



Ethnopharmacological communication

In vitro antiparasmodial screening of ethnopharmacologically selected South African plant species used for the treatment of malariaM. Johanna Bapela^{a,*}, J.J. Marion Meyer^a, Marcel Kaiser^b^a Department of Plant Science, Plant Sciences Complex, University of Pretoria, Hatfield 0083, South Africa^b Swiss Tropical and Public Health Institute, Socinstrasse 57, CH-4002 Basel, Switzerland

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ABSTRACT

Ethnopharmacological relevance: Plant species used by Venda people of South Africa in the treatment of malaria and associated symptoms were evaluated for their antiparasmodial efficacy as well as cytotoxic properties and some showed significant activity.

Materials and methods: *In vitro* antiparasmodial activity and cytotoxic properties were evaluated on 20 indigenous plant species. Ground plant material was extracted in dichloromethane: 50% methanol (1:1). Antiparasmodial activity was evaluated against the chloroquine-sensitive strain of *Plasmodium falciparum* (NF54). The cytotoxicity of the plant extracts were assessed against mammalian L-6 rat skeletal myoblast cells and the selectivity index (SI) calculated.

Results: Of the 43 plant extracts evaluated, 10 exhibited pronounced antiparasmodial activity ($IC_{50} \leq 5 \mu\text{g/ml}$) with good therapeutic indices ($SI \geq 10$). Lipophilic plant extracts were relatively more potent than polar extracts. *Tabernaemontana elegans* Stapf. (Apocynaceae) and *Vangueria infausta* Burch. subsp. *infausta* (Rubiaceae) extracts displayed significant antiparasmodial activity ($IC_{50} < 2 \mu\text{g/ml}$).

Conclusion: Findings of this study partly support the ethnomedical use of the investigated plant species by Venda people as antimalarial remedies. The study also highlights some of the knowledge gaps that require further phytochemical studies on the specified plant species.

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1. Introduction

Despite the significant advances made in lessening the burden of malaria in recent years, the disease still remains a major public health problem affecting many people in tropical and subtropical regions (Murray et al., 2012). This is especially the case in sub-Saharan Africa where 90% of the estimated annual global malaria deaths occur (World Health Organization, 2013). Most of the conventional drugs are no longer effective due to the emergence of drug resistant strains. Additionally, some of the indispensable drugs that are still effective suffer from problems related to toxicity, prolonged treatment schedules, variable responses between strains, non-compliance by patients and inaccessibility to proper health facilities (Olasehinde et al., 2012). These factors combined with the absence of effective vaccines highlight the need for new chemotherapeutic agents with novel modes of action that may alleviate the burden of malaria. In our search for novel antimalarial plant products (Prozesky et al., 2001; Tetyana et al., 2002; Adelekan et al., 2008), 20 indigenous plant species used to

treat malaria and/or malarial symptoms by Venda people, were evaluated for their antiparasmodial efficacy. We report here on the results of the study.

2. Materials and methods

2.1. Plant collection

An ethnobotanical survey and a chemotaxonomic approach were followed to select and collect indigenous plant species used to treat malaria and its symptoms by Venda people. The selection of medicinal plants investigated in this study was based on informal interviews with Venda people living in Mutale Municipality of Limpopo Province. Main questions asked were which local plants are used in cases of malaria or its related symptoms, plant parts harvested for such purposes and where are they collected. The data was gathered from Venda people and from published literature. In cases where the locally used plant species were not documented in ethnopharmacological data, the plant was not harvested. Likewise, if plants were documented in literature, and not used locally, it was not collected for this study. Plant samples from the selected 20 species (Table 1.) were collected and voucher

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Table 1

Plant species evaluated for antiparasmodial activity, their ethnomedicinal uses against malaria (Bandeira et al., 2001; Mabogo, 1990; Watt and Breyer-Brandwijk, 1962), antiparasmodial activity, cytotoxicity and selectivity indices. IC₅₀ values are expressed as a mean value of two independent assays and were recorded in µg/ml.

