Ethnodiagnostic skills of the Digo community for malaria: a lead to traditional bioprospecting

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Malaria is a major public health problem that is presently complicated by the development of resistance by *Plasmodium falciparum* to the mainstay drugs. Thus, new drugs with unique structures and mechanism of action are required to treat drug-resistant strains of malaria. Historically, compounds containing a novel structure from natural origin represent a major source for the discovery and development of new drugs for several diseases. This paper presents ethnophytotherapeutic remedies, ethnodiagnostic skills, and related traditional knowledge utilized by the Digo community of the Kenyan Coast to diagnose malaria as a lead to traditional bioprospecting. The current study was carried out in three Digo villages of Diani sub-location between May 2009 and December 2009. Data was collected using semi-structured interviews, and open and close-ended questionnaires. A total of 60 respondents (34 men and 26 women) provided the targeted information. The results show that the indigenous knowledge of Digo community on malaria encompasses not only the symptoms of malaria but also the factors that are responsible for causing malaria, attributes favoring the breeding of mosquitoes and practices employed to guard against mosquito bites or to protect households against malaria. This knowledge is closely in harmony with scientific approaches to the treatment and control of the disease. The Digo community uses 60 medicinal plants distributed in 52 genera and 27 families to treat malaria. The most frequently mentioned symptoms were fever, joint pains, and vomiting while the most frequently mentioned practices employed to guard against mosquito bites and/or to protect households against malaria was burning of herbal plants such as *Ocimum suave* and ingestion of herbal decoctions and concoctions. The Digo community has abundant ethnodiagnostic skills for malaria which forms the basis of their traditional bioprospecting techniques.

**Keywords:** malaria, antimalarials, ethnopharmacology, ethnodiagnostic skills, Digo community, bioprospecting

**INTRODUCTION**

Malaria kills 1–2 million people each year globally and 300–500 million new clinical cases of the disease are reported annually (Snow et al., 2005). Malaria constitutes one of the biggest health problems in tropical Africa and is slowly spreading to hitherto non-malaria areas (Trape, 2002). The emergence of resistant parasites, changes in climatic conditions over a large part of Africa, changes in land use and population migration (Foster, 1991; Ridley, 1997) are extending the areas of malaria transmission, which requires innovative strategies for malaria and the mosquito vector control. It is estimated that the malaria incidence range between 350 and 500 million cases globally, with 90% of these being in tropical Africa (World Health Organization, 2005). In Kenya, more than 90% of malaria is caused by *Plasmodium falciparum* (Khambay et al., 1994) transmitted by *Anopheles gambiae* which is the most widespread in Africa and difficult to control. Each year, there are over 8.2 million malaria infections in Kenya (Jean-Marie, 2002) mostly due to inadequate medical care, unavailability of insecticide treated nets and increased resistance of the parasites to drugs. The disease accounts for 30% of all the outpatient cases and 19% of all admissions, 5.1% of whom die, and 72 children below the age of 5 years die daily (World Health Organization, 1996; Mouchet, 1999; Director of Medical Services, 2006). The disease is endemic in the lowlands, particularly the coastal strip where transmission is sufficiently intense (Muthaura et al., 2011). Both incidence and prevalence of infection reach more than 90% of the population within 10–12 weeks after the beginning of the rainy season (Hoffman et al., 1996).

Human malaria transmitted by female *Anopheles* mosquitoes is caused by four species of *Plasmodium*, which are, *P. falciparum*, *P. vivax*, *P. ovale*, and *P. malariae*. Most cases of malaria and deaths are caused by *P. falciparum*. The development of resistance...
to mainstay drugs like chloroquine and controlled use of new artemisinin analogs have created an urgent need to discover new antimalarial agents. The life cycle, immunological defense mechanisms, and clinical development of malaria in humans are complex processes (Kumar et al., 2002) and successful chemotherapeutic intervention is essential in control of the disease. Nature remains an ever evolving source for compounds of medicinal importance. The use of medicinal plants for the treatment of parasitic diseases is well known and documented since ancient times. For example, use of Cinchona succirubra (Rubiaceae) for the treatment of malaria infection is known for centuries. Several compounds isolated from nature also form a rich source of diverse structures for optimization to obtain improved therapeutics. A number of natural products having antimalarial activities have been documented (Sharma and Sharma, 2001).

The Digo community is one of the nine deeply traditional ethnic groups that form the Mijikenda community of the Kenyan coast. They inhabit a malaria endemic zone and have developed impressive traditional procedures to diagnose, prevent, and treat malaria. In addition, they have a well established ethnomedical practice to cure and control the disease. This knowledge acquired through history taking, observation, and palpation of sick members of the society has evolved into an ethnodiagnostic procedure, which is a major contributor to the Digo traditional bioprospecting skills. Ethnopharmacological studies on antimalarial herbal remedies in the Digo inhabited regions of Kenya have been conducted (Nguta et al., 2010a). Studies utilizing specialized knowledge to document plants traditionally used by the Digo community to treat malaria have also been accomplished (Muthaura et al., 2007). These activities are focused on the discovering of new antimalarial drugs of plant origin to combat antimalarial drug resistance. In the neighboring country of Uganda, herbal medicines used in the treatment of malaria as well as the existing knowledge, attitudes, and practices related to malaria recognition, control, and treatment in Budiope county have also been documented (Tabuti, 2008). In Tanzania, medicinal plants have been screened against malarial causal agent, P. falciparum (Maregesi et al., 2010). The Digo people occupy a high incidence area for malaria at the Kenyan coast (Director of Medical Services, 2006) and have a great variety of unique traditional knowledge about malaria recognition and they widely use natural resources in treatment of the disease. However, the ethnodiagnostic skills utilized by the Digo community to treat malaria have not been documented.

The main objectives of the current study were to explore the traditional knowledge of malaria diagnosis and ethno-phytotherapeutic practices in three Digo villages of Mwamambi A, Mwamambi B, and Mwaroni. The documented information will be the basis of: (1) selection of antimalarial plant species for pharmacological, toxicological, and phytochemical studies (2) collection and preservation of the valuable popular knowledge concerning antimalarial plant use (3) addition of information to the valuation of biodiversity and to forward suggestions for its sustainable use and conservation (4) establishing comparisons with other territories sharing similar characteristics (5) selection of plants for isolation of new and novel molecules for development as antimalarials and (6) setting up health policies in regard to prevention and treatment of malaria. The paper also addresses the questions: (1) which ethnodiagnostic skills do the Digo community utilize as a lead to traditional bioprospecting? (2) which plants does the Digo community use to treat malaria?

