

**REVIEW ARTICLE****Medicinal plants in JKUAT, their phytochemistry & pharmacological activity****Ezbon Kiprotich Male¹** ¹*Department of Biochemistry, School of Biomedical Sciences, Jomo Kenyatta University of Agriculture and Technology, Nairobi, Kenya*Corresponding author email: ezbonkm@gmail.com**Abstract**

Medicinal plants in Kenya and Africa have withstood the test of time and the rapid advancements brought about by western medicine. Traditional medicine practices are based mostly on herbal plants used for centuries and passed on to the successive generations. The knowledge of their active compounds is vital for the scientific community in the optimization of the herbal medicine. The study aims to perform a literature review on some of the common medicinal plants, which have been used to treat a variety of diseases and their phytochemical compositions. The study was done at Jomo Kenyatta University of Agriculture and Technology (JKUAT), Main Campus, Juja from 2023 to 2024. Relevant data used was collected from publications, books, newsletters and research journals. The literature review comprised of data for 11 medicinal plants, including their physical characteristics and appearances, habitats, geographical distributions, methods of preparation, pharmacological actions and the phytochemical properties. Images of the respective plants were taken on site, the species determined using google images webpage and the classification verified with 'Plant of the World Online' and 'The Plant List' websites. From the study, 11 plants were identified and their phytochemical properties determined. Most of the plant species were found to contain alkaloids, flavonoids, Tannins, saponins and glycosides. Most species were documented to have antimicrobial, antioxidant, anti-inflammatory, antiseptic, and anti-rheumatic actions. Their preferred mode of administration was orally, using prepared decoctions of the leaves, roots or barks. The literature review outlines the documented knowledge of medicinal plants used for the treatment of various diseases and complications. Analysis of the data reveals the need to preserve medicinal plants for their use in traditional medicine and current advancements in medicine. However, there is need to perform further experimental studies on individual species to ascertain their value and potential for drug developments.

Keywords: Traditional medicine, medicinal plant, flavonoids, alkaloids, antioxidant, malaria**1.0 Introduction**

Traditional medicine has been based on herbal plants and has existed since the advent of humanity with the need to cure diseases. Up to 80% of the world's population is estimated to use traditional medicine. The world health organization reports that 170 out of the 194 WHO

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Member States use traditional medicine ([World Health Organization, 2020](#)). A medicinal plant is any plant whose plant parts can be used for therapeutic purposes and maybe used for the synthesis of useful drugs and treatments.

Medicinal plants have been the principle components of the indigenous systems such as the Indian Ayurveda, Moslem Unani, traditional Chinese, and Siddha medicine. These systems have evolved throughout time and have come to be accepted and appreciated in their various countries as important sources of medicine. On the other hand, African Traditional medicine faces numerous challenges of environmental and habitat loss, stigmatization and neglect by the government, safety and efficacy concerns and adulterations. Nonetheless, traditional knowledge on medicinal plants has provided a key foundation for the drug research and development by enabling the identification of plant species with therapeutic properties.

Different cultures in Kenya have varying plant species that have been used as herbal medicine. Plant parts and methods of preparations have been based on their efficacy based on knowledge acquired throughout time, their availability and ease of reach.

Kenya has experienced great developments in medicine since the pre-colonial ages and with the emergence of modern hospitals and other health facilities western medicine has been greatly welcomed. This has also been attributed to change in lifestyles among communities and the rural-urban migration. This also leads to the loss of knowledge about traditional medicine amongst the younger generations leading to disregard by the younger population. Nevertheless, traditional medicine has in itself continue to enjoy significant use in the rural settings due to their ease of access and relatively cheaper prices.

The study analyses some of the common medicinal plants that have been used with the aim of identifying their pharmacological activities and phytochemical constituents. This is hoped to add on the need for preservation of medicinal plants and to highlight the need for further research on the plant species.

2.0 Methodology

2.1 Study design

A literature review of documented data on some of the common medicinal plants found in JKUAT, with focus on their phytochemical properties and pharmacological activities.

2.2 Location and duration of study

The study was done at the Jomo Kenyatta University of Agriculture and Technology, Main campus in Juja from 2023 to 2024.

2.3 Data collection

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Data on medicinal plants was collected from different journals, books, publications, articles and webpages. This information was found on databases such as the science direct, springer nature, cell press and NCBI. The journals included; Journal of Advanced Pharmaceutical Technology & Research, Pharmacognosy Reviews and Chemistry Central Journal.

Photographic images of the plants were captured on site using a smart phone camera (Huawei Y6-Prime 2019 model) and their species determine online using the google images webpage, <https://images.google.com/>, and the species name confirmed using <https://powo.science.kew.org/> and the <http://www.theplantlist.org/> webpages with reference to their databases to determine the plant's habitats and distribution. The following images were the results of the data collection;

i) *Vachellia xanthophloea* / fever tree



ii) *Nymphaea stellate* / waterlilyiii) *Acacia sieberiana* / Paperbark thorn/ Paperbark acacia

iv) *Mangifera indica* / Mangov) *Vepris nobilis* / Delilevi) *Helianthus annuus* L. / Common sunflower/ Cultivated sunflower

vii) *Fargesia rufa* / Fountain bamboo/ Dragonhead Bamboo



viii) *Washingtonia robusta* H. Wendl / Mexican fan palm



- ix) *Callistemon viminalis* / Weeping bottlebrush



- x) *Casuarina equisetifolia* / Australian pine



xi) *Dalbergia melanoxylon* / African Blackwood


Table 1: A summary of the results indicating the plant species, native region, ethno-pharmacological use, plant part used, the pharmacological activity and the phytochemistry.

