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Ethnobotanical, Pharmacochemical and Cosmetic Study of the Plant *Chrysopogon Nigritanus* - A Review

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ABSTRACT

Chrysopogon nigritanus is a plant widely used traditionally for various purposes, especially in traditional medicine for its various properties of pharmaceutical and cosmetic interest. Scientifically, this plant has not been widely studied, especially in the field of pharmacology. This paper is a bibliographic review in which we have listed the ethnobotanical study of the plant, its uses in traditional medicine, ecology, and cosmetology, and previous pharmacochemical studies. This review provides an overview of all known phytochemical studies on the plant Chrysopogon nigritanus. We have presented the physicochemical studies and biological tests carried out, as well as all the structural identification work on compounds derived from the Chrysopogon nigritanus plant, to establish solid prospects for further scientific research into the pharmaceutical and cosmetic benefits of this plant.

Keywords: *Chrysopogon nigritanus, phytotherapy, phytochemicals, biological properties.*

Introduction

Plants are an immense source of complex chemical molecules exploited by humans in several fields, such as the cosmetics industry, the agri-food industry, and the pharmaceutical industry. The study of the use of plants in African pharmacopoeia and traditional medicine has led to the identification of many active ingredients in various drugs currently used in modern medicine [1]. The diversity of these natural molecules, which are not essential to the viability of plants, remains a mystery to scientists trying to decipher their role in nature. Similarly, elucidating the biosynthetic pathways leading to original natural products is an inexhaustible field of investigation for scientists. In Africa, the therapeutic properties of plants were well known empirically by our ancestors and parents. However, it must be noted that there is a lack of knowledge about the chemical composition of these medicines used daily by these populations for healthcare [2].

According to estimates by the World Health Organization (WHO), approximately 80% of the population in developing countries use traditional medicine, particularly herbal medicine, for their healthcare needs. In some continents, such as Africa and Asia, herbs are even used as the first line of treatment for conditions such as malaria, diabetes, hypertension, dermatoses, and, more recently, diseases caused by pathogens that can cause serious infections in people living with HIV/AIDS. In fact, more than 120 pharmaceutical products commonly used today are derived from plants, most of them from tropical regions of the world, including Africa [3].

Currently, there is an increase in the use of compounds of natural origin, justifying the increase in the production of certain aromatic and medicinal plants (AMP). Many of these MAPs are used for their essential oils (EOs), which are the result of the synthesis and accumulation of volatile organic compounds present in the form of tiny droplets in the leaves, bark, fruit, resin, branches, and roots [4].

Due to its location, Senegal has a biodiversity of prime importance with many plants of therapeutic interest. These are divided into several families, classified into several genera, including numerous species.

This is how we became interested in the species *Chrysopogon Nigritanus* of the genus Chrysopogon, subgenus Plantae, belonging to the family Poaceae of the class Liliopsida. It is an aromatic medicinal plant widely used in West Africa, particularly in Senegal.

In light of this, the objective of our work is to study and characterize the chemical compositions and evaluate the biological and pharmaceutical activities of several extracts from the *Chrysopogon Nigritanus* plant and the essential oil from its roots, to promote and rationalize their traditional uses.

This work involves first conducting a bibliographic review in the context of a comprehensive analysis involving an ethnobotanical study, the use of the *C. Nigritanus* plant in traditional medicine and other fields, as well as previous chemical, biological, and pharmacological studies.

I. Presentation of the *Chrysopogon nigritanus* plant

1. General information about the *C. Nigritanus* plant family

To identify a plant, the first step is to know its family. Generally, a local flora is used for this purpose, which allows species to be identified based on observation, especially of the reproductive organs. These are considered stable and independent of ecological conditions, thus allowing for accurate and rigorous identification [5].

C. nigritanus is a species of the Poaceae family, also known as Gramineae, a cosmopolitan family that includes a large number of species and genera. It is of major economic importance to the development of humanity. Indeed, it provides highly nutritious foods (rice, corn, wheat, etc.), raw materials of great importance in the food industry (sugar cane, sorghum: Sorghum bicolor), in the paper industry (*alfalfa: Stipa tenacissima), in perfumery (Vetiveria: Chrysopogon zizanioides, C. nemoralis, C. nigritanus*), and as building materials (bamboo). In addition, certain species of this family are used in traditional medicine to treat various conditions such as inflammation, malaria, urinary tract infections, diarrhea, rheumatism, as an aphrodisiac and to facilitate childbirth [6].

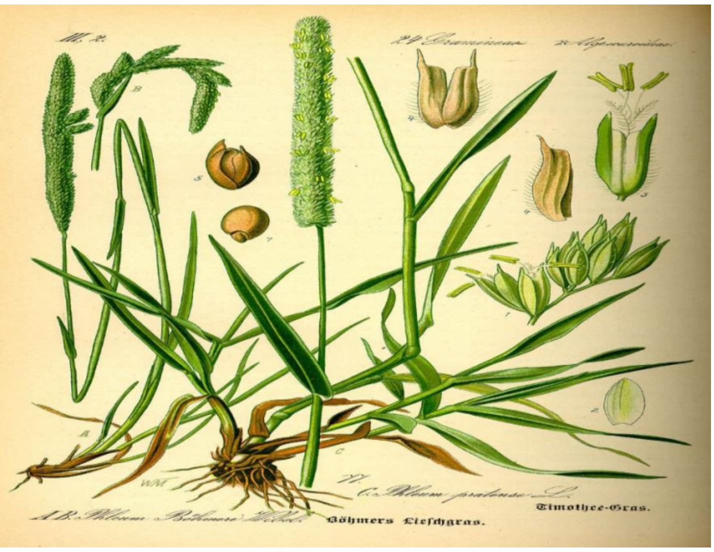


Figure 1: Image of the Poaceae family

The species in this family have a remarkable ability to adapt. They cover virtually all natural environments. The family comprises 13 subfamilies, around 800 genera, and more than 12,000 species. They are herbaceous plants, either perennial or annual, hermaphroditic, monoecious, or dioecious.

Characteristics that identify Poaceae:

- The leaves are generally linear, alternate, and distichous, and have a sheath split on the side opposite the blade. They usually have ligules and no petioles (bamboo has a false petiole).
- The stems, also called culms, are: round, sometimes oval, hollow or filled with pith, sometimes lignified and large (bamboo, reeds, etc.).
- The inflorescences are formed by spikelets grouped in spikes and panicles.
- The spikelet always has two bracts at its base, called glumes.
- Flowers: Each flower is surrounded by two glumes: the lemma and palea, the calyx and corolla, reduced to tiny organs.
- The fruit is a special type of achene: the pericarp and seed are fused, with no wall between them [7].

