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Review of Antimalarial, Pesticidal and Repellent Plants in The Ethiopian Traditional Herbal Medicine

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Abstract

A bibliographic survey of information available in various sources was undertaken and a rich assemblage of plants used as antimalarials, insecticides and repellents in the Ethiopian traditional herbal medicine system was compiled. Those plant species were tabulated in Excel spreadsheet and descriptive statistics applied for analysis of the data. A total of 177 plant species belonging to 148 genera and 65 families were documented. Shrubs (40.1%) and herbs (39.5%) accounted for higher proportions (80%) of the total species. The uses of leaves (61 spp.) and roots (29 spp.) claimed higher frequencies than other parts. The species were recorded from a wide range of altitudes with 38.5% coming from below 2400 m, areas generally known for being malarious. Most of these species were said to be used in connection with malaria and nuisance arthropods. The findings could assist research in phytochemistry, pharmacology, biomedicine, conservation and related works on top of documenting the biocultural heritage of the various Ethiopian ethno-linguistic communities. This compilation would also be beneficial to the healthcare services as it provides valuable ethnobotanical leads to plants with useful medicinal properties for possible drug discovery. The findings notify that there is a rich tradition of using plants especially for the treatment and prevention of malaria. The findings send a clear signal about the fragility of the associated indigenous knowledge/skills of the local communities in the face of escalating anthropogenic and natural pressures. The way forward calls for in situ conservation and putting the indigenous knowledge in to practice in order to mitigate the impeding problems facing the plants as well as the knowledge.

Keywords: antimalarials, insecticides, mosquitocides, pesticides, repellents

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INTRODUCTION

Background

Malaria control still remains to be an urgent matter in countries where the disease is rampant. Ethiopia is among such countries experiencing the malaria epidemic, which is a leading public health problem even though various control methods are being mounted [1]. Strategies adopted by local communities to combat malaria, as in many other countries, largely rely on plant-based prevention and treatment methods founded on their indigenous botanical and traditional herbal medical knowledge.

Over the years, some researchers focused attention to gathering of information both on the traditional medicinal plants associated with the control of malaria and the indigenous

medical lore as practiced by local communities [2, 3] while other researchers concentrated on plants for the control and eradication of various pests affecting humans and their livestock. The bulk of the reported ethnobotanical information, however, is scattered in various published and unpublished volumes and databases.

We believed that a bibliographic compilation of such scattered information would be a good service to researchers who are interested in extraction and testing of plant products for their antimalarial actions, insecticidal properties and repellent activities. This in turn could be effectively used in the efforts to control malaria, mosquito bites and to handle ticks, harmful farmland insects and other household arthropods such as fleas, lice and bedbugs.

Such a list would be a good starting point for many researchers and graduate students. This drive was further fueled by our observation of increasing ethnobotanical research results furnishing records of candidate medicinal plants available in various volumes and texts in spite of which there is no comprehensive list that could be used as a quick reference for researchers. The growing number of researchers involved in malaria both in the pharmaceutical and biological areas will be served by the outcome. The data can also be used as a basis for developing management plans for conservation and sustainable use of these medicinal plants [4, 5].

The General Ecology and Epidemiology of Malaria

More than two billion people, mostly in tropical countries, are at risk from mosquito-borne diseases such as malaria, dengue, hemorrhagic fever and filariasis [6]. Malaria causes an estimated 310-515 million clinical episodes (cases) with 1.5-3.0 million deaths per year, mostly children worldwide and sub-Saharan Africa shares 80% of the cases and 90% of deaths [6-9]. Likewise, malaria is a leading communicable disease seen at health facilities in Ethiopia where 68% (57.3 million) of inhabitants are estimated to be at risk of malaria and the problem is compounded by increasing frequency and magnitude of malaria epidemics [1].

Physical and climatic conditions are favourable to malaria transmission, typically the breeding of mosquito carriers, is very temperature-sensitive [10]. Altitude is significant in determining the distribution of malaria and its seasonal impact on many regions of the world. In Africa, for example, altitudes above 1,000-1,500 m are considered safe from malaria. However, it must be cautioned that with continuing global climate change, these figures may change, extending the range of mosquitoes well above those altitudes as ambient temperatures rise [8, 11-13]. Ethiopia is characterized by seasonal, largely unstable and intense malaria transmission. The major transmission of malaria follows the June-September rains and occurs between September-December. The major transmission season occurs in almost every part of the country. There are five major

eco-epidemiological strata of malaria in the country [9] cited in MoH (2007):

- Malaria free highland areas above 2,500 meters altitude;
- Highland border areas between 1,500-2,500 meters (affected by frequent epidemics);
- Lowland areas below 1,500 meters (with seasonal pattern of transmission);
- Arid areas where malaria is only found near semi-permanent water bodies; and
- Stable malaria areas (characterized by all year round transmission) in the western lowlands and river basin areas of Gambella and Benishangul-Gumuz Regional States.

Knowledge on local malaria situations is thus an important step in planning scientific study and control activities since the transmission dynamics and determinants differ in time and space.

Causes of Parasites and Transmission of Malaria

Plasmodium falciparum is by far the most aggressive species, distributed globally especially common in Africa [7, 13, 14]. *P. falciparum* and *P. vivax* are the most dominant malaria parasites in Ethiopia, distributed all over the country and accounting for 60 and 40% of malaria cases respectively. *P. malariae* accounts for less than 1% and *P. ovale* is rarely reported. The parasite is principally transmitted from person to person by the major mosquito vector known as *Anopheles arabiensis*, which bites only at night [9]. In some areas *A. pharoensis*, *A. funestus* and *A. nili* also transmit the disease [7, 14].

Factors Influencing Malaria Control

In addition to many factors that include rapid environmental and biological changes, the burden of malaria has also been increasing due to increasing anti-malaria drugs and insecticide resistance, and complex social structures [8, 12, 15]. Consequently, there is no single method of malaria control that is completely effective in high transmission areas [16]. Even the most widely tested interventions, using bed nets treated with pyrethroid insecticides, have proven difficult to implement correctly because of problems related to equity, accessibility, user

compliance and insecticide resistance [17, 18]. The management of the disease with modern medicines is severely weakened by a widespread presence of *P. falciparum* strains resistant to the most affordable drugs, like chloroquine, mefloquine, and sulfadoxine [19]. The other challenge in effective modern medicines like Coartem, the treatment is also too expensive for wider use in resource poor countries like Ethiopia [20]. Other concerns included fear associated with possible health hazards and negative environmental impacts of the insecticides [18]. In Ethiopia, efforts to combat the disease are also constrained by shortage of trained human resource, drugs, laboratory supplies and field logistics [9, 17].

Traditional Herbal Medicine in Controlling Malaria

Malaria control receives much attention in modern research [8, 18] including through drug discovery and application. Modern healthcare focused on malaria in Ethiopia started as a pilot project in the 1950s and scaled up as a national malaria eradication campaign in the 1960s, followed by a control strategy in the 1970s. These efforts have remained inadequate given the magnitude of the problem. The traditional medicine side of malaria control, which continued since immemorial times, relied on the rich plant resources that notably feature in the local flora and indigenous medical lore [21]. Traditional medicinal plants are nature's gifts developed by indigenous people in their prolonged struggle with diseases affecting humans and livestock and this continues to the present [2, 3, 14, 22, 23]. These plants are sources of environmentally friendly and biodegradable natural products as an alternative green measure of control [8, 15, 24]. Cognizant of the key roles of such medicinal plants, biologists, pharmacists and medical scientists have sharply focused research attention on them. Ethnobotanical surveys among local communities in particular accompanied with extractions and testing of promising plant species have started yielding potentially good compounds. Insecticides, insect repellents and phytomedicines of plant origin have been used for a long time and are traditionally tested to be suitable for safe use in the control of malaria and its vectors [19, 25–28].

The sciences of ethnobotany and ethnomedicine are developing rapidly due to the integration of traditional medicine with modern healthcare services. This is important to standardize and develop plant extracts into various dosage forms with an effective drug at an affordable cost [12, 29, 30]. However, to what extent such endeavours will be fruitful and impact on malaria burden in the future, is basically depending on the capacity of both modern scientists and traditional medicine practitioners in trusting and respecting each other. The objective of this study was to compile ethnobotanical information on anti-malarials, mosquitocidal/insecticidal, mosquito/insect repellents and other vector born diseases combating traditional medicinal plants of Ethiopia used by local communities.

MATERIALS AND METHODS

The information on anti-malarial, mosquitocidal/insecticidal, and mosquito/insect repellent plants were collected from documents (published or grey literature) available in various forms: books, published articles, theses, research reports, herbarium databases and other written sources. Different ethnobotanical publications by staff and graduate students over the past couple of decades, the relevant ethnobotanical MSc and PhD theses as well as other botanical sources were reviewed. Various on-line sources including Google Scholar were browsed using some important key words. The scientific names were checked and confirmed with volumes of the Flora of Ethiopia and Eritrea [1–8]. For each plant species, medicinal use information were gathered in details to include the antimalarials, pesticides (mosquitocide, insecticide), repellents (mosquito, insect) and repellents of other arthropods. Appropriate data collection format was prepared to tabulate scientific, family and local names of species along with; plant habit, altitude of collection, floristic region and site (district, locality) of collection and the sources of references each species. The information was entered in Excel spread. The collected data were analyzed using descriptive statistics to evaluate the percentage and frequency of different aspects such as, categories of medicinal plants, growth forms, altitudinal ranges, method of preparation and

plant parts used. The results were presented with graphs, charts and tables.

RESULTS AND DISCUSSION

Number of Plant Species in Various Reviewed Sources

Among the many materials we reviewed, there were 33 sources of which 24 were masters' theses, 10 were journal articles, 4 were books and 1 was database. Different sources gave different number of species used in connection with malaria. Names of 166 species were compiled from the masters' theses, 107 species from journal articles and others are indicated in Table 1.

The various surveys carried out in Ethiopia have allowed the description of a large number of plants used by the indigenous people to treat different diseases, and malaria is one disease for which a considerable number of species were listed especially in the endemic areas of its prevalence. This is quite larger than that of researchers in Nigeria [8], reported 101 species used in connection with malaria in their review.

Taxonomic Diversity of Antimalarials, Mosquitoecides/Insecticides, and Mosquito/Insect Repellents

In the present survey, a total of 177 plant species which belong to 148 genera and 65 families were compiled. Of these, 96 antimalarial plant species, 25 repellents (mosquito/insect) and 13 pesticidal species were documented (Table 2). The recent practice of treating repellent plants with plants used as insecticides is not considered sound. Thus, in this study, we treated them separately even though there may be some overlaps.

Table 1: Number of Species and Type of Written Sources Reviewed.

Source	Number of Species	Sum of Different Reference	% of Frequency
MSc theses	94	166	93.8
Journal articles	86	107	60.5
Books	53	57	32.2
Herbarium database	32	32	18.1
Total	265	362	204.6

- Total no. of species is more than 100% because the same plant species have been mentioned by different researchers in different areas. Again, some of the sources listed herein, were also found in Databases.

Table 2: Taxonomic Diversity of Antimalarial, Pesticidal (Mosquitoecides/Insecticides) and Repellents (Mosquito/Insect) in Ethiopia.

