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PHARMACOGNOSTIC AND PRO-FERTILITY EVALUATION OF DRACAENA ARBOREA (WILLD) LINN

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ABSTRACT

Dracaena arborea (Willd.) Linn., a medicinal plant widely used in traditional African medicine, has gained scientific attention for its potential role in improving male reproductive health. The present study aims to evaluate the pharmacognostic characteristics and pro-fertility activity of *Dracaena arborea* through phytochemical, pharmacological, and experimental investigations. The plant was subjected to detailed botanical identification, phytochemical screening, and pharmacological evaluation using aqueous and ethanolic extracts. Phytochemical analysis revealed the presence of bioactive compounds such as flavonoids, alkaloids, saponins, phytates, cyanogenic compounds, and calcium oxalate crystals, which are known to possess significant biological activities. Experimental studies in animal models demonstrated that the extracts significantly improved sperm count, motility, viability, and morphology, while maintaining testicular architecture and germ cell integrity. The plant also exhibited strong antioxidant activity by increasing endogenous antioxidant enzymes such as superoxide dismutase, catalase, and reduced glutathione, along with reducing lipid peroxidation. Furthermore, *D. arborea* enhanced serum testosterone levels and modulated neuroendocrine pathways involved in reproductive function. These findings scientifically support the traditional use of *Dracaena arborea* as an aphrodisiac and fertility-enhancing agent, suggesting its potential as a natural therapeutic option for male infertility.

KEYWORDS: Dracaena arborea; Pharmacognostic evaluation; Pro-fertility activity; Male infertility; Antioxidant activity; Phytochemicals; Aphrodisiac; Spermatogenesis.

INTRODUCTION

Pharmacogonsy is the branch of pharmaceutical science that deal with the study of medicinal drugs derived from natural source, including plants, animals, minerals, and microorganisms. It involves the identification, extraction, isolation and characterization of bioactive compounds, which can be used for therapeutic use.

The term pharmacogonsy is derived from the Greek word pharmakon [drug] and gnosis [knowledge] meaning knowledge of drugs from natural sources. Traditionally pharmacogonsy focused on crude drugs and herbal medicine, biotechnology and molecular pharmacology.

Dracaena arborea is a medicinal plant used in Cameroon against male sexual impairments. Traditional healers use a mixture of palm wine and the roots of D. arborea (Wild) Link (Dracaenaceae) as an aphrodisiac to treat male sexual dysfunctions.[1]

In previous studies, we shown that this plant's ethanol and aqueous extracts stimulate androgen synthesis, spermatogenesis, and sexual activity in normal, castrated, and diabetic rats, which increases copulatory activity.[2]

Additionally, we found that D. arborea prevents any rise in stress markers and impairment of sperm parameters in rats with three days of varicocele[3] and protects and stimulates the proliferation of testicular germ cells in diabetic rats.[4]

Flavonoids, alkaloids, saponins, cyanides, and phytates may be responsible for D.arborea's therapeutic qualities. 14, Antioxidant, anti-inflammatory, and anti-allergic properties include the antioxidant properties of flavonoids.

15 Alkaloids have an extremely Bitter taste, and saponins are known to have antibacterial and antifungal qualities. Their effects on humans have led to the development of painkillers.

Fertility is the latent ability of an organism to reproduce itself while infertility is the incapability to conceive and carry a pregnancy to live birth. It is a worldwide medical and social problem that affects above 10-15% of married couples.[5] The vertebrate reproductive cycle depends upon delicate interrelationships between the sex hormones and the pituitary gonadotropi hormones.

The incapability to a male to consider a fertile woman is defined as male infertility. Hormonal disorders, low sperm production, poor sperm quality, abnormal sperm function, and other disorders can cause it. Semen quality is used as an alternative measure of male fecundity

One of the main causes of male infertility in the world is varicocele (VCL). It is represented by an unusual enlargement of the pampiniform plexus, which blocks the removal of metabolite waste and the supply of testes.[5]

These days, varicocelectomy, radiography, embolisation, sclerotherapy, or medication (chorionic gonadotropic hormone) are the main treatments for VCL. Oral antioxidant medications are commonly utilised to restore the reproductive potential of VCL patients since oxidative stress appears to be the primary mechanism in varicocele-induced testis impairment and/or male infertility.

Figure 1: Dracaena Arborea.