Plant species, family and voucher number	Ethnomedicinal uses	Plant part used (DCM:50% MeOH)	IC ₅₀ (parasite) (Pf-NF54) DCM/50% MeOH	IC ₅₀ (mammalian cell) (L6-cells) DCM/50% MeOH	^a Selectivity index
<i>Albizia versicolor</i> Welw. ex Oliv. (Fabaceae) Mutambapfunda, 120322	Root and stem bark are used as ingredients to prepare a polyherbal decoction taken against malaria	Roots Stem bark	2.12 /23.8 7.08/27.3	55.1/42.0 72.1/52.3	26.0 /1.76 10.18/1.92
<i>Anthocleista grandiflora</i> Gilg. (Loganiaceae) Mueneene, 120323	A decoction of the stem bark and leaves is administered in cases of malaria	Stem bark	8.69/ > 50	55.6/70.1	6.40/n.d.
<i>Bridelia mollis</i> Hutch. (Phyllanthaceae) Mukumbakumba, 120324	Root infusion from a closely related plant species, <i>Bridelia micrantha</i> , is used against malaria-related fevers	Roots	3.06 /28.5	51.4/49.6	16.8 /24.6
<i>Capparis tomentosa</i> Lam. (Capparidaceae) Moubadali, 120325	Root decoction is drunk as an antipyretic in the treatment of malaria	Roots	2.19 /29.2	40.8/70.4	18.6 /2.41
<i>Clematis brachiata</i> Thunb. (Ranunculaceae) Tshumbeumbe, 120326	Hot root decoction is used for steaming or taken orally for malaria and colds	Roots	5.36/ > 50	42.6/72.3	7.95/n.d.
<i>Clerodendrum glabrum</i> E. Mey. (Verbenaceae) Umnukalembaba, 120327	Leaf infusion is taken as a remedy for fevers associated with malaria	Leaves	8.89/ > 50	62.2/72.7	3.02/n.d.
<i>Cussonia spicata</i> Thunb. (Araliaceae) Musenzhe, 120328	A root infusion made from a handful of roots are used as emetics for fevers	Root bark	3.25 / > 50	47.8/69.1	14.7 /n.d.
<i>Dichrostachys cinerea</i> Wight et Arn. (Fabaceae) Murenzhe, 120329	Crushed roots are soaked in water and administered in cases of febrifuge	Roots	2.10 / > 50	51.6/65.3	24.6 /n.d.
<i>Diospyros mespiliformis</i> Hochst. ex A.DC. (Ebenaceae) Musuma, 129330	Root decoction is used to alleviate febrile symptoms	Roots	4.40/28.4	24.3/60.4	5.52/2.13
<i>Pappea capensis</i> Eckl. & Zeyh. (Sapindaceae) Tshikavhavhe, 120331	Branches are boiled and taken as tea for malaria	Twigs	5.47/24.8	54.0/55.2	9.87/2.23
<i>Parinari curatellifolia</i> Planch. Ex Benth. (Rosaceae) Muvhula, 120332	Stem bark soaked together with other plant species are used for the treatment of malaria	Stem bark	6.99/16.9	57.6/55.4	8.24/3.28
<i>Pyrenacantha grandiflora</i> Baill. (Icacinaeae) Bwere, 120333	A decoction prepared from powdered roots is used for malaria	Roots	5.82/ > 50	0.52/10.5	0.089/n.d.
<i>Rauvolfia caffra</i> Sond. (Apocynaceae) Munadzi, 120334	Used as a substitute for <i>T. elegans</i> (of the same family) to treat malaria and fevers	Stem bark	2.13 /10.8	26.9/57.2	12.6 /5.30
<i>Senna petersiana</i> (Bolle) Lock. (Fabaceae) Munembenembe, 120335	Leaf infusion are taken as tea for malaria	Leaves	22.5/22.1	59.3/66.8	2.64/3.02
<i>Syzygium cordatum</i> Hochst. (Myrtaceae) Mutu, 120336	Leaf infusions administered for febrifuge and headaches related to malaria	Leaves	6.15/10.4	65.7/53.8	10.68/5.17
<i>Tabernaemontana elegans</i> Stapf. (Apocynaceae) Muhatu, 120337	Stem bark and root decoctions are used for febrifuge and malaria	Stem bark	0.331/0.834	4.68/38.2	14.1/45.8
<i>Vangueria infausta</i> Burch. subsp. <i>infausta</i> (Rubiaceae) Muzwilu, 120338	Infusions made from the roots and leaves is taken orally to treat malaria	Roots	1.84 / > 50	45.7/71.5	24.8 /n.d.
^b <i>Ximenia americana</i> Linn. (Olacaceae) Muthanzwa, 120339	Root infusions are taken for febrifuge and ground root powder is applied topically for febrile headaches	Roots	28.2	69.1	2.45
<i>Ximenia caffra</i> Sond. (Olacaceae)	Powdered leaves and twigs are used for fevers and febrifuge	Leaves	3.01/ > 50	8.68/ > 50	2.88/n.d.

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