2. Ethnobotanical study of *Chrysopogon nigritanus*

a. Description of the plant

Chrysopogon nigritanus (Benth), better known by its taxonomic synonym *Vetiveria nigritana*, is a perennial grass species in the Poaceae family, monocotyledonous. Native to South Asia, it has been used for more than a century in India, Thailand, and sub-Saharan Africa [8]. It grows in dense clumps with short simple rhizomes and stands upright, reaching a height of about 2.4 meters. It features large, open, spreading purple panicles, composed of long, slender racemes, each with a fine stem and arranged in 8 to 10 whorls around a central axis, bearing numerous slender spikes with short, fine, scarcely visible awns, straight or slightly curved. The leaves are erect or ascending, forming an acute angle with the stem, long and linear, up to 1 m x 1 cm, and pale green. The stems are coarse and pale green-yellow, cylindrical in their upper part, and the roots are yellow, sometimes emerging from a short rhizome [9].

Table 1: Vernacular names of C. nigritanus

Ethnic group	Soninké	Wolofs	Peulh	Sérère	Diola
Name	Khamaré	Ceep	Sodhorè	Sintché	Gongoli

Figure 1: An image of the Chrysopogon Nigritanus plant

b. Climate and environmental adaptation of the *C. Nigritanus* plant

A hygrophilous species, it grows in low floodplains and along the banks of rivers and ponds. This species bridges the gap between aquatic and terrestrial plants. Vetiver is also used because of its drought tolerance due to its ability to grow in infertile soils with extreme temperatures ranging from 14°C to 55°C. The plant tolerates drought, frost, salinity, metals, and other unfavorable chemical conditions in the soil [10, 11]. Although the plant is highly resistant to extreme soil and climate conditions, as mentioned above, it cannot tolerate shade at all. Shading reduces its growth and, in extreme cases, could even eliminate vetiver in the long term [10].

II. Uses of the *C. nigritanus* plant

1. Ecological uses

C. Nigritanus is of interest for the conservation, stabilization, and elimination of certain trace metals (Al, As, Cd, Cu, Cr, Pb, Zn) from soils. It produces high levels of biomass, and its dense root system provides a large specific surface area and delimits a significant rhizosphere zone. It could therefore be used for the rehabilitation of arsenic-contaminated soils. [12] Rapid growth and high biomass are preferred criteria for selecting plants for phytoremediation, which is why it is a very promising candidate; It is used as an alternative to synthetic chemical pesticides. One of the special characteristics of vetiver is its ability to form a dense hedge when planted closely together. A vetiver hedge can withstand water flow of up to 0.6 m in depth, forming a vegetative barrier that retains and distributes runoff water. The vetiver hedge also acts as a highly effective filter, retaining sediments and agricultural chemicals before they reach waterways. It is also used for water treatment by removing trace metals from domestic wastewater in micro-phytostations [13, 14, 15]. Vetiver grass is introduced as a resilient forage alternative in the Mediterranean basin in the face of climate change, which poses a threat to the sustainability of forage crop production [16]. It has potential as a wood preservative against termites and wood borers [17].

2. Use in traditional medicine

The therapeutic use of medicinal plants dates back to ancient times in Africa, where they are more numerous than on any other continent.

During the colonial period, these medicinal practices were suppressed, but today doctors often work in close collaboration with traditional healers. In traditional medicine, different parts of specific plants are used, including the leaves, bark, roots, fruits, or even the entire plant [18, 19].

In India

Native to India, vetiver has been used for several centuries as a medicinal and aromatic plant. Different parts of the vetiver plant are used for various purposes to treat conditions such as mouth ulcers, boils, epilepsy, burns, snake bites, scorpion stings, rheumatism, fever, headaches, and more. Fresh root paste heals burns, snake bites, and scorpion stings, and a decoction of the roots is used as a tonic against weakness.

The root extract is used for headaches and toothaches. The tribes of Varanasi and Oraon inhale the root vapors to treat malaria and use root ash to relieve acidity. Leaf pastes effectively relieve rheumatism, lower back pain, and sprains, and the dried roots are used to scent clothes [20, 22].

In Indonesia

Indonesia was the world's leading producer of vetiver oil. The plant is used to treat symptoms and also for cosmetic purposes. For example, the roots are used to eliminate unpleasant body odors caused by sweating. It is also used to treat rheumatism.

In Pakistan

Vetiver, known under the names Khas, Aseer, or Daron, is widely used in traditional medicine to treat heart weakness, palpitations, fainting, and to counteract the harmful effects of air pollution. It is consumed in the form of syrup, powdered infusion, or drink to treat fever, inflammation, and stomach irritations [23]. Thanks to its cooling and astringent properties, and its ability to quench thirst, vetiver is also used as an antipyretic in cases of bilious and blood fevers. Vetiver oil is used to control vomiting in cholera, and the vapors from vetiver leaves burned with benzoin are effective in treating headaches caused by liver diseases [24].

In Thailand

Thais use vetiver roots to dissolve gallstones, reduce fever, treat liver and gallbladder conditions, and relieve stomach aches. Additionally, vetiver is used for medicinal purposes depending on the region. In the Pho Prathap Chang district of Phichit province, the properties of vetiver roots are used to treat stomach aches, reduce gas, and digestive disorders. The leaves are used to treat urinary problems, and the roots mixed with other plants in various ways are used to treat many ailments [23].

In Senegal

In traditional Senegalese medicine, there are many medicinal uses of *V. Nigritana*, many of which revolve around its aphrodisiac properties. It is also known and used as a water purifier (antiseptic), giving taste and fragrance, as well as for its antibacterial properties. Young women use a vetiver root infusion to relieve menstrual pain. After childbirth, the infusion is used to cleanse the reproductive system. It is recognized as an effective purifier for the feminine parts under stress. Vetiver is useful in skincare as an antiseptic, tonic, and detoxifier. Powdered vetiver roots are used as an astringent to speed up wound healing. The infusion of the roots in water is used to disinfect and eliminate pathogenic bacteria, and also for diarrhea in breastfeeding mothers and young infants [23-26].

