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Review Article
Ethnopharmacology and Therapeutic Value of *Clematis brachiata* Thunb. (Family: Ranunculaceae): A Narrative Review

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Abstract

Clematis brachiata Thunb. is a widely recognized medicinal plant commonly utilized across tropical Africa. This review consolidates information on the medicinal applications and pharmacological activities of *C. brachiata*. Data regarding its traditional uses and ethnopharmacological significance were sourced from various platforms, including Google Scholar, Web of Science, ScienceDirect®, Scopus®, SpringerLink®, PubMed® and SciELO, as well as older printed literature available in the university library. The findings highlight the use of different parts of *C. brachiata*, such as branches, flowers, leaf juice, leaves, root bark, roots, shoots, stem bark, stems and the entire plant, for various purposes. These include serving as a vermifuge, in charms and rituals and traditional remedies for conditions like back pain, eye disorders, fever, febrile illnesses, gastrointestinal issues, headaches, malaria, respiratory problems, skin infections, snakebites, sexually transmitted infections and sores. Chemical compounds identified from *C. brachiata* include tannins, saponins, flavonoids, terpenoids, steroids and cardiac glycosides. The crude extracts of *C. brachiata* flowers, leaves, roots, root bark, stems and whole plants exhibited acaricidal, analgesic, antihelmintic, antibacterial, antifungal, anti-inflammatory, antileishmanial, antioxidant, antiplasmodial and antipyretic activities. Future studies should focus on detailed ethnopharmacological evaluation of *C. brachiata*, particularly its phytochemistry, pharmacological properties and toxicological evaluations, *in vivo* and clinical research.

Key words: Buttercup family, *Clematis brachiata*, materia medica, Ranunculaceae, traditional medicine, tropical Africa

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Competing Interest: The author has declared that no competing interest exists.

Data Availability: All relevant data are within the paper and its supporting information files.

INTRODUCTION

Clematis brachiata Thunb. (Fig. 1), commonly known as "Old man's beard" "Traveler's joy" or "Wild clematis" is a member of the cosmopolitan Ranunculaceae or Buttercup family. The family Ranunculaceae consists of approximately 2500 species distributed in about 60 genera and these taxa are mostly woody vines, small shrubs or herbs exhibiting the largest diversity in the wet temperate regions but extending their distribution into the tropics[1,2]. Species belonging to the Ranunculaceae family have demonstrated anti-inflammatory, anthelmintic, analgesic, antibacterial, antifungal, antiparasitic, antioxidant, antiproliferative and antitumor properties[1,3]. Similarly, species belonging to the genus *Clematis* L. are characterized by triterpene saponins, alkaloids, flavonoids, lignans, steroids, coumarins, macrocyclic compounds, anthocyanins, phenolics, volatile oils and glycosides[1,4,5]. The genus *Clematis* consists of approximately 385 perennial species, which are mostly woody climbing lianas, scramblers or vines[4,6]. The leaves, roots and stems of *C. brachiata* are widely sold as sources of traditional medicines in the Eastern Cape, KwaZulu Natal and Mpumalanga Provinces in South Africa[7-9]. Due to its medicinal properties, *C. brachiata* is, therefore, cultivated as a medicinal plant in some home gardens in KwaZulu Natal Province in South Africa[10]. *Clematis brachiata* is recognized as a significant medicinal plant in Southern Africa and is featured in the monograph titled "Medicinal and magical plants of Southern Africa: An Annotated Checklist[11]". Beyond its medicinal value, this versatile climber serves multiple purposes, with its branches commonly utilized in crafting and basketry[10]. Additionally, the stems are often fashioned into stirring sticks[10].

In Ethiopia, the whole plant parts of *C. brachiata* are thrown into dirty water to purify the water and the leaves are also used as pesticides[12]. In the Central African Republic, the roots of *C. brachiata* are mixed with those of *Cryptolepis nigrescens* (Wennberg) L. Joubert & Bruyns (Family Apocynaceae) as arrow poison to hunt small game[12]. In South Africa, the leaves of *C. brachiata* are used as a food flavoring and/or preservative[13]. *Clematis brachiata* is an attractive and successful ornamental and garden plant, easily grown from seed or cuttings and ideal for private gardens and parking areas[10]. In this context, the study was conducted to gather comprehensive information on the medicinal applications and ethnopharmacological properties of *C. brachiata*.

