Letters in Applied NanoBioScience
Open-Access Journal (ISSN: 2284-6808)

Review
Volume 15, Issue 1, 2026, 12
https://doi.org/10.33263/LIANBS151.012

A Review on Botanicals, Ethnomedicinal Uses, Phytochemicals, Therapeutic Potentials, and Toxicity Profiles of *Olax subscorpioïdea*

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Received: 9.06.2025; Accepted: 20.02.2026; Published: 30.03.2026

Abstract: *Olax subscorpioïdea* Oliv. (Olacaceae) it is a medicinal shrub characterized by its woody properties and is used in various African regions to treat numerous health problems, including sickle cell anaemia, pain, sexually transmitted diseases, diabetes, inflammation, arthritis, cancer, and bacterial infections. In this study, the medicinal uses, phytochemical constituents, potential health benefits, and toxicity profiles of *O. subscorpioïdea* were comprehensively investigated. The data for this study were obtained from various online databases, such as PubMed, Google Scholar, MDPI, ScienceDirect, Springer, and Wiley. Phytochemical studies of *O. subscorpioïdea* have revealed a number of bioactive compounds, including phytol, hexadecanoic acid, methyl ester, rutin, quercetin, n-hexadecanoic acid, morin, caffeic acid, octadecanoic acid, squalene, hentriacontane, and ferulic acid. Scientific studies have shown that *O. subscorpioïdea* provides numerous health benefits, such as anthelmintic, antioxidant, antiarthritic, analgesic, antidepressant, antihyperglycemic, antidiabetic, anti-inflammatory, hepatoprotective, cardioprotective, neurosedative, anti-Alzheimer's, antianaemic, anticancer, and antimicrobial effects. Our analysis revealed that various studies have highlighted the ethnopharmacological uses of *O. subscorpioïdea*. Nevertheless, chronic toxicity studies and human trial studies confirming safe and effective dosages for the treatment of these diseases are lacking. Therefore, further chronic toxicity assessments, clinical trials, and investigations into the mechanisms of pharmacological effects are crucial to thoroughly establish the therapeutic potential of *O. subscorpioïdea*.

Keywords: *Olax subscorpioïdea*; traditional uses; phytochemistry; pharmacological activities.

1. Introduction

The use of medicinal plants for nutritional and therapeutic purposes is widespread throughout the world. For more than a decade, the use of plants with medicinal properties or their bioactive compounds to treat various diseases, including critical conditions such as cancer and diabetes, has increased significantly [1-3]. Studies have shown that approximately 88% of the world's population relies on traditional medicine for healthcare, whereas more than 40% of modern medicines are derived from natural substances [4-7]. Notable examples include vinblastine and vincristine, which are anticancer agents extracted from *Catharanthus roseus*; artemisinin, a powerful antimalarial derived from *Artemisia annua* [8]; morphine, an analgesic sourced from *Papaver somniferum*; and galantamine, used for treating mild to moderate dementia, obtained from *Galanthus nivalis* [9]. Owing to their therapeutic uses and contribution to the production of conventional drugs, medicinal plants have received global attention [1,10,11]. Among the medicinal flora in Africa, *Olax subscorpioïdea* stands out for its therapeutic use for the treatment of various diseases. This plant, which is part of the Olacaceae family, is prevalent in Nigeria and other regions of Africa [12-15]. In Nigeria, *Olax subscorpioïdea* is recognized by various local names; for example, Yoruba refers to it as Ewe Ifon, Igbo refers to it as Igbulu, and Hausa refers to it as Gwaanon kurmii [13, 15].

Olax subscorpioïdea is a woody shrub that can grow up to 10 m tall, or approximately 30 feet tall [14,15]. *Olax subscorpioïdea* is notable for its roots, trunk, and bark, which emit a distinctly unpleasant odour. The branches of the plant are elongated, slender, and frequently exhibit a drooping tendency. The fruits transition from green in their unripe state to yellow upon ripening. Both the roots and the crushed bark of the stems are characterized by a garlic-like scent. In the realm of traditional medicine, *O. subscorpioïdea* is employed for various therapeutic purposes, such as the treatment of asthma [16], diabetes [17], ulcers [18], pain alleviation, and arthritis [19], as well as for treating convulsions in children, central nervous system (CNS) disorders [20], and a range of infectious diseases [21]. Furthermore, it is recognized for its anthelmintic effects [22] and is also utilized as an aphrodisiac [23], as illustrated in Figure 1.

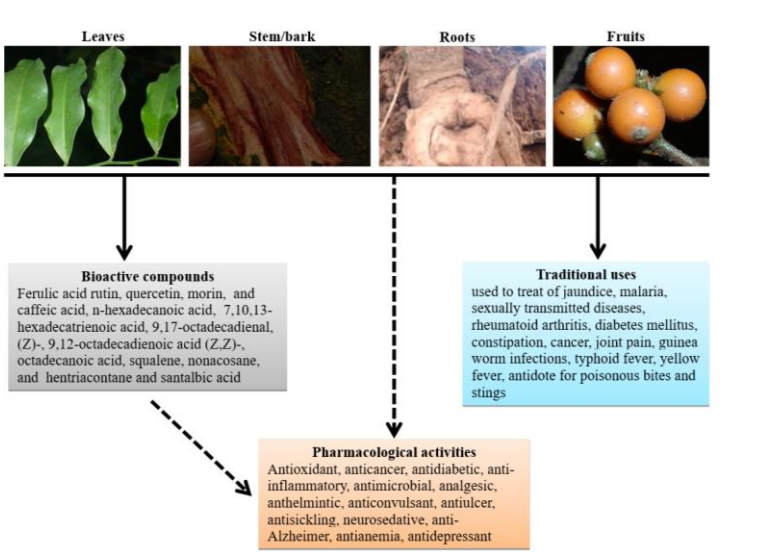

Figure 1. Different parts of *O. subscorpioïdea*, traditional uses, bioactive compounds, and pharmacological activities.