Category of Plants Used	Number of Species	% of Total
Antimalarial only	96	54.2
Antimalarial, pesticidal, repellent	22	12.4
Pesticidal only	13	7.4
Repellents (mosquito/insect) only	25	14.1
Repellents for other arthropods	21	11.9
Total	177	100.0

Of the total 65 families, Asteraceae and Lamiaceae were found to be represented by the highest number of species. Other families were represented by more than four species included Solanaceae, Fabaceae, Euphorbiaceae, Cucurbitaceae, Acanthaceae and malvaceae.

Three families had 4 species, the other 5 families with 3 species each, 14 families with 2 species each and the remaining 35 families were represented by 1 species each (Appendix 3). As ethnobotanical studies made in various parts of Ethiopia [23, 30] and elsewhere [24] showed; the family Asteraceae consistently came up with high number of species (18), followed by Lamiaceae (15).

Indeed, these families are also among the largest represented dicotyledonous families in the Flora of Ethiopia and Eritrea with 440 and 170 species, respectively.

Plant Species Most Frequently Reported by Different Researchers

Generally, there are many medicinal plants that are claimed to be antimalaria, mosquitoecides/insecticides, and mosquitoes/insects repellents. As shown in different sources of references (Appendix 1), however, the same plant species have been utilized in most areas of the country although there are slight variations in their ethnobotanical application (i.e., the diseases can be treated and used parts). Of the total plants species, only 123 species were restricted on one site in a specific local community. About 27 and 11 species were found in 2 and 3 sites respectively. The most frequently mentioned 16 species found in more than 3 local areas are listed in Table 3.

Table 3: The Most Frequently Used Plant Species as Shown by the Frequency of Encounter in the Literature.

S. No	Scientific Name of Species	Frequency of Encounter in the Literature
1	<i>Allium sativum</i>	13
2	<i>Vernonia amygdalina</i>	12
3	<i>Carica papaya</i>	10
4	<i>Croton macrostachyus</i>	10
5	<i>Dodonea angustifolia</i>	9
6	<i>Lepidium sativum</i>	8
7	<i>Calpurnia aurea</i>	7
8	<i>Justicia schimperiana</i>	6
9	<i>Phytolacca dodecandra</i>	6
10	<i>Ajuga integrifolia</i>	4
11	<i>Capsicum annuum</i>	4
12	<i>Clerodendrum myricoides</i>	4
13	<i>Millettia ferruginea</i>	4
14	<i>Momordica foetida</i>	4
15	<i>Maesa lanceolata</i>	4
16	<i>Withania somnifera</i>	4
Total		102

The growth form analysis of total species indicates that shrubs represented the dominant habits (71 species, 40.1%), followed by herbs (70 species, 39.5%) and the details shown in Figure 1. This finding is in line with the study in Burkina Faso in which half of the selected (in their potential prophylactic use) antimalarial plant remedies were shrubs [12].

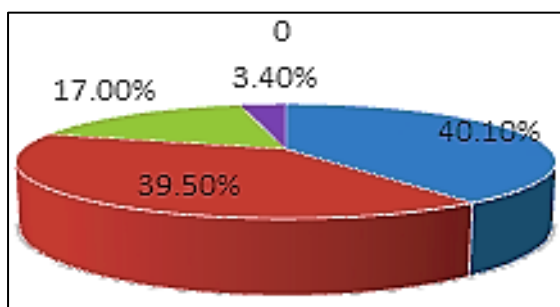


Fig. 1: Proportion of Habit Diversity of Antimalarial, Insecticidal and Repellent Plant Species.

Plant Parts Used and Method of Preparation

Herbal remedies can be prepared from either freshly collected or dry plant samples. The plant parts recorded being used for malaria

treatment were leaves, barks, fruits, seeds, roots, bulbs, rhizomes and combination of plant parts (Appendix 2). With regard to plant parts used, the most frequently used parts were leaves (34.4%), followed by root and root barks (16.4%), and further details were given in Table 4.

Table 4: Frequency of Antimalarial, Insecticidal and Repellent Plant Parts Used.

Plants Parts	Frequency	Percent of Total
Leaf only	61	34.4
Root and Root bark	29	16.4
Whole plant parts	17	9.6
Root and leaf	14	7.9
Fruit only	11	6.2
Seed only	11	6.2
Leaf, Fruit and Seed	8	4.5
Above ground parts	8	4.5
Stem and Stem bark	8	4.5
Leaf and stem	4	2.2
Root, leaf and fruit	1	0.6
Root and Stem	1	0.6
Root and fruit	1	0.6
Rhizome only	1	0.6
Fruit and Seed	1	0.6
Bulb	1	0.6
Total	177	100.0

The common use of leaf for preparation of remedies could partly be due to the relative ease of finding and simplicity of preparation of this part. Leaves were shown to be the most commonly utilized parts in other findings, i.e. 50.7% in Ref. [31]; 71% in Ref. [32]; 32.6% in Ref. [23] and these were also common in elsewhere [24, 33]. Moreover, collecting leaf parts for medicinal purpose is usually not a threat to the survival of plants as compared to the use of whole parts, roots and stem barks [34–36]. This may be related to the medical culture of the people and environmental condition of the area. Apart from monotherapy, some of the physicians claimed that some of the plants can still be combined in twos, threes and even in fours as they believed the combinations increase the medicinal potentials of the herbal preparations [24]. Although some of the sources have shortage of full ethnobotanical information, the herbal remedies used in liquid, solid, semi-solid or vapour form. Milk products, honey, coffee,

traditional ale, food and water are some additives used by healers when preparing remedies to improve the taste and ointments of MPs (Appendix 2). A study in Abia State, Southeast Nigeria also indicated that water and alcohol are usually the main solvent of extraction of the active components either by maceration, decoction, and infusion or concoction [13].

Geographic Distributions of Antimalarals, Insecticidal and Repellents Species in Ethiopia

The highest numbers of species (94, 22.5%) originated from the altitudinal ranges of 1501-2000 m, followed by 89 species (21.3%) in the altitudinal ranges of 1001-1500 m, which are assigned as frequently malaria affected areas and stable/seasonal malaria areas in eco-epidemiological strata respectively as given in Figure 2 below. Figure 2 depicts the distribution of plant species at 500 m intervals with five major eco-epidemiological strata of malaria areas. Several recent reviews on climate change stressed the possibility of some malaria vectors occupying regions of higher altitudes than previously recorded. Indeed, highland malaria has been observed in several African nations, possibly attributable to changes in land use, vector control and local climate [11, 13]. Thus, the presence of antimalarials and malarial vector repellents in the Ethiopian flora will add a greater degree of success to the integrated control of malaria in highland and lowland regions. Although there are 16 regions used to describe the distribution

of plants in the Flora of Ethiopia including Eritrea, our review collected data on 14 Ethiopian floristic regions. The highest number of species (80) was recorded in SU, followed by GJ and HA with 45 species each and the rest are enumerated in Table 5. Several researchers have been contributing a lot in the area of ethnobotany.

The ethnobotanical information, however, is scattered in various published and unpublished volumes and databases. Based on the retrieved journal articles, MSc and PhD theses, books and the medicinal plant database of the National Herbarium were among the main sources reviewed. From the 24 masters’ theses reviewed, a single source listed a maximum of 20 species while single journal article and book gave 27 species each (Table 6). The relevance of such information is vital at present to salvage several threatened medicinal plant species [37].

Conservation Status and Endemicity of Antimalarial, Mosquitocide/Insecticide and Mosquito/Insect Repellent Plants

According to Red List [37] of species, four species listed came under the category of threatened plant species. Of these four species, two of them are plants endemic to Ethiopia (Table 6). Although the number of threatened plant species is limited at present, the result of overharvesting may lead in the near future to disappearance of some medicinal plant species [34, 38].

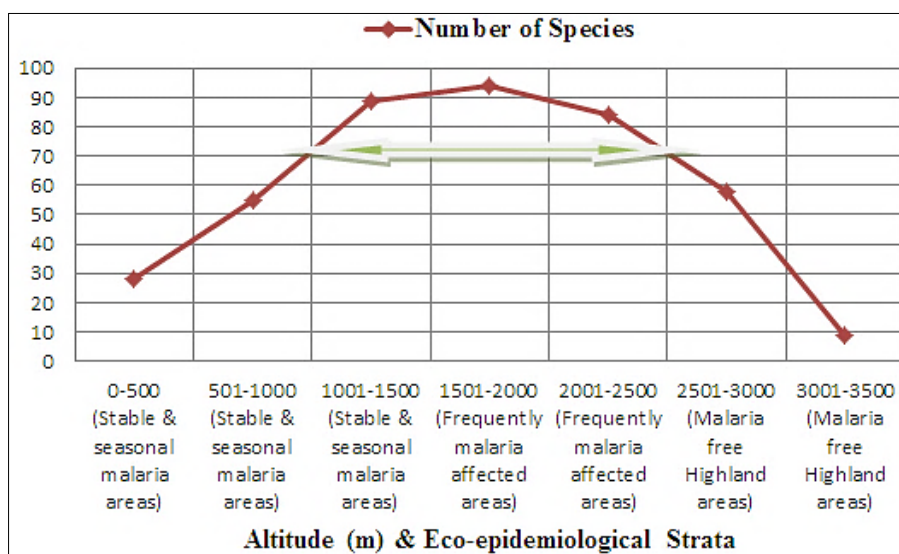


Fig. 2: Distribution of Antimalarials, Insecticidal and Repellent Species in Altitudinal Ranges.

Table 5: Floristic Regions of Collection with Number of Species and Site of Collection.

Floristic Region of Collection (Flora Regions Use Names of the Old Administrative Regions)	No of Species	% of Total	Locality/Wereda of Collection of Some of the Species
SU (Shewa above 1000 m)	80	20.6	Fiche, Ada'a, Akaki, Bosat (Wolenchiti), Chelya, Minjar-Shenkora, North shoa zone, Fentalle
GJ (Gojam)	45	11.7	Jabitehanan, Mecha, Gozomen, Dibatie, Guangua, Zegie Peninsula
HA (Harege)	45	11.7	Shinile, Babile (Erer)
WG (Welega)	33	8.7	Goma, Gimbi, Wayu Tuka
SD (Sidamo)	32	8.5	Wonago, Blue Hora, Wondo Genet, Kochere
GD (Gondar)	31	7.7	Debark, Libo Kemkem, Farta
WU (Welo above 1000 m)	24	6.0	Delanta
GG (Gamo Gofa)	23	5.7	Konso, Chench
BA (Bale)	17	4.2	Mana Angatu, Bale Mountains
AR (Arsi)	15	3.7	Seru
AF (Afar below 1000 m)	12	3.0	Chifra
KF (Kefa region)	14	3.5	Not specified in the primary source
TU (Tigray above 1000 m)	12	3.0	Not specified in the primary source
IL (Iubabor)	8	2.0	Not specified in the primary source
Total frequency	403	100.0	

Table 6: Sources Reviewed and Cited with the Corresponding Number of Antimalarial Plant Species and Locality of Collection.

