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Review Article

African Herbal Plants used as Anti-Malarial Agents - A Review

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ABSTRACT

Malaria is an infectious disease caused by single-celled obligate parasite known as Plasmodium and is transmitted to man through the vector Anopheles mosquito. It has persistently been a major public health problem to the global community. As estimate has shown that globally, about 3.3 billion people were at risk of malaria in the year 2011. It has now been ranked among the world's top killer infectious diseases and remains the most prominent cause of death and illness in Africa particularly among pregnant women and children under the age of five years. Due to the development of drug-resistance by the malaria parasites and also the development of resistance to various insecticides by the vector, development of new antimalarial agents is imperative and herbal plants have for long been a major source of new drug discovery. Consequently, in various African countries, several plants have been reported to be having antimalarial effects and are being applied traditionally as antimalarial agents. The purpose of this review article therefore, is to collate and document different plants used traditionally as antimalarials in six African countries (Nigeria, Ghana, Ethopia, Benin, Cameroon and Togo). One hundred and fifteen herbal plants from the six African countries have been captured in this article due to their local usage as antimalarial agents. The array of medicinal plants employed as antimalarial agents in Africa, unveils a promising source for the development of new and better antimalarial drugs. Scientific investigations should therefore be carried-out on them.

Keywords: Malaria treatment, herbal plants, Africa

INTRODUCTION

Malaria is an infectious disease caused by single-celled obligate parasite known as Plasmodium and is transmitted to man through the vector Anopheles mosquito. The various plasmodium species are *Plasmodium ovale, Plasmodium vivax, Plasmodium malariae, Plasmodium knowlesi* and *Plasmodium falciparum*. *Plasmodium falciparum* is however known to be the most deadly specie. Malaria is usually characterized by headache, chills, fever, myalgias, malaise and gastrointestinal upset. The most deadly complications however include respiratory distress resulting from metabolic acidosis, severe anaemia and cerebral malaria which may lead to death. [1] Malaria has persistently been a major public health problem to the global community. [2] Estimate has shown that globally, about 3.3 billion people were at risk of malaria in the year 2011. Malaria has now been ranked among the world's top killer infectious diseases and remains the most prominent cause of death and illness in Africa particularly among pregnant women and children under the age of five years. [3, 4] Though several malaria control programs have been put in place by various countries, it seems only a little success have been achieved. Various therapies have been developed for the treatment of malaria some which includes

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Chloroquine, Mefloquine, Quinine, Primaquine, Artemisinin and its derivatives like artesunate, artemether and arteether. However, the treatment and control of malaria have now evolved to a more complicated process. This is due to the development of drug-resistance by the malaria parasites and also the development of resistance to various insecticides by the vector (Anopheles mosquito). [5 - 7] Hence, the development of new antimalarial agents is imperative and herbal plants have for long been a major source of new drug discovery.

APPLICATION OF HERBS IN THE TREATMENT OF MALARIA IN AFRICA

Africa is said to be having the highest burden of malaria, this is due to the fact that *Plasmodium falciparum* (which is the most deadliest specie) occurs more in Africa and have led to an increased mortality rate (of about 600,000 deaths yearly) as well as morbidity. [8, 9] In fact, about 80% cases of malaria and 90% malaria deaths are from Africa. [10] Estimates have revealed that about 3.5 - 4 billion people globally, depend on herbs for drugs to treat of several ailments. [11] Africa has been known to be among the highest patronizers/consumers of herbal medicines. About 80% populations in most African countries rely on traditional medicines (especially herbs) for primary health care. [12] History has revealed the successful use of plants/plant products in the treatment of several ailments including malaria. Records have even shown that some of the currently used antimalarial drugs were derived from plants. For example, the premiere antimalarial drug, was gotten in 1820 from the stem-bark of Cinchona plant. Even Artemisinin the now famous antimalarial drug, was gotten from the plant *Artemisia annua*. [13 - 16] These and many more successes in herbal medicine research have therefore encouraged more investigations on various herbal plants used traditionally as antimalarial agents. Consequently, in various African countries, several plants have been reported to be having antimalarial effects and are being applied traditionally as antimalarial agents. The purpose of this review article therefore, is to collate and document different plants used traditionally as antimalarials in six African countries (Nigeria, Ghana, Ethopia, Benin, Cameroon and Togo). This is important because herbal plants have always been a vital source for developing new drugs, hence novel antimalarial compounds/drugs may be developed from them if further scientific studies are carried-out on them.

