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Cissampelos torulosa (Menispermaceae): a synthesis and review of its botany, medicinal uses and biological activities

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Abstract

Cissampelos torulosa is a slender climber widely used as herbal medicine in southern Africa. The current study critically reviewed the botany, medicinal uses and biological activities of *C. torulosa*. Literature on botany, medicinal uses and biological activities of *C. torulosa* was collected from multiple internet sources including Elsevier, Google Scholar, SciFinder, Web of Science, Pubmed, BMC, Science Direct and Scopus. Complementary information was gathered from pre-electronic sources such as books, book chapters, theses, scientific reports and journal articles obtained from the University library. This study revealed that the species is used to induce labour, for hallucinations and ritual purification, and herbal medicine for kidney problems, swellings, hematemesis, syphilis, gastro-intestinal problems, respiratory problems and toothache. Ethnopharmacological research showed that the crude extracts of the species have anti-amoebic, antibacterial, antifungal, cytotoxicity and toxicity activities. *Cissampelos torulosa* should be subjected to detailed phytochemical, pharmacological and toxicological evaluations aimed at correlating its medicinal uses with its phytochemistry and pharmacological activities.

Keywords: *Cissampelos torulosa*, herbal medicine, indigenous knowledge, Menispermaceae, southern Africa

INTRODUCTION

Cissampelos torulosa E. Mey. ex Harv. is a slender climber belonging to the Menispermaceae or moonseed family. The family Menispermaceae consists of approximately 70 genera and 450 species distributed throughout the tropics.[1-6] The family Menispermaceae contains a wide range of biologically active bisbenzylisoquinoline alkaloids and therefore, used in traditional medicines in the tropics.[7-10] The family is also characterized by various pharmacological activities which include anthelmintic, antibacterial, antifungal, antiviral, antiplasmodial, cytotoxic, analgesic, antipyretic, anti-inflammatory, anti-allergic, bronchodilator, immunomodulatory, memory-enhancing, antidepressant, histamine release inhibition, neuroprotective, antimalarial, antiparasitic, anti-ulcer, anticancer, antioxidant, cardiovascular, inhibition of antinociceptive, muscle-relaxant, antipsychotic, immunomodulating, hepatoprotective, antidiabetic, antidiarrhoeal, acetylcholinesterase (AChE) inhibitory, antifertility and antivenom.[10-16] The genus *Cissampelos* L. consists of mainly climbers or rarely erect shrubs or perennial herbs of approximately 20 species in north and south America, Africa and Asia.[1] The species belonging to the genus *Cissampelos* have a long history of traditional use as herbal medicines throughout the distributional range of the genus.[14] The species are used for a wide range of therapeutic applications which include asthma, cough, fever, arthritis, obesity, dysentery, snakebite, jaundice and heart, blood pressure and skin-related problems.[14] In southern Africa, four closely related *Cissampelos* species, *C. capensis* L.f., *C. hirta* Klotzsch, *C. mucronata* A.Rich. and *C. torulosa* are widely used as traditional medicines.[17-26] The leaves and stems of *C. torulosa* are sold as herbal medicines in informal herbal medicine markets in Gauteng and KwaZulu Natal provinces in South Africa.[27-29] The leaves of *C. torulosa* are collected from the wild and used as leafy vegetables in the Limpopo province in South Africa.[30-32] *Cissampelos torulosa* appears to be an important food plant and source of traditional medicines within its distributional range in southern Africa, and therefore, there is need for formal documentation and systematic research which is beneficial to indigenous and traditional systems of herbal medicine. It is within this context that this review was undertaken aimed at reviewing the botany, medicinal uses and biological activities of *C. torulosa* so as to provide baseline data required in evaluating the therapeutic potential of the species.

Botanical profile of *Cissampelos torulosa*

The genus name *Cissampelos* is derived from the Greek words “kissos” meaning “ivy” and “ampelos” meaning “vine” or “climber” in reference to the species of genus *Cissampelos* being confused with species of the genus ivy (*Hedera* L., family Araliaceae) as both plant groups are climbers or creepers.[33,34] The specific epithet “*torulosa*” is derived from the Latin word “torulus” meaning little bumps in reference to small swellings associated with the species.[35] The English common name of the species is “kidney-leaf” in reference to kidney-shaped leaves. Synonyms associated with the name *C. torulosa* include *Menispermum capense* Thunb., *C. torulosa* E.Mey., *C. torulosa* E.Mey. ex Harv. & Sond., *C. truncata* Engl., *C. truncatus* Engl. and *C. wildemaniana* Van de Bossche ex De Wild.[36-40] *Cissampelos torulosa* is a perennial, dioecious, sparsely hairy to glabrescent vine, reaching 15 m in length.[36-39] *Cissampelos torulosa* is a slender climber with a woody rootstock. The leaves are simple, broadly to very broadly ovate and shallowly to deeply cordate at the base, often broader than long, obtuse or rounded at the apex, discolorous, slightly pubescent or glabrescent on