MATERIALS AND METHODS

The literature search on medicinal uses and ethnopharmacological properties of *Clematis brachiata* was conducted from December, 2023 to October, 2024. This information on these aspects was obtained using online databases such as Google Scholar, Web of Science, ScienceDirect®, Scopus®, SpringerLink®, PubMed® and SciELO. Additional information on the medicinal uses and ethnopharmacological properties of *Clematis brachiata* was also obtained by a systematic search of various resources that are not covered by electronic databases and these included journal papers, books, dissertations, book chapters, thesis and other scientific articles obtained from the university library. The keywords used in the search included "*C. brachiata*", the synonyms of the species "*Clematis brachiata* Thunb.", English common names "Old man's beard", "Traveler's joy" and "Wild clematis". An additional search was also conducted using the keywords "Biological Activities of *Clematis brachiata*", "Pharmacological Properties of *Clematis brachiata*", "Ethnobotany of *Clematis brachiata*", "Medicinal Uses of *Clematis brachiata*", "Phytochemistry of *Clematis brachiata*" and "Traditional Uses of *Clematis brachiata*".

RESULTS AND DISCUSSION

Morphological description and taxonomy of *Clematis brachiata*: The genus name *Clematis* is derived from the Greek word *klematis* which means "A vine" or "A climbing plant". The species name *brachiata* is derived from the Latin word *brachiatus* which means "Branched at right angles" or "having arm-like branches at right angles to one another" about the side branches of the species which come off at right angles to the stem. The synonyms of *C. brachiata* include *C. biloba* Steud., *C. brachiata* Ker Gawl., *C. brachiata* Thunb. var. *burkei* Burtt Davy, *C. comosa* DC., *C. glaucescens* C.Presl., *C. kerrii* Steud., *C. massoniana* DC., *C. orientalis* L. subsp. *brachiata* (Thunb.) Kuntze, *C. orientalis* L.f. *massoniana* (DC.) Kuntze, *C. orientalis* L. var. *subglabra* Kuntze, *C. oweniae* Harv., *C. petersiana* Klotzsch, *C. stewartiae* Burtt Davy, *C. stewartiae* Burtt Davy var. *wilmsii* Burtt Davy, *C. thunbergii* Steud., *C. thunbergii* Steud. var. *congensis* A.Chev., *C. tibestica* Quézel, *C. triloba* Thunb. and *C. triloba* Thunb. var. *congensis* (A.Chev.)[14,15].

Clematis brachiata is a vigorous woody, deciduous climber or scrambler reaching 6 m in height with petiole or leaf rachis twining around any available support object[10].

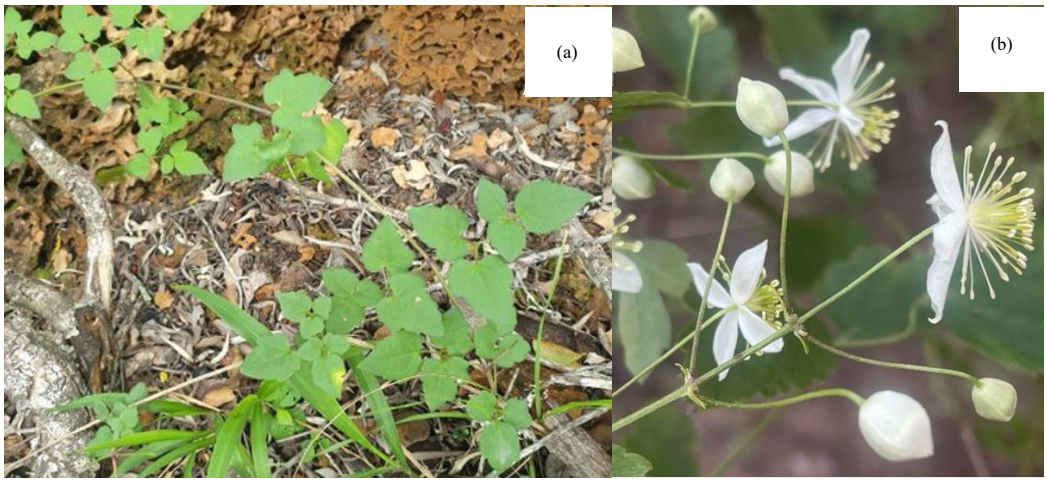

Fig. 1(a-b): *Clematis brachiata*, (a) General habitat of the species and (b) Branch showing flowers