Table 1: African plants locally used in malaria treatment

Country	Botanical Name	Family	Local Name	Part Used	Reference
Nigeria	*Khaya grandifoliola*	Meliaceae	Oganwo	Bark	[17]
	Azadirachta indica	Meliaceae	Dogonyaro	Bark, leaves	[17]
	Chromolaena odorata	Compositae	Ewe Awolowo	Root, leave	[17]
	Lecaniodiscus cupanioides	Sapindaceae	Orinbo arinka	Leave, stem	[18]
	Ananas comosus	Bromeliaceae	Ope-Oyinbo	Unripe Fruit	[17]
	Cymbopogon citratus	Poaceae	Kooko-Oba	Leaves	[17]
	Cajanus cajan	Fabaceae	Otili	Leaves	[18]
	Heliotropium indicum	Boraginaceae	Ogberi-akuko	Whole plant.	[17]
	Carica papaya	Caricaceae	Ibepe	Leaves, fruit	[17]
	Rytigynia nigerica	Rubiaceae	Elegun oko	Root, Bark	[18]
	Morinda morindiodes	Rubiaceae	Ponju owiwi	Aerial part, Root, bark	[18]
	Pycnanthus angolensis	Myristicaceae	Akomu	Bark	[17]
	Cajanus cajan	Fabaceae	Waken suya	Leaves	[19]

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	Ocimum gratissimum	Labiatae	Efirin-nla	Leaves	[17]
	Citrus medica	Rutaceae	Osan were	Leaves, fruit	[18]
	Vernonia amygdalina	Compositae	Ewuro	Leaves	[17]
	Sclerocarya birrea	Anacardiaceae	Danya	Stem bark	[19]
	Solanum nigrum	Solanaceae	Odu	Leaves	[17]
	Theobroma cacao	Malvaceae	Koko	Stem bark	[18]
	Allium sativum	Liliaceae	Ayuu	Bulb	[17]
	Ceiba pentandra	Bombacaceae	Araba	Leaves	[17]
	Spondias mombin	Anacardiaceae	Iyeye	Leaves, stem bark	[18]
	Hyptis suaveolens	Labiatae	Jogbo	Leaves	[17]
	Citrus paradisi	Rutaceae	Osan gerepu	Leaves, root, fruit	[17]
	Garcina kola	Guttiferae	Goro	Stem bark	[19]
	Gossypium hirsutum	Malvaceae	Ela owu	Leaves	[17]
	Abrus precatorius	Fabaceae	Oju ologbo	Leaves	[18]
	Physalis angulata	Solanaceae	Koropo	Leaves, whole plant	[17]
	Rauvolfia vomitoria	Apocynaceae	Asofeyeje	Roots, barks, leaves	[17]
	Argemone Mexicana	Papaveraceae	Mafowokon	Leaves	[18]
	Psidium guajava	Myrtaceae	Gilofa	Bark, leave	[17]
	Lophira alata	Ochnaceae	Ponhan	Stem bark	[18]
	Quassia amara	simaroubaceae	Raken giwa	Leaf	[19]
	Senna podocarpa	Caesalpiniaceae	Asunwonibile	Bark, leaves	[17]
Ghana	*Anogeisus leiocarpus*	Combretaceae	Sisinrah	Leaves, twigs	[15]
	Acanthospermum hispidum	Asteraceae	Bongore	Whole plant.	[15]
	Ficus platyphylla	Moraceae	Selinge	Leaves, stem bark	[15]
	Khaya senegalensis	Meliaceae	Koke	Stem bark	[15]
	Strychnos spinosa	Loganiaceae	Dajekokora	Leaves	[15]
	Xeroderris stuhlmannii	Fabaceae	N/A	Leaves	[15]
	Sterculia setigera	Sterculiaceae	Bulinyanie	Leaves	[15]
	Ricinus communis	Euphorbiaceae	Beton	Leaves	[15]
	Pseudocedrela kotschyi	Maliaceae	Kpela	Twigs, leaves	[15]
	Ocimum canum	Lamiaceae	Worobagnui	Whole plant	[15]
	Nauclea latifolia	Rubiaceae	Gongan	Leaves, root	[15]
	Paullinia pinnata	Sapindaceae	Chiau	Leaves	[15]
	Indigofera pulchra	Fabaceae	Balesama	Whole plant	[15]
	Ozoroa insignis	Anacardiaceae	Dato	Twigs, leaves	[15]
	Lannea acida	Anacardiaceae	Gbentore	Leaves	[15]
	Jatropha gossypiifolia	Euphorbiaceae	Natogyere	Leaves	[15]
	Pterocarpus erinaceus	Papilionoideae	Pulinyie	Leaves	[15]
	Hyptis spicigera	Lamiaceae	Donbeleva	Leaves	[15]
	Combretum ghasalense	Combretaceae	Kpamara	Whole plant	[15]
	Mitragyna inermis	Rubiaceae	Yiele	Stem bark	[15]
	Strychnos innocua	Loganiaceae	Kolan	Leaves	[15]
	Cochlospermum tinctorium	Bixaceae	Gbelonbile	Roots	[15]