S.No.	MSc Theses	Species	Site of Collection	Journal Articles	Species	Site of Collection	Books	Species	Site of Collection
1	[61]	20	Fiche	[2]	13	Jabitehanan	[34]	1	Northern Ethiopia
2	[45]	4	Ada'a	[40]	27	Shinile	[38]	20	In Ethiopia
3	[52]	11	Goma	[39]	7	Babile	[58]	9	In Ethiopia
4	[46]	7	Bosat	[3]	21	Akaki	[66]	27	In Ethiopia
5	[50]	10	Chelya	[59]	2	Bosat			
6	[44]	3	Mana Angatu	[30]	10	Konso			
7	[54]	4	Debark	[42]	17	Dibatie/ Guangua			
8	[64]	8	Gimbi	[62]	2	Chench			
9	[48]	8	Wonago	[68]	6	Zegie Peninsula			
10	[65]	9	Mecha	[60]	2	Fentalle			
11	[53]	6	Libo Kemkem						
12	[47]	5	Minjar-Shenkora						
13	[51]	1	Sabata Awas						
14	[69]	1	Bale mountain						
15	[63]	3	Gozomen						
16	[43]	5	North shoa						
17	[55]	6	Seru						
18	[70]	1	Bul Hora						
19	[23]	15	Delanta						
20	[56]	8	Wayu Tuka						
21	[49]	11	Farta						
22	[57]	10	Wondo Genet						
23	[67]	2	Kochere						
24	[41]	9	Chifra						

Table 7: Ethiopian Endemic Species and Their Status Based on IUCN Red List of Threatened Species Version 2013.2.

S.No.	Species	Status	Population Trend	Endemicity
1	<i>Aloe camperi</i>	Least Concern ver 3.1	Increasing	Not Endemic
2	<i>Aloe pirottae</i>	Least Concern ver 3.1	Unknown	Endemic
3	<i>Aloe pulcherrima</i>	Vulnerable B1ab(iii) ver 3.1	Decreasing	Endemic
4	<i>Laggera tomentosa</i>	Not listed in IUCN	Not indicated in IUCN	Endemic
5	<i>Leucas stachydiformis</i>	Not listed in IUCN	Not indicated in IUCN	Endemic
6	<i>Podocarpus falcatus</i>	Least Concern ver 3.1	Unknown	Not Endemic
7	<i>Solanecio gigas</i>	Not listed in IUCN	Not indicated in IUCN	Endemic
8	<i>Solanum marginatum</i>	Not listed in IUCN	Not indicated in IUCN	Endemic

- A taxon is *Least Concern* when it has been evaluated against the criteria and does not qualify for *Critically Endangered*, *Endangered*, *Vulnerable* or *Near Threatened*.
- A taxon is *Vulnerable* when the best available evidence indicates that it meets any of the criteria A to E for *Vulnerable*, and it is therefore considered to be facing a high risk of extinction in the wild.

CONCLUSION AND RECOMMENDATIONS

This survey has attempted to highlight diverse medicinal plants claimed to be used or associated with malaria therapy in the Ethiopian herbal medicine system.

Moreover, not only plants used as antimalarials, insecticidal and insect repellents but also plants that can be used as repellents for other harmful arthropods are included.

The use of antimalarials, insecticides and insect repellents is common among many communities in Ethiopia and the results indicate that such use would be beneficial in reducing biting by vectors and preventing disease transmission.

The finding that roots are the second largely used parts and that most of the species grow on their own in the wild, and the fact that numerous human activities are leading to exploitation of natural resources constitute problems of destruction of the most frequently used plants.

The plants compiled in this report may probably contain yet undiscovered antimalaria properties, which can serve as the basis for developing broad spectrum potentially effective and environment friendly drugs.

Listing these plants and mentioning about their ethnobotanical applications cannot be an end in itself, rather a means to an end in the long

range. Thus, the following recommendations are forwarded:

1. The medicinal plants listed in this report need to be made targets of conservation and continued research about their occurrence, distribution, abundance, drug discovery, insecticidal and repellent properties.
2. Those who handle these and other medicinal plants or even other wild useful plants must respect the ethnobiology code of ethics.
3. The widespread use of antimalarial, pesticides and repellents has a potential to complement other control measures and must be put to effective use.
4. There is an urgent need to map out strategies for conservation of the plants listed in the IUCN Red List category to avoid their extinction in the near future.
5. This bibliographical survey does not claim to be the final word in ethnobotanical opinion for every plant group listed, but it provides a basis for further screening and research on the plants used for malaria treatment and prevention, typically many of the species on the prioritized list and other species still lacking some essential ethnobotanical information. The species in the latter group obviously require further studies for the details on their ethnobotanical applications.
6. Ultimately, it is the developing countries which are rich in endemic plant biodiversity that the antimalarials, pesticides and repellents may have their greatest impact in future integrated pest

management (IPM) and malaria control programmes due to their safety to non-target organisms and the environment.

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APPENDICES

Appendix 1: List of Plant Species Claimed to Have Antimalaria, Insecticidal and Repellent Properties with Local Names, Habits, Flora Distribution and References.

No.	Scientific Name of Plant	Local Name of Plant (Lang.)	Family	Habit	Alt (m)	Fl. Region/ Wereda/locality	Reference
1	<i>Acacia robusta</i> Burch.	Wangeyo (Orom.)	Fabaceae	T	500-1450	HA, Babile (Erer)	[39]
2	<i>Acalypha indica</i> L.	Habrid (Som.)	Euphorbiaceae	H	0-1300	HA, Shinile	[40]
3	<i>Acalypha</i> sp.	Subaaci (Afar)	Euphorbiaceae	H		AF, Chifra	[41]
4	<i>Acanthus polystachyus</i> Delile	Dendero (Amh.)	Acanthaceae	H	1500-2500	GJ, Dibatie/ Guangua	[42]
5	<i>Achyranthes aspera</i> L.	Telenge (Amh.)	Amaranthaceae	H	350-3050	SU, North shoa zone ; BA, Mana Angatu	[43,44]
6	<i>Acokanthera schimperii</i> (A. DC.)Schweinf.	Kararu (Orom.), Dogor, Oboyo (Som.)	Apocynaceae	S	800-2100	HA, Babile (Erer); HA, Shinile	[39, 40]
7	<i>Agave sisalana</i> Perrine ex Engel.	Qacaa /Qacha (Orom.)	Agavaceae	S	1500-2300	SU, Ada'a; SU, Akaki	[45,3]
8	<i>Ageratum conyzoides</i> L.	Tufo (Orom.)	Asteraceae	H	1900-2400	SU, Akaki	[3]
9	<i>Ajuga integrifolia</i> Buch-Ham.	Tut astil (Amh.)	Lamiaceae	H	1500-3400	SU, North shoa zone; SU, Bosat (Wolenchiti); SU, Akaki	[43,46, 38, 3]
10	<i>Allium sativum</i> L.	Nechshinkurt (Amh.); Dimoxxa sunkurae (Gid.); Qullubbii-adii (Orom.)	Alliaceae	H	1850-2150 (2805)	SU, Minjar-Shenkora; SD, Wonago; WU, Delanta; GD, Farta; SU, Chelya; SU, Sabata Awas; WG, Goma; GD, Libo Kemkem; GD, Debark; SU, Ada'a; AR, Seru; WG, Wayu Tuka; SD, Wondo Genet	[47, 48, 23, 49,50, 51, 52, 53,54, 45, 55, 56, 57, 58]
11	<i>Aloe camperi</i> Schweinf.	Eret (Amh.)	Aloaceae	S	2625	SU, North shoa zone	[43]
12	<i>Aloe pirottae</i> Berger*	Hargeysa (Orom.), Gebedhera (Som.)	Aloaceae	S	1300-1820	HA, Babile (Erer)	[39]
13	<i>Aloe pulcherrima</i> Gilbert and Sebsebe (ined.)*	Hargessadhala (Orom.)	Aloaceae	H	2667	SU, Akaki	[3]
14	<i>Aloe</i> sp.	Quureyta (Afar); Eret (Amh.); Dahar-kinin (Som.)	Aloaceae	S		AF, Chifra; GJ, Dibatie/ Guangua; HA, Shinile	[41, 42, 40, 58]
15	<i>Andrachne aspera</i> Spreng.	Etse tekeze (Amh. & Ge'ez), Qoricha ilman gobana (Orom.)	Euphorbiaceae	H	0-2250	SU, Bosat ; SU, Fentalle	[59,60]
16	<i>Anethum graveolens</i> L.	Karmn (Som.)	Apiaceae	S	1350-2000	HA, Shinile	[40]
17	<i>Artemisia absinthium</i> L.	Arrity (Amh.)	Asteraceae	H	1700-2440	TU GD SU WG HA	[38]
18	<i>Artemisia afra</i> Jack. ex Wild.	Artii (Orom.); Chugughee (Gid.)	Asteraceae	H	2792	SU, Fiche; SD, Wonago	[61,48]
19	<i>Artemisia annua</i> L.	Chiqugn (Amh.)	Asteraceae	S	1000-1500	GG, Chench	[62]
20	<i>Artemisia abyssinica</i> Sch.Bip.	Sunado hayiso (Sid.)	Asteraceae	H	2667	SD, Wondo Genet	[57]
21	<i>Asparagus africanus</i> Lam.	Sariitii (Orom.); Geday (Som.)	Asparagaceae	S	2651	AR, Seru; HA, Shinile	[55, 40]
22	<i>Azadirachta indica</i> A. Juss	Ged-kinin (Som.); Kinina (Orom.); Neem (Amh.)	Meliaceae	T	1500	HA, Shinile; HA, Babile (Erer); GJ, Dibatie/ Guangua	[40, 39,42]
23	<i>Balanites aegyptiaca</i> (L.) Del.	Bedeno (Orom.), Kutun (Som.)	Balanitaceae	T	7001800	HA, Babile (Erer)	[39]
24	<i>Balanites rotundifolia</i> (Van Tiegn.) Blatter	Qaalayto (Afar); Kulen (Som.)	Balanitaceae	S	300-1500	AF, Chifra; HA, Shinile	[41, 40]
25	<i>Brassica nigra</i> (L.) Koch.	Senafch (Amh.); Sanafica (Orom.)	Brassicaceae	H	2675	GJ, Gozomen; SU, Akaki	[63, 3]
26	<i>Brucea antidysenterica</i> Fresen.	Qomonyo (Orom.)	Simaroubaceae	S	1650-2800	SU, Chelya; WG, Gimbi	[50,64]
27	<i>Buddleja polystachya</i> Fresen.	Adadoo (Orom.)	Loganiaceae	S	2530	AR, Seru	[55]
28	<i>Calotropis procera</i> (Ait.) Dry. in Ait	Ginda, Tobbeya, Yahara-zaf (Amh.)	Asclepiadaceae	S	0-2250	SU, North shoa zone; SU, Bosat (Wolenchiti);	[43, 46,38]
29	<i>Calpurina aurea</i> (Ait.) Benth.	Digita, Zikita (Amh.); Ceeqa, Ceekaa (Orom.)	Fabaceae	S	2178-2318(2528)	GD, Farta; GJ, Mecha; WG, Gimbi; SU, Akaki; GJ, Dibatie/ Guangua; WG, Goma; WG, Wayu Tuka	[49, 65, 64, 3, 42, 52, 56, 66]
30	<i>Canna indica</i> L.	Cale (Orom.)	Cannaceae	S	500-2400	SU, Akaki	[3]

