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REVIEW ARTICLE

Biological activity and phytochemistry of *Dracaena angolensis* Welw. ex Carrière

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Abstract

Dracaena angolensis Welw. ex Carriere also known as *Sansevieria cylindrica* is a decorative plant due to its unique shape. Beside its ornamental value, it is recognized for its ability to eliminate unpleasant odours and absorb air pollutants. In various African and Asian countries, the plant's leaves and roots have been widely used as traditional medicine to treat an assortment of ailments, including coughs, diarrhoea, hemorrhoids, chickenpox, rheumatism, gynaecological problems, as well as an antiseptic, snake bites, wound healing and refreshing beverage. Previous research showed that leaves and rhizomes of *D. angolensis* contain bioactive compounds such as alkaloids, saponins, cardenolides, polyphenols, steroids and abamagenin. Therefore, this review aims to provide information on the *D. angolensis* plant in terms of its distribution, taxonomy, phytochemical content and pharmacological potential. It presents the use of *D. angolensis* as traditional medicine in various regions as a candidate for natural medicine and identifies the opportunities for its development. Based on pharmacological literature, the plant has the potential as an antioxidant, anticancer, antibacterial and antitoxic agent. However, the literature on its antioxidant and anticancer potential is more extensive than its antibacterial and antitoxic properties. Further research on the pharmacological potential of this plant is necessary and its safety parameters need to be research in greater detail.

Keywords

Dracaena angolensis, ethnobotany, ethnopharmacology, *Sansevieria.*

Introduction

Most of the species the genus *Dracaena* originate from the continent of Africa and Asia. Morphologically, the genus has thick leaves with high water content and various of leaf shapes, from cylindrical to rigid sword-like blades (1). Similarly, the colors and patterns also vary, from green, yellow, to white (2, 3).

The species of *Dracaena* that is commonly used and easy to grow is *Dracaena angolensis* Welw. ex Carrière or commonly known as *Sansevieria cylindrica*. African spear or Cylindrical snake plant is a succulent indoor decorative plant. Beside its decorative value, this plant is a traditional medicine commonly used to treat influenza, coughs and respiratory tract inflammation (1, 4-7). In ethnobotanical research, it has been used by communities in several regions such as the Buton tribe in Southeast Sulawesi Province, Central Sulawesi, South Sulawesi, Liwa in Lampung, Lubuk Linggau in South Sumatra, Purwakarta in West Java and Kaliurang Village in Yogyakarta (8-11). The leaves and rhizomes of the genus are used in traditional medicine to treat various ailments such as cough, asthma, eczema, edema, malaria, anuria in Lampung and Lubuk Linggau. All parts of this plant are used by locals in Purwakarta to treat conditions like viral hepatitis, weak sexual function, high blood pressure, piles, colic, jaundice, palpitations and insect and snake bites. The leaves are medicine for coughs, flu and diarrhoea South Sulawesi and Buton. Meanwhile, the roots treat snake bites in the Bulan Jaya area of Central Sulawesi. People living on the slopes of Mount Merapi in Yogyakarta use *D. angolensis* as an air freshener, pollution absorber and treat wounds (11-14).

A study was shown that the leaves and rhizomes of *D. angolensis* contain saponins, cardenolins, polyphenols, methyl glucoronate acid and abamagenin (3). GC-MS data from the leaves of several *Sansevieria* species have shown the presence of antibacterial and antioxidant compounds such as 3,4-Dimethoxybenzoic anhydride, 2,5-Dimethoxybenzhydrazide, Diallyl Acetal, 1,2-Benzenedicarboxylic Acid, BIS(2- Ethylhexyl) ester, 1-Butyl 2-(8-Methylnonyl) Phthalate, Palmitaldehyde, Delta-Undecalactone, n-Hexadecanoic acid, Dodecanoic acid and 6,10,14- trimethyl-2-Pentadecanone (15). The phytochemical compounds in the leaves of *D. angolensis* have the potential to treat various diseases such as wounds, antiseptics, hemorrhoids, chickenpox, worms, eye and ear diseases, coughs, snakebites and as a refreshing drink (16-18).