PLANT SPECIES	NATIVE REGION	ETHNOPHARMACOLOGICAL USE	PART USED	PHARMAC- OLOGY	PHYTOCHEMISTRY
<i>V. xanthophloea</i> (<i>Acacia xanthophloea</i>)	East and Southern Africa	Malaria, abdominal pains, tuberculosis, fever	Bark, roots	Antiplasmodial, antimalarial	Methyl-gallate, catechin, lupeol, quercetine
<i>Nymphaea nouchali/stellata</i>	Southern and N. Eastern Asia	Diabetes, inflammation, liver disorders, urinary disorders, menorrhagia	Flowers	Hepatoprotective, anti-inflammatory, antidiabetic	Nymphayol, Gallic acid, caffeic acid, kaempferol, catechin, luteolin
<i>Acacia sieberiana</i>	Sahel and Sub-saharan Africa	Tapeworms infection, oedema, gout, and diarrhoea	Leaves, stem bark, barkresin	Antitumor, antihelminthic	Chrysoeriol-7-O-rutinoside, luteolin-7-O-rutinoside, apigenin, luteolin
<i>Mangifera indica</i>	Bangladesh, India, Malaysia, Myanmar	Respiratory problems, Diarrhoea, Kidney, Scabies	Fruit, Leaves, Bark, Gum	Antioxidant, immunomodulatory, anti-inflammatory, anti-bone resorption	Mangiferin, Mangiferonic acid, quercetine, monoterpenes

*Pharmacological activity of medicinal plants*

<i>Vepris nobilis</i>	East tropical Africa	Malaria, pneumonia, asthma, common cold	Bark decoction, roots, leaves	Anti-inflammatory, analgesic, pyretic, malarial	Triterpenoids, flavonoids, Taninns, steroid glycosides, polyuronides, glucides, coumarin
<i>Helianthus annuus L.</i>	USA, Mexico, Southern Canada	Colds, Malaria, ailments	coughs, Lung seeds, leaves	Anti-inflammatory, analgesic,	Quercetine, kaempferol, luteolin, apigenin, caffeic acid, chlorogenic acid, Phytosterol
<i>Fargesia rufa</i>	China	Haemorrhage, dysentery	Leaves, shoots, Joints	Anti-oxidant, anti-inflammation, anti-diabetic	Flavonoid glycosides, phenylpropanoids
<i>Washingtonia robusta</i>	Mexico, Baja Carlifornia peninsula	Sore throat, toothache, urinary disorders	scabies, asthma, seeds, palm oil	Anti-oxidant, anti-septic	Phenolic acids, Tocols, Carotenoids, flavonoids, Phytosterols
<i>Callistemon viminalis</i>	South Wales, Australia	Hemorrhoids, diarrhoea, infections	Leaves, skin flowers	Antibacterial, antifungal, antiviral, hemolytic	Essential oils;1,8-cineole, terpinen-4-ol, triteroenoids
<i>Casuarina equisetifolia</i>	Australia	Kidney problems, rheumatic infections, respiratory problems; cold, flu,cough	Turpentine, bark, leaves	Anti-septic, diuretic, antibacterial, antitumor	Kaempferol, lupeol, gallic acid, sitosterol, catechin, gallo catechol
<i>Dalbergia melanoxylon</i>	Eastern and Southern Africa	Abdominal pain, gonorrhoea, Gonorrhoea, Headache, cleaning	Root decoction, smoke from roots, bark powder	Antimicrobial, anti-oxidant, cytotoxic	Tannins, flavonoids, sterols, flavones , anthraquinones, alkaloids

3.0 Discussion

3.1 Vachellia xanthophloea / fever tree

3.1.1 Background

The *V. xanthophloea* (*Acacia xanthophloea*) / fever tree usually known as the acacia tree is an attractive, semi-deciduous to deciduous tree approximately 10- 20 meters tall and has an open, rounded to spreading or flattish crown which is sparsely foliated. It belongs to the Fabaceae family. The characteristic, almost luminous, lime green to greenish-yellow bark is smooth, slightly

flaking, and coated in a yellow powdery substance. It is native to East and Southern Africa; Somalia, Kenya, Tanzania, Malawi, Mozambique, Zimbabwe and South Africa. (PLANTBOOK, 2024)

3.1.2 Traditional uses

V. xanthophloea has long been associated with malaria and was earlier on thought to cause malarial by the discoverers thus the name fever tree. However, this was only a coincidence as the tree grows in ideal breeding ground for mosquitoes. In Zulu and Tanzanian traditional medicine, the powdered stem bark and roots is used for malaria treatment and prevention and stem bark decoctions are used against abdominal pains and anemia. Interviews conducted with traditional health practitioners in Meru County, Kenya indicated that *V. xanthophloea* is used to treat malaria. In South Africa, it is used to treat the symptoms of tuberculosis, such as a fever, a cough, and blood in the sputum. (Tajuddeen et al., 2022)

3.1.3 Phytochemical composition

Compounds isolated from the leaves of *V. xanthophloea* in this study were flavonoids, phenolics, glycosides. Other derivatives identified include: 3-O-methylquercetin, dihydroquercetin, catechin gallic acid, methyl gallate, apigenin, phytol and lupeol (Tajuddeen et al., 2022).

3.1.4 Bioactive compound and pharmacological activity

Methyl gallate is responsible for the anti-plasmodial activity observed for the *V. xanthophloea* leaf extract (Tajuddeen et al., 2022) and its presence in the leaf extract might account for the traditional use of the plant as an antimalarial agent. However, there has not been any final product that has undergone clinical trials.

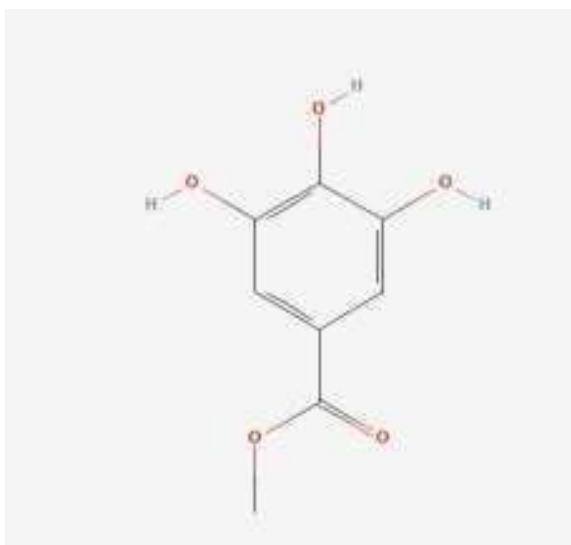


Fig 1. Chemical structure of Methyl gallate © PubChem

3.2 *Nymphaea nouchali* (*Nymphaea stellata*) / water lily

3.2.1 Background

Nymphaea nouchali/ *N. stellata* is a perennial aquatic rooting herb, wild / cultivated, generally found in tanks and ponds. It belongs to the family *Nymphaeaceae* and genus *Nymphaea*. In Greek *nymphala* refers to water nymph and *stellata* in Latin means star-shaped. *N. nouchali* is also referred to as *N. stellata* or known by common names star lotus, red water lily, dwarf aquarium lily, blue water lily of genus *Nymphaea*. Part of the leaves are submerged, while others rise slightly above the surface. The leaves are round and green on top and they usually have a darker underside. This water lily has a beautiful flower, which is usually white, blue, violet, purple, pink & cream/yellowish white colours. It is native to southern and eastern parts of Asia, and is the national flower of Bangladesh and Sri Lanka. In its natural state, *N. nouchali* is found in static or slow-flowing aquatic habitats such as ponds of low to moderate depth. (POWO, 2024a)