The stem is woody with deep furrows, young branches are hairy and ribbed and the bark is grey in color and flaking. The leaves are compound, opposite, petiolulate, coarsely-toothed and scattered up the stem (Fig. 1a). The leaflets are papery, ovate to rhombic, base cuneate, apex acute or attenuate, upper surface glabrous and lower surface sparsely pubescent. The inflorescence is large and attractive and flowers are dull white (Fig. 1b) with yellow anthers, sweet-scented and hairy, occurring in clusters and terminal panicles. The fruit is a small dry achene, many formed per flower and each fruit is topped by a silky, hairy and persistent style that has the appearance of soft wool. *Clematis brachiata* has been recorded in Angola, Botswana, Burundi, Cameroon, Central African Republic, Chad, Congo, Eswatini, Ethiopia, Kenya, Lesotho, Madagascar, Malawi, Mozambique, Namibia, Rwanda, Senegal, Somalia, South Africa, Tanzania, Zambia and Zimbabwe. *Clematis brachiata* has been recorded in forest margins, montane forest, woodland, wooded grassland, on rocky hillsides, kloofs and watercourses at an altitude ranging from 400 to 2450 m above sea level[14,15]. *Clematis brachiata* is often seen from the roadside, climbing onto trees or scrambling over bushes, fences or rocks or sometimes trailing in the bushes and grasses[10]. Morphologically, *C. brachiata* is similar to *C. hirsuta* Perr. & Guill. as both species are characterized by numerous small white flowers[15]. However, leaf characters and geographical distribution data can be used to distinguish the two species[15].

Medicinal uses of *Clematis brachiata*: Throughout tropical Africa, *C. brachiata* is used as a traditional medicine (Table 1). In traditional medicine, the branches, flowers, leaf juice, leaves, root bark, roots, shoots, stem bark, stems and whole plant parts of *C. brachiata* are used against 58 human and animal diseases and ailments (Table 1). The medicinal uses of *C. brachiata* have been recorded in Botswana, Eswatini, Kenya, Lesotho, Mozambique, Namibia, South Africa, Tanzania, Zambia and Zimbabwe, representing 54.5% of the countries where *C. brachiata* is indigenous. The main ailments and diseases treated by *C. brachiata* crude extracts include its use as vermifuge, charm and rituals and traditional medicine against backache, eye problems, febrile illness, fever, gastro-intestinal problems, headache, malaria, respiratory problems, skin infections, snakebites, sexually transmitted infections and sores (Fig. 2). Majority of literature sources documented medicinal applications of *C. brachiata* as traditional medicine against respiratory infections, followed by headache, gastrointestinal problems, malaria and sexually transmitted infections (Fig. 2). This study also showed that at least two literature sources documented usage of *C. brachiata* as charm and for rituals, vermifuge and traditional medicine against eye problems, febrile illness, fever, skin infections and snakebites in at least two countries for each disease or ailment (Fig. 2). In South Africa, the leaves and stems of *C. brachiata* are mixed with those of *Lippia javanica* (Burm.f.) Spreng. (Family Verbenaceae) as traditional medicine for blocked noses, chest pains and cough[16,17]. Similarly, the whole plant parts of *C. brachiata* are mixed with those of *Bidens pilosa* L. (Family Asteraceae), *Ranunculus multifidus* Forssk. (Family Ranunculaceae) and *Sarcophyte sanguinea* Sparrm. (Family Balanophoraceae) as a remedy for genital sores and warts[18]. In Zimbabwe, the roots of *C. brachiata* are mixed with those of *Julbernardia globiflora* (Benth.) Troupin (Family Fabaceae) as a remedy for diarrhoea[19]. The roots of *C. brachiata* are mixed with *Berkheya setifera* DC. (Family Asteraceae) as a remedy for syphilis[20] or seeds of *Solanum aculeastrum* Dunal (Family Solanaceae) as a remedy for gonorrhoea and syphilis[21].

