

Original Research Article

Phytochemical Screening and Antimicrobial Activity *Jatropha curcas*

ABSTRACT

As a measure of testing the medicinal properties of *Jatropha curcas*, this study screens aqueous, methanol and ethanolic extracts obtained from the leaf for phytochemicals and investigates the growth inhibition of *Escherichia coli*, *Staphylococcus aureus*, *Proteus spp*, *Klebsiella pneumonia* and *Pseudomonas aeruginosa* by methanolic, ethanolic and aqueous leaf extracts of *Jatropha curcas*. Tannins, saponins, flavonoids, alkaloids, oxalates and cyanogenic glycosides were the phytochemicals present. The test microorganisms were all significantly inhibited by the leaf extracts but the presence of oxalates and cyanogenic glycosides in the leaf renders it inedible and reduces its application to topical use only.

Keywords: *Jatropha curcas*, Phytochemical, antimicrobial

INTRODUCTION

Microbial infections are prima public health problems in the developed countries. Due to general use of commercial antibiotics, the relative incidence of multiple antibiotic resistances in human pathogens is not only large but also growing (Li and Krumholz, 2007). Intractable problems of resistance to antibiotics by microorganisms previously thought to have been brought under control have led to the resurface of interest in herbal products as source of noble compounds to suppress or possibly eradicate the ever increasing problems of emergence of newer diseases (Jain 1996, Mothanaa 2005). The World Health Organization estimated that about 80% of people still rely mainly on traditional remedies such as herbs for their medicines (WHO, 2003). Most of the plants used by the rural residential areas have biologically active compounds that have been proven by generations to be potent against specific disorders (Mark, 2002). The prevention and treatment of diseases by the use of available and accessible medicinal plants in a particular locality will continue to play important roles in medical health care implementation in the developing countries as plants make up the primary source of new pharmaceuticals and health care products (Ivanona *et al.*, 2005).

There have been major role played by *Jatropha curcas* in the treatment of different kinds of diseases ranging from bacterial to fungal infections (Thomas *et al.*, 2008). Glycosides, tannins, phytosterol, flavonoids and steroidal sapogenins are contained in different parts of the plants (leaves, fruits, latex and bark); a feature which enables it to demonstrate vast range of medicinal properties (Dalziel, 1955; Duke, 1988; Duke, 1994; Edeoga *et al.*, 2005; Agbogidi and Eruotor, 2012). The leaves have been reported to be a therapy for malaria, scabies, paralysis and hard tumor (Duke *et al.*, 2002; Aliyu, 2006). Also, because of the presence of ansovitexin, apigenin and vitexin in the leaves, they can serve as a cure for rheumatism and muscular pains (Rejore and Batra, 2003; El-Ekanali, 2010; Agbogidi and Ekeke, 2011). Antibiotic activities of *Jatropha curcas* seed have been demonstrated against *Staphylococcus aureus* and *Escherichia coli* (Thomas *et al.*, 2008). With the wealth of tradomedicinal claims surrounding the use of *Jatropha curcas* leaves (Esimone *et al.*, 2009), there is need for investigation of antibiotic potential of the leaves against some common pathogenic microorganisms. This research therefore investigates the growth inhibition of *E. coli*, *S. aureus*, *Proteus spp*, *Klebsiella pneumonia* and *Pseudomonas aeruginosa* by methanolic, ethanolic and aqueous leaf extracts of *Jatropha curcas*.

MATERIALS AND METHODS

3.1 MATERIALS

Media Used: Nutrient media (Micro master) and MacConkey agar (Lab M).

Test Organisms: While carrying out this work, the following bacteria were used as the test organisms: *Escherichia coli*, *Staphylococcus aureus*, *Proteus spp*, *Klebsiella pneumonia* and *Pseudomonas aeruginosa*. These organisms were obtained from the Microbiology Laboratory of Abia State University, Nigeria.

Leave Extracts: Fresh leaves of *Jatropha curcas* were collected from farm land in Agbani, Enugu State, Nigeria. The plant was identified appropriately. Ethanolic, methanolic and aqueous extracts of the leaves were prepared with the corresponding solvents. Ethanol and methanol used were of analytical grade. The separated extracted were then filtered through Whatman's No. 1 filter paper and the aqueous, ethanol and methanol filtrate were separately concentrated to dryness using a rotary evaporator to remove the ethanol and methanol.

Phytochemical analysis of the plant extract

The extracts were subjected to qualitative phytochemical tests for tannins, saponins, flavonoids, alkaloids, oxalates and glycosides in accordance with Trease and Evans (1989) and Harborne (1998) with little modification.

Antimicrobial activity

The agar well diffusion method was used in the assessment of the antimicrobial activity of the plant, this method was achieved by using a sterile cork borer to make six wells on each Nutrient and MacConkey agar plates after which plant extracts were dropped into wells and allowed to diffuse for 5 minutes after which, plates were kept to stand in the incubator for 24 hours at 37°C (Igbinosa *et al*, 2009). Zones of inhibition were measured and recorded. The experiment was done in triplicate and the results are expressed as mean $\pm$ standard deviation.