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	Cassia sieberiana	Fabaceae	Vabine	Roots	[15]
	Ficus gnaphalocarpa	Moraceae	Konkon	Roots	[15]
Ethopia	*Cissampelos mucronata*	Menispermaceae	N/A	Roots	[20]
	Asparagus africanus	Liliaceae	N/A	Roots, leaves	[20]
	Gnidia stenophylla	Thymeleaceae	N/A	Roots	[20]
	Plumbago zylonica	piumbaginaceae	N/A	Roots	[20]
	Withania somnifera	Solanaceae	N/A	Roots	[20]
	Euclea schimperi	Ebenaceae	N/A	Roots	[20]
	Warburgia ugandesis	canellaceae	N/A	Bark	[20]
	Vernonia bipontini	Plantaginaceae	N/A	Leaves	[20]
	Clerodendrum myricoides	Lamiaceae	N/A	Roots	[20]
Benin	*Acanthospermum hispidum*	Asteraceae	N/A	Aerial part	[21]
	Heliotropium indicum	Boraginaceae	N/A	Leaves	[21]
	Carpolobia lutea	Polygalaceae	N/A	Leaves	[21]
	Dialium guineense	Leguminoseae	N/A	Leaves	[21]
	Byrsocarpus coccineus	Comaraceae	N/A	Leaves	[21]
	Pupalia lappacea	Amaranthaceae	N/A	Leaves	[21]
	Anchomanes difformis	Araceae	N/A	Roots	[21]
Cameroon	*Tamarindus indica*	Caesalpiniaceae	Djabbé	Fruits, leaves	[22]
	Zea mays	Poaceae	Masardji	Flowers	[22]
	Allium cepa	Liliaceae	Tigneree	Bulb	[22]
	Haemastotaphis barteri	Anacardiaceae	Tursujee	Ripe fruits	[22]
	Pennisetum glaucum	Poaceae	Gawri	Roots and seeds	[22]
	Cuviera longiflora	Rubiaceae	N/A	Leaves	[23]
	Piliostigma thonningii	Caesalpiniaceae	Barkedji	Barks	[22]
	Cassia italic	Caesalpiniaceae	Wabderehi	Leaves	[22]
	Vismia guinesis	Asteraceae	N/A	Stem bark	[23]
	Musa sinensis	Musaceae	Banana	Leaves and roots	[22]
	Dacrydes edulis	Burseraceae	Zo'o	Leaves	[23]
	Sorghum bicolour	Poaceae	Muskuwari	Roots	[22]
	Sclerocarya birrea	Anacardiaceae	Eedi	Barks	[22]
	Voandzei subterranean	Fabaceae	Biriji	Seeds	[22]
	Kotschya speciosa	Leguminoceae	N/A	Whole plant	[23]
	Arachis hypogeal	Fabaceae	Arachide	Seeds	[22]
	Acanthospermum hispidum	Asteraceae	Mazaivri	Leaves and roots	[22]
	Eucalyptus globules	Myrtaceae	Klatusse	Leaves	[23]
	Acacia nilotica	Mimosaceae	Gabdé	Barks and seeds	[22]
	Parkia biglobosa	Mimosaceae	Naredje	Roots	[22]
	Corchorus olitorius	Tiliaceae	Lalo	Seeds	[22]
	Coula edulis	Olacaceae	Walnut	Stem bark	[23]
	Hibiscus sabdariffa	Malvaceae	Folere	Flowers	[22]
Togo	*Tectona grandis*	verbenaceae	Tantouna	Leaves	[24]
	Blighia sapida	Saindaceae	Kpizou	Root	[24]

