CODEN (USA): IAJPB ISSN: 2349-7750

INDO AMERICAN JOURNAL OF
PHARMACEUTICAL SCIENCES
http://doi.org/10.5281/zenodo.292965

Available online at: http://www.iajps.com Review Article

THE PHARMACOLOGICAL POTENTIAL OF *DACTYLOCTENIUM AEGYPTIUM*- A REVIEW

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Received: 20 December 2016 **Accepted:** 21 January 2017 **Published:** 11 February 2017

Abstract:

The phytochemical analysis of Dactyloctenium aegyptium showed that the plant contained carbohydrates, proteins, amino acids, terpenoids, alkaloids, saponins, tannins, flavonoids, steroids , fixed oils and phenols. The pharmacological investigations revealed that Dactyloctenium aegyptium possessed antimicrobial, antioxidant, reproductive, cytooxic, antidiabetic and gastointestinal effects. The current review will highlight the chemical constituents and pharmacological effects of Dactyloctenium aegyptium.

Keywords: *Dactyloctenium aegyptium, contents, pharmacology, therapeutic*

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*Please cite this article in press as Ali Esmail Al-Snafi, **The Pharmacological Potential of Dactyloctenium Aegyptium- A Review**, Indo Am. J. P. Sci, 2017; 4(01).*

INTRODUCTION:

Herbal medicine is the oldest form of medicine known to mankind. It was the mainstay of many early civilizations and still the most widely practiced form of medicine in the world today. Plants generally produce many secondary metabolites which are bio-synthetically derived from primary metabolites and constitute an important source of many pharmaceutical drugs [1-30]. The phytochemical analysis of *Dactyloctenium aegyptium* showed that the plant contained carbohydrates, proteins, amino acids, terpenoids, alkaloids, saponins, tannins, flavonoids, steroids , fixed oils and phenols. The pharmacological investigations revealed that *Dactyloctenium aegyptium* possessed antimicrobial, antioxidant, reproductive, cytooxic, antidiabetic and gastointestinal effects. The current review will highlight the chemical constituents and pharmacological effects of *Dactyloctenium aegyptium*.

Synonyms:

Aegilops saccharina, *Cenchrus aegyptius*, *Cenchrus mucronatus*, *Chloris guineensis*, *Chloris mucronata*, *Chloris prostrata*, *Ctenium nukaviense*, *Cynosurus aegyptiacus*, *Cynosurus carolinianus*, *Cynosurus cavara*, *Cynosurus ciliaris*, *Cynosurus distachyos*, *Cynosurus macara*, *Dactyloctenium ciliare*, *Dactyloctenium distachyum*, *Dactyloctenium figarei*, *Dactyloctenium meridionale*, *Dactyloctenium mpuetense*, *Dactyloctenium mucronatum*, *Dactyloctenium prostratum*, *Eleusine aegyptia*, *Eleusine ciliate*, *Eleusine cruciata*, *Eleusine egyptia*, *Eleusine pectinata*, *Eleusine prostrate*, *Rabdochloa mucronata*, *Syntherisma aegyptiaca* [31].

Taxonomic classification:

Kingdom: Plantae; **Phylum**: Tracheophyta; **Division**: Magnoliophyta; **Class**: Liliopsida; **Order:** Poales; **Family**: Poaceae; **Genus**: *Dactyloctenium*; **Species**: *Dactyloctenium aegyptium* [31].

Common names:

Afrikaans: Abudati, Cincere ba; **Arabic**: na'eem el-saleeb, rigl'al'harbaya; **Brazil**: estrela, grama-de-dedo-egípcia, grama-egípcia, mão-de-sapo, três-dedos; **English**: crowfoot grass, Egyptian crowfoot grass, Egyptian grass, coast button grass, comb fringe grass, duck grass,, Durban crowfoot, finger comb grass, finger grass; **French**: Chiendent, Pattes de poule, Pied poule; **India**: Makri; **Japan**: tatsunotsumegaya; **Philippines**: alam, damong baling; **Spanish:** Estrella del mar, Paja de palma, Pata de gallina falsa, Tres dedos, Yerba de egipto; **Swedish**: knapphirs; **Tamil**: Ka-kka-kalpul, Makaraa, Makari, Timidaa [32-33].

