



Medicinal application, phytochemistry and biological activities of *Combretum padoides* Engl. & Diels

Alfred Maroyi*

Department of Biotechnology and Biological Sciences, University of Fort Hare, Alice 5700, South Africa

*Correspondence: Alfred Maroyi^{*}, amaroyi@ufh.ac.za

Abstract

Combretum padoides Engl. & Diels is a shrub or small tree which is widely used as a source of traditional medicine in tropical Africa. The current study was aimed at documenting the medicinal applications, phytochemistry and biological activities of *C. padoides*. This review is based on literature obtained from scientific databases such as SpringerLink®, PubMed®, Scopus®, Web of Science (WoS), Google Scholar, ScienceDirect® and SciELO, as well as literature obtained from pre-electronic sources such as books, book chapters and other scientific publications obtained from the university library. Results from this research showed that *C. padoides* is used as a source of traditional medicines against conjunctivitis, snakebites, wounds, diarrhoea, hookworms and malaria. Chemical compounds identified from *C. padoides* include flavonoids, steroids, phenolics, cardiac glycosides, tannins, terpenoids and saponins. The crude extracts of *C. padoides* and phytochemical compounds isolated from the species exhibited antibacterial, antimycobacterial, antifungal, anti-inflammatory, antioxidant, antiparasmodial and cytotoxicity activities. Advanced ethnopharmacological research is required to establish the linkage between the varied phytochemical and pharmacological properties of *C. padoides* and its therapeutic applications. Therefore, future studies on *C. padoides* should provide further details on the phytochemical, pharmacological and toxicological evaluations, as well as *in vivo*, pre-clinical and clinical studies.

Keywords: bioactive compounds; Combretaceae; *Combretum padoides*; ethnopharmacology; materia medica; thicket combretum; traditional ecological knowledge

Received: 23 September 2025. **Accepted:** 02 June 2026. **Published:** Version 1.0: 03 October 2026; Version 2.0: 13 October 2026.

Cite this article: Alfred M. Medicinal application, phytochemistry and biological activities of *Combretum padoides* Engl. & Diels. Plant Science Today. 2026; 13(4): 1-13. <https://doi.org/10.14719/pst.11923>

1. Introduction

Combretum padoides Engl. & Diels is a thicket-forming shrub or small tree which is widely used in traditional medicine in tropical Africa (Fig. 1) (1–3). This species is a member of the bush willow, Indian almond, white mangrove or Combretaceae family. The Combretaceae family consists of about 530 species belonging to 10 genera, including *Combretum* Loefl., *Conocarpus* L., *Dansiea* Bymes, *Getonia* Roxb., *Guiera* Adans. ex Juss., *Laguncularia* C.F.Gaertn., *Lumnitzera* Willd., *Macropteranthes* F.Muell., *Strephonema* Hook.f. and *Terminalia* L. (4–6). Majority of the plants belonging to the Combretaceae family are woody, mostly trees, shrubs or lianes (7–9). In the last 50 years, phytochemical and pharmacological evaluations of the species belonging to the Combretaceae family focused mainly on the two largest genera, that is, *Terminalia* and *Combretum* (10–14). Some of the *Combretum* species that are used in traditional medicine include *Combretum adenogonium* Steud. ex A.Rich., *Combretum apiculatum* Sond., *Combretum cafrum* (Eckl. & Zeyh.) Kuntze, *Combretum coccineum* (Sonn.) Lam., *Combretum collinum* Fresen, *Combretum comosum* G.Don, *Combretum erythrophyllum* (Burch.) Sond., *Combretum hereroense* Schinz, *Combretum imberbe* Wawra, *Combretum*

indicum, *Combretum kraussii* Hochst., *Combretum micranthum* G.Don, *Combretum molle* R.Br. ex G.Don, *Combretum mucronatum* Schumach. & Thonn., *Combretum nigricans* Lepr., *Combretum padoides* Engl. & Diels, *Combretum paniculatum* Vent., *Combretum Zeyheri* Sond. and *Combretum platypterum* (Welw.) Hutch. & Dalziel (3, 15, 16). In tropical Africa, at least three *Combretum* species are known to have commercial potential needed for developing pharmaceutical drugs and health promoting products and these are *C. coccineum*, *C. nigricans* and *C. micranthum* (17, 18). Similarly, the socio-economic, cultural and medicinal importance of the *Combretum* genus, including *C. padoides* have been recorded in previously studied literatures (19–22). It is within this context that *C. padoides*, a widely used medicinal plant species in tropical Africa (1–3) was selected for detailed review of its medicinal applications, phytochemical and biological activities. Medicinal plants like *C. padoides* have a long history of usage in the treatment and management of human and animal diseases and ailments. Approximately 80 % of the people in both developed and developing countries depend on traditional medicines for their primary health care needs (1, 10). Literature records show that traditional medicines, plant-derived medicines,

other natural products and their derivatives are becoming increasingly popular in modern society as natural alternatives to synthetic chemicals (17, 18). Therefore, detailed analysis of medicinal plant species such as *C. padoides*, including traditional ecological knowledge about the identity of the plant species, as well as their medicinal applications, plant parts used, dosage and administration and ethnopharmacological properties is important.

In some studies, focusing on ecosystem services and goods that are derived from plant resources, *C. padoides* is categorised as a multipurpose tree species as the taxon is deliberately kept and managed as fodder, source of traditional medicines, firewood or charcoal (23–26). Previous research showed that multipurpose species and agricultural crops cultivated in home gardens and different agroforestry landscapes provide provisioning services and maintain habitat and regulation services (27, 28). *Combretum padoides* is used throughout its distributional range as an important source of building materials for houses, livestock enclosures, craft work, furniture, fencing posts, fuelwood and charcoal (29, 30). *Combretum padoides* is sometimes cultivated as windbreak, shade, garden or ornamental tree (30). The leaves, branches and twigs of *C. padoides* are browsed by game and livestock and the flowers are important sources of bee forage (31). The tender leaves and twigs of *C. padoides* are collected from the wild and home gardens, chopped up and cooked as leafy vegetables (30). Given this background of the species, a study was therefore, undertaken, aimed at evaluating the medicinal applications, phytochemistry and biological activities of *C. padoides*. This research is part of a bigger project compiling baseline data on traditional ecological knowledge about medicinal plants, their phytochemical and biological activities. Such research is important as it contributes to conservation, preservation and sustainable use of plant species used as medicinal

plants, associated traditional ecological knowledge about the species and development of natural products, health promoting products and pharmaceutical drugs.

2. Materials and Methods

This review is based on literature sources which provided information on the medicinal uses, phytochemical and biological activities of *C. padoides*. A literature search was conducted using scientific databases such as PubMed® (<https://pubmed.ncbi.nlm.nih.gov/>), Scopus® (<http://www.scopus.com/>), ScienceDirect® (<https://www.sciencedirect.com/search>), Web of Science (<https://www.webofknowledge.com>), Google Scholar (<https://scholar.google.com/>), SpringerLink® (<https://link.springer.com/>) and SciELO (<https://search.scielo.org/>), as well as the pre-electronic sources which included books, book chapters and other publications which were obtained from the university main library. The literature search was undertaken from January to May 2025 using the following keywords: “*Combretum padoides*”, “biological activities of *Combretum padoides*”, “pharmacological properties of *Combretum padoides*”, “ethnobotany of *Combretum padoides*”, “medicinal uses of *Combretum padoides*”, “phytochemistry of *Combretum padoides*” and “traditional uses of *Combretum padoides*”. Literature sources excluded from this review are grey literature, articles not published in English and those articles that are partially accessed, that is, accessed as abstracts only and also published or unpublished ethnopharmacological surveys lacking information on medicinal uses and ethnopharmacological properties of *C. padoides* (Fig. 2). The search covered publications from 1961–2025, a very long period to capture the necessary literature focusing on the medicinal uses, phytochemistry and biological activities of *C. padoides*.



Fig. 1. *Combretum padoides*: (A) entire plant in flower; (B) branches showing leaves and flowers.