**MATERIALS AND METHODS**

**STUDY AREA**
In South Coast, the study area centered around 04° 28' 59.2"S latitude and 039° 33' 36.2"E longitude in and around Mwaroni, Mwamambi A, and Mwamambi B villages of Ngomboto sub-location, Diani location found in Diani division, Msambweni district in Coast province of Kenya. The area is hot and humid all year round with annual mean temperatures ranging between 23 and 34°C and the average relative humidity ranging between 60 and 80%. The soils are made of sandstone and grit and are fairly fertile for cultivation. The area has monsoon climate, hot and dry from January to April while June to August is the coolest period. Rainfall comes in two seasons with short rains from October to December and long rains from March/April to July. The total precipitation varies from 900 to 1500 mm per annum along the coastal belt to 500–600 mm in the hinterland, which comprise 92% of the land whose agricultural potential is low (Nguta et al., 2010a). The study area is mainly inhabited by the Digo community, a Bantu tribe with a population of 225,000 (1999 Kenya National Population Census), 90% of who are Muslims and are concentrated on the southern coastal strip of Kenya between Mombasa and the border of Tanzania (Nguta et al., 2010a). The traditional way of life and customary beliefs of the Digo community are quite intact and the acceptability of antimalarial medicinal plants as claimed effective remedies is quite high among the population of this area. The Kaya forests in Digo area are the social-cultural focal points of the community. They are preserved as sacred ceremonial sites, and cultural taboos prohibit the cutting of trees except for select purposes, thus biodiversity is sustained. More than half of Kenyan's rare plants have been identified within the Kaya forest patches (Muthaura et al., 2007). The traditional medicinal knowledge from the resources of these forests requires documentation for the benefit of the current and future generations.

The medicinal knowledge of the Digo community is considered communal. The Digo community have good knowledge on the use of medicinal plants and this knowledge was bequeathed to them by their fathers, albeit orally, from generation to generation (Muthaura et al., 2007). The community is rural and depends on crop agriculture as its major source of livelihood. P. falciparum is the commonest species in the study area and is associated with significant morbidity and mortality of children aged 5 years and below and pregnant women (Director of Medical Services, 2006). Other species include P. malariae and P. ovale which sometimes occur as mixed infections with P. falciparum whilst P. vivax is very rare (Director of Medical Services, 2006). The prevalence of P. falciparum is reported to exceed 50% and the area is classified as a malaria endemic zone (Director of Medical Services, 2006). The inhabitants of the study area are generally poor and cannot afford conventional antimalarial drugs (Nguta et al., 2010a).

**METHODS**
Data on traditional knowledge of malaria diagnosis and ethno-phytotherapeutic practices in three Digo villages was collected through survey employing semi-structured interviews and guided open and closed ended questionnaires (Huntington, 2000).
Semi-structured interviews were conducted using a checklist of questions and were held with individuals and local area leaders. The questionnaire included questions on causes of malaria, known signs and symptoms of malaria, details of harvesting, preparation, and application of malaria herbal medicines. The questionnaire was translated into vernacular, ki-digo, the principal language spoken in the study area. Two group discussions that were held with community members complemented the interview and questionnaire survey, one in each of the study villages. Participants in the group discussions were identified by the local area leaders. Respondents for the questionnaire were selected randomly using the multi-stage random sampling method as follows: Diani location was selected from among the 11 locations of Msambweni district and was considered the primary sampling unit. Within Diani location, one sub-location (Ngombato) was selected. In turn, three villages of Mwamambi A, Mwamambi B, and Mwaroni were selected from Ngombato sub-location. The desired sample size was fixed at 60 respondents by assuming that 80% of the community had good knowledge regarding malaria diagnosis and its treatment; a desired confidence interval of 95%; and a relative error of estimation of 10%.

Thirty-two households were randomly selected from each village by consulting the village household registers. From among the selected households, a random sample of 16 households was picked from which men were to be interviewed while the remainder constituted the women respondents. In this way, a total of 40 respondents were interviewed in Mwamambi A and Mwamambi B villages and 20 from Mwaroni. The sample consisted of 34 male and 26 female respondents. Two guides identified with the help of the local leader were hired in each village to help locate the selected respondents and to introduce the team members to the respondents. All plant materials mentioned by respondents in the study were identified in the field. A voucher specimen of each species was collected for confirmation and deposited at the herbarium in the Department of Land Resources Management (LARMAT), University of Nairobi. Species nomenclature followed the flora for tropical East Africa (Nguta et al., 2010a).

In addition, a written informed consent was obtained from the community representatives. The research objectives and methods were explained to respondents before every interview. At the end of the study, the findings were discussed with the community in a workshop.

DATA ANALYSIS
The comparative relative importance of each plant species and the collected ethnobotanical data was analyzed according to the method of Friedman et al. (1986) and this was used to determine the rank-order priority (ROP) depending on the proposed effectiveness of each plant. To reach this goal, the fidelity level (FL) of each plant was calculated as follows: \( FL = \frac{lp}{lu} \times 100 \), where \( lp \) is the number of respondents who cited a given species and \( lu \) is the total number of respondents. Questionnaire survey data was entered in Excel spreadsheets. It was checked and edited for errors, and coded as described in Sarantakos (Nguta et al., 2010b). Thereafter, it was summarized using SPSS and reported in tables. Semi-structured interview data was studied and the responses grouped into classes expressing similar ideas.

RESULTS
DIGO ETHNODIAGNOSTIC SKILLS
Respondents had good knowledge about malaria and they could readily distinguish it from other fever types on the basis of accepted signs and symptoms. These included fever, chills, joint pains, weakness, headache, lethargy, abdominal pain, sneezing, and flu-like symptoms, loss of appetite, coughing, and vomiting (Table 1).