Traditional healers use a plant Dracaena arborea as an aphrodisiac to treat sexual disorders. Our research group's previous research demonstrated that the aqueous (500 mg/kg) and ethanolic (100 mg/kg) extracts of D. arborea protect and regulate the increased rate of testicular germ cell death by apoptosis in streptozotocin-induced diabetic rats (Wankeu-Nya et al., 2013), stimulate copulatory activity of normal and androgen-deprived (castrated) rats through the dopaminergic and/or cholinergic pathway.

Rats with diabetes caused by the streptozotocin (Wankeu-Nya et al., 2014). By blocking the dopaminergic and oxytocinergic receptors in the bulb spongiosus muscles, D. arborea also delays the pro-ejaculatory action of dopamine and oxytocin in the spine of male rats (Watcho et al., 2014). Also, we showed that D. arborea has androgenic properties to be responsible for

its reducing effects on diabetic reproductive problems in rats (Wankeu-Nya et al., 2019). also a recent study found that in normal and prediabetic male Wistar rats, a mixture of Mondia whitei, D. arborea, and Bridelia ferruginea had sexual stimulant effects (Watcho et al., 2019).

Aqueous and ethanolic extracts of D. arborea demonstrated notable bioactivities in experimental models, according to pharmacological research. For example, dopamine and oxytocin-induced ejaculatory responses in spinal male rats had been dose-dependently reduced by intravenous administration of aqueous and ethanol root extracts, showing that the plant contains compounds that interact with neuroendocrine pathways essential for reproductive physiology.

D. arborea has the ability for reducing oxidative damage to male reproductive organs due to its significantly enhanced sperm density, motility, and viability in experimental varicocele models while reducing oxidative stress markers such malondialdehyde and boosting antioxidant enzyme activities.

Further research suggests a chance that D. arborea includes fertility-enhancing properties. Traditional claims of reproductive benefits have been confirmed by oral administration of methanolic leaf extract in albino rats, that was associated with increases in sperm count and testicular weight and also improved histological indices of spermatogenesis.

PLANT DESCRIPTION

BOTANICAL CLASSIFICATION

Kingdom: Plantae

Family: Asparagaceae

Genus: Dracaena

Species: Dracaena arborea

Synonyms: Tree Dracaena, African dragon tree

Order: Asparagaceae

Domian: Eukarya

Class: Liliopsida (monocots)

Division: Magnoliophyta

Common name: Tree Dracaena, African dragon tree, Giant dragon tree

VERNACULAR NAMES

English: Tree Dracaena, African dragon tree

Hindi: Dracaena vriksh

Tamil: Dracaena maram

Malayalam: Dracaena maram

Telugu: Dracaena chettu

Kannada: Dracaena mara

French: Dragonnier arborescent

PHYTOCHEMICAL REVIEW

- **TREE:** D. arborea trees can reach height of 20 meters and trunk in diameter of 20 to 30 cm. They are often planted as ornamentals or as boundaries.

Figure 2: Dracaena arborea tree.

- **LEAVES:** The leaves are narrowly oblanceolate to sword-shaped, size 50–120– 150 cm in 4–6–10 cm, tapering to both ends, in the widest part distinctly above the middle and an acute tip. Fresh leaves are bright green to dark green, shiny, and have parallel sometimes irregular transverse venation (Bos, 1986).

Figure 3: Leaves of dracaena arborea.

- **FLOWER:** The ovary is cylindrical to bottle-shaped, up to 3 mm x 2 mm, style up to ¼ mm in diameter, reaching the top of the perianth, and stigma about 1 mm in diameter. The flowers are white, 17–20–22 mm long, with a receptacle extending for about 2–3 mm below the ovary into a cone, perianth tube 5–8 mm long, lobes up to twice as long, 10–13 mm wide, and it has a single median vein.

Figure 4: Flower of dracaena arborea.

- **FRUITS:** Fruits are 12 to 24 mm long, 12 to 27 mm in diameter, bright orange, depressed globose, and more lobed when more than one seed is present. The persistent receptacle is 3 to 6 mm long. The seeds of a plant are spherical and teeth white to pale brown.

Figure 5: Fruits of dracaena arborea.

PHYTOCHEMICAL REVIEW

Seven phytochemicals were examined. They included cyanide, phytate, lectin, alkaloids, flavonoids, saponins and calcium oxalate crystals.

Quantitative phytochemicals analysis

Similarly, quantitative test was carried out using standard procedures.