The roots of this plant contain an essential oil with sesquiterpene alcohols responsible for its disinfectant and antiseptic properties. It has a pleasant smell and is widely used to disinfect drinking water. The latter is highly used and acts mainly on the nervous system, having both a calming and invigorating effect. It is excellent for treating depression, nervous tension, fatigue, insomnia, and many stress-related ailments, and acts as an aphrodisiac. It is also used in massages and baths to relieve stress, anxiety, nervous tension, and insomnia [27].

3. Uses in perfumery and cosmetics

In skincare, vetiver is used to balance sebum secretion and is also an effective antiseptic and mild astringent. It is used to treat oily skin, acne, oozing wounds, and serves as an antiseptic, tonic, and detoxifier [27]. That is why we now see soaps, facial creams, and scrubs made from this plant. Due to its rich, sensual, and deeply soothing fragrance, it is also called the oil of tranquility and the scent of the earth. Since the Middle Ages, it has been the most commonly used oil in perfumes. The cosmetic industry widely uses vetiver essential oil and its extracts. In diluted form, vetiver oil is used to provide a soft and calming note. Vetiver has been used as a raw material for various scented products such as perfumes, deodorants, lotions, soaps, cosmetics, and so on. It is soluble in several alcohols, which is an advantage in the field of perfumery [28].

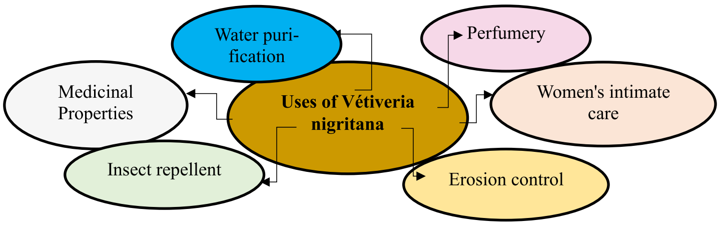


Figure 2: Uses of V. nigritana

Previous chemical and pharmaceutical work

The *C. Nigritanus* plant has not been studied extensively in terms of its chemical and pharmacological properties, but despite this, there are previous studies, and, according to our research, its essential oil is the most studied component.

1. Chemical studies on *C. nigritanus*

Vetiver has a very diverse chemical composition in its various parts, which explains its wide therapeutic use.

a. On the roots of *C. nigritanus*

Studies conducted on the aqueous extract and the isopropanol extract show that there are different families of secondary metabolites present in both extracts, distributed as follows: the presence of terpenes, polyphenols, flavonoids, and coumarins in both extracts; the presence of alkaloids, condensed tannins, and gallotannins in the aqueous extract; the absence of saponins in both extracts; and the absence of condensed tannins and gallotannins in the isopropanol extract. The determination of the polyphenol and flavonoid levels in the two extracts shows that these two extracts have virtually similar polyphenol contents, but the aqueous extract has a higher flavonoid content than the other extract [29]. Studies on the methanolic extract of the roots have determined the total polyphenol content and that of proanthocyanidins to be 5.7+/-0.47 GAE and 6.415+/-0.2 mg/g CE, respectively [30].

Analysis of fatty acids after saponification of the petroleum ether extract obtained from the rhizomes yielded an acid fraction which, after isolation and weighing, represented 64.95% of the extract; 84% of the constituents of this fraction could be identified and quantified. Classic fatty acids were noted, but also a significant proportion of sesquiterpene organic acids, which are characteristic of the Vétiveria genus (68.39%). Fatty acids constitute only 15.39% of the acid fraction; these are mainly saturated acids (9.49%), with palmitic acid (4.91%) as the main compound; unsaturated fatty acids are not very abundant (5.9%) [31]. The unsaponifiable fraction was also fractionated and, after isolation and weighing, was found to represent 21.57% of the extract, of which 73.07% of the constituents of this fraction have been identified, and the majority of compounds (54.8%) belong to the sesquiterpenoid group. These are mainly sesquiterpene alcohols (46.84%), including cedar-8-ene-15-ol and khusimol. The other compounds are divided between aldehydes (4.57%), ketones (1.88%), hydrocarbons (1.51%), and sterols (13.7%), which are sterols frequently found in the plant kingdom [31].

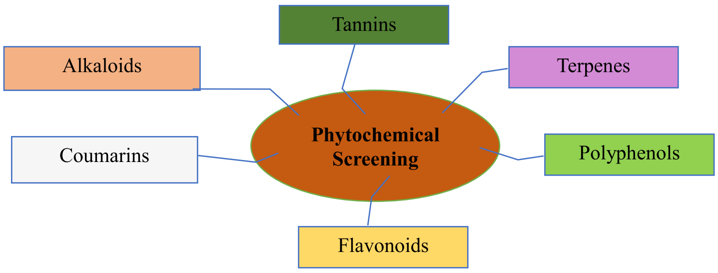


Figure 3: the major chemical families revealed by screening

Table 2: Composition of fatty acids, organic acids, and compounds identified in the unsaponifiable fraction

Fatty acids and organic	Compounds in the unsaponifiables	
Isozizanoic	α-funebrene	Préziza-7(15) -en-12-ol
Zizanoic	Preziza-7(15) -ene	Tricosane
C14H21COOH	Zizaene	Eicosene
Palmitic (hexadecanoic)	Eremophila-1(10),7(11)-diene	Pentacosane
Margaric (heptadecanoic)	12-nor-preziza-7(15)-en-2-one	Hexacosane
Linoleic (octadecadienoic)	5-nor-funebran-3-one	Heptacosane
Oleic ((Z)-octadecenoic)	Khusimone	Octacosane
Elaidic ((E)-octadecenoic)	Cedrenol (cedr-8(15)-en-9a-ol)	Squalene
Stearic (octadecanoic)	Epi-cedrol	Nonacosane
Arachidic (eicosanoic)	Prezizaan-15-al	Triacontane
Behenic (docosanoic)	α-funebrene-15-al	Hentriacontane
Tricosanoic	Preziza-7(15)-en-3a-ol	Campesterol
Lignoceric (tetracosanoic)	2-epiziza-6(13)-en-3a-ol	Stigmasterol
Pentacosanoic	Khusian-2-ol	β-sitosterol
Cerotic (hexacosanoic)		