The respondents knew that mosquitoes were involved in transmission of malaria. They also reported that young children, pregnant mothers, individuals with malnutrition and those with diseases such as acquired immunodeficiency syndrome (AIDS) and tuberculosis were most commonly affected. However, some people thought that keeping a dirty homestead or drinking dirty water caused malaria, while some believed that it was caused by dense bush or pools of stagnant water close to their homesteads. Conditions likely to favor the breeding of mosquitoes were observed in all homesteads. Garbage, empty tins, tall grass, cattle sheds, and uncleared bushes were within 5 m of most homes. All homesteads had large plants within 3–5 m of the house as well as untreated stagnant water in the compound. Furthermore, many homesteads were in close proximity to wetlands and or open wells.

| Symptom                                      | Percentage of respondents citing the symptom |
|----------------------------------------------|---------------------------------------------|
| Fever                                        | 65                                          |
| Joint pains                                  | 50                                          |
| Vomiting                                     | 45                                          |
| Headache                                     | 40                                          |
| High temperature                             | 35                                          |
| Chills                                       | 30                                          |
| Shivering                                    | 35                                          |
| Loss of appetite/anorexia                    | 25                                          |
| Diarrhea                                     | 25                                          |
| Abdominal pain                               | 20                                          |
| Fatigue/lethargy                             | 15                                          |
| Sweating                                     | 20                                          |
| Diagnosis from hospital                      | 20                                          |
| Confusion                                    | 5                                           |
| Yellow eyes                                  | 10                                          |
| Red eyes                                     | 10                                          |
| Backache                                     | 10                                          |
| Dizziness                                    | 10                                          |
| Tiredness                                    | 5                                           |
| Coughing                                     | 10                                          |
| Scratching/itching                           | 5                                           |
| Pulsation of blood vessels                   | 10                                          |
| Weakness                                     | 5                                           |
| Inability to stand                           | 5                                           |
| Abdominal disturbances                       | 5                                           |
| Extreme coldness                             | 5                                           |
| Flu-like symptoms/sneezing                   | 5                                           |
| Abdominal disturbances                       | 5                                           |
| Yellow vomit                                 | 5                                           |

Table 1 | Malaria symptoms mentioned by respondents (n = 20) in Diani location.
A variety of strategies were employed by respondents to stop mosquito bites (Table 2). These included the use of mosquito nets and mosquito repellants such as mosquito coils, cleaning the environment, burning the leaves of fresh *Azadirachta indica* (L) Burm. (20%), burning the ripe seeds of *Plectranthus barbatus* Andr. (25%); burning stems of plants such as *Ocimum basilicum* L.; burning the leaves of *Ocimum suave* Willd. (55%) and also removing materials likely to promote the breeding of mosquitoes such as draining stagnant water (30%) and treating water ponds with old engine oil (10%). Respondents also reported that they cleared bushes around their homesteads to keep mosquitoes away from their houses. They also reported that they did cut grass around the homesteads (10%). However, this was not observed during the study, and instead, bushes were always observed close to households.

**HERBAL MEDICINES USED TO TREAT MALARIA**

Sixty species distributed between 52 genera and 31 families were reportedly used in herbal preparations for the treatment of malaria (Table 3). The mode of preparation, voucher specimen number and the part of the medicinal plant used for preparation of antimalarial herbal remedy was documented (Table 3). Most of these species were woody plants (Shrubs and trees). Mature leaves were commonly used in the preparations. Respondents reported that the appropriate plant parts were collected as and when they were needed, and that there was no specific time to collect. They did not perform any rituals during collection or processing of herbal remedies.

The herbal remedies were prepared mostly as infusions, decoctions, or concoctions. The infusions and decoctions were prepared as mono-preparations from single plant species. The preparations were mostly administered orally and also at times topically as steam baths. Oral doses were variable and were administered according to the age of the patient. They varied between 80 and 500 ml for adults; 80 and 125 ml for older children (more than 5 years) and 1–3 tablespoons for children younger than 5 years. The herbal drugs were taken 1–3 times a day for a period of 3–5 days. Prepared herbal remedies were consumed immediately and never kept. The preparation that remained after use was discarded. There was no need to keep any since the plants from which they were produced from were readily accessible. Respondents who used herbal remedies indicated that they were effective and had no side effects if the correct dose was taken.

### Table 3 | Practices employed to guard against mosquito bites and/or to protect households against malaria (n = 20) by the Digo community in Diani location.

| Practice                                           | (%) |
|----------------------------------------------------|-----|
| Taking herbal remedies                              | 90  |
| Burning plants to repel mosquitoes, e.g., *Ocimum basilicum* L. | 55  |
| Clearing bushes around homesteads                   | 35  |
| Use of mosquito nets                                | 35  |
| Cleaning the environment                            | 30  |
| Draining stagnant water                             | 30  |
| Burning the ripe seeds of *Plectranthus barbatus* Andr. | 25  |
| Burning the fresh leaves of *Azadirachta indica* (L) Burm | 20  |
| Garbage collection                                  | 15  |
| Cutting tall grass around homesteads                | 10  |
| Treating stagnant water with old engine oil         | 10  |
| Treating drinking water                             | 5   |
| Boiling drinking water                              | 5   |
| Burning mosquito coil                               | 5   |
| Burning garbage/bushes                              | 5   |
| Cleanliness                                         | 5   |
| Planting mosquito repellant trees around homesteads | 5   |
| Constructing cattle sheds far from homesteads       | 5   |
| Burning the leaves of *Ocimum suave* Willd.         | 5   |
| Treating drinking water with water guard             | 5   |

### DISCUSSION

**DIGO ETHNODIAGNOSTIC SKILLS**

One of the objectives of the current study was to document the ethnodiagnostic skills utilized by the Digo community to diagnose malaria. Indeed, researchers need to document how people describe the signs (or symptoms) of illnesses (Heinrich et al., 2009). The study community has developed abundant ethnodiagnostic skills for malaria which forms the basis of their traditional bioprospecting techniques. The respondents interviewed in the current study had good knowledge about malaria and readily distinguished it from other illnesses on the basis of widely accepted malaria signs and symptoms (Tabuti, 2008). The community recognized that the clinical features of uncomplicated and severe malaria included chills, profuse sweating, joint pains, abdominal pain, diarrhea, vomiting, anorexia, and inability to stand. Malaria continues to be a major health challenge in Kenya especially due to the emergence of parasite resistance to the commonly used and relatively cheap antimalarials. Knowledge about malaria has steadily improved in Kenya, but some misconceptions still remain about the causes and symptoms of severe malaria, and this were also documented in this study. However, majority of the respondents knew that malaria was spread by mosquitoes and one of the major symptoms of the disease was fever. This relatively good understanding of the causes and signs of the disease may help in the implementation of intervention measures aimed at reducing its incidence and prevalence since the Digo knowledge about the transmission and major symptoms of disease are congruent with science and they do not associate it with witchcraft, as do some communities elsewhere (Nuwaha, 2002).