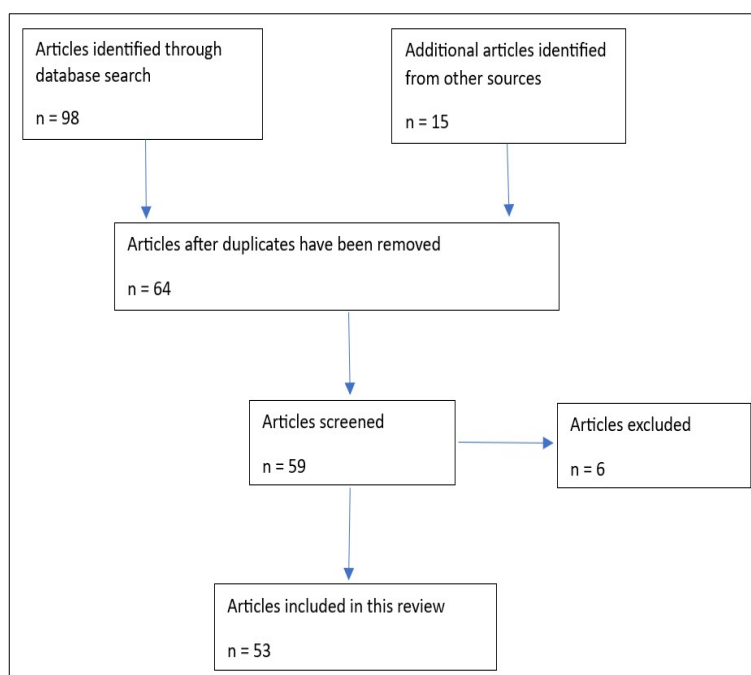


Fig. 2. Preferred reporting items for systematic reviews and meta-analyses (PRISMA) flow diagram detailing the literature identification, screening and inclusion process, culminating in the final 53 articles included for synthesis.

3. Results and Discussion

Botanical description of *Combretum padoides*

The *Combretum* Loebl. genus consists of about 276 species worldwide (8, 9, 32). The genus *Combretum* has a pantropical distribution, recorded in tropical Africa and Asia, with no records of the genus in Australia and the Pacific Islands (8, 9, 32). Approximately 140 *Combretum* species have been reported in central, east, southern and west Africa and about 20 species have been recorded in Madagascar (3). These records imply that tropical Africa has the highest number of *Combretum* species and therefore, the region is the centre of diversity of the genus (32, 33). The *Combretum* genus comprises shrubs, trees and lianas which are characterised by leaves which are whorled, opposite or rarely alternate, with the leaf margins that are entire (32). The leaves lack stipules or if present are very small, but the petioles are persistent and often form hooked and woody spines (32). The flowers of *Combretum* are actinomorphic and bisexual, with an ovary that is inferior and fruits that are winged and at times with an unwinged nut (32). The name of the genus, '*Combretum*' is historically important, as the name was used for the first time by the Roman natural philosopher, naturalist, military commander and naval, Gaius Plinius Secundus (23–79 AD), who is known in the English history as Pliny and used the genus name *Combretum* in reference to an unknown plant (34, 35). The genus name *Combretum* was later reused by the prominent Swedish botanist and naturalist Pehr Löfving (31 January 1729–22 February 1756) (34, 35). The specific species name "*padoides*" means resembling

the leaves of the plants belonging to the genus *Padus* Mill., is now treated as part of the genus *Prunus* L. which belongs to the family Rosaceae (36). The common names of *C. padoides* include "thicket bushwillow" and "thicket combretum" (36, 37). The synonyms of *C. padoides* include *Combretum giorgii* De Wild. & Exell, *Combretum homblei* De Wild., *Combretum tenuipes* Engl. & Diels and *C. minutiflorum* Exell (38–40). *Combretum padoides* is an untidy scrambling shrub, multi-stemmed and often thicket-forming, with its long trailing branches scrambling into adjacent trees (Fig. 1A). *Combretum padoides* grows to a height of about 12 m (37, 41). The bark of *C. padoides* is light brownish gray in colour, smooth and flaking irregularly to reveal paler patches below. The leaves of *C. padoides* are simple, sub-opposite to opposite, ovate to elliptic in shape, thinly textured, dull green in colour, above and slightly pale green below with hairs along the veins below, net-veining indistinct with scales on the under surface. The leaves of *C. padoides* leaves are tapering at the apex to a point while the base is roundish, with entire and waxy leaf margins. Its flowers are simple or branched, small and creamy yellow in colour (Fig. 1B), sweet-scented, axillary or terminal. The young fruits are pale yellowish green in colour and drying to light brown and borne on a slender stalk and often in profusion. *Combretum padoides* has been reported in Kenya, DRC, Malawi, Somalia, South Africa, Mozambique, Tanzania, Zimbabwe and Zambia (42–47) (Fig. 3). *Combretum padoides* has been recorded in dry woodland, riverine fringes, on rocky hills and along escarpments and in mixed woodland and bushveld at an altitude which ranged from 30 m above sea level to 1500 m (41). *Combretum padoides* is very similar to



Fig. 3. Distribution of *Combretum padoides* in tropical Africa.

Combretum celastroides Welw. ex M.A.Lawson but differs in the intrastaminal disc of the flowers which is hairy and in the fruit which lacks the persistent style (48).

Medicinal uses of *Combretum padoides*

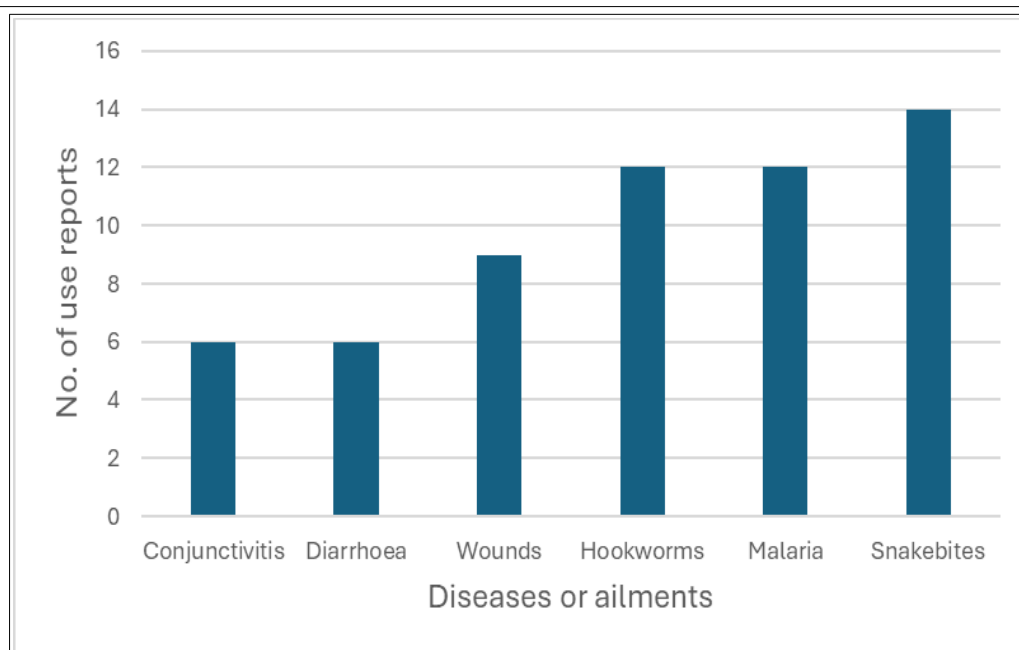
The leaf or root decoctions of *C. padoides* are mainly used for six human diseases or ailments (Fig. 4). The leaf or root decoctions are applied topically against conjunctivitis, snakebites and wounds. Similarly, the leaf or root decoctions of *C. padoides* are taken orally as traditional medicines for diarrhoea, hookworms and malaria. *Combretum padoides* is an important source of traditional medicines in tropical Africa and the plant species is listed and described in three books focusing on botanical description of the species, parts used as sources of traditional medicines, medicinal uses, dosage and preparation, phytochemical compounds, biological activities and distribution of the species. These books are "medicinal and magical plants of southern Africa: An annotated checklist" (49), "medicinal plants of East Africa" (2) and "plant resources of tropical Africa 11: medicinal plants 2" (3). Closely related *Combretum* species such as *C. zeyheri*, *C. apiculatum*, *C. caffrum*, *C. collinum*, *C. erythrophyllum*, *C. hereroense*, *C. imberbe*, *C. kraussii*, *C. molle* and *C. paniculatum* and are used for infertility, coughs, venereal diseases, stomach problems, wounds and sores (16, 50, 51) (Table 1).

