

**Research Paper**

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ISSN 0189-6016©2008**ANTIMICROBIAL ACTIVITY OF SOME MEDICINAL PLANTS USED BY HERBALISTS
IN EASTERN PROVINCE, KENYA**

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Abstract

The aqueous extracts from medicinal plants commonly used by herbalists in Mbeere, and Embu districts of Eastern province, Kenya, were tested for their inhibitory activity against three selected strains of bacteria. All the selected plant extracts (infusions: 1.0g sample in 100 ml water) investigated showed activity against *Escherichia coli* with inhibition zone diameters ranging from 5.8 – 18.0 mm. *Terminalia brownii* gave the largest inhibition zones against *E. coli* and *Staphylococcus aureus*. *Vernonia lasioporus* and *Tithonia diversifolia* were inactive to *S. aureus* and *Bacillus subtilis*, respectively. Eighteen and sixteen plants showed sensitivity of greater than 10 mm against *S. aureus* and *B. subtilis*, respectively. All control discs gave zones of inhibition of 12 - 24 mm, which were larger than those of the extracts. The present study validated the use of the selected medicinal plants by the herbalists in the treatment of bacterial ailments caused by the strains of bacteria investigated. Medicinal plants used for non-bacterial diseases also exhibited sensitivity towards bacterial strains tested. This implied they could be used as multi-purpose medicinal plants.

Key words: *Terminalia brownii*, inhibition zone, aqueous extract, *Escherichia coli*, Kenya

Introduction

Microbial infections pose a health problem throughout the World, and plants are a possible source of antimicrobial agents (Burapadaja & Bunchoo, 1995; Adenisa et al., 2000). Medicinal plants contain active principles which can be used as an alternative to cheap and effective herbal drugs against common bacterial infections. Embu and Mbeere districts of Eastern Province, Kenya, are endowed with a wide variety of indigenous medicinal plants. These plants are used by the local herbalists for treatment of a number of diseases, both bacterial and non-bacterial type and are distributed in various plant families: Papilionaceae, Labiate, Verbenaceae and Compositae, among others. Table 1 summarizes the traditional uses of some plants used by the Mbeere and Embu herbalists (Kareru et al., 2007). There was need, therefore, to assess the antimicrobial activities of these plants. Scientific proof and clinical validation of herbal formulations can be achieved by various methods: chemical standardization, biological assays, animal models and clinical trials. Thus, antimicrobial assays (Moleyar et al., 1992; Cebo et al., 1999; Moses et al., 2006; Millogo-Kone et al., 2002), cytotoxicity (Alluri et al., 2005), antiprotozoal, (Camacho et al., 2003), and anthelmintic (Abebe et al., 2000; Dawo et al., 2001; Wasswa et al., 2006) activities have been used for validation of plant extracts. However, validation should go hand in hand with regulation and evaluation of herbal treatments to avoid the administration of dangerous concoctions.

In the present investigation, some medicinal plants traditionally used by the Mbeere and Embu herbalists of Eastern Province, Kenya, were tested against three strains of bacteria and are reported. The results validated use of the medicinal plants by the herbalists.

Table 1: Ethnomedicinal uses of selected Medicinal Plants (Kareru et al., 2007)

Plants	Family	Parts used	Traditional Use
<i>Osyris abyssinica</i> A.Rich.	Santalaceae	Bark Root Leaves	Roots used for dysentery; Leaves decoction used to treat Typhoid
<i>Abrus precatorius</i> L. Verdc.	Papilionaceae	Leaves Bark	Roots decoction used for gonorrhoea; leaf decoction is emetic, and treats coughs in children
<i>Leonatis mollissima</i> Guerke	Labiatae	Stem bark	Used for gall sickness and stomach pains
<i>Carphalea glaucescens</i> Hiern. (Verdc).	Rubiceae	Leaves	Used as anti-termite
<i>Terminalia brownii</i> Fresen.	Combretaceae	Leaves Bark	Treats allergy, eye, Kidney, worms and for family planning
<i>Lonchocarpus eriocalyx</i> Harms	Papilionaceae	Roots	Used for Blood pressure and Diabetes
<i>Cassine aethiopica</i> Thunb	Celatraceae	Bark	Bark decoction antiseptic
<i>Rhus natalensis</i> Krauss	Anacardiaceae	Roots	Decoction of root taken for diarrhea, influenza.
<i>Vitex strickeri</i> Vatke & Hilderbr.	Verbenaceae	Roots	Decoction for Malaria
<i>Comiphora Africana</i> (A.Rich.) Engl.	Burseraceae	Bark	Decoction treats Pneumonia
<i>Abrus schimperi</i> Bak. Ssp. Africana (Vatke) Verdc.	Papilionaceae	Leaves	Root decoction cures Pneumonia
<i>Olea Africana</i> Mill.	Oleaceae	Bark	Sap used for bone-setting (fracture)
<i>Securidaca longipedunculata</i> Fres.	Polygnlaceae	Stem	Infusion reduces swellings
<i>Dalbergia melanoxydon</i> Guill. & Perr.	Papilionaceae	Leaves	Boiled part mixed with goat soup and taken against back- and joint-aches
<i>Albizia amara</i> (Roxb.) Boiv.	Mimosaceae	Leaves	Decoction treats stomach pains
<i>Albizia anthelmintica</i> Brong.	Mimosaceae	Bark	Bark infusion used as emetic and for malaria
<i>Crotalaria goodformis</i> Vatke.	Papilionaceae	Leaves- Stem	This plant used as fibre source
<i>Clerodendrum myricoides</i> (Hoschst.) Vatke.	Verbenaceae	Leaves	Decoction treats Pneumonia
<i>Senna singueana</i> (Del.) Lock	Caesalpiniaceae	Leaves	For worms and stomach pains
<i>Ocimum gratissimum</i> Willd.	Labiatae	Leaves	Infusion used for Bronchitis, Malaria
<i>Milletia leucantha</i> Kurtz	Fabaceae/Leguminosae	Bark	
<i>Strychnos henningsii</i> Gilg.	Loganiaceae	Leaves	Decoction from roots/leaves mixed with soup/honey for Malaria and Rheumatism
<i>Vernonia lasiopus</i> O. Hoffm.	Compositae	Leaves- Stem	Decoction used for Malaria and Worms
<i>Ocimum basilicum</i> L.	Labiatae	Leaves	Decoction treats Malaria
<i>Tithonia diversifolia</i> (Hemsl.) A. Gray	Compositae	Leaves	Decoction treats stomach pains and Typhoid
<i>Entada leptostachya</i> Harms.	Mimosaceae	Roots	Decoction of root used for worms