**HERBAL MEDICINES USED BY THE DIGO COMMUNITY TO TREAT MALARIA**

Antimalarial plant species in the study area are the dominant commercial element as they are sought by a wider spectrum of the society. Most of the plants collected have been reported in the literature, as having been used for malaria or fever (Table 4), an indication that the community could be trusted for the information they imparted about the plants they use. The results of the current study show that a large number of medicinal plants are traditionally used for treatment of malaria among the Digo community. Sixty species in 52 genera and 27 families were
Table 3 | Plant species commonly reported by Digo people for the treatment of malaria in Diani location (n = 60).

| Scientific name/voucher specimen number | Family | FL | Part used | Method of preparation | Route of administration | lp/growth characteristic |
|----------------------------------------|--------|----|-----------|-----------------------|-------------------------|--------------------------|
| **Acacia seyal** Delile (JN01) Fabaceae | 16     | Roots | Decoction | Oral                  | 10/tree                 |
| **Adansonia digitata** L. (JN02) Malvaceae | 25     | Leaves | Decoction | Oral                  | 15/tree                 |
| **Agathisanthemum globosum** (Hochst. ex A. Rich.) Bremek. (JN03) Rubiaceae | 16     | Roots | Decoction | Oral                  | 10/herb                 |
| **Albizia anthelmintica** Brongn. (JN04) Fabaceae | 10     | Stem bark; root bark | Decoction | Oral                  | 6/shrub                 |
| **Aloe deserti** A. Berger (JN04) Xanthorrhoeaceae Dumort. | 20     | Leaves | Infusion | Oral                  | 12/herb                 |
| **Aloe macrocephala** Baker (JN05) Xanthorrhoeaceae Dumort. | 20     | Leaves | Infusion | Oral                  | 12/herb                 |
| **Aloe secundiflora** Engl. (JN06) Xanthorrhoeaceae Dumort. | 10     | Leaves | Infusion | Oral                  | 6/herb                  |
| **Aloe vera** L. ex Webb (JN07) Xanthorrhoeaceae | 23     | Leaves | Infusion | Oral                  | 14/herb                 |
| **Amaranthus hybridus** L. (JN08) Amaranthaceae | 33     | Leaves | Decoction | Oral                  | 20/herb                 |
| **Azadirachta indica** A. Juss. (JN09) Meliaceae | 98     | Roots, stem bark, leaves | Concoction | Oral; inhalation; topical | 59/tree                 |
| **Bridelia micrantha** (Hochst.) Baill. (JN010) Phyllanthaceae | 67     | Stem bark; leaves | Concoction | Oral                  | 40/tree                 |
| **Canthium glaucum** Hiern (JN011) Rubiaceae | 33     | Fruits | Decoction | Oral                  | 20/tree                 |
| **Carissa edulis** (Forssk.) Vahl (JN042) Apocynaceae | 16     | Root bark | Decoction | Oral                  | 10/shrub                |
| **Cassia occidentalis** hort. ex Steud. (JN012) Fabaceae | 37     | Roots; leaves | Decoction | Oral                  | 22/shrub                |
| **Centella asiatica** (L.) Urb. (JN043) Apiaceae | 07     | Leaves | Decoction | Oral                  | 4/liana                 |
| **Cissampelos mucronata** A. Rich. (JN047) Menispermaceseae Juss. | 07     | Root bark | Decoction | Oral                  | 4/liana                 |
| **Clausena anisata** (Willd.) Hook. f. ex Benth. (JN013) Rutaceae | 42     | Leaves | Decoction | Oral                  | 25/herb                 |
| **Clerodendrum myricoides** R. Br. (JN050) Lamiaceae | 10     | Root bark | Decoction | Oral                  | 8/shrub                 |
| **Combretum molle** Engl. & Diels (JN058) Combretaceae | 67     | Leaves | Decoction | Oral                  | 40/tree                 |
| **Combretum puboides** Engl. & Diels (JN014) Combretaceae | 50     | Leaves | Decoction | Oral                  | 30/tree                 |
| **Commiphora schimperi** (O. Berg) Engl. (JN015) Burseraceae Kunth | 40     | Roots; stem bark | Decoction | Oral                  | 24/tree                 |
| **Dichrostachys cinerea** (L.) Wight & Arn. (JN016) Fabaceae | 33     | Roots | Decoction | Oral                  | 20/tree                 |
| **Flagaropsis angolensis** (Engl.) Dale (JN017) Rutaceae Juss. | 40     | Leaves | Decoction | Oral                  | 24/tree                 |
| **Ficus bussei** Warb. ex Mildbr. & Burret (JN018) Moraceae | 43     | Roots | Decoction | Oral                  | 26/tree                 |
| **Flacourtia indica** (Burm. f.) Merr. (JN019) Salicaceae | 50     | Roots | Decoction | Oral                  | 30/tree                 |
| **Flueggea virosa** (Roxb. ex Willd.) Baill. (JN049) Phyllanthaceae | 10     | Root bark | Decoction | Oral                  | 6/herb                  |