DETERMINATION OF CYANIDE

Each test tube was filled with 1 ml of the sample extract, 4 ml of alkaline picrate, and allowed for 5 minutes. A standard and a blank with distilled water were taken and a spectrophotometer used for measuring the absorbance at 490 nM. This is in accordance with Onwuka's (2005) method.

DETERMINATION OF CALCIUM OXALATE

10 ml of each extract was transferred to 100 ml flasks, and 30 ml of diethyl ether was added to each flask according to Pearson's (1978) method. The pH of each filtrate was adjusted to 7.0 with NH4OH. Each filtrate was titrated with 0.1 M KMnO4, and the initial and final volumes of KMnO4 was recorded.

DETERMINATION OF ALKALOID

20 ml of each extract was heated over a water bath to a quarter of their initial volume in accordance with Harborne's (1973) method. Drop to drop, all NH4OH solution was added until its precipitation was finished and allowed to settle. The precipitates were collected, washed with a dilute NH4OH solution, and then filtered. weighing the residues, the crude alkaloid was observed.

DETERMINATION OF SAPONIN

The method described by Obadoni and Ochuko (2001) involved transferring 10 ml of each extract in 250 ml separator funnels and washing them with 20 ml of diethyl ether. Each had two distinct layers: the ether layer and the aqueous layer. The ether layers were thrown away and the aqueous layers were recovered. The washing process was carried out once again. By adding 60 ml of n-butanol, the extracts was twice washed with 10 ml of 5% aqueous NaCl. A water bath was used to heat the remaining solutions. Following evaporation, the samples were dried in an oven to exact weights in beakers that had already been weighed. The saponin was estimated in percentages when the final weights were determined.

DETERMINATION OF FLAVONOID

Whatman filter papers number A1, B1, C1, A2, B2, and C2 were used to filter 100 ml of each extract following to Boham and Kocipa's (1974) procedure. The filtrates were transferred into weighed crucibles and evaporated to dryness over a water bath. When re-weighed each crucible and percentage of flavonoid was calculated.

DETERMINATION OF LACTIN

In accordance with Harborne's (1973) method, 1 ml of heparinized rabbit blood was added to 1 ml of each extract diluent in a test tube. After forming a blank of red blood cells and normal saline, the extracts in the test tubes were allowed to stand at room temperature for 4 hours. After adding 1 ml of normal saline to all tube and allowed to stand for 10 min, a spectrophotometer was using to measure the absorbance at 620 nM. The blank was a test tube containing only blood cells and normal saline. Letin unit/mg= (b-a) x F, where b is the absorbance of the test sample solution, an is the absorbance of the blank, F is the experimental factor given by F= (1/w x vf/va) D, where w is the sample weight, vf is the total volume of extract, va is the volume of extract used in the assay, and D is the dilution factor (if any).

DETERMINATION OF PHYTATE

4 test tubes with ground glass stoppers were filled with 0.5 ml of each extract using the Oberlease (1973) procedure. 0.2 g of NH4+Fe (111) sulphate in 1 ml. Each was filled with 100 ml of 12 H2O and 100 ml of 2 N HCl, which were also fixed with clips. The tubes were heated for 30 min in a bath of boiling water, taking care to remain the tubes well stoppered for the first 5 mins of heating. For 15 minutes of cooled in ice water, they were allowed to adjust to room temperature. Each tube's content mixed and centrifuged at 3000 rpm for 30 minutes.

PHARMACOLOGICAL ACTIVITY

- **ANTIOXIDANT ACTIVITY**

Dracaena arborea has been demonstrated through experiments to have considerable antioxidant activity. When the plant's aqueous and ethanolic extracts were administered, endogenous antioxidant enzymes like superoxide dismutase (SOD), catalase (CAT), and reduced glutathione (GSH) were elevated, while malondialdehyde (MDA), an indicator of lipid peroxidation, was decreased. These results indicate that it plays a part in collecting free radicals and protecting tissues from damage due to oxidative stress.

- **APHRODISIAC AND PROESEXUAL ACTIVITY**

Traditionally, Dracaena arborea has been used as an aphrodisiac. This statement has been supported by scientific research showing greater testosterone level, increased mounting frequency, increased intromission frequency, and enhanced sexual behaviour in male rats. It has been demonstrated that the plant extract modifies sexual function via routes in the central

nervous system.