Materials and Methods

The plants were collected in Mbeere and Embu districts of Eastern Province, Kenya, in the dry season. A plant taxonomist authenticated the medicinal plant specimens. Plants specimens used for bacterial and non-bacterial infections were sampled. Collected samples were given voucher specimen numbers and deposited with the Botany Department of Jomo Kenyatta University of Agriculture and Technology.

The collected plants' parts were dried in the shade, chopped, and ground to a fine powder. A hot water infusion (1.0 g powder in 100 ml hot water) was used for the tests. The filtered infusions were diluted five times with distilled water prior to use.

Isolates of three bacteria species were obtained from a medical research centre and the required suspension of bacteria was prepared equivalent to McFarland standard 1 (1×10^8 CFUs/ml) in 0.85% NaCl (aq) and adjusted by the standard plate count method (Black, 1996). Six-millimeter sterile paper discs were dipped into the aqueous sample extracts. The discs were then placed on cultured pathogenic bacteria on agar plates, and incubated at 37 °C. The inhibition zone diameters of bacteria growth were measured after 24 hours. The sensitivity of *Escherichia coli*, *Staphylococcus aureus* and *Bacillus subtilis* to the 26 infusions were determined in triplicate. This was repeated using commercial discs of tetracycline (100 µg), streptomycin (25 µg), sulphamethoxazole (200 µg), cotrimoxazole (25 µg) and gentamicin (10 µg) as positive controls.

Results

The results are presented in Tables 2 and 3.

Discussion

In a previous study, the herbalists were known to treat bacterial infections such as diarrhea, gonorrhoea, pneumonia, stomach pains, and typhoid with forty-two medicinal plants. The latter diseases were among those reported in the local hospital morbidity data (Kareru et al., 2007) and treatable by the herbalists. In the present research, the plants investigated were distributed in sixteen plant families: five from Papilionaceae; three in each case from Labiate and Mimosaceae; two each from Verbenaceae and Compositae, and one each from eleven other plant families (Table 1). The most potent plant extracts against the microorganisms tested were from Combretaceae, Santalaceae, and Verbenaceae families respectively, and the least potent was from Compositae family. However, one of the least potent plants (*Vernonia lasiopus* O. Hoffm.) from the Compositae family was traditionally used for non-bacterial infections. In addition, eight other medicinal plants used by the herbalists for non-bacterial conditions were active against the strains of bacteria tested. This implied that some plants could be used as multi-purpose medicinal plants, that is, for bacterial and non-bacterial infections.

Table 2 summarizes the sensitivities of aqueous medicinal plant extracts against *E. coli*, *S. aureus* and *B. subtilis*. All the plant infusions were active against the test organisms (inhibition zone diameter 5.8 – 18.0 mm), except *Vernonia lasiopus* and *Tithonia diversifolia* extracts which were not sensitive to *Staphylococcus aureus* and *Bacillus subtilis* respectively. *Terminalia brownii* extracts gave the highest sensitivities to *E. coli* and *S. aureus*, respectively. Among all the plants tested, *Vitex strickeri* gave the smallest inhibition diameter against *E. coli* (5.8 mm), but relatively larger towards *S. aureus*. All control discs gave zones of inhibition of 12-24 mm, which were higher or comparable to those of the plant extracts.