31	<i>Capparis tomentosa</i> Lam.	Gombor (Orom.) Gimero (Amh.)	Capparidaceae	S	500-(2093) 2200	SU, North shoa zone; BA, Mana Angatu	[43, 44, 66]
32	<i>Capsicum annuum</i> L.	Karia, keto, mitmita (Amh.)	Solanaceae	H	2193-2450	WU, Delanta; GD, Farta; GJ, Dibatie/ Guangua; GD, Libo Kemkem	[23, 49,42,53]
33	<i>Carica papaya</i> L.	Papaya (Amh.); Papaayaa (Orom.)	Caricaceae	T	0-1800	SU, Minjar-Shenkora; SD, Wondo Genet; WG, Gimbi; SU, Chelya; SD, Kochere; GJ, Dibatie/ Guangua; WG, Goma; GD, Libo Kemkem; GJ, Zegie Peninsula; GJ, Jabitehanan	[47, 57, 65, 50, 67, 42, 52, 53, 68, 2]
34	<i>Carissa spinarum</i> L.	Agam (Amh.); Agamsa (Orom.)	Apocynaceae	S	550-(2392)2500	SU, Bosat (Wolenchiti); SU, Minjar-Shenkora; AR, Seru	[46, 38, 47, 55, 58]
35	<i>Carthamus tinctorius</i> L.	Suf (Amh.)	Asteraceae	H	1000-2400	TUGD WU SU AR WG KF HA	[66]
36	<i>Chenopodium ambrosioides</i> L.	-----	Chenopodiaceae	H	950-2500	AF GD GJ WU SUSD BA HA	[66]
37	<i>Chenopodium schraderianum</i> Schult.	Sinign (Amh.)	Chenopodiaceae	H	2584	WU, Delanta	[23]
38	<i>Cicer arietinum</i> L.	Shimbra (Amh.)	Fabaceae	H	1000-2200	SU, Minjar-Shenkora; GD, Libo Kemkem	[47,53]
39	<i>Cissus rotundifolia</i> (Forssk.) Vahl.	Armon (Som.)	Vitaceae	H	550-1900	HG, Shinile	[40]
40	<i>Citrus aurantifolia</i> (Christm.)	Lommi (Orom.)	Rutaceae	T	1994	SU, Akaki	[3]
41	<i>Citrus limon</i> Burm.F.	Lomii (Orom.)	Rutaceae	S	2809	SU, Fiche	[61]
42	<i>Clausena anisata</i> (Willd.) Benth.	Limich (Amh.)	Rutaceae	S	2157	GJ, Mecha	[65]
43	<i>Clematis simensis</i> Fresen.	Yeazohareg (Amh.)	Ranunculaceae	C	2584	GJ, Gozomen	[63, 66]
44	<i>Clerodendrum myricoides</i> (Hochst.) Vatke	Misrich (Amh.); Marasisa (Orom.)	Lamiaceae	S	700-(2392) 2600	GJ, Mecha; SU, Chelya, AR, Seru, BA, Mana Angatu	[65, 50, 55, 44]
45	<i>Clutia abyssinica</i> Jaub. &Spach.	Fiyel fejjii (Amh.)	Euphorbiaceae	S	2532-2997	SU, Fiche	[61]
46	<i>Clutia lanceolata</i> Forssk.subsp. lanceolata	Fiyele fej (Amh.)	Euphorbiaceae	S	2829	GD, Farta	[49]
47	<i>Coffea arabica</i> L.	Bunna (Amh.)	Rubiaceae	S	(1000)1500-1900	SD, Wondo Genet	[57]
48	<i>Combretum molle</i> R. Br.ex G. Don.	Aballo (Amh.)	Combretaceae	S	2097	WU, Delanta	[23]
49	<i>Commicarpus grandiflorus</i> (A.Rich.) Standl.	Engurbaba (Amh.)	Nyctaginaceae	H	2098	WU, Delanta	[23]
50	<i>Conyza pyrhopappa</i> Sch.Bip. ex A.Rich.	Dadaho (Som.)	Asteraceae	S	1300-2700	HG, Shinile	[40]
51	<i>Cordia africana</i> Lam.	Wanza (Amh.)	Boraginaceae	T	2 500-1994	GD, Farta	[49]
52	<i>Crabbea velutina</i>	Malgissa (Kon.)	Acanthaceae	H	850-2000	Konso	[30]
53	<i>Croton macrostachyus</i> Hochst. ex Del.	Mekenisa, Misana Bissana Asisi (Amh.); Bissano (Gid.); Mekanisaa, Bakkanisaa (Orom.)	Euphorbiaceae	T	500-2350 (2485)	WU, Delanta; GJ, Mecha; SD, Wonago; GJ, Gozomen; WG, Goma; WG, Wayu Tuka; GJ, Jabitehanan; SU, Bosat (Wolenchiti); GJ, Dibatie/ Guangua	[23, 65, 48,63, 52, 56, 2,46, 38, 42]
54	<i>Cucumis ficifolius</i> A.Rich.	Anun demerit (Som.)	Cucurbitaceae	H	2656	HA, Shinile	[40, 66]
55	<i>Cucumis melo</i> L.	Hare joge (Orom.)	Cucurbitaceae	H	200-1100	SU, Fentalle	[60]
56	<i>Cucumis prophetarum</i> Jua.	Yemdr Embuay (Amh.) 'mbway(Amb.)	Cucurbitaceae	H	200-1950	AFTUWUSU SD	[66]
57	<i>Cucurbita pepo</i> L.	Buqqee (Orom.)	Cucurbitaceae	H	2669	WG, Wayu Tuka	[56]
58	<i>Cyphostemma adenocaula</i> (Steud.ex A. Rich) Desc. ex Wild & Dr.	Aserkush (Amh.)	Vitaceae	C	2205	WU, Delanta	[23]
59	<i>Datura stramonium</i> L.	Manjii (Orom.); Astenagire (Amh.)	Solanaceae	H	2531	SU, Chelya; SU, Minjar-Shenkora	[50,47]
60	<i>Discopodium penninervium</i> Hochst.	Raji (Orom.)	Solanaceae	T	2792	SU, Fiche	[61]
61	<i>Dodonaea angustifolia</i> L.f.	Kitkita (Amh.); Itancha (Sid.); Itacha, Dhitecha (Orom.); Ittechhae (Gid.);	Sapindaceae	S	500-2285 (2900)	GJ, Jabitehanan; GJ, Mecha; SD, Wondo Genet; SU, Akaki; SD, Wonago; SU, Fiche; BA, Bale mountains; GJ, Dibatie/ Guangua	[2, 65, 57, 3, 48, 61, 69, 38, 42]
62	<i>Dombeya torrid</i> (J. F. Gmel.)P. Bamps	Wulkfa (Amh.)	Malvaceae	T	1600-3100	TU GD GJ WU SUAR WG IL KF GG SD BA HA	[66]
63	<i>Elucine coracana</i> (L.) Gaertn.	Dagussa (Amh.)	Poaceae	H	2310	GD, Farta	[49]

64	<i>Eleusine jaegeri</i> Pilg.	Akrma 9Amh.)	Poaceae	H	3000	-----	[66]
65	<i>Entada abyssinica</i> (Steud. ex A. Rich.)Gilb. & Bout.	Ambalta (Orom.)	Fabaceae	T	13002050	WG, Gimbi	[64]
66	<i>Eucalyptus globulus</i> Labill	Barzafae (Gid.); Baarzaafii adii (Orom.)	Myrtaceae	T	3253	SD, Wonago; WG, Goma	[52,48]
67	<i>Euclea divinatorum</i> Hiern	Maqayta (Kon.)	Ebenaceae	S	1000-2400	Konso	[30]
68	<i>Euclea racemosa</i> Murr.	Dedeho (Orom.)	Ebenaceae	S	2286	SU, Fiche	[61]
69	<i>Euclea racemosa</i> Murr. subsp. schimper (A.DC.) White	Dedeho (Amh.)	Ebenaceae	S	(700-)1000-2900	GJ, Jabitehanan	[2]
70	<i>Euphorbia abyssinica</i> Gmel.	Adaami, Dharkena (Orom.); Kulkual (Amh.)	Euphorbiaceae	T	2506	HA, Babile (Erer); WG, Goma; GD, Libo Kemkem	[39, 52, 53, 58]
71	<i>Ficus platyphylla</i> Del.	Hadawa (Kon.)	Moraceae	T	600	Konso	[30]
72	<i>Ficus sur</i> Forssk.	Odako (Sid.)	Moraceae	T	2653	SD, Wondo Genet	[57]
73	<i>Foeniculum vulgare</i> Miller	Kamon (Som.)	Apiaceae	H	2600	HA, Shinile	[40]
74	<i>Gardenia lutea</i> Fresen.	Gambelo (Amh.)	Rubiaceae	S	900-2250	GJ, Dibatie/ Guangua	[42]
75	<i>Gardenia ternifolia</i> Schumach. & Thonn.	Gambello (Orom.)	Rubiaceae	S	1600	SD, Blue Hora	[70]
76	<i>Gardenia dalenii</i> Van Geelsubsp. dalenii	Parrot gladiolus (Eng.)	Iridaceae	H	870-1600	SU, WG, SD, HA	[38]
77	<i>Gnidia involucrata</i> Steud ex.A.Rich.	Boto/Beto (Amh.)	Thymelaceae	H	1500-2500	GJ, Jabitehanan; GJ, Mecha	[2, 65, 34]
78	<i>Gossypium barbadense</i> L.	Tit (Amh.)	Malvaceae	S	0-2000	GJ, Jabitehanan	[2]
79	<i>Gossypium hirsutum</i> L.	Tit (Amh.)	Malvaceae	S	2244	WU, Delanta	[23]
80	<i>Grewia ferruginea</i> Hochst.ex A.Rich.	Alenqoza, lenquata (Amh.)	Tiliaceae	S	2193	TU GD GJ WU SUAR WGKF SD BA HA	[66]
81	<i>Guizotia scabra</i> (Vios.)Chiov.	Tuufoo (Orom.)	Asteraceae	H	1300-2850	WG, Wayu Tuka	[56]
82	<i>Guizotia schimperii</i> Sch.Bjp.ex Walp	Adaa/Mechi (Orom.)	Asteraceae	H	2680	SU, Fiche	[61]
83	<i>Hagenia abyssinica</i> (Bruce) J.F. Gmel.	Kosso (Amh.)	Rosaceae	T	3206	WU, Delanta	[23]
84	<i>Halothamnus somalensis</i> (N.E.Br.) Bostch.	Mirow (Som.)	Chenopodiaceae	S	700-1900	HA, Shinile	[40]
85	<i>Holothrix sp.</i>	-----	Orchidaceae	H	-----	-----	[66]
86	<i>Hydnora johannis</i> Becc.	Liko (Som.)	Hydnoraceae	H	1000-1500	HA, Shinile	[40]
87	<i>Hypoestes forskalei</i> (Vahl) R. Br. (Vahl) R.Br.	Quneyta (Kon.)	Acanthaceae	H	2653	Konso	[30]
88	<i>Hypoestes triflora</i> (Forsk.) Roem & Schult.	-----	Acanthaceae	H	2419	GD, Farta	[49]
89	<i>Impatiens rothi</i> Hook.f.	Ensosila (Amh.)	Balsaminaceae	H	1800-3500	TU GD SU AR WG KF SD BA HA	[66]
90	<i>Impatiens tinctoria</i> A. Rich.	Gushirit (Amh.)	Balsaminaceae	H	1600-3500	GDSU AR KF SD BA	[66]
91	<i>Indigofera articulata</i> Gouan	Gabalday (Som.)	Fabaceae	S	1300 (2700)	HA, Shinile	[40]
92	<i>Indigofera coerolea</i> Roxb.	Gabalday (Som.)	Fabaceae	H	1350	HA, Shinile	[40]
93	<i>Jasmonium abyssinica</i> Hochst.	Tenbele (Amh.)	Oleaceae	S	1700-2800	GJ, Jabitehanan	[2]
94	<i>Jasmonium grandiflorum</i> L. subsp. floribundum (R.Br. ex Fresen.)P.S.Green		Oleaceae	C	1600-2800	TUGD GJWU SU AR GG SD HA	[66]
95	<i>Jatropha curcas</i> L.	Habet-muluk, Anddelmeluc (Som.)	Euphorbiaceae	S	450-1300	HA, Shinile	[40, 38]
96	<i>Justicia schimperiana</i> (Hochst. ex Nees) T. Anders	Simiza, Sensel (Amh.); Dhummuugaa, Kisha (Orom.)	Acanthaceae	S	1997-2395 (2700)	GJ, Mecha; SD, Kochere; WG, Wayu Tuka; GD, Debark; SU, Fiche; GJ, Jabitehanan	[65, 67, 56, 54, 61, 2, 66]
97	<i>Kniphofia isoetifolia</i> Steud. ex Hochst.	Yejb shnkurt (Amh.)	Asphodelaceae	H	2050-3650	TU GD GJ SU AR KF GG BA HA	[66]
98	<i>Kosteletzkyia adoensis</i> (Hochst.ex A.Rich.) Mast	Nacha (Amh.)	Malvaceae	H	1200-2750	TUGDGJWUSUAR WGILKF GGSDBA HA	[66]

