family, having tinged purple colour stems, and slightly flattened in shape (Figure 1).

Fig 1: *Cynodon dactylon*

1.2. *C. dactylon*: potential forage crop

C. dactylon is distributed throughout the southernmost portions of the United States and region having similar climates worldwide. It cannot withstand freezing temperatures so, its propagation in colder belt is limited. It is abundant in some continental climates, such as the mid-South, Texas, Oklahoma, where cold winters exist. Its growth begins only in the late spring and is maximized under the hot conditions of summer. Its growth could be established by using seed or stolon cuttings. This plant can tolerate continuous grazing therefore, over sown with other cool-season annual grasses (like ryegrass) to improve pasture production in the fall, winter and early spring periods [6].

C. dactylon has good growth rate in sandy loam soils but it can also thrive in wide range of soil types from sand to clay. On lighter soil condition, it propagates by rhizomes

and stolons. It has increased establishment rate on clay soils because rhizomes and stolons cannot spread freely. The rate may however get decreased due to weed invasion but once, *C. dactylon* establishes strongly on clay soil, then it starts growing profusely.

C. dactylon is considered a forage crop that is tolerant of close grazing and need minimum management. It also acts as alternative for tall fescue during summer months. It is a versatile grass which can be grazed, hayed, and grown together with cool-season plants during dormant season. When season becomes favourable for its growth then, it becomes difficult to grow this plant with other companion forages. In some areas, alfalfa is grown with this grass. Also, Clovers could be grown with this plant, but elevated management is required for the establishment of legume and their persistence. To use this plant as forage crop in all grazing systems, one must determine the proper stocking rate of this plant under grazing management. This plant has great potential in managing grazing animals, forage production would be better if rotational grazing is preferred.

1.3. Common name and synonyms of *C. dactylon*

C dactylon has other two scientific names: *Panicum dactylon* and *Capriola dactylon*. It is also known by various names across the globe: Durva, Dhoob, Bermuda grass, Dubo, Bahama grass, Couch grass, Dog's tooth grass, Devil's grass, Arugampul, Scutch grass, Grama and Indian doab.

1.4. Sacred Belief

In Assam also, it holds a sacred position with medicinal qualities. It is commonly called Dubori bon in Assam, many poems and novel has mention of this name. In Hindu rituals like puja and yagya, this grass is used as puja offerings to the Gods. The priest makes a ring with this grass and wear on his finger throughout the religious rituals. It is believed that the grass has purifying effect. In Ganesha temple, this grass is used as offering. As per Hindu belief, Durva grass was created by churning the mountain Mandara for Amrita (attain immortality). This churning of mountain took place between Devatas and Asuras. There is also another belief that this grass grew from the drops of Amrita which fell when Devatas were drinking it.

1.5. Traditional medicine in India

C. dactylon is a weed cum medicinal plant. According to Ayurvedic Pharmacopoeia, it is pungent and bitter in taste which bears a characteristic fragrance and has cold potency. According to Unani system of medicine, this plant possesses a sharp, hot taste and pleasant odour. The aerial parts and rhizomes of the plant have been reported to be used in cardio protection, besides possessing antibacterial, antimicrobial, antioxidant, wound healing, anti-diabetic and diuretic effects. Also, it is traditionally used for jaundice, as astringent, to stop bleeding in piles and skin infections in some parts of India namely, West Bengal, Assam, Manipur, and Mizoram [7]. Furthermore, traditional healers use it for purifying the blood, anuria, biliousness, conjuctivitis, diarrhoea, gonorrhoea, itches, Leucorrhoea, Irregular menstruation, and stomach-ache [8]. In South India, its juice is commonly consumed as health drink early in the morning to restore a healthy life. In Ayurvedic medicine, the juice of the plant could be used for treatment of hysteria, epilepsy, and insanity [9].