(Continued)
| Scientific name/voucher specimen number | Family               | FL | Part used | Method of preparation | Route of administration | Ip/growth characteristic |
|----------------------------------------|----------------------|----|-----------|-----------------------|------------------------|--------------------------|
| Gerrardanthus lobatus C. Jeffrey (JN020) | Cucurbitaceae Juss. | 50 | Roots     | Decoction             | Oral                   | 30/climber               |
| Grewia hainesiana Hole (JN021)         | Malvaceae Juss.      | 33 | Leaves    | Decoction             | Oral                   | 20/shrub                 |
| Grewia trichocarpa Hochst. ex A. Rich. (JN022) | Malvaceae Juss. | 33 | Roots     | Decoction             | Oral                   | 20/shrub                 |
| Harrisonia abyssinica Oliv. (JN023)  | Rutaceae Juss.       | 40 | Root bark | Decoction             | Oral                   | 24/shrub                 |
| Harungana madagascariensis Lam. ex Poir. (JN053) | Hypericaceae Juss. | 73 | Root bark; Stem bark | Decoction             | Oral                   | 44/tree                  |
| Heeria insignis (Delile) Kunze (JN024) | Anacardiaceae        | 33 | Stem bark | Decoction             | Oral                   | 20/shrub                 |
| Hoslundia opposita Vahl (JN025)        | Lamiaceae            | 43 | Roots     | Decoction             | Oral                   | 26/shrub                 |
| Landolphia buchananii (Hallier f.) Stapf (JN027) | Apocynaceae Juss. | 33 | Leaves    | Decoction             | Oral                   | 20/climber               |
| Lantana camara L. (JN026)              | Verbenaceae          | 50 | Leaves    | Decoction             | Oral                   | 30/shrub                 |
| Launaea cornuta (Hochst. ex Oliv. & Hierl) C. Jeffrey (JN028) | Asteraceae Bercht. & J. Presl | 63 | Leaves    | Decoction             | Oral                   | 30/herb                  |
| Momordica foetida Schumach. (JN060)    | Cucurbitaceae Juss.  | 80 | Leaves    | Decoction             | Oral                   | 48/climber               |
| Ocimum balansae Briq. (JN029)          | Lamiaceae Martinov   | 43 | Leaves    | Decoction             | Oral                   | 26/shrub                 |
| Ocimum gratissimum L. (JN058)         | Lamiaceae            | 55 | Leaves    | Decoction             | Oral                   | 33/herb                  |
| Ocimum suave Willd. (JN030)            | Lamiaceae            | 33 | Leaves    | Decoction             | Oral                   | 20/shrub                 |
| Pentanisia ouranogyne S. Moore (JN031) | Rubiaceae            | 40 | Roots     | Decoction             | Oral                   | 24/herb                  |
| Pentas bussei K. Krause (JN048)        | Rubiaceae            | 16 | Root bark | Decoction             | Oral                   | 10/herb                  |
| Pentas longiflora Oliv. (JN056)        | Rubiaceae            | 70 | Root bark | Decoction             | Oral                   | 42/herb                  |
| Plectranthus barbatus Andrews (JN032)  | Lamiaceae            | 33 | Leaves    | Decoction             | Oral                   | 20/shrub                 |
| Rauwolfia Cothen. (JN051)              | Apocynaceae Juss.    | 50 | Root bark | Decoction             | Oral                   | 30/shrub                 |
| Ricinus communis L. (JN033)            | Euphorbiaceae        | 50 | Roots, leaves | Concoction           | Oral; topical          | 30/herb                  |
| Rottboellia Dumort. (JN034)            | Poaceae              | 37 | Leaves    | Decoction             | Oral                   | 22/grass                 |
| Securidaca longifolia Poep. (JN035)    | Polygalaceae         | 42 | Roots     | Decoction             | Oral                   | 25/tree                  |
| Senecio syringifolius O. Hoffm. (JN036) | Asteraceae Bercht. & J. Presl | 33 | Leaves    | Decoction             | Oral                   | 20/climber               |
| Solanum incanum L. (JN037)             | Asteraceae Bercht. & J. Presl | 47 | Roots, Leaves | Decoction             | Oral                   | 28/shrub                 |
| Suregada zanzibariensis Baill. (JN045) | Euphorbiaceae Juss.  | 13 | Root bark | Decoction             | Oral                   | 8/shrub                  |
Table 3 | Continued

| Scientific name/voucher specimen number | Family               | FL | Part used       | Method of preparation | Route of administration | lp/growth characteristic |
|----------------------------------------|----------------------|----|-----------------|------------------------|-------------------------|---------------------------|
| *Tamarindus indica* L. (JN038) Fabaceae Lindl | 33 Roots; leaves     | Decoction | Oral            | 20/tree                |
| *Teclea simplicifolia* (Engl.) L. I. Verd. (JN039) Rutaceae Juss. | 43 Roots & Decoction | Oral | 26/shrub        |
| *Terminalia spinosa* Northr. (JN052) Combretaceae | 66 Stem bark | Cold water infusion | Oral | 40/tree |
| *Toddalia asiatica* (L.) Lam. (JN055) Rutaceae | 58 Root bark | Decoction | Oral | 35/shrub |
| *Tridax procumbens* L. (JN054) Asteraceae | 47 Whole plant | Cold water infusion | Oral | 28/herb |
| *Uvaria scheffleri* Diels (JN041) Annonaceae Juss. | 16 Leaves | Decoction | Oral | 10/lima |
| *Vernonia amygdalina* A. Chev. (JN057) Asteraceae | 43 Leaves | Decoction | Oral | 26/shrub |
| *Warburgia stuhlmannii* Engl. (JN044) Canellaceae Mart. | 20 Stem bark | Decoction | Oral | 12/tree |
| *Zanthoxylum chalybeum* Engl. (JN040) Rutaceae | 53 Root bark | Decoction | Oral | 32/tree |

*FL* is the fidelity level.
*lp* is the number of respondents citing each species.
*Lu* is the total number of respondents (60).
*Decoction* is a method of preparation in which the plant part is boiled in water.
*Concoction* is a method of preparation in which more than one plant part is boiled in water.
*Infusion* is a method of preparation that involves soaking of a plant part in water.

documented. Lamiaceae (six species), Rutaceae (six species), Rubiaceae (five species), and Fabaceae (five species) families represented the species most commonly cited. Studies from other regions of Africa indicate Rubiaceae to have many species used in the management of malaria in different countries (Iwu, 1994). This was consistent with our results but Rutaceae had a higher number of species (six species) cited as sources of antimalarial remedies compared to Rubiaceae (five species; Table 4), which would indicate the importance of this family as a possible source of antimalarial plants. The information on frequently utilized antimalarial plant species is also an important lead to the species that can be targeted for antiplasmodial tests, toxicological tests, and phytochemical analysis. Since there is no safer, effective, and cheaper antimalarial remedy than chloroquine in the treatment of malaria, development of new antimalarial drugs from plant sources may be the way forward in dealing with global drug-resistant problems of malaria (Gessler et al., 1995). Natural products and their derivatives represent over 50% of all the drugs in clinical use in the world (Van Wyk et al., 2002). The results of this study show that both indigenous and introduced species are in use for malaria treatment. This indicates that traditional medicinal practices in this region are dynamic, and this could be influenced by modern communication and informal information exchange between people.

