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Ethnobotanical Survey of Plants Used In the Treatment of Malaria in the Sekyere Central District of Ashanti Region of Ghana

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Abstract: **An ethnobotanical survey was conducted from September to December 2013 in the Sekyere Central district of the Ashanti region of Ghana. The survey aimed at identifying the plants used in the treatment of malaria in the Sekyere central district of Ashanti region of Ghana. The survey involved use of questionnaires and interviews with herbalist, house–to-house and the field that have a rich knowledge on the plants. A total of 29 medicinal plants species were recorded from the survey. To compare the usages of the plant species, an index of performance (*Ip*) was calculated for each plant species, from the number of citations of treatment actually recorded from the households against the proportion of each plant among the general flora. The survey revealed that, 6 of the 29 species of plants identified have not been authenticated for its antimalarial activity. *Afzelia africana, Antrocaryon micraster, Afraegle paniculata, Persea americana* and *Antiaris africana* spp. and *Panda oleosa*. The remaining 23 species have gone through various degrees of scientific authentications and validations.**

Keywords: Afzelia africana, Antrocaryon micraster, Afraegle paniculata, Persea Americana, Antiaris africana* spp. and *Panda oleosa.

1. INTRODUCTION

Malaria is caused by a single celled protozoan parasites called *Plasmodium* and transmitted to man through the anopheles mosquito. It is one of the major fatal diseases in the world, especially in the tropics and is endemic in some 102 countries with more than half of the world population at risk .The disease affects 350–500 million people per year worldwide and is responsible for 1.1 million deaths per year. In many parts of the world the parasites have developed resistance to a number of antimalarials such as chloroquine and derivatives, the most widely used treatment for malaria, and so there is an urgent need to discover new compounds with an original mode of action. Plants commonly used in traditional medicine are a source of active new compounds. (Symth, 1994).

A large number of antimalarial compounds with a wide variety of structures have been isolated from plants and can play a role in the development of new antimalarial drugs. Ethnopharmacological approaches appear to be a promising way to find plant metabolites that could be used as templates for designing new derivatives with improved properties. Ethnobotany is the study of how communities of a particular region employ indigenous plants for food, clothing, medicine and other activities (Aiyeloja and Bello, 2006), the documentation of which is crucial for the conservation and utilization of biological resources (Muthu *et al*., 2006). Sofowora (1982) reported that Africa has as much as three hundred thousand medicinal plants. In African countries, approximately 80% of the population uses traditional medicine for the treatment of various diseases and ailments like malaria, typhoid, ulcers, skin diseases, diabetes, reproductive problems, aches and pains for various socio- cultural and economic reasons.

In view of this study, various other plants (traditionally used in the treatment of malaria) have been identified by other ethnobotanical studies like Bussmann (2006), Njoroge and Bussmann (2006) in Kenya, Asase *et al*. (2005, 2010) in Ghana, Titanji *et al*. (2008) in Cameroon, and Idowu *et al*. (2009), Kayode *et al*. (2009), Olowokudejo *et al*. (2008), Ajibesin *et al*. (2008) and Odugbemi *et al*. (2007) in Nigeria.

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Other ethno-survey have also reported Azadirachta indica, (Meliaceae), Morinda lucida (Rubiaceae) and Nauclea latifolia (Rubiaceae)– which were noted to have been utilized in the treatment of malaria in Ghana were also identified to be used in the south-western regions of Nigeria (Ayitey- Smith, 1989; Abbiw,1990; Mshana *et al*., 2001).

Plant materials have been a major source of natural therapeutic remedies and are used to treat various infectious diseases in many developing countries (Ody, 1993). Nowadays, natural products of plant sources have been the centre of focus as the main source of new, safer and more effective bioactive compounds with medicinal properties (Nitta *et al*., 2002). A vast majority of prescription drugs used in the world contain compounds that are directly or indirectly, via semi-synthesis, derived from plants (Oksman-CaldenteyandInze, 2004). African flora is greatly rich with a lot of medicinal plants, which indigenous people are familiar with and have used over time.

Ethnobotanical surveys have shown that these traditional medicines have been found to be effective especially in the treatment of malaria which is of great concern to any African nation (WHO, 2002). The constant evolution of the malaria parasite has rendered the cheapest and most widely available anti-malarial treatments ineffective, more so with their centre ports about the increasing resistance of *Plasmodium falciparum* to artemisinin-based compounds (Htut, 2009; Cui *et al*., 2012). Accordingly, there is deep concern that

The aim of this study was to collate information from an indigenous group of people living in the Sekyere central district in the Ashanti region of Ghana about their current traditional uses of plants for the treatment of malaria and to scientifically authenticate those less explored.

