



Ethnobotanical Survey of Selected Medicinal Plants used by Ogiek Communities in Kenya against Microbial Infections

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Research

Abstract

The role played by traditional medicine based on the use of medicinal plants for health purposes is significant both in growing and developed economies. Although the use of medicinal plants is already considerably documented across the globe, their increased use has only been noted in the recent past. In the African context, however, the dosage of such plants together with their pharmacological observations is yet to be well documented. In this paper, an attempt is made at documenting such knowledge with respect to traditional medicine among the Ogiek for future generations and to serve as a repository for further scientific studies on traditional medicine. The study was carried out involving the Ogiek community who live in the Mau forests in the central Rift Valley of Kenya where they still depend largely on hunting and gathering. A total of 20 traditional healers aged between 50 and 70 years were interviewed by use of a questionnaire. It was evident from the 32 plant families collected that the majority are used in treating malaria (21.88%), pneumonia (21.88%), stomachache (21.88%), and tonic related diseases (21.88%). Other remedies used fewer plant families. It is therefore recommended that follow up studies pertaining to these plants be carried out for validation of their efficacy by *in vitro* and *in vivo* studies. It is also recommended that further studies on hygienic administration of these drugs be carried out. Conservation of the endangered plant species involving conventional methods should be encouraged. There should be clear policies regarding traditional medical practices in Kenya and elsewhere in East Africa.

Introduction

Fifty to eighty percent of the global population still rely on traditional health care systems, of which phytomedicine is a major component (Busia 2005, WHO 1978, 2001). As much as 33% of modern allopathic medicines are of

plant origin (Ali 2008). In certain societies (as exhibited in Southeast Asia) medicinal practices involving plants are as old as humankind (Rajan *et al.* 2002). Regional studies have also pointed out the potential of plants for integrating medicinal plants and folklore into regular medical practices (Akiyemi *et al.* 2005, Aslam 2002, Atindehou 2002, Dewick 2002b, Healy 2002, Williamson 2002). Several compounds that are now used in modern pharmaceutical systems have been elucidated and validated from extracts of plants used in folklore therapies (Klayman 1985, Kochhar 1989, Marston *et al.* 1993, Taniguchi & Kubo 1993). The greatest challenge to phytomedicine remains the accelerated destruction of natural forest sources, regardless of efforts to restore degraded areas (Martin 1995).

As forests are destroyed, so are the lives of the human populations that depend almost entirely on them. Perhaps owing to pressures for survival, growing human settlements are sent into the forest for space and for food. As this encroachment progresses, indigenous minority forest dwellers often find themselves absorbed into the en-

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croaching dominant populations. The norm is almost always that hunting or gathering lifestyles of forest dwellers are replaced by more developed community lifestyles. Yet not all is lost by traditional groups in the assimilation. Conservative individuals may identify with a dominant group as necessary for situations, but revert to old lifestyles in private. Anthropological research accessing intricate information about these pragmatic community choices takes a long time (Schulte 1980). Transmission of indigenous knowledge about plant bio-dynamics may lead some scientists to assert that there is little or no correlation between native uses of medicinal plants and the chemistry of each species. The same erroneous assumption may have been made about ethnomedicine among the Ogiek (Towett 2004).

Ogiek communities constitute a kaleidoscope of cultural heritage of Kalenjin speaking people. The origin of the Ogiek ethnic group is believed to have been the Nile valley, but they moved southward with the onset of the Sahe-lization of north Africa and spreading deserts of the Sahara. Their southward migration must have been in search of pastures and game animals (National Archives 1913). The Ogiek associated with new neighbors with different lifestyles and competition for land resources. For example, the populous Kikuyu community acquired or leased some of the land originally owned by the Ogiek for livestock grazing. The greater Kiambu and parts of Muranga districts were actually occupied by the Ogiek until the first two decades of the 20th century (Archives 1913). The inevitable integration among the neighboring communities caused them to depend on one another. For instance, to their Kalenjin and Maasai neighbors, the Ogiek offered their veterinary services. In addition to this, the Ogiek also

assisted in the initiation of their neighbors into adulthood through circumcision (Towett 2004).

Presently, the Ogiek live in the Mau forest in the center of the Rift Valley of Kenya where they still depend largely on hunting and gathering. The estimated community population is 10,000 (Towett 2004). They are well versed in honey collecting techniques. Their staple foods are root tubers and other forest products. The Ogiek are also known for their territorial lifestyle since their firewood collection territories, honey harvesting territories, and hunting areas are demarcated on family basis (Towett 2004).

Materials and Methods

This study covered the Nessuit and Mariashoni locations of Nakuru County and Tinet and Kaptuiget forests in Kericho and Baringo Counties, respectively (Figure 1). The survey was done with the help of a questionnaire that was double administered with each respondent. An ethnomedical method, employing purposive sampling, was used during the study. Respondents were selected with the assistance of the Ogiek Welfare Council, a Non-Governmental Organization interested in conservation of Ogiek culture. Through this council, traditional healers were selected from within the 50 and 70 age range. This is because people falling within this category among the Ogiek are understood as custodians of indigenous knowledge. A total of 20 traditional healers from the community were interviewed. Records on the plants, time of collection, part of plant used, method of preparation, precautions on use, formulation, dosage and other mixtures were noted. A topographical record, coupled with the geographical location and time of collection, was also included for each plant.