Phytochemical profiling of different parts of *O. subscorpioïdea* has revealed flavonoids, tannins, alkaloids, triterpenes, and saponins [12,15,24]. Pharmacological

investigations have demonstrated that *O. subscorpioïdea* has numerous therapeutic properties, such as antidepressant [25], neurosedative [26, 27], antioxidant [28, 29], analgesic [30,31], anti-inflammatory [29,32], antiarthritic [33], antidiabetic [34], anticancer [14], antiulcer [18], antimicrobial [24] and hepatoprotective effects [32, 35], as illustrated in Figure 1. The diverse pharmacological activities of *O. subscorpioïdea* may be the result of an array of biologically active compounds in the plant. This review offers a thorough and current overview of the traditional applications, geographical distribution, phytochemical constituents, and pharmacological effects of *O. subscorpioïdea*.

2. Materials and Methods

This review utilized peer-reviewed journal articles published from January 2000 to August 2024 (Figure 2). The articles were obtained from a range of databases, including MDPI, Springer, ScienceDirect, PubMed, and Wiley. Only those articles written in English were included in this analysis. The chemical structures were illustrated via ChemDraw (version 12.0.2).

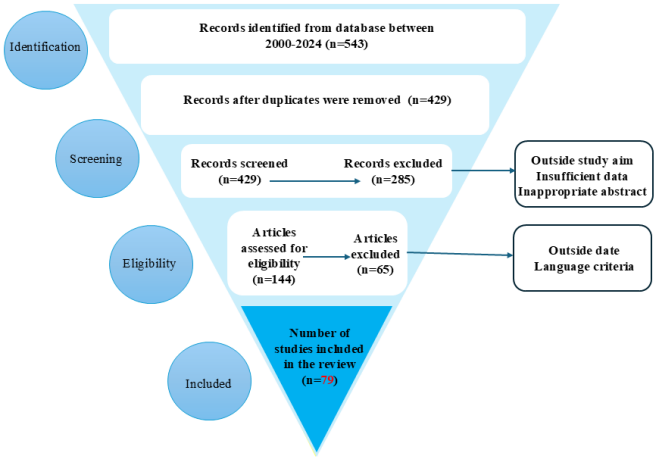

Figure 2. PRISMA Flow Diagram of the Literature Selection Process.

3. Taxonomy and Geographical Distribution

3.1. Taxonomy.

Kingdom: Plantae
Phylum: Streptophyta
Class: Equisetopsida
Order: Santalales
Family: Olaceae
Genus: Olax
Species: subscorpioïdea

3.1.1. Geographical distribution.

Olax subscorpioïdea is native to the Ivory Coast, Benin, Zaire, Cameroon, Burkina, Chad, Congo, Côte d'Ivoire, Gabon, Liberia, Ghana, Nigeria, Guinea, Senegal, and Togo (Figure 3).

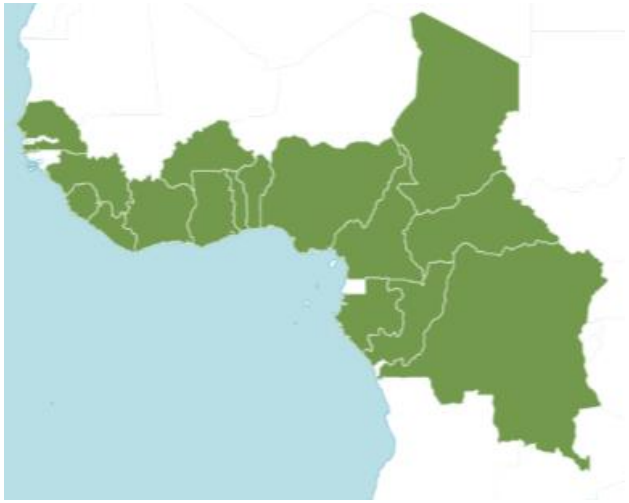

Figure 3. Geographical distribution of *Olax Subscorpioïdea*.
(https://powo.science.kew.org/taxon/urn:lsid:ipni.org:names:608152-1) open-accessed on August 4, 2024.

4. Traditional Uses of *O. subscorpioïdea*

Different parts of *O. subscorpioïdea* (fruits, leaves, twigs, roots, stems, bark, and seeds) are utilized for the treatment of diseases. In Nigeria, the leaves are used to treat depression and Alzheimer's disease [36, 37]. The root is recognized for its efficacy against conditions such as rheumatoid arthritis, diabetes mellitus, constipation, cancer, typhoid fever, and obesity during pregnancy [16, 38, 39]. In Ekiti State, Nigeria, the bark of the stem and root are utilized for the treatment of jaundice, malaria, and sexually transmitted diseases [40]. In Ibadan, Nigeria, a mixture of *O. subscorpioïdea* seeds with *Tetrapleura tetraptera* and *Xylopia aethiopic*a, combined with traditional black soap, is commonly used to address scalp infections in children. In northern Nigeria, the entire plant is utilized, either alone or in conjunction with *Eleusine indica*, for the treatment of infectious diseases, anxiety, and mental disorders [27, 41] The bark, twigs, and leaves serve as antidotes for venomous bites and stings, as well as for treating fever, liver diseases, rheumatism, arthritis, and sexually transmitted infections (STIs) [35]. In the Republic of Congo, decoctions made from leaves, bark, and stems are used to alleviate rheumatism, joint pain, guinea worm infections, and STIs [13, 30, 39]. In Côte d'Ivoire, roots are utilized to treat intestinal worms and malaria [22, 42]. In Cameroon, decoctions made from fruits, bark, leaves, and seeds are used to combat yellow fever, jaundice, constipation, and guinea worm infections [13, 39, 43].

