A review : Potensi Dracaena liberica (Gérôme & Labroy) Christenh sebagai etnomedicine dan treaupetic

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Abstract. *Dracaena liberica*, an ornamental plant found in various African and Asian countries, has a long history of traditional medicinal use. This article aims to offer an overview of *D. liberica* based on its taxonomic characteristics, distribution, habitat, and traditional medicinal applications, while also conducting literature review for its therapeutic potential in terms of antioxidant, antibacterial, anticancer, and antitoxicity properties. The platform used for this article's literature review focuses on materials relating to plants of the Genus *Dracaena* and the species *D. liberica*. Furthermore, the article discusses the active compounds that have been identified in previous studies, such as phytol, stigmasterol, linoleic acid, oleic acid, stearic acid, palmitic acid, β-sitosterol, and β-stigmasterol. This review article suggests that this plant has the potential to exhibit antioxidant, anticancer, antimicrobial, and antitoxic activities. Antitoxic and anticancer activities are more promising than antimicrobial and antioxidant activities. Recent research has highlighted the roots and leaves of *D. liberica* as particularly promising sources of anticancer and antitoxicity agents. Consequently, *D. liberica* holds great potential for the development of natural medicines.

1 Introduction

Dracaena liberica Gérôme & Labroy originates from Liberia or also called *Sansevieria liberica*. *D. liberica* is often used as an ornamental plant. The diverse shapes, sizes, and patterns of the leaves make this plant popular among the public. *D. liberica* is widely distributed in all tropical regions. *D. liberica* has been cultivated in Nigeria to extract its leaf fibers, which are used to make ropes, bowstrings, and fishing lines. In Ghana, the fibers are made into cloth using hand looms. The fibers are still used to string valuable and sacred ornaments and to make sponges. *D. liberica* has the ability to absorb some harmful pollutants in the air. Based on the results of the National Aeronautic and Space Administration (NASA) research, this plant can absorb harmful chemical compounds such as benzene, trichloroethylene and formaldehyde[1]. In addition to its ability to absorb harmful compounds, this plant is also a source of fiber that is used in making ropes, fishing lines, bowstrings, weaving, and clothing [2]. In the realm of traditional medicine, the juice or

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decoction extracted from the leaves is ingested as a remedy for conditions such as gonorrhea, earache, and toothache. The latex of the leaves is applied to boils, sores and used for earache and toothache. The fermented rhizomes are eaten to cure malaria. The root decoction is used as an anticonvulsant. In Ghana, the roots of this plant have been traditionally employed for inducing abortion and are administered during childbirth. In Nigeria, the leaves and roots are utilized in traditional medicine to treat various conditions including asthma, stomach ache, colic, diarrhea, eczema, gonorrhea, hemorrhoids, hypertension, menorrhagia, sexual weakness, snake bites, and foot ulcers [3], [4], [5] .

The plant, *D. liberica*, is commonly found in places of worship and has been associated with numerous myths. In the past, its collection was restricted in Africa due to religious beliefs. Traditional healers often include this medicinal plant in their private gardens because of its reputed effectiveness in treating various common and uncommon illnesses [6]. In Nigeria, different parts of *D. liberica*, particularly the leaves and roots, are highly valued in the field of ethnomedicine. These plant parts are employed to alleviate symptoms associated with malaria, including fever, headache, and cold. They are also utilized for their analgesic, anti-infective, sedative, anticonvulsant, anti-inflammatory, abortifacient, and labor-inducing properties [7].

The leaves of *D. liberica* have long been used in traditional remedies for malaria fever, convulsions, and pain. Some of the medicinal claims associated with *D. liberica* have been scientifically evaluated and published in various journals. For instance, Adeyemi (2007) found that the aqueous root extract of *D. liberica* is an effective treatment for diarrhea [5]. Furthermore, different research teams have investigated and reported on the plant's effectiveness in treating conditions such as snake venom, asthma, diabetes, abdominal pains, cancer, liver protection, central nervous system depression, epilepsy, pain relief, inflammation, diabetes, leishmaniasis, and malaria [8], [9], [10], [11].