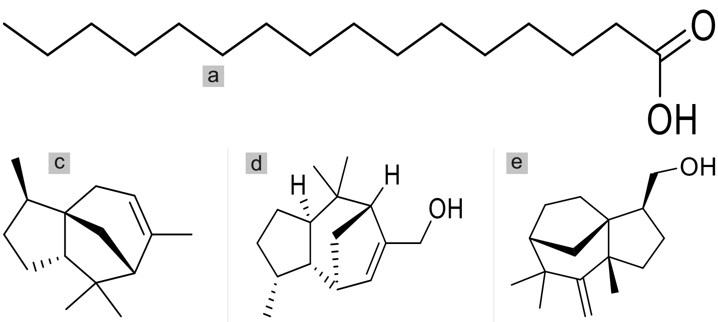


Figure 5: Structures of palmitic acid (a), α-funebrene (c), cedr-8-ene-15-ol (d) and khusimol (e)

GC-MS analysis of the essential oil sample from the roots of *C. Nigritanus* cultivated in Sudan shows that the main components of the oil were sesquiterpene hydrocarbons and their oxygenated derivatives. Of the fifty compounds detected, forty-one were identified; the major product is longifène-D (25.1%), followed by 2-hydroxycypérol (9.7%) and aromadendrene oxide (8.8%). These results do not match the known fingerprint of vetiver oil, which contains more of the sesquiterpenes α-vetivone, β-vetivone, and khusimol [32].

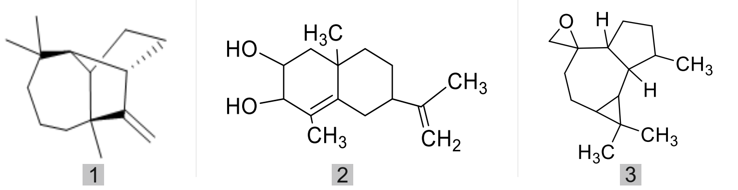


Figure 6: Structure of longifene-D (1); 2-hydroxycyperol (2) and aromadandene-1 oxide (3)

Other studies on this oil from the roots *of C. Nigritanus* cultivated in Sudan revealed a total of 19 compounds, most of which were oxygenated sesquiterpenes (64.3%), with Cedr-8-en-15-ol (28.7%) as the main constituent. Sesquiterpene hydrocarbons accounted for 4% of the oil, while monoterpenes were not detected. Additionally, the alkane triacontane (20.1%) was found in relatively abundant amounts [33]

The chemical analysis of the essential oil extracted from the roots of *V. nigritana* from Burkina Faso made it possible to identify twenty-seven (27) compounds, among which the main components can be cited as dehydronigritene (24.24%), zizanoic acid (11.48%), preziza-7-(15)-en-3-ol (6.42%), khusimol + preziza-7(15)-en-12-ol (5.83%), khusian-2-ol (5.09%), ziza-6(13)-en-3-beta-ol (3.21%), prezizaan-15-al (3.00%), and khusimone (2.69%) [34]

In Mali, the analysis of root oils of *V. nigritana* by GC-MS revealed a varying composition of fifty-four constituents, with prezzanoic acid (15.0%), preziza-7(15)-en-12-ol (9.5%), cedren-8-en-15-ol (6.2%), preziza-7(15)-en-3α-ol (6.0%), and zizanoic acid (5.9%) being the main components. Among the constituents, two sesquiterpene hydrocarbons, dehydronigritene and nigritene, and two sesquiterpene acids, cedren-15-oic acid and 2-epi-prezzanoic acid, were confirmed by EI-MS and NMR [25].

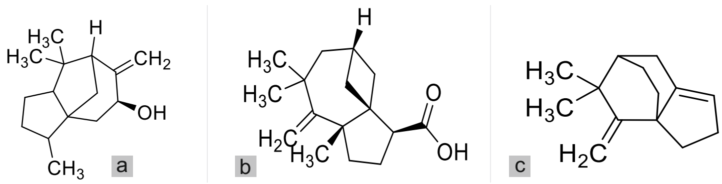


Figure 7: Structures of cedr-8-en-15-ol (a), zizanoic acid (b), and dehydronigritene ©

Gas chromatography coupled with mass spectroscopy (GC-MS) analyses showed the presence of 36 compounds in the essential oil (EO) of *Chrysopogon Nigritanus* roots harvested in Senegal, specifically in Thiès [36].

By examining the mass spectra of the various products in the essential oil and the IR spectrum, we discovered that this oil contained: sesquiterpenes and sesquiterpenols in high concentrations, which was confirmed by IR and MS; the presence of sesquiterpene ketones was also noted by analyzing the MS, but the IR analysis did not confirm this presence. Acids such as isovalencenic acid and zizanoic or khusenic acid, as well as sesquiterpene esters such as andrographolide, which is a diterpene lactone, were also observed.

The variation in the chemical composition of essential oils from *C. nigritanus* roots could be attributed to the maturity of the plant, environmental factors, temperature, rainfall, and the season or month of harvest [33].

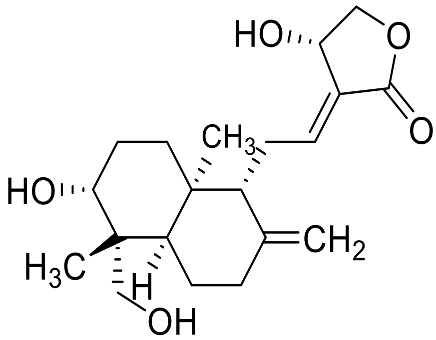


Figure 4: Structure of andrographolide

Analysis of the root oil collected in Benin by GC and GC-MS revealed sixty constituents, of which ledene oxide (52.1%), zizanoic acid (49.8%), hexadecanoic acid (43.5%), prezizanoic acid (29.1%), cedrol (43.6%), khusinol (23.0%), cedr-8-en-15-ol (21.5%), khusimol (14.8%), khusian-2-ol (14.0%), phytol (13.4%), and α-cedrene (16.1%) are the main components [37].