In Africa, herbal medicines are an important part of the culture and traditions of its people and biodiversity. Herbal remedies have played major specific roles in the cultural evolution of human societies (Mugabe and Clark et al., 1998). Apart from their cultural significance, traditional medicines have been accessible and affordable and most people in Kenya especially in rural areas use traditional medicine and medicinal plants to treat many diseases including malaria (Njoroge and Bussmann, 2006). The role of ethnopharmacology is to give direction on the plant species for selection as well as data for plant preparation, posology, effects, and side effects which could provide specific targets for isolation of active compounds and pharmacological investigation in the quest for development of new pharmaceuticals (Cox and Balick, 1994). Recent work on African plants used in the treatment of malaria is very encouraging. It is striking how many different plants are reported by communities and herbalists to cure malaria. The challenge will be to translate herbal medicine practice with these plants into an evidence-based monotherapy or combined therapy as suggested by Rasoanaivo et al. (1999). There is need therefore, to corroborate with communities, traditional healers, and clinicians for observational retrospective treatment-outcome and prospective clinical study of a traditional medicine. The administration of a traditional treatment (e.g., a plant preparation) as a decoction/concoction, and the systematic follow up of the outcome in a clinical study with the effect of a rapid and...
Table 4 | Plants used by the Digo community to treat malaria and the published evidence of their activities and/or other uses.

| Family              | Species/voucher number | Traditional treatment | Plant part used | Bioactive or potentially active compounds | Screened activity |
|---------------------|------------------------|-----------------------|-----------------|-------------------------------------------|-------------------|
| Amaranthaceae       | *Amaranthus hybridus* L. (JN08) | Malaria (Nguta et al., 2010a, 2010b) | Leaves | Not identified | Bioactivity (Cantrell, 2003) |
| Anacardiaceae       | *Heeria insignis* (Delile) Kunze (JN24) | Epilepsy (Moshi et al., 2005) | Stem bark | Myrcene, β-pinene, α-pinene (Ayedoun et al., 1998) | Not screened |
| Annonaceae Juss.    | *Uvaria scheffleri* Diels (JN041) | Malaria (Kokwaro, 1993; Beentje, 1994) | Leaves | Indole alkaloid-(DL)-scheffline (Nkunya et al., 2004) | Antiplasmodial activity (Nkunya et al., 1991) |
| Apiaceae            | *Centella asiatica* (L.) Urb. (JN043) | Fever (Manandhar, 1993) | Leaves | Alkaloids, Sesquiterpenes | Antiplasmodial activity (Clarkson et al., 2004) |
| Apocynaceae Juss.   | *Carissa edulis* (Forssk.) Vahl (JN042) | Malaria (Kokwaro, 1993; Kirra et al., 2006) | Root bark | Saponins (Reed, 1986), Sesquiterpenes (Achenbach et al., 1985) | Antiplasmodial activity (Clarkson et al., 2004; Koch et al., 2005) |
| Apocynaceae Juss.   | *Landolphia buchananii* (Hallier f.) Stapf (JN027) | Malaria (Nguta et al., 2010a, 2010b) | Leaves | Not identified | Not screened |
| Apocynaceae Juss.   | *Rauwolfia* Cothen. (JN051) | Malaria (Kokwaro, 1993; Beentje, 1994) | Root bark | Yohimbine-an indole alkaloid (Iwu and Court, 1979) | Antiplasmodial activity (Veennen et al., 1990) |
| Asteraceae          | *Vernonia amygdalina* A. Chev. (JN057) | Malaria (Asase et al., 2005) | Leaves | Not identified | Antiplasmodial activity (Tona et al., 2004) |
| Asteraceae          | *Tridax procumbens* L. (JN054) | Malaria and stomachache (Kokwaro, 1993) | Whole plant | Cpd-bergenin (Akbar et al., 2002) | Antimalarial activity (Veennen et al., 1990; Clarkson et al., 2004) |
| Asteraceae Bercht. & J. Presl | *Launaea cornuta* (Hochst. ex Oliv. & Hiern) C. Jeffrey (JN028) | Typhoid (Kokwaro, 1993) | Leaves | Tannins and astringents (Burkill, 1985) | Not screened |
| Asteraceae Bercht. & J. Presl | *Senecio syringifolius* O. Hoffm. (JN036) | No previous reports | Leaves | Not identified | Not screened |
| Burseraceae Kunth   | *Commiphora schimperi* (O. Berg) Engl. (JN015) | Malaria and constipation (Koch et al., 2005) | Roots; stem bark | Not identified | In vitro antimalarial and cytotoxic activity (Koch et al., 2005) |
| Canellaceae Mart.   | *Warburgia stuhlmannii* Engl. (JN044) | Tooth ache and rheumatism (Beentje, 1994) | Stem bark | Sesquiterpenes (Manguro et al., 2003) | Antibacterial, Bacillus subtillis (Taniguchi et al., 1978) |
| Combretaceae        | *Terminalia spinosa* Northr. (JN052) | Jaundice (Beentje, 1994) | Stem bark | Not identified | Antimalarial activity (Omulokoli et al., 1997) |
| Combretaceae        | *Combretum molle* Engl. & Diels (JN059) | Malaria (Labuti, 2008) | Leaves | Not identified | Not screened |
| Combretaceae R. Br. | *Combretum padois* Engl. & Diels (JN014) | Hookworms (Neuwing, 2000) | Leaves | Mono and bi-desmosidic triterpenoids from leaves (Rodgers and Coombes, 1999) | Antimicrobial effects (Elof, 1999) |
| Cucurbitaceae Juss. | *Gerrardanthus lobatus* C. Jeffrey (JN020) | Malaria (Nguta et al., 2010a) | Roots | Flavonoids (Imperato, 2005) | Not screened |
| Cucurbitaceae Juss. | *Momordica foetida* Schumach. (JN060) | Malaria (Gessler et al., 1995) | Leaves | Not identified | Antimalarial activity (Waako et al., 2005) |
| Euphorbiaceae       | *Ricinus communis* L. (JN033) | Antimalarial agent (Burkill, 1935); fever (Burkill, 1994) | Roots; leaves | Not identified | Antimalarial activity (Clarkson et al., 2004) |
| Euphorbiaceae Juss. | *Suregada zanzibariensis* Baill. (JN045) | Malaria (Chhabra et al., 1990) | Root bark | Alkaloids (Smolenski et al., 1975) | Antimalarial activity (Omulokoli et al., 1997) |