Phytochemical and biological activities of *Combretum padoides*

Evaluation of the phytochemical properties of the bark, stem bark, leaves, stems and ash of *C. padoides* showed that the species is characterised by flavonoids, steroids, phenolics, cardiac glycosides, tannins, terpenoids and saponins (53, 69–72) (Table 2). *Combretum padoides* is also characterised by proteins, minerals such as copper (Cu), calcium (Ca), iron (Fe), manganese (Mn), magnesium (Mg), phosphorus (P), zinc (Zn), sodium (Na) and potassium (K) and the species is good source of energy (Table 3). The species has a protein content of 7.0–14.0 % which implies that *C. padoides* has a higher browse value than other *Combretum* species which include *C. imberbe* characterised by twigs and leaves having the protein content of about 4.0 % (73). Literature studies revealed limited nutritional assessment of the species, but the fruits, leaves, twigs and branches of *C. padoides* are characterised by macro and micro elements and classical nutrients which include energy and proteins required by livestock and game (74). Evaluation of some of the active ingredients isolated from *C. padoides* and the extracts of the species demonstrated antifungal, antibacterial, antimycobacterial, anti-inflammatory, antioxidant, antiparasmodial, cytotoxicity properties, corroborating some of the medicinal applications of the species (Table 4).

Table 1. Medicinal uses of *Combretum padoides*

Medicinal use	Plant part used and administration	Reference
Conjunctivitis	Leaf or root decoction applied topically	(52–57)
Diarrhoea	Leaf or root decoction taken orally	(52–57)
Hookworms	Root decoction taken orally	(1, 30, 31, 53, 54, 56, 58–63)
Malaria	Leaf or root decoction taken orally	(30, 52–57, 61, 62, 64–66)
Snakebites	Leaf or root decoction applied topically	(1, 30, 31, 53, 54, 56, 58–63, 67, 68)
Wounds	Leaf or root decoction applied topically	(30, 31, 52–57, 63)

**Fig. 4.** Main diseases and ailments treated and managed by *Combretum padoides* in tropical Africa.**Table 2.** Phytochemical composition of *Combretum padoides*

Phytochemical compound	Formula	Part	Reference
1 α ,23 β -dihydroxy-12-oleanen-29-oic-acid-23 β -O- α -L-4-acetylramnopyranside	C ₃₈ H ₆₀ O ₁₀	Leaves	(71)
1,22-dihydroxy-12-oleanen-30-oic acid	C ₃₀ H ₄₈ O ₄	Leaves	(71)
3'-O-methyl-4-O-(β -d-xylopyranosyl) ellagic acid	C ₂₀ H ₁₆ O ₁₂	Stem bark	(53)
24-ethylcholesta-7,22,25-trien-O- β -D-glucopyranoside	C ₃₅ H ₅₆ O ₆	Leaves	(71)
25(27)-dehydroperiferasterol	C ₂₉ H ₄₆ O	Leaves	(70)
Corilagin	C ₂₇ H ₂₂ O ₁₈	Stem bark	(53)
Ellagic acid arabinoside	C ₁₉ H ₁₄ O ₁₂	Stem bark	(53)
Ellagitannin	C ₄₄ H ₃₂ O ₂₇	Stem bark	(53)
Gallic acid	C ₇ H ₆ O ₅	Stem bark	(53)
Gallotannin	C ₇₆ H ₅₂ O ₄₆	Stem bark	(53)
β -glucogallin	C ₁₃ H ₁₆ O ₁₀	Stem bark	(53)
Methyl ellagic acid xyloside	C ₂₁ H ₁₈ O ₁₂	Stem bark	(53)
α -Punicalagin anomer	C ₄₈ H ₂₈ O ₃₀	Stem bark	(53)

Table 3. Proximate, mineral and trace metals composition of ashes, leaves and stems of *Combretum padoides* (72)

Mineral	Value	Plant part
Ash (%)	4.0	Leaves and stems
Moisture (%)	8.0	Leaves
Protein (%)	7.0–14.0	Leaves and stems
Energy (kj)	14.0–17.0	Leaves and stems
Calcium (mg/mL)	104.0–132.0	Leaves and stems
Cobalt (mg/mL)	0.7–1.3	Leaves and stems
Copper (ppm)	0.4–0.5	Leaves and stems
Iron (ppm)	1.2– 2.0	Leaves and stems
Manganese (mg/mL)	1.2– 2.6	Leaves and stems
Magnesium (g/kg dry matter)	13.5– 34.7	Leaves and stems
Nickel (mg/mL)	1.2– 3.0	Leaves and stems
Phosphorus (g/kg dry matter)	2.4	Leaves and stems
Potassium (g/kg dry matter)	26.1–37.1	Leaves and stems
Sodium (mg/mL)	5.1–10.0	Leaves and stems
Zinc (ppm)	0.4–0.6	Leaves and stems

Table 4. Summary of pharmacological activities of extracts and phytochemical compounds isolated from *Combretum padoides*

Extract or phytochemical compound	Plant part	Model	Effect	Reference
Antibacterial activities				
Acetone	Leaves	Microdilution	Showed activities against <i>Ec</i> with MIC value of 0.8-3.0 mg/mL, <i>Ef</i> (0.8 mg/mL), <i>Pa</i> (< 0.1 - 0.8 mg/mL) and <i>Sa</i> (3.0 - 6.0 mg/mL)	(75)
Methanol	Roots	Agar diffusion	Showed activities against <i>Bs</i> with inhibition zone of 23.0 mm, <i>Ea</i> (32.0 mm), <i>Sa</i> (31.0 mm) and <i>Se</i> (24.0 mm)	(76)
Methanol	Stem bark	Agar diffusion	Showed activities against <i>Bs</i> with inhibition zone of 23.0 mm, <i>Ea</i> (31.0 mm), <i>Sa</i> (31.0 mm) and <i>Se</i> (24.0 mm)	(76)
Crude	Leaves	Microdilution	Showed activities against <i>Ec</i> with MIC value of 156.0 µg/mL, <i>Ef</i> (78.0 µg/mL), <i>Pa</i> (156.0 µg/mL) and <i>Sa</i> (156.0 µg/mL)	(77)
Hexane	Leaves	Microdilution	Showed activities against <i>Ec</i> with MIC value of 19.0 µg/mL, <i>Ef</i> (19.0 µg/mL), <i>Pa</i> (78.0 µg/mL) and <i>Sa</i> (19.0 µg/mL)	(77)
Dichloromethane	Leaves	Microdilution	Showed activities against <i>Ec</i> with MIC value of 19.0 µg/mL, <i>Ef</i> (19.0 µg/mL), <i>Pa</i> (39.0 µg/mL) and <i>Sa</i> (39.0 µg/mL)	(77)
Ethyl acetate fraction soluble in acetone	Leaves	Microdilution	Showed activities against <i>Ec</i> with MIC value of 312.0 µg/mL, <i>Ef</i> (156.0 µg/mL), <i>Pa</i> (625.0 µg/mL) and <i>Sa</i> (156.0 µg/mL)	(77)
Ethyl acetate fraction soluble in methanol	Leaves	Microdilution	Showed activities against <i>Ec</i> with MIC value of 312.0 µg/mL, <i>Ef</i> (156.0 µg/mL), <i>Pa</i> (312.0 µg/mL) and <i>Sa</i> (156.0 µg/mL)	(77)
Butanol fraction soluble in acetone	Leaves	Microdilution	Showed activities against <i>Ec</i> with MIC value of 156.0 µg/mL, <i>Ef</i> (78.0 µg/mL), <i>Pa</i> (312.0 µg/mL) and <i>Sa</i> (156.0 µg/mL)	(77)
Butanol fraction soluble in methanol	Leaves	Microdilution	Showed activities against <i>Ec</i> with MIC value of 39.0 µg/mL, <i>Ef</i> (78.0 µg/mL), <i>Pa</i> (19.0 µg/mL) and <i>Sa</i> (156.0 µg/mL)	(77)
Water	Leaves	Microdilution	Showed activities against <i>Ec</i> with MIC value of > 2500.0 µg/mL, <i>Ef</i> (312.0 µg/mL), <i>Pa</i> (312.0 µg/mL) and <i>Sa</i> (312.0 µg/mL)	(77)