1.6. Chemical constituents of *C. dactylon*

Whatever might be the Hindu belief for sacred plant, the presence of phytochemicals in *C. dactylon* defines the pharmacological role of the plant. GC-MS analysis of ethanol extract of plant as a whole, showed presence of glycerin; stigmasterol; gamma sterol; 1-Hydrazino-2-propanol; n- Hexadecanoic acid; Hexadecanoic acid ethyl ester; 9,12,15-Octadecatrienoic acid (Z, Z, Z); 1-Triacontanol, 2-Dodecen-1-yl (-) succinic anhydride; 3,7,11,15-tetramethyl-2-hexaden-1-ol (phytol) [10].

Preclinical studies of *C. dactylon* have shown that the oral administration at a dose of 20 mg/kg/body wt decreased the adjuvant-induced inflammatory response. It also reduced oxidative stress and ameliorated the arthritic changes to normal conditions. When compared with the control, extract of *C. dactylon* decreased the levels of inflammatory mediators, myeloperoxidase, nitrite, C-reactive protein, ceruloplasmin, and reactive oxygen species. Simultaneously, increased level of antioxidant system like catalase, superoxide dismutase, glutathione peroxidase, glutathione, vitamins C and E has been reported [3].

The plant is also used in treating dropsy [11], syphilis [12], and diabetes [13]. Studies have shown that active principles of *C. dactylon* found in ethanolic extracts exhibited antioxidant activity, namely, Cyanidin, beta-carotene, and triticin [14].

Studies have shown that protein fraction of *C. dactylon* could sensitized the humoral and cell mediated immunity [15]. Research work conducted in year 1999 [16], revealed that the administration of *C. dactylon* could significantly increase the antibody responsiveness in mice to sheep RBCs by increasing the counts of macrophages and antibody-synthesizing cells. Another study conducted in 2009, also proved that this plant could increase humoral antibody response against antigen. Also, it could inhibit the release of TNF-α, IL-6, and IL-1[17]. A study reported its anti-inflammatory action by observing increased IL 10 secretion which in turn suppressed proinflammatory cytokines [18]. This plant not only could modulate immunity in mice, but also when *Catla catla* fish was supplied with food containing *C. dactylon* extract, a nonspecific immunity could be observed which protected it from bacterial infection caused by *Aeromonas hydrophila* [19].

This plant contains a minor storage protein triticin which is reported with antioxidant activity. Triticin is a storage protein of wheat endosperm which is nutritionally rich due to the presence of unique lysine- rich decapeptide repeat motif inserted in the hyper variable region of this gene [20]. It belongs to legumin super family (11-12S globulins) storage protein. It is predominant in seeds of legumes and some cereals such as rice and oat [21].

It has been also reported that this plant contains very important metabolite called cyanidin (Fig 2). It is a plant pigment of anthocyanidin origin and very potent chemopreventive agent. Most of berries display the colours due to Anthocyanins, particularly glucosides and galactosides of cyanidin, peonidin, delphinidin, petunidin and malvidin. During ripening season, pigment secretion increases whereas decreased secretion has been seen for polyphenols (−)-epicatechin, (+)-catechin and dimeric proanthocyanins [22].

C. dactylon exhibits antioxidant properties due to the presence of phytochemicals like beta carotene which has been reported in this plant [14]. Beta-carotene belongs to the group of carotenoids consisting of isoprene units. The presence of conjugated pi-system in the long carbon chain of beta-carotene acts as a chromophore responsible for its

specific color [23]. It is the most abundant form of carotenoid, and it is a precursor of vitamin A. Beta-carotene is composed of two retinyl groups. It can be found in yellow, orange, and green leafy vegetables and fruits [24].

β-Carotene (Fig 3) is an antioxidant that has greater efficacy against the reactive oxygen species, i.e., singlet oxygen ($^1O_2$) compared to vitamin E and vitamin C [25]. Feeding β-carotene in the diet of C57BL/6J mice beginning at 1 month or at 20 months of age for the duration of the life span increased the serum concentration of β-carotene by 60% but did not change the β-carotene content of heart, liver, or kidney and neither significantly affected the mean nor the maximal life span [26].