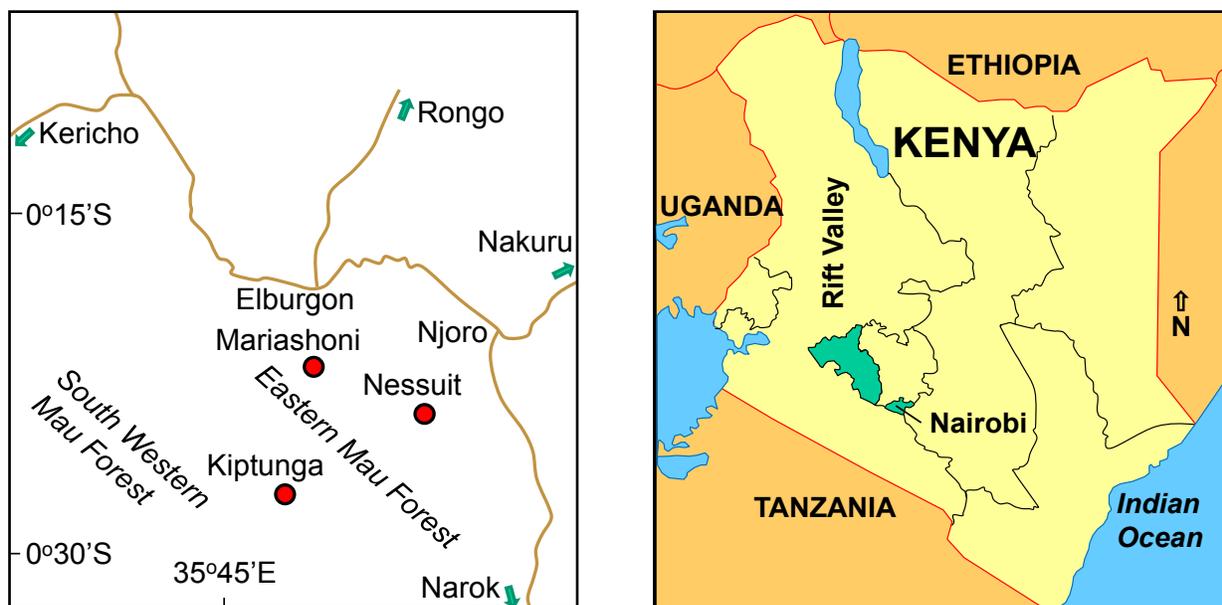


Figure 1. Ogiek study area with locations at Mariashoni, Nessuit, and Kiptunga, of the Mau Complex in Nakuru County of the Rift Valley, Kenya.

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Availability and environmental status of each plant species were reported by the healers.

The percentage use of each plant species was calculated by: Actual respondents x100 ÷ Total number of respondents interviewed.

Voucher specimens of each plant were made and deposited at the National Museum of Kenya for authentication. Each plant part used by the community was thus collect-

ed and dried under shade to obtain a moisture content of 13% before being ground and sieved through a 0.5mm sieve. The plant parts were then hermetically stored in refrigerators for future processing.

Results

Tabulation of plant descriptions, percentages of use, and therapeutic uses are summarized in Table 1. Percent usage of plant families for various microbial ailments is re-

Table 1. Medicinal plants used by the Ogiek communities in Kenya against microbial infections. Percentage use for each plant reflect the proportion of sampled community members reporting uses for a plant.

Scientific Name	Usage and dosage	% use	Indigenous Name	Therapeutic uses
Acanthaceae				
<i>Hypoestes verticillaris</i> (L.f.) Sol. ex Roem. & Schult.	300 grams of roots are mixed with 300gm <i>Toddalia asiatica</i> (L.) Lam., roots and boiled in 1½ liters of water. 250ml of extract are drunk to treat tuberculosis, various chest complaints and dry coughs.	100	Narubat	tuberculosis, chest complaints, dry cough, pneumonia
Araliaceae				
<i>Schefflera abyssinica</i> (Hochst. ex A.Rich.) Harms	Wax is formed from the exudates in mature trees directly scrapped to form 1 teaspoonful of powder. The powder is then mixed with 3 tablespoonfuls of honey and then eaten once daily for about 4 days to treat asthmatic and respiratory disorders like bronchitis and coughs. About 600gm of dried bark is boiled thoroughly in about 2 liters of water. This may be bottled. 200ml is taken twice daily to restore vitality (aphrodisiac) in men.	100	Chelembut	bronchitis, coughs, pneumonia, aphrodisiac
Apocynaceae				
<i>Gomphocarpus semilunatus</i> A.Rich.	Leaves are chewed to relieve toothache and the milky sap from the plant is applied twice daily to cover affected areas of gums until lesions disappear. About ½kg of the roots are boiled in about 2 liters of water. 200ml of the decoction is drunk for treatments.	10	Toiliotilio	tooth ache, syphilis, gonorrhoea, gastroenteritis
<i>Periploca linearifolia</i> Quart.-Dill. & A.Rich.	The Kalenjin, Maasai. The Ogiek use this during circumcision and in initiation: a big ring is made which is taken to the river by the person to be circumcised. About 200gm of roots are washed and cooked in 1 liter of water. The water extract is decanted, and about 250ml is drunk to treat colds. About 250gm of roots are cooked in mutton to add flavor to the soup. The soup is known to produce vitality in men. The leaves are dried, pounded, and the resulting powder is applied to wounds inflicted by Herpes zoster and also mixed with 30ml of honey and eaten once daily to treat oral thrush.	100	Senendet	root tonic, circumcision, colds, Herpes zoster, oral thrush
Asparagaceae				
<i>Asparagus racemosus</i> Willd.	1kg of roots is cooked as a soup which is believed to act as an immuno-booster. 1kg of roots is mixed with 1 kg of <i>Dovyalis abyssinica</i> (A.Rich.) Warb. and <i>Solanum aculeastrum</i> Dunal roots, then cooked in 1.5 liter of water. 250ml of resulting infusion is drunk twice daily to treat syphilis and malaria, until recovery.	10	Kaptalelit	immuno-booster, stomach ache, syphilis, malaria