5. Phytochemistry

The methanol extract of *O. subscorpioïdea* root is abundant in a variety of phytochemicals, such as alkaloids, glycosides, anthraquinones, flavonoids, proanthocyanidins, terpenes, and saponins [18,44]. Ayandele and Adebiyi [12] reported that the stem bark of *O. subscorpioïdea* contains alkaloids, steroids, and flavonoids. The methanol leaf extract of *O. subscorpioïdea* contains cardiac glycosides, tannins, flavonoids, saponins, and alkaloids [26]. Additionally, methanol extracts of seeds contain tannins, phenols, flavonoids, triterpenes, and alkaloids [24]. The bioactive phenolic compounds identified in *O. subscorpioïdea* include ferulic acid and various bioactive flavonoids, such as morin, rutin, quercetin, and caffeic acid [25]. The bioactive volatile compounds found in *O. subscorpioïdea* include phytol,

hexadecanoic acid, methyl ester [45], 7,10,13-hexadecatrienoic acid, 9,12-octadecadienoic acid (Z,Z)-, octadecanoic acid, 9,17-octadecadienal (Z)-, nonacosane, n-hexadecanoic acid, hentriacontane, and squalene [46] and santalbic acid [25], as shown in Table 1 and Figure 4.

Table 1. Bioactive compounds in *O. subscorpioïdea*.

S/N	Name of compound	Method of identification	Beneficial effects
1	Rutin	HPLC analysis of the leaf [25]	Cardioprotective, anti-diabetic, antioxidant, antiallergic, anti-inflammatory, and Anticancer [47]
2	Quercetin	HPLC analysis of the leaf [25]	Antidiabetic, inflammatory, antibacterial, anticancer, antioxidant, anti-Alzheimer, anti-asthmatic, anti-hypertensive activities [48]
3	Morin	HPLC analysis of the leaf [25]	Antioxidant [49], anti-inflammatory [50]
4	n-hexadecanoic acid	GC–MS analysis of leaf [46]	Antioxidant, antibacterial activities [3]
5	Caffeic acid	HPLC analysis of the leaf [25]	Anticancer, anti-diabetes, atherosclerosis, anti-Alzheimer's disease [51]
6	7,10,13-Hexadecatrienoic acid	GC–MS analysis of leaf [46]	Antioxidant, antimicrobial, anti-inflammatory [52]
7	9,17-Octadecadienal, (Z)-	GC–MS analysis of leaf [46]	Anti-inflammatory, antimicrobial activities [53, 54]
8	9,12-Octadecadienoic acid (Z,Z)-	GC–MS analysis of leaf [46]	Anti-inflammatory, hypocholesterolaemic, anticancer, hepatoprotective [54]
9	Octadecanoic acid	GC–MS analysis of leaf [46]	Antimicrobial [55]
10	Squalene	GC–MS analysis of leaf [46]	Oxygen scavenger and lipid peroxidation inhibition [56]
11	Hentriacontane	GC–MS analysis of leaf [46]	Anti-inflammatory, antitumour [57]
12	Ferulic acid	HPLC analysis of the leaf [25]	Antioxidant, anti-inflammatory [58]
13	Phytol	GC–MS analysis of leaf Dania *et al*. [45]	Anti-inflammatory, antioxidant effects [45]
14	Hexadecanoic acid, methyl ester		

Contd: Bioactive compounds in *O. subscorpioïdea*.

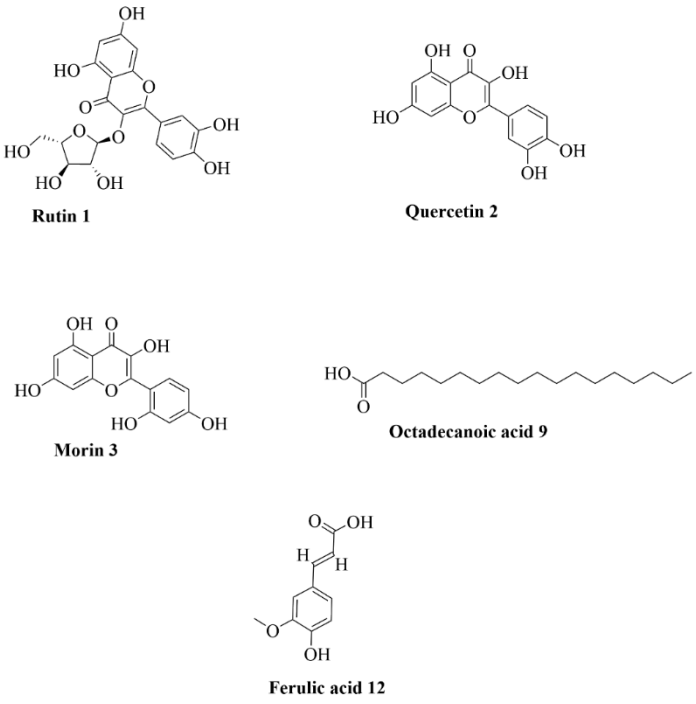

Figure 4. Structures of selected bioactive compounds in *O. subscorpioïdea*.