Dracaena angolensis is also capable of absorbing pollutants and reducing unpleasant odours. Each leaf blade contains active compounds of pregnane glycosides, which are steroid compounds that can break down toxins into organic acids, sugars and some amino acids. National Aeronautics and Space Administration (NASA) research identified the active ingredients of pregnane glycosides, namely 1beta, 3beta-dihydroxypregna-5,16-dien-20-one glycoside, ruscogenin, abamagenin, neoruscogenin, sansevierigenin and saponin. *Sansevieria* can absorb up to 107 pollutants, including nicotine from tobacco, carbon monoxide, dioxins and naphthalene (15, 19-25).

According to the preceding information, *D. angolesis* has numerous advantages and contains active compounds that are beneficial to the environment and medicine (1, 2, 21, 26-31). However, no ethnopharmacology-related literature studies have ever been conducted. As a result, a systematic review of its traditional use in various countries is required. Furthermore, information from the literature about the pharmacological properties of *D. angolensis* must be studied and analysed.

Distribution and Habitat

Dracaena angolensis, commonly known as snake plant or mother-in-law's tongue, originates from West Africa. The plant is found in tropical countries from eastern Nigeria to Congo and has been naturalized in Madagascar, India and other tropical regions. The plant can grow up to 4 feet tall in its natural habitat, while indoor plants typically grow to around 2 feet tall (32). *Dracaena* is a genus of xerophytic perennial plants with 60 species distributed in tropical Africa, Asia and Arabia. There are wide hybrid and horticultural varieties of *Dracaena*, which makes the classification of plants in this genus difficult (33). Within the genus *Dracaena*, *D. angolensis* is the most commercially traded species in the nursery industry. It was reported that at least 20 cultivars of this species are sold in nurseries worldwide, distributed to America, Asia, Australia and the Pacific Islands as ornamental and fiber plants. Furthermore, the plant is widely naturalized in Asia (India, Indonesia, Malaysia, Thailand and Vietnam), Australia, America (United States, Puerto Rico and the Virgin Islands), and in several Pacific islands (Cook Islands, Fiji, Palau, Western Samoa and Hawaii) (34).

The native habitat of this plant was originally in the form of weeds on roadsides, growing in neglected gardens, waste areas, abandoned sites, coastal environments and the edges of wet and dry forests in tropical, subtropical and warm climates. Species within the genus have several adaptations to survive in dry arid areas such as thick and watery leaves to store water and a thick leaf cuticle that reduces moisture loss. The species use crassulacean acid metabolism (CAM) for photosynthesis, reducing water loss through nocturnal transpiration and increasing drought and heat tolerance. Additionally, *D. angolensis* has high salt tolerance level and low nutrient requirements (33). This species grows in various light conditions ranging from open areas with full sun exposure under forest canopies, in tropical, subtropical and warmer climates (1, 31).

Taxonomic characters

Dracaena angolensis is a succulent plant with a striking morphology. The roots have fibrous or wild roots grown from the base of stem. Another characteristic of *D. angolensis* has rhizomes that grow on the surface or inside the soil (3, 16). The stem is inside the creeping rhizome and has relatively thick soil. The rhizome is bright orange on the outside and whitish on the inside. It has round, rough and stiff leaves with fine greenish-grey lines. One leaf is 1.2-3 cm thick and grows 0.9-2.1 m long with a dense, stiff, cylindrical leaf colony that grows in a fan shape from the basal rosette. Furthermore, it has slow growth supported by underground rhizomes that support 3-4 or more leaves (16). The plant has many flowers that grow in clusters near the top of the plant. They grow in groups of 1-3 along the stem that produces the flowers. The flower stalk stands upright, relatively slender and shorter than the leaves with a 30-75 cm long stalk. The flowers are 2.5 - 4 cm long, tube-shaped, smooth and colored greenish-white to pink. The plant can produce white flowers with pink buds up to 90 cm tall when grown in sufficiently bright light. The plant blooms once a year and can flower more frequently at a young age than other species (16). The solitary flowers are arranged in 2 or 3 clusters. These flowers have six flower sepals partly fused into a tube about 6-12 mm long and separated into six 15-20 mm long lobes the end. The lobes are narrow and bend backward when the flower is fully open. Each flower is supported on a stalk that is 6-8 mm long, has 6 stamens about 7-8 mm long and a pistil about 15-18 mm long with a small stigma on top. The fruit of *D. angolensis* is small and round and the color changes from green to bright orange when ripe. This fleshy fruit has a 7-9 mm diameter and consists of two seeds, which are pale brown and elongated in shape, with a length and width of 6-7 mm and 5 mm (33) (Fig. 1).