The root and leaf extracts of *D. liberica* contain many active compounds that can act as antimicrobials, anticancer, antianalgesics, antiallergics, anti-inflammatories [12]. Among them are compounds from the phenolic, alkaloid, terpenoid, and saponin groups [13]. The demand for *D. liberica* plants in the community continues to increase. In 2013, the demand for *D. liberica* plants was 16,584,580 seedlings [7]. With the many uses of *D. liberica* and the increasing demand for this plant, it is necessary to study the potentials of this plant as one of the sources of plants that will become natural medicine candidates. Therefore this plant has great potential for the development of drugs from natural materials. This article aims to offer an overview of *D. liberica* by examining its taxonomic characteristics, distribution, habitat, and traditional medicinal applications, while also exploring its therapeutic potential in terms of antioxidant, antibacterial, anticancer, and antitoxicity properties.

2 Materials and methods

The platform used for the literature review in creating this article focuses on sources related to plants within the Genus *Dracaena* and the species *D. liberica*. The search study is centered around the potential of *D. liberica* in terms of ethnopharmacology and its phytochemistry. The journals referenced are those included in Web of Science, Scopus, and other reputable journals that support this study. The selected journals or articles are those published within the last ten years. Meanwhile, the referenced books are those related to the family and species associated with *D. liberica*.

3 Results and discussion

Based on the literature review, the study of *D. liberica* is categorized into several sections: habitat and geographical distribution, taxonomic characteristics, ethnomedical use, biological activities, and pharmacological activities. In terms of biological and pharmacological activities, its potential as an antioxidant, anticancer, antimicrobial, and antitoxicity agent is examined.

3.1 Taxonomical Character

Dracaena liberica belongs to the genus *Dracaena*, belonging to the Asparagaceae familis. The type of leaf is stiff blades. *D. liberica* exhibits the growth of multiple rigid leaves characterized by elliptical shapes and red edges, emerging from robust underground rhizomes. This plant has concave, short leaf stalks, some of which are horizontally striped with light and dark green colors, as well as linear stripes ranging from whitish-green to light and dark green [14] (Figure 1). The leaves contain more than 2% fiber. Often confused with *Sansevieria senegambica*, this plant shares similarities but can be distinguished by its larger leaves and more pronounced bands, while *S. senegambica* has smaller leaves and less distinct bands. The distribution of *S. senegambica* ranges from Senegal to Ivory Coast. The native habitat of *D. liberica* is a desert, which accounts for its stiff and succulent leaves [15].

Its leaves form a rosette consisting of 1-6 leaf blades without leaf stems. The leaf blades are oblanceolate in shape, with a length of approximately 45-105 cm and a width of 5-12.5 cm. The leaves have dark and green stripes, with red and white lines marking their margins. The tips of the leaves are pointed, and they have a thick fibrous texture. The leaves are typically solitary, with 1-3 leaves per plant, lanceolate in shape, with a length of 45 - 100 cm, and a width of 7 - 10 cm. The leaves are smooth and generally green with white or yellow spot patterns[15].

Its roots are fibrous roots, also known as wild roots. All of its roots grow from the base of the stem and are fibrous in shape. Healthy roots are white and appear full. Another characteristic of *D. liberica* is its rhizomes, which grow either above or below the surface of the soil. This plant has long rhizomes with long fibrous roots and a rapid growth rate. The rhizomes are roundly branched and have an average diameter of 19 mm [16], [17].

D. liberica produces flowers in March and April. The cream-colored flowers are arranged in compact clusters. They are fragrant and quickly fall off. The flowers are white and borne on regular stems that are severed. The inflorescence resembles a spike with a length of 60-80 cm, and the flower stems have persistent membranous bracts, with lower bracts measuring 4 cm. The flowers are bisexual, regular, with pedicel length of 5 mm, tubular perianth 5-7 cm long, and 6 white lobes; there are 6 stamens, a superior ovary with 3 cells, filiform stigma, and a long style [18].