RESULT AND DISCUSSION

Table 1: Phytochemical screening of methanolic, ethanolic and aqueous extract of *Jatropha curcas* Leaves

Phytochemicals	Methanolic extract	Ethanolic extract	Aqueous extract
Saponin	-	-	+++
Tannins	-	++	+
Flavonoids	+++	+	-
Cyanogenic glycosides	+++	++	++
Alkaloids	-	+	+++
Oxalate	++	+++	-

+++Highly present, ++Moderately present, +Present, -Absent

Phytochemical screening of *Jatropha curcas* leaf, presented in Table 1, revealed the presence of tannins, saponins, flavonoids, alkaloids, oxalates and cyanogenic glycosides. These phytochemicals are biologically active and can be said to responsible for the antimicrobial activity of the plant. The mechanisms through which these secondary metabolites exert their antimicrobial activities differ. Tannins have been reported to form irreversible complexes with proline rich protein (Shimada, 2006), thereby inhibiting cell protein synthesis. (Parekh and

Another secondary metabolite observed in the leave extract of *J. curcas* was alkaloid. Alkaloids have analgesic effects (Sutradhar *et al.*, 2007) and have been used in pain killer medications (Kam and Liew, 2002). Alkaloids have been acclaimed for their antimicrobial activities, especially against gram negative bacteria (Cushnie *et al.*, 2014). Other secondary metabolites present in *J. curcas* whose antimicrobial activities have been documented are flavonoids and saponins (Hodek *et al.*, 2002).

Though traditionally used in the fermentation of cassava, *J. curcas* is inedible. This is due to the presence of oxalate and cyanogenic glycosides in it as presented in Table 1. Oxalate is an antinutrient and an acute toxin (Munro and Bassir, 1996). Cyanogenic glycosides are not just distasteful but also toxic, as they release hydrogen cyanide which generates free radicals and causes oxidative stress (Gleadow and Woodrow, 2002).

Table 2: Antibacterial Activity of *Jatropha Curcas* Leaves Extracts Using Each Solvent (Water, Ethanol And Methanol) at Different Concentrations.

Organisms	Zone of Inhibition (mm)							
	W ₁	W ₂	E ₁	E ₂	M ₁	M ₂	Control	AI
<i>Escherichia coli</i>	7.0±1.4	7.0±1.4	9.0±1.4	10.0±2.8	11.0±4.2	9.0±1.4	8	7.25
<i>Staphylococcus aureus</i>	8.5±0.71	8.0±0.17	8.0±1.4	8.0±1.4	7.5±2.12	8.5±0.7	9	4.9
<i>Proteus spp</i>	6.5±0.71	6.5 ± 0.71	7.0±0	6.5±0.71	8.0±1.4	7.0±0	7	5.9
<i>Klebsiella pneumonia</i>	6.5±2.12	6.5±2.12	8.0±1.4	8.0±1.4	11.5±3.5	10.5±2.12	9	5.8
<i>Pseudomonas aeruginosa</i>	7.5±0.71	7.0±0	7.5±0.71	7.0±0	8.0±1.4	8.0±1.4	7	6.8

96	<i>Means+Standard Deviation</i>
97	W_1 = Water extract (refrigerated) 4°C
98	W_2 = Water extract (evaporated) 100°C
99	E_1 = Ethanolic extract (refrigerated) 4°C
100	E_2 = Ethanolic extract (evaporated) 100°C
101	M_1 = Methanolic extract (refrigerated) 4°C

102 M_2 = Methanolic extract (evaporated) 100°C
 103 AI (Activity Index) = $\frac{\text{Mean of zone of Inhibition}}{\text{Zone of Inhibition of Antibiotic drug}}$
 104
 105

106 As presented in Table 2, all the extracts demonstrated significant inhibition against the test
 107 microorganisms. Ethanolic extract however demonstrated the greatest inhibition. This is
 108 consistent with the high level of phytochemicals in the ethanolic extract. The inhibition was most
 109 effective against *E coli* with mean inhibition zone of 8.33mm. The use of *J. curcas* as a
 110 medication for diarrhea is however not feasible because of the presence of oxalate and
 111 cyanogenic glycosides in it. The extracts are also active against *Staphylococcus aureus* and
 112 *Klebsiella pneumonia*. *Staphylococcus aureus* is the causative organism for skin infections such
 113 as abscesses, respiratory infections such as sinusitis, and food poisoning (Curran *et al.*, 1980).
 114 *Klebsiella pneumonia* infections are seen mostly in people with a weakened immune system.
 115 *Klebsiella* infections are often nosocomial. The most common condition caused by *Klebsiella*
 116 outside the hospital is pneumonia (Brooks, *et al.*, 2004). *Klebsiella* is also implicated in urinary
 117 tract, lower biliary tract, and surgical wound sites infections (Ryan and Ray, 2004). The
 118 inhibition of *S. aureus* and *K. pneumonia* by the leave extract substantiates the trado-medicinal
 119 use of *J. curcas* in wound healing, scabies and other skin infections (Thomas *et al.*, 2008).

120 Other microorganisms inhibited include *Proteus spp* and *Pseudomonas aeruginosa*.
 121 *Pseudomonas aeruginosa* is a ubiquitous multi drug resistant pathogen that is associated with
 122 serious illnesses - especially nosocomial infections such as ventilator-associated pneumonia and
 123 various sepsis syndromes as well as hot-tub rash (Balcht and Smith, 1994). *Proteus spp* is
 124 implicated in urinary, septic and wound infections, often nosocomial (Guentzel, 1996). However,
 125 it is opportunistic and only affects immunosuppressed individuals (Brooks, *et al.*, 2004). The
 126 inhibition of *Proteus spp* by *Jatropha curcas*, as shown in Table 2, substantiates the reported
 127 wound healing ability of *Jatropha curcas* (Shetty *et al.*, 2006; Esimone *et al.*, 2008).

128 CONCLUSION

129 Phytochemical screening of *Jatropha curcas* leaf revealed the presence of several biological
 130 active compounds including tannins, saponins, flavonoids, alkaloids, oxalates and cyanogenic
 131 glycosides; which can be responsible for the observed antimicrobial action of the leave. The leaf

demonstrated considerable inhibition zone against the test microorganisms but can only be used for topical treatment because of its inedibility.

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