Methanol	Leaves	Microdilution	Showed activities against <i>Bc</i> with MIC value of 0.2 mg/mL, <i>Ef</i> (1.5 mg/mL), <i>Ec</i> 1.3 mg/mL, <i>Kp</i> (1.0 mg/mL), <i>Pa</i> (3.0 mg/mL), <i>St</i> (0.3 mg/mL), <i>Ss</i> (1.3 mg/mL), <i>Sa</i> (1.5 mg/mL) and <i>Se</i> (1.0 mg/mL)	(78)
1 α ,23 β -dihydroxy-12-oleanen-29-oic-acid-23 β -O- α -L-4-acetylramnopyranoside	Leaves	Microdilution	Showed activities against <i>Ec</i> with MIC value of 0.03 mg/mL and <i>Sa</i> (0.06 mg/mL)	(71)
1,22-dihydroxy-12-oleanen-30-oic acid	Leaves	Microdilution	Showed activities against <i>Ec</i> with MIC value of 0.06 mg/mL and <i>Sa</i> (0.06 mg/mL)	(71)
24-ethylcholesta-7,22,25-trien-O- β -D-glucopyranoside	Leaves	Microdilution	Showed activities against <i>Ec</i> with MIC value of 0.06 mg/mL	(71)

Antimycobacterial activities

Butanol	Stem bark	Microdilution	Showed activities against <i>Ms</i> with MIC value of 2500.0 μ g/mL	(53)
Methanol	Stem bark	Microdilution	Showed activities against <i>Ms</i> MIC value of 1250.0 μ g/mL	(53)

Antifungal activities

Methanol	Stem bark	Agar diffusion	Showed activities against <i>Ca</i> with inhibition zone of 23.0 mm	(76)
Methanol	Roots	Microdilution	Showed activities against <i>Cg</i> with MIC value of 6.25 mg/mL and <i>Cn</i> (6.25 mg/mL)	(58)
Acetone	Leaves	Microdilution	Showed activities against <i>Af</i> with MIC value of 0.02–0.3 mg/mL, <i>Ca</i> (0.3 mg/mL), <i>Cn</i> (0.3 mg/mL), <i>Mc</i> (0.02–0.08 mg/mL) and <i>Sc</i> (0.3 mg/mL)	(79)
Dichloromethane	Leaves	Microdilution	Showed activities against <i>Af</i> with MIC value of 0.3–2.5 mg/mL, <i>Ca</i> (0.3 mg/mL), <i>Cn</i> (0.3 mg/mL) and <i>Mc</i> (0.1–0.2 mg/mL)	(79)
Hexane	Leaves	Microdilution	Showed activities against <i>Af</i> with MIC value of 0.02–0.3 mg/mL, <i>Ca</i> (0.3 mg/mL), <i>Cn</i> (0.6 mg/mL) and <i>Mc</i> (0.1–0.6 mg/mL)	(79)
Methanol	Leaves	Microdilution	Showed activities against <i>Af</i> with MIC value of 0.3 mg/mL, <i>Cn</i> (0.3 mg/mL), <i>Mc</i> (0.02–0.08 mg/mL) and <i>Sc</i> (0.6 mg/mL)	(79)
Crude	Leaves	Microdilution	Showed activities against <i>Af</i> with MIC value of 156.0 μ g/mL, <i>Ca</i> (312.0 μ g/mL) and <i>Cn</i> (39.0 μ g/mL)	(77)
Hexane	Leaves	Microdilution	Showed activities against <i>Af</i> with MIC value of 156.0 μ g/mL, <i>Ca</i> (312.0 μ g/mL) and <i>Cn</i> (156.0 μ g/mL)	(77)
Dichloromethane	Leaves	Microdilution	Showed activities against <i>Af</i> with MIC value of 78.0 μ g/mL, <i>Ca</i> (19.0 μ g/mL) and <i>Cn</i> (625.0 μ g/mL)	(77)
Ethyl acetate fraction soluble in acetone	Leaves	Microdilution	Showed activities against <i>Af</i> with MIC value of 78.0 μ g/mL, <i>Ca</i> (312.0 μ g/mL) and <i>Cn</i> (19.0 μ g/mL)	(77)
Ethyl acetate fraction soluble in methanol	Leaves	Microdilution	Showed activities against <i>Af</i> with MIC value of 312.0 μ g/mL, <i>Ca</i> (625.0 μ g/mL) and <i>Cn</i> (312.0 μ g/mL)	(77)
Butanol fraction soluble in methanol	Leaves	Microdilution	Showed activities against <i>Af</i> with MIC value of 156.0 μ g/mL, <i>Ca</i> (156.0 μ g/mL) and <i>Cn</i> (312.0 μ g/mL)	(77)
Water	Leaves	Microdilution	Showed activities against <i>Af</i> with MIC value of 625.0 μ g/mL, <i>Ca</i> (625.0 μ g/mL) and <i>Cn</i> (312.0 μ g/mL)	(77)

Anti-inflammatory activities

Acetone	Leaves	COX-1 bioassay	Showed activities by showing inhibition of 75.0 %	(80)
---------	--------	----------------	---	------

Ethyl acetate	Leaves	COX-1 bioassay	Showed activities by showing inhibition of 79.0 %	(80)
Crude	Leaves	Soybean 15-lipoxygenase inhibition	Showed activities by exhibiting the median LC ₅₀ value of 30.8 µg/mL	(77)

Antioxidant activities

Crude	Leaves	ABTS	Showed activities with half maximal EC ₅₀ value of 4.2 µg/mL	(77)
Hexane	Leaves	ABTS	Showed activities with EC ₅₀ value of 22.7 µg/mL	(77)
Dichloromethane	Leaves	ABTS	Showed activities with EC ₅₀ value of 4.0 µg/mL	(77)
Ethyl acetate fraction soluble in acetone	Leaves	ABTS	Showed activities with EC ₅₀ value of 0.7 µg/mL	(77)
Ethyl acetate fraction soluble in methanol	Leaves	ABTS	Showed activities with EC ₅₀ value of 1.3 µg/mL	(77)
Butanol fraction soluble in acetone	Leaves	ABTS	Showed activities with EC ₅₀ value of 0.4 µg/mL	(77)
Butanol fraction soluble in methanol	Leaves	ABTS	Showed activities with EC ₅₀ value of 0.6 µg/mL	(77)
Water	Leaves	ABTS	Showed activities with EC ₅₀ value of 1.5 µg/mL	(77)
Crude	Leaves	DPPH	Showed activities with EC ₅₀ value of 4.4 µg/mL	(77)
Hexane	Leaves	DPPH	Showed activities with EC ₅₀ value of 12.7 µg/mL	(77)
Dichloromethane	Leaves	DPPH	Showed activities with EC ₅₀ value of 3.3 µg/mL	(77)
Ethyl acetate fraction soluble in acetone	Leaves	DPPH	Showed activities with EC ₅₀ value of 0.4 µg/mL	(77)
Ethyl acetate fraction soluble in methanol	Leaves	DPPH	Showed activities with EC ₅₀ value of 0.5 µg/mL	(77)
Butanol fraction soluble in acetone	Leaves	DPPH	Showed activities with EC ₅₀ value of 0.2 µg/mL	(77)
Butanol fraction soluble in methanol	Leaves	DPPH	Showed activities with EC ₅₀ value of 0.7 µg/mL	(77)
Water	Leaves	DPPH	Showed activities with EC ₅₀ value of 0.8 µg/mL	(77)
Crude	Leaves	FRAP	Showed activities with EC ₅₀ value of 6.4 µg/mL	(77)
Hexane	Leaves	FRAP	Showed activities with EC ₅₀ value of 17.0 µg/mL	(77)
Dichloromethane	Leaves	FRAP	Showed activities with EC ₅₀ value of 22.7 µg/mL	(77)
Ethyl acetate fraction soluble in acetone	Leaves	FRAP	Showed activities with EC ₅₀ value of 54.2 µg/mL	(77)
Ethyl acetate fraction soluble in methanol	Leaves	FRAP	Showed activities with EC ₅₀ value of 47.8 µg/mL	(77)
Butanol fraction soluble in acetone	Leaves	FRAP	Showed activities with EC ₅₀ value of 44.1 µg/mL	(77)
Butanol fraction soluble in methanol	Leaves	FRAP	Showed activities with EC ₅₀ value of 40.5 µg/mL	(77)
Water	Leaves	FRAP	Showed activities with EC ₅₀ value of 9.6 µg/mL	(77)
Acetone	Leaves	DPPH	Showed dose-dependent scavenging activities ranging from 60.0–85.0 %	(72)