6. Health Benefits of *O. subscorpioïdea*

6.1. Antioxidants.

The antioxidant capabilities of *O. subscorpioïdea* have been acknowledged as a significant component of its therapeutic efficacy. Research conducted by Adeniyi *et al*. [59] indicated that pretreatment with 100 mg/kg methanol extract from *O. subscorpioïdea* notably

reduced oxidative stress, safeguarded endogenous antioxidants, and mitigated neuroinflammation in a scopolamine-induced model of Alzheimer-like dementia. In addition, investigations by Konan *et al*. [35] revealed that the administration of *O. subscorpioïdea* leaf extract at doses of 25 and 100 mg/kg to rats subjected to carbon tetrachloride (CCl_4)-induced hepatotoxicity reduced thiobarbituric acid reactive substances and improved serum DPPH scavenging activity and overall antioxidant capacity. In addition, Popoola *et al*. [29] reported that *O. subscorpioïdea* root extract significantly decreased intracellular ROS in HeLa cells and lowered ROS levels induced by peroxide. Furthermore, Tsakem *et al*. [60] reported that the ethanol, n-butanol crude extracts, and ethyl acetate fractions (EAFs) of *O. subscorpioïdea* demonstrated substantial antioxidant activity, as evaluated by the FRAP method, with EC50 values ranging from 85.77--86.39 mmol FeSO4/g and DPPH EC_{50} values ranging from 6.29 to 18.19 µg/ml. Additionally, Adelegan *et al*. [61] revealed that the EAF of *O. subscorpioïdea* leaf extract (250 mg/kg body weight) increased SOD and GSH levels and decreased MDA levels in female rats exposed to 7,12-dimethylbenz(α)anthracene (DMBA)-induced cell proliferation. Adelegan *et al*. [61] proposed that the elevated concentration of phenolic compounds in *O. subscorpioïdea* may contribute to its antioxidant properties (Table 2, Figure 5).

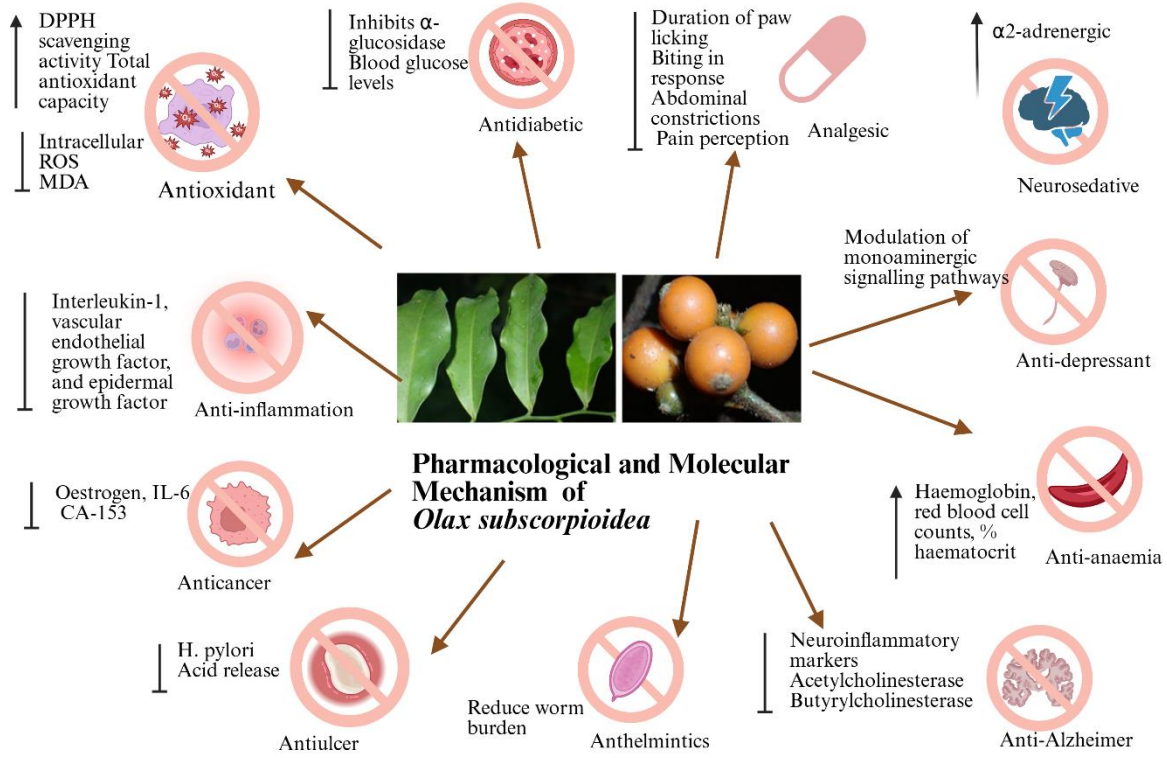

Figure 5. Schematic representation of the Pharmacological and molecular mechanisms of *O. subscorpioïdea*. Black up-arrows indicate activation/upregulation, while black down/inhibition arrows indicate deactivation/downregulation.

Table 2. Summary of the potential health benefits of *O. subscorpioïdea* in different experimental models.

Dose	Experimental model	Observations	References
25, 50, and 100 mg/kg of *O. subscorpioïdea* leaf extract	Mice	Alleviated oxidative stress, protected endogenous antioxidants, and inhibited neuroinflammation	[59]
25 and 100 mg/kg of ethanolic extract of *O. subcorpioidea*	Rats	Increased serum DPPH scavenging and total antioxidant activities	[35]