3.2.2 Traditional uses

Nymphaea stellata is an important medicinal plant, widely used in the Indian (Ayurveda and Siddha) systems of medicines for the treatment of diabetes, inflammation, liver disorders, urinary disorders, menorrhagia, leucorrhagia, menstruation problem, and as a bitter tonic. There seems to be an agreement between the traditional use and experimental observations, such as, hepatoprotective, anti-inflammatory, antidiabetic, antihelminthic, antipyretic, and antitumor. During pregnancy, petiole stripes with *Pinus longifolia* roots are used to cure fever, diarrhea, sickness, cough, dizziness, discomfort, and bleeding. (Tiwari et al, 2023a)

3.2.3 Phytochemical composition

Different solvent extracts of the entire plant have shown the presence of sterols, alkaloids, saponins, tannins, and flavonoids. Nymphyol, a new sterol has been isolated from the successive chloroform extract of the flower. Protein, pentosan, mucilage, and tannins are reported in the seeds. Gallic acid, caffeic acid, kaempferol, catechin, luteolin, epigallocatechin, epicatechin gallate were identified as the major polyphenolic compounds by HPLC analysis in *N. nouchali* leaves (Anand et al, 2019).

3.2.4 Bioactive compound and drug use

Seeds extract have been shown to protect against CCl₄-induced hepatic injury in mice. The seeds decreased the lengthening of sleep time and avoided CCl₄ induced increase in liver mass as well as necrosis of the liver.

Nymphyol, a steroid isolated from the flowers has been scientifically proved to be responsible for the traditionally claimed antidiabetic activity; it reverses the damaged endocrine tissue and stimulates secretion of insulin in the B-cells. However, taking into account the magnitude of its traditional uses, the studies conducted are still negligible. Administration of nymphyol was found to lower blood glucose level and increase the levels of insulin content in diabetes-induced rats.

Nymphayol was found to increase the number of B-cells with the observation of Islet-like cell clusters in the islets of Langerhans by histochemical assays. (Tiwari et al, 2023a)

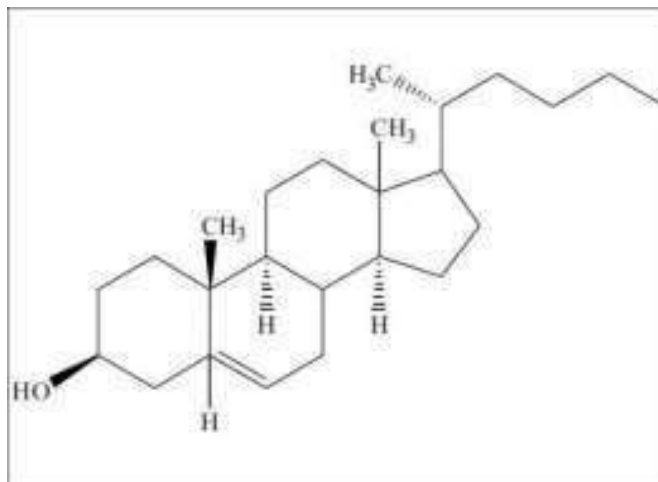


Fig. 2 Chemical structure of Nymphayol, (ResearchGate)

3.3 *Acacia sieberiana* / paperbark thorn/ paperbark acacia

3.3.1 Background

Acacia sieberiana is also known as *Vachelia sieberiana*. It is a small to medium-sized tree native to tropical Africa, 3-25 m. *A. sieberiana* grows in the savannah and woodland. It occurs with various botanical characteristics in the entire Sahel and other semi-arid regions in Africa. The species is mainly suited for riverbanks and is fast growing. This impressive tree develops its wide spreading flat-topped shape while still young. It has abundant, fragrant, creamy, puffball flowers from that attract insects and birds. These are followed by hard woody pods that are nutritious and eaten by cattle and game (SouthWorld, 2019).

3.3.2 Traditional uses

The leaves, stem bark and resin derived from the bark are used for treatment of a variety of diseases and disorders in traditional medicine. The stem bark decoction/infusion is used to treat tapeworms, oedema, gout, and diarrhoea. The decoction is also administered for the treatment of inflammation of the urinary tract and as a pain reliever. (SouthWorld, 2019) In addition, the bark decoction is also used as an astringent for cold, chest problems, cough, haemorrhage, eye inflammation, and for the treatment of gonorrhoea in some parts of Africa. The stem bark infusions of *A. sieberiana* are used to relieve back pain and pounded bark is used to relieve fever in children. The root decoction of *Acacia sieberiana* is utilized in Nigeria to treat hepatic diseases. The bark and stem decoction of the *A. sieberiana* are also used to manage jaundice (Watafua et al, 2022).

3.3.3 Phytochemical composition

The phytochemicals found are mainly flavonoids and their glycoside such as chrysoeriol-7-*O*-rutinoside, luteolin-7-*O*-rutinoside, chrysoeriol-7-*O*- β -D-glucopyranoside, apigenin-7-*O*- β -D-glucopyranoside, luteolin-3',4'-dimethoxyether-7-*O*- β -D-glucoside, luteolin and sitosterol-3-*O*- β -D-glucoside (Ngaffo et al,2020).

3.3.4 Bioactive compound and Pharmacological activity

Acacia sieberiana extract has been shown to have hepatoprotective activity against liver damage possibly by modulation of biochemical and oxidative stress markers. (Watafua et al, 2022). The results of the investigation demonstrated that *Acacia sieberiana* is a good cytotoxic plant that can help to fight cancers, including Multi Drug Resistance phenotypes. Treatment of CCRF-CEM leukemia celllines with the crude extract, led to important increased in ROS level. This suggests that ROS production contributes to crude extract-induced cell death. Its active constituents such as chrysoeriol-7-*O*-rutinoside and luteolin-7-*O*-rutinoside is thought to act synergically to contribute to the cytotoxicity of the plant. This extract should be further explored to develop a new drug to fight cancers (Ngaffo et al, 2020).