(Continued)
Table 4 | Continued

| Family | Species/voucher specimen number | Traditional treatment | Plant part used | Bioactive or potentially active compounds | Screened activity |
|--------|--------------------------------|-----------------------|-----------------|------------------------------------------|-------------------|
| **Fabaceae** | | | | | |
| | *Cassia occidentalis* hort. ex Steud. (JN012) | Oxytocin, cholagogue, anti-fever medicine, anti-worm medicine and remedy for swellings (Neuwinger, 1994) | Roots; leaves | Terpenes, steroids, coumarins, flavonoids, phenolic acids, lignans, xanthones, anthraquinones (Cimanga, 2004) | Antiplasmodial activity (Tona, 1999; Cimanga, 2004) |
| | *Albizia anthelmintica* Brongn. (JN046) | Malaria, fever, and as emetic (Johns et al., 1994) | Stem bark | Triterpenes (El-Hamidi, 1970) | Antiparasitic activity (Gathuma et al., 2004) |
| | *Acacia seyal* Delile (JN01) | Malaria (Nguta et al., 2010b) | Roots | Not identified | Not screened |
| | *Dichrostachys cinerea* (L.) Wight & Arn. (JN016) | Malaria (De La Pradilla, 1988) | Roots | Not identified | Not screened |
| | *Tamarindus indica* Lindl (JN038) | Malaria (De La Pradilla, 1988; Asase et al., 2005) | Roots; leaves | Luteoline, apigenine, orientine, isorientine, vitexine, and pinitol (De La Pradilla, 1988) | Not screened |
| **Hypericaceae** | *Harungana madagascariensis* Lam. ex Poir. (JN053) | Malaria (Gessler et al., 1994) | Root bark; stem bark | Anthraquinones, saponins, steroids (Tona et al., 1998) | Antiplasmodial activity (Gessler et al., 1994) |
| **Lamiaceae** | *Hoslundia opposita* Vahl (JN025) | Malaria (Hedberg et al., 1983) | Roots | Not identified | Anti-malarial activity (Gessler et al., 1994) |
| | *Ocimum suave* Willd. (JN030) | Mosquito repellent (Watt and Breyer-Brandwijk, 1962) | Leaves | Not identified | Antiplasmodial activity (Meyer, 2002) |
| | *Plectranthus barbatus* Andrews (JN032) | | | | |
| | *Ocimunum gratissimum* L. (JN058) | Malaria (foranyin et al., 2003) | Leaves | Not identified | Not screened |
| | *Clerodendrum myricoides* R. Br. (JN050) | Malaria (Kokwaro, 1993) | Root bark | Spermidine alkaloids (Bashwira and Hootele, 1988) | Anti-malarial activity (El Tahir et al., 1999) |
| | *Ocimunum balansae* Briq. (JN029) | Abdominal cramps (Fuchs, 1543; Sifkas, 1980) | Leaves | linalool, geranial, compounds (Damboleina, 2007) | Antifungal activity (Damboleina, 2007) |
| | *Adansonia digitata* L. (JN02) | Malaria (Nguta et al., 2010a); fevers (Watt and Breyer-Brandwijk, 1962; Abbiv, 1990) | Leaves | Not identified | Antiplasmodial activity (Kristina, 2002); bioactivity (Cantrell, 2003) |
| **Meliaceae** | *Grewia hainesiana* Hole (JN021) | Malaria (Nguta et al., 2010a) | Leaves | Triterpenoids (Raghunathaiyar, 1996) | Not screened |
| | *Grewia trichocarpa* Hochst. ex A. Rich. (JN022) | Malaria (Nguta et al., 2010a) | Roots | Not identified | Not screened |
| **Menispermaceae** | *Cissampelos munronata* A. Rich. (JN047) | Malaria (Gessler et al., 1994) | Root bark | Bisbenzylisoquinoline alkaloids (Tshibangu et al., 2003) | Antiplasmodial activity (Gessler et al., 1994) |
Table 4 | Continued

| Family       | Species/voucher specimen number | Traditional treatment | Plant part used | Bioactive or potentially active compounds | Screened activity |
|--------------|----------------------------------|-----------------------|-----------------|------------------------------------------|-------------------|
| Moraceae     | Ficus bussei Warb. ex Mildbr. & Burret (JN018) | Malaria (Kerharo and Bouquet, 1950) | Roots           | Steroidal sapogenins (Wall, 2006)         | Not screened      |
|              |                                  |                       |                 |                                          |                   |
| Phyllanthaceae| Bridelia micrantha (Hochst.) Baill. (JN010) | No previous reports | Stem bark; leaves | Not identified                           | Antiplasmoidal activity (Edith et al., 2005) |
| Phyllanthaceae| Flueggea virosa (Roxb. ex Willd.) Bailey (JN049) | Chest pains (Beentje, 1994) | Root bark       | Cp’d-bergenin (Nyasse et al., 2004); alkaloids (Gan et al., 2006) | Antiplasmoidal activity (Clarkson et al., 2004) |
| Poaceae      | Rottboellia Dumort. (JN034)       | Epilepsy (Moshi et al., 2005) | Leaves          | Not identified                           | Not screened      |
|              |                                  |                       |                 |                                          |                   |
| Polygalaceae | Securidaca longifolia Poepp. (JN035) | Malaria (Williamson, 1975) | Roots           | Steroids, saponosides, and monotropitoside (De La Pradilla, 1988) | Activity against Candida albicans (Taniguchi et al., 1978; Desta, 1993) |
| Rubiaceae    | Agathisanthemum globosum (Hochst. ex A. Rich.) Bremek. (JN031) | No previous reports | Roots           | Not identified                           | Not screened      |
|              | Canthium glaucum Hiern (JN011)   | Malaria (Nguta et al., 2010a) | Fruits          | Not identified                           | Not screened      |
|              | Pentanisia ouranogyne S. Moore (JN031) | No previous reports | Roots           | Not identified                           | Not screened      |
| Rubiaceae    | Pentas bussei K. Krause (JN048)   | Venereal diseases (Beentje, 1994) | Root bark       | Oxygen heterocycles (Bukuru et al., 2003) | Not screened      |
| Rubiaceae    | Pentas longiflora Oliv. Hook. f. ex Benth. (JN056) | Malaria (Kokwaro, 1993) | Root bark       | Quinoid cpds (El-Hady et al., 2002)       | Antiplasmoidal activity (Vanyoike et al., 2004) |
| Rutaceae     | Clausena anisata (Willd.) Hook. f. ex Benth. (JN013) | Malaria (Weenen et al., 1990) | Leaves          | Not identified                           | Antiplasmoidal activity observed (Clarkson et al., 2004) |
| Rutaceae     | Zanthoxyllum chalybeum Engl. (JN040) | Malaria (Beentje, 1994) | Root bark       | Quinoline alkaloids (Kato et al., 1996)   | Antiplasmoidal activity (Gessler et al., 1994) |
|              | Toddalia asiatica (L.) Lam. (JN055) | Malaria (Chhabra et al., 1991) | Root bark       | Quinoline alkaloids (Ishii et al., 1991)  | Antiplasmoidal activity (Kuria et al., 2001) |
| Rutaceae Juss. | Fagaropsis angolensis (Engl.) Dale (JN017) | Malaria (Njoroge and Bussmann, 2006) | Leaves          | Not identified                           | Antiplasmoidal activity (Kuria et al., 2006) |
| Rutaceae Juss. | Teclea simplicifolia (Engl.) l. Verd. (JN039) | Malaria (Nguta et al., 2010a) | Roots           | Quinoline compounds (Vondimu et al., 1999) | Not screened      |
| Rutaceae Juss. | Harrisonia abyssinica Oliv. (JN023) | Fever (Kokwaro, 1993) | Root bark       | Not identified                           | Antimalarial activity (El Tahir et al., 1999) |
| Salicaceae   | Flacourtia indica (Burm. f.) Merr. (JN019) | Malaria cure (Burkill, 1994) | Roots           | Not identified                           | Antiplasmoidal activity (Clarkson et al., 2004) |
| Solanaceae   | Solanum incanum L. (JN037)        | Fever (Kokwaro, 1993) | Roots; leaves   | Triterpenoids (Hirotta et al., 1990)      | Anti-ulcerogenic effect (Farina et al., 1999) |
| Verbenaceae  | Lantana camara L. (JN026)         | Malaria (Burkill, 2000) | Leaves          | Lantanine (Burkill, 2000)                | Antiplasmoidal activity (Clarkson et al., 2004) |
| Xanthorrhoeaceae | Aloe secundiflora Engl. (JN06)   | Leaf decoction is used to treat the spleen (Kokwaro, 1993) | Leaves          | Not identified                           | Antimalarial activity (Okeyto et al., 1999) |
|              | Aloe vera L. ex Webb (JN07)       | Malaria (De La Pradilla, 1989) | Leaves          | Stimulation of gap junctional intercellular communication and proliferation of human skin fibrob lasts in diabetes mellitus (Abdullah, 2002) | (Continued) |
Table 4 | Continued