99	<i>Lagenaria siceraria</i> (Molina) Standl.	Kil (Amh); Buqqehadhaa (Orom.)	Cucurbitaceae	H	300-2800	SU, Bosat; SU, Chelya	[59,50]
100	<i>Laggera tomentosa</i> (Sch. Bip.ex A. Rich.) Oliv. & Hiern. *	Alashume (Amh.)	Asteraceae	S	2632	WU, Delanta	[23]
101	<i>Lawsonia inermis</i> L.	Elan (Som.)	Lythraceae	T	0-1100	HA, Shinile	[40]
102	<i>Leonotis ocymifolia</i> (Burm. f.) Iwarsson	Ferszeng, Yeferes Zeng (Amh.)	Lamiaceae	S	2858-2997	SU, Fiche; WU, Delanta	[61, 23, 66]
103	<i>Lepidium sativum</i> L.	Feto (Amh., Kon.); Feecoo, Fexo, Fetto, Shinafaa (Orom.); Feaxxo (Gid.)	Brassicaceae	H	2314	Konso, SU, Chelya, SU, Akaki; SD, Wonago; WG, Goma; SU, Fiche	[30, 50, 3, 48, 52, 56, 61]
104	<i>Leptadenia hastata</i> (Pers.) Decne.	Mesker (Som.)	Asclepiadaceae	Cl	300-1600	HA, Shinile	[40]
105	<i>Leucas stachydiformis</i> (Hochst. ex Benth.) Briq. *	Qumudu (Orom.)	Lamiaceae	H	1700-3200	WG, Goma	[52]
106	<i>Lippia adoensis</i> Hochst. ex Walp var <i>adoensis</i>	Koseret (Amh., Gur.)	Verbenaceae	S	1600-3000	SU, Bosat (Wolenchiti)	[46, 38]
107	<i>Lippia javanica</i> (Burm.f.) Spreng	Kusaye (Orom.)	Verbenaceae	S	900-1700	SU, Akaki; WG, Gimbi	[38, 64]
108	<i>Lobelia</i> sp.	Jibira (Amh.)	Lobeliaceae	S		GJ, Dibatie/ Guangua	[42]
109	<i>Lycium shawii</i> Roem and Schult	Hedalusayto (Afar)	Solanaceae	S	500-1600	AF, Chifra	[41]
110	<i>Maerua oblongifolia</i> (Forssk.) A.Rich.	Ja'a (Som.)	Capparidaceae	S	0-1800	HA, Shinile	[40]
111	<i>Maesa lanceolata</i> Forssk. Suwaria	Abayi (Orom.); Kalawa (Amh.)	Myrsinaceae	T	1350-3000	SU, Akaki; SU, Bosat (Wolenchiti)	[3, 46, 38, 58]
112	<i>Melia azedarach</i> L.	Kiniin (Sid.); Nim (Amh.); Mim (Orom.)	Meliaceae	T	2590	SD, Wondo Genet; GD, Farta; WG, Goma	[57, 49, 52]
113	<i>Mentha spicata</i> L.	Nana (Som.)	Lamiaceae	H	1700-1800	HA, Shinile	[40]
114	<i>Milletia ferruginea</i> (Hochst.) Bak.	Sotallo (Orom.); Birbira (Amh.); Hengedicho (Sid.);	Fabaceae	T	2427	WG, Gimbi; GD, Farta; GJ, Zegie Peninsula; SD, Wondo Genet	[64, 49, 68, 57]
115	<i>Momordica foetida</i> Schum.	Marqura, areg riesa (Amh.); haragoge, Laqana Qura (Orom.)	Cucurbitaceae	H	530-3450	GJ, Zegie Peninsula, GJ, Jabitehanan; SU, Akaki;	[68, 2, 38, 3]
116	<i>Moringa oleifera</i> Lam.	Shiferaw (Afar)	Moringaceae	T	1000-1650	AF, Chifra	[41]
117	<i>Moringa stenopetala</i> (Baker f.) Cufod.	Haleko (Shelaqta) (Kon.)	Moringaceae	T	1200-1650	Konso	[30]
118	<i>Mukia maderaspatana</i> (L.) M.J. Roem.	Gim Hareg (Amh.)	Cucurbitaceae	H	2271	SU, Fiche	[61]
119	<i>Nicotiana tabacum</i> L.	Tambo (Orom.)	Solanaceae	H	300-2400	SU, Akaki	[3]
120	<i>Ocimum basilicum</i> L.	Besobila (Amh.)	Lamiaceae	H	2764	SU, Fiche	[61]
121	<i>Ocimum gratissimum</i> L. var. <i>gratissimum</i>	-----	Lamiaceae	H	1500	GJ, Dibatie/ Guangua	[42]
122	<i>Ocimum lamifolium</i> Hochst. ex.Benth	Qoricha Michi (Orom.)	Lamiaceae	S	2641	SU, Akaki	[3]
123	<i>Ocimum spicatum</i> Defflers	Shero (Som.)	Lamiaceae	H	900-1600	HA, Shinile	[40]
124	<i>Oreosyce africana</i> Hook.f.	Manabasi (Orom.)	Cucurbitaceae	Cl	1650-2000	SU, Akaki	[3]
125	<i>Otostegia integrifolia</i> Benth.	Tinjut (Amh.)	Lamiaceae	S	2160-2392	WU, Delanta; GJ, Mecha; GJ, Dibatie/ Guangua	[23, 65, 42, 58]
126	<i>Phytolacca dodecandra</i> L.'Herit.	Handoodee (Orom.); Indoodae (Gid.); Mehan endod (Amh.)	Phytolaccaceae	S	2660	AR, Seru; SD, Wonago; SU, Minjar-Shenkora; GD, Libo Kemkem; GD, Farta GJ, Jabitehanan	[55, 48, 47, 53, 49, 2, 58, 66]
127	<i>Plectranthus barbatus</i> Ander.	Keskeso (Orom.)	Lamiaceae	S	2792	SU, Fiche	[61]
128	<i>Plectranthus igniarius</i> (Schweinf.) Agrew.	Tontona (Sid.)	Lamiaceae	S	350-1650	SD, Wondo Genet	[57]
129	<i>Plumbago zeylanica</i> L.	Amira (Amh.)	Plumbaginaceae	S	700-2200	GJ, Dibatie/ Guangua	[42]
130	<i>Podocarpus falcatus</i> (Thunb.)R.B. ex. Mirb	Zigba (Kon.)	Podocarpaceae	T	1800-2400	Konso	[30]
131	<i>Premna schimperi</i> Engl.	Urgessa (Orom.)	Lamiaceae	S	1350-2400	WG, Gimbi; SU, Akaki	[64, 3]
132	<i>Prunus persica</i> (L.) Batsch	Kok (Amh.)	Rosaceae	T	1800-2200	GJ, Dibatie/ Guangua	[42]
133	<i>Pupalia micrantha</i> Hauman	Ma'abis (Som.)	Amaranthaceae	S	800-1250	HA, Shinile	[40]
134	<i>Rhamnus prinoides</i> L'Herit.	Gesho	Rhamnaceae	S	1400-3200	TU GD WU SU AR GJ WG IL KF GG SD BA HA	[66]
135	<i>Rhoicissus revouilii</i> Planch.	Iddefitii (Orom.)	Vitaceae	H	2285	SU, Fiche	[61]