Traditional medical Uses

D. angolensis Welw. ex Carrière originates from subtropical regions of Africa and is cultivated in Myanmar as an ornamental plant. This species is also utilized as a traditional medicine, particularly in remote rural areas of the country where herbal remedies are commonly used insteas of less available Western drugs. The entire plant is used to treat cuts, sprains and broken bones, while the roots are used to treat snakebites. It was reported that *D. angolensis* contains several amino acids and proteins useful for healing certain diseases (24). It is traditional use in several countries includes the treatment of fever, itching, respiratory infections, coughs, hemorrhoids, influenza, cough, diabetes, cancer and respiratory infections (35). As a hair tonic, natural antibiotic and pain reliever, this plant is often used externally for treating bruises, sprains, wounds and boils. It is used by boiling its leaves and roots before consumption. For external treatment such as wounds and snakebites (Table 1).

(A) Habit, (B) Leaf (C) Bark (D) Rhizomes (E) Fruit (F) Flowers

Fig. 1. *Dracaena angolensis* Welw. ex Carrière

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

Sl. No.	Country	Ethnomedical use	Plant part(s)	Preparation	References
1	Indonesia	Cough, snake bite, insect bite, dysentery, diarrhea and stomach problems	Leaves and rhizomes	Crushed, infusion, decoction	(11-14)
2	Philippines	Air pollution, asthma, abdominal pains, colic, diarrhea, hemorrhoids, hypertension, menorrhagia, piles, sexual weakness, foot wounds, cough, leprosy, rheumatism, glandular enlargement, nutritional deficiencies and snake bite	Leaves and rhizomes	No remark	(45, 53)
3	India	Bronchitis, asthma, food poisoning, toxemia, cough, snake bite and insect bite	Leaves and rhizomes	Brewed, decoction, pasted	(54)
4	West Africa, Nigeria	Hemorrhage, dysentery, diarrhea, stomach and external ulcers, wounds, leucorrhea, fractures, piles, diabetes and tumors	Leaves and rhizomes	Brewed, decoction, pasted	(21)
5	Congo	Against rheumatism and gynaecological problems	Leaves	Brewed	(21, 55)
6	Myanmar	Blood, blood-forming organs, immune mechanism, cancerous tumor and digestive constipation	Leaves and rhizomes	No remark	(56)
7	Yemen	Hemorrhage, dysentery, diarrhea, stomach and external ulcers, wounds, leucorrhea, fractures, piles, diabetes and tumors. Also used for anti-inflammatory and antioxidant effects, promoting skin repair, stopping bleeding and enhancing blood circulation	Leaves and rhizomes	Brewed, decoction, pasted	(7, 19, 21, 29, 57)
8	China	Treating pain and stopping hemorrhages. Found and used as a substitute for the traditionally imported dragon's blood, called Long-Xue-Jie	Leaves and rhizomes	Brewed, decoction	(21, 58, 59)
9	Vietnam	Cough, leprosy, rheumatism, glandular enlargement, nutritional deficiencies and snake bite	Leaves and rhizomes	Brewed, decoction, pasted	(20)
10	Cambodia	Cough, leprosy, rheumatism, glandular enlargement, nutritional deficiencies and snake bite	Leaves and rhizomes	Brewed, decoction, pasted	(20)
11	Thailand	Cough, leprosy, rheumatism, glandular enlargement, nutritional deficiencies and snake bite	Leaves and rhizomes	Brewed, decoction	(20)
12	Malaysia	Ear pain, swellings, boils and fever	Leaves and rhizomes	Pasted, brewed, decoction	(60, 61)
13	Yemen	Enhance immune function, promote skin repair, stop bleeding and enhance blood circulation	Leaves and rhizomes	Pasted, brewed, decoction	(21)

Antioxidant Activity

The research on *D. angolensis* indicates the exploration of its potential as an antioxidant and the testing method used was the 2,2-diphenyl-1-picrylhydrazyl (DPPH) (Table 2). Furthermore, 3 research on the antioxidant potential showed IC_{50} values below 100 µg/mL (21, 22, 36), indicating high and promising antioxidant activity. High antioxidant activity is influenced by the phytochemical compounds present in *D. angolensis*, especially phenolic compounds (37, 38). Previous studies have reported that *D. angolensis* leaf extracts contain phenolic compounds, including flavonoids such as homoisoflavone and pyran-isoflavone (3, 26, 39). In addition, triterpenoid compounds, namely squalene and saponin compounds have also been reported to have antioxidant activity (40, 41).

