



Antimicrobial Activities of Azadirachta indica, Adansonia digitata and Moringa oleifera: A Review Paper

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Abstract: Medicinal Drug resistance to human infectious diseases cause premature deaths throughout the world. Plants have proved to be a sources of Phytochemical used for treating various diseases. Scientists have been engaged with developing drugs that can inhibit the growth of pathogens or kill with no toxicity to the host. This paper review the antimicrobial activities of three forest species of biomedical importance in Nigeria. They includes Azadirachta indica, Adansonia digitata and Moringa oleifera. Azadirachta indica a Meliaceae family have been identified as the potential plant systems possessing a vast array of biologically active compounds which are chemically diverse and structurally complex. Using in vitro studies we analyse the antimicrobial activities of this forest tree. Tree species of Adansonia digitata possesses wide range of medicinal properties which are effective against various infectious diseases. Moringa oleifera is a woody tree with nutritional and medicinal uses. Studies have shown that the leaf, flower, bark, root, seed, and nearly all types of plants tissues exhibit antimicrobial activity including antibacterial, antifungal, antiviral and antiparasitic activity. This review look at progress on research conducted to understand the antimicrobial activities of Azadirachta indica, Adansonia digitata and Moringa oleifera compounds, and discusses the potential use of Moringa oleifera in the control of pathogenic microbes.

Keywords: Antimicrobial activities, Pathogenic bacterial, A. digitata, Moringa oleifera; Azadirachta indica.

1. Introduction

Plants constitute one of the major raw materials of drugs for treating various human diseases. The use of plants to heal diseases, including many infectious illnesses, has been extensively applied in indigenous medicine from time immemorial and the literature survey reveals that the medicinal plants are of great potential for therapeutic treatment, in spite of the fact that they have not been completely investigated (Basam,2012; Pomnha,2014). Medicinal herbs with antimicrobial activities are considered

a potent source of novel antimicrobial function. Plant based antimicrobials represent a vast untapped source for medicines by possessing enormous therapeutic potential. They are effective in the treatment of infectious diseases while simultaneously mitigating many of the side effects that are often associated with synthetic antimicrobials. Nearly 80% of the world's population relies on traditional medicines for primary health care, most of which involve the use of plant extracts (Sandhya et al., 2006).

One mechanism for disease resistance in plants is their ability to accumulate low-molecular-weight compounds (secondary metabolites) with high antimicrobial activities, such as alkaloids, coumarins, isoflavonoids, polyacetylenes, quinones, tannins and terpenes.

The species *Adansonia digitata* L. is a multipurpose tree, widely used for food and medicine. The species is a globally endangered and medicinally important tree commonly called as *Baobab tree* belonging to the family Bombacaceae (Sidibe,2012). It has multi-purpose uses, as it produces food and non-food products such as medicines, fuel, timber, fodder (Sidibe,2012). Root, stem bark, leaves, flowers, seeds and fruit wall extracts of this valuable tree *A. digitata* are known to possess bioactive compounds and found to be rich in phenolic and flavonoids (Samantha and Ramaswamy,2016).

Moringa oleifera has traditionally been used in the treatment of malaria, parasitic diseases, skin diseases, hypertension and diabetes. It has been demonstrated that *Moringa oleifera* exhibits pharmacological properties such as antioxidant (Owen,1970) anti-inflammatory, anti-cancer, anti-hyperglycemic and anti-hyperlipidemic properties (Abdul,2014). Leone et al. have reviewed the cultivation, genetics, Ethnopharmacology, phytochemistry and pharmacology of *Moringa oleifera* (Leon,2015), whereas the health benefits and medicinal use of *Moringa oleifera* has been reviewed by (Abdull Razis et al,2014, Anwar et al,2017) . (Stohs et al,2015) found that aqueous, hydro alcohol or alcohol extracts of *Moringa oleifera* exhibited various biological activities including antioxidant, tissue protective, and analgesic properties, whereas the leaf extracts were shown to be safe to use based on safety studies in animals.

Various classes of chemical constituents were isolated from different parts of meliaceous members. Chemically, the Meliaceae is characterized by synthesis of modified tri-terpenes known as limonoids. Over 300 limonoids have been isolated to date and they are more diverse and abundant in this particular family than in any other family. Several triterpenoidal derivatives were also isolated from different genera of Meliaceae. Amongst different members of Meliaceae, *Azadirachta indica* had been extensively studied for its chemicals. Limonoids are secondary metabolites produced in plants found in the order Rutales. Over 300 limonoids have been isolated to date (Taylor, 1986; Champagne et al., 1992).

2. Antimicrobial activity of *Azadirachta indica*

Plant extracts that inhibit pathogenic microorganisms without harming the host may have potential use as therapeutic agents. The susceptibility of a microorganism to antibiotics and other chemotherapeutic agents can be determined by the different methods available like tube-dilution, Paper-disk-plate, cylinder and well methods, single disk method and agar overlay method (Bauer et al, 1966). Antibacterial activity of methanol and acetone flower extracts of *Azadirachta indica* by disk assay on most sensitive organisms like *Staphylococcus aureus*, *Escherichia coli*, *Bacillus cereus* and *Salmonella infant's* were tested by (Alzoreky and Nakahara, 2003). (Samy and Ignacimuthu, 1998) reported that when antibacterial activity of different crude extracts of seed kernel, seed coat and leaves of *Azadirachta indica* were tested against *Escherichia coli*, *Pseudomonas aerogenes*, *Klebsiella aerogenes* and *Proteus vulgaris*, only the seed kernel extracts was found to show significant antibacterial activity . Table 1 shows a referenced antimicrobial potentials of *Azadirachta indica* leaf, seed, bark and root indifferent extraction medias on various bacterial.