Table 1: Medicinal uses of *Clematis brachiata*

Medicinal use	Part used	Country	References
Mono-therapeutic applications			
Abortifacient	Leaf juice taken orally	Burundi and Rwanda	Neuwinger[12]
Allergies	Not specified	South Africa	Mhlongo and van Wyk[22]
Arthritis	Root decoction applied topically	Kenya	Murigi *et al.*[23]
Backache	Roots decoction taken orally	Kenya and South Africa	Amuka *et al.*[21]; Mhlongo and van Wyk[22]
Bilharzia	Leaves and stems	South Africa	Spargs *et al.*[24]
Blisters	Leaf decoction or infusion applied topically	South Africa	Watt and Breyer-Brandwijk[25]
Blood problems	Leaf decoction taken orally	Botswana	Watt and Breyer-Brandwijk[25]
Charm to drive away evil spirits	Not specified	Lesotho and South Africa	Moteetee and van Wyk[20]
Dizziness	Leaf decoction taken orally	Tanzania	Kingo and Maregesi[26]
Ear infections	Steam from boiled leaves inhaled	Kenya	Njoroge and Bussmann[27]
Elephantiasis	Whole plant decoction or infusion applied topically	South Africa	Adams *et al.*[28]
Eye problems	Leaf juice applied topically	Namibia, South Africa and Tanzania	York *et al.*[16]; Kingo and Maregesi[26]; Pendota *et al.*[29]
Febrile illness	Leaf juice or macerate taken orally	Rwanda and Tanzania	Neuwinger[12]; Okalebo *et al.*[30]
Fever	Leaf decoction taken orally	South Africa and Zambia	Neuwinger[12]; York *et al.*[16]; Mhlongo and van Wyk[22]; Chinsembu[31]
Gastro-intestinal problems (abdominal disorders, diarrhoea, stomach cramps and problems)	Leaf, leaf juice, root, stem decoction, infusion or macerate taken orally	Burundi, Kenya, South Africa and Tanzania	Neuwinger[12]; Mhlongo and van Wyk[22]; Watt and Breyer-Brandwijk[25]; Okalebo *et al.*[30]; Chhabra *et al.*[32,33]
Headache	Leaf, root, stem or whole plant decoction or infusion taken orally or boiled and steam inhaled	Kenya, South Africa, Tanzania, Zambia and Zimbabwe	York *et al.*[16]; Watt and Breyer-Brandwijk[25]; Kingo and Maregesi[26]; Okalebo *et al.*[30]; Chinsembu[31]; Liengme[34]; Arnold and Gulumian[35]; Semenya and Maroyi[36-38]
Heatstroke or sunstroke	Leaf decoction applied topically	South Africa	Watt and Breyer-Brandwijk[25]
Herpes	Root and stem decoction of infusion applied topically	South Africa	Watt and Breyer-Brandwijk[25]
Hiccough	Root powder sniffed	Zimbabwe	Gelfand *et al.*[19]
Impotency	Leaf decoction taken orally	Tanzania	Kingo and Maregesi[26]
Inflammation	Whole plant decoction or infusion applied topically	South Africa	Adams *et al.*[28]
Joint pains	Leaf decoction applied topically	Tanzania	Kingo and Maregesi[26]
Leprosy	Whole plant decoction applied topically	Rwanda	Nwude and Ebong[39]
Malaria	Leaf, leaf juice, root, root bark stem or stem bark decoction or infusion or macerate taken orally	Kenya, Mozambique, Rwanda, South Africa and Tanzania	Neuwinger[12]; Watt and Breyer-Brandwijk[25]; Okalebo *et al.*[30]; Chhabra *et al.*[33]; Koch *et al.*[40]; Muthaura *et al.*[41,42]
Menstrual problems	Not specified	South Africa	Mhlongo and van Wyk[22]
Nose infections	Stem from boiled leaves inhaled	Kenya	Njoroge and Bussmann[27]
Oral thrush	Root or stem decoction applied topically	South Africa	Watt and Breyer-Brandwijk[25]
Pain	Leaf or whole plant decoction or infusion applied topically	South Africa	Adams *et al.*[28]
Respiratory infections (asthma, blocked and runny nose, chest pains, colds, congested nasal passages, cough, influenza, sinusitis, sore throat and tuberculosis)	Branch, leaf, root, stem or whole plant decoction or infusion taken orally or smoke or steam from boiled or burnt parts inhaled	Kenya, Lesotho, Mozambique, South Africa, Tanzania and Zambia	Zobolo and Mkabela[10]; York *et al.*[16]; Mhlongo and van Wyk[22]; Watt and Breyer-Brandwijk[25]; Njoroge and Bussmann[27]; Okalebo *et al.*[30]; Chinsembu[31]; Chhabra *et al.*[33]; Liengme[34]; Semenya and Maroyi[37,38,43-45]; Conde *et al.*[46]; Seleteng-Kose *et al.*[47,48]; van Vuuren *et al.*[49]; Sitoe and van Wyk[50]
Sexually transmitted infections (gonorrhea, syphilis and venereal diseases)	Branch, flower, leaf, root and stem decoction or infusion taken orally	Eswatini, Kenya, Lesotho, Rwanda, South Africa and Tanzania	Asowata-Ayodele *et al.*[13]; Watt and Breyer-Brandwijk[25]; Chhabra *et al.*[33]; Seleteng-Kose *et al.*[51]
Skin problems (cleaning, cosmetic, diseases, rashes and wrinkles)	Leaf juice, leaves, roots and whole plant pounded and applied topically	Kenya, Lesotho, Rwanda, South Africa and Tanzania	Neuwinger[12]; Mhlongo and van Wyk[22]; Watt and Breyer-Brandwijk[25]; Okalebo *et al.*[30]; Nwude and Ebong[39]; Afolayan *et al.*[52]
Snakebites	Leaf, root and stem decoction applied topically	South Africa and Tanzania	Watt and Breyer-Brandwijk[25]; Chhabra *et al.*[33]
Sores	Leaf decoction applied topically	Botswana and South Africa	Mhlongo and van Wyk[22]; Watt and Breyer-Brandwijk[25]