both sides with yellowish hairs at the base of nerves. The leaves of *C. torulosa* are kidney-shaped with three to five veins from the base of the leaf.[35] The flowers are green in colour, supra-auxillary above a hairy gland, male inflorescence is an auxillary cyme, solitary or two together while the female inflorescence is a cyme of one to four cymes.[36,37,41] The fruit is an ovate-compressed drupe which is yellowish in colour. *Cissampelos torulosa* has been recorded in Malawi, Mozambique, South Africa, Swazialnd, Tanzania, Zambia and Zimbabwe.[33,35-39,41-51] *Cissampelos torulosa* has been recorded along the margins of evergreen forest at an altitude ranging from sea level to 1980 m above sea level.[35-39,41]

Medicinal uses of *Cissampelos torulosa*

The bark, leaves, roots, stems and whole plant parts of *C. torulosa* are used to induce labour, for hallucinations and ritual purification, and herbal medicine for kidney problems, swellings, hematemesis, syphilis, gastro-intestinal problems, respiratory problems and toothache (Table 1, Figure 1). The leaves of *C. torulosa* are mixed with those of *Knowltonia bracteata* Harv. ex Zahlbr. as herbal medicine for itching skin.[8]

Phytochemistry of *Cissampelos torulosa*

Watt and Breyer-Brandwijk[57] argued that the chemical constituents of *C. torulosa* include pelosine. The leaves and stems of *C. torulosa* contain alkaloids such as bulbocapnine, cissacapine, cycleanine, dicentrine, insulanoline, lauroscholtzine, pronuciferine, reticuline and salutaridine.[22]

Biological activities of *Cissampelos torulosa*

The following biological activities have been reported from the leaves and whole plant extracts of *C. torulosa*: anti-amoebic,[55] antibacterial,[54,55,64,65] antifungal,[64,65] cytotoxicity and toxicity[55,64,65,67,68] activities.

Anti-amoebic activities

Samie et al.[55] evaluated anti-amoebic activities of methanol whole plant extracts of *C. torulosa* against Entamoeba histolytica with metronidazole (0.01 µg/ml to 2 µg/ml) as a positive control. The extract exhibited activities with the same 50% inhibitory concentration (IC_{50}) and 90% (IC_{90}) value of > 10.0 mg/ml which was higher than 0.05 µg/ml to 0.1 µg/ml exhibited by the positive control.[55]

Table 1: Medicinal uses of *Cissampelos torulosa* in South Africa and Swaziland

Medicinal use	Parts used	References
Anxiety	Roots	Hulley and Van Wyk[52]
Backache	Roots	Hulley and Van Wyk[52]
Candidal infections	Bark	Masevhe et al.[53]
Fatigue	Roots	Hulley and Van Wyk[52]
Gastro-intestinal problems (diarrhoea, dysentery and stomach problems)	Leaves and stems	De Wet and Van Wyk[8]; Oyen[22]; Mabogo[30]; Constant and Tshisikhawe[31]; Samie et al.[54]; Samie et al.[55]; Stark et al.[56]
Hallucinations	Leaves	De Wet and Van Wyk[8]; Van Wyk and Gericke[19]; Oyen[22]; Watt and Breyer-Brandwijk[57]; Hutchings et al.[58]; Sobiecki[59]; Long[60]
Hematemesis	Leaves	De Wet and Van Wyk[8]; Oyen[22]; Watt and Breyer-Brandwijk[57]; Hutchings et al.[58]
Induce labour	Leaves	De Wet and Van Wyk[8]; Hutchings et al.[58]
Insomnia	Roots	Hulley and Van Wyk[52]
Itching skin	Leaves mixed with those of *Knowltonia bracteata* Harv. ex Zahlbr.	De Wet and Van Wyk[8]
Kidney problems	Roots	De Wet and Van Wyk[8]; Oyen[22]
Respiratory problems (flu, scrofula and sore throat)	Leaves and stems	De Wet and Van Wyk[8]; Mabogo[30]; Constant and Tshisikhawe[31]; Samie et al.[54]; Samie et al.[55]; Watt and Breyer-Brandwijk[57]; Bryant[61]
Ritual purification	Whole plant	De Wet and Van Wyk[8]; Mabogo[30]; Constant and Tshisikhawe[31]
Swellings	Leaves	Oyen[22]; Hutchings et al.[58]; Bryant[61]
Syphilis	Leaves and roots	De Wet and Van Wyk[8]; Oyen[22]; Masevhe et al.[53]; Watt and Breyer-Brandwijk[57]; Hutchings et al.[58]
Toothache	Bark and roots	De Wet and Van Wyk[8]; Oyen[22]; Masevhe et al.[53]; Watt and Breyer-Brandwijk[57]; Hutchings et al.[58]; Mayr[62]; Hutchings[63]; Akhalwaya[64]; Akhalwaya et al.[65]; Sagbo and Mbeng[66]