Table 2. Antioxidant activity of *D. angolensis*

No.	Sample	IC_{50} value	Method	Reference
1	Ethanol extract of leaves *D. angolensis*	100 µg/mL	DPPH	(26)
2	Methanol fraction of leaves *D. angolensis*	100 µg/mL	DPPH	(26)
3	Methanol extract of rhizomes of *D.* angolensis	20 µg/mL	DPPH	(22)
4	Ethanol extract of leaves *D. angolensis*	35.2 µg/mL	DPPH	(21)
5	Methanol extract of leaves *D. angolensis*	25.95 µg/mL	DPPH	(39)
6	Methanol extract of rhizomes *D. angolensis*	100 µg/mL	DPPH	(4)

Anticancer activity

Based on Table 3, research on the cytotoxicity of *D. angolensis* has been conducted on breast cancer cells (MCF-7), colon cancer cells (Caco-2), colon cancer cells (HT116), liver cancer cells (HepG2) and cervical cancer cells (HeLa). Cytotoxicity activity categories based on the US National Cancer Institute ((42, 43), showed that the methanol extract of *D. angolensis* rhizomes exhibited very strong cytotoxic activity against HeLa cells. The methanol extract of *D. angolensis* leaves showed weak and moderate cytotoxic activity against MCF-7 cells HepG2 cells. The methanol extract of *D. angolensis* also showed moderate cytotoxicity activity leaves against MCF-7, HT116 and HepG2 cells, while weak cytotoxic activity was shown against Caco-2 cells. From Table 3, it is evident that the strongest anticancer activity is present in the roots.

Further investigation is still needed on the potential of phytochemical compounds contained in both the roots and leaves of *D. angolensis* as anticancer agents. Exploration of other solvents and plant parts that can be used, such as flowers, is necessary. Moreover, it is necessary to examine which compounds present in the roots are responsible for the anticancer activity that is not found in the leaves.

Antimicrobial activity

Research on the antibacterial activity of *D. angolensis* is still very limited. It was reported that the leaves extract have the potential as an antibacterial agent (44). Active compounds functioning as antibacterial agents include saponins, polyphenols and flavonoids (44). Phytochemical tests of *D. angolensis* root and leaf extracts contain alkaloids, tannins, anthraquinones, terpenoids, saponins, flavonoids, steroids and phenols and have the ability as a natural antiseptic and antibacterial agent to inhibit the growth of *Staphylococcus aureus*, *Escherichia coli* and *Pseudomonas aeruginosa* (15, 20, 26, 45). Further studies are still needed to explore the full potential of *D. angolensis* as an antibacterial agent.

The methanol, ethyl acetate and ethanol extracts of *D. angolensis* leaves can inhibit pathogenic bacteria such as *Staphylococcus aureus* (ATCC 25923), *S. epidermidis, Streptococcus pyogenes, S. viridans, Proteus vulgaris, P. mirabilis, Enterococcus faecalis, B. cereus, Escherichia coli* (ATCC 25922), *Klebsiella pneumoniae, Bacillus subtilis, Salmonella typhi, S. typhimurium* and *Shigella dysenteriae* type 1, *Pseudomonas aeruginosa* and *Escherichia coli* (Table 4). The antibacterial activity is stronger than that of other *Dracaena* species, such as *D. trifasciata*. Based on research conducted (46), the active fraction of *D. trifasciata* leaves can inhibit biofilm formation and virulence-related genes of *Pseudomonas aeruginosa* more effectively than *D. angolensis* (46). Further research into the potential phytochemical compounds found in *D. angolensis* as antibacterials is required to validate the plant's potential. Exploration of other solvents and plant parts such as flowers and roots also need to be conducted. Additionally, the mechanism of action of the ethanol extract of the leaves needs to be further research at the cellular and molecular levels.