Table 1: Continue

Medicinal use	Part used	Country	References
Toothache	Leaf or stem decoction applied topically	Kenya	Okalebo *et al.*[30]
Tonic	Not specified	South Africa	Mhlongo and van Wyk[22]
Vermifuge	Leaf infusion taken orally	Lesotho and South Africa	Moteetee and van Wyk[20]; Watt and Breyer-Brandwijk[25]
Yaws	Leaf or stem decoction applied topically	Kenya	Okalebo *et al.*[30]
Ethnoveterinary medicine			
Bile acid malabsorption	Root infusion	South Africa	Motsoari *et al.*[53]
Parasites (*Gasterophilus intestinalis* horse bot fly)	Leaf and shoot infusions	South Africa	Watt and Breyer-Brandwijk[25]; McGaw and Eloff[54]
Sores on ears	Roots and stems	South Africa	McGaw and Eloff[54]
Sores on horses	Leaves	South Africa	McGaw and Eloff[54]
Vermifuge in horses	Leaf and shoot infusions	South Africa	Watt and Breyer-Brandwijk[25]; McGaw and Eloff[54]
Used in combination with other species			
Blocked nose, chest pains and cough	Leaves and stems mixed with *Lippia javanica* (Burm.f.) Spreng. (Family Verbenaceae)	South Africa	York *et al.*[16]; Maroyi[17]
Diarrhea	Roots mixed with those of *Julbernardia globiflora* (Benth.) Troupin (Family Fabaceae)	Zimbabwe	Gelfand *et al.*[19]
Genital sores and warts	The whole plant mixed with *Bidens pilosa* L. (Family Asteraceae), *Ranunculus multifidus* Forssk. (Family Ranunculaceae) and *Sarcophyte sanguinea* Sparrm. (Family Balanophoraceae)	South Africa	de Wet *et al.*[18]
Gonorrhea and syphilis	Roots mixed with seeds of *Solanum aculeastrum* Dunal (Family Solanaceae)	Kenya	Amuka *et al.*[21]
Syphilis	Roots mixed with those of *Berkheya setifera* DC. (Family Asteraceae)	Lesotho and South Africa	Moteetee and van Wyk[20]