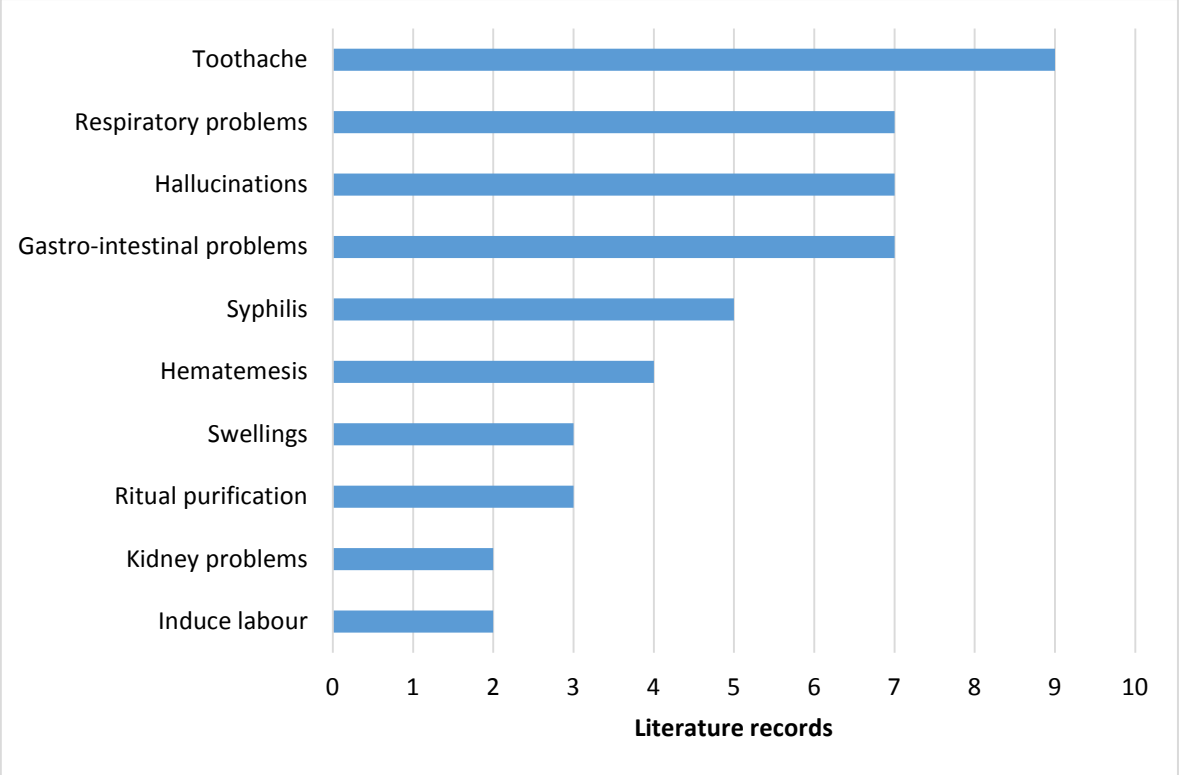

Figure 1. Medicinal applications of *Cissampelos torulosa* derived from literature records