Distribution:

Dactyloctenium aegyptium has a pantropical distribution, with some extensions in the subtropics. It is found in Africa (Kenya, Tanzania, Uganda, Eritrea, Ethiopia, Somalia, Sudan, Egypt, Libya, Morocco, Tunisia, Angola, Malawi, Mozambique, Zambia, Zimbabwe, Botswana, Namibia, Benin, Burkina Faso, Gambia, Ghana, Guinea; Liberia, Mali, Mauritania, Niger, Nigeria, Senegal, Sierra Leone, Togo, Cameroon, Equatorial Guinea, Zaire, Madagascar, Mauritius); Asia (Bahrain, Kuwait, Oman, Qatar, Saudi Arabia, United Arab Emirates, Yemen, Iraq, China, Afghanistan; Palestine, Lebanon, Turkey, India, Nepal, Pakistan, Sri Lanka, Myanmar, Malaysia, Philippines); Europe (Italy, Spain); Northern America and Southwestern America [33].

Description:

Annual, never stoloniferous. Culms up to 50 cm tall, up to 5 noded, geniculately ascending, usually rooting from the lower nodes, thus giving the plants a pseudo-stoloniferous appearance, not rarely forming radiate mats, branched from the lower nodes; internodes cylindrical, glabrous, smooth, striate, exserted above, variable in length; nodes thickened and glabrous. Young shoots cylindrical or rounded. Leaf-sheaths keeled, up to 5 cm long, rather lax, striate, tuberculately hairy on the keel or quite glabrous; ligule membranous, about 1 mm long, ciliolate along the upper edge; leaf blades flat when mature, rolled when in bud, linear, tapering to a fine point, up to 20 cm long and 12 mm wide, with 3-5 primary nerves on either side of the midrib, glaucous, usually more or less densely tuberculately hairy along the margins and the keel, less conspicuously so on the adaxial surface towards the tip. Inflorescence digitate, composed of 4-8 spreading spikes. Spikes 1.5-6 cm long, on maturity often somewhat recurved, greenish-yellow or pallid; rachis keeled, smooth near the base, scaberulous towards the apex, tip mucroniform and curved. Spikelets 4 mm long, strongly compressed, ovate, solitary, sessile, patent alternately left and right on the ventral side of the axis; dense, forming a very flat comb, usually 3-flowered; lower florets bisexual, the upper florets rudimentary; axis without terminal stipe. Lower glume 2 mm long and 2 mm wide, ovate in profile, 1-nerved, sharply keeled, keel scabrid; upper glume 2 mm long excluding the 1.5-2 mm-long awn, oblong in profile, 1-nerved, sharply keeled, keel scabrid. Rachilla slender. Lemmas 3-4 mm wide, the upper smaller in dimensions (but similar), folded about the keel which is scabrid, broadly ovate in profile, lateral nerves delicate and indistinct; uppermost lemma epaleate. Paleas about 3 mm long, 2-nerved, keels scabrid, dorsally concave, shortly bifid at the apex. Three anthers, pale-yellow, 0.3-0.5 mm long, anther cells somewhat remote, with a conspicuous connective. Caryopsis sub-triangular or sub-quadrate, laterally compressed, rugose, light-brown, apex truncate, never convex, remains of pericarp at times visible [34-37].

Traditional uses:

This plant was widely used as forage and is relished by all types of ruminants [38]. It was considered as astringent, cooling, constipating, and diuretic [39]. It was used traditionally bitter tonic, anti-anthelmintic, to treat gastrointestinal, biliary and urinary ailments, for the treatment of cough, polyurea, fevers, smallpox, heart burn, immunodeficiency, urinary lithiasis, spasm of maternity, renal infections, gastric ulcers and for wounds healing [40-42]. Plant juice was used for fevers, used externally for wounds and ulcers dysentery and acute hemoptysis [43].