2. MATERIALS AND METHOD

2.1 The study area:

The study area Sekyere central is situated in Nsuta-Kwamang-Beposo, Ashanti, Ghana, its geographical coordinates are 7° 1' 0" North, 1° 23' 0" West and its original name (with diacritics) is Nsuta, the district capital. The major towns that were visited during the survey are Nsuta, Kwamang, Beposo, Jaduako, Asuafu, Atwea, Aframso, Atonsu, Kyebi and towns beyond. The district has an estimated population of 71,232 by the 2010 population census.

The indigenes encountered in these regions were predominantly farmers. The main ethnic groups encountered in these areas were the Akans with the other tribes present. The selected towns were found to be malaria endemic areas with similar tropical climatic conditions, which are characterized by two distinct conditions of wet and dry seasons. These regions experience high rainfall and high humidity for most of the years. The fig1. Below shows the location of study area from national and international perspective. The area is located within Sekyere west municipality where the Sekyere central district was carved into its district. (Ashanti districts, 2010)

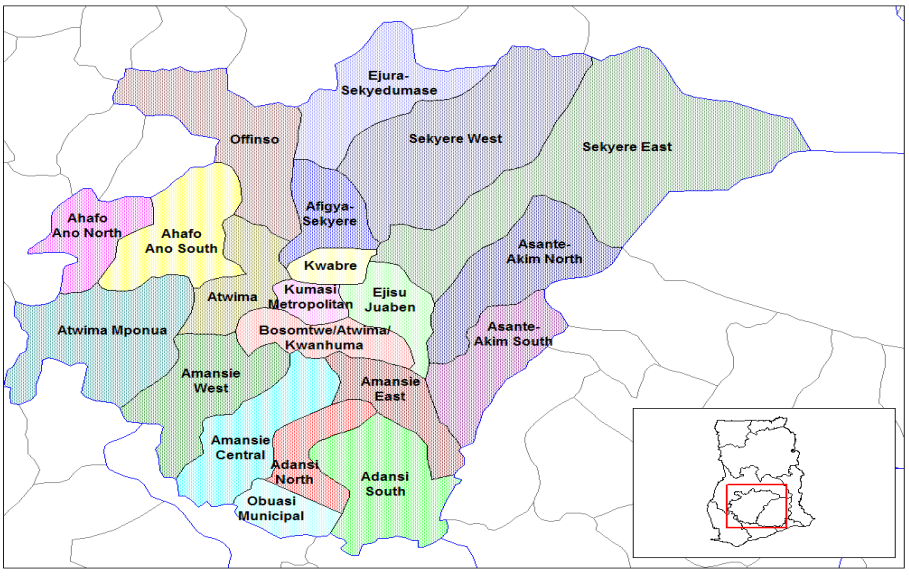

Fig. 1 Geographical location of study area (Sekyere West)

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2.2 Ethnobotanical survey:

This research piece of survey was conducted at Sekyere central district between September to December 2013 involving the administration of questionnaires among household, herbalist and field interviews.

2.2.1 Questionnaire administration:

The survey was carried out from September to December 2013 in which semi-structured questionnaires were used to interview the local population about their knowledge of plants used in the treatment of malaria (Table 1). Though the questionnaires had to be filled, direct questions were avoided. The questionnaires were targeted at three main groups of people, interviews involved direct interaction with herbalist, house-to house and the field. The basic information needed was collected through conversations, during the oral interviews. Respondents were chosen without distinction of gender. Individuals from all age groups (except children below 18 years) were interviewed on their knowledge of plants used in the treatment of malaria in the area. The random sampling technique was used and a total of 40 respondents were interviewed, of which 64% (26) females and 36% (14) males. Information such as the demographic structure of the study population (age groups and sex of individuals) were generated and respondents provided information on parts of plants employed in the treatment of malaria, mode of preparation, method of extraction, administration, other medicinal uses, accessibility and frequency of mention. The methods used for ethnobotanical data collection were semi- structured interviews, field observation, preference ranking. The respondents often accompanied the investigators to the field to collect plant material.

3. RESULTS

Data analysis:

The information obtained through the ethnobotanical interviews were analyzed and expressed as tabulated based on the following parameters:

(i). family, and parts of the plant used to treat malaria.