PHARMACOLOGICAL PROPERTIES OF *CLEMATIS BRACHIATA*

Qualitative phytochemical analysis of *C. brachiata* leaves revealed the presence of tannins, saponins, flavonoids, terpenoids, steroids and cardiac glycosides[55,56]. The crude extracts of *C. brachiata* flowers, leaves, roots, root bark, stems and whole plants exhibited acaricidal, analgesic, antihelmintic, antibacterial, antifungal, anti-inflammatory, antileishmanial, antioxidant, antiplasmodial and antipyretic activities.

Acaricidal activities: Fouche *et al.*[57] evaluated the acaricidal activities of acetone and ethanol extracts of *C. brachiata* whole plants using the contact method on *Rhipicephalus turanicus* ticks at a concentration of 200.0 mg/mL. The acetone and ethanol extracts exhibited mortality of 60.0 and 53.0%, respectively.

Analgesic activities: Mostafa *et al.*[55] evaluated the analgesic activities of aqueous extracts of *C. brachiata* leaves using the acetic acid writhing, formalin-induced pain and tail immersion test models in male albino rats of Wistar strain with indomethacin as a positive control. The extract at 400.0 mg/kg body weight exhibited analgesic activities.

Antihelmintic activities: Sparg *et al.*[24] evaluated the antihelmintic activities of crude extracts of *C. brachiata* leaves and stems against schistosomule of the species *Schistosoma haematobium*. The crude extracts at 25.0 mg/mL killed 66.7% of schistosomula worms after 1 hr and the extracts were 100.0% lethal at 12.5 mg/mL.

Antibacterial activities: Pretorius *et al.*[58] evaluated the antibacterial activities of crude extracts of *C. brachiata* leaves at a concentration of 50.0 mg/mL against *Pseudomonas solanacearum* and *Clavibacter michiganensis* pv. *michiganensis* using the agar diffusion assay with dimethyl dodecyl ammonium chloride as a positive control. The extract showed activities against the tested pathogens by exhibiting inhibition zone of 7.0 mm. York *et al.*[59] assessed the antibacterial activities of dichloromethane:methanol (1:1) extracts of *C. brachiata* leaves and stems against *Mycobacterium smegmatis*, *Klebsiella pneumoniae*, *Moraxella catarrhalis* and *Staphylococcus aureus* using the microdilution method with ciprofloxacin as the positive control. The extract exhibited activities against the tested pathogens with minimum inhibitory concentration (MIC) values ranging from 2.0 mg/mL to >16.0 mg/mL. Mostafa and Afolayan[60] evaluated the antibacterial activities of acetone