Table 1: Antibacterial Potential of *Azadirachta indica*

Plant Name	Part used	Extract	Microbes used	Reference
<i>Azadirachta indica</i>	Leaf	Methanol	<i>Staphylococcus aureus</i> , <i>Escherichia coli</i>	Mishra et al., 2013
	Leaf	Chloroform, Hexane, methanol	<i>Bacillus subtilis</i> , <i>Staphylococcus aureus</i> , <i>Escherichia coli</i> , <i>Klebsiella pneumoniae</i> , <i>Aspergillus niger</i> , <i>Aspergillus fumigatus</i> , <i>Trichoderma viride</i> , <i>Cladosporium herbarum</i> , <i>Fusarium oxysporum</i>	Verma et al., 2013 Leaf
	Leaf, bark, seed	Distilled water	<i>Staphylococcus aureus</i> , <i>Pseudomonas aeruginosa</i> , <i>Proteus mirabilis</i> , <i>Enterococcus faecalis</i> , <i>Aspergillus fumigatus</i> , <i>Candida albicans</i>	Reddy et al., 2013
	Leaf, stem and root	Hot water and ethanol	<i>Staphylococcus aureus</i> , <i>Escherichia coli</i> , <i>Pseudomonas aeruginosa</i> , <i>Proteus vulgaris</i> , <i>Bacillus subtilis</i>	Sharma et al., 2011
Seed	Volatile oil	<i>Staphylococcus aureus</i> , <i>Escherichia coli</i>	Sandanasamy et al., 2013	

3. Antimicrobial activities of *Adansonia digitata*

Antibacterial activity of methanol extracts of leaf, flower and fruit wall extracts of *A. digitata* has been studied extensively by many researchers to exhibit activity against pathogenic bacteria including, *Escherichia coli*, *Proteus vulgaris*, *Klebsiella pneumoniae*, *Staphylococcus aureus* and *Enterobacter aerogenus*.

According to observations, all the extracts of *A. digitata* exhibited antibacterial activity against all the pathogenic bacteria under study except the fruit wall extract which didn't show any inhibition against *K. pneumoniae*. Similarly, considerable numbers of studies have been conducted on the antimicrobial activity of medicinal plants such as *Psidium guava*, *Terminalia chebula*, *Oroxylum indicum*, and *Annona reticulata* showed promising potency against multi-drug resistant microorganisms (Priscilla et al, 2007). The previous investigation has also proved that extracts of medicinally valuable tree species of *A. digitata* are potent against most pathogenic bacteria.

4. Antimicrobial Activities of *Moringa oleifera*

Crude extracts from different tissues of *Moringa oleifera* show antibacterial activities against both Gram-negative and Gram-positive bacteria (Pal et al, 1995) evaluated the antimicrobial activity of

Moringa oleifera leaf extracts. Four Gram-positive bacteria (*Bacillus cereus*, *Bacillus subtilis*, *Staphylococcus aureus* and *Sarcinalutea*) and two Gram-negative bacteria (*Escherichia coli* and *Acid fast Mycobacterium phlei*) were used to test the antibacterial activities of *Moringa oleifera*. The results revealed that the average zone of four Gram-positive bacteria and two Gram-negative bacteria was inhibited by the ethanol extract of *Moringa oleifera* leaves. Using modified disk diffusion to screen antibacterial activity, (Peixoto et al,2011) found that aqueous ethanol extracts of *Moringa oleifera* leaves showed effective antibacterial activity against *Staphylococcus aureus*, *Vibrio parahaemolyticus*, *Enterococcus faecalis* and *Aeromonas caviae*, whereas no effects were seen against *Escherichia coli*, *Pseudomonas aeruginosa* and *Salmonella enteritidis*. The experiments carried out by (Daotam et al,2016) confirmed that the methanol extract of *Moringa oleifera* leaves showed different inhibition patterns against different bacteria strains out of the (Murugen et al,2013) Gram-negative bacteria strains tested, including *Escherichia coli*, *Enterobacter aerogenes*, *Klebsiella pneumonia*, *Pseudomonas aeruginosa* and *Providencia stuartii*. Further chemical composition analysis revealed that the *Moringa oleifera* leaf extract with antibacterial activities contains alkaloids, polyphenols, flavonoids, anthraquinones, coumarins, tannins, triterpenes, sterols saponins and some secondary metabolites. It was suggested that *Moringa oleifera* leaf extracts might be used in the control of many infectious diseases alone or together with other antibiotics (Dzotam et al, 2016).

5. Conclusion

In conclusion, the leaves, bark, root, flower, fruit and seed of *Moringa oleifera* are all reported with antimicrobial activities against different microorganisms. Also it has been envisaged that crude extracts of *Azadirachta indica* and different extracts of *A. digitata* contain potential antimicrobial compounds that may be of great use for the development of antibacterial agents against various infectious diseases.

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