- **ANDROGENIC ACTIVITY**

Evaluation shows that Dracaena arborea improves androgen-dependent reproductive parameters and improves serum testosterone levels. Sexual performance and spermatogenesis are enhanced by this androgenic activity.

- **ANTI-EJACULATORY AND ERECTILE DYSFUNCTION- LLEVIATING ACTIVITY**

Evaluation indicates that Dracaena arborea increases serum testosterone levels and androgen-dependent reproductive parameters. This androgenic activity enhances spermatogenesis and sexual activity.

- **ANTICOAGULANT AND ANTITHROMBOTIC ACTIVITY**

Dracaena arborea leaf extracts showed anticoagulant activity by prolonging clotting time in in vitro studies. This property supports its typical application in thrombotic and cardiovascular diseases.

- **ANTI-INFLAMATORY ACTIVITY**

Phytochemical profiling using GC-MS showed bioactive compounds with anti- inflammatory activities. After getting treated with D. arborea fractions, experimental models demonstrated a significant reduction in inflammation.

- **ANTI-MICROBIAL ACTIVITY**

Antimicrobial activity of extracts from its root, stem, and leaves against various strains of bacteria. Although the results vary based on the type of extract and the microbial strain tested, Dracaena arborea has been reported to have antibacterial effects. With inhibition zones ranging from 10 to 30 mm and minimum inhibitory concentrations (MICs) between 50 and 200 mg/mL, ethanol extracts of the leaves, stems, and roots exhibit strong antibacterial properties in vitro, indicating effectiveness against a number of pathogenic bacteria (Alozie et al., 2020). However, methanol extracts of the plant did not exhibit any activity against multidrug-resistant pathogens, such as Klebsiella pneumoniae, Pseudomonas aeruginosa, and Staphylococcus aureus, showing that the antimicrobial potential is extract-dependent and may not apply to resistant strains (Umoh et al., 2020). Tannins, saponins, flavonoids, and alkaloids are the phytochemicals found in the plant which are generally associated with antibacterial

properties (Alozie et al., 2020). The therapeutic potential of D. arborea was demonstrated by comparative tests with commonly used antibiotics, which indicated that ethanol extracts might induce inhibitory zones similar in magnitude to medications like metronidazole and cephalexin (Alozie et al., 2020). Overall, the results shows that the Dracaena arborea has antibacterial activity, further research is required to determine its range, effectiveness, and mode of action (Umoh et al., 2020).

- **FERTILITY-ENHANCING ACTIVITY(PROFERTILITY)**

The benefits of Dracaena arborea for male reproductive health has been thoroughly studied. Extracts from this plant have been demonstrated to significantly improve sexual characteristics in animal models, primarily rats. Among the primary activities are:

1. **Improvement in sperm parameters**

Increases the amount, motility Viability of sperm causes Abnormal sperm morphology.

2. **Improvement of sperm parameters**

Increases the quantity, motility, and viability of sperm. Promotes abnormal sperm orphology.

3. **Production of testicular structure**

Maintains the integrity of germ cells and seminiferous tubules. Reduces testicular cell death caused on by diabetes or oxidative stress.

4. **Hormonal modulation**

Enhances the quantity of testosterone in the blood. Supports reproductive processes that depend on androgens.

5. **Oxidative stress reduction**

Increases antioxidant enzymes such as glutathione (GSH), catalase (CAT), superoxide dismulase (SOD).

Protect testes and sperm from oxidative damage by reducing pid peroxidation (MDA).

6. **Neuromodulatory effects**

Enhances sexual activity and sexual control via dopaminergic, oxytocinergic, and cholinergic pathways.

MATERIAL AND METHODS

PLANT COLLECTION, EXTRACT PREPARATION

The roots were chopped into small pieces, shade-dried, and later transformed into a powder using an electric grinder. The powder was used to prepare the extractsD. arborea powder (800g) was macerated in distilled water (5L) for 72 hours to produce the aqueous extract. After filtration, 39.68g of a brownish residue (extraction yield: 4.96%) was obtained after oven-dried the filtrate at 45°C. (Wankeu-Nya, 2013; 2014).