Scientific Name	Usage and dosage	% use	Indigenous Name	Therapeutic uses
<i>Dracaena afromontana</i> Mildbr.	Approximately 250g of fresh young growing leaves are crushed and soaked in about 500ml of cold water for about 2 hours. The solution is decanted, then 125ml is given twice daily until recovery for children suffering from stomach problems and swollen spleen. The stem is also used as toothbrush.	100	Lebekuet	stomach problems, swollen spleen
Asteraceae				
<i>Baccharoides lasiopus</i> (O.Hoffm.) H.Rob.	About 30gm of fresh leaves are washed, chewed and the resultant liquid swallowed twice daily until recovery to treat abdominal problems like stomach ache.	10	Segumeriet	stomach-ache, liver problems
<i>Helichrysum schimperi</i> (Sch. Bip. ex A.Rich.) Moeser	About 30gm of fresh roots are washed, chewed and the resultant liquid swallowed twice daily to treat abdominal problems like stomach-ache and other related ailments twice daily till recovery.	10	Manarariat	stomach ache
<i>Solanecio manni</i> (Hook.f.) C.Jeffrey	A handful of fruits and about 200gm of roots are washed and chewed once daily for colds and chest infections.	100	Masagariet	colds, chest infections, otitis media
<i>Solanecio nandensis</i> (S.Moore) C.Jeffrey	Approximately ½kg of leaves is pounded and boiled in 2 liters of water, cooled and decanted. 250ml is taken once daily for 3 days for malaria and stomach ache.	100	Masageriet	malaria, stomach ache
<i>Vernonia brachycalyx</i> O.Hoffm.	About 100-150gm of fresh leaves are boiled in 1 liter of water, decanted, and cooled. 250ml is taken once daily for 5 days to treat stomach ache and cough.	30	Segumeriet	stomach ache, cough, colds
Balsaminaceae				
<i>Basella alba</i> L.	6 pieces of roots measuring 3-4 inches are washed, then boiled in 300ml of water, decanted, cooled and given to an expectant woman to enhance safe baby delivery during labor.	20	Nderemiet	placenta removal
<i>Impatiens tinctoria</i> A. Rich		20	Pumbuetiet	
Clusiaceae				
<i>Garcinia buchananii</i> Baker	500gm of bark is cleaned and soaked in 1½ liter of water then decanted. 20ml of decoction is given to a child with stomach problems twice daily until recovery.	20	Nderiot	stomach problems
Crassulaceae				
<i>Kalanchoe densiflora</i> Rolfe	Leaves are heated over fire until tender, then used to massage the whole body in cases of rheumatism, muscular/bone dislocations, and general muscular aches.	10	Misigiliet	rheumatism, muscular/ bone dislocations, muscle aches
Curcubitaceae				
<i>Lagenaria sphaerica</i> (Sond.) Naudin	About 1kg of fresh flowers and young fruit are pounded and soaked in about 5 liters of water. The decoction is used to bathe the body daily of those inflicted with scabies, candidiasis, ringworms or leprosy until the areas heal, 5ml injected into the birth canal to expel the placenta after child delivery.	50	Mtondoruet	scabies, candidiasis, ringworms, leprosy, placenta removal

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Scientific Name	Usage and dosage	% use	Indigenous Name	Therapeutic uses
<i>Momordica rostrata</i> A. Zimm.	Underground storage tuber is chopped into small pieces and dried completely. 200gm is then ground into very fine powder. 3 teaspoonfuls (15ml) of powder is mixed with 15ml of honey and swallowed at once in a single dose to treat malaria and acts as a brain stimulant. Caution: it has a nauseating effect and must be handled with care.	50	Chepkologolio	malaria, brain stimulant, tuberculosis
<i>Zehneria scabra</i> Sond.	About 1kg of stem bark is dried, finely ground, boiled, and allowed to cool for about 15 minutes. The resultant water extract is strained out, and drunk twice for 1 day to treat malaria. Fresh exudate from the plant is applied to fresh wounds to enhance the healing process.	100	Sumeito	malaria, fresh wounds
Euphorbiaceae				
<i>Clusia kilimandscharica</i> Engl.	About 100gm of root bark is pounded, cooked in 500gm of meat into a soup taken as an aphrodisiac.	100	Kirbanyat	aphrodisiac, tonic
<i>Macaranga kilimandscharica</i> Pax	About 500gm of roots is washed, pounded, and boiled in 1 liter of water. The extract is decanted and 250ml is drunk once to treat bilharzia. 500gm of roots may be cooked in 1 liter of water, and 250ml of decoction drunk once daily for coughs. 0.5g of leaf decoction is cooked and 250ml drunk daily to treat stomach problems.	100	Logomaita	bilharzia, cough, stomach ache
Fabaceae				
<i>Senna didymobotrya</i> (Fresen.) H.S.Irwin & Barneby	About 500gm of leaves is boiled in 1½ liters of water to form two glasses (500ml) of the resultant decoction. This is drunk twice daily for 3 days to treat malaria and fever.	100	Senetuet	malaria, fever, rashes
Lamiaceae				
<i>Hoslundia opposita</i> Vahl	About 10 freshly collected leaves are boiled in 1 liter of water and the resultant infusion taken as a hot tonic.	90	Chepsagitiet	tonic, stomach ache
<i>Micromeria biflora</i> (Buch.-Ham. ex D.Don) Benth.	About 200gm of roots/whole plants is crushed and boiled in 1 liter of water and decanted. 200ml of the decoction is drunk daily for 4 days for stomach ache, gastroenteritis and pneumonia.	90	Chepsagitiet (Cherunguet)	stomach ache, gastro-enteritis, pneumonia
Malvaceae				
<i>Dombeya torrida</i> (J.F.Gmel.) Bamps	200gm of bark is mixed with 300gm of <i>Senna didymobotrya</i> (Fresen.) H.S.Irwin & Barneby, leaves, crushed, and boiled in 1 liter of water. The resultant extract is cooled and 250ml is drunk 3 times daily for 3 days for chest problems.	100	Silibuet	chest problems, cough
Melanthiaceae				
<i>Bersama abyssinica</i> Fresen.	About 1kg of freshly collected bark is cooked along with 5 ripe seeds of <i>Solanum aculeastrum</i> Dunal, in 4 liters of water. The resultant infusion is decanted and 1 liter given daily for 3 days to animals suffering from black water fever, east coast fever and Rift Valley fever.	100	Sagaweita	black water fever, east coast fever, Rift Valley fever