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

Sample	Cell Model	IC_{50} Value (µg/mL)	Reference
Methanolic extract of *D. angolensis* rhizome	HeLa (cervix adenocarcinoma)	20	(22)
Methanolic extract of *D. angolensis* leaves	Hepatocellular HepG-2	6.21	(62)
Methanolic extract of *D. angolensis* leaves	MCF-7	23.25	(62)
Methanolic extract of *D. angolensis* leaves	Intestinal epithelium Caco-2 carcinoma cells	18.86	(62)
70% aqueous methanolic leaves extract	MCF7	11	(50)
70% aqueous methanolic leaves extract	HT116	12	(50)
70% aqueous methanolic leaves extract	HepG2	13	(50)

Table 4. Antimicrobial activity of *D. angolensis*

No.	Sample	Tested microorganism	MIC	Reference
1	Ethanolic extract of *D. angolensis* leaves	• *Escherichia coli* • *Staphylococcus aureus* • *Pseudomonas aeruginosa*	•60 µg/mL •80 µg/mL	(20)
2	Ethanolic extract of *D. angolensis* leaves	• *Escherichia coli* • *Staphylococcus aureus* (ATCC 25923), • *S. epidermidis, Streptococcus pyogenes*, • *S. viridans*, • *Enterococcus faecalis*, • *Bacillus subtilis*, *B. cereus*, • *Escherichia coli* (ATCC 25922), • *Klebsiella pneumoniae*, • *Proteus vulgaris*, *P. mirabilis*, • *Salmonella typhi*, *S. typhimurium*, and • *Shigella dysenteriae* type	300 µg/mL 50 µg/mL	(15, 63)
3	Ethanolic extract of *D. angolensis* leaves	• *Pseudomonas aeruginosa*	16 mg/mL	(18)

Toxicity

Toxicity testing of *D. angolensis* is still limited, and based on Table 5, several species have been used for toxicity testing, including Wistar albino rats and indomethacin-induced ulcer in pyloric-ligated rats. The results of toxicity testing using the indomethacin-induced ulcer in pyloric-ligated rats showed that various extracts of *D. angolensis* had a toxic effect. Meanwhile, the LC_{50} values below 1000 μg/mL indicate a toxic treatment. Different results were shown in toxicity testing on Wistar Albino Rats, where the LC_{50} value was higher than the LC_{50} value in indomethacin-induced ulcer in pyloric-ligated rats. Acute toxicity with the brine shrimp lethality test is classified as toxic when the LC_{50} value is below 1000 μg/mL (47). However, research on the safety of *D. angolensis* still needs to be conducted, considering its effects on various organs such as the kidney, liver, and reproductive organs. In addition, toxicity testing using the brine shrimp test needs to be carried out.

Effective antioxidants, antitoxins and antibacterial can be extracted from the leaves of *D. angolensis* using ethanol and methanol. According to one report (48), compounds present in the ethanol leaves extract can work synergistically, indicating the potential of the extract as a candidate for antibacterial and antioxidant agents. Meanwhile, methanol extract, on the other hand, is commonly used for anticancer activity of both leaves and roots.

Phytochemistry

The potential of *Dracaena/Sansevieria* plants to treat various health disorders is certainly influenced by the phytochemical compounds contained within them. Previous studies have identified the phytochemical compounds in *Dracaena*. Phytochemical compounds identified in the leaves of several species of *Dracaena* with GC-MS showed that contain antibacterial and antioxidant compounds such as 3,4-Dimethoxybenzoic anhydride, 1,2-Benzenedicarboxylic Acid, BIS(2-Ethylhexyl) ester, Palmitaldehyde, Diallyl Acetal, 1-Butyl 2-(8-Methylnonyl) Phthalate, Delta-Undecalactone, n-Hexadecanoic acid, 6,10,14-trimethyl -2-Pentadecanone, Dodecanoic acid and 2,5-Dimethoxybenzhydrazide (22, 49, 50).