Dose	Experimental model	Observations	References
250 mg/kg of ethyl acetate fraction of *O. subscorpioïdea* leaf	Rats	Increased SOD and GSH, and decreased MDA	[61]
5, 25, 50, and 100 µg/ml of *O. subscorpioïdea* ethanolic leaf extract	Cells	Reduced intracellular ROS and peroxide-induced ROS	. [29]
250 mg/kg ethyl acetate fraction and ethanol leaf extract of *O. subscorpioïdea*	Rats	Reduced oestrogen, IL-6, and CA-153 levels, promoted acini normalization, and inhibited mammary gland cell growth.	[61]
250 mg/kg of *O. subscorpioïdea* hexane root extract	Rats	Decreased blood glucose	[34]
100, 200, and 400 mg/kg of methanolic *O. subscorpioïdea* root extract	Rats	Decreased blood glucose	. [62]
400, 600 and 800 mg/kg ethanol *O. subscorpioïdea* root extract	Rats	Reduced TNF-α, IL-1B and IL-6	[33]
250, 500, and 1000 mg/kg of methanol, aqueous, butanol, and hexane *O. subscorpioïdea* leaf extract	Rats	Decreased paw oedema	. [19]
5, 10, 25, and 50 µg/ml of ethanolic *O. subscorpioïdea* leaf extract	RAW264.7 cells	Inhibited nitric oxide production	[29]
1000 mg/kg aqueous or butanol fraction of *O. subscorpioïdea* leaf extract	Rats	Reduced ear swelling, reduced paw edema, and significantly inhibited granuloma development	[63]
1000 mg/kg aqueous or butanol leaf extracts of *O. subscorpioïdea*	Rats	Reduced interleukin-1, VEGF, and EGF	[64]
12.5, 25, 50, and 100 kg/ml of ethanol *O. subscorpioïdea* root extract	Microbial organisms	Inhibited microbial growth	[65]
0.05 and 0.072 g/ml of ethanolic and aqueous stem *O. subscorpioïdea* extract	Bacteria and fungi	Inhibited bacterial and fungal growth	[12]
20, 40, 80, and 100 mg/ml of methanol *O. subscorpioïdea* root extract	Bacterial	Inhibited bacterial growth	. [54]
125, 250, and 500 mg/ml of ethanol *O. subscorpioïdea* leaf extract	Bacterial	Inhibited bacterial growth	[68]
12.5, 25, 50, and 100 kg/ml of ethanol *O. subscorpioïdea* root extract	Microbial organisms	Inhibited microbial growth	[65]
0.05 and 0.072 g/ml of ethanolic and aqueous stem *O. subscorpioïdea* extract	Bacteria and fungi	Inhibited bacterial and fungal growth	[12]
20, 40, 80, and 100 mg/ml of methanol *O. subscorpioïdea* root extract	Bacterial	Inhibited bacterial growth	. [54]
125, 250, and 500 mg/ml of ethanol *O. subscorpioïdea* leaf extract	Bacterial	Inhibited bacterial growth	. [68]
20, 50, 100, and 200 µl of ethanolic *O. subscorpioïdea* root extract	Bacterial	Inhibited bacterial growth	[77]

Dose	Experimental model	Observations	References
25, 50, 100 mg/ml of methanol *O. subscorpioïdea* leaf extract	Fungi	Inhibited fungi growth	[78]
200, 400, and 800 mg/kg ethanol extracts from the leaves and stem bark of *O. subscorpioïdea*	Rats	Reduced serum concentrations of liver enzymes	[32]
200, 400, and 800 mg/kg of aqueous *O. subscorpioïdea* leaf extract	Rats	Normalized haemoglobin levels, RBC, and percentage hematocrit in rats with phenylhydrazine-induced anaemia	[75]
250, 500, and 1000 mg/kg Methanol, butanol, aqueous, hexane of *O. subscorpioïdea* leaf extract	Rats	Percentage inhibition of abdominal constriction and inhibition of writhes.	[19]
200 and 400 mg/kg hydroethanolic root extract of *O. subscorpioïdea*	Rats	Reduced abdominal constriction and paw licking	[70]
400 mg/ml of *O. subscorpioïdea* root extract	Mice	Reduced total worm burden	[22]
3.125, 6.25, 12.5, and 25 mg/kg of ethanol *O. subscorpioïdea* leaf extract	Animals	Reduced the frequency of rearing and grooming behaviour	[41]
100, 200, and 400 mg/kg of methanol *O. subscorpioïdea* leaf extract	Chicks and Mice	Protected against the maximal shock induced by electric shocks	[26]
50, 100, and 200 mg/kg of ethanol *O. subscorpioïdea* leaf extract	Animals	Prolonged the initiation of seizures and extended the time to mortality in convulsions induced by pentylenetetrazole.	[27]
200, 400 and 600 mg/kg methanol *O. subscorpioïdea* root extract	Rats	Inhibited ulcer	[18]
100 mg/kg methanol extract of *O. subscorpioïdea*	Mice	Reduced transfer latency, neuroinflammation, and suppressed acetylcholinesterase (ACHE) activity.	[59]
108.44- 255.84 µg/mL of aqueous *O. subscorpioïdea* leaf extract	Rats	Inhibited cholinesterase enzymes	[36]
25 and 50 mg/kg of ethanolic *O. subscorpioïdea* leaf extract	Animals	Decreased durations of immobility were observed in both the forced swim and tail suspension assessments, alongside a reduction in locomotor activity during the open field evaluation.	[41]

6.3. Antidiabetic.

The administration of an oral extract from *O. subscorpioïdea* at a dosage of 250 mg/kg to rats subjected to starch treatment resulted in a notable reduction in blood glucose levels, indicating that the extract exhibited significant hypoglycaemic effects [34]. Ayoola *et al*. [62] reported that rats given glucose experienced hypoglycemia in less than one hour following the administration of 200 mg/kg and 400 mg/kg *O. subscorpioïdea*, with these levels remaining lower than those recorded for glibenclamide (5 mg/kg) after 2- 4 hours. Kazeem *et al*. [34] explored the impact of *O. subscorpioïdea* leaf extracts in acetone, n-hexane, and ethyl acetate on the activities of α-glucosidase and α-amylase in an in vitro setting. These findings indicated that the n-hexane extract was the most potent inhibitor, with an IC_{50} of 0.10 mg/ml for α-glucosidase and 0.72 mg/ml for α-amylase. Additionally, Kazeem *et al*. [34] examined the antidiabetic properties of *O. subscorpioïdea* extracts through oral administration to rats fed a

starchy diet and monitored blood glucose levels over a two-hour timeframe, which demonstrated a significant reduction in these levels among the rats (Table 2, Figure 3).