Scientific Name	Usage and dosage	% use	Indigenous Name	Therapeutic uses
Meliaceae				
<i>Ekebergia capensis</i> Sparm.	About 1kg of bark is pounded, boiled in about 2 liters of water, cooled, and decanted. 250ml is taken with juice daily until recovery for dysentery and diarrhea due to HIV related opportunistic infections.	100	Ororouet	dysentery, diarrhea
Oleaceae				
<i>Olea capensis</i> subsp. <i>macrocarpa</i> (C.H.Wright) I.Verd.	1kg each of <i>Olea capensis</i> and <i>Olea europaea</i> subsp. <i>cuspidata</i> , fresh bark are mixed, boiled in 5 liters of water, and allowed to cool. 1 liter of the cooled water extract is given to livestock to treat east coast and Rift Valley fevers. About 125ml of same extract is given once to humans to treat malaria, general body ache and pneumonia.	90	Murunguyet	east coast fever, Rift Valley fever, malaria, general body aches, pneumonia,
<i>Olea europaea</i> subsp. <i>cuspidata</i> (Wall. & G.Don) Cif.	Approximately 150gm of fresh bark is peeled, coarsely smashed, and boiled in 2.5 liters of water, cooled, and decanted. 250ml is drunk twice daily for 3 days to treat malaria and fever.	90	Masaieta	malaria, fever, pneumonia
Penaeaceae				
<i>Olinia rochetiana</i> A.Juss.	A handful of young growing leaves at the growth terminals are chewed, from the growing tips, daily to treat colds, coughs, and other chest related complaints like pneumonia.	20	Kabideleliet	colds, cough, pneumonia, malaria
Piperaceae				
<i>Piper umbellatum</i> L.	A few (10), 6cm root pieces are chewed once daily until recovery to treat bronchitis and general body ailments.	70	Ketagan	bronchitis, general body ailments, pneumonia
Pittosporaceae				
<i>Pittosporum lanatum</i> Hutch. & E.A.Bruce	About 1.5kg of stem bark is boiled in 1½ liter of water then decanted. 250ml is taken once to induce vomiting in cases of malaria and nausea.	100	Mtabonit	induce vomiting, malaria, nausea
Primulaceae				
<i>Embelia schimperi</i> Vatke	1kg of fresh stem bark is boiled in 1.5 liters of water to 1 liter of concentrate. This is bottled. 10ml of concentrate is drunk 4 times daily indefinitely to treat rheumatic fever, tuberculosis and other chest complaints like pneumonia.	100	Sachuonet	rheumatic fever, tuberculosis, pneumonia, colds, brucellosis
<i>Rapanea melanophloeos</i> (L.) Mez	3-5 berries are chewed and swallowed or the seeds may be pounded together with millet or finger – millet at the rate of 20 seeds to 0.5 kg of the cereal grains, cooked, and drunk as a medicated gruel to remove intestinal worms. Alternatively, 20gm of ground berries is mixed with milk and drunk to act as a purgative and anthelmintic.	100	Kwarabariet	purgative, anti-helminthic, stomach ache,
Proteaceae				
<i>Faurea saligna</i> Harv.	About 1km of fresh scraped stem bark is boiled in 2 liters of water, then cooled. 250ml of resultant decoction is taken as a tonic to restore male vitality.	70	Msombriet	tonic, liver problems, urinary tract infections

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Scientific Name	Usage and dosage	% use	Indigenous Name	Therapeutic uses
Pteridaceae				
<i>Pteris pteridioides</i> (Hook.) Ballard	Fresh roots of young plants are washed and about 30gm chewed. Sap is swallowed once for treatment.	40	Chesmit	stomach ache, gonorrhoea
Ranunculaceae				
<i>Clematis brachiata</i> Thumb.	This plant is used against severe ailments. 400gm of roots are boiled in 1 liter of water. 250ml of decoction is drunk 3 times daily, indefinitely until recovery for back ache ailments. 800gm of roots is mixed with about 3-4 ripe seeds of <i>Solanum aculeastrum</i> Dunal, and boiled in about 2 liters of water. 250ml of the resultant extract is drunk 3 times daily until recovery from syphilis and gonorrhoea.	100	Pissinda	back ache, syphilis, gonorrhoea
Rhamnaceae				
<i>Rhamnus prinoides</i> L'Hér.	Four pieces (500gm) or roots are boiled in 1½ liters of water then decanted. About 250ml of the decoction is mixed with an extract of <i>Dovyalis abyssinica</i> (A.Rich.) Warb., roots also prepared separately through the same process. The mixtures of both the decoctions are drunk once to treat amoebiasis and bacillary dysentery. Meat soup may also be used as a vehicle by mixing the decoction with <i>Solanum aculeastrum</i> Dunal, roots.	100	Kosisito	amoebiasis, bacillary dysentery, tonic, pneumonia
<i>Scutia myrtina</i> (Burm.f.) Kurz	Approximately 200gm of fresh scraped bark is boiled in 1 liter of water to make a tonic drink. About 300gm of roots is chopped and combined with 10 other plant species in equal proportions to form a cocktail which is decanted and stored. 250ml is taken once daily for 28 days to treat female sterility.	100	Sumbeyet	tonic, sterility, pneumonia
Rosaceae				
<i>Prunus africana</i> (Hook.f.) Kalkman	About 500gm of mature bark is boiled in 2 liters of water. 250ml of infusion is taken once daily until recovery from prostate cancer.	100	Tenduet	prostat cancer, malaria
<i>Rubus kenoensis</i> Koidz.	200gm of roots is boiled in 1.5 liters of water, cooled, and decanted. 250ml is taken once for stomach ache.	10	Tagaimaet	stomach ache, food poisoning
Rubiaceae				
<i>Galium simense</i> Fresen.	About 500gm of leaves is pounded and then soaked in 1 liter of water. After about 30 minutes of soaking the mixture is used to bathe cancerous areas of the body and used to treat general body rashes.	20	Tipsoliet	cancer, general body rashes, malaria
Rutaceae				
<i>Toddalia asiatica</i> (L.) Lam.	Roots are chewed to treat various body ailments ranging from malaria, stomachache and sore throat. A handful of roots is boiled in 1 liter of water and the decoction taken as a tonic against harsh environmental conditions	60	Chepindoruet	malaria, stomach ache, sore throat, tonic, chest complaints