Dracaena plant is reported to be rich in sapogenins and steroid saponins. *D. angolensis* contains phytochemical compounds believed to be involved in its pharmacological activity. Several research showed that the roots, rhizomes and leaves of *D. angolensis* contain various groups of compounds including alkaloids, tannins, terpenoids, saponins, steroids, phenols, cardenolides, polyphenols, methyl glucuronate acid, glycosides, carbohydrates and abamagenin. Additionally, the plant is rich in bioactive phenolic compounds, including rare homoisoflavonoids that form a characteristic subclass. Meanwhile, previous phytochemical investigations of *D. angolensis* leaves have shown inhibition of capillary permeability. A new steroid saponin has been isolated from the leaves of *D. angolensis* that exhibits capillary permeability inhibition. The structure of this saponin was (3beta,12beta,15alpha,25S)-26-(beta-D-glucopyranosyloxy)-22-hydroxyfurost-5-en-3-yl 12-O-(6 -deoxy-alpha-L-mannopyranosyl)-15-O-(6-deoxy-alpha-L-mannopyranosyl)-beta-D lucopyranoside (Table 6). Moreover, (+)-Trifasciatine B and dihydrochalcone (+)-trifasciatine C from *D. angolensis* are known to exhibit moderate cytotoxicity against MCF7 cells (19, 28, 50).

Specifically, the chemical compounds identified in the leaves and rhizomes of *D. angolensis* include tannin, gluco-galin, gallic acid, corilagin, ellagic acid, terchebin, chebulagic acid, chebulinic acid, mucic acid, phyllembic acid and emblicol (Table 6). The content of steroid saponin in the methanol extract of *D. angolensis* leaves was 0.058 mg of DE/g and the rhizomes was 0.065 mg of DE/g. Some of the chemical compounds studied in the leaves and rhizomes of *D. angolensis* include (25R)-26-O-β-D-glucopyranosyl-furost-5-ene 1β, 3β, 22α, 26-tetrol-1-O-α-L-rhamnopyranosyl-(1→2)-[β-D-xylopyranosyl-(1→3)]-α arabinopyranoside (25S)-ruscogenin-1-O-α-L-rhamnop-yranosyl-(1→2)-β-D-glucopyranoside, (25S)-ruscogenin-1-O -α-L-rhamnopyranosyl-(1→2)-[β-D-xylopyranosyl-(1→3)]-α-L arabinopyranoside 5, (25S)-ruscogenin-3-O-α-L-rhamnopyranosyl-(1→4)-β-D-glucopyranoside, (25S)-ruscogenin-3-O-β-D-glucopyranoside-4, 1β-hydroxy-kryptogenin-1-O-α-L-rhamnopyranosyl-(1→2)-a-L-arabino-pyranoside, 2,4-dihydroxy-3-methoxy-3,4-methylenedioxy-8-hydroxy methylenedihydrochalcone, (3S)-3,7-dihydroxy-8-methoxy-3-(3',4'-methylenedioxybenzyl)saponin alliospiroside A, genin 1β-hydroxy-kryptogenin and homoisoflavanone (19, 28, 50). These compounds were capable of inhibiting biofilm growth and reducing the expression of genes in *P. aeruginosa* that cause its pathogenicity (17). Furthermore, Squalene, campesterol, neophytadiene, palmitic acid and linoleic acid have been reported to have anticancer properties (40, 48, 51, 52).

D. angolesis contains bioactive compounds that could be used in the development of natural medicine. The presence of these phytochemical compounds strengthens the potential of *D. angolensis* to be used as a medicinal plant in the community, including its potential as an antioxidant, anticancer, antimicrobial, antitoxicity agent. The plant can be a valuable source of natural products with the potential to be recommended for applications in

Table 5. Toxicity of *D. angolensis*

No	Sample	Toxicity value	References
1	Ethanolic extract of *D. angolensis* leaves	Wistar albino rats, 2000 mg/kg body weight	(5, 6)
2	Methanolic extract of *D. angolensis* leaves	Indomethacin-induced ulcer in pyloric-ligated rats, 100 mg/kg	(28)