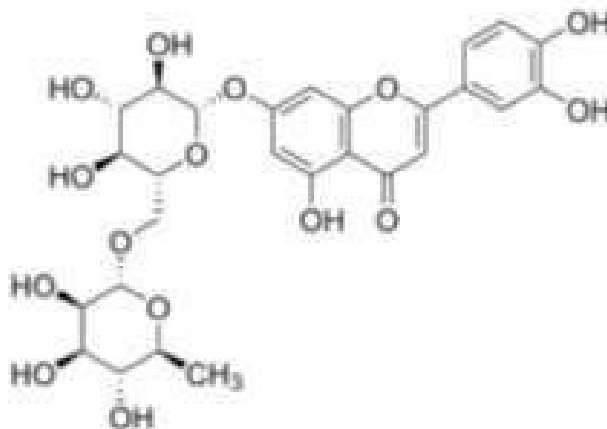


Fig. 3 Chemical Structure of Luteoline-7-*O*-rutinoside ©Merck-SigmaAldrich

3.4 *Mangifera indica* (Mango)

3.4.1 Background

Mangifera indica (MI), has been an important herb in the Ayurvedic and indigenous medical systems for over 4000 years. Mangoes belong to genus *Mangifera* that consists of about 30 species of tropical fruiting trees in the flowering plant family Anacardiaceae. *Mangifera indica* is a large evergreen tree that grows 30-40 m tall with a dark green, umbrella-shaped crown. Trunk stout, 90 cm in diameter; bark brown, smoothish. Leaves are alternate, simple, leathery, oblong-lanceolate. The fruit is an irregularly egg-shaped and slightly compressed fleshy fruit. Usually yellow when ripe. The mango thrives in both the subtropics and the tropics. It is native to

Bangladesh, India, Malaysia, Myanmar and exotic in countries such as Kenya, Uganda, Tanzania, Mali, Nigeria, Eritrea, Ethiopia, Ghana, Chad and Togo in Africa ([Kumar et al, 2021](#)).

3.4.2 Traditional uses

Extracts have been utilized for traditional medicines to cure diabetes, bronchitis, diarrhea, asthma, kidney, scabies, respiratory problems, syphilis, and urinary disorders. According to ayurveda, varied medicinal properties are attributed to different parts of mango tree. Various parts of plant are used as a dentrifice, antiseptic, astringent, diaphoretic, stomachic, vermifuge, tonic, laxative and diuretic and to treat diarrhea, dysentery, anaemia, asthma, bronchitis, cough, hypertension, insomnia, rheumatism, toothache, leucorrhoea, haemorrhage and piles. The bark is known for its astringent properties, beneficial in treating diarrhea and diabetes. Mango leaves, rich in vitamins C, B, and A, are used to manage diabetes and hypertension, while the seeds aid in treating diarrhea, diabetes, and obesity ([Ayutherapy, 2024](#)).

Sweet mango improves immunity and strength; it has a very nourishing and calming effect on the body. Mango tree bark has astringent properties, which make it useful to pacify kapha, and pitta disorders, including indigestion, acid reflux, ulcers, and skin disorders. Roots of this tree can treat Diarrhea. In the Ayurveda system, mango oil has been used for oral health problems the flowers have also been used to purify blood. Sour mango has been used to relieve anorexia as well as cure throat problems ([Meenakshi, 2019](#)).

3.4.3 Phytochemical composition

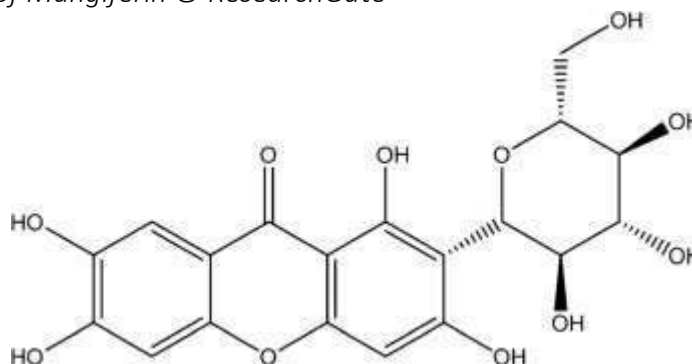
In a study by ([Kumar et al, 2021](#)), they identified phytochemicals such as mangiferin, phenolic acids, benzophenones, and other antioxidants such as flavonoids, carotenoids, quercetin, isoquercetin, ascorbic acid, and tocopherols. Mangiferin is the main contributor of most of the biological activities of Mango leaves extract. Mango leaf oil (MLO) contains monoterpenes, sesquiterpenes, minor quantities of other analogues, and trace amounts of non-terpenoid hydrocarbons and oxygenated hydrocarbons. The essential oil from leaf extracts also possesses bacteriostatic properties and contains several antimicrobial constituents.

3.4.4 Bioactive compound and Pharmacological activity

Mangiferin is the most predominant compound ([Yap et al, 2021](#)). The extensive survey of literature revealed that MI is an important source of many pharmacologically and medicinally important chemicals such as mangiferin and its derivatives such as mangiferonic acid, hydroxymangiferin, polyphenols and carotenes. Many different pharmacological activities, antioxidant, radioprotective, immunomodulatory, anti-allergic, anti-inflammatory, antitumor, antidiabetic, lipolytic, antitumor resorption, monoamine oxidase-inhibiting, antimicrobial and

antiparasitic, have been reported for mangiferin. Anti-plasmodial activity has been reported for the leaf extracts (Adeleke et al, 2014)

Fig 4. Chemical structure of Mangiferin © ResearchGate



3.5 *Vepris nobilis* (delile)

3.5.1 Background

Vepris nobilis is an evergreen shrub or, more commonly, a tree usually growing from 3 - 12 metres tall, occasionally even taller when growing in the rain forest. It is native to east tropical Africa and belongs to the Rutaceae family. Its habitat is in evergreen and dry forest, thickets on rocky hills, wooded grassland, riverine formations, rain forest, and lakeshores at elevations from 900 - 2,600 meters. It is mainly found in Eastern Africa; Kenya, Djibouti, Eritrea, Ethiopia, Sudan, Uganda and southwards to Zimbabwe (POWO, 2024b).