Scientific Name	Usage and dosage	% use	Indigenous Name	Therapeutic uses
<i>Zanthoxylum chalybeum</i> Engl.	In combination of <i>Carissa spinarum</i> L. and <i>Withania somnifera</i> (L.) Dunal, a handful of the roots of each is mixed, boiled, and cooled. A glassful of the extract is drunk to treat chest pains and stomach problems. The same mixture is put in a pot with about 5 liters of water, and tightly sealed while boiling. This is used in a steam bath to treat diseases such as anthrax and measles. Branches are also used as tooth brushes and mouth fresheners.	30	Kikomit	chest pains, stomach problems, anthrax, measles, tonic, urinary tract infections
Salicaceae				
<i>Dovyalis abyssinica</i> (A.Rich.) Warb.	500gm of roots is crushed and cooked with meat to boost body immunity. About 500gm of roots is crushed and mixed with 500gm of <i>Clusia kilimandscharica</i> Engl. roots then boiled and decanted. 250ml is drunk daily until recovery to treat stomach ache and chest ailments.	100	Nkyuiat	boost body immunity- tonic, stomach ache, chest ailments
Solanaceae				
<i>Solanum aculeastrum</i> Dunal	Ripe fruit are used in various illness conditions in domestic animals and humans. In cattle, a few (10) ripe fruit are squeezed into 3 liters of hot water, cooled, and decanted. 1 liter of decoction is given to the sick animal 3 times daily for five days to treat Rift Valley and East Coast fevers. Stem branches are used as toothbrushes and are known to treat tooth ache. Ripe fruit are squeezed into 1 tablespoonful (10ml) and the resultant juice is taken once to treat nausea fever by inducing vomiting. Ripe fruit are cut and the juice is squeezed on areas affected by what is believed to be osteomyelitis, once daily after bathing until recovery.	100	Sigowet	Rift Valley fever, east coast fever, tooth ache, nausea fever, osteomyelitis
<i>Solanum mauense</i> Bitter	Small ripe, orange seeds are dried and ground into fine powder. About 100gm is put into 250ml of boiling water, then decanted. 10ml of decoction is drunk by adults (5ml by children) once to expel worms, as a purgative, and to treat chest ailments.	70	Ng'onoyiek	anthelmintic, purgative, chest ailments, tuberculosis
<i>Solanum nakurense</i> C.H. Wright	Juice from about 2 ripe fruit is squeezed daily until recovery into ears to treat otitis media.	70	Tiliet	otitis media
Urticaceae				
<i>Urtica massaica</i> Mildbr.	Plants are cut and placed in a sting line of two rows. Boys who are to be circumcised run through it several times until the whole body is numb and ready for the ritual.	100	Ila ila	circumcision ceremonies
Verbenaceae				
<i>Lippia javanica</i> (Burm.f.) Spreng.	About 50gm of fresh leaves is carefully wrapped around a fresh wound to enhance healing.	80	Labotuet	fresh wounds
Xylariaceae				
<i>Engleromyces goetzei</i> Henn.	200gm of the fungi is boiled in about 1 liter of water over a long period of time. The extract is cooled and decanted. About 250ml is drunk as a purgative and against malaria. It is taken in low doses of about 20ml once for malaria, treating bacillary dysentery and amoebiasis by acting as a purgative.	100	Puindaii	purgative, malaria, bacillary dysentery, amoebiasis

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Table 2. Percent usage (n=32 species) of plant families for various microbial ailments by the Ogiek communities in Kenya.

Ailment	Plant families used	%
Bowel disorder/ stomach ache	7	22
Malaria	7	22
Pneumonia	7	22
Tonic	7	22
Coughs	4	13
Tuberculosis	3	9
Circumcision ceremonies	2	6
Dysentery	2	6
East coast fever	2	6

Ailment	Plant families used	%
Liver problems (hepatitis)	2	6
Leprosy	1	3
Gonorrhoea	1	3
Otitis media	1	3
Placenta removal	1	3
Syphilis	1	3
Toothache	1	3
Fresh wounds	1	3

ported in Table 2. Plant part usage frequency is reported in Table 3. Finally, plant families and the number of remedies for which they are used for treatment of microbial infections is reported in Table 4.

A majority of the plant remedies are formulated in water with a few formulated in honey or cooked with meat soup. A few of the plant raw materials are soaked in water for some time, after which the material is decanted and an aliquot taken for treatment.

Plant species used are categorized by plant parts into three main groups; (i) those that are used to resolve veterinary problems (ii) those that are used to resolve human health problems and diseases, and (iii) those that are used in both human and veterinary problems and diseases. It also emerged that there are various categories of traditional healers and forest product users in the community as shown in Table 1. These are forest product gatherers and hunters. This category involves nearly everyone within the Ogiek community.

The herbalists who treat people and livestock may use animal extracts alone, herbal medicine alone, or both in combination. Although the Ogiek were found to have undergone cultural assimilation, a proportion of members of this community still adhere to their culture. For instance, some of the respondents admitted to possessing the ability to communicate with friendly spiritual powers or their

ancestors through the use of plant preparations, e.g., *Periploca linearifolia* Quart.-Dill. & A.Rich. is used this way during circumcision ceremonies.