Antibacterial activities

Samie et al.[54] evaluated the antibacterial activities of acetone, hexane and methanol leaf extracts of *C. torulosa* against *Aeromonas hydrophila, Bacillus cereus, Bacillus pumilus, Bacillus subtilis, Enterobacter cloacae, Enterococcus fecalis, Escherichia coli, Klebsiella pneumoniae, Pantoea agglomerans, Proteus mirabilis, Pseudomonas aeruginosa, Salmonella cholerae-suis, Serratia marcescens, Staphylococcus aureus* and *Shigella flexneri* using the disc diffusion and the micro-dilution methods with gentamicin as a positive control. The methanol extract exhibited activities against most of the pathogens with the exception of *Bacillus subtilis, Klebsiella pneumoniae, Pseudomonas aeruginosa, Salmonella cholerae-suis* and *Serratia marcescens* with diameter of zone of inhibition ranging from 8 mm to 18 mm which was much lower than 18 mm to 30 mm exhibited by the positive control. The hexane extract exhibited activities against *Bacillus cereus, Bacillus subtilis* and *Proteus mirabilis* with zone of inhibition ranging from 8 mm to 9 mm. The minimal inhibitory concentration (MIC) values of methanol, acetone and hexane extracts against the tested bacteria ranged from 3.0 mg/ml to >12.0 mg/ml which was much higher than MIC value of 0.01 mg/ml to 0.02 mg/ml exhibited by the control[54]. Samie et al.[55] evaluated antibacterial activities of methanol leaf extracts of *C. torulosa* against *Campylobacter* isolates using a microdilution method with gentamicin (0.25 µg/ml to 32.0 µg/ml) as a positive control. At a concentration of 6.0 mg/ml, the extract exhibited weak activities, suppressing 38% of the *Campylobacter* isolates.[55] Akhalwaya[64] and Akhalwaya et al.[65] evaluated antibacterial activities of aqueous and dichloromethane : methanol (1 : 1) leaf and stem extracts of *C. torulosa* against *Streptococcus mutans, Streptococcus sanguis, Lactobacillus acidophilus, Lactobacillus casei, Porphyromonas gingivalis* and *Fusobacterium nucleatum* using the microtiter plate dilution assay with ciprofloxacin (0.1 mg/mL) as a positive control. The extracts exhibited activities with MIC values ranging from 0.05 mg/mL to >8.0 mg/mL.[64,65]

Antifungal activities

Akhalwaya[64] and Akhalwaya et al.[65] evaluated antifungal activities of aqueous and dichloromethane : methanol (1 : 1) leaf and stem extracts of *C. torulosa* against *Candida albicans, Candida glabrata* and *Candida krusei* using the microtiter plate dilution assay with amphotericin B (0.01 mg/mL) as a positive control. The extracts exhibited activities with MIC values ranging from 1.3 mg/mL to >8.0 mg/mL.[64,65]

Cytotoxicity and toxicity activities

Samie et al.[55] evaluated cytotoxicity activities of methanol leaf extracts of *C. torulosa* using Vero cell cultures. The extract exhibited activities with the IC_{50} value of 206.4 µg/ml.[55] Van Zyl et al.[67] evaluated the cytotoxicity activities of methanol rhizome extracts of *C. torulosa* using the tetrazolium cell proliferation assay against human kidney epithelial cells. The extract exhibited activities with IC_{50} value which was <25.0 µg/ml.[67] De Wet et al.[68] evaluated cytotoxicity activities of crude alkaloidal extracts isolated from the rhizome of *C. torulosa* using MCF7 (breast), UACC62 (melanoma) and

TK10 (renal) cancer cell lines with adriamycin and 5-fluorouracil as positive controls. The crude extract exhibited weak activities with total growth inhibition (TGI) values ranging from 28.0 µg/ml to 50.0 µg/ml. The GI_{50} (concentration required for 50% inhibition of cell growth) values ranged from 9.0 µg/ml to 12.5 µg/ml.[68] Akhalwaya[64] and Akhalwaya et al.[65] evaluated toxicity activities of aqueous stem extracts of *C. torulosa* using the brine shrimp lethality assay with potassium dichromate (1.6 mg/mL) as a positive control. The extract exhibited 100% mortality in brine shrimp assay after 24 hours of exposure. The median lethal concentration (LC_{50}) value after 24 hours and 48 hours was 135.0 µg/mL and 129.0 µg/mL, respectively which was comparable to LC_{50} value of 100.0 µg/mL exhibited by the positive control.[64,65]

CONCLUSION

The present review summarizes the ethnomedicinal uses and ethnopharmacological properties of *C. torulosa*. A few ethnopharmacological studies have focused on evaluating anti-amoebic, antibacterial, antifungal, cytotoxicity and toxicity activities of the different extracts of the species. But there is not yet enough data on ethnopharmacological evaluation and clinical research on the species and no evaluations of target-organ toxicity have been documented. Since *C. torulosa* contain potentially toxic compounds, future studies should include the identification of toxic compounds, possible side effects caused by taking *C. torulosa* as herbal medicine, and mechanisms of how potential toxic components of the species can be managed.

Conflict of interest

The author declares that he has no conflict of interest.

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