Its fruit is a berry that ranges in color from reddish to orange. The fruit has a diameter of up to about 1.25 cm and is slightly pointed and round. Each fruit contains seeds, which are red and occur in groups of 1-3 seeds [19], [20]

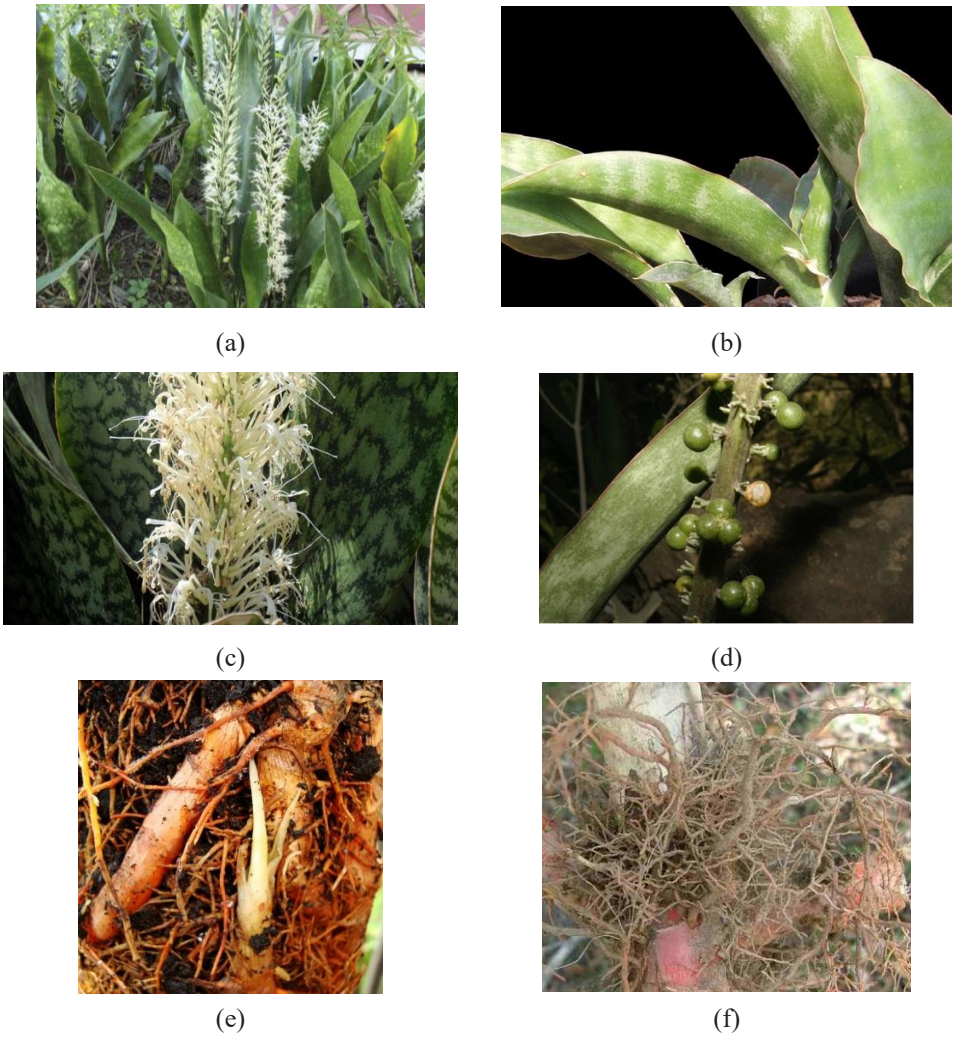

Fig. 1. Plant of *Dracaena liberica:* a) Whole plant of *D. liberica*, b) Leaves, c) Flowers, d) Fruits, e) Rhizomes f) Roots [7]

3.2 Habitat and geographical distribution

D. liberica originates from tropical West Africa (from Morocco to Chad) and extends to several parts of Central and East Africa (Central African Republic, Ethiopia, Kenya, and Tanzania). This plant is distributed from Sierra Leone to Nigeria and Central Africa. It has been locally naturalized in southeastern Queensland and has subsequently spread widely to Southeast Asian regions. This succulent species is commonly cultivated as a garden plant and is regularly discarded as garden waste, from where it spreads into scrubland and forms dense colonies. It is propagated through leaf-tip cuttings [15].