Chemical constituents:

Chemical and physicochemical analysis of *Dactyloctenium aegyptium* gave the following values (on dry basis): crude protein: 7.25%; fibre: 33.74%; N-free extract: 45.32%; ether extract: 1.23%; total ash: 12.46%; ash solubility in HCl: 8.65%; CaO: 0.91%; P_2O_7: 0.49%; MgO: 0.70%; Na: 0.074%; and K2O: 3.75% [39].

The phytochemical analysis showed that the plant contained carbohydrates, proteins, amino acids, terpenoids, alkaloids, saponins, tannins, flavonoids, steroids , fixed oils and phenols [44-46].

Aqueous extract revealed the presence of carbohydrates, proteins, amino acids, saponins, flavonoids and tannins. Hydroalcoholic extract revealed the presence of carbohydrates, proteins, amino acids, saponins, flavonoids, tannins, terpenoids and alkaloids. Ethanolic extract revealed the presence of carbohydrates, proteins, amino acids, saponins, flavonoids, tannins, terpenoids and alkaloids. Ethyl acetate extract revealed the presence flavonoids, tannins, terpenoids and alkaloids, while, chloroform and n- hexane extracts revealed the presence of terpenoids [47].

Quantitative analysis showed that *Dactyloctenium aegyptium* leaf extract contained alkaloids 0.540 ± 0.083, phenols 0.246 ± 0.041, Saponins 1.120 ± 0.047, and tannins 0.430 ± 0.032 mg/g dry weight [48].

Dactyloctenium aegyptium also contained cynogenic glycosides, oxalic acid oxalates, glutamic and aspartic acids, cystine and tyrosine [49-50]. 5-hydroxypyrimidine- 2,4 (3H,5H)- dione; 6'Glyceryl asysgangoside,and 2 amino, 2 methyl, (5,6 di hydroxymethyl), 1,4 dioxane P. hydroxy benzaldhyde, tricin, P. hydroxy benzoic acid, vanillic acid, β-sitosterol-3-O-β-D-glucoside, asysgangoside adenine, uridine and sucrose were isolated from the aerial parts of *Dactyloctenium aegyptium* aerial parts [51].

Pharmacological effects:

Antimicrobial effects:

The methanolic extract of *Dactyloctenium aegyptium* possessed antibacterial activity against standard *Stapylococcus aureus* (ATCC 25953) and hospital isolated *Stapylococcus aureus* strains with MIC of 7.6-7.7 mg/ml [52].

Dactyloctenium aegyptium methanolic extract possessed antibacterial activity against *Stapylococcus aureus* and *Escherichia coli* with MIC of 6.5-7 mg/ml [53].

Antimicrobial activities of *n*-hexane, ethyl acetate and *n*-butanol fractions of *Dactyloctenium aegyptium* aerial parts were investigated against Gram positive bacteria [*Staphylococcus aurous*(RCMB 010028) and *Bacillis subtilis*(RCMB 010067)], Gram negative bacteria [*Escherichia coli* (RCMB 010052) and *Pseudomonas aeruginosa* (RCMB 010043)] and fungal strains [*Aspergillus fumigates* (RCMB 02568) and *Candida albicans* (RCMB 05031)]. The ethyl acetate extract was the most active against *C. albicans* and *E. coli* compared to that of *n*-butanol. The *n*-hexane showed no antimicrobial activity against all microorganisms tested [51].

The antibacterial activity of *Dactyloctenium aegyptium* was studied against *Staphylococcus aureus, Pseudomonas aeruginosa, E.coli, Klebsiella pneumoniae, Proteus vulgaris* by disc diffusion method. The maximum zone of inhibition was observed against *pseudomonas aeruginosa* and the minimum zone of inhibition was observed against *Proteus vulgaris, E.coli, Klebsiella pneumoniae* for ethanol extract [54].