136	<i>Ricinus communis</i> L.	Qobo (Orom.)	Euphorbiaceae	S	2658	SU, Akaki	[3]
137	<i>Rubia cordifolia</i> L. var. <i>discolor</i> (Turc) Eng	Matanay (Orom.)	Rubiaceae	H	1000-2850	TU GD GJ WU SU AR KF SD BA HA	[38]
138	<i>Rumex abyssinicus</i> Jacq.	Momoqo (Amh.)	Polygonaceae	H	2905	GD, Debark	[54]
139	<i>Ruta chalepensis</i> L.	Tenadam (Amh.); Ciladama (Orom.)	Rutaceae	H	2167	GJ, Mecha; SU, Akaki	[65, 3]
140	<i>Salvadora persica</i> L.	Qadayto (Afar); Ader (Som.)	Salvadoraceae	S	0-1300	AF, Chifra; HA, Shinile	[41, 40]
141	<i>Salvia schimperii</i> Benth.	Gimekitel, Yahya joro (Amh.)	Lamiaceae	H	2662-2858	WU, Delanta; SU, Fiche	[23, 61]
142	<i>Schinus molle</i> L.	Qundo-berbere	Anacardiaceae	T	2738	GJ, Dibatie/ Guangua	[42]
143	<i>Securidaca longepedunculata</i> Fresen.	Etse amanahi (Amh.)	Polygalaceae	S	500-1750	TU GD GJ WG SU IL GG	[66]
144	<i>Senna italica</i> Mill.	Female Ayrowagit (Afar); Salamaki (Som.)	Fabaceae	H	0-1850	AF, Chifra; HA, Shinile	[41, 40]
145	<i>Senna singueana</i> (Del.) Lock	Gufa (Orom.)	Fabaceae	T	2276	SU, Fiche	[61]
146	<i>Sesamum orientale</i> L.	Selit (Amh.)	Pedaliaceae	H	550-1800	GD GJ WG IL KF GG	[66]
147	<i>Silene macrosolen</i> A.Rich.	Wegert (Amh.)	Caryophyllaceae	H	2832	GD, Debark	[54]
148	<i>Solanecio gigas</i> (Vatke.) C. Jeffery*	Jirmajaldeeasa (Orom.)	Asteraceae	S	2667	SU, Chelya	[50]
149	<i>Solanum adoense</i> (Hochst) ex A.Rich.	Zirch enbuay (Amh.)	Solanaceae	S	2780	GD, Farta	[49]
150	<i>Solanum anguivi</i> L.	Hidi (Orom.)	Solanaceae	S	2661	WG, Goma	[52]
151	<i>Solanum dasyphyllum</i> Schumach.	Hongorcaa (Orom.)	Solanaceae	S	200-2400	SU, Chelya	[50]
152	<i>Solanum incanum</i> L.	Xabbooli (Afar); Hiddii (Orom.) Yedi (Amh.)	Solanaceae	S	1500-2209	AF, Chifra; SU, Ada'a	[41,45]
153	<i>Solanum macrocarpon</i> L.	Hidi Warabesa (Orom.)	Solanaceae	S	1400-1700	SU, Akaki	[3]
154	<i>Solanum marginatum</i> L. f.*	Hidii (Orom.)	Solanaceae	S	2715	SU, Fiche	[61]
155	<i>Solanum nigrum</i> L.	Tikur Awut (Amh.)	Solanaceae	H	700-2350	GDSU KF SD HA	[66]
156	<i>Solanum</i> sp.	Mie'godel (Som.)	Solanaceae	S		HA, Shinile	[40]
157	<i>Solenostemon latifolius</i> (Hochst. ex Benth.) J.K.	Dachet (Orom.)	Lamiaceae	H	2571	SU, Fiche	[61]
158	<i>Stephania abyssinica</i> (Dillon & A.Rich.) Walp.	Yeayit-hareg (Amh.)	Menispermaceae	H	2584	WU, Delanta	[23]
159	<i>Stereospermum kunthianum</i> Cham.	Zana (Amh.), botooro (Orom.)	Bignoniaceae	T	500-1950	GJ, Dibatie/ Guangua	[42]
160	<i>Sruga hermonthica</i> (Del.) Benth.	Yemashila kitgn (Amh.)	Scrophulariaceae	H	2584	WU, Delanta	[23]
161	<i>Tagetes minuta</i> L.	Hada (Orom.)	Asteraceae	H	1350-2200	SU, Akaki	[3]
162	<i>Tamarindus indica</i> L.	Roka (Orom. Som.), Hamer (Som.)	Fabaceae	T	1500	HA, Babile (Erer); HA, Shinile	[39,40]
163	<i>Terminalia Schimperiana</i> Hochst.	Abalo (Amh.)	Combretaceae	T	1300-2200	SU, Minjar-Shenkora	[47]
164	<i>Turraea mombessana</i>	Pitercama (Kon.)	Meliaceae	S	1400	Konso	[30]
165	<i>Verbena officinalis</i> L. subsp. <i>africana</i> R. Fernandes	Atuch (Amh.)	Verbenaceae	H	1500-2500 (2268)	GJ, Zegie Peninsula; GJ, Jabitehanan;	[68, 2 38, 58]
166	<i>Vernonia adoensis</i> Sch.Bip.ex Walp.	Feres-zeng, Tikwa (Amh.)	Asteraceae	H	500-2000	GJ, Zegie Peninsula; GJ, Jabitehanan	[68, 2, 38]
167	<i>Vernonia amygdalina</i> Del.	Fashayta (Kon.); Hecho (Sid.); Eebicha, Ebicha (Orom., Gid.); Girawa (Amh.)	Asteraceae	S	650-(2858)3000	SD, Wondo Genet Konso; SU, Chelya; SD, Wonago; WG, Goma; SU, Ada'a; WG, Wayu Tuka; GJ, Zegie Peninsula; SU, Fiche; GJ, Jabitehanan; JJ, Chencha	[30, 57, 50,48, 52, 45, 42, 68, 61, 2, 52, 38, 66]
168	<i>Vernonia hochstetteri</i> Sch. Bip. ex Walp		Asteraceae	S	1200-2500	TU GD GJ SU WG IL KF GG SD BA HA	[38]
169	<i>Vernonia hymenolepis</i> A. Rich	Dolku (Bench); Mudane (Orom.)	Asteraceae	S	1200-3000	GJ SU AR WG IL KF GG SD BA HA	[38]
170	<i>Vernonia karaguensis</i> Olive. & Hiern	Difu (Orom.)	Asteraceae	H	1400-2750	SU, Bosat (Wolenchiti)	[46,38]
171	<i>Vernonia myriantha</i> Hook f.	Ebecha (Orom.); Reejja (Sil.)	Asteraceae	S	1750-2900	GJ SU AR KF GG BA SD HA	[38]
172	<i>Vernonia wollastonii</i> S. Moore		Asteraceae	H	1500-2435	SU WG KF GG SD BA	[38]

173	<i>Warburgia ugandensis</i> Sprague	Bifti (Orom.)	Canellaceae	T	1400-1600	WG, Gimbi	[64]
174	<i>Withania somnifera</i> (L.) Dunal	Chemotita (Kon.); Ged-deksi (Som.)	Solanaceae	S	2651	Konso; HA, Shinile	[30, 40, 58, 66]
175	<i>Zaleya pentandra</i> (L.) Jeffrey	Abuuri (Afar)	Aizoaceae	H	0-2400	AF, Chifra	[41]
176	<i>Zehneria scabra</i> (L. f.) Sond.	Yequra-hareg/ Areg-resa (Amh.)	Cucurbitaceae	C	2654	GJ, Dibatie/Metekel) Guangua (Agew-Awi)	[42, 66]
177	<i>Ziziphus spina-christi</i> (L.) Desf.	Qurqura (Amh.), Geba (Orom.)	Rhamnaceae	T	2130	SU, Fiche	[61]

*Stands for the endemic taxa which are restricted to Ethiopia and shared with Eritrea

Appendix 2: List of Plant species and Their Category in Traditional Uses as Antimalarial, Mosquitocide, Insecticidal and Insect Repellents, and Parts Used.

No.	Scientific Name of Plant	Traditional Uses						Parts Used and Method of Application
		Anti-malarial	Pesticide		Repellent			
			Mosquitocide	Insecticide	Mosquito	Insect	Other Arthropods	
1	<i>Acacia robusta</i>	√						Root concoction with water can be taken
2	<i>Acalypha indica</i>	√						The aerial parts pounded and boiled with water and drunk.
3	<i>Acalypha</i> sp.	√						The dried leaf of the plant is pounded and then added into a dish containing water, the dish is heated over fire and the smoke inhaled.
4	<i>Acanthus polystachyus</i>	√						Root concoction with water can be taken
5	<i>Achyranthes aspera</i>	√						Whole plant pounded and squeezed with water, is drunk
6	<i>Acokanthera schimperi</i>	√			√	√		Water infusion of leaf parts are used; Smoking stem the area to stifle the insect/mosquitoe
7	<i>Agave sisalana</i>			√			Ticks	Leaves juice sprayed in the house; Stem grounded with fruit of <i>S. incanum</i> and polishing the bitten area.
8	<i>Ageratum conyzoides</i>			√				Whole plant juice sprayed in the house
9	<i>Ajuga integrifolia</i>	√		√				Whole plant juice, drunk and sprayed the sediment in the house
10	<i>Allium sativum</i>	√	√		√			The bulb is chopped and mixed with freshly <i>C. annum</i> pod in small amount of water in the bowls eaten with Injera; mixed with butter, pepper powder ('dikus') and baked with bread or rhizome of <i>G. officinale</i> are pounded and eaten with honey; Chewing alone in raw and swallowed early morning for four days before breakfast until recovery same as <i>C. arietinum</i> . The bulb with the root of <i>S. dasyphyllum</i> , seed of <i>L. sativum</i> , <i>W. somnifera</i> , <i>S. s molle</i> , <i>S. schimperi</i> and <i>V. amaglidina</i> aretogether crushed, powdered, mixed with little water and drunk. Blub is pounded, mixed with the crushed fresh leaves of <i>R. chalepensis</i> , <i>S. nigrum</i> , and applied externally to prevent the disease.
11	<i>Aloe campari</i>	√						Leaf ground ointment jell extract concoction, extracted sap
12	<i>Aloe pirottae</i>	√						Leaf ground ointment jell extract concoction, extracted sap
13	<i>Aloe pulcherrima</i>				√	√		Leaves juice sprayed in the house and leaves smoking
14	<i>Aloe</i> sp.	√						The leaf of the plant is boiled in water and drunk. The latex of the plant is taken orally. Syrup prepared from dried leaves of <i>A. africanus</i> and <i>S. italica</i>
15	<i>Andrachne aspera</i>	√						Root concoction with water can be taken
16	<i>Anethum graveolens</i>	√						Decoction of leaf is given.
17	<i>Artemisia absinthium</i>	√						Fruit, leaf is pounded and sequested with water, is taken
18	<i>Artemisia afra</i>	√						The powder mix with butter and drink with coffee for three days before breakfast; Fresh leaf is squeezed with <i>A. sativum</i> , filtered liquid and applied through oral.

19	<i>Artemisia annua</i>	√						Fruit, leaf is pounded and sequested with water, is taken
20	<i>Artemisia abyssinica</i>	√						Fresh leaf crushed and pounded with water, filtered and drunk until recovery.
21	<i>Asparagus africanus</i>		√					Leaf is crushed, mixed with milk and taken one coffee cup every morning until the individual back to the malarious area. Leaf pounded and mixed with the leaf of <i>Aloe</i> sp. is drunk.
22	<i>Azadirachta indica</i>	√						Fresh leaves (buds) and flowers are pounded, soaked and the filtrate drunk with/without lemon, salt and sugar.
23	<i>Balanites aegyptiaca</i>	√						Boiled the root with tea/ <i>hoja</i> Concoction
24	<i>Balanites rotundifolia</i>	√						The fresh leaf/root of the plant is pounded and then soaked in water for some time and drunk the decoction with/without sugar.
25	<i>Brassica nigra</i>	√		√				The seed roasted and finely ground. Water added to the flour and let them an hour to ferment. Served as food by mixing with 'bokelt' made from chickpea or pea or bean. Seed crushed and its juice rubbed on the body.
26	<i>Brucea antidysenterica</i>	√					Ecto-parasities (Cinii)	Taking one raw seed every month for prevention. The leaf is pounded and mixed with water in dish. The mixture is used to wash skin of cattle, donkey, mule and horse for 3-5 days.
27	<i>Buddleja polystachya.</i>	√	√					Leaves are pounded together with <i>Calpurnia aurea</i> , mixed with water and the infusion is drunk to cure or prevent it.
28	<i>Calotropis procera</i>	√						Leaf sap, latex, rootbark, ethanol extract of flower
29	<i>Calpurnia aurea</i>	√	√	√			Ticks	The leaf is mixed with bulbs of garlic, leaf and fruits of rue are crushed, soaked in the water for overnight, decanted and one cup is taken orally during night and sleeping. The leaf is ground along with barks of <i>Milletia ferruginea</i> and sprayed on the area of problem (body, cloth, room, bed). Leaf is crushed, soaked in water and bathing the body of cattle/ chicken for 2 days to kill body lice.
30	<i>Canna indica</i>			√				Rhizome juice sprayed in the house
31	<i>Capparis tomentosa</i>	√						Leaves are crushed and mixed to water, drunk filtered
32	<i>Capsicum annum</i>	√				√		Pod the same method as used in <i>A. sativum</i> , Smoking the dried paper in the home against ant.
33	<i>Carica papaya</i>	√						A boiled leaves juice is taken and smoked, leaves pounded with <i>A. sativum</i> boiled and taken with honey every morning for three days, seed paste is taken with honey, a boiled roots by adding sugar and taken. The ripe fruit with that of <i>Persea americana</i> is consumed.
34	<i>Carissa spinarum</i>	√						Fresh root and fruit with fruit of <i>D. angustifolia</i> is crushed mixed with water and a tea cup is drunk every morning for 3 days. A pounded leaf in water also taken.
35	<i>Carthamus tinctorius</i> L.						Ticks, lice	Root
36	<i>Chenopodium ambrosoides</i> L.			√				Root for detoxification of sorghum insects (Akara).
37	<i>Chenopodium schraderianum</i>					√		Above ground parts are chopped and fumigated chickens' rooms
38	<i>Cicer arietinum</i>	√						Crushed fresh seeds, leaves, roots, stem bark, mixed with little water, boiled and then drunk the solution when cold every morning for 2-5 days. Germinated seed eaten with bulb of <i>A. sativum</i> until recovery.
39	<i>Cissus rotundifolia</i>	√						A boiled extracted root bark is given.