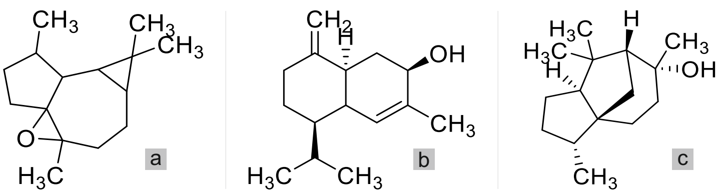


Figure 5: Structures of leden oxide (a), cedrol (b), and khusinol (c)

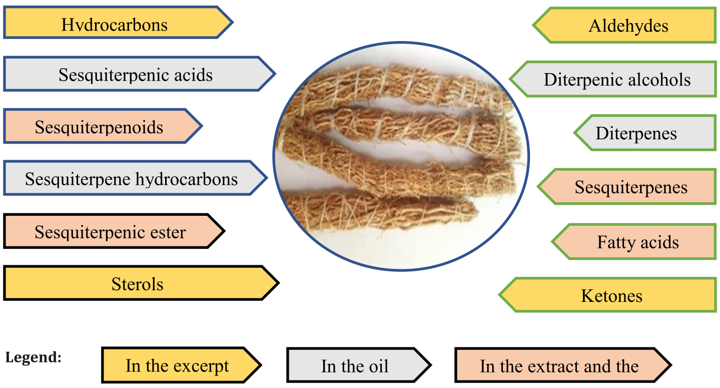


Figure 6: Chemical richness of C. Nigritanus roots

Phytoremediation studies of chromium-6 ions by vetiver roots carried out on samples from boreholes and wells in a given area in Senegal show that *V. Nigritana* roots can trap hexavalent chromium in water after 6 hours of contact. The percentage of elimination varies between 33.33% and 80%, and the amount of chromium adsorbed per unit mass of vetiver ranges from 0.003 to 0.008 mg/g [38].

b. On the aerial part of *C. nigritanus*

Fatty acid analysis after saponification and the constituents of unsaponifiables in petroleum ether extracts obtained from flowering tops and rhizomes were performed on the species growing in Mali, and the results show that after isolation, fatty acids represent 13.1% of the petroleum ether extract. 79.9% of the fatty acids were identified and quantified. It is noted that 71.5% are saturated fatty acids, among which palmitic acid (20.17%), lauric acid (8.76%), and myristic acid (7.11%) are the most abundant; unsaturated fatty acids (7.75%) are represented only by oleic acid (4.07%) and linoleic acid (3.68%). The presence of long-chain fatty acids, with 22 to 34 carbon atoms, as well as fatty acids with an odd number of carbon atoms, which are rarely found in the plant kingdom, was noted in this composition, as well as diacids (4%). [31]

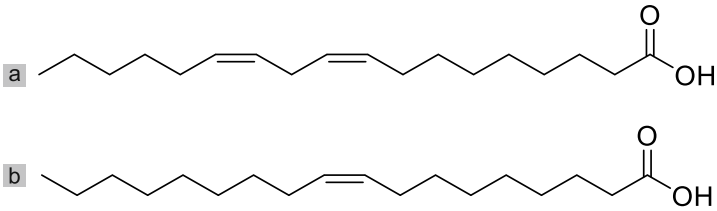


Figure 7: structures of linoleic acid (a) and oleic acid (b)

For the flowering tops extract, the fraction after isolation and weighing represents 68.9% of the petroleum ether extract, and 82.56% of the constituents of this fraction have been identified. The main group of constituents is represented by sterols (43.89%), with two compounds being predominant, β-sitosterol and stigmasterol (18.36% and 10.08%, respectively), and cholesterol representing 1.64%. Saturated aliphatic hydrocarbons (C23 to C35) represent the second largest group of constituents (30.1%); of these, 24.79% are compounds with an odd number of carbon atoms, which is common in the plant kingdom.

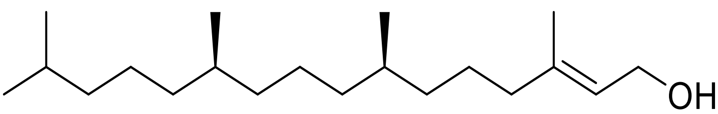
Tocopherols account for 1.48% of the unsaponifiable matter, with the α-tocopherol isomer, which has high antioxidant activity, constituting about half of the total tocopherols. The presence of squalene is noted, although it is in small quantities (0.71%). Only one terpene derivative has been identified, fernenol, a compound reported in many species of Poaceae [31].

Table 3: Acid composition of flowering tops

Fatty acids	
Caprylic (octanoic)	Stearic (octadecanoic)
Pelargonic (nonanoic)	Nonadecanoic
Capric (decanoic)	Arachidic (eicosanoic)
Suberic (octanedioic)	Henicosanoic
Lauric (dodecanoic)	Behenic (docosanoic)
Azelaic (nonanedioic)	Tricosanoic
Tridecanoic	Lignoceric (tetracosanoic)
Sebacic (decanedioic)	Pentacosanoic
Myristic (tetradecanoic)	Cerotic (hexacosanoic)
Pentadecylic (pentadecanoic)	Carboceric (heptacosanoic)
Palmitic (hexadecanoic)	Montanic (octacosanoic)
Margaric (heptadecanoic)	Melissic (triacontanoic)
Linoleic (octadecadienoic)	Dotriacontanoic (C32:0)
Oleic ((Z)-octadecenoic)	Tetratriacontanoic

Table 4: Compounds identified in the unsaponifiable fraction

Compounds identified in the unsaponifiable fraction	
Phytol	Hentriacontane
Tricosane	Cholest-5-en-3-ol
Tetracosane	α-Tocopherol
Entacosane	Campesterol
Hexacosane	Stigmasterol
Heptacosane	Tritriacontane
Octacosane	β-Sitosterol
Squalene	Ethyl-cholestan-3β-ol
Nonacosane	Stigmasta-3,5-diene-7-one
Triacontane	9,19-Cyclolanostan-3-ol,24-methyl-Fern-7-en-3β-ol
c-tocopherol	Pentatriacontane



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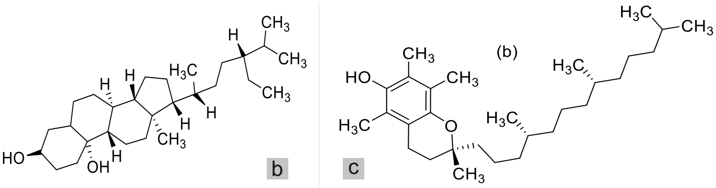

Figure 8: structures of β-sitosterol (a), α-tocopherol (b), and fernenol (c)

Studies on the aerial parts of *V. nigritana* have identified five flavonoid compounds [39]. The structures of the compounds were identified and confirmed by NMR as follows: carlinoside (1); neocarlinoside (2); 6,8-di-C-arabinopyranosylluteolin (3); isoorientin (4); and tricin-5-OH-glucoside (5). The same flavonoids were identified for the first time in both species, except for compound (4), which is only present in V. zizanoides.

These results showed that the aerial parts mainly contained 6,8-di-C-heterosides or luteolin. These flavonoids share a common structural component, which likely indicates the presence of a C-glycosidic step in the flavone biosynthesis pathway. Moreover, it should be noted that this is the first time that 6,8-di-C-arabinopyranosyl-luteolin has been isolated in the Poaceae family [39].