Ethanolic extract of *Dactyloctenium aegyptium* were examined for antimicrobial potential against three standard bacteria (*Escherichia coli, Klebsiella Pneumonia, Staphylococci*) and one standard fungus (*Aspergillus niger*). The ethanolic extract of *Dactyloctenium aegyptium* showed antifungal activity and antibacterial activity against all the tested bacteria with a dose dependent increase in zone of inhibition [44].

The antimicrobial potential of the methanolic extracts of nine medicinal plants from Saudi folk medicine was studied against seven pathogens (*E coli, B. cereus, S. typhi, K. pneumonia, P. aeruginosa, S. aureus* and *Candida albicans*). *Dactyloctenium aegyptium*, showed good antimicrobial activity [41].

The antiviral activity against HSV-2 , HSV-1 and HAV-10 of *Dactyloctenium aegyptium* aerial parts extracts was investigated using cytopathic effect inhibition assay. The ethyl acetate showed weak antiviral activity, *n*-butanol extracts of *Dactyloctenium aegyptium* showed moderate antiviral effects against HAV-10 and HSV-1. The *n*-hexane extract showed strong antiviral activity against all viruses tested [51].

Cytotoxic effects:

The cytotoxicity of the *n*-hexane, ethyl acetate and *n*-butanol fractions of *Dactyloctenium aegyptium* aerial parts were evaluated against three human tumor cell lines; hepatocellular carcinoma cells (HepG-2), colon carcinoma cells (HCT-116) and breast carcinoma cells (MCF-7). The ethyl acetate

and *n*-hexane of *Dactyloctenium aegyptium* were the most active extracts as cytotoxic agents against the tested cell lines with IC_{50} values from 6.1 to 9.6µg/ml compared to that of *n*-butanol [51].

The antiproliferative and cytotoxic effects of the hexane and butanol extracts of *Dactyloctenium aegyptium* were studied *in vitro*. All the extracts exhibited selective growth inhibitory effect on human lung cancer (A549) and cervical cancer (HeLa) cells relative to normal human lung MRC-5 fibroblasts with IC_{50} values in a range of 202 to 845 mg/ml. Apparently, HeLa cells were more sensitive to the extracts than A549 cells. Moreover, all the extracts induced lethality in both cancer cell lines at concentrations close to 1,000 mg/ml, indicating their selective cytotoxicity effects. ELISA assay showed that only the hexane extract of *Dactyloctenium aegyptium* significantly increased the apoptotic level in extract-treated A549 cells. However, DNA ladder assay detected classic DNA ladder patterns, a characteristic feature of apoptosis, in both cancer cell lines treated with all extracts in a dose- and time-dependent manner. The authors concluded that the cytotoxic activity of the *Dactyloctenium aegyptium* extracts against lung and cervical cancer cells is mediated through the induction of apoptosis [55].

Reproductive effects:

Fertility was estimated in adult male rats treated with whole *Dactyloctenium aegyptium* ethanolic extract 200, 400 and 600 mg/kg body weight. Groups received ethanolic extract of *Dactyloctenium aegyptium* showed significant decrease in serum testosterone levels and increase in serum estrogen levels when compared to control group. The final body weight of rats of all treated groups showed no significant increase in body weight when compared with initial body weights. A significant decrease in weight of testis, epididymis (caput and cauda), vas deferens, seminal vesicle and prostate were noted in all treated groups when compared with control group. A significant reduction of total sperm count and increase in motility, abnormality of sperm in caput and cauda was observed in all treated groups compared to control. Histologically, the treated groups showed dose related reduction in the diameter of seminiferous tubules, with reduced layering, less spermatozoa, hyper-cellularity of Leydig cells with the presence of large multinucleated cells. The administration of ethanolic extract of *Dactyloctenium aegyptium* showed dose dependent decrease in number of pregnant females and number of fetuses [46]. Male rats treated with whole *Dactyloctenium aegyptium* ethanolic extract 200, 400 and 600 mg/kg body weight, showed significant decrease in SOD, catalase, GSH compared to control group [46].