6.4. Anti-inflammatory effects.

The extract derived from *O. subscorpioïdea* significantly inhibited the production of nitric oxide in RAW264.7 cells exposed to lipopolysaccharide, highlighting its possible role in reducing inflammation [29]. Ezeani *et al*. [33] noted that the extract demonstrated considerable antiarthritic activity at doses of 400, 600, and 800 mg/kg body weight. Odoma *et al*. [19] revealed that butanol or aqueous fractions of the extract displayed pronounced anti-inflammatory effects. Odoma *et al*. [63] used models to induce inflammation in carrageenan-treated rats, inflammation from xylene in mice, and inflammation from cotton pellets in rats and reported that aqueous or butanol-treated leaf fractions of *O. subscorpioïdea* at a dosage of 1000 mg/kg significantly reduced ear swelling, alleviated paw edema, and inhibited granuloma formation. Odoma *et al*. [64] reported that the administration of 1000 mg/kg aqueous or butanol leaf extracts of *O. subscorpioïdea* decreased proinflammatory cytokine levels and increased anti-inflammatory cytokine levels in a carrageenan-induced paw oedema model. Ishola *et al*. [37] reported that 400 mg/kg *O. subscorpioïdea* leaf extract inhibited chronic inflammation in rats. These results suggest that *O. subscorpioïdea* could be a promising therapy for the treatment of both acute and subacute inflammation (Table 2, Figure 3).

6.5. Antimicrobial.

Osuntokun and Adesemoye [65] reported that 100 mg/ml *O. subscorpioïdea* root extract produced inhibition zone diameters between 6 and 9 mm. In addition, *O. subscorpioïdea* root extracts exhibited antimicrobial effects against multidrug-resistant *E. coli* strains [66]. Ayandele and Adebiyi [12] reported that *O. subscorpioïdea* ethanol stem extracts presented notable antibacterial and antifungal properties, with inhibition zones ranging from 7.2 to 21.5 mm. Compared with various antibiotics, the extract from *O. subscorpioïdea* was noted to yield larger inhibition zones [67]. Moreover, a fruit extract of *O. subscorpioïdea* demonstrated strong inhibitory effects against *Candida tropicalis* and *Candida albicans*. When administered orally to experimental rats, this fruit extract reduced the concentration of *Candida albicans* cells in the rats' bloodstream [43]. A related study revealed an MIC of 125 mg/ml for ethanolic extracts of O. subscorpioïdea leaves against clinical isolates of *K. pneumoniae*, *E. coli*, *P. aeruginosa*, *S. typhi*, and *S. aureus*, as well as the molds *Aspergillus niger* and Penicillium sp. Compared with the positive standard drugs chloramphenicol and fluconazole, the extract of *O. subscorpioïdea* exhibited superior antimicrobial activity [68]. Badawe *et al*. [69] reported the potency of *O. subscorpioïdea* methanolic seed extract against multidrug-resistant clinical isolates of *S. aureus*, especially when it was combined with certain conventional antibiotics. Using the efflux pump inhibitor phenylalanine arginine-β-naphthylamide against various bacteria, Fankam *et al*. [24] reported minimal inhibitory effects of the methanolic extract of *O. subscorpioïdea* against both clinical and reference strains of enteric bacteria, including *P. aeruginosa*, P. stuartii, *E. coli*, *K. pneumoniae*, *E. aerogenes*, and *E. cloacae*. These findings suggest the potential for these organisms to develop resistance to extracts of *O. subscorpioïdea*, particularly via efflux mechanisms. Therefore, the use of efflux inhibitors may be crucial if *O. subscorpioïdea* is to be considered a viable basis for the development of conventional pharmaceuticals (Table 2, Figure 3).

6.6. Hepatoprotective effects.

Konan *et al*. [35] reported that the hydroethanolic extract of *O. subscorpioïdea* markedly lowered the serum levels of AST, ALT, and ALP compared with those in a control group subjected to carbon tetrachloride (CCl_4) toxicity. The administration of this extract at dosages of 25 and 100 mg/kg correlated with reductions in gamma-glutamyl transferase and total bilirubin levels. Furthermore, the extract was observed to increase the concentrations of ($\alpha1$, $\alpha2$, β, and γ)-globulin in a dose-dependent manner. Notably, the 100 mg/kg dosage resulted in nearly normal liver cell morphology, characterized by a mild inflammatory response and diminished fatty infiltration, with no indications of necrosis, in contrast to the results in the subjects exposed to CCl_4. Okoro *et al*. [32] demonstrated that the administration of ethanol extracts from the leaves and stem bark of *O. subscorpioïdea* (200, 400, and 800 mg/kg) reduced the serum levels of AST, ALP, ALT, MDA, and bilirubin in CCl_4-induced rats. Furthermore, their research revealed that these extracts not only increased SOD and catalase but also increased the levels of albumin and glutathione. The extracts notably alleviated liver necrosis and inflammation associated with CCl_4 exposure (Table 2, Figure 3).