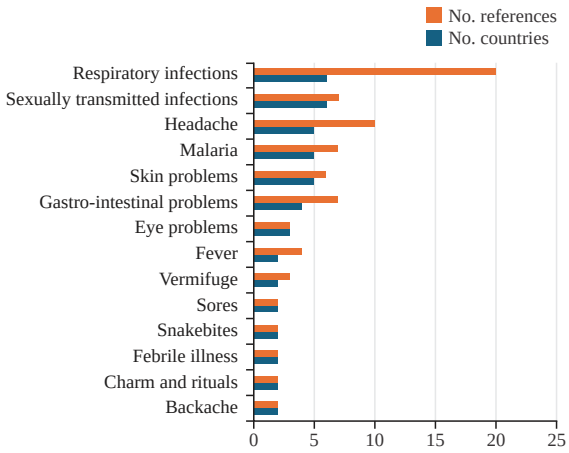

Fig. 2: Main medicinal applications of *Clematis brachiata* in tropical Africa

and methanol extracts of *C. brachiata* leaves against *Staphylococcus epidermidis*, *Staphylococcus aureus*, *Serratia marcescens*, *Bacillus cereus*, *Shigella flexneri*, *Klebsiella pneumoniae*, *Streptococcus faecalis*, Pseudomonas aeruginosa, *Micrococcus kristinae* and *Escherichia coli* using the agar dilution method with chloramphenicol and streptomycin as positive controls. The extracts exhibited activities against the tested pathogens with MIC values ranging from 2.0 to 3.0 mg/mL. Naidoo *et al.*[61] evaluated the antibacterial activities of dichloromethane:methanol (1:1) and water extracts of *C. brachiata* leaves against *Gardnerella vaginalis*, *Oligella ureolytica*, *Neisseria gonorrhoeae*, *Ureaplasma urealyticum* and *Trichomonas vaginalis* using the micro-titer plate dilution assay with ciprofloxacin as a positive control. The extracts exhibited activities against the tested pathogens exhibiting MIC values ranging from 1.0 mg/mL to >16.0 mg/mL. Akhalwaya *et al.*[62] evaluated the antibacterial activities of dichloromethane:methanol (1:1) and water extracts of *C. brachiata* flowers, leaves, roots and stems against *Streptococcus sanguis*, *Streptococcus mutans*, *Lactobacillus casei*, *Lactobacillus acidophilus*, *Fusobacterium nucleatum* and *Porphyromonas gingivalis* using the microtiter plate microdilution method with ciprofloxacin as a positive control. The extracts exhibited activities against the tested pathogens with M IC values ranging from 0.67 mg/mL to >8.0 mg/mL.

Antifungal activities: York *et al.*[59] assessed the antifungal activities of dichloromethane:methanol (1:1) and water extracts of *C. brachiata* leaves and stems against *Cryptococcus neoformans* using the microdilution method with amphotericin B as the positive control. The organic and water extracts exhibited activities against the tested pathogens with MIC values of 1.0 and 4.0 mg/mL, respectively. Mostafa and Afolayan[60] evaluated the antifungal activities of acetone and methanol extracts of *C. brachiata* leaves against *Aspergillus flavus*, *Aspergillus niger*, Candida albicans and *Penicillium notatum* using the agar dilution method. The extracts exhibited activities at 10.0 mg/mL against the tested pathogens. Naidoo *et al.*[61] evaluated the antifungal activities of dichloromethane:methanol (1:1) extracts of *C. brachiata* leaves against *Candida albicans* using the micro-titer plate dilution assay with amphotericin B as a positive control. The extract exhibited activities against the tested pathogen exhibiting a MIC value of 1.0 mg/mL. Akhalwaya *et al.*[62] evaluated the antifungal activities of dichloromethane: methanol (1:1) and water extracts of *C. brachiata* flowers, leaves, roots and stems against *Candida glabrata, Candida albicans* and *Candida krusei* using the microtiter plate microdilution assay with amphotericin B as a positive control. The extracts exhibited activities against the tested pathogens with MIC values ranging from 0.33 mg/mL to >8.0 mg/mL.

Anti-inflammatory activities: Jäger *et al.*[63] assessed the anti-inflammatory properties of ethanolic extracts derived from *C. brachiata* stems through an *in vitro* assay targeting cyclooxygenase inhibitors, using indomethacin as a reference. The extract demonstrated notable activity, achieving 73.0% inhibition, which surpassed the 66.5% inhibition observed with the positive control. Mostafa *et al.*[55] evaluated the anti-inflammatory activities of aqueous extracts of *C. brachiata* leaves using the carrageenan and histamine-induced edema models in male albino rats of Wistar strain with indomethacin as a positive control. The extract at 400.0 mg/kg body weight exhibited anti-inflammatory activities.

Antileishmanial activities: Bapela *et al.*[64] evaluated the antileishmanial activities of dichloromethane extracts of *C. brachiata* roots against *Leishmania donovani* with miltefosine as a positive control. The extracts exhibited activities with a half-maximal Inhibitory Concentration (IC_{50}) value of 10.5 µg/mL.