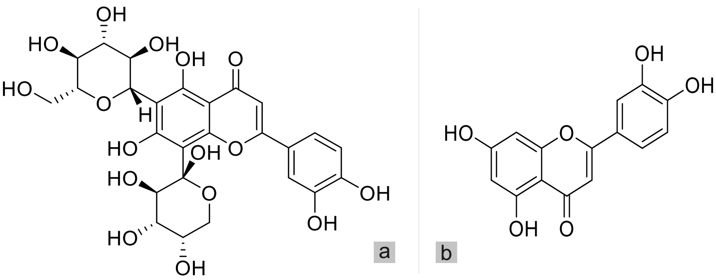

Figure 9: structures of carlinoside (a) and luteolin (b)

2. Previous pharmaceutical research on *C. nigritanus*

Pharmaceutical research on medicinal plants involves studying their biological properties to discover new drugs and explore their therapeutic potential.

a. Antioxidant activity of *C. nigritanus*

Antioxidants are widely used as food additives to protect foods from oxidative degradation by free radicals. They also have many beneficial effects on human health.

The antioxidant activity of *C. Nigritanus* roots was studied on the aqueous and isopropanol extracts using three methods: DPPH free radical scavenging, CUPRAC method, and ABTS+. The results obtained with the CUPRAC method revealed that the aqueous extract had the highest antioxidant capacity with 2.914 mg TE/g Ms, while that of the isopropanol extract was 0.925 mg TE/g Ms. The results of the DPPH method show a 5.4% difference in inhibition in favor of the aqueous extract, and for the method using the ABTS+ cation radical, the aqueous extract also shows the best result with an IC50 of 0.13 compared to 0.194 for the isopropanol extract. It also follows that the latter gives the best activity [29].

A comparative study of the anti-radical activity of essential oil from *C. Nigritanus* grown in the wild in Sudan with *Chamaecyparis obtusa* and *Lavandula coronopifolia* shows that, in 4 out of 6 tests (DPPH, ABTS, CUPRAC, FRAP, MCA, and PBD) that *C. Nigritanus* oil has the most significant anti-radical activity [33].

Studies on the anti-radical activity of essential oil from *C. Nigritanus* roots harvested in Burkina Faso confirm the existence of antioxidant activity in the latter, but it is somewhat weak compared to standards (ascorbic acid and quercetin). The highest IC50 was obtained with *V. nigritana* (28.35 µl) essential oil, and the lowest with quercetin (12.45 µl). *Vétiveria nigritana* essential oil had radical scavenging power, but this activity was lower than that of quercetin and ascorbic acid, but quite similar to that of butylated hydroxytoluene (BHT) (26.94 µl) [34].

Antioxidant tests we performed on essential oil from *C. Nigritanus* roots harvested in Senegal yielded positive results for the antioxidant activity of the latter, with an IC50 of 0.71mg/L for the DPPH test and 1.6 mg/L for the $ABTS^+$ test, compared to 0.02 and 0.056 mg/L, respectively, for ascorbic acid, which was the standard [36].

Studies on some pharmacological properties of the methanolic extract of *V. Nigritana* roots compared with other plants in Togo by [30] show radical scavenging activity (DPPH method) with an IC50 of 5.7+/- 3.34µg/mL, which is higher than that of the standard, ascorbic acid. This activity was also correlated with the total polyphenol content and that of proanthocyanidins, with a GAE of 5.7+/-0.47 and EC of 6.415+/-0.2 mg/g, respectively.

The study on the ability of *Vetiveria nigritana* rhizomes to preserve food was conducted, and the results indicate that this plant would be the most suitable plant species as a preservative for syrup made from local plants. The use of *Vetiveria nigritana* rhizomes followed by hot packaging and canning allowed the product to be preserved for more than a year [26].

b. The antibacterial activity of the *C. Nigritanus* plant

The antimicrobial activity of the oil was evaluated against four pathogenic bacteria. Antibacterial activity varied, ranging from total resistance in *Escherichia coli* (inhibition zone of 0 mm) to significant activity in *Pseudomonas aeruginosa* (inhibition zone diameter of 23 mm). Two bacteria, *Bacillus subtitis* and *Staphylococcus aureus*, were less sensitive to the oil (15.5- and 11.3-mm inhibition diameter) [32].

The evaluation of the antibacterial activity of *V. nigritana* essential oil showed effectiveness against all the microbial strains studied. The inhibition diameters (ID) of the essential oil ranged from 8.5 mm *(Salmonella infantis, Salmonella typhimurium, Shigella flexnerii) to 23.5 mm (Bacillus subtilis*). A strong inhibitory action (ID > 15 mm) was observed on strains of *Bacillus, Clostridium perfringens, Escherichia coli ATCC 25922, and Staphylococcus hominis*. A moderate inhibitory action (10 mm ≤ ID ≤ 15 mm) was observed on strains of *Enterococcus faecalis, Escherichia coli, Listeria monocytogenes, Micrococcus luteus, Salmonella enteridis, Salmonella nigeria, Shigella dysenteriae, Staphylococcus aureus, Yersinia enterocolitica, Candida albicans, Kefir Candida, and Saccharomyces cerevisiae*. For strains of *Pseudomonas aeruginosa, Salmonella infantis, Salmonella typhimurium, Shigella flexnerii, and Candida tropicalis*, a weak inhibitory effect was noted (DI < 10 mm) sur les [34].

The same studies [20] also focus on antibacterial activity and show that the methanolic extract of *C. nigritanus* roots is active against only 3 out of 8 bacterial strains, namely *Serratia mirabilis, Shigella flexneri* and *Salmonella enteritidis*, with the same mean inhibitory concentration (MIC) of 1800 µg/L.

Studies have focused on the isolation and screening of bacteria on *V. nigritana* rhizomes harvested in Namibia. These roots were rinsed with sterile distilled water, then transferred to a phosphate-buffered saline solution and vortexed. Following this procedure, a bacterial isolate 100% similar to the *Bacillus sp29* (2010) isolate was found [40].

c. Hemolytic activity

The hemolytic activity of the methanolic extract of *C. Nigritanus* roots was studied [30] using saponin R as a standard. The latter showed total hemolysis at concentrations above 6µg/mL, and by equating the concentrations of the extract used and saponin R, the results obtained are as follows: for 10µg/mL of vetiver extract, there is a hemolysis production equivalent to 1.5µg/mL of saponin R; for 100 µg/mL, 3 µg/mL is equivalent, and for 400 µg/mL, 5.25 µg/mL of the standard. Therefore, the results obtained with 400 µg/mL of *C. nigritanus* extract are somewhat close to total hemolysis.

d. Insecticide activities

A study was conducted on *Vétiveria nigritana* as a means of controlling termites on agricultural land in southwestern Nigeria. The results of this study found that vetiver is a complementary strategy to chemical control, and that specialists in natural products and bioprospecting should further investigate the termiticide potential of vetiver with a view to developing environmentally friendly termiticide formulations compatible with tropical agricultural systems [41].