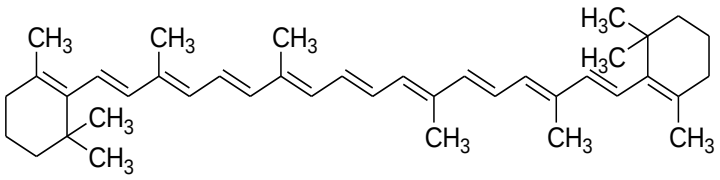

Fig 3 β- carotene

1.7. Pharmacological properties of *C. dactylon*

Scientific report has shown that aluminium induced neurotoxicity could be suppressed by pre-treatment with aqueous extract of *C. dactylon* at dose of 750mg/kg/day orally. The study also reported that various regions of the brain like cerebral cortex, hippocampus and cerebellum could be protected from aluminium toxicity [27]. In 2011, Rai *et al*. reported that the aqueous extract of this plant could develop new anticholinesterase and antioxidant activity against carbofuran. Also, scopolamine induced amnesia in rats could be restored by treating with hydro-ethanolic extract of *C. dactylon* which decreased acetylcholinesterase enzyme level and increased antioxidant levels [28].

Antidiabetic property of *C. dactylon* was also experimentally validated in different models. In 2008, non-polysaccharide fraction of aqueous extract could effectively produce hypoglycemic condition in fasting normal rats [29]. Again in 2013, *in silico* evaluation revealed that aqueous extract of *C. dactylon* contains luteolin, apigenin, 6-C-pentosyl-8-C-hexosyl apigenin and 6-C-hexosyl-8-C-pentosyl luteolin which can interact

with sodium glucose transporter-2. The study acclaims that this plant could be an alternative for the treatment of diabetes [30].

Many research works have highlighted different pharmacological properties such as antioxidant, antiarthritic, anti-inflammatory, antimicrobial, antidiuretic, and anti-atherosclerotic property. In 2014, antiarthritic study revealed that *C. dactylon* could effectively improve WBCs, ESR, C- reactive protein (CRP) and reduce TNF alpha level. Also, the study mentioned that the plant could protect arthritic joints by improving bone lesions [31]. Another study conducted in 2009 showed that when *C. dactylon* dose of 20mg/kg/body weight were given orally to arthritic rats after adjuvant injection, a significant improvement in the inflammatory response, oxidative stress and ameliorated arthritic changes to reach normal state was observed [3]. Early atherosclerotic changes in the vessel wall would be prevented by treating the high cholesterol diet rats with ethanolic extract of *C. dactylon* [32]. Also, reports have shown that this plant could show a strong protective effect on right heart failure by giving positive inotropic action and improving cardiac functions [33]. A study revealed that aqueous decoction of *C. dactylon* could reduce stone formation at dose of 200mg/kg/ body weight [34]. Also, this plant has the capacity to prevent and eliminate Calcium oxalate deposition into kidneys of rat which supports the traditional belief of the plant to be used in treatment of kidney stones [35]. Even fractional analysis of this grass has supported the traditional belief of kidney stone treatment [36]. In 2015, 2017 and 2018, different studies were conducted which promoted different stages of wound healing like angiogenesis [37]; collagenesis [38] and Collagen Silica Cynodon extract scaffold for treating wounds [39].

2. Conclusions

C. dactylon, a sacred plant of Indian culture has so many beneficial roles to the ecosystem and judicious use of this plant would benefit both mankind and environment. Much research has been done in understanding its role as forage crop and its use as medicinal herb. As per traditional belief *C. dactylon* is very good herb for gynaecological issues like Leucorrhoea, irregular menstruation. However, systematic study is yet to be done for its validation.

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