(ii). Preference ranking (PR) method was employed. The plants were ranked according to their level of effectiveness in the treatment of malaria by the local people. Each rank is given an integer (1, 2 o r 3) with the most effective plants assigned a value of 3.

(iii). Availability of literature of previous studies on the plants identified e.g., anti-malarial or anti-plasmodial investigations, extractions solvents utilized and phytochemicals isolated from them.

Antimalarial plants used in the Sekyere central district.

Table 1. Method of antimalarial species identification and preference range

No	Name	Family	Common name	Local name	Parts used	Method of preparation
1	*Afraegle paniculata*	Leguminosae	Powder flask	obuobi	Leaves	Boiling of leaves
2	*Afzelia Africana*	Rutaceae	African mahogany	papao	Stem bark	Boiling with water
3	*Anacardium occidentale*	Anacadiaceae	Cashew	Atea	Stem bark	Aqueous boiling
4	*Ananas comosus*	Bromeliaceae	Pinneaple	Abrobe	Fruit cover	Aqueous boiling
5	*Anthrocayon Micraster*	Anacardiacea e	Aprokuma	Apurukuma	Stem bark, roots, leaves	Boiling with water
6	*Antiaris Africana*	Moraceae	Bark cloth	Kyenkyen	Leaves	Aqueous boiling
7	*Azadiracta indica*	Meliaceae	Neem	Gyenedua	Stem, leave	Aqueous boiling
8	*Camelia sinensis*	Theaseae	Citronella	Esere	Leaves	Aqueous boiling
9	*Carica papaya*	Cannaceae	Pawpaw	Brofere	Leaves	Aqueous boiling
10	*Cassia alata*	Fabaceae	Cassia	Sempe	Leaves, stem bark	Aqueous boiling
11	*Cassia occidentallis*	Fabaceae	Cassia	-	Leaves, stem bark	Aqueous boiling
12	*Citrus aurantifolia*	Rutaceae	Lime	Akutu	Leaves, fruit	Aqueous boiling
13	*Ficus exasperata*	Moraceae	Fig	Onyenkyere	Leaves	Aqueous boiling

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				ne		
14	*Luwigia peruviana*	Onagraceae	Primrose	-	Stem bark, Leaves	Aqueous boiling
15	*Magnifera indica*	Annacardiaceae	Mango	Mango	Stem bark, leave	Aqueous boiling
16	*Momordica chiranta*	Cucurbitaceae		Nunum	Leaves	Aqueous Tincture
17	*Morinda lucida*	Rubiaceae	Brimstone tree	Onwono	Stem bark, leave	Aqueous boiling
18	*Moringa olerifera*	Moringaceae	Moringa	Moringa	Leaves	Aqueous boiling
	Nuclea latifolia	Rubiaceae			Leaves	Aqueous boiling
19	*Ocimium viride*	Lamiaceae		Nunum	Leaves	Aqueous boiling
20	*Panda oleosa*	Pandaceae	Panda	Apurokuma	Stem bark	Aqueous boiling
21	*Paulinia Pinnatum*	Sapindaceae	Bread and cheese	Tuantini	Roots	Aqueous boiling
22	*Persia Americana*	Lauraceae	Pear	Paya	Leaves	Boiling with water
23	*Taraxacum Oficinale*	Compositae	Dandelion	Gyatase	Whole plant	Aqueous boiling
24	*Tectonia grandis*	Lamiaceae	Teak	Teak	Leaves	Aqueous boiling
25	*Terapleura Tetraptera*	Fabaceae	Gabanum	Prekese	Fruit	Aqueous boiling
26	*Terminalia Cattapa*	Combretaceae	Engligh Almond	Abrofo nkate	Leave	Aqueous boiling
27	*Theobroma Cacao*	Malvaceae	Cocoa	Cocoa	Seeds, leaves	Aqueous boiling
28	*Viscum album*	Santalaceae	Miscletoe	Nkranpa	Leaves, stem	Aqueous boiling