Comparative studies on the use of the plant *C. nigritanus* as a pesticide compared to synthetic pesticides on two types of soils (lixisols and vertisols) show that in the presence of Vetiveria nigritana, there is a decrease in total microbial biomass of 0.3% and 32%, respectively. A decrease in soil respiratory activity of 31.6% and 10.72%, respectively, in lixisols and vertisols was noted compared to the control (soil without pesticides). These preliminary results further highlight the importance of the presence of the plant species with its inhibitory effect on respiratory activity regardless of soil type [15].

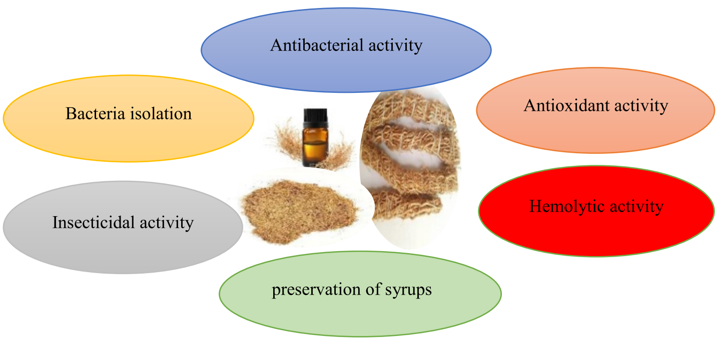

Figure 10: previous biological tests

Conclusion

In summary, it can be said that the plant *C. Nigritanus* is not yet widely exploited from a pharmaco-chemical point of view. Research indicates that it has a rich chemical composition and pharmaceutical activities such as antioxidant, antibacterial, hemolytic, and insecticidal properties. Although the rhizomes have been studied more extensively and their properties are better known to users of the plant, studies have also been conducted on its aerial parts. In the next phase of our work, we will deepen our research to try to exploit the plant's benefits to the fullest scientifically by building on work already done on other organic extracts, but also by focusing more on other chemical studies, such as alkaloid dosage, analysis, isolation, and structural identification of other molecules. We will also evaluate other pharmaceutical activities such as anti-inflammatory, antifungal, antiviral and insecticidal activity, test for minerals to assess its mineral composition, and verify the toxicity of the *C. Nigritanus* plant.

References

1. A.A. Dahounom et K. Koudouvo. Ethnobotanical survey on medicinal plants used in the traditional management of infectious diseases in the Lomé-Commune Health region of Togo. European Scientific Journal, 2021, 17(21) pages 46-60
2. K. N'Guessan et al. Phytochemical screening of some Ivorian medicinal plants used in the Krobou region (Agboville, Côte d'Ivoire). Journal Sciences & Nature, 2009, 6(1) : pages 1 - 15. https://doi.org/10.4314/ scinat.v6i1.48575
3. Organisation Ouest-Africaine de la Santé (OOAS). Pharmacopée d'Afrique de l'-ouest. Copyright © 2013, p7
4. R. Ismail et al. Etude de l'activité antioxydante des huiles essentielles de plantes aromatiques et médicinales marocaines. Revue Scientifique Européenne, 2017, 13(12), p :323 DOI :10. 19044
5. H. Puig et al. Clé d'identification des principales familles et des principaux genres à espèces arborées de Guyane. Revue forestière française, 2003, V55, pages : 84-100. DOI :10.4267/2042/5788
6. P. Ozonda. Les végétaux : organisation et diversité biologique. Dunod, 2000 ; ISBN : 978-2-10-004684-3
7. E. Brugel et al. Plantes et végétation en Limousin - atlas de la flore vasculaire. Conservatoire régional des espaces naturels du limousin, 2008, V19, pages : 1-20
8. P. Champagnat et al. Une étude sur la composition des huiles essentielles de Vétiver de différentes origines géographiques. Journal de recherche sur les huiles essentielles, 2006, 18(4) pages : 416-422
9. R. Innes. Manual of Ghana grasses. Ministry of overseas development. Land Ressources Division, Surbiton, Surrey, England, 1977, page 265 ISBN : 0902409441
10. B. Lisan. Planter en milieux arides et salins. Amazon éditions, 2016, 2(2), pages : 101-102.
11. I. Senou et al. Phytoextraction of cadmium, copper, lead, and zinc by Vetiveria nigritana in tropical ferruginous soils and vertic soils in Burkina Faso (West Africa). International Journal of Biological and Chemical Sciences, 2012, 6(4), pages 1437-1452
12. J. B. Cyrille et al. Phytoextraction Capacity of *Chrysopogon nigritanus* Grown on Arsenic Contaminated Soil. Open Journal of Applied Sciences, 2021, 11(7), pages : 846-859. DOI : 2021.117062
13. L.T. Danl et al. *Vetiver grass*, *vetiveria zizanioides*: a choice plant for phytoremediation of heavy metals and organic wastes. International Journal of Phytoremediation, 2009, DOI :10.1080/152265109 02787302
14. T. Yangongo et al. Capacity of microphytostation planted with *chrysopogon nigritanus benth*. and *hyparrhenia diplandra* (hack.) stapf in the elimination of trace metals from domestic wastewater in the municipality of N'sele in Kinshasa/RD Congo. International Journal of Progressive Sciences and Technologies (IJPSAT), 2022, 32(1), pages 433-439
15. I. Senou et al. Effects of three Pesticides (*Atrazine, Deltamethrin and Acetamiprid + Cypermethrin*), two Plant Species (*Vetiveria nigritana Benth. and Oxythenantera abyssinica Linn.*) and Their Interactions on the Biological Activity of Lixisols and Vertisols of Cotton Agrosystems of Burkina Faso (West Africa). International Journal of Plant & Soil Science, 2018, 22(6), pages 1-11
16. B. Romdhane *et al.* Le rendement fourrager et la valeur nutritive du vétiver sont affectés par les régimes d'irrigation de l'eau et la densité végétale dans des conditions climatiques méditerranéennes. Euro-Mediterr J Environ Integr, 2025, 10, 1639–1655 https://doi.org/10.1007/s41207-024-00530-2
17. _F. K. Owofadeju and A. O. Alawode. Evaluation of vetiver (*vetiveria nigritana*) plant extract as eco-friendly wood preservative. Arid Zone Journal of Engineering, Technology and Environment, 2016, Vol. 12, page 49-57