1 kg of D. arborea powder was macerated in 5L of 95% ethanol for 72 hours to prepare the ethanolic extract. After filtration, 30g of the brownish residue (an extraction yield of 3%) was obtained after evaporated the filtrate under a reduced pressure using a rotative 1 kg of D. arborea powder was macerated in 5L of 95% ethanol for 72 hours to prepare the ethanolic extract. After filtration, 30g of the brownish residue (an extraction yield of 3%) was obtained after evaporated the filtrate under a reduced pressure using a rotative evaporator (Wankeu-Nya et al., 2013; 2014). Plant extract and vitamin E doses were selected based on previous studies (Watcho et al., 2007; Wankeu-Nya et al., 2013; 2014; Khosravanian et al., 2015). According to our pilot studies(Watcho et al., 2007; Wankeu-Nya et al., 2013; 2014), the working solutions of aqueous and ethanolic extracts were prepared in distilled water and administered at 500 mg/kg and 100 mg/kg, respectively.

ANIMALS

In this research, we used adult male Wistar rats that were 2.5 months old and weight in 190 – 210 g. They came from the University of Dschang, Cameroon's Faculty of Science's animal house. The animals had unlimited access to food and water were maintained in a standard environment (22–25°C; approximately 12 hours of light and 12 hours of dark). The Scientific Committee of the Department of Animal Biology at the University of Dschang presented and accepted the project, which follows to the internationally accepted standard ethical guidelines for the use and care of laboratory animal as described in the European Economic Community guidelines, EEC Directive 2010/63/EU, of September 22, 2010 (European Union, 2010).

VARICOCELE INDUCTION

According to Turner (2001), varicocele was induced. In brief, a midline laparotomy incision was used to expose the upper left abdominal quadrant, and the left renal vein was carefully dissected at the middle point of the spermatic vein's insertion. A silk suture was used to

secure a 20-gauge needle over the renal vein. The midline incision was then sutured using silk thread after the needle was carefully removed.

EXPERIMENTAL PROTOCOL

Thirty-six animals were divided into six groups of six animals each, 12 with had varicocele and 24 of which did not. The animals were treated as follows: Group 1, of normal rats receiving distilled water (10 ml/kg bw); Group 2, of sham-operated rats receiving distilled water (10 ml/kg bw); Group 3, of varicocele rats receiving distilled water (10 ml/kg bw); Group 4, of varicocele rats receiving vitamin E (150 mg/kg bw); and Groups 5 and 6, of varicocele rats receiving aqueous (500 mg/kg) and ethanolic (100 mg/kg) extracts of D. arborea. For 30 days, the rats were oral treated with drugs and a vehicle. We measured the testes and epididymis weights, sperm characteristics, and biochemical parameters related to oxidative stress at the end of the treatment period.

TISSUE PREPARATION AND SAMPLE ANALYSIS

All rats were sacrificed under diazepam (10 mg/kg) and ketamine (50 mg/kg) anaesthesia on day 31, the day after the last treatment. After separated from adherent tissue, the testes and epididymis were weighed and cleared in a saline solution. The following formula was used to calculate relative sexual organ weights: This method used for relative sex organ weight = (absolute sexual organ weight/body weight) × 100. Sperm count, motility, and morphology were measured using the left and right epididymis. After homogenised the left and right testes in Tris buffer (PH = 7.4) to make a 15% (g/ml) homogenate, 100 µl of this homogenate were used for the measurement of total protein and oxidative stress markers (MDA, SOD, and catalase).

SPERM DENSITY AND MOTILITY

On day 31, the day after last treatment, all rats were sacrificed under anaesthesia and diazepam (10 mg/kg) and ketamine (50 mg/kg). The testes and epididymis were weighed and cleared in a saline solution after being separated from adherent tissue. Relative sexual organ weights are calculate by the following formula: This method for relative sex organ weight is (absolute sex organ weight/body weight) × 100. The left and right epididymis were using to measure sperm count, motility, and morphology. The left and right testes were homogenised in Tris buffer (PH = 7.4) to make a 15% (g/ml) homogenate. Total protein and oxidative stress markers (MDA, SOD, and catalase) were measurement using 100 µl of this homogenate.

Percentage of motile spermatozoa (%) = (number of motile spermatozoa/total number of counted spermatozoa) x 100

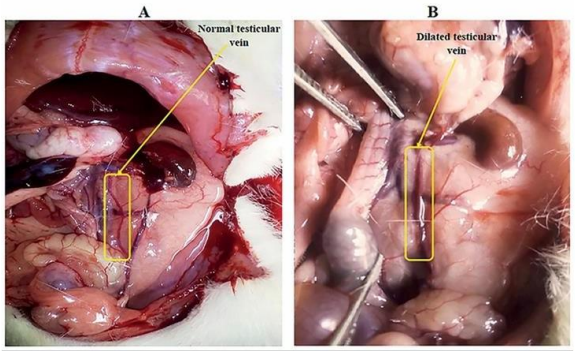

Figure 1. Aspect of the internal spermatic vein (A) before and (B) after partial ligation of the left renal vein.