3.5.2 Traditional uses

Vepris nobilis is used in folk or traditional medicine to treat several diseases or illnesses. A decoction of the aerial parts of the plant has been reported to treat malaria; stem bark as a remedy for gonorrhea and pain; a mixture of the bark and leaves as analgesics and antipyretic; leaves as a cure for fever, pneumonia and malaria; roots for treating rheumatism, arthritis, pneumonia, as an anthelmintic, weight loss and chronic cough. A decoction of stem bark and root in treating asthma, common cold, headache, joint and chest pains. Steam inhalation of the leaves was reported to cure fever and stem bark as a chewing stick for brushing teeth. A concoction made from the boiled bark and roots of *Vepris nobilis* has been used by traditional healers in Elgeyo Marakwet, Kenya to treat back pains. The decoction is also used in arthritis, as a blood cleanser, invigorant and immunostimulant (Kigen et al, 2017).

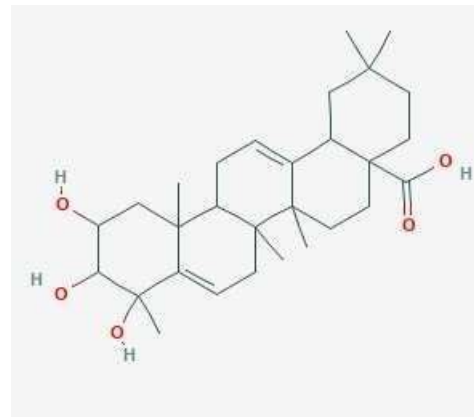
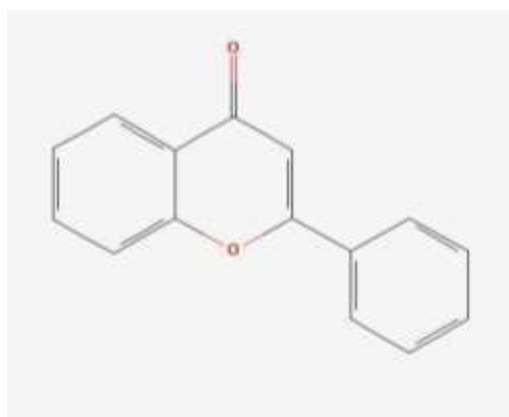
3.5.3 Phytochemical composition

Phytochemical analyses of the leaves, fruits, roots and stem bark have indicated presence of several phytochemicals. For instance, ethanol extract *Vepris nobilis* root, bark and the leaves were found to contain tannins, reducing compounds, alkaloids, steroid glycosides, polyuronides,

glucides, starch, coumarin derivatives and flavonoids. The fractionation of the different plant part extract has resulted in the identification of several quinoline and furoquinoline alkaloids, terpenoids and flavonoids (Omuja *et al.*, 2020).

3.5.4 Bioactive compound and Pharmacological activity

The extracts and phytochemical compounds extracted from the different parts have shown promising pharmacological antimalarial, analgesic, anti-inflammatory and antipyretic activities. Toxicity studies also indicate that *V. nobilis* is generally safe. In the study by (Omuja *et al.*, 2020), the root bark extract of *V. nobilis* exhibited in this study a strong anti-inflammatory activity at dose levels of at least 400 mg/kg bodyweight within 2hrs and is thought to inhibit release of histamine and serotonin in the second hour before inhibiting the activity of membrane-associated cyclo-oxygenase enzyme (COX1). From the phytochemical analyses, the anti-inflammatory activity of root bark extract is through flavonoids by inhibition of key enzymes responsible for synthesizing prostaglandins, triterpenoids by reductions of the cells expressing inducible nitric acid synthase and alkaloids by inhibition of vascular permeability induced by histamine. However, there is need to study each compound in the extract to evaluate their activity for potential anti-inflammatory drugs. 4,6-dimethoxy-7-((3-methylbuta-1,3-dien-1-yl)oxy) furo [2,3-b] quinolone has been derived from *Vepris nobilis* and found to be a potential drug for cancer management. Its administration can be done orally (Chepkirui *et al.*,



2020).

Fig 5. Chemical structure of flavone
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Fig 6. Chemical structure of Triterpenoid
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3.6 *Helianthus annuus* L. (Common sunflower)

3.6.1 Background

The cultivated sunflower (*Helianthus annuus* L.) is a plant of the family Asteraceae (Compositae). The term *Helianthus* is derived from the Greek *helios*, meaning sun, and *anthos*, meaning flower. It is tall, fast-growing annual with broad, oval to heart-shaped, roughly hairy leaves 10-40cm

long. In summer, it bears huge flowers of 10-50cm diameter with bright yellow petals and dark brown or purple centres. The flowers attract bees and the seeds that follow provide food for birds. It is native to USA, Mexico and southern Canada. Usually cultivated in other regions and prefers full sun, moderately fertile, humus rich, moist, neutral to alkaline, well-drained soils. Grows at altitudes of about 2630m (POWO, 2024c).

3.6.2 Traditional uses

Medicinal uses for the sunflower include use as a remedy for pulmonary affections, a preparation of the seeds has been widely used for cold and coughs, in the Caucasus the seeds have served as a substitute for quinine in the treatment of malaria, and sunflower seeds are used as a diuretic and expectorant. Sunflower pith has been used by the Portuguese in making moxa, which was used in the cauterization of wounds and infections. Traditional uses of *H. annuus* date back 3000 years. It has been used to treat the common cold, heart disease, cough, respiratory infections, whooping cough, and other ailments (Singh et al, 2022).

A tea made from the leaves is astringent, diuretic and expectorant; it is used in the treatment of high fevers. The crushed leaves are used as a poultice on sores, swellings, snakebites and spider bites. The leaves are harvested as the plant comes into flower and are dried for later use. A tea made from the flowers is used in the treatment of malaria and lung ailments. The flowering head and seeds are febrifuge, nutritive and stomachic. The seed is also considered diuretic and expectorant. It has been used with success in the treatment of many pulmonary complaints. A decoction of the roots has been used as a warm wash on rheumatic aches (PFAF, 2024).

3.6.3 Phytochemical composition

A variety of terpenoid compounds have been found in *Helianthus* species, primarily sesquiterpene lactones and diterpenes. Flavonoids such as heliannone, quercetin, kaempferol, luteolin, apigenin and phenolic acids such as caffeic acid, chlorogenic acid (Peter et al, 2025), caffeoylquinic acid, gallic acid, protocatechuic, coumaric, ferulic acid, and sinapic acids have been identified from the sunflower seed and sprout and have been shown to contribute to its pharmaceutical activities (Singh et al, 2022).

3.6.4 Bioactive compound and Pharmacological activity

The anti-inflammatory and analgesic properties are due to its high concentration of vitamin E and other microelements such as magnesium, which serves as an excellent source of fat-soluble antioxidants to the body. Triterpene glycosides derived from the methanol extract of sunflower petals were found to have anti-inflammatory and inhibitory effects in mice with ear oedema.