Discussion

This discussion focused on plants in the phylogenetic, family categories, recognizing that chemical and pharmacological activity of plants are likely related to shared environmental histories and genetic adaptations.

Acanthaceae

Hypoestes verticillaris L. is used to treat tuberculosis, chest complaints and dry coughs. Among the Marakwet, *Hypoestes forsskaolii* (Vahl) R.Br. is used as a pesticide (Kipkore *et al.* 2014).

Araliaceae

Schefflera abyssinica (A. Rich) Harms. is used to treat asthma, bronchitis and coughs, and is also used in men to restore vitality. This finding coincides with other uses in the Rift Valley (Kipkore *et al.* 2014).

Apocynaceae

The Ogiek community uses *Gomphocarpus semilunatus* A.Rich., for sexually transmitted infections. Other plants

Table 3. Plant part usage frequency (n=32 species), by plant family, for treatment of microbial infections by the Ogiek communities in Kenya.

Plant part	Frequency of use	%
Roots	13	41
Stem bark	12	38
Leaves	9	28
Fruit	3	9

Plant part	Frequency of use	%
Whole Plants	3	9
Tubers	1	3
Seeds	0	0

Table 4. Plant families and the and number of remedies for which they are used for treatment of microbial infections by the Ogiek communities in Kenya. Plant parts used: (F) fruit, (L) leaves, (R) roots, (E) seeds, (S) stem bark, (T) tubers, and (W) whole plants.

Family	Remedies	Plant Parts Used						
		S	L	R	T	F	E	W
Acathaceae	4			X				
Araliaceae	4	X						
Apocynaceae	8			X				X
Asparagaceae	5			X				
Asteraceae	8		X	X				
Balsaminaceae	1				X			
Clusiaceae	1	X						
Crassulaceae	3		X					
Curcubitaceae	8	X				X		X
Euphorbiaceae	5			X				
Fabaceae	3		X					X
Lamiaceae	3	X	X	X				
Malvaceae	2	X						
Melanthiaceae	4	X						
Meliaceae	1	X						
Oleaceae	5	X						
Penaeaceae	4		X					

Family	Remedies	Plant Parts Used						
		S	L	R	T	F	E	W
Piperaceae	3			X				
Pittosporaceae	1			X				
Primulaceae	9	X						
Proteaceae	3	X						
Pteridaceae	2			X				
Ranunculaceae	2	X						
Rhamnaceae	3	X		X		X		
Rosaceae	4	X	X	X				
Rubiaceae	3		X					X
Rutaceae	1	X						
Salicaceae	3			X				
Solanaceae	5			X		X		
Urticaceae	2		X					
Verbenaceae	1		X					
Xylariaceae	4							X
Xylariaceae	1							X

from the same family such as *Calotropis procera* (Aiton) Dryand., are known to have bacteriolytic substances (Aslam 2002). Possibly, this is why *G. semilunatus* is used to treat gonorrhoea and syphilis. *Alstonia scholaris* (L.) R. Br. is another plant in the Apocynaceae that has been used in traditional Ayurvedic medicine to treat thrombopeietic tumors and cancer (Rajan *et al.* 2002). Likewise, until recently, *Catharanthus roseus* (L.) G. Don was the source of vincristine and vinblastine, which were the drugs of choice for leukemia, lymphomas in children, and Kaposi's sarcoma in adults (Dev 1989).

Asparagaceae

Asparagaceae (including Dracaenaceae) is a relatively small family but has resins with medicinally useful steroids (Mills 2002). The Ogiek community use *Dracaena afromontana* Mildbr. in the treatment of enlarged spleen in children.

Asteraceae

Asteraceae includes the largest number of medicinal genera (e.g., *Artemisia*) in the world and these contain a wide variety of bioactive chemical constituents (Rajan *et al.* 2002). The Ogiek community uses *Baccharoides lasiopus* (O. Hoffm.) H. Rob. in the treatment of malaria and hepatitis, both of which remain worldwide problems (Paulo *et al.*

1994). Certain plants from the family Asteraceae in East Africa, like *Aspilia mossambicensis* (Oliv.) Wild (Mbogo 1996), are effective against malaria and *Cladosporium* ssp. (Okeke *et al.* 2005, Sofowara 1993). *Vernonia amygdalina*, whose stem branches are chewed in West Africa, possess antibacterial characteristics (Sofowara 1993). In the same family there have been observations which suggest that chimpanzees use *Vernonia amygdalina* Delille to treat dysentery (Huffmann 1997). The Ogiek have surely observed forest animals using plants for remedies and have applied this knowledge for similar human ailments.

Balsaminaceae

Impatiens tinctoria A. Rich is believed to enhance baby safety and produce faster delivery in the Ogiek community. We could not find mention of this plant, or its relatives, in the medicinal literature except as bedding plants in ornamental horticulture (Fish 2004).

Basellaceae

Certain plants may be used both as pot herb vegetables and as medicines (Kokwaro *et al.* 1998). One such plant having multiple uses in the Ogiek community is *Basella alba* L. (Basellaceae). Its medicinal value among the people is more pronounced (see Table 1), as compared to its value as a vegetable. When mixed with other plant

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species, the concoction is used in veterinary gynecology to enhance expulsion of the uterus after calf delivery in cows.

Crassulaceae

Among the Maasai *Cotyledon barbeyi* Schweinf. ex Baker leaves are heated before they are rubbed on the body as a remedy for body pains (Beentje 1994). From the same plant family, Crassulaceae, the Ogiek use *Kalanchoe densiflora* Rolfe in the same manner.

Curcubitaceae

Curcubitaceae fruit are widely used in East African communities as containers and utensils (Kokwaro 1998) and foods (Pursglove 2004). The Ogiek cut stems of *Zehneria scabra* Sond. and squeeze the sap onto fresh wounds to enhance healing.