18. P. Iserin et al. Encyclopédie des plantes médicinales (2nd Edition). Larousse-Bordas. Copyright © 1996. ISBN: 2-03-560252-1
19. Y. S. A. Aziz et al. Current state of knowledge on the virtues and uses of some medicinal plants in Niger: Bibliographical summary. International Journal of Innovation and Applied Studies, 2025, Vol. 44 No. 4 Feb. 2025, pp. 847-860
20. S. K. Jain. Dictionnaire de la médecine populaire indienne et de l'ethnobotanique : un manuel de référence sur les relations homme-plante, les groupes ethniques et les ethnobotanistes en Inde. Deep Publications, 1991. ISBN : 8185622000, 9788185622002
21. Singh et Maheshwari. Phytothérapie traditionnelle chez les tribaux du district de Varanasi, Uttar Pradesh, Inde ; Journal de botanique économique et taxonomique,1983, 4(3). DOI : 829-8381983. ISBN : 0250-9768.
22. R.R. Rao et M.R. Suseela. *Vetiveria zizanioides* (Linn.) Nash - une herbe écologique polyvalente de l'Inde. Institut national de recherche botanique Lucknow, Inde, 2000, pages :439-442
23. N. Chomchalow. L'utilisation du vétiver comme plante médicinale et aromatique plantes avec une référence particulière à la Thaïlande ; Réseau Vétiver du Pacifique. Bulletin technique No. 2001/1, 2001. ISBN: 974-7774-75-5
24. Usmanghani et al. Indusyunic medicine: traditional medicine of herbal animal and mineral origin in Pakistan. Dept of Pharmacognosy, Faculty of Pharmacy, University of Karachi, 1997
25. C. N. Shelly. Encyclopédie des Remèdes Naturels Könemann, Édition 1998, ISBN : 9783829017121
26. Dénou et al. Mise au point d'une technique d'amélioration de la conservation des sirops d'extraits de Guiera senegalensis J.F. Gmel (Combretaceae). Journal of Applied Biosciences, 2021, vol 165, pages 17110 – 17119
27. S. Curtis. Huile essentielle : remèdes de Neal's Yard. Aurum press. 1996. ISBN : 978154104137
28. D. Balasankar et al. Utilisations traditionnelles et médicinales du vétiver. Revue des études sur les plantes médicinales, 2013, 1(3), pages : 191-200, ISSN : 2320-3862
29. M. Mbodj et al. Phytochemical study and evaluation of the antioxidant activity of *Chrysopogon nigritanus* root extracts. European Journal of Medicinal Plants, 2023, 34 (3), pp: 12-21. DOI: 10.9734/ejmp/2023/v34i3 1126
30. S. D. Karou et al. Dépistage des plantes médicinales togolaises pour quelques propriétés pharmacologiques. Résolution de Pharmacognosie, 2012, 4(2), pages 116-122, DOI : 10.4103/0974-8490.94737, PMID : 22518084
31. P. Champagnat et al. Acides gras et insaponifiables d'extraits obtenus à partir des sommités fleuries et des rhizomes de *Vétiveria nigritana* (Benth.) Stapf, Poaceae. Oléagineux Corps gras Lipides, 2006, 13(2-3), pges 190-194, DOI:10.1051/ocl.2006.0022
32. Khalil et Ayoub. Analysis of the essential oil of Vetiveria nigritana (Benth.) Stapf root growing in Sudan, Journal of Medicinal Plants Research, 2011, 5(32), pges : 7006-7010. ISSN 1996-0875, DOI :10.5897/JMPR11.1079
33. L. M. H. Eltayeb. Essential oil composition and biological activity of Chamaecyparis obtusa, Chrysopogon nigritanus, and Lavandula coronopifolia grown wild in Sudan. Molecules, 2023, 28(3), page 1005, DOI: 10.3390/molecules28031005. PMID: 36770673; PMCID: PMC9921792
34. Z. Semde. Chemical composition, antioxidant and antimicrobial activities of essential oil from Vetiveria nigritana (Benth.) Stapf roots originating from Burkina Faso. Journal of Applied Biology & Biotechnology, 2017, 5(04), pp. 029-036, DOI: 10.7324/JABB.2017.50405
35. P. Champagnat et al. News compounds from the essential oil of *Vetiveria nigritana* roots from Mali. Flavour and Fragrance Journal., 2007, 22(6). Pages : 488-493. DOI :10.1002/ffj.1828. ISSN: 1099-1026
36. A. Diop et al. Extraction, caractérisation et évaluation de l'activité antioxydante de l'huile de *Chrysopogon Nigritanus.* Afrique Science, 2023, 22(3), 23-33
37. C. Kossouoh et al. Composition chimique des huiles essentielles de racines de Vetiveria nigritana (Benth.) Stapf du Bénin. Journal des plantes à huiles essentielles,2008, 11(5), 468-475, DOI :10.1080/0972060X.2008.10643655
38. M. Hane. Etude de la qualité des eaux de puits et de forages de la commune de Sinthiou Malème et environs : dosage des parametres physico-chimiques et phytoremediation des ions chrome 6. Thèse de doctorat unique, 2022, université Cheikh Anta Diop de Dakar
39. P. Champagnat et al. Flavonoïdes de Vétiveria zizanoïde et Vétiver nigritana (Poacées). Systématique biochimique et écologie Biochimique, 2008, 36(1), pages 68-70, DOI : 10.1016/j.bse.2007.05.015
40. D. H. Haiyambo et al. Isolation and Screening of Rhizosphere Bacteria from Grasses in East Kavango Region of Namibia for Plant Growth Promoting Characteristics. Current Microbiology Journal, 2015, DOI: 10.1007/s00284-015-0886-7
41. E. A. Ewetola et al. Farmr's perception of the usefulness of vetiver grass for termite control on Ogbomoso Agricultural Zone famlands, south-westem Nigeria. Journal of King Saud University, 2018, 30(2), Pages 214-222, DOI : 10.1016/j.jksus.2017.01.002