Antiplasmodial activities

Methanol	Roots	[G- ³ H] hypoxanthine incorporation assay	Showed activities against <i>Plasmodium falciparum</i> chloroquine sensitive (D6) and chloroquine resistant (W2) with half maximal IC ₅₀ value of 21.7 and 59.4 µg/mL, respectively	(52)
Methanol	Roots	Peter's 4-days suppressive test	Extract exhibited 50.6 % chemo-suppression	(52)

Cytotoxicity activities

Methanol	Roots	Alamar Blue method	Extract showed activities against HeLa (cervical carcinoma) demonstrating inhibition percentage of 17.4 %, T24 (bladder carcinoma) (31.4 %) and MCF 7 breast cancer cell lines (64.6 %)	(59)
Methanol	Stems	Alamar Blue method	Extract showed activities against HeLa demonstrating inhibition percentage of 97.2 %, T24 (51.6 %) and MCF 7 (62.0 %)	(59)
Crude	Leaves	MTT assay	Extract demonstrated activities exhibiting LC ₅₀ value of about 9.0 µg/mL	(77)

ABTS: 2,2'-azino-bis (3-ethylbenzothiazoline)-6-sulphonic acid; DPPH: 2,2-diphenyl-1-picrylhydrazyl; FRAP: Ferric reducing antioxidant power; MTT: 3-(4,5-dimethylthiazol-2-yl)-2,5-diphenyltetrazolium bromide; COX-1: cyclooxygenase-1; MIC: minimum inhibition concentration; LC₅₀: lethal concentrations; EC₅₀: effective concentration; IC₅₀: inhibitory concentration; Ec: *Escherichia coli*; Ef: *Enterococcus faecalis*; Pa: *Pseudomonas aeruginosa*; Sa: *Staphylococcus aureus*; Bs: *Bacillus subtilis*; Ea: *Enterobacter aerogenes*; Se: *Staphylococcus epidermidis*; Bc: *Bacillus cereus*; Kp: *Klebsiella pneumoniae*; St: *Salmonella typhimurium*; Ss: *Shigella sonnei*; Ms: *Mycobacterium smegmatis*; Ca: *Candida albicans*; Cg: *Candida glabrata*; Cn: *Cryptococcus neoformans*; Af: *Aspergillus fumigatus*; Mc: *Microsporium canis*; Sc: *Sporothrix schenckii*.

Antibacterial properties

The antibacterial activities of acetone crude extracts of the leaves of *C. padoides* were assessed against *Pseudomonas aeruginosa*, *Staphylococcus aureus*, *Escherichia coli* and *Enterococcus faecalis* using the twofold serial dilution method with gentamycin as the positive control (Table 4). The extract of the species demonstrated antibacterial properties against the tested pathogens exhibiting the minimum inhibition concentration (MIC) values which ranged from < 0.1–6.0 mg/mL (75). Similarly, the antibacterial properties of methanol extract of *C. padoides* stems were evaluated against *Staphylococcus epidermidis*, *Staphylococcus aureus*, *Enterobacter aerogenes*, *Bacillus subtilis*, *Micrococcus luteus* and *Sarcina* spp. using the agar diffusion assay with ampicillin and streptomycin as positive controls (76). The extract demonstrated weak antibacterial activities against the tested bacterial pathogens exhibiting inhibition zone which ranged from 17.0–31.0 mm versus 31–62 mm demonstrated by the positive controls (76). Water, dichloromethane, butanol and ethyl acetate extracts of the leaves of *C. padoides* demonstrated antibacterial activities against *P. aeruginosa*, *E. coli*, *S. aureus* and *E. faecalis* exhibiting MIC values which ranged from 19.0 µg/mL to > 2500.0 µg/mL (77). The antibacterial activities demonstrated by *C. padoides* extracts were higher than 0.2–1.6 µg/mL exhibited by gentamycin used as a positive control (77). The methanol extract of the leaves of *C. padoides* showed antibacterial activities against *B. cereus*, *S.*

aureus, *K. pneumoniae*, *S. epidermidis*, *S. sonnei*, *E. coli*, *E. faecalis*, *P. aeruginosa* and *S. typhimurium* exhibiting MIC values which ranged from 0.16–3.0 mg/mL (78). Similarly, the phytochemical compounds isolated from *C. padoides* leaves, that is, 1,22-dihydroxy-12-oleanen-30-oic acid, 1 α ,23 β -dihydroxy-12-oleanen-29-oic-acid-23 β -O- α -L-4 acetylramnopyranoside and 24-ethylcholesta-7,22,25-trien-O- β -D-glucopyranoside demonstrated antibacterial activities against *S. aureus*, *E. coli*, *P. aeruginosa* and *E. faecalis* exhibiting MIC values which ranged from 0.03 mg/mL to > 25.0 mg/mL and these values were higher than 1.9×10^{-3} – 3.9×10^{-3} mg/mL exhibited by neomycin, used as a positive control (71). These documented antibacterial activities of extracts and phytochemical compounds isolated from *C. padoides* somehow confirm the antibacterial potential of the species and its application in the treatment and management of diarrhoea and wounds (30, 31, 52–57, 63).

Antimycobacterial properties

The butanol and methanol extracts of *C. padoides* stem bark demonstrated antimycobacterial activities against *Mycobacterium smegmatis* exhibiting MIC values which ranged from 1250.0–2500.0 µg/mL and these values were much higher than 52.0 µg/mL exhibited by rifampicin used as a positive control (53).

Antifungal properties

The methanol extract of *C. padoides* stem bark demonstrated antifungal activities against *C. albicans* with the inhibition zone of 23.0 mm which was slightly



higher than 26.0–31.0 mm exhibited by amphotericin B, the positive control (76). In a different study, the methanol extract of *C. padoides* roots demonstrated antifungal activities against *Candida glabrata* and *Cryptococcus neoformans* with MIC values of 6.25 mg/mL which was much higher than 0.003–0.2 mg/mL exhibited by amphotericin B and itraconazole that were used as positive controls (58). The dichloromethane, methanol, hexane and acetone extracts of the leaves of *C. padoides* demonstrated antifungal activities against *Microsporum canis*, *C. albicans*, *C. neoformans*, *Sporothrix schenckii* and *Aspergillus fumigatus* with MIC values ranging from 0.02 mg/mL to > 2.5 mg/mL (79). The water, dichloromethane, butanol and ethyl acetate extracts of the leaves of *C. padoides* demonstrated antifungal activities against *C. neoformans*, *C. albicans* and *A. fumigatus* with MIC values ranging from 19.0–625.0 µg/mL and these values were higher than 0.7–6.3 µg/mL exhibited by amphotericin that was used as positive control (77).

Anti-inflammatory properties

The acetone and ethyl acetate extracts of *C. padoides* leaves demonstrated anti-inflammatory activities by showing inhibition of cyclooxygenase which ranged from 75.0–79.0 % and these values were higher than 52.0–68.0 % exhibited by indomethacin which was used as a positive control (80). The crude extract of *C. padoides* leaves demonstrated anti-inflammatory activities by exhibiting lipoxygenase inhibitory capacity with median lethal concentration (LC₅₀) value of 30.8 µg/mL (77).