Among the Ogiek, *Lagenaria sphaerica* (Sond.) Naudin is externally used for skin conditions ranging from scabies and leprosy to candidiasis. Elsewhere, extracts from the family have been used to treat tumors (Houghton 2002). There are also instances where the Curcubitaceae have been reported as being highly toxic to humans and to higher animals (Kokwaro 1993). Management of diabetes in Ayurvedic medicine is achieved through the use of *Momordica charantia* L. (Rajan *et al.* 2002). Other members of this genus, e.g., *Momordica reticulata* Salisb., are capable of accumulating selenium which is fatally toxic.

Clusiaceae

The Ogiek also use an infusion made from the bark of *Garcinia buchananii* Baker to treat stomach ailments in children. In West Africa, *Garcinia kola* Heckel branches are used as chewing sticks, and when boiled, the bark is used to treat stomach ailments (Atindehou *et al.* 2002). In Thailand and Southeast Asia, *Garcinia × mangostana* L. bark is used to treat infections (Voravuthikunchai & Kitpitpit 2005). In East Africa, *Garcinia livingstonei* T.Anderson root infusion is mixed with milk and drunk by women for abdominal pain during pregnancy or shortly after birth (Kokwaro 1993).

Euphorbiaceae

The family Euphorbiaceae is used for general medicinal purposes in the Ogiek community. *Clusia kilimandscharica* Engl. roots are used as a tonic cooked with meat. *In-vitro* studies carried out to establish efficacy against selected bacteria revealed that the responses were too low to justify their continued use (Akiyemi *et al.* 2005). It may be argued that *in-vitro* studies do not necessarily describe *in-vivo* activity. In Southeast Asia and India various Euphorbiaceae have been used to treat physiological disorders such as diabetes (Rajan *et al.* 2002).

Fabaceae

Fabaceae is a major source of foods and medicines. Ayurvedic and Unani medical practices include Fabaceae that are poisonous when ingested such as *Abrus precatorius* L. whose seeds may lead to blindness when ingested (Kokwaro 1993). In Ayurvedic and Unani medicine, the leaves are used in the treatment of syphilis, coughs and gonorrhoea (Dewick 2002a). Uses of other species range from antifungal and antibacterial to laxative and antitussive (Newton *et al.* 2000). The Ogiek use the leaves from *Senna didymobotrya* (Fresen.) H.S.Irwin & Barneby to treat malaria, stomach pains.

Lamiaceae

The Ogiek use mints as tonic drinks, antiseptics, teas, anti-tussives, as emetics, and to treat stomach aches. In other cases, they have been used as culinary, as source of volatile oils, and as anti-insect growth hormones (Dev 1989, Kokwaro 1993). Among the Ogiek *Micromeria biflora* (Buch.-Ham. ex D.Don) Benth. roots are used in the treatment of upper respiratory tract ailments. *Hoslundia opposita* Vahl leaves are used in tea by the Kipsigis of Kenya (Kokwaro 1993); so do the Ogiek.

Malvaceae

There are several genera in this family that are reportedly used in medicine in Tanzania (Chhabra *et al.* 1993). Genus *Dombeya* has six species that are known for their medicinal value in Northern Tanzania (Kokwaro 1993). *Dombeya burgesiae* Gerrard ex Harv. is one of the species used against malaria. A decoction prepared from the leaves and roots of *Dombeya acutangula* Cav. is used to treat vomiting, chest pains and dysmenorrhoea. Root decoctions of *Dombeya shupangae* K.Schum., *Dombeya rotundifolia* (Hochst.) Planch. and *Dombeya quinqueseta* (Delile) Exell are rubbed on the whole body to rid it of evil effects from witchcraft. Stem bark is also used to treat rheumatism, diarrhoea, colic and abdominal pains (Kokwaro 1993). The Ogiek use the bark of *Dombeya torrida* (J.F.Gmel.) Bamps in combination with the leaves of *S. didymobotrya* to treat pneumonia, coughs and colds. The stem bark of the plant is also used in making ropes and dyes for fabrics.

Melanthiaceae

The Melianthaceae family is less mentioned in the literature except for having extracts with cardiovascular activities (Williamson 2002). A leaf decoction of *Bersama abyssinica* Fresen. is used as an emetic in animals to treat east coast fever symptoms similar to brucellosis.

Meliaceae

Ekebergia capensis Sparrm. is nearly extinct as a result of timber exploitation, however, its bark is used as an antiseptic/antibiotic in South Africa and the surrounding regions (Samie *et al.* 2005). Among the Ogiek, a bark decoction is used to treat dysentery. Recently, it has also been found to manage HIV related dysentery.

Oleaceae

Olea europaea L. fruit oil is widely used as a food, and due to its low acidity levels in parenteral preparations. Within the Ogiek community, *Olea capensis* subsp. *macrocarpa* (C.H.Wright) I.Verd. is used for the treatment of animals suffering from east coast fever, and malaria and fever in human beings. *Olea europaea* subsp. *cuspidata* (Wall. & G.Don) Cif. and *O. capensis* subsp. *macrocarpa* are the two main taxa used medicinally in the community for the treatment of malaria and fever. The bark is heavily exploited so the species are considered endangered.

Penaeaceae

There are hardly concrete citations in current literature in Oliniaceae. Nonetheless, the Ogiek use the bark of *Olinia rochetiana* A.Juss. as well as freshly forming leaves for chewing as toothbrushes/mouth fresheners and for pneumonia. The Maasai also use the decoction from the bark for coughs (Kokwaro 1993).