| Family                  | Species/voucher specimen number | Traditional treatment | Plant part used | Bioactive or potentially active compounds | Screened activity |
|-------------------------|---------------------------------|-----------------------|-----------------|------------------------------------------|-------------------|
| Xanthorrhoeaceae Dumort. | Aloe deserti A. Berger (JN04)   | A leaf decoction is used to treat the spleen (Kokwaro, 1993) | Leaves          | Anthrone C-glycosides, chromones, and phenolic compounds (Reynolds, 2008) | Not screened      |
| Xanthorrhoeaceae Dumort. | Aloe macrostiphon Baker (JN05)  | A leaf decoction is used to treat the spleen (Kokwaro, 1993) | Leaves          | Not identified                           | Not screened      |

complete cure, without failure and or severe side effects, would lead to further research of the product with a view to isolating active constituents that would form the basis of a monotherapy or combination therapy.

Within a context of growing antimalarial resistance and the difficulties for households to afford and access effective antimalarials, the development, and promotion of phytomedicines may be the only sustainable solution to malaria treatment (Tabutu, 2008). This focus is justified because herbal medicines are widely accepted as safe and efficacious remedies by the study community. Indeed many drugs used in malaria treatment have been derived from higher plants using leads from traditional knowledge. Many plant species reported in this study have been investigated for their phytoconstituents (53%) and pharmacological activities (65%), the latter are in agreement with ethnopharmacological uses reported in this paper. Lamiaceae and Rutaceae represent families with commonly cited species. In Msambweni district, traditional methods of treatments based on medicinal plants are still an important part of social life and culture and the acceptability of these plants as claimed effective remedies is quite high among the population of this area. There is a very high probability of discovering new medicines from bioprospecting activities because the Digo ethnomedical practice is well developed and compares favorably with modern medical practice. The Digo ethnomedicine depends on an elaborate indigenous knowledge of malaria diagnostic procedure and medicinal plants used to treat the disease which is endemic in South Coast, Kenya. The claimed therapeutic value of the reported species call for modern scientific studies to establish their safety and efficacy and to preserve and document this flora which may otherwise be lost due to erosion of age old traditional methods of biodiversity conservation and medicinal knowledge. It is concluded that, the Digo ethnodiagnostic skill is the basis of their traditional bioprospecting techniques.

There are species, which were commonly cited in this study that are used as antimalarial remedies in other parts of Kenya or other countries. This convergence in use of the same species in different cultures over a long period suggests strongly that these species may be effective in the treatment of malaria (Van Wyk and Wink, 2004). It is however, important to validate all claims of therapeutic efficacy and safety by undertaking pharmacological, toxicological, and controlled clinical studies. Validation of traditional medicinal practices is important because it may generate higher confidence and hence wider use of such species. Wider acceptance of traditional herbal remedies can yield significant benefits for primary health care and also extend the market and possibility for value addition of an herbal medicine. Validations may proceed from observations of the treatment responses among patients taking the herbal medicines (Diallo and Paulsen, 2000). Promising herbal medicines identified in this way can then be subjected to pharmacological screening, toxicological screening, phytochemical analysis, and clinical trials to confirm their efficacy and safety, and also determine administration doses (World Health Organization, 2000).

CONCLUSION

Many plant species reported in this study have been investigated for their phytoconstituents (53%) and pharmacological activities (65%), the latter are in agreement with ethnopharmacological uses reported in this paper. Lamiaceae and Rutaceae represent families with commonly cited species. In Msambweni district, traditional methods of treatments based on medicinal plants are still an important part of social life and culture and the acceptability of these plants as claimed effective remedies is quite high among the population of this area. There is a very high probability of discovering new medicines from bioprospecting activities because the Digo ethnomedical practice is well developed and compares favorably with modern medical practice. The Digo ethnomedicine depends on an elaborate indigenous knowledge of malaria diagnostic procedure and medicinal plants used to treat the disease which is endemic in South Coast, Kenya. The claimed therapeutic value of the reported species call for modern scientific studies to establish their safety and efficacy and to preserve and document this flora which may otherwise be lost due to erosion of age old traditional methods of biodiversity conservation and medicinal knowledge. It is concluded that, the Digo ethnodiagnostic skill is the basis of their traditional bioprospecting techniques.

The local community of South Coast, Kenya is the owner of the traditional knowledge presented in this paper; consequently, any benefits that may accrue from the use of this knowledge must be shared with them.

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