Antioxidant properties

The water, dichloromethane, butanol and ethyl acetate extracts of *C. padoides* leaves demonstrated antioxidant activities by exhibiting half maximal effective concentration (EC₅₀) values which ranged from 0.2–22.7 µg/mL for ferric reducing antioxidant power (FRAP), 2,2'-azino-bis (3-ethylbenzothiazoline)-6-sulphonic acid (ABTS) and 2,2-diphenyl-1-picrylhydrazyl (DPPH) free radical scavenging assays (77). These values are comparable to EC₅₀ values of 1.0–56.5 µg/mL exhibited by trolox and ascorbic acid used as positive controls (77). Similarly, the acetone extract of the leaves of *C. padoides* demonstrated dose-dependent antioxidant activities against DPPH with the scavenging activities ranging from 60.0–85.0 % (72).

Antiplasmodial activities

The methanol extract of *C. padoides* roots demonstrated antiplasmodial activities by exhibiting half maximal inhibitory concentration (IC₅₀) values of 59.4 and 21.7 µg/mL against *Plasmodium falciparum* chloroquine resistant (W2) and chloroquine sensitive (D6), respectively (52). These values exhibited by *C. padoides* are higher than 0.002–0.06 µg/mL exhibited by chloroquine and artemisinin used as positive controls (52). In another experiment, the *in vivo* bioassay was done in a mouse model assay using the Peter's 4-days suppressive test. In this assay, the extract exhibited 50.6 % chemo-suppression which was lower than 95.2 % demonstrated by a positive control (52).

Cytotoxicity properties

The methanolic extract of *C. padoides* stems demonstrated cytotoxicity activities against T24 (bladder carcinoma), HeLa (cervical carcinoma) and MCF 7 breast cancer cell lines with inhibition percentage ranging from 36.4–82.6 % (59). Similarly, the crude extracts of the leaves of *C. padoides* demonstrated cytotoxicity activities against the African green monkey kidney (Vero) cell exhibiting the median lethal concentration (LC₅₀) value of about 9.0 µg/mL and this value was higher than 0.008–1.9 µg/mL exhibited by berberine chloride which was used as a positive control (77).

4. Conclusion

As outlined in the present study, *Combretum padoides* is a shrub or tree with great potential as medicinal plant characterised by several cultural applications and uses in traditional medicine in tropical Africa. The ethnopharmacological knowledge and properties of *C. padoides* have not been properly studied. Given the traditional and current uses of the species, there is no doubt that *C. padoides* is a promising materia medica in African traditional pharmacopoeia. To realise the full ethnopharmacological potential of *C. padoides*, therefore, further studies should focus on evaluating the pharmacological activities of the active ingredients of the species using various *in vivo* and *in vitro* models. Literature studies focusing on medicinal applications, phytochemical and biological activities of *C. padoides* showed that there is lack of information on standardised quality, mode of action, toxicology, evidence-based safety and regulatory approvals involving the species. Therefore, future studies involving *C. padoides* should aim at pharmacological validation of crude extracts derived from the species as well as phytochemical compounds and any natural products associated with *C. padoides*. The *in vitro*, *in vivo* and clinical studies are the most convincing scientific methods of proving safety and efficacy of plant-based therapies and natural products involving *C. padoides*. Such detailed ethnopharmacological studies could make a valuable contribution to growing ethnomedicinal knowledge about *C. padoides*, its phytochemical, pharmacological properties and ultimately leading to commercial development of natural, health promoting and pharmaceutical products.

Acknowledgements

I want to thank the reviewers for their constructive and helpful comments, which have significantly improved the quality and clarity of this manuscript.

Compliance with ethical standards

Conflict of interest

Authors do not have any conflicts of interest to declare.



Ethical issues

None

References

- Neuwinger HD. African traditional medicine. Stuttgart: MedPharm Scientific Publishers; 2000.
- Kokwaro JO. Medicinal plants of East Africa. Nairobi: University of Nairobi Press; 2009.
- Schmelzer GH, Gurib-Fakim A. Plant resources of tropical Africa 11: Medicinal plants 2. Leiden: Backhuys Publishers; 2013.
- Maurin O, Chase MW, Jordaan M, Van Der Bank M. Phylogenetic relationships of Combretaceae inferred from nuclear and plastid DNA sequence data: implications for generic classification. *Bot J Linnean Soc.* 2010;162(3):453–76. <https://doi.org/10.1111/j.1095-8339.2010.01027.x>
- Maurin O, Gere J, Van Der Bank M, Boatwright JS. The inclusion of *Anogeissus*, *Buchenavia* and *Pteleopsis* in *Terminalia* (Combretaceae: Terminaliinae). *Bot J Linnean Soc.* 2017;184(3):312–25. <https://doi.org/10.1093/botlinnean/box029>
- Christenhusz MJM, Byng JW. The number of known plants species in the world and its annual increase. *Phytotaxa.* 2016;261(3):201–17. <https://doi.org/10.11646/phytotaxa.261.3.1>
- Leistner OA. Seed plants of southern Africa: families and genera. Pretoria (South Africa): Strelitzia 10, National Botanical Institute; 2000.
- Stace CA. Proposal to conserve *Terminalia* nom. cons. (Combretaceae) against an additional name *Bucida*. *Taxon.* 2002;51(1):193–4. <https://doi.org/10.2307/1554985>
- Stace CA. Combretaceae. In: Kubitzki K, editor. The families and genera of vascular plants, volume 9. Berlin: Springer; 2007. p. 67–82. https://doi.org/10.1007/978-3-540-32219-1_11
- Hedberg I, Staugård F. Traditional medicine in Botswana: traditional medicinal plants. Gaborone (Botswana): Ipeleng Publishers; 1989.
- Rogers CB, Verota L. Chemistry and biological properties of the African Combretaceae. In: Hostettmann K, Chinyanganya F, Maillard M, Wolfender J-L, editors. Chemistry, biological and pharmacological properties of African medicinal plants. Harare: University of Zimbabwe Publications; 1996. p. 121–42.
- Eloff JN, Katerere DR, McGaw LJ. The biological activity and chemistry of the southern African Combretaceae. *J Ethnopharmacol.* 2008;119(3):686–99. <https://doi.org/10.1016/j.jep.2008.07.051>
- Zhang X-R, Kaunda JS, Zhu H-T, Wang D, Yang C-R, Zhang Y-J. The genus *Terminalia* (Combretaceae): an ethnopharmacological, phytochemical and pharmacological review. *Nat Prod Bioprospect.* 2019;9(6):357–92. <https://doi.org/10.1007/s13659-019-00222-3>
- Umoh SD, Bojase G, Masesane IB, Loeto D, Majinda RT. A comprehensive review of *Combretum* flavonoids and their biological activities: an update between 1990 and 2022. *Biochem Syst Ecol.* 2023;108:104644. <https://doi.org/10.1016/j.bse.2023.104644>
- Burkill HRM. The useful plants of West Tropical Africa. Richmond (UK): Royal Botanic Gardens, Kew; 1994.
- Hutchings A, Scott AH, Lewis G, Cunningham AB. Zulu medicinal plants: an inventory. Pietermaritzburg (South Africa): University of Natal Press; 1996.
- Van Wyk B-E. A review of commercially important African medicinal plants. *J Ethnopharmacol.* 2015;176:118–34. <https://doi.org/10.1016/j.jep.2015.10.031>
- Van Wyk B-E. A review of African medicinal and aromatic plants. In: Neffati M, Najjaa H, Mathé A, editors. Medicinal and aromatic plants of the world: Africa volume 3. Leiden: Springer; 2017. p. 19–60.
- Irvine FR. Woody plants of Ghana: with special reference to their uses. Oxford: Oxford University Press; 1961.
- Gelfand M, Mavi S, Drummond RB, Ndemera B. The traditional medical practitioner in Zimbabwe: his principles of practice and pharmacopoeia. Gweru: Mambo Press; 1985.
- Iwu MM. Handbook of African medicinal plants. London: CRC Press; 2014.
- Dharani N. Field guide to common trees and shrubs of East Africa. Cape Town (South Africa): Struik Nature; 2019.
- Nair PKR, Kumar BM, Nair VD. Multipurpose trees (MPTs) and other agroforestry species. In: Nair PKR, Kumar BM, Nair VD, editors. An introduction to agroforestry. Cham: Springer; 2022. p. 281–351. https://doi.org/10.1007/978-3-030-75358-0_13
- Kimaro OD, Desie E, Kimaro DN, Vancampenhout K, Feger K-H. Salient features and ecosystem services of tree species in mountainous indigenous agroforestry systems of North-Eastern Tanzania. *Front Forests Global Change.* 2024;6:1082864. <https://doi.org/10.3389/ffgc.2023.1082864>
- Roy MK, Fort MP, Kanter R, Montagnini F. Agroforestry: a key land use system for sustainable food production and public health. *Trees For People.* 2025;20:100848. <https://doi.org/10.1016/j.tfp.2025.100848>
- Dogbo SF, Salako KV, Agoundé G, Dimobe K, Adiko AEG, Gebauer J, et al. Potential impacts of future climate on twelve key multipurpose tree species in Benin: insights from species distribution modeling for biodiversity conservation. *Trees For People.* 2025;19:100744. <https://doi.org/10.1016/j.tfp.2024.100744>
- Kristanto Y, Tarigan S, June T, Wahjunie ED, Sulistyantara B. Water regulation ecosystem services of multifunctional landscape dominated by monoculture plantations. *Land.* 2022;11(6):818. <https://doi.org/10.3390/land11060818>
- Kristanto Y, Tarigan S, June T, Sulistyantara B, Wijayanti P. Indirect use value of improved soil health as natural capital that supports essential ecosystem services: a case study of cacao agroforestry. *Agr Econ Czech.* 2024;70(3):137–54. <https://doi.org/10.17221/281/2023-AGRICECON>
- Luoga EJ, Witkowski ETF, Balkwill K. Differential utilization and ethnobotany of trees in Kitulungalo forest reserve and surrounding communal lands, eastern Tanzania. *Econ Bot.* 2000;54(3):328–43. <https://doi.org/10.1007/BF02864785>
- Matu EN. *Combretum padoides* Engl. & Diels. In: Schmelzer GH, Gurib-Fakim A, editors. Plant resources of tropical Africa 11: Medicinal plants 2. Leiden: Backhuys Publishers; 2013. p. 84–5.
- Ruffo CK, Birnie A, Tengnäs B. Edible wild plants of Tanzania. Nairobi: RELMA Technical Handbook Series 27, Regional Land Management Unit (RELMA); 2002.
- Boon RGC, Jordaan M, Van Wyk AE. A new species of *Combretum* sect. *Ciliatipetala* (Combretaceae) from South Africa. *Phytotaxa.* 2020;434(1):1–12. <https://doi.org/10.11646/phytotaxa.434.1.1>
- Gere J, Yessoufou K, Daru BH, Maurin O, Van der Bank M. African continent a likely origin of family Combretaceae (Myrtales): a biogeographical view. *Annual Res Review*