Clinical trials have been conducted to test the clinical efficacy and allergy potential of *Helianthus annuus* seed oil. Application of sunflower seed improved skin condition in preterm infants and is effective for improving neonatal outcomes, particularly in low birth-weight infants whose skin

barrier is temporarily but critically compromised due to immaturity and who are frequently susceptible to infection due to their underdeveloped skin. According to the study, infants who received a daily skin treatment with sunflower oil were 41 percent less likely to develop infections in the hospital (Singh et al, 2022). Ozonized sunflower oil (OSO) has been shown to reduce mite counts, clinical signs, and pruritus in dogs with demodectic mange (Zamora et al, 2021).

Certain chemical structure such as phytosterols similar to cholesterol is found in sunflower seeds and the presence of phytosterols in large amount in the human diet tends to reduce blood levels of cholesterol, improve immune response and risk factors to certain disease such as cancers (Farahmandfar et al, 2018).

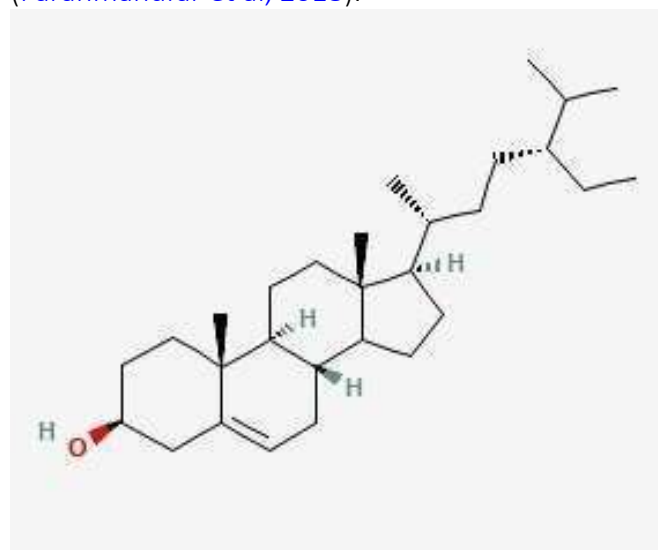


Fig 7. Phytosterol structure © PubChem

3.7 *Fargesia rufa* (fountain bamboo/ dragonhead bamboo)

3.7.1 Background

Fargesia rufa also known as *Fargesia dracocephala*, commonly known as dragonhead bamboo, is a fast-growing, shade-tolerant, evergreen, cold-hardy bamboo that typically grows in a clump up to 2.5 to 3.5 m tall and to 1.5 to 2 m wide. It is used as an ornamental plant since it has lush green foliage and yellow canes. It is native to China but has also been used as an ornamental worldwide as it is very adaptable, good for pots and attractive low edge (POWO, 2024d).

3.7.2 Traditional uses

A juice made from the leaves has been made into a bamboo-flavored beer. The increasing utilization of bamboo shoots provides healthy food due to their richness with essential amino acids besides their delicacy. A decoction of bamboo joints is said to increase the flow of lochia after delivery. The juice of leaves with aromatics is given in haematemesis. In combination with other astringent medicines, it is also given in chronic dysentery and internal haemorrhage.

(Srivasta et al., 2011).

3.7.3 Phytochemical Composition

Chemical compounds, including flavonoids and flavonoid glycosides, volatile components, phenolic acids, polysaccharide, coenzyme Q10, phenylpropanoid and amino acids have been reported to be present (Cheng et al, 2023).

It has been noted that the bamboo plant has unusually high levels of acetylcholine (which acts as a neurotransmitter in animals and humans). The bamboo leaves contain flavonoids vitexin and orientin. The young shoots contain 0.3 per cent hydrocyanic acid and are lethal to mosquito larvae.

3.7.4 Bioactive compounds and their pharmacological activity

The bamboo leaf extracts have recently been utilized as a source of flavonoid-C-glycosides such as vitexin and orientin, used as antioxidants. The flavonoids may reduce inflammation, promote circulation, and inhibit allergy reactions. C-glycosides from bamboo leaf flavonoid have been isolated, the main bioactive ingredient of bamboo leaf. Currently, bamboo leaf is mainly used for the treatment of atherosclerotic, diabetic, hepatic diseases and nervous system related symptoms, which are attributed to the presence of bioactive components of bamboo leaf (Cheng et al, 2023).

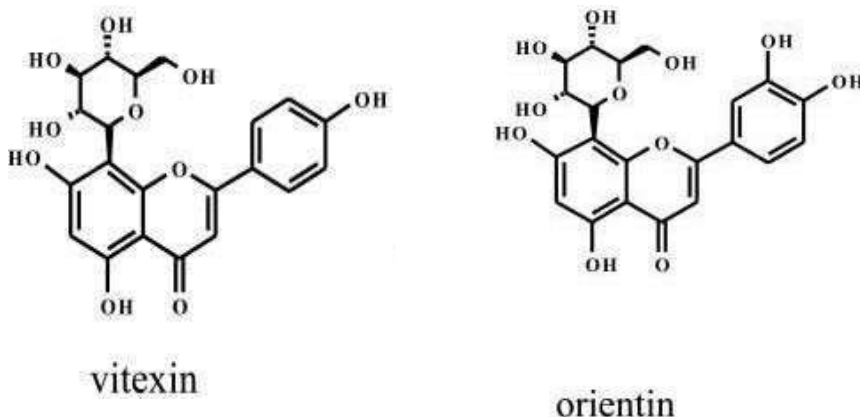


Fig 8. Chemical structures of flavonoid-C-Glycosides © ResearchGate

3.8 *Washingtonia robusta* H. Wendl. (Mexican fan palm)

3.8.1 Background

Washingtonia robusta is a tall, fast-growing, evergreen palm with a slender trunk that swells considerably at the base on mature specimens. Large fan-shaped leaves with leaflets up to 1.5m long are borne on spine-edged petioles to 1m long. It is native to Mexico and the Baja California peninsula. (CAL-IPC, 2024)

3.8.2 Phytochemical composition

The Mexican fan palm provides many useful products; they are rich in oils, terpenoids and phenolic compounds. Meso-carp and endocarp oils include a range of volatile compounds and other terpenoids that are reported beneficial for health, such as phytosterols, carotenoids and pro-vitamin A, tocopherols and vitamin E and triterpene penta-cyclics. Among the phenolic compounds, phenolic acids, caffeic acid, p-coumaric acid, gallic, anthocyanins, flavones, flavonols, dihydroflavonoids, flavan-3-ol, procyanidins and lignans have been described in different tissues of this palm, especially in fruit pulp, seeds and leaves (Armenta et al, 2019).