6.7. Analgesic.

The aqueous leaf extract of *O. subscorpioïdea* has been demonstrated to markedly decrease the average frequency of abdominal constrictions [37]. At a dosage of 50 mg/kg, the extract had the most significant effect, achieving an activity level of 68.28%, which is comparable to that of the standard analgesic ibuprofen (67.74%). Furthermore, at a higher dose of 200 mg/kg, the extract notably reduced both licking and paw biting duration in response to formalin-induced pain [37]. The extract also induced a significant and time-dependent increase in pain latency at doses of 50 and 400 mg/kg [37]. In a related investigation, Popoola *et al*. [70] reported that the hydroethanolic root extract of *O. subscorpioïdea* significantly reduced abdominal constriction in a dose-dependent manner. In addition, this extract significantly decreased paw licking in response to formalin-induced pain at dosages of 200 and 400 mg/kg [70]. The aqueous and butanol fractions also significantly increased pain latency during the hot plate test, which was both dose- and time-dependent [19]. Leaf extracts of *O. subscorpioïdea* consistently and significantly reduce abdominal twitching and pain responses [19, 30]. Moreover, these extracts significantly extended pain latency in the hot plate test, thereby reinforcing their central analgesic properties [30]. The analgesic effects of the extract are likely mediated through interactions with the opioidergic system [30] (Table 2, Figure 3).

6.8. Anthelmintics.

Koné *et al*. [71] demonstrated that *O. subscorpioïdea* has notable anthelmintic effects on mice infected with Schistosoma mansoni when it is administered at dosages of 400 and 800 mg/kg body weight. Furthermore, the anthelmintic effectiveness of *O. subscorpioïdea* was further validated by subsequent studies conducted by Koné *et al*. [22]. Their research indicated that a single oral dose of 400 mg/ml *O. subscorpioïdea* root extract led to a significant decrease of 60.2% in the overall worm burden and an 84.5% reduction in the female worm population in mice infected with *Schistosoma mansoni* [22] (Table 2, Figure 3).

6.9. Anticonvulsants.

Nazifi *et al*. [26] reported that the leaf extract of *O. subscorpioïdea*, administered at dosages of 100 and 200 mg/kg, provided protective effects against maximal shock induced by electrical stimuli, achieving efficacy rates of 30% and 70%, respectively. Additionally, Adeoluwa *et al*. [27] reported that 50 mg/kg extract significantly delayed the onset of seizures. Studies have also shown that both ethanol and methanol extracts of *O. subscorpioïdea* leaves considerably prolong the latency to seizure onset and the time of mortality [26, 41] (Table 2, Figure 3).

6.10. Antiulcer.

Victoria *et al*. [18] reported that *O. subscorpioïdea* root extract exhibited an antiulcer effect, with notable efficacy observed at a dosage of 600 mg/kg, which was similar to the effects of the standard treatment (Table 2, Figure 3).

6.11. Antisickling.

M'Befehè *et al*. [72] reported that a decoction extract concentration of 0.312 mg/mL resulted in an 84% reduction in falciformation. Additionally, these extracts effectively inhibited sickle cells obtained from individuals with the SS genotype *in vitro*. Egunyomi *et al*. [73] reported the in vitro effects of a formulation derived from asymptomatic individuals, concentrating on the prevention of red blood cell sickling triggered by sodium metabisulfite. Their results revealed a 63.4% reduction in red blood cell sickling among HbSS individuals. Moreover, Agbedahunsi *et al*. [74] performed *in vitro* assays utilizing both inhibitory and reversal methodologies to evaluate *O. subscorpioïdea* leaf extracts on sickling erythrocytes. The results revealed an inhibitory effect of 75.8% and a reversal effect of 66.6% (Table 2, Figure 3).

6.12. Neurosedative.

Adeoluwa *et al*. [41] reported that the ethanol extract derived from the leaves of *O. subscorpioïd*ea led to a significant decrease in both rearing and grooming activities, with the degree of this decrease being dependent on the dosage given. This reduction may suggest a possible calming and anxiolytic effect of the extract, likely attributed to its interaction with the α2-adrenergic system. Additionally, a dosage of 25 mg/kg *O. subscorpioïdea* extract had a depressant effect on the central nervous system (CNS), resulting in a notable decline in locomotor activity in rats, which was comparable to the effects produced by diazepam at a dosage of 2 mg/kg. Furthermore, Adeoluwa *et al*. [41] reported that the extract significantly and in a dose-dependent manner diminished the frequency of head nodding and extended the duration of sleep induced by pentobarbitone (Table 2, Figure 3).

6.13. Anti-Alzheimer.

Adeniyi *et al*. [59] revealed that treatment with 100 mg/kg methanol extract from *O. subscorpioïdea* reduced transfer latency, decreased neuroinflammatory markers, and lowered the activity of acetylcholinesterase (AChE) in a scopolamine-induced model of Alzheimer's-like dementia. Furthermore, Saliu and Oabiyi [36] reported that *O. subscorpioïdea* leaf extract

inhibited both butyrylcholinesterase (BChE) and acetylcholinesterase (AChE) (Table 2, Figure 3).

6.14. Antianemia.

M'béfèhê *et al*. [75] reported that administering 200, 400, or 800 mg/kg of a decoction derived from whole *O. subscorpioïdea* successfully restored haemoglobin concentrations and RBC and haematocrit percentages in rats suffering from phenylhydrazine-induced anaemia (Table 2, Figure 3).

6.15. Antidepressant.

Adekunle *et al*. [76] revealed that *O. subscorpioïdea* ethanol leaf extract alleviated diarrhea in a reserpine-induced depression model and dose-dependently reduced immobility duration in the tail suspension and forced swimming tests. Adeoluwa *et al*. [27] demonstrated that the ethanol leaf extract of *O. subscorpioïdea* led to a significant reduction in immobility duration during the forced swim and tail suspension tests, as well as a decrease in crossing behavior in the open field test. Furthermore, their research revealed a marked reduction in diarrhea within the context of the reserpine-induced depression model. Adeoluwa *et al*. [25] reported that the butanol leaf extract of *O. subscorpioïdea* effectively alleviated depressive symptoms in rats, presumably through the modulation of monoaminergic signalling pathways (Table 2, Figure 3).