Table 2: Medicinal Plants With Scientific Validation

No	Species	Family	Method of interview	(PR)
1	*Afraegle paniculata*	Leguminosae	House-to-house	1
2	*Afzelia Africana*	Rutaceae	House –to – house	2
3	*Anacardium occidentale*	Anacadiaceae	House – to –house	2
4	*Ananas comosus*	Bromeliaceae	House – to house	2
5	*Anthrocayon micraster*	Anacardiaceae	House – to –house	2
6	*Antiaris Africana*	Moraceae	Herbalist	2
7	*Azadiract aindica*	Meliaceae	House – to –house, Herbalist	3
8	*Baiden pilosa*	Astaraceae	House-to-house, Field	2
9	*Camelia sinensis*	Theaseae	Herbalist, Field, house – to –house	2
10	*Carica papaya*	Cannaceae	House- to – house, Field	3
11	*Cassia alata*	Fabaceae	House – to –house	2
12	*Cassia occidentallis*	Fabaceae	Herbalist, House-to-house	2
13	*Citrus aurantifolia*	Rutaceae	House-to-house	2
14	*Ficus exasperate*	Moraceae	Herbalist, Field	2
15	*Luwigia peruviana*	Onagraceae	Herbalist, House-to-house	1
16	*Magnifera indica*	Annacardiaceae	House-to-house, Field	3
17	*Momordica Charantia*	Cucurbitaceae	Herbalist, Field, House-to-house	3
18	*Morinda lucida*	Rubiaceae	Herbalist, Field, House-to-house	3
19	*Moringa olerifera*	Moringaceae	House-to-house, Field	3
20	*Nuclea latifolia*	Rubiaceae	Herbalist, Field, House-to-house	3
21	*Ocimium viride*	Pandaceae	House-to-house, Field, herbalist	3
22	*Panda oleosa*	Sapindaceae	House-to –house	2
23	*Paulinia pinnatum*	Sapindaceae	House-to-house, Herbalist	2
24	*Persia Americana*	Lauraceae	Field	1
25	*Taraxacum oficinale*	Compositae	House-to-house, Herbalist, field	2
26	*Tectonia grandis*	Lamiaceae	Herbalist, House-to-house, Field	2
27	*Terapleura tetraptera*	Fabaceae	House-to-house, Herbalist	3
28	*Terminalia cattapa*	Combretaceae	Field, House-to-house	2
29	*Theobroma cacao*	Malvaceae	House-to-house, Herbalist, field	3

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Table 3. Medicinal plants used in combination

No.	Name	Extracts tested	Part used	Stage of validation	References
1	*Afraegle paniculata*	Water	Leaves	Ethno survey	(Alex *et al*, 2005)
2	*Afzelia Africana*	Water	Bark, leaves	Ethno survey	(Alex *et al*, 2005)
3	*Anacardium occidentale*	Ethanol	Leaves	*In-vitro*	(Mann *et al*, 2003)
4	*Ananas comosus*	-	-	-	-
5	*Anthrocayon micraster*	-	-	-	-
6	*Antiaris africana*	-	-	-	-
7	*Azadiracta indica*	Water, Methanol	Bark, leaves	*In-vitro, in-vivo*	(Idowu *et al, 2009*)
8	*Baiden pilosa*	Ethanol	Root	*In-vitro*	(Oliveira *et al*, 2004)
9	*Camelia sinensis*	Ethanol	Leaves, stem bark	*Invitro, invivo*	(Anna *et al*, 2014)
10	*Carica papaya*	Water	Leaves, Seeds	*In-vitro*	(Ayola *et al*, 2008)
11	*Cassia alata*	Ethanol	Bark	*In-vitro*	(Tona *et al*, 2000)
12	*Cassia occidentallis*	Methanol	Leaves	*In-vitro*	(Tona *et al*, 1999)
13	*Citrus aurantifolia*	Ethyacetate, water, methanol	Whole plant	*In-vitro*	(Saroj *et al* ,2014)
14	*Ficus exasperate*	Methanol, water, dichloromethane	Leaves, stem bark	*In-vitro*	(Shittu *et al*, 2011)
15	*Luwigia peruviana*	Water	Leaves, root , bark	Ethnosurvey	(Dike *et al*, 2012)
16	*Magnifera indica*	Pet ether	Bark, Leaves	*In-vitro*	(Awe *et al*, 1998)
17	*Momordica Charantia*	Ethanol	Leaves	*Invitro*	(Ueno *et al*., 1996),(Ramalhete *et al*., 2010)
18	*Morinda lucida*	Pet ether	Leaves	*In-vitro, in-vivo*	(Aderenmu, *et al*)
19	*Moringa olerifera*	Ethanol	Laves	*Invivo, In-vitro*	(Olasehinde *et al*, 2012)
20	*Nuclea latifolia*	Water	Stem bark, roots	*ivt*	(Benoit- Vicala *et al*., 1998)
21	*Ocimium viride*	Water	Leaves	*In-vitro*	(Inbaneson *et al*, 2011)
22	*Panda oleosa*	-	-	-	-
23	*Paulinia pinnatum*	Ethanol	Leaves	*In-vitro*	(Maje *et al*, 2007)
24	*Persia Americana*	Water	Leaves	*Ethnosurvey*	(Dike *et al*, 2012)
25	*Taraxacum oficinale*	Methanol	Whole plant	*In-vitro*	(Ramzi *et al*, 2014)
26	*Tectonia grandis*	Methanol	Leaves	*In-vitro*	(Kopa , 2014)
27	*Terapleura tetraptera*	Methanol, dichloromethane	Fruit	*In vitro*	(Jean *et al*, 2011)
28	*Terminalia cattapa*	Ethylacetate, methanol,water	Leaves	*In-vitro*	(Oyindamola *et al*,2011)
29	*Theobroma cacao*	Methanol	Leaves, Bark	*In-vitro, in-vivo*	(Murakame, 2003)