Flavonoid content was different between pulp and seeds. While rutin and quercetin were found in pulp, the flavonoids; epigallocatechin, mangiferin, gallic, gallic acid, and kaempferol were identified and quantified in seeds (Armenta et al, 2019).

3.8.3 Bioactive compound and pharmacological activity

Palm oil is used as antiseptic and regulates urinary disorders. It is beneficial for sore throat. Its oil is beneficial for scabies & toothache. It is used for malnutrition and weakness. It purifies blood and used in asthma. High antioxidant activities were found in the pulp than the leaves and is due to the high content of phenols in the leaves. Phenolic compounds were shown to provide health benefits including the provision of natural antioxidants, which is attributed to their ability to chelate metals and scavenge free radicals (Armenta et al, 2019).



Fig 9. Chemical structures of phenolic acids © ScienceDirect

3.9 Callistemon viminalis/ Melaleuca viminalis (Weeping Bottlebrush)

3.9.1 Background

Callistemon viminalis is a large shrub or small tree growing to 10 m tall with hard, fibrous, furrowed bark, a number of trunks and usually pendulous branches. Its leaves are arranged alternately and are 25–138 mm long, 3–27 mm wide, more or less flat, very narrow elliptical to narrow egg-shaped with the narrower end towards the base and the other end tapering to a sharp point. The leaves have a mid-vein, 9-27 lateral veins and large number of conspicuous oil glands. The flowers are bright red and are arranged in spikes on and around the ends of branches, which continue to grow after flowering. *Callistemon* (*Melaleuca viminalis*) has lanceolate leaves and hairy flowers. It has darker and wavy bark, leatherier leaves, and bright red "bottlebrush" inflorescences (Chaudhary et al, 2023). It is Native to South Wales and Australia.

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3.9.2 Traditional uses

In traditional Chinese Medicine pills, *Callistemon viminalis* is used for treating hemorrhoids. Hot drink locally 'tea' in Jamaica from *Callistemon viminalis* has been used for the treatment of gastro-enteritis, diarrhea and skin infections. It is an herb that has been used by natives for a long time to treat gastro- enteritis, diarrhea and skin infection problems. In countries like Australia, Sri Lanka, South America, and India, it is cultivated as an ornamental plant, and used as a source of essential oil (Chaudhary et al, 2023).

3.9.3 Phytochemical composition

Phytochemical analyses have been carried out on *C. viminalis* extracts, and showed that the plant is rich in phenolics, triterpenoids, flavonoids, saponins, steroids, alkaloids, tannin, carbohydrates, amino acids and proteins compounds. The essential oil composition of *C. viminalis* showed the presence of 1,8-cineole (eucalyptol) as the main compound. In addition, linalool, limonene, terpinen-4-ol, α -terpineol, α -pinene, and menthyl acetate were also reported. The flowering tops are rich in alkaloids, phenols, tannins, triterpenoids, saponins, steroids and flavonoids (Shweta et al, 2023).

3.9.4 Pharmacological activity

Their study showed that extracts as well as the isolated compounds have a potent biological activity; antibacterial, antifungal, antiviral, hemolytic, anthelmintic and insecticidal activities and a good media for nanoparticle synthesis. N-hexane of leaf extracts showed potential activity against skin pathogen *S. aureus*, *Streptococcus*. Because extracts of *C. viminalis* are rich in polyphenols and flavonoids content, they have advantages for nanoparticle synthesis. The nanoparticles were successfully synthesized using *C. viminalis* leaf extract or flower as reducing

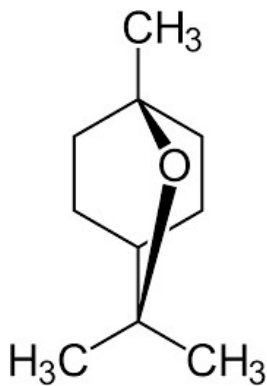


Fig 10. Chemical structure of 1,8-Cineole ©ResearchGate

agent and stabilizer for nanoparticles. Aqueous leaf extract of *C. viminalis* was used to synthesis gold nanoparticles. The isolated phloroglucinols from *C. viminalis*, which have been observed good antibacterial activity against *E. coli* and *B. subtilis* also, have antiviral and antioxidant

activities ([Mohammed et al, 2017](#)).

3.10 Casuarina equisetifolia (Australian pine)

3.10.1 Background

Australian pine has a horsetail-like thin and jointed gray-green branches that resemble pine needles and give it its name *equisetifolia* (like a horsetail). Although not a pine, this tree is called Australian pine because one of its countries of origin is Australia and its tiny leaves tightly pressed to the stem give it the characteristic needle appearance of a pine tree. In addition, this tree produces small, woody, cone-like structures that resemble a pinecone. It belongs to the beefwood family ([CSBE, 2021](#)). The tree is 7–25 m. high, often pyramidal and much branched the trunks have a diameter of about 30 cm ([POWO, 2024e](#)).

3.10.2 Traditional uses

The turpentine obtained from the resin of Australian pine has been used as an antiseptic, diuretic, rubefacient and vermifuge. It is a valuable remedy used internally in the treatment of kidney and bladder complaints and is used both internally and as a rub and steam bath in the treatment of rheumatic affections. It is also very beneficial to the respiratory system and so is useful in treating diseases of the mucous membranes and respiratory complaints such as coughs, colds, influenza and TB. Externally it is a very beneficial treatment for a variety of skin complaints, wounds, sores, burns, boils and is used in the form of liniment plasters, poultices, herbal steam baths and inhalers ([Michael G. et al, 2022](#)).

3.10.3 Phytochemical composition

Research has shown the presence of alkaloids, proteins, glycosides, saponins, phenolics, flavonoids, tannins, steroids, amino acids, gum, reducing sugars, triterpenoids and phyto sterols such as kaempferol, quercetin, alicyclic acids, taraxerol, lupenone, lupeol, gallic acid, sitosterol, catechin, gallo catechol, campesterol, stigmasterol, cholesterol ([Tiwari et al, 2023b](#)).

