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Short Communication

Antibacterial screening of the root, stem and leaf extracts of *Terminalia albida* sc. elliot on selected pathogenic bacteria

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The ethanol extracts of the root, stem and leaves of *Terminalia albida* were evaluated for their antibacterial activities using agar diffusion method to justify the ethno botanical uses of the plant parts by the traditional healers in Nigeria. The ethanol extracts of the root, stem and leaves were effective against the test bacteria (*Staphylococcus aureus*, *Klebsiella pneumoniae*, *Pseudomonas aeruginosa*, *Escherichia coli* and *Proteus mirabilis*) at all the concentrations used (100 l- 500 mg/ml). The root extract at 500 mg/ml is most effective against *E. coli* and *K. pneumoniae,* the stem extract at 500 mg/ml was most effective against *P. aeruginosa* and *P. mirabilis* while the leaves extract at 500 mg/ml was most effective against *P. mirabilis.* The minimum inhibitory concentrations (MIC) test of the root, stem and leaves extracts showed that the test organisms were inhibited at all concentrations. The root extract showed more inhibitory effect than the stem and leaf extracts. The results of this study validated the use of various parts of this plant in traditional medicine in many parts of Africa.

Key words: *Terminalia albida*, antibacterial screening, root, stem, leaves.

INTRODUCTION

The use of plants in traditional medicine is as old as the history of man on earth. In other words, traditional medicine in many countries of the world can be traced back to antiquity. Traditional medicine has always played and will continue to play a very important role in health care delivery for a very long time to come (Sofowora, 1984). Exploitation of wild plants for medicinal purposes has gained popularity in many countries long before the advent of orthodox medical practices. Some Asian countries like China and Japan have popularized the use of herbs in their health care delivery (Nwogu, 1997). In some African countries, indigenous plants have also been used for the production of new drugs. These African countries include Egypt, Burkina Faso, Ghana, Zimbabwe, Zambia and South Africa (Sofowora, 1984).

In many developing countries, herbal medicine can not be totally ignored because it is mostly practiced in the remotest parts where the practice of orthodox medicine is limited or completely absent (Sofowora, 1986, 1993). The practice of herbal medicine in modernized form is now gaining momentum in many developing nations as many health officials and other persons have realized the potencies and efficacies of some of the indigenous plants (Nwuogu, 1997).

Terminalia albida Sc. Elliot (family Combretaceae) is a small tree or shrubs of about 6 -13 feet high with twisted bole and open crown recognizable even from a distance by its silvery - white foliage. The bark is fissured, corky, thick and grey brown. Stems are entirely pubescent, silvery white. Leaves alternate, narrowly oblong or elliptic- lanceolated, approximately 3 times longer than broad. They plant flowers during the second half of the dry season in the tropics and commonly found in Guinea, Sudan savannahs and dry forest zones (Arbonnier, 2004).

From my personal experience, the root of this plant is commonly used to prevent and treat pile and dysentery in our local villages. The bark and the root are soaked to prepare concoctions which are used as antibiotics. The fact that micro organisms develop resistance to many drugs, and a situation where some of the common and

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Table 1. Susceptibility of test bacteria to the root extract of *T. albida*. Mean diameter of zone of inhibition (mm) at different concentration of extract.

	Extract concentration				
Test bacteria	**100 mg/ml**	**200 mg/ml**	**300 mg/ml**	**400 mg/ml**	**500 mg/ml**
S. aureus	13	16	18	21	26
K. pneumoniae	15	20	22	24	31
P. aeruginosa	11	16	19	21	23
E. coli	18	22	26	27	32
P. mirabilis	12	15	17	20	21

The values are the averages of two measurements across each zone of inhibition and in duplicates.

less expensive anti-microbial agents are loosing effectiveness has created interest in herbal remedies in several parts of the world with many of the herbs being incorporated into orthodox medicine (Okunzua, 1973). The aim of this study is to determine the anti-bacterial activities of the stems, roots and leaves of *T. albida* against selected pathogenic bacteria.

MATERIALS AND METHODS

The experimental plant

Fresh plant of *T.* albida was collected in Mopa, Mopamuro Local Government Area of Kogi State, Nigeria. The plant was identified in the Department of Botany, Delta State University, Abraka, Nigeria. The fresh plant samples (root, stem and leaves) collected were washed individually under running water to remove soil particles and other dirt. The leaves were air dried in the laboratory at room temperature (30 ± 2°C) for 10 days according to Tonna et al. (2001) while the root and stem samples were dried at 60°C for 3 days in an oven. The dried samples were blended into powder with sterile blender.

Extraction of the plant materials

Extraction was carried out as described by Onoruvwe and Olorunfemi (1998). Seventy gram of each powdered leaf, stem and root were Soxhlet extracted using 70% ethanol (300 ml) for 48 h. Each of the ethanol extract was evaporated to dryness using a rotary evaporator at 40°C to yield 96% w/w of dry weight residue which was stored at -4°C until when needed. A solution of each dried extract was prepared in sterile distilled water and the solution of each sample was further diluted to the desired concentrations (100, 200, 300, 400 and 500 mg/ml).