- Biol.2015;8:1–20.
<https://doi.org/10.9734/ARRB/2015/17476>
- 34) Palmer E, Pitman N. Trees of southern Africa, covering all known indigenous species in the Republic of South Africa, South-West Africa, Botswana, Lesotho and Swaziland. Cape Town (South Africa): AA Balkema; 1972.
 - 35) Venter F, Venter J-A. Making the most of indigenous trees. Pretoria (South Africa): Briza Publications; 2015.
 - 36) Schmidt E, Lotter M, McClelland W. Trees and shrubs of Mpumalanga and Kruger National Park. Johannesburg (South Africa): Jacana Media; 2017.
 - 37) Palgrave MC. Keith Coates Palgrave trees of southern Africa. Cape Town (South Africa): Struik Publishers; 2002.
 - 38) Wickens GE. Combretaceae: Flora of Tropical East Africa. London: Crown Agents for Oversea Governments and Administrations; 1973.
 - 39) Exell AW. Combretaceae. In: Launert E, editor. Flora Zambesiaca volume 4. Richmond: Kew Publishing and Flora Zambesiaca Managing Committee; 1978. p. 100–83.
 - 40) Thulin M. Flora of Somalia volume 1. London: The Royal Botanic Gardens, Kew, Richmond; 1993.
 - 41) Germishuizen G, Meyer NL. Plants of southern Africa: an annotated checklist. Pretoria (South Africa): Strelitzia 14, National Botanical Institute; 2003.
 - 42) Drummond RB. A list of trees, shrubs and woody climbers indigenous or naturalised in Rhodesia. Kirkia. 1975;10:229–89.
 - 43) Da Silva MC, Izidine S, Amude AB. A preliminary checklist of the vascular plants of Mozambique. Pretoria (South Africa): Southern African Botanical Diversity Network Report No. 30, SABONET; 2004.
 - 44) Mapaura A, Timberlake J. A checklist of Zimbabwean vascular plants. Pretoria (South Africa): Southern African Botanical Diversity Network Report No. 33, SABONET; 2004.
 - 45) Phiri PSM. A checklist of Zambian vascular plants. Pretoria (South Africa): Southern African Botanical Diversity Network Report No. 32, SABONET; 2005.
 - 46) Jordaan M, Van Wyk AE, Maurin O. A conspectus of *Combretum* (Combretaceae) in southern Africa, with taxonomic and nomenclatural notes on species and sections. Bothalia. 2011;41(1):135–60.
<https://doi.org/10.4102/abc.v41i1.36>
 - 47) Burrows J, Burrows S, Lötter M, Schmidt E. Trees and shrubs of Mozambique. Cape Town (South Africa): Publishing Print Matters; 2018.
 - 48) Wild H, Mavi S, Biegel SM. A Southern Rhodesia botanical dictionary of native and English plant names. Salisbury (Zimbabwe): Government Printer; 1972.
 - 49) Arnold TH, Prentice CA, Hawker LC, Snyman EE, Tomalin M, Crouch NR, et al. Medicinal and magical plants of southern Africa: an annotated checklist. Pretoria (South Africa): National Botanical Institute; 2002.
 - 50) Watt JM, Breyer-Brandwijk MG. The medicinal and poisonous plants of southern and eastern Africa being an account of their medicinal and other uses, chemical composition, pharmacological effects and toxicology in man and animal. London: E & S Livingstone Ltd; 1962.
 - 51) Van Wyk B-E, Van Oudtshoorn B, Gericke N. Medicinal plants of South Africa. Pretoria (South Africa): Briza Publications; 2013.
 - 52) Gathirwa JW, Rukunga GM, Mwitari PG, Mwikwabe NM, Kimani CW, Muthaura CN, et al. Traditional herbal antimalarial therapy in Kilifi district, Kenya. J Ethnopharmacol.2011;134:434–42.
<https://doi.org/10.1016/j.jep.2010.12.043>
 - 53) Fyhrquist P, Salih EYA, Helenius S, Laakso I, Julkunen-Tiitto R. HPLC-DAD and UHPLC/QTOF-MS analysis of polyphenols in extracts of the African species *Combretum padoides*, *C. zeyheri* and *C. psidioides* related to their antimycobacterial activity. Antibiotics. 2020;9:459.
<https://doi.org/10.3390/antibiotics9080459>
 - 54) IEjidike IP, Mtunzi FM, Ledwaba I, Phele MJ, Ejidike OM, Ogunleye O, et al. *Combretum* species around Africa as alternative medicine: ethnopharmacological and ethnobotanical importance. J Appl Pharmaceut Sci. 2023;13(8):12–29.
<https://doi.org/10.7324/JAPS.2023.20644>
 - 55) Mutie FM, Mbuni YM, Rono PC, Mkala EM, Nzei JM, Phumthum M, et al. Important medicinal and food taxa (orders and families) in Kenya, based on three quantitative approaches. Plants. 2023;12:1145.
<https://doi.org/10.3390/plants12051145>
 - 56) Silén H, Salih EYA, Mgbeahuruik EE, Fyhrqvist P. Ethnopharmacology, antimicrobial potency, and phytochemistry of African *Combretum* and *Pteleopsis* species (Combretaceae): a review. Antibiotics. 2023;12:264. <https://doi.org/10.3390/antibiotics12020264>
 - 57) Ali JI, Asogwa FK, Ugwu CO, Okorie HN, Ujam TN, Obidiegwu OC, et al. A review on the chemical constituents, anti-inflammatory and antioxidant agents from *Combretum* genus. Asian Plant Res J. 2024;12(3):52–61. <https://doi.org/10.9734/APRJ/2024/v12i3253>
 - 58) Fyhrquist P, Mwasumbi L, Hæggström C-A, Vuorela H, Hiltunen R, Vuorela P. Antifungal activity of selected species of *Terminalia*, *Pteleopsis* and *Combretum* (Combretaceae) collected in Tanzania. Pharmaceut Biol. 2004;42:308–17.
<https://doi.org/10.1080/13880200490511891>
 - 59) Fyhrquist P, Mwasumbi L, Vuorela P, Vuorela H, Hiltunen R, Murphy C, et al. Preliminary antiproliferative effects of some species of *Terminalia*, *Combretum* and *Pteleopsis* collected in Tanzania on some human cancer cell lines. Fitoterapia.2006;77:358–66.
<https://doi.org/10.1016/j.fitote.2006.05.017>
 - 60) Fyhrquist P. Traditional medicinal uses and biological activities of some plant extracts of African *Combretum* Loefl., *Terminalia* L. and *Pteleopsis* Engl. species (Combretaceae). PhD thesis. Helsinki: University of Helsinki; 2007.
 - 61) Nguta JM, Mbaria JM, Gakuya DW, Gathumbi PK, Kiama SG. Traditional antimalarial phytotherapy remedies used by the South Coast community, Kenya. J Ethnopharmacol. 2010;131:256–67.
<https://doi.org/10.1016/j.jep.2010.06.031>
 - 62) Nguta JM, Mbaria JM, Gakuya DW, Gathumbi PK, Kiama SG. Antimalarial herbal remedies of Msambweni, Kenya. J Ethnopharmacol.2010;128:424–32.
<https://doi.org/10.1016/j.jep.2010.01.033>
 - 63) Quattrocchi U. CRC world dictionary of medicinal and poisonous plants: common names, scientific names, eponyms, synonyms, and etymology. Boca Raton: CRC Press; 2012.
 - 64) Nguta JM, Mbaria JM, Gathumbi PK, Gakuya D, Kabasa JD, Kiama SG. Ethnodiagnostic skills of the Digo community for malaria: a lead to traditional bioprospecting. Front Pharmacol. 2011;2(30):1–14.
<https://doi.org/10.3389/fphar.2011.00030>
 - 65) Omara T. Antimalarial plants used across Kenyan communities. Evid Based Complement Alternat Med. 2020;2020:4538602.
<https://doi.org/10.1155/2020/4538602>



