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ANTIMICROBIAL ACTIVITY OF SOME MEDICINAL PLANTS USED BY HERBALISTS IN EASTERN PROVINCE, KENYA

*Kareru P. G[1]., Gachanja A. N[1]., Keriko J M[1]., Kenji G. M[2].
[1]Department of Chemistry, [2]Department of Food Science and Post-Harvest Technology,
Jomo Kenyatta University of Agriculture and Technology, P.O. BOX 62000 - 00200,
Nairobi, Kenya.
***Email:** pgkareru@yahoo.com

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 lasiopus* 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
Osyris abyssinica A.Rich.	Santalaceae	Bark Root Leaves	Roots used for dysentery; Leaves decoction used to treat Typhoid
Abrus precatorius L. Verdc.	Papilionaceae	Leaves Bark	Roots decoction used for gonorrhea; leaf decoction is emetic, and treats coughs in children
Leonatis mollissima Guerke	Labiate	Stem bark	Used for gall sickness and stomach pains
Carphalea glaucescens Hiern. (Verdc).	Rubiceae	Leaves	Used as anti-termite
Terminalia brownii Fresen.	Combretaceae	Leaves Bark	Treats allergy, eye, Kidney, worms and for family planning
Lonchocarpus eriocalyx Harms	Papilionaceae	Roots	Used for Blood pressure and Diabetes
Cassine aethiopica Thunb	Celatraceae	Bark	Bark decoction antiseptic
Rhus natalensis Krauss	Anacardiaceae	Roots	Decoction of root taken for diarrhea, influenza.
Vitex strickeri Vatke & Hilderbr.	Verbenaceae	Roots	Decoction for Malaria
Comiphora Africana (A.Rich.) Engl.	Burseraceae	Bark	Decoction treats Pneumonia
Abrus schimperi Bak. Ssp. Africana (Vatke) Verdc.	Papilionaceae	Leaves	Root decoction cures Pneumonia
Olea Africana Mill.	Oleaceae	Bark	Sap used for bone-setting (fracture)
Securidaca longipedunculata Fres.	Polygnlaceae	Stem	Infusion reduces swellings
Dalbergia melanoxylon Guill. & Perr.	Papilionaceae	Leaves	Boiled part mixed with goat soup and taken against back- and joint-aches
Albizia amara (Roxb.) Boiv.	Mimosaceae	Leaves	Decoction treats stomach pains
Albizia anthelmintica Brong.	Mimosaceae	Bark	Bark infusion used as emetic and for malaria
*Crotalaria goodformis*Vatke.	Papilionaceae	Leaves-Stem	This plant used as fibre source
Clerodendrum myricoides (Hoschst.) Vatke.	Verbenaceae	Leaves	Decoction treats Pneumonia
Senna singueana (Del.) Lock	Caesalpiniaceae	Leaves	For worms and stomach pains
Ocimum gratissimum Willd.	Labiate	Leaves	Infusion used for Bronchitis, Malaria
Milletia leucantha Kurtz	Fabaceae/Leguminosae	Bark	
Strychnos henningsii Gilg.	Loganiaceae	Leaves	Decoction from roots/leaves mixed with soup/honey for Malaria and Rheumatism
Vernonia lasiopus O. Hoffm.	Compositae	Leaves-Stem	Decoction used for Malaria and Worms
Ocimmum basilicum L.	Labiate	Leaves	Decoction treats Malaria
Tithonia diversifolia (Hemsl.) A. Gray	Compositae	Leaves	Decoction treats stomach pains and Typhoid
Entada leptostachya 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 º C. The inhibition zone diameters of bacteria growth were measured after 24 hours. The sensitivity of *Escherichia coli*, *Staphylococcus aureu*s 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, gonorrhea, 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	*Escherichia coli*	*Staphylococcus aureus*	*Bacillus subtilis*
Osyris abyssinica	Bark Root Leaves	6.3 ± 0.6 14.8 ± 0.3 6.5 ± 0.5	8.8 ± 0.8 15.2 ±0.7 7.8 ±0.8	9.2 ± 0.5 15.5 ±0.5 9.7 ± 0.9
Abrus precatorius	Leaves Bark	6.3 ± 1.3 7.2± 0.8	15.7 ± 0.5 10.8 ± 1.0	8.7 ± 1.3 10.7 ±1.2
Leonatis mollissima	Stem bark	9.5 ± 0.4	11.5 ± 0.4	12.5 ± 0.4
Carphalea glaucescens	Leaves	8.7 ± 0.5	11.8 ± 0.8	11.2 ± 1.4
Terminalia brownii	Leaves Bark	10.3 ± 0.9 11.7± 0.5	18.0 ± 0.8 17.0 ± 0.4	9.0 ± 0.8 12.8 ± 1.0
Lonchocarpus eriocalyx	Roots	6.2 ± 0.2	10.3 ± 0.9	11.0 ± 1.6
Cassine aetiopica	Bark	10.2 ± 0.6	9.5 ± 1.1	11.5 ± 0.4
Rhus natalensis	Roots	9.7 ± 0.5	12.0 ± 0.8	9.3 ± 1.2
Entada leptostachya	Roots	10.2 ± 0.2	11.5 ± 0.4	8.8 ± 0.2
Vitex strickeri	Roots	5.8 ± 0.2	12.8 ± 0.2	6.5 ± 0.2
Comiphora Africana	Bark	10.5 ± 1.1	8.2 ± 0.6	10.2 ± 0.8
Abrus schimperi	Leaves	7.0 ± 0.3	6.2 ± 0.2	6.8 ± 0.2
Olea Africana	Bark	7.8 ± 0.8	10.2 ± 0.6	6.3 ± 0.5
Securidaca longipedunculata	Stem	7.2 ± 0.6	12.5 ±2.2	12.5 ± 0.4
Dalbergia melanoxylon	Leaves	7.8 ± 1.3	8.8 ±0.3	6.8 ± 0.3
Albizia amara	Leaves	6.2 ± 0.2	7.8 ± 0.6	7.3 ± 0.6
Albizia anthelmintica	Bark	6.3 ± 0.3	6.8 ± 0.3	11.3 ± 1.8
Crotalaria goodformis	Leaves-Stem	7.2 ± 0.6	14.8 ± 0.2	11.2 ± 1.4
Clerodendrum myricoides	Leaves	10.5 ± 1.2	13.8 ± 0.2	14.2 ± 1.3
Senna singueana	Leaves	8.5 ± 0.4	10.8 ± 0.8	11.5 ± 0.4
Ocimum gratissimum	Leaves	6.5 ± 0.4	9.5 ± 1.1	9.2 ± 0.2
Milletia leucantha	Bark	9.8 ± 0.6	12.5 ± 1.3	12.2 ± 2.2
Strychnos henningsii	Leaves	6.3 ± 0.5	10.5 ± 1.1	9.2 ± 0.7
Vernonia lasiopus	Leaves-Stem	6.5 ± 0.4	0.0	13.2 ± 0.8
Ocimmum basilicum	Leaves	6.5 ± 0.4	10.0 ± 0.8	10.0 ± 0.4
Tithonia diversifolia	Leaves	6.5 ± 0.4	9.8 ± 0.8	0.0

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

Antibiotic Name	*Escherichia coli*	*Staphylococcus aureus*	*Bacillus subtilis*
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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