Fig. 2. Distribution map of *D. liberica* [21]

The ideal environment for *D. liberica* growth is at an altitude of 600 m - 1000 m above sea level, with a temperature of 24°C - 32°C, at a light intensity of 55 - 75%, and a soil pH of 5.5 - 6.5. *D. liberica* is a slow-growing plant that can reach a height of up to 6 feet (1.8 meters). *D. liberica* can generally be planted in every type of soil. *D. liberica*, being a hardy plant, thrives in hot and bright environmental conditions. Typically, *D. liberica* is found near riverbanks, rocky outcrops, in shaded locations in savannas, and forests with a minimum annual rainfall of 250 mm. This plant can tolerate a range from dry to moderately humid soils. The ideal substrate for its growth is sandy loam. The plant can withstand temperatures as low as 1°C. For commercial production, such as fiber production, *D. liberica* is recommended to be grown in warm, humid climates with adequate shade and good drainage, slightly alkaline soil [18], [19].

3.3 Ethnomedical uses

D. liberica, known as "Ida orisa" in West Nigeria (Agavaceae), is traditionally used for the treatment of asthma, diabetes, stomach pain, hypertension, menorrhagia, and sexual dysfunction [22], [23]. In traditional Nigerian medicine, the leaves and roots of the plant are used to treat stomachaches, asthma, diarrhea, skin diseases (eczema), gonorrhea, hemorrhoids, hypertension, sexual weakness, snakebites, and wounds [3], [5]. Leaf extracts or decoctions are consumed for the treatment of gonorrhea, earaches, and toothaches. Leaf latex is applied to boils and ulcers, as well as for earaches and toothaches. Fermented rhizomes are ingested to cure malaria. Root decoctions are used as anticonvulsants. In Ghana, the roots are used for abortion and given during childbirth. As a fetish plant, it is cultivated in graveyards, temples, and sacred complexes. Juice extracted from the leaves or leaf decoctions is consumed for the treatment of gonorrhea, earaches, and toothaches. Leaf latex is applied to boils and wounds [24] .

Various parts of the *D. liberica*, including leaves and roots, have medicinal properties and can be ingested or applied externally for the treatment and cure of diseases. These plant parts can be chewed, swallowed, or prepared as a beverage. Additionally, the plant can be crushed and used topically through sticking, rubbing, or smearing. Furthermore, *D. liberica* can be employed to repel pests and eliminate unpleasant odors when placed in the surrounding environment. However, it is necessary to properly process these plants. Processing methods may involve boiling, brewing, crushing, or burning, either with or without additional ingredients. For instance, leaves and rhizomes can be burned, boiled, and subsequently ground into a paste. The resulting liquid from boiling the plant material can be consumed by placing the plant parts in a container with a specific volume of water and heating it until boiling or until the volume reduces. Alternatively, the medicinal plant parts can be soaked in hot water for consumption [6], [7], [8], [25], [26], [27].

Preceding the boiling process, it is common practice to first dry the *D. liberica* plant material. According to Sumarni et al. (2019), drying serves as an initial step before boiling, with the objective of preventing the absorption of sap into the body during consumption. Boiling is the most frequently employed method for medicinal preparation, with an efficacy rate exceeding 43%. For instance, the Dayak Kanayatn tribe in West Kalimantan utilizes boiling to expedite the dissolution of active ingredients in water, leading to faster healing upon consumption of the resulting infusion [28], [29]

Root decoctions are used in traditional medicine as tonics, cough remedies, for hemorrhoids, and to alleviate convulsions. In Ghana, the roots are used for abortion and childbirth. In Togo, rhizomes macerated in palm wine are used to treat prostatic hypertrophy. This plant is also considered a talisman in traditional medicine. Therefore, in addition to its ornamental use, it is often planted in graveyards and places of worship [30].