Antidiabetic effects:

The anti-diabetic activity of different solvent extracts of *Dactyloctenium aegyptium* was evaluated in streptozotocin induced diabetic rats. All extracts showed significant decrease in serum glucose levels, and the antidiabetic potency of extracts was in the order of ethanolic extract > hydroalcoholic extract > aqueous extract > ethyl acetate extract > chloroform extract > n-hexane extract. The animals treated with ethanolic extract showed significant decrease in blood glucose, HbA1c, malondialdehyde levels and significant increase in insulin, Hb, SOD, catalase, reduced glutathione and body weight [47].

The antidiabetic effect of n-hexane, chloroform, ethyl acetate and methanolic fractions from ethanolic extract of *Dactyloctenium aegyptium* was investigated in streptozotocin induced diabetic rats. The methanolic fraction of ethanolic extract of *Dactyloctenium aegyptium* has favourable effect in bringing down the severity of diabetes. Animals treated with Methyl fraction showed significant decrease in blood glucose, HbA1c, malondialdehyde levels and significant increase in insulin, Hb, SOD, catalase, reduced glutathione and body weight [56].

Gastro-intestinal effects:

The ethanolic extract of *Dactyloctenium aegyptium* was investigated for its anti-ulcer activity against aspirin plus pylorus ligation induced gastric ulcer in rats, HCl -ethanol induced ulcer in mice and water immersion stress induced ulcer in rats at 300 mg/kg body weight orally. A significant ($P< 0.01$- $P< 0.001$) anti-ulcer activity was recorded in all the models. Pylorus ligation showed significant ($P< 0.01$) reduction in gastric volume, free acidity and ulcer index in animals treated by *Dactyloctenium aegyptium* extract compared to control. *Dactyloctenium aegyptium* extract also caused 89.71% ulcer inhibition in HCl- ethanol induced ulcer and 95.3% ulcer protection index in stress induced ulcer [57].

Crude extract of *Dactylotenium aegyptium* and its fractions were evaluated to rationalize their use in gastrointestinal ailments. In spontaneous contracting rabbit jejunum preparation, *Dactyloctenium aegyptium* possessed concentration dependent spasmogenic effect (0.01-0.1 mg/ml) followed by spasmolytic effect at higher doses (0.3-3.0 mg/ml). Pretreatment of the tissue preparations with atropine resulted in suppression of the spasmogenic response. Furthermore, *Dactyloctenium aegyptium* (1.0 mg/ml) caused relaxation of K^+ (80 mM)-induced spastic contractions in isolated rabbit jejunum preparations and there was non -parallel shift in Ca^{++} dose response curves towards right (0.1-0.3 mg/ml). These effects were comparable with verapamil, a standard Ca^{++} channel blocker. The solvent-solvents fractionation reflected segregations of spasmogenic and

spasmolytic effects in respective aqueous and dichloromethane fractions [40].

Antioxidant effects:

The radical scavenging activity of the crude extract of *Dactyloctenium aegyptium* was determined by DPPH method. *Dactyloctenium aegyptium* crude extract showed high percent radical scavenging activity (66.59%), but less when compare to standard, ascorbic acid (78.40%) [58].

Toxicity:

No toxicity was found up to 2000 mg/kg of ethanolic extracts of *Dactyloctenium aegyptium* in rats and mice [46-47].

The effects of whole *Dactyloctenium aegyptium* ethanolic extract 200, 400 and 600 mg/kg body weight was investigated on serum biochemical parameters like protein, albumin, globulin, creatinine and liver marker enzymes like SGOT, SGPT and ALP. Ethanolic extract 200, 400 and 600 mg/kg body weight caused no great changes in these biochemical parameters. However, high dose, decreased albumin, globulin and SGOT significantly [46].

CONCLUSION:

The current paper reviewed the chemical constituent and pharmacological effects of *Dactyloctenium aegyptium* as promising herbal drug because of its safety and effectiveness.

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