Conclusions

In conclusion, all the medicinal plants investigated were effective against bacterial strains tested except two plants *Vernonia lasiopus* and *Tithonia diversifolia*, which were not sensitive to *S. aureus* and *B. subtilis*. This validated the use of the plants in the treatment of bacterial diseases by the herbalists. Some medicinal plants used for non-bacterial infections also exhibited activity to the strains of bacteria tested.

Table 2: Inhibition Zone Diameters (mm) of plant aqueous extracts

Plants	Parts used	<i>Escherichia coli</i>	<i>Staphylococcus aureus</i>	<i>Bacillus subtilis</i>
<i>Osyris abyssinica</i>	Bark	6.3 ± 0.6	8.8 ± 0.8	9.2 ± 0.5
	Root	14.8 ± 0.3	15.2 ± 0.7	15.5 ± 0.5
	Leaves	6.5 ± 0.5	7.8 ± 0.8	9.7 ± 0.9
<i>Abrus precatorius</i>	Leaves	6.3 ± 1.3	15.7 ± 0.5	8.7 ± 1.3
	Bark	7.2 ± 0.8	10.8 ± 1.0	10.7 ± 1.2
<i>Leonatis mollissima</i>	Stem bark	9.5 ± 0.4	11.5 ± 0.4	12.5 ± 0.4
<i>Carphalea glaucescens</i>	Leaves	8.7 ± 0.5	11.8 ± 0.8	11.2 ± 1.4
<i>Terminalia brownii</i>	Leaves	10.3 ± 0.9	18.0 ± 0.8	9.0 ± 0.8
	Bark	11.7 ± 0.5	17.0 ± 0.4	12.8 ± 1.0
<i>Lonchocarpus eriocalyx</i>	Roots	6.2 ± 0.2	10.3 ± 0.9	11.0 ± 1.6
<i>Cassine aetiopica</i>	Bark	10.2 ± 0.6	9.5 ± 1.1	11.5 ± 0.4
<i>Rhus natalensis</i>	Roots	9.7 ± 0.5	12.0 ± 0.8	9.3 ± 1.2
<i>Entada leptostachya</i>	Roots	10.2 ± 0.2	11.5 ± 0.4	8.8 ± 0.2
<i>Vitex strickeri</i>	Roots	5.8 ± 0.2	12.8 ± 0.2	6.5 ± 0.2
<i>Comiphora Africana</i>	Bark	10.5 ± 1.1	8.2 ± 0.6	10.2 ± 0.8
<i>Abrus schimperi</i>	Leaves	7.0 ± 0.3	6.2 ± 0.2	6.8 ± 0.2
<i>Olea Africana</i>	Bark	7.8 ± 0.8	10.2 ± 0.6	6.3 ± 0.5
<i>Securidaca longipedunculata</i>	Stem	7.2 ± 0.6	12.5 ± 2.2	12.5 ± 0.4
<i>Dalbergia melanoxylon</i>	Leaves	7.8 ± 1.3	8.8 ± 0.3	6.8 ± 0.3
<i>Albizia amara</i>	Leaves	6.2 ± 0.2	7.8 ± 0.6	7.3 ± 0.6
<i>Albizia anthelmintica</i>	Bark	6.3 ± 0.3	6.8 ± 0.3	11.3 ± 1.8
<i>Crotalaria goodformis</i>	Leaves-Stem	7.2 ± 0.6	14.8 ± 0.2	11.2 ± 1.4
<i>Clerodendrum myricoides</i>	Leaves	10.5 ± 1.2	13.8 ± 0.2	14.2 ± 1.3
<i>Senna singueana</i>	Leaves	8.5 ± 0.4	10.8 ± 0.8	11.5 ± 0.4
<i>Ocimum gratissimum</i>	Leaves	6.5 ± 0.4	9.5 ± 1.1	9.2 ± 0.2
<i>Milletia leucantha</i>	Bark	9.8 ± 0.6	12.5 ± 1.3	12.2 ± 2.2
<i>Strychnos henningsii</i>	Leaves	6.3 ± 0.5	10.5 ± 1.1	9.2 ± 0.7
<i>Vernonia lasiopus</i>	Leaves-Stem	6.5 ± 0.4	0.0	13.2 ± 0.8
<i>Ocimum basilicum</i>	Leaves	6.5 ± 0.4	10.0 ± 0.8	10.0 ± 0.4
<i>Tithonia diversifolia</i>	Leaves	6.5 ± 0.4	9.8 ± 0.8	0.0

Table 3: Inhibition zone diameters (mm) of control drugs (antibiotics)

Antibiotic Name	<i>Escherichia coli</i>	<i>Staphylococcus aureus</i>	<i>Bacillus subtilis</i>
Tetracycline	24.0 ± 0.1	23.0 ± 0.2	24.0 ± 0.3
Streptomycin	16.0 ± 0.2	18.0 ± 0.1	15.0 ± 0.3
Sulphamethoxazole	23.0 ± 0.3	22.0 ± 0.2	13.0 ± 0.2
Cotrimoxazole	19.0 ± 0.2	20.0 ± 0.1	12.0 ± 0.2
Gentamicin	21.0 ± 0.4	18.0 ± 0.2	23.0 ± 0.2

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