Table 1. The use of D. liberica as traditional medicine in various countries

Country	Ethnomedical use	Plant part(s)	Preparation	References
Indonesia	Air pollution, diabetes, antiallergic	Leaves	Crushed and decoction	[31]
Nigeria	menorrhagia (excessive menstrual bleeding), menstrual pains, diarrhea, abdominal pains, gonorrhea, eczema, piles, snake bites, impotence, asthma, high blood pressure, microbial infections, diabetes, dyslipidemia, otitis (ear inflammation), wounds, prostatic hypertrophy (enlarged prostate), and fatigue.	Leaves	Brewed, decoction, pasted	[25], [32]
Nigeria	malarial symptoms such as fever, headache, and cold. It is also known for its analgesic properties. Additionally, it is believed to possess anti-infective, sedative, anticonvulsant, and anti-inflammatory effects. In traditional practices, it has been used as an abortifacient and administered during labor. Furthermore, the plant has been associated with the treatment of conditions such as asthma, abdominal pains, colic, diarrhea, eczema, gonorrhea, hemorrhoids, hypertension, menorrhagia, piles, sexual weakness, snake bites, and foot wounds.	Leaves and Roots	No remark	[6]
Uganda	treatment of snakebites	Leaves, Rhizomes, and Roots	No remark	[2]

India	treating various ear and eye infections, as well as reducing inflammation when the juice from its leaves is applied. For toothaches, a combination of fruit juice and fluid from snails is used. The fumes produced by burning the leaves are inhaled to alleviate symptoms of fever, headache, and cold. The root decoction of the plant is utilized for treating conditions such as cough, pain, inflammation, infections, convulsions, diarrhea, and as a stimulating tonic. It is also believed to be effective in the treatment of hemorrhoids, ear and eye problems, pain, smallpox, chickenpox, measles, venereal diseases, malnutrition, paralysis, epilepsy, convulsions, spasms, pulmonary issues, and as a vermifuge to eliminate intestinal worms.	Leaves and root	Decoction, juice	[12]
Cameroon	Maceration of leaves is taken orally and to bathe against body itches.	Leaves	maceration	[24]

3.4 Therapeutic actions

D. liberica is known to exhibit various pharmacological activities, including antimicrobial, healing, antitumor, antitussive, antidiabetic, antihaemorrhoidal, hepatoprotective, anti-inflammatory, hypolipidemic, antianemic, and immunomodulatory effects [7]. In laboratory studies, it has been observed that the ethanol extract derived from the rhizomes of *D. liberica* exhibits antimicrobial and antifungal properties. Moreover, it has demonstrated cytotoxic effects against Vero cells. The plant has also been found to possess in vitro activities against trypanosomes, leishmania parasites, and plasmodium, indicating its potential as an antitrypanosomal, antileishmanial, and antiplasmodial agent [33]. The plant's extracts have also demonstrated antidiarrheal [5] , central nervous system depressant, anticonvulsant [5], [27], analgesic, and anti-inflammatory activities [9].

Furthermore, *D. liberica* has been reported to possess antihypertensive, anticancer, diuretic, antioxidant, hepatoprotective, hypoglycemic, and antihyperglycemic activities [11], [12], [23]; [34], [35]. Several compounds isolated from its stem bark and leaves include mpavetannin, aplysamine-2, abscisic acid, α-conidendinin, and quercetin-3-O-α-L-arabinofuranoside [10]. Terpenoids such as β-stigmasterol, β-sitosterol, and campesterol have also been isolated from the plant [23]. In a recent study, Ayoola and colleagues reported significant and consistent antihyperglycemic and antioxidant activities from extracts, partitioned fractions, and columns of its rhizomes[36]. The n-hexane fraction from the extract was found to exhibit promising activity comparable to glibenclamide [24].

3.4.1 Antioxidant activity

The antioxidant potential of *D. liberica* has not been extensively researched. Three studies have investigated its antioxidant activity using the 2,2-diphenyl-1-picrylhydrazyl (DPPH) method, with IC50 values of 0.0625 µg/mL, 100 µg/mL, and 44.5 µg/mL[6], [32] . The presence of phenolic compounds in *D. liberica* contributes to its high and promising antioxidant activity, as indicated by IC50 values below 100 µg/mL. The phytochemical compounds present in *D. liberica* play a significant role in influencing its antioxidant activity.

The group of phytochemical compounds that act as antioxidants is phenolic compounds [37], [38], [39]. Meanwhile, an IC50 activity of 100 µg/mL is considered moderate.