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	Citrus aurantiifolia	Rutaceae	Akanka	Fruit	[24]
	Sarcocephalus latifolius	Rubiaceae	Kidjitchilou	Leave	[24]
	Securidaca longepedunculata	Polygolaceae	Fozi	Root	[24]
	Pericopsis laxifola	Fabaceae-Mimosoideae	Tchemany	Stem bark	[24]
	Trichialia emetic	Meliaceae	Adjindjinkpizou	Root	[24]
	Anthocleista djalonensis	Gentianaceae	Assoubobissaou	Stem bark	[24]
	Ocimum americanum	Lamiaceae	Kozosogan	Leaves	[24]
	Hyptis suaveolens	Lamiaceae	Botifadini	Leaves	[24]
	Philenoptera cyanescens	Fabaceae-Faboideae	Tchele	Leaves	[24]
	Excoecaria graphamii	Euphorbiaceae	Katchikadou	Stem bark	[24]
	Phyllanthus amarus	Euphorbiaceae	Seniseniyo	Root	[24]
	Jatropha gossypiifollia	Euphorbiaceae	Sawou	Leaves	[24]
	Euphorbia hirta	Euphorbiaceae	Kovoyoyilim	Root	[24]
	Bridelia ferruginea	Euphorbiaceae	Kolou	Root	[24]
	Gymnosporia senegalensis	Celastraceae	Tchintchingan	Root	[24]
	Borassus aethiopum	Arecaceae	Kpirou	Root	[24]

N/A=Not available

DISCUSSION

Knowledge concerning herbal medicines in Africa is currently transmitted from one generation to another principally by verbal medium without concise documentation. This has therefore led to the availability of only minute documented information about traditional herbal medicine in Africa. This article however, documents several medicinal plants used as antimalarial agents in various African countries. One hundred and fifteen herbal plants from six African countries have been captured in this article due to their local usage as antimalarial agents. The array of medicinal plants employed as antimalarial agents in Africa (Table 1), unveils a promising source for the development of new and better antimalarial drugs. This is however very important due to the current urgent need for novel antimalarial drug development so as to curtail the challenges being faced currently in the treatment/control of malaria. [25] This need have turned the search-light of the scientific community towards herbal medicine. Though herbal medicines are broadly employed in the treatment of malaria, and are said to be characterized with several advantages (which include more affordable and easy accessibility than Western drugs), they are as well with some limitations. Some of the limitations are non-established dosage and unpredictable efficacy. This therefore calls for critical investigations on these herbs so as to ascertain their pharmacological information as well as toxicity profile. These investigations should include both pre-clinical and clinical trials. This should also include studies based on observation of patients using the antimalarial herbs, employing the guidelines outlined by the Research Initiative on Traditional Antimalarial Methods. [26, 27] These studies need to be carried-out, so as to obtain reliable information on the actual effects of the antimalarial herbs on humans.

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