Piperaceae

Williamson's (2002) study of medicinal plants and animals includes a host of species from Piperaceae that are used medicinally but now considered obsolete. In South Pacific Island, an aqueous extract of *Piper methysticum* G. Forst. root is consumed as a ritual sedative with larger doses causing intoxication (Williamson 2002). Elsewhere, the root of the plant is used as a diuretic, stimulant, and tonic. A decoction of *Piper umbellatum* L. bark is used by the Maasai to treat coughs (Beenje 1994). The Ogiek use the roots of *P. umbellatum* for bronchitis and general body ailments.

Pittosporaceae

Pittosporum lanatum Hutch. & E.A.Bruce bark is to induce vomiting in cases of nauseating conditions particularly if malaria infection is suspected. The Kipsigis use a bark infusion as a purgative, emetic and antimalarial (Beenje 1994). This is quite similar to the Ogiek use.

Primulaceae

Embelia ribes Burm.f. and *Embelia tsjeriam-cottam* (Roem. & Schult.) A.DC. have been used to treat tapeworms, chest infections, skin ailments, cholera, diarrhea,

weak pulse, pleurisy, infertility and pneumonia (Mills 2002, Rajan *et al.* 2002). Among the Ogiek *Embelia schimperi* Vatke is used in the treatment of several similar conditions (rheumatics fever, tuberculosis and other chest related problems). The community uses seeds of *Rapanea melanophloeos* (L.) Mez that as a purgative or anthelmintic.

Proteaceae

With about 62 genera and about 1050 species, the Proteaceae family is well represented in Australia, New Zealand and South Africa. However, the family is sparingly mentioned in pharmacognosy. In East Africa though, there are certain uses worth mentioning. *Faurea saligna* Harv. roots are used for indigestion (Kokwaro 1993). *Faurea saligna* stem bark is used by the community as a tonic and to treat respiratory tract infections. Currently there is an over exploitation of the species.

Ranunculaceae

Actaea racemosa L. is now used in menopausal and other female disorders as well as for treatment of various rheumatic conditions (Mills 2002) while *Actaea simplex* (DC.) Wormsk. ex Prantl is used in Chinese medicine (Mills 2002). The Ogiek use *Clematis brachiata* Thumb. root decoction to treat malaria and diarrhoea (Beenje 1994) and stem bark to treat syphilis and/ or gonorrhoea.

Rhamnaceae

Rhamnus spp., *Scutia* spp. and *Ziziphus* spp. are widely distributed in East Africa (Beentjee 1994). In the New World, *Frangula purshiana* Cooper is used as a source of cascariosides (Dev 1989). *Ziziphus jujuba* Mill. has edible fruit that are used as a mild sedative in Chinese medicine (Williamson 2002). Within the Ogiek community, *Rhamnus prinoides* L'Hér. is used in the treatment of amoebic dysentery. *Scutia myrtina* (Burm.f.) Kurz stem bark is taken as a tonic.

Rosaceae

Rosa × damascena Herrm. and *Prunus africana* (Hook.f.) Kalkman oils are used in perfumery and in the preparation of rose waters used to treat prostatitis (Beentje 1994). In the Ogiek communities, a *P. africana* stem bark decoction is used to treat malaria and urinogenital problems. *Rubus kenoensis* Koidz. root decoction is taken to treat stomachache.

Rutaceae

Aegle marmelos (L.) Corrêa is used as an immuno-modulator and *Zanthoxylum clava-herculis* L. as an anti-rheumatic (Mitcher *et al.* 1975, Williamson 2002). *Murraya paniculata* (L.) Jack is used for anti implantation (Partwad-

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han *et al.* 2005). In the Ogiek community, *Toddalia asiatica* (L.) Lam. is used as a tonic.

Salicaceae

Salicaceae family is known to yield metabolites which have bacteriocidal effects as in the case of the seed extracts of *Hydnocarpus* ssp that have been known to have bacteria effects on *Micrococcus* ssp of leprosy (Kochhar, 1989). Similarly, the Ogiek community derive several benefits from *Dovyalis abyssinica* whose fruits are picked when ripe and eaten, while the roots are cooked along with mutton to yield a tonic soup. It is believed that decoction of the roots treats gonorrhoea and also serves as a tonic against harsh environmental conditions.

Solanaceae

The Family Solanaceae, *S. eculeastrum*, is used by the community to a large extent in combination with other drugs *B. abyssinica* to manage animal ill health. Its use in combination with *B. abyssinica* summed up to 100%. *S. eculeastrum* roots are also used in milk preparation for preservation. There were also two other species from the Family that are extensively used by the community. The uses were predominantly against bacterial infections. These were: *S. nakuruense* and *S. mauense*. There is very limited mention of the genus as medicines elsewhere in literature.

Urticaceae

Urtica massaica Mildbr. is used in circumcision by several communities living with and around the Ogiek. There are incidences of the plant being used as a vegetable and the seed eaten as grain during famines. When combined with *P. africana* it is used to treat urine blockage. Generally, species in the urticaceae are used to alleviate prostatitis (Mitcher *et al.* 1987, William 2002).

Verbenaceae

Lippia javanica is used to treat fresh wounds. The same species has been used as a mosquito repellent by populations in East Africa and South Africa (Lukwa 1996). Previous studies in Kenya have shown that oils from *L. javanica* have strong and lasting repellent activity against Bruchids (Machocho & Tarus 2006).

Xylariaceae

The Ogiek use the bracket fungi to treat malaria and inducement vomiting. Among the Mbeere of Kenya, the plant is used against malaria (Kareru *et al.* 2007). In China, the plant is also used medicinally (Lui 2007).

Conclusion and recommendations

The paper documents plants used by the community to treat probable microbial infections. Further studies are needed to verify efficacy and safety. Analysis will require careful consideration of ethical issues involved in such research and that work be carried out with full participation of the community. Finally, it is recommended that further studies consider conservation of any endangered plant species. Currently, there are no clear policies governing the practice of traditional medicine in Kenya. It is thus recommended that these policies be developed and put in place.

Declaration

We, the authors, hereby declare no overriding individual interest in the publication of this paper.

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