Test organisms

The pure clinical isolates of *Staphylococcus aureus*, *Klebsiella pneumoniae*, *Escherica coli*, *Streptococcus pyogenes*, *Pseudomonas aeruginosa* and *Proteus mirabilis were* collected from Lahor Research Diagnostic and Environmental Consortium in Benin City, Nigeria. The cultures were maintain at 35°C on nutrient agar and used for the study.

Test for antimicrobial activity

The diluted extracts were tested for their antibacterial properties using the agar-well technique (Pelczar et al., 1993). Nutrient agar (NA) medium was used for testing bacteria. Three plates were used for each organism. Wells were aseptically made in the media with a sterile 5.0 mm diameter cork borer. Zero point five milliliter of different concentrations of the root, stem and leaves extracts were dispensed aseptically into each of the wells. The plates were initially incubated for two hours to allow the diffusion of the solution of the plant extracts. The plates were later incubated at 37°C for 24 h. The diameters of the zones of inhibition of microbial growth were measured in the plates and the average value for each bacterium was recorded. The minimal inhibitory concentration (MIC) was determined for the root, stem and leaves using the tube technique of Atlas (1995).

RESULTS AND DISCUSSION

The result has shown that the ethanol extract of the root, stem and leaves of *T. albida* inhibited the growth of *S. aureus, K. pneumoniae, E. coli, S.pyogenes, P. aureiginosa and P. mirabilis* (Tables 1 - 3). The antimicrobial activity of *Terminalia citrina* has been reported by Burapadaja and Bunchoo (1995). They demonstrated that the presence of tannins in the leaf extracts of *T. citrina* inhibited cell wall formation in fungi leading to the death of the organisms. In this study, the presence of tannins and some other phyto chemicals present in the root, stem and leaves of *T. albida* may be responsible for their antibacterial activity. *Terminalia* genus has been used extensively in many African countries for traditional medicine. Arbonnier (2004) reported that extracts from different species of *Terminalia* are used for the treatment of many diseases such as dysentery, jaundice, liver failure, ulcer, gonorrhea, diarrhea, leprosy, cough etc. The antimicrobial effect of the root, stem and leaves extracts of *T. albida* is similar to other medicinal plants in Nigeria (Rojas et al.,1992;Gill, 1992; Akpulu et al.,1994; Akueshi et al., 2002; Anyanwu and Dawet, 2005; Odoemena et al., 2007). The root extract at 500 mg/ml was most effective against *E. coli* and *K. pneumoniae* (Table 1), the stem extract at 500 mg/ml was most effective against *P. aeruginosa* and

Table 2. Susceptibility of test bacteria to the stem extract of *T. albida*. Mean diameter of zone of inhibition (mm) at different concentration of extract.

	Extract concentration				
Test bacteria	**100 mg/ml**	**200 mg/ml**	**300 mg/ml**	**400 mg/ml**	**500 mg/ml**
S. aureus	9	12	14	16	19
K. pneuaoniae	10	11	13	15	17
P. aeruginosa	12	14	17	19	24
E. coli	7	10	13	14	18
P. mirabilis	11	12	14	17	21

The values are the averages of two measurements across each zone of inhibition and in duplicates.

Table 3. Susceptibility of test bacteria to the leaf extract of *T. albida*. Mean diameter of zone of inhibition (mm) at different concentration of extract.

	Extract concentration				
Test bacteria	**100 mg/ml**	**200 mg/ml**	**300 mg/ml**	**400 mg/ml**	**500 mg/ml**
S. aureus	6	10	12	15	18
K. pneumoniae	9	11	12	14	19
P. aeruginosa	6	10	11	13	17
E. coli	7	9	13	15	16
P. mirabilis	10	11	14	16	21

The values are the averages of two measurements across each zone of inhibition and in duplicates.

P. mirabilis (Table 2), while the leaves extract at 500 mg/ml was most effective against *P. mirabilis* (Table 3). It was observed that the antibacterial activity of the extracts increased with concentrations (100 - 500 mg/ml (Table 1 - 3). This observation agreed with the findings of Akueshi et al. (2002), Kurosaki and Nishi (1983) who reported that the higher the concentration of antimicrobial substances in the extracts of medicinal plants, the more the growth inhibitions.

The minimum inhibitory concentration (MIC) test of the extracts on the test microorganisms revealed that all concentrations of the extracts tested inhibited the test bacteria (Table 4). The root extracts showed more inhibition than the stem and the leaf extracts (Tables 1 and 4). This indicates that the antimicrobial properties are more concentrated in the root than in the leaves and stem. This observation confirmed the common use of the roots of this plant in traditional healing process than the stem and leaves. This present study provides some scientific justification for the utilization of extracts of *T. albida* and other *Terminalia* species in traditional medicine for the treatment of different diseases.

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