Table 2. Antioxidant activity of *D. liberica*

Sample	IC50 value	Method	Reference
Methanolic extract of leaves *D. liberica*	0.0625 µg/mL	DPPH	[32]
Methanolic extract of leaves *D. liberica*	100 µg/mL	DPPH	[6]
Dichloromethane extract of *D. liberica* leaves	44.5 µg/mL	DPPH	[33]

3.4.2 Anticancer activity

The current body of research exploring the potential anticancer properties of *D. liberica* remains limited in scope and depth. Studies on cancer activity have been conducted on ethanol extracts of *D. liberica* roots. Based on Table 3, it is known that research on the cytotoxicity of *D. liberica* has been conducted on HCT-116 (colon), HeLa (cervix), A549, and THP-1 (leukemia) cancer cells. Cytotoxicity categorization based on the US National Cancer Institute [40], [41] reveals that the cytotoxic activity of ethanol extracts of *D. liberica* roots against HCT-116, HeLa (cervix), and THP-1 cells exhibits moderate cytotoxic activity [6] [35]. Additional research is required to investigate the potential phytochemical compounds present in *D. liberica* that could potentially serve as anticancer agents. Furthermore, it is necessary to explore different solvents and other plant parts, such as flowers and roots, that can be utilized for this purpose. The mechanism of action of ethanol leaf extracts of *D. liberica* as anticancer agents needs to be studied to understand their effects on the hallmark of cancer.

Table 3. Anticancer activity of *D. angolensis* in various cell model

Sample	**Cell Model**	**IC50 value (µg/mL)**	**Reference**
Ethanolic extract of *D. liberica* roots	HCT-116 (colon)	23 μg/mL -HCT	[7], [12], [35]
	HeLa (cervix)	22 μg/mL,HeLa	
	THP- 1 (leukemia)	23 μg/mL - THP	
Ethanolic extract of *D. liberica* roots	HeLa (cervix)	IC_{50} 23 μg/mL	[12]
	HCT-116 (colon)	IC_{50} 22 μg/mL	
	A549 (lung)	IC_{50} 23 μg/mL	
	THP-1 (leukimia)	IC_{50} 18 μg/mL	

3.4.3 Antimicrobial activity

Research on antibacterial activity has shown its potential against various microbes such as fungi and bacteria (Table 4). The extracts used for antibacterial activity testing in these studies were methanol extracts from both the root and leaf organs [10], [19], [25]. The active

compounds found in these extracts, including saponins, polyphenols, and flavonoids, exhibit antibacterial properties [42]. The antibacterial potential of *D. liberica* extracts is promising and warrants further investigation to better understand their mechanisms of action and potential applications in combating bacterial infections.

Table 4. Antimicrobial activity of *D. liberica*

Sample	Tested microorganism	MIC	Reference
Isolated compound of *D. liberica* roots methanolic extract	• *Candida albicans* • *Methicithinness staphaureus*; • *Staphylococcus aureus* • *Escheridia coli*.	400 μg/ml	[25]
Methanolic extract of *D. liberica* leaves	• *B. cereus* • *S. aureus* • *E. coli* • *S. thypii*	6.25 mg/mL 6.25 mg/mL 125 mg/ml 125 mg/ml	[19]
Methanolic extract of *D. liberica* leaves	• *B. sublitis* • *S. aureus* • *P. aeruginosa* • *E. coli*	12.5 mg/mL	[10]

3.4.4 Antitoxicity

Based on the conducted research, the water extract of *D. liberica* rhizomes has shown hypoglycemic, hypolipidemic, antianemic, immunomodulatory, oculoprotective, hepatoprotective, and nephroprotective activities in diabetic Wistar rats [11]. In studies conducted on rat paw edema, both crude extracts and fractions of *D. liberica* have demonstrated anti-inflammatory properties. [10]. Hydroalcoholic extracts of *D. liberica* rhizomes demonstrate in vitro and in vivo anticarcinogenic effects [12]. Ikewuchi (2012) demonstrated that water extracts of *D. liberica* leaves protect Wistar rats from liver damage caused by carbon tetrachloride.