40	<i>Citrus aurantifolia</i>						Tick	Fruit paste is applied to the affected area
41	<i>Citrus limon</i>					√		Fruit is squeezed with leaf of <i>L. ocyimifolia</i> seed of <i>L. sativum</i> , <i>Salvia schiperi</i> , <i>R. chalepensis</i> and <i>A. sativum</i> , all of these are mixed together in water and drunk for Hen.
42	<i>Clausena amisata</i>					√		The leaf is crushed, squeezed with water and Injera, given to hens.
43	<i>Clematis simensis</i>					√		The leaf and stem chopped and mixed with water. The mixture stays 21 days to ferment and sprayed over on cereal crops.
44	<i>Clerodendrum myricoides</i>	√						The leaf and fruits with bulb of garlic, are mixed, crushed, powdered and soaked in honey for one day (24 hours) and one glass is taken continuously. Root together with the root of <i>Withania somnifera</i> are pounded, mixed with water, boil, cool and then drunk
45	<i>Clutia abyssinica</i>						Ecto-parasites	Dried or fresh stem is crushed in two centimeter length and tie or hung with neck for pregnant women and transfer to the chilled after born. (See <i>Achyranthes aspera</i>).
46	<i>Clutia lanceolata</i> subsp. lanceolata						Ecto-parasities	Its leaf & the leaves of <i>C. aurea</i> are crushed and mixed with cattle's urine and then washed their skin
47	<i>Coffea arabica</i>	√						Whole parts are burned and smoking and Seeds are cocked and chewed and swallowed
48	<i>Combretum molle</i>	√						Fresh leaf is boiled in water and drunk the decoction by a cup of tea
49	<i>Commicarpus grandiflorus</i>					√		Above ground parts to repel (lice, fleas and bugs) by placing it on the bed
50	<i>Conyza pyrropapp</i>	√						Crushed leaf and stem are used for bathing.
51	<i>Cordia africana</i>	√						Washed and boiled its leaf, and two glasses are drunk before meal.
52	<i>Crabbea velutina</i>	√						Leaves are crushed and mixed to water, drunk filtered
53	<i>Croton macrostachyus</i>	√	√	√				Leaf/bark/root are collected from seven branches, crushed, pounded and mix with water and soaked in boiled honey, then mix with <i>A. sativum</i> (bulb) roasted with salt and butter. Over dosage has strong negative effect to health. Bark of croton put on fire and the smoke used as to protect mosquito bite. Crushed fresh leaf with root of <i>C. adenocaulis</i> and <i>S. hermonthica</i> is soaked in ale and decanted when cattle ate the leaf of Sorghum that contained poisoned insects
54	<i>Cucumis ficifolius</i>	√						Whole part of the plant crushed, boiled and then drunk.
55	<i>Cucumis melo</i> L.	√						Root infusion is drunk
56	<i>Cucurbita pepo</i>						Ticks	Fruit cooked and rubbed on affected part
57	<i>Cucumis prophetarum</i>	√						Root
58	<i>Cyphostemma adenocaulis</i>			√				Leaf/bark/root, same method & ingredients as used in <i>C. macrostachyus</i>
59	<i>Datura stramonium</i>	√						Leaves/fruit with the bulb of <i>Allium sativum</i> are dried, finely crushed, powered, mixed with water and honey, one tea cup/ three to four spoons are taken every morning for three days.
60	<i>Discopodium penninervium</i>					√		Leaf is crushed and rubs the skin to kill insects particularly, house fly.
61	<i>Dodonaea angustifolia</i>	√				√	Ecto-parasites	The leaf and fruits/seed mixed with ¼ of bulb of garlic, crushed, powdered, soaked in honey and one glass is taken continuously. Leaves juice sprayed to the affected body of Horse. Fresh leaves are crushed and pounded with water then painted on the infected body by lice, fleas and ticks.
62	<i>Dombeya schimperiana</i>						Ticks, lice	Bark

63	<i>Elucine coracana</i>	√					Soaked & fermented seeds for seven days and then drunk like local alcohol ("tella") continuously.
64	<i>Eleusine jaegeri</i> <i>Pilger</i>					Tiks, lice	Leaf
65	<i>Entada abyssinica</i>	√					The stem bark ground along with rhizome of <i>Z. officinale</i> and bulb of <i>A. sativum</i> and chewed once a day for few months.
66	<i>Eucalyptus globulus</i>	√		√			Crushed its leaf, pounded and mix with water and wash all the body for three days. Crushed its leaf and Smoked
67	<i>Euclea divinorum</i>	√					Root concoction with water can be taken
68	<i>Euclea racemosa</i>	√				Ecto-parasite	Leaves are crushed and pasted on warts both human and livestock. Small ectoparasites around sheep eye are removed.
69	<i>Euclea racemosa</i> . <i>subsp.schimper</i>	√				Ecto-parasite	Leaves are crushed and pasted on warts both human and livestock. Small ectoparasites around sheep eye are removed.
70	<i>Euphorbia abyssinica</i>	√				Mule malaria	Stem syrup is mixed with the prepared <i>Eragrostis tef</i> dough and backed together and eaten it. Fumigating the mule with leaf.
71	<i>Ficus platyphylla</i>	√					Crushed and ground stem bark concoction with water is drunk
72	<i>Ficus sur</i>	√					Dry fruits pounded, powdered and then mixed with honey and taken orally twice
73	<i>Foeniculum vulgare</i>	√					A boiled root is drunk as tea.
74	<i>Gardenia lutea</i>	√					Root concoction with water can be taken
75	<i>Gardenia ternifolia</i>	√					Crushing the roots, making s/n & drinking half of coffee cup once for all.
76	<i>Gardenia dalenii</i> <i>subsp dalenii</i>	√					Leaves is pounded with a little amount of water and drunk
77	<i>Gnidia involucrata</i>	√					The root and leaf is crushed, soaked in local 'Tella' for one day and one glass is drunk continuously.
78	<i>Gossypium barbadense</i>	√					Ground seed is soaked in water with small amount of salt
79	<i>Gossypium hirsutum</i>	√					Ground seed is soaked in water with small amount of salt and drunk by a cup of tea
80	<i>Grewia ferruginea</i>					Tiks, lice	Root bark
81	<i>Guizotia scabra</i>					Ticks	Leaves with crushed leaves of <i>Calpurnia aurea</i> and rubbed.
82	<i>Guizotia schimperi</i>					Ecto-parasite	Leaf is squeezed, mixed with water and creamed on cattle skin to kill ticks and other ectoparasites.
83	<i>Hagenia abyssinica</i>	√					Chopped and powdered stem bark with the root of <i>Silene macrosolen</i> , <i>Phytolacca dodecandra</i> and <i>C. ficifolus</i> and the leaf of <i>C. myricoides</i> , is drunk in a half size cup of coffee
84	<i>Halothamnus somalensis</i>	√					Root pounded and boiled with sugar and drunk with goat milk.
85	<i>Holothrix sp.</i>					Tiks, lice	Root
86	<i>Hydnora johannis</i>	√					Crushed and boiled root is given.
87	<i>Hypoestes forskalei</i>	√					Leaves and roots crushed and drunk the filtered solution
88	<i>Hypoestes triflora</i>					Ticks	Roasted leaves powdered & mixed with fresh butter and creamed the body for consecutive days.
89	<i>Impatiens rothi</i>			√			Root
90	<i>Impatiens tinctoria</i>			√			Root
91	<i>Indigofera articulata</i>	√					Crushed and boiled root is given.
92	<i>Indigofera coerulea</i>	√					Leaves are pounded and boiled, then drunk.
93	<i>Jasmonium abyssinica</i>	√					Leaves are pounded and boiled, then drunk.
94	<i>Jasmonium floribundum</i> Fresen.	√					Root
95	<i>Jatropha curcas</i>	√					The internal part of seed is chewed or taken with camel milk.

96	<i>Justicia schimperiana</i>	√				√		The leaf and shoot is crushed, boiled in the water with salt, milk and one glass is taken for 3 days on empty stomach. Leaf is mixed with <i>Rumex nervosus</i> , <i>Citrus limon</i> and <i>Vernonia amygdalina</i> in equal ratio, squeezed with little water and half of a cup is taken orally. Fresh leaves crushed and given for hen or cock.
97	<i>Kniphofia isoetifolia</i>			√				Leaf
98	<i>Kosteletzkya adoensis</i>						Ticks, lice	Leaf
99	<i>Lagenaria siceraria</i>	√						Ripe fruit and leaves, roots are bored rinsed with cold water; one glass is used as a drink early in the morning.
100	<i>Laggera tomentosa</i>					√		Above ground parts, against mites attack in harvested crops
101	<i>Lawsonia inermis</i>	√						Leaf juice is added to the soup of camel or goat meat and boiled for four hrs.
102	<i>Leonotis ocyimifolia</i>	√			√	√		Flowers, root, leaves are useful for against malaria. Fresh leaf is mixed with leaf of <i>S. schimperii</i> , powdered seed of <i>L. sativum</i> , juice of <i>C. lemon</i> , <i>R. chalepensis</i> and <i>A. sativum</i> , all of these are mixed together in water squeezed and given for Hen with food. Material for prevention of caterpillar in house.
103	<i>Lepidium sativum</i>	√		√				Seed with the bulb of <i>A. sativum</i> are pounded together and given to human with honey or rubbed the body for protection from mosquito bite. After each dose, one glass of melted butter is recommended for immediate recovery. Seed crushed and its juice sprayed in the house. Smoked its seed with <i>Echinops Kebericho</i> and leaves of <i>C. macrostachyus</i> .
104	<i>Leptadenia hastata</i>	√						A boiled extracted root bark is given.
105	<i>Leucas stachydiformis</i>	√						The whole parts boiled with <i>Ocimum lamiifolium</i> and the vapour is inhaled.
106	<i>Lippia adoensis</i>	√						whole plant
107	<i>Lippia javanica</i>				√	√		Shoot, leaf and stem burned, the smoke keeps away the mosquitoes and any insects in the house.
108	<i>Lobelia sp.</i>	√						Roots are pounded and boiled, then drunk.
109	<i>Lycium shawii</i>	√						The fresh whole plant is pounded with fresh root of <i>Salvadora persica</i> and then soaked in water. It is decanted and the solution drunk and administered topically and intranasally weekly for three weeks.
110	<i>Maerua oblongifolia</i>	√						Leaves pounded, boiled with goat milk and drunk or taken with pounded leaves of <i>Withania somnifera</i> .
111	<i>Maesa lanceolata</i>	√		√				Taken its fruit and its juice also sprayed in the house
112	<i>Melia azedarach</i>	√				√	Ecto-parasities	Fresh leafs pounded with water, filtered, and then 1/4 coffee cup drunk in the morning for three days. One handful leaves is crushed, squeezed & mixed with pieces of bread, and then given to chicken and washed the cattle body with decoction.
113	<i>Mentha spicata</i>	√						Infusion of fresh aerial part is drunk, also bathing with crushed
114	<i>Milletia ferruginea</i>					√	Ecto-parasities	Taking off the stem bark & putting the bare stick in camp of ants. Juice of leaves or stem is used as ear drop. Fresh leaf and stem bark is crushed and pounded with water and given orally and painting on the body.
115	<i>Momordica foetida</i>		√	√				Whole plant juice sprayed in the house
116	<i>Moringa oleifera</i>	√						The fresh leaf of the plant is pounded and then boiled in water. It is decanted and the solution drunk before meal.
117	<i>Moringa stenopetala</i>	√						Leaves and roots