SPERM VIABILITY AND MORPHOLOGY

On a slide, 10 µl of sperm suspension, 10 µl of eosin (1%), and 30 µl of nigrosin (5%) were mixed thoroughly to evaluate sperm viability. The World Health Organization's (WHO) 2010 guidelines to the examination and processing of semen were observed when using the eosin-nigrosin staining procedure (WHO, 2010). A light microscope (OLYMPUS, 40X) was used to examine the stained sperm mixture that was spread out in the slide. In order to differentiate between sperm that were stained pink or red, which are considered to become dead, and unstained sperm, which are considered to be viable, ten (10) fields on the slide were selected. The following formula was used to express the proportion of sperm ability to survive.

$$\%SPZv = (SPZv/SPZt) \times 100$$

Where %SPZv: percentage of viable spermatozoa; SPZn: number of viable spermatozoa; SPZt: total number of counted spermatozoa.

Eosin/nigrosin staining was used to determine the morphology of the sperm. Ten ml of sperm suspension were added to thirty ml of nigrosin (5%) and ten ml of eosin (1%). After being incubated in an oven at 45°C for 5 minutes, the produced smear was used. To observe different spermatozoa defects (such as head and tail abnormalities, cytoplasmic droplets, and tailless spermatozoa), ten (10) fields on the slide were selected. The following formula was used to calculate the percent of normal spermatozoa for each field and the mean percentage of all slides (Ngoula et al., 2007)

$$\%SPZn = (SPZn/SPZt) \times 100$$

Where %SPZn: percentage of normal spermatozoa; SPZn: number of normal spermatozoa; SPZt: total number of counted spermatozoa.

OXIDATIVE STRESS PARAMETERS

10% supernatant was extracted from the homogenate after the testis was crushed in a mortar with tampon tris and cold centrifuged for 10 minutes at 3,000xg. Protein, MDA, SOD, and catalase analysis were performed using the supernatant. A commercial kit (Roche Diagnostics Cobas C-1111) was used to measure the proteins, and the steps were performed out according with the instructions provided by the manufacturer. The thiobarbituric acid reaction was used to figure out the MDA content (Soni et al., 2018). The catalase and SOD activities in the tissue was evaluated based on the method described by Aristophile et al. (2006).

STATISTICAL ANALYSIS

The results are presented as mean ± S.E.M. To determine statistical differences, one-wayanalysis of variance (ANOVA) followed by Tukey-HSD post hoc test were used. The Statistica software (version 8.0, StatSoft, Inc., Tulsa, USA) was used for all analysis.

CONCULISION

In the treatment of male reproductive disorders, Dracaena arborea has grown into a pharmacologically significant medicinal plant with high medicinal importance. Research shows that in pathological conditions such as diabetes and varicocele, aqueous (500 mg/kg) and ethanolic (100 mg/kg) root extracts significantly improve sperm quality parameters, such as sperm count, motility, viability, and morphology, while maintaining testicular structure and germ cell integrity. By improving endogenous antioxidant enzymes such as superoxide dismutase (SOD), catalase (CAT), and reduced glutathione (GSH) and decreasing the lipid peroxidation marker malondialdehyde (MDA), the plant shows strong antioxidant activity and protects reproductive tissues from oxidative stress-induced damage. Furthermore, by increasing the blood testosterone levels and changing dopaminergic, oxytocinergic, and cholinergic pathways, all of which enhance reproductive activity and spermatogenesis— D. arborea improves sexual behaviour and hormonal balance. The presence of biologically active substances such flavonoids, alkaloids, saponins, phytates, and cyanogenic components is confirmed by phytochemical evaluations, which could explain the reported antioxidant, androgenic, and fertility-enhancing activity. Overall, the traditional use of Dracaena arborea as an aphrodisiac and pro-fertility drug is strongly based on the most recent experimental and pharmacological data. However, further study on molecular mechanisms, standard extract formulations, toxicity profiling, and controlled clinical trials is required to determine its therapeutic security and efficacy for potential usage in the management of male reproductive

health.

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