Flavonoid compounds and phenolics have been identified from ethyl acetate and butanol extracts. The compounds were identified as caffeic acid, ferulic acid, apigenin, quercetin, kaempferol, apigenin-7-O- glucoside, kaempferol-3,7-O-dirhamnoside and luteolin 6,8-di-C-glucoside ([Abdalla et al, 2024](#)).

3.10.4 Bioactive compound and Pharmacological activities

The plant extracts have been screened for their antimicrobial activity against six microorganisms, including two Gram-positive bacteria, two Gram-negative bacteria, and two fungal species. The study measured the total phenolic and flavonoid content and discovered that the extracts had different degrees of antimicrobial activity against all tested isolates. The ethyl acetate extract was found to have a larger inhibition zone, while the methanol extract showed the most cytotoxic activity against cancer cell lines with low IC₅₀ values. The antimicrobial properties of the

methanol extract of *Casuarina equisetifolia* against these microorganisms may be attributed to the presence of phenolic compounds, alkaloids, saponin, and flavonoids in the leaf extract, which interacts with extracellular proteins and the bacterial cell wall (Abdalla et al, 2024).

These findings suggest that the combination of antioxidant, antimicrobial and cytotoxic properties make *C. equisetifolia* extracts useful for treating diseases such as cancer thus further studies should be done on the extracts. *Casuarina equisetifolia* is useful to treat some common disease and disorders includes high blood cholesterol, liver diseases, diabetes, arthritis and various antitumor, antiulcer, hepatoprotective, nephroprotective and anti-inflammatory activities (Tiwari et al, 2023b).

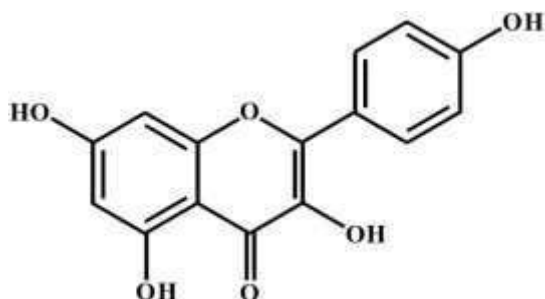


Fig. 11 Chemical structure of Kaempferol ©ResearchGate

3.11 *Dalbergia melanoxylon* (African blackwood)

3.11.1 Background

Dalbergia melanoxylon is a small, spiny, heavily branched deciduous tree, typically 5 - 10 metres tall but occasionally reaching 15 metres. The tree is harvested from the wild as a local source of medicines and materials. The wood is one of the most valuable produced in Africa with a wide range of uses. Grows under a wide range of conditions including semi-arid, subhumid and tropical lowland areas. It is often found on dry, rocky sites but is most frequent in the mixed deciduous forests and savannahs of the coastal region. *Dalbergia melanoxylon* is widely distributed in Africa, from Senegal across to Sudan, Eritrea and northern Ethiopia, Uganda and Kenya. To the south, it ranges from Angola, Namibia, Tanzania, Botswana and South Africa (Iplantz, 2024)

3.11.2 Traditional uses

Root decoction has been used for treatment of abdominal pain and gonorrhea, also used for abortion and as an anthelmintic (for intestinal parasites). Smoke of the burning root is used for headache, rhinitis and bronchitis. The bark is an antidiuretic and the leaves are used for throat inflammations, heat problems, syphilis, gonorrhea and dysentery. A sharp knife is used to scrape the heartwood and mix the shavings with skin lotion or oil to treat skin disease. The wood smoke is inhaled to treat headaches, colds and bronchitis. The stem and root bark is used in traditional medicine to treat diarrhea in combination with baobab or tamarind fruits. A bark decoction or

bark powder is used to clean wounds (Navnath et al, 2023).

3.11.3 Phytochemical composition

Studies have shown the phytochemical properties *Dalbergia melanoxylon* extracts and ash analysis, indicate presence of starch, proteins, tannins, saponins, reducing sugars, anthroquinones, alkaloids and glycosides (Vyas et al, 2019).

Phytochemical studies carried out on extracts of *Dalberegia melanoxylon* leaves of tannins, saponins sterols/triterpene, glycosides were found but alkaloids and flavonoids were absent. In the bark of *Dalberegia melanoxylon*, sterols, flavonoids, alkaloids, glycosides and tannins were identified with saponins absent (Najeeb et al, 2018).

3.11.4 Pharmacological activity

Bark extracts have shown antibacterial and antifungal activities, thus supporting the traditional application for cleansing wounds. The revealed the presence of phytochemical compounds in *D. melanoxylon* indicates that the plant had biologically active compounds as secondary metabolites, which exert antimicrobial activity through different mechanisms. Flavones, sterol, anthraquinones, triterpenes, glycosides and other compounds is responsible for the therapeutic effects of *D. melanoxylon*. The ethanolextract showed activity against *bacteria B. subtili* and *E. coli* and the fungus *C. albicans*. The ethanolic extracts of the leaves also indicated high antioxidant activity. The leaves were found to have moderate antioxidant and cytotoxic activities, which were lowered compared to the bark extracts (Najeeb et al, 2018).

The plant extracts phytochemicals have been associated with anthelmintic and antioxidant activities. Further, the plants extracts have in vitro anthelmintic activities in earthworms at dose level of 50 mg/ml.

The plants extracts studied have no in vivo toxicity in normal mice at dose level of 100 and 300 mg/kgbody weight (Mwangi, 2022).

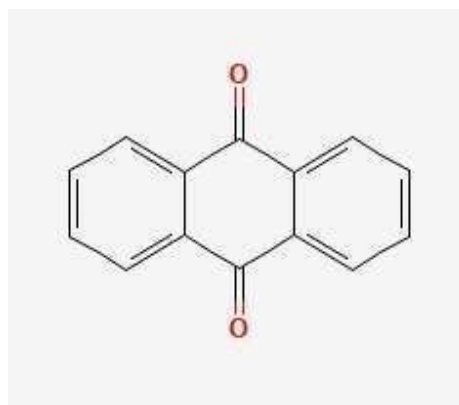


Fig 12. Chemical structure of anthraquinone ©PubChem

4.0 Conclusion

This study gives a broad overview of the medicinal plants and their importance in management of diseases owing to their phytochemical compositions. Traditional medicine faces a lot of challenges thus the need for sensitization and positive campaigns to preserve the natural habitats of the medicinal plants. The literature review also highlights the gaps in the research of herbal plants. Thus the need for further reviews and extensive scientific and experimental studies to ascertain the clinical potential and efficacy of medicinal plants. This will also pave way for identification of potential drug candidates.

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