118	<i>Mukia maderaspatana</i>	√						Roots and stems are crushed and then chopped together; coated with cloth and hanged on neck or attached around waist.
119	<i>Nicotiana tobacum</i>						Tick	Pounded leaves applied topically for leech infestation cattle
120	<i>Ocimum basilicum</i>	√						Leaf is squeezed and half of a cup is taken orally.
121	<i>Ocimum gratissimum</i> var. <i>gratissimum</i>	√						Leaves are pounded and boiled, then drunk.
122	<i>Ocimum lamifolium</i>				√			Whole growing plant nearby houses, rubbing its juice on the body and whole plant smoking
123	<i>Ocimum spicatum</i>	√						Powdered leaves are boiled and drunk alone or with coffee.
124	<i>Oreosyce africana</i>		√	√				Leaf juice sprayed in the house
125	<i>Otostegia integrifolia</i>	√				√		The leaf and shoot is crushed with garlic and soaked in honey for one day and one glass is taken at night continuously. Its fumigation against pests (Lice, fleas and bugs)
126	<i>Phytolacca dodecandra</i>	√						Handful of leaves and roots are crushed, pounded mixed with water and about two glasses are drunk for 3days. The antidote is 'tella' -traditional alcohol and coffee.
127	<i>Plectranthus barbatus</i>					√	Spiders	Leaf is added on fire; fumigate the house to kill bugs, flies and poisonous insects that cause allergic, such as spiders.
128	<i>Plectranthus igniarius</i>						Ticks	Fresh leaves are pounded the painting on infected cattle body
129	<i>Plumbago zeylanica</i>	√						Leaves are pounded and boiled, then drunk.
	<i>Podocarpus falcatus</i>	√						Leaves
131	<i>Premna schimperi</i>			√			Ecto-parasities	The shoot, stem and leaf burned to fumigate the house, animal cage, so as to disinfect mosquito & flies.
132	<i>Prunus persica</i>	√						Seed ground
133	<i>Pupalia micrantha</i>	√						Root boiled and drunk.
134	<i>Rhamnus prinoides</i>						Tiks, lice	Leaf
135	<i>Rhoicissus revoilii</i>					√		Leave is added on fire, and fumigate the house in order to kill wheel.
136	<i>Ricinus communis</i>			√				Seed crushed and its juice rubbed on the skin
137	<i>Rubia cordifolia</i> var. <i>discolor</i>	√						Whole plant
138	<i>Rumex abyssinicus</i>	√						Its leaf with the leaf of <i>Zehneria scabra</i> ispounded, powdered, mixed withmilk and boiled and then drunkis cooled
139	<i>Ruta chalepensis</i>	√				√		The branches are boiled with rhizome of zinger and bulb of garlic in the tea and one cup is taken continuously. Fruit smoking in the house.
140	<i>Salvadora persica</i>	√						Decoction of the root and leaf is taken. (See <i>Lycium shawii</i>)
141	<i>Salvia schimperi</i>					√		Leaf is squeezed by mixing with leaf of <i>L. ocymifolia</i> seed of <i>L. sativum</i> , juice of <i>C. lemon</i> , <i>R. chalepensis</i> and <i>A. sativum</i> , together in water and drunk or given with food for Hen. Against bug pests when placed the aerial parts under bed.
142	<i>Schinus molle</i>	√						Seed
143	<i>Securidaca longepedunculata</i>	√						Root
144	<i>Senna italica</i>	√						Dried leaf powder is boiled and drunk with goat/camel milk. See <i>Zaleya pentandra</i>
145	<i>Senna singueana</i>					√		Fresh leaves are put with crops in order to prevent from destroying by wheels.
146	<i>Sesamum orientale</i>			√				Seed

147	<i>Silene macrosolen</i>	√						Its root with the root of <i>Echinops kebericho</i> is pounded, powdered and placed on fire and fumigating the smoke
148	<i>Solanecio gigas</i>						Ecto-parasities	Leaf of <i>Solanecio gigas</i> is used to wash hair of calf, as it kills lice.
149	<i>Solanum adoense</i>					√		The fruit latex is mixed with water & 2-3 droplets are dropped in to the hole of ear to eradicate or to kill Kinkin (ear parasite).
150	<i>Solanum anguivi</i>						Ecto-parasite	Crushed its seed and added to the infected parts.
151	<i>Solanum dasyphyllum</i>						Cinii	Fruit of <i>Solanum dasyphyllum</i> is rubbed on skin of calf.
152	<i>Solanum incanum</i>	√					Repel ticks	The whole fresh plant is pounded and then soaked in water. It is decanted and the solution administered for children. Infusion of fresh fruit mixed with kerosene gas and spray on its skin.
153	<i>Solanum macrocarpon</i>			√				Fruit juice sprayed in the house
154	<i>Solanum marginatum</i>						Ecto-parasite	Fruit is crushed, mixed with water, and then the foam is creamed or spread on cattle Tick.
155	<i>Solanum nigrum</i>			√				Leaf
156	<i>Solanum sp.</i>	√						Fresh root is crushed, boiled and drunk.
157	<i>Solenostemon latifolius</i>					√		The fresh leaf is squeezed with the leaf of <i>S. schimperi</i> , <i>L. ocyimifolia</i> and <i>L. sativum</i> ; given to hen to treat Coccidiosis disease (by coccoides vector).
158	<i>Stephania abyssinica</i>					√		Above ground parts as against bed pests housed in cordage materials
159	<i>Stereospermum kunthianum</i>						scorpion bites	Stem bark
160	<i>Striga hermonthica</i>			√				The leaf/bark/ root-same method & ingredients as used in <i>C. macrostachyus</i>
161	<i>Tagetes minuta</i>					√		Whole plant smoking
162	<i>Tamarindus indica</i>	√					Parasite	Concoction powder of its flower and infusion of fruit is drunk.
163	<i>Terminalia Schimperiana</i>	√						Its seed and fruit is grounded, powdered and mixed with powdered <i>A. sativum</i> bulb, water and then one coffee cup(sini) is drunk every morning for 3-5 days
164	<i>Turraea mombessana</i>	√						Roots
165	<i>Verbena officinalis</i> . subsp. <i>africana</i>	√						whole plant
166	<i>Vernonia adoensis</i>	√						Root
167	<i>Vernonia amygdalina</i>	√					Ecto-parasities (Cinii)	Fresh Leaves, roots and stem bark alone or mixed with <i>R. nervosus</i> , <i>C. limon</i> , <i>R. chalepensis</i> and <i>J. schimperiana</i> in equal ratio, squeezed with little water and half of a cup of exudates is taken orally for 3-5 days. Wash the patient body with the plant part.
168	<i>Vernonia hochstetteri</i>	√						Leaves are pounded and boiled, then drunk.
169	<i>Vernonia hymenolepis</i>	√						Leaves
170	<i>Vernonia karaguensis</i>	√						Leaves
171	<i>Vernonia myriantha</i>	√						Leaves
172	<i>Vernonia wollastonii</i>	√						Leaves
173	<i>Warburgia ugandensis</i>	√						The stem bark along with leaf of <i>C. papaya</i> crushed finely and eaten with honey once a day for 3 weeks.
174	<i>Withania somnifera</i>	√						Dried leaves and roots grounded, boiled and drunk with goat/camel milk.
175	<i>Zaleya pentandra</i>	√						The fresh whole plant is pounded with fresh leaf of <i>Indigofera sp.</i> or <i>S. italica</i> and then soaked in water for some minutes. It is decanted and administered intranasally and drunk.
176	<i>Zehneria scabra</i>	√						Leaf/root
177	<i>Ziziphus spina-christi</i>					√		Leaf/root is added on fire and fumigates to eradicate flies.

Appendix 3: List of Total Plant Families with Corresponding Number of Genera and Antimalarial Plants Species.

Family	Genera	Species	% Spp.	Families	Genera	Species	% Spp.	Families	Genera	Species	% Spp.
Asteraceae	9	19	10.7	Combretaceae	2	2	1.1	Iridaceae	1	1	0.6
Lamiaceae	11	15	8.8	Moraceae	1	2	1.1	Loganiaceae	1	1	0.6
Solanaceae	7	14	8.0	Moringaceae	1	2	1.1	Lythraceae	1	1	0.6
Fabaceae	8	10	5.6	Balsaminaceae	1	2	1.1	Menispermaceae	1	1	0.6
Euphorbiaceae	8	9	5.1	Rosaceae	2	2	1.1	Myrsinaceae	1	1	0.6
Cucurbitaceae	7	9	5.1	Oleaceae	1	2	1.1	Myrtaceae	1	1	0.6
Acanthaceae	4	5	3.0	Poaceae	1	2	1.1	Nyctaginaceae	1	1	0.6
Malvaceae	3	5	3.0	Rhamnaceae	2	2	1.1	Phytolaccaceae	1	1	0.6
Aloaceae	1	4	2.3	Agavaceae	1	1	0.6	Plumbaginaceae	1	1	0.6
Rubiaceae	3	4	2.3	Aizoaceae	1	1	0.6	Podocarpaceae	1	1	0.6
Rutaceae	3	4	2.3	Alliaceae	1	1	0.6	Polygonaceae	1	1	0.6
Ebenaceae	1	3	1.7	Anacardiaceae	1	1	0.6	Polygalaceae	1	1	0.6
Meliaceae	3	3	1.7	Asphodelaceae	1	1	0.6	Pedaliaceae	1	1	0.6
Verbenaceae	2	3	1.7	Asparagaceae	1	1	0.6	Orchidaceae	1	1	0.6
Vitaceae	3	3	1.7	Balanitaceae	1	1	0.6	Ranunculaceae	1	1	0.6
Chenopodiaceae	2	3	1.7	Bignoniaceae	1	1	0.6	Salvadoraceae	1	1	0.6
Amaranthaceae	2	2	1.1	Boraginaceae	1	1	0.6	Sapindaceae	1	1	0.6
Apiaceae	2	2	1.1	Canellaceae	1	1	0.6	Scrophulariaceae	1	1	0.6
Apocynaceae	2	2	1.1	Caricaceae	1	1	0.6	Simaroubaceae	1	1	0.6
Asclepiadaceae	2	2	1.1	Caryophyllaceae	1	1	0.6	Thymelaceae	1	1	0.6
Brassicaceae	2	2	1.1	Hydnoraceae	1	1	0.6	Tiliaceae	1	1	0.6
Capparidaceae	2	2	1.1	Lobeliaceae	1	1	0.6				
Total								65	148	177	100.0