Table 6. Phytochemical component of *D. angolensis*

No	Compound	Isolated part	Plant sources	Reference
1	Alkaloids; tannins; terpenoids; saponins; steroids; phenols; cardenolides; polyphenols; methyl glucuronate acid; glycosides; carbohydrates; steroidal saponin; abamagenin; (25R)- 26-O-β-D-glucopyranosyl-furost-5-ene 1β, 3β, 22α, 26-tetrol-1-O-α-L-rhamnopyranosyl-(1→2)-[β-Dxylopyranosyl-(1→3)]-α-arabinopyranosid, 1β-hydroxy-kryptogenin-1-O-α-L-rhamnopyranosyl-(1→2)-a-L-arabino- pyranoside; and (3S)-3,7-dihydroxy-8 -methoxy-3-(30,40-methylenedioxybenzyl) saponin alliospiroside A	Aerial part (Stem and leaves)	Egypt	(64)
2	Terpenoids; phenolic, triterpenoid; and flavonoid	Leaves	Indonesia	(18)
3	Sapogenin; tannins gluco-galin; gallic acid; corilagin; ellagic acid; terchebin, chebulagic acid; chebulinic acid; mucic acid; phyllembic acid; and emblico	Leaves and rhizomes	Brasil	(19)
4	Pregnane glycosides : 1beta, 3beta-dihydroxypregna-5,16-dien-20-one glikosid; ruscogenin; abamagenin; neoruscogenin, sansevierigenin, and saponin	Leaves	Ukraine	(15)
5	(22*R*,25*S*)-Spirost-5-ene-1β,3β-diol [(*R*)-ruscogenin] 1-*O*-α-L-rhamnopyranosyl-(1→2)	Rhizomes	Myanmar	(21)
6	Homoisoflavone : dihydrochalcone (–)-trifasciatine C and trifasciatine A and and (–)-(3R)-cambodianol Phenylpropane derivative: hydroxychavicol [3,4-dihydroxyallylbenzene (APC) alkaloids : trans-N-p-coumaroyl tyramine [synonyms; N-(p-hydroxyphenyl)ethyl p-hydroxycinnamide and paprazine]; (–)- trans-N-p-coumaroyl octopamine ; (–)-trans-N-feruloyl octopamine . Furanoflavones: lanceolatin B and pongaglabol methyl ether methoxyflavone, de(s) methoxy kanugin Pterocarpan : (–)-(6aR,11aR)-homopterocarpin	Rhizomes	Myanmar	(65)
7	Sappanin-type 3-benzyl chroman-4-one (homoisoflavanone); (3S)-3-(4′-methoxybenzyl)-3,5-dihydroxy-7-methoxy-6-methyl chroman-4-one, together with known congeners (3S)-3-(4′-methoxybenzyl)-3,5-dihydroxy-7-methoxy chroman-4-one; (3S)-3-(4′-hydroxybenzyl)-3,5-dihydroxy-7- methoxy-6-methyl chroman-4-one; (3S)-3-(4′-hydroxybenzyl)-3,5-dihydroxy-7-methoxy chroman-4-one; 3-(3′,4′-methyledioxybenzyl)-7-hydroxy-8- methoxy chroman-4-one; stigmasterol and ergosterol peroxide	Rhizomes	Myanmar	(22)
8	Steroids; falvonoids; saponins; tannins; and phenolic acids.	Leaves	India	(26)
10	(25S)-ruscogenin-1-O-α-L- rhamnopyranosyl-(1→2)-β-D-glucopyranoside; (25S)-ruscogenin-3-O-α-L-rhamnopyranosyl-(1→4)-β-D-glucopyranoside; (25S)-ruscogenin-3-O-β-D-glucopyranoside-4, (25S)-ruscogenin-1-O-α-L-rhamnopyranosyl-(1→2)-[β-D-xylopyranosyl-(1→3)]-α-L arabinopyranoside 5; 2,4,dihydroxy-3-methoxy-3,4-methylenedioxy-8-hydroxy methylen dihydrochalcone; and homoisoflavone	Aerial part (stem and leaves)	Egypt	(50)
11	Alkaloids; flavonoids; tannin;, phenols; Hexadecanoic acid; n-Octyl ester; Carbonic acid,2-ethylhexyl nonyl este; Diisooctyl phthalate; Phthalic acid,6 – methylhept-2-yl octyl ester; and 1,2 – Benzene dicarboxylic acid, bis(1-methylethyl) Ester	Whole plant	India	(5, 6)

human and veterinary medicine in the future.

Conclusion

D. angolensis Welw. ex Carriere has the potential to be developed as a source of antioxidants, anticancer, antibacterial and antitoxin. Research on the safety of using *D. angolensis* also needed to assess the level of toxicity in short-term and long-term use. This will help in the development of modern drugs from natural materials using *D. angolensis* as a potential source.

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Authors' contributions

WFD gathered references, conceived of the study and wrote the review content. NT contributed by making important suggestions for points to be discussed in the review and writing the manuscript. The final manuscript was read and approved by all authors.

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