Table 5. Toxicity of *D. liberica*

Sample	Toxicity value	Ref
Hydroethanolic extract of *D. liberica* leaves	Albino mice, 3.599 μg/kg body weight	[6]
The extract and fractions obtained from the rhizomes of *D. liberica* include n-hexane, ethyl acetate, and butanol fractions.	LD50 of μg/kg. N. naja nigricollis venom-induced mortality	[7]
Methanolic fraction of *D. liberica* leaves	Mice, 400 mg/kg body weight	[10]
aqueous extract of the rhizomes of *D. liberica*	Wistar albino rat 100 and 200 mg/kg body weight	[11]
Methanolic fraction of *D. liberica* leaves	Adult Wistar rats 500 mg/kg	[10]

aqueous extract of the rhizomes of *D liberica*	Wistar albino rats 100 mg/kg	[18]
n-hexane fraction of *D. liberica* leaves	5 000 mg/kg in mice.	[9]
aqueous extract of *D .liberica* leaves	Wister strain rats 4570 mg/kg	[18]
The aqueous root extract of *D. liberica*	668.3 mg/kg in mice	[26]

According to Amelliya (2021), the water extract of *D. liberica* rhizomes has hematological, plasma biochemical, and ocular oxidative stress index effects on locus-induced diabetic rats. This revealed the pharmacological activity of active compounds in the rhizome extract, indicating its potential for hypoglycemic, hypolipidemic, antianemic, immunomodulatory, ocular protective, and hepato-renal protective effects. All of these highlight the cardioprotective and protective capabilities of *D. liberica* rhizome and support its use in traditional healthcare practices for managing diabetes mellitus.

3.5 Phytochemistry

Table 6. Phytochemical component of *D. liberica*

Isolated/detected chemical compound	**Plant part**	**Plant sources**	**Reference**
Various bioactive compounds including alkaloids, saponins, flavonoids, terpenoids, steroids, glycosides, reducing sugars, tannins, resins, carbohydrates, proteins, acidic compounds, fats, oils, and hexacosane. Additionally, it has been reported that cardiac glycosides and anthraquinones are also present in the plant.	Leaves, Rhizomes, and Roots	Nigeria	[9], [25], [43]
alkaloids, carotenoids, flavonoids, saponins, sterols, terpenes, and tannins	Leaves	Senegal, Nigeria	[6], [32]
Terpenoids, flavonoids, saponins	Rhizome, Root	Taiwan	[44]
Alkaloids (poxy-3,7-dimethoxycrinane-11-one, buphanidrine , ambelline, augustamine, crinamidine, 6-hydroxyundulatine, crinane-3α-ol .	Whole plant	Nigeria	[45], [46]
Allicins : diallylthiosulphinate avenacins B-1.	Root	India	[12]
flavonoids, steroids, alkaloids, glycosides	Leaves	Nigeria	[10]
various flavonoids in the following approximate percentages: 31.94% apigenin, 20.66% quercetin, 11.28%	Rhizomes		[18]

kaempferol, 5.99% naringenin, 5.83% (-)-epicatechin, 3.69% biochanin, 3.58% (+)-catechin, 2.72% diadzein, 2.20% ellagic acid, and 2.04% butein.			
steroidal saponins/Trifasciatune: 1,2-(dipalmitoyl)-3-*O*-*β*-D-galactopyranosylglycerol (**6**), aconitic acid (**7**), and 1-methyl aconitic acid	Leaves	Germany	[47], [48]
sappanin-type homoisoflavonoids, named trifasciatine A and (-)-(3*R*)-trifasciatine B Dihydrochalcone (+)-(8*S*)-trifasciatine C	Whole Plant	Myanmar	[49]
steroids or terpenoids	Leaves	Indonesia	[50]
phytol, stigmasterol, linoleic acid, oleic acid, stearic acid, and palmitic acid.	Leaves	Indonesia	[51]
β-sitosterol and β-stigmasterol	Rhizome	Nigeria	[36]

4 Conclusion

D. liberica, a plant rich in active compounds like phytol, linoleic acid, oleic acid, stearic acid, palmitic acid, β-sitosterol, and β-stigmasterol, shows potential for various activities including antioxidant, anticancer, antimicrobial, and antitoxic effects. The article suggests that the plant exhibits more promising antitoxic and anticancer activities compared to its antimicrobial and antioxidant activities. To explore its potential as a source for developing modern drugs from natural substances, it is crucial to assess the toxicity levels associated with both short-term and long-term use.

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