7. Toxicity Profile of *O. subscorpioïdea*

Adekunle *et al*. [15] reported that a single oral administration of methanol extract from the root of *O. subscorpioïdea* at dosages of 2000 mg/kg and 5000 mg/kg did not lead to observable toxicity or mortality. However, a 21-day subacute toxicity assessment revealed a dose-dependent effect on red blood cell counts, hemoglobin levels, and hematocrit values in the 500 and 1000 mg/kg groups compared with those in the control group. Histopathological analysis of the treated rats revealed significant vascular congestion in the liver, interstitial congestion and hemorrhage, and moderate glomerular damage in the kidneys. These findings imply that while the methanol root extract of *O. subscorpioïdea* appears to be nontoxic following acute exposure, it may present a risk of toxicity with subacute oral administration. The intraperitoneal median lethal dose (LD_{50}) for the methanol and ethanol leaf extracts of *O. subscorpioïdea* was 3800 mg/kg [41] and 300 mg/kg [26], respectively. Furthermore, the acute toxicity evaluation of the methanol root extract indicated an LD_{50} of 2154 mg/kg [18]. The hydroethanolic leaf extract of *O. subscorpioïdea*, when administered at doses of 500, 1000, 2000, and 4000 mg/kg, resulted in various behavioral alterations and mortality in mice. Notably, at the higher doses of 2000 and 4000 mg/kg, the extract elicited acute toxicity symptoms, including restlessness, aggression, body twisting, convulsions, and diarrhea. A notable increase in alkaline phosphatase (ALP) levels was observed at dosages of 500, 750, and 1000 mg/kg, with a significant increase in the plasma ALB concentration, specifically at the 1000 mg/kg level. Furthermore, there were substantial reductions in the mean corpuscular haemoglobin, lymphocyte count, white blood cell count, and haemoglobin concentration, alongside a pronounced increase in the neutrophil count at the 1000 mg/kg dosage. The extract did not induce significant variations in red blood cell count, packed cell volume, mean corpuscular volume, platelet count, or mean corpuscular hemoglobin concentration.

Histopathological assessments revealed no significant changes in liver or kidney tissues across all administered dosages [79]. Additionally, the administration of n-hexane leaf extract of *O. subscorpioïdea* at a dosage of 50 mg/kg led to a significant reduction in hemoglobin levels, red blood cell counts, packed cell volume, and monocyte counts. [46]. Similarly, Adekunle *et al* reported a reduction in hematocrit, red blood cell counts, and hemoglobin levels in female mice administered with 500mg/kg of the methanol root extract of *O. subscorpioïdea* [14]. These effects, suggestive of anemia, could be attributed to the presence of saponins, which have been reported to cause hemolysis and disruption of the cell membrane, leading to an increase in cytosolic Ca^{2+} and suicidal erythrocyte death [14, 46] (Table 2, Figure 3).

8. Conclusion

This review highlights the substantial evidence that *O. subscorpioïdea* is quite promising; therefore, its biological properties should be further evaluated in addressing a variety of health conditions, such as cancer, diabetes, inflammation, microbial infections, seizures, ulcers, sickle cell anaemia, Alzheimer's disease, and depression. Although there is a scarcity of phytochemical research on this species, the limited studies available have identified biologically active compounds that corroborate the pharmacological claims associated with the plant. Nonetheless, comprehensive pharmacological investigations of the different plant parts are necessary to validate their traditional applications. Additional research is needed to characterize, identify, and isolate the biologically active compounds responsible for the observed pharmacological effects, as well as to clarify the mechanisms by which these phytochemicals exert their effects. A review of toxicity assessments for *O. subscorpioïdea* indicates that the plant may exhibit various toxic effects, including hematotoxicity and hepatotoxicity. Therefore, caution is advised when using extracts from different parts of *O. subscorpioïdea* in patients, especially patients with symptoms of anaemia or liver diseases. We advocate further investigations into the chronic and reproductive toxicity of the various plant parts utilized in traditional medicine. Furthermore, rigorous scientific studies, including clinical trials and the standardization of dosages for the treatment of diverse diseases, should be conducted.

Author Contributions

Conceptualization, E.A.U., V.C.N.; methodology, E.A.U.; software, V.C.N.; validation, N.J., J.U.N., E.D.D.; formal analysis, J.U.N., U.O.A.; investigation, C.L.I.; resources, X.X.; data curation, C.E.U.; writing—original draft preparation, E.A.U.; writing—review and editing, N.J., V.C.N., F.C.J.; visualization, M.E.U.; supervision, E.A.U.; project administration, V.C.N.; funding acquisition, Y.Y. All authors have read and agreed to the published version of the manuscript.

Institutional Review Board Statement

Not applicable.

Informed Consent Statement

Not applicable.

Data Availability Statement

No new data were created or analyzed in this study. Data sharing is not applicable.

Funding

This research received no external funding.

Acknowledgments

Declared none.

Conflicts of Interest

The authors declare no conflict of interest.

Abbreviations

The following abbreviations are used in this manuscript:

Abbreviation	Definition
ALP	Alkaline Phosphatase
ALT	Alanine Transaminase
AST	Aspartate Transaminase
CCl_4	Carbon Tetrachloride
CNS	Central Nervous System
DPPH	2,2-diphenyl-1-picrylhydrazyl
EAFs	Ethyl Acetate Fractions
FRAP	Fluorescence Recovery After Photobleaching
GC-MS	Gas-Chromatography Mass Spectrometry
GSH	Gluthatione
HPLC	High-Performance Liquid Chromatography
MDA	Malondialdehyde
ROS	Reactive Oxygen Species
SOD	Superoxide Dismutase
STIs	Sexually Transmitted Infections

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