Antioxidant activities: Twilley *et al.*[65] investigated the antioxidant properties of ethanol extracts derived from *C. brachiata* leaves. The evaluation was conducted using the 2,2-diphenyl-1-picrylhydrazyl (DPPH) free radical scavenging assay, with ascorbic acid serving as the reference standard. The study reported an IC_{50} value of 75.9 µg/mL for the extract. Mostafa *et al.*[56] evaluated the antioxidant activities of methanol extract of *C. brachiata* leaves using the 2,2-azinobis [3-ethylbenzothiazoline-6-sulfonic acid] diammonium (ABTS) and DPPH free radical scavenging assays with butylated hydroxytoluene (BHT) as a positive control. The extract exhibited activities with IC_{50} values of 60.0 and 180.5 µg/mL against ABTS and DPPH, respectively.

Antiplasmodial activities: Okalebo *et al.*[30] evaluated the antiplasmodial activities of methanol extract of *C. brachiata* roots using the [3H]-hypoxanthine incorporation assay against the multidrug-resistant strain *Plasmodium falciparum* VI/S with chloroquine diphosphate as a positive control. The extract showed activities with an IC_{50} value of 39.2 µg/mL. Clarkson *et al.*[66] evaluated the antiplasmodial activities of dichloromethane and methanol (1:1) extracts of *C. brachiata* flowers, leaves and stems against the chloroquine-sensitive strain (D10) of *Plasmodium falciparum* using the parasite lactate dehydrogenase (pLDH) assay with chloroquine diphosphate as a positive control. The extract exhibited activities with an IC_{50} value of 20.0 µg/mL. Koch *et al.*[40] evaluated the antiplasmodial activities of methanol extract of *C. brachiata* root bark using the [3H]-hypoxanthine incorporation assay against chloroquine-sensitive *Plasmodium falciparum* strain with chloroquine as a positive control. The extract showed activities with IC_{50} value of 39.2 µg/mL. Bapela *et al.*[67,68] conducted a study to assess the antiplasmodial properties of a dichloromethane extract derived from *C. brachiata* roots. The investigation employed the [3H]-hypoxanthine incorporation assay to evaluate the extract's activity against the chloroquine-sensitive *Plasmodium falciparum* NF54 strain, using chloroquine diphosphate as a positive control. The extract demonstrated notable activity, with an IC value of 5.4 µg/mL. Similarly, Muthaura *et al.*[41] analyzed the antiplasmodial potential of water extracts obtained from the root bark of *C. brachiata*. Their research targeted the chloroquine-resistant W2 strain of *P. falciparum* using a semi-automated micro-dilution method, which quantifies the inhibition of (3H)-hypoxanthine uptake by the parasite. In this case, the extract showed weak activity, recording an IC value of 96.5 µg/mL.

Antipyretic activities: Mostafa *et al.*[55] evaluated the antipyretic activities of an aqueous extract of *C. brachiata* leaves using Brewer's yeast-induced hyperthermia in male albino rats of the Wistar strain with indomethacin as a positive control. The extract, at 400.0 mg/kg body weight, exhibited antipyretic activities.

CONCLUSION

The current study provides a summary of the medicinal and pharmacological properties of *C. brachiata.* Such evaluations are important as *C. brachiata* is widely used in traditional medicine throughout its distributional range in tropical Africa. However, future studies should focus on detailed phytochemical studies of the species, as well as toxicological, *in vivo* and clinical research aimed at corroborating the traditional medicinal applications of the species. There is also a need to assess the combinational effects of *C. brachiata* extracts with other plant species such as *B. pilosa*, *B. setifera*, *J. globiflora*, *L. javanica*, *R. multifidus*, *S. aculeastrum* and *S. sanguinea.*

SIGNIFICANCE STATEMENT

This study contributes to the existing traditional knowledge about medicinal applications of *C. brachiata* that could be useful in bio-prospecting for new health-promoting and pharmaceutical products. Compilation of the medicinal applications and biological activities of *C. brachiata* is an important step towards the identification of knowledge gaps required to corollate the medicinal applications of the species with its ethnopharmacological properties. Therefore, future studies on *C. brachiata* should focus on conducting detailed phytochemical evaluations, pharmacological properties and toxicological evaluations of the species, *in vivo* and clinical research aimed at corroborating the medicinal applications of the species.

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