- 66) Irungu B, Okari E, Nyangi M, Njeru S, Koech L. Potential of medicinal plants as antimalarial agents: a review of work done at Kenya Medical Research Institute. *Front Pharmacol.* 2023;14:1268924. <https://doi.org/10.3389/fphar.2023.1268924>
- 67) Omara T. Plants used in antivenom therapy in rural Kenya: ethnobotany and future perspectives. *J Toxicol.* 2020;2020:1828521. <https://doi.org/10.1155/2020/1828521>
- 68) Omara T, Nakiguli CK, Naiyl RA, Opondo FA, Otieno SB, Ndiege ML, et al. Medicinal plants used as snake venom antidotes in East African community: review and assessment of scientific evidences. *J Med Chem Sci.* 2021;4:107–44. <https://doi.org/10.26655/JMCHEMSCI.2021.2.4>
- 69) Carr JD, Rogers CB. Chemosystematic studies of the genus *Combretum* (Combretaceae). I. A convenient method of identifying species of this genus by a comparison of the polar constituents extracted from leaf material. *S Afr J Bot.* 1987;53(2):173–6. [https://doi.org/10.1016/S0254-6299\(16\)31454-5](https://doi.org/10.1016/S0254-6299(16)31454-5)
- 70) Rogers CB. New mono- and bidesmosidic triterpenoids isolated from *Combretum padoides* leaves. *J Nat Prod.* 1989;52(3):528–33. <https://doi.org/10.1021/np50063a011>
- 71) Angeh JE, Huang X, Swan GE, Möllman U, Sattler I, Eloff JN. Novel antibacterial triterpenoid from *Combretum padoides* (Combretaceae). *Arkivoc.* 2007;9:113–20.
- 72) Mathipa MM, Mphosi MS, Masoko P. Phytochemical profile, antioxidant potential, proximate and trace elements composition of leaves, stems and ashes from 12 *Combretum* spp. used as food additives. *Int J Plant Biol.* 2022;13:561–78. <https://doi.org/10.3390/ijpb13040045>
- 73) McGregor J. Woodland resources: ecology, policy and ideology. An historical case study of woodland use in Shurugwi communal area, Zimbabwe. Loughborough: PhD thesis, Loughborough University of Technology; 1991.
- 74) Geng Y, Ranjitkar S, Yan Q, He Z, Su B, Gao S, et al. Nutrient value of wild fodder species and the implications for improving the diet of mithun (*Bos frontalis*) in Dulongjiang area, Yunnan province, China. *Plant Diversity.* 2020;42(6):455–63. <https://doi.org/10.1016/j.pld.2020.09.007>
- 75) Eloff JN. The antibacterial activity of 27 Southern African members of the Combretaceae. *S Afr J Sci.* 1999;95:148–52.
- 76) Fyhrquist P, Mwasumbi L, Hæggström C-A, Vuorela H, Hiltunen R, Vuorela P. Ethnobotanical and antimicrobial investigation of some species of *Terminalia* and *Combretum* (Combretaceae) growing in Tanzania. *J Ethnopharmacol.* 2002;79:169–77. [https://doi.org/10.1016/S0378-8741\(01\)00375-0](https://doi.org/10.1016/S0378-8741(01)00375-0)
- 77) Ahmed AS, McGaw LJ, Elgorashi EE, Naidoo V, Eloff JN. Polarity of extracts and fractions of four *Combretum* (Combretaceae) species used to treat infections and gastrointestinal disorders in southern African traditional medicine has a major effect on different relevant *in vitro* activities. *J Ethnopharmacol.* 2014;154:339–50. <https://doi.org/10.1016/j.jep.2014.03.030>
- 78) Anokwuru CP, Sandasi M, Chen W, Van Vuuren S, Elisha IL, Combrinck S, et al. Investigating antimicrobial compounds in South African Combretaceae species using a biochemometric approach. *J Ethnopharmacol.* 2021;269:113681. <https://doi.org/10.1016/j.jep.2020.113681>
- 79) Masoko P, Picard J, Eloff JN. The antifungal activity of twenty-four southern African *Combretum* species (Combretaceae). *S Afr J Bot.* 2007;73:173–83. <https://doi.org/10.1016/j.sajb.2006.09.010>
- 80) McGaw LJ, Rabe T, Sparg SG, Jäger AK, Eloff JN, Van Staden J. An investigation on the biological activity of *Combretum* species. *J Ethnopharmacol.* 2001;75:45–50. [https://doi.org/10.1016/S0378-8741\(00\)00405-0](https://doi.org/10.1016/S0378-8741(00)00405-0)

Additional information

Peer review: Publisher thanks the Sectional Editor and anonymous reviewers for their contribution to the peer review of this work.

Reprints & permissions information: Available at https://horizonpublishing.com/journals/index.php/PST/open_access_policy.

Publisher's Note: Horizon e-Publishing Group remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.

Indexing: See https://horizonpublishing.com/journals/index.php/PST/indexing_abstracting.

Copyright: © The Author(s). This is an open-access article distributed under the Creative Commons Attribution License CC BY 4.0.

Publisher information: Plant Science Today is published by Horizon e-Publishing Group with support from Empirion Publishers Private Limited, Thiruvananthapuram, India.