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Table 4.

Combination of two plants	Combination of three	Combination of four	Combination of five
Cassia alata, Afzelia Africana	*Taraxacum oficinale, Magnifera indica, Persia Americana.*	*Persia Americana, Cassia occidentallis, Terapleura tetraptera, Anthrocayon micraster*	*Camelia sinensis, Terminalia cattapa, Tectonia grandis, Theobroma cacao, Ananas comosus.*
-	*Azadiracta indica, Cassia occidentallis, Carica papaya*	*Tectonia grandis Carica papaya Ananas comosus Terapleura tetraptera*	-
-	-	*Panda oleosa, Persea Americana and Terapleura tetraptera and Cassia occidentallis*	-

4. DISCUSSION

The survey has provided information about 29 species of plants used in the treatment of malaria in the Sekyere central district of the Ashanti region of Ghana. The study has also revealed how different interviewing methods can influence the scope of information obtained about the uses of each species.

To the best of available knowledge, none of the 23 previously investigated plants have passed the stages of orthodox clinical trials for their anti-malarial properties, but in vitro and in vivo analyses with significant anti-malarial activity have been reported (Table 3). Thus, further studies that might lead to the identification of new and cheaper anti-malarial drugs will be required. The other 6 plants have been traditionally used for the treatment of malaria, but no scientific study has been carried out to confirm their activity.

The result of the study has also revealed the usage of plants in combination which has proven effective at eradicating the *plasmodium faciparum* (Table 4) and this may be due to the synergistic effect of these plants in the destruction of the plasmodium species.

Though various other plants (traditionally used in the treatment of malaria) have been identified by other ethnobotanical studies like Bussmann (2006), Njoroge andBussmann(2006) in Kenya, Asase etal.(2005) in Ghana, Titanji etal.(2008) in Cameroon, and Idowu etal.(2009), Kayode etal.(2009), Olowokudejo etal.(2008), Ajibesin etal.(2008) and Odugbemi et al.(2007) in Nigeria, this is the first report on the traditional usage of *Panda oleosa*, *Antrocaryon micraster* and *Antiaris africana*. This could possibly translate to a relatively unexplored possibility and viable option for the treatment of malaria.

The majority of the herbal preparations identified in this study involved boiling the plant material and then drinking the extract. However, none of the people interviewed provided any information about how they might "standardize" treatments and the amounts used were generally vague. Thus the quality could vary greatly among prescriptions.

From table 4, six medicinal plants namely, *Afzelia africana, Persea americana, Panda oelosa, antrocaryon micraster, Antiaris africana, Afraegle paniculata* were reported to have been used for the treatment of malaria in the Sekyere central district. It is recommended that screening of all the above mentioned plants for anti-malarial activity be carried out in order to justify their local usage. These studies might lead to the isolation (and possibly the identification) of potentially active compounds, which may be regarded as future promising phyto-therapeutics in the treatment of malaria.

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5. CONCLUSION

The survey has revealed that, plants continue to be natural, cheaper and most affordable means of treatment methods for various ailments. Plants have also proven to be a source of major drug lead for synthetic counterpart.

The survey has therefore revealed that, *Afezelia Africana*, *Antiaris africana*, *Afraegle paniculata* ,*antrocaryon micraster*, *persea americana*, *ananas comosus* and *panda oleosa* are new plants species used in the management of malaria without any scientific validation. Further works is therefore required to assess the in-vitro, in-vivo, and mechanism of action, toxicity, efficacy of the newly detected plant species for the management and treatment of malaria.

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