



©Biotechnology Society



[www.bti.org.in](http://www.bti.org.in)  
ISSN 0974-1453  
Research Article

## ANTIBACTERIAL EFFECTS OF DIFFERENT PARTS OF *LANTANA CAMARA* AGAINST SOME ISOLATED PATHOGENIC BACTERIA

Al-Khafaji Nazar Jabbar<sup>1</sup>; Al-Zubaedi Raad Mahmood\*<sup>1</sup>; Al-Khafaji Mayada Nazar<sup>2</sup>

<sup>1</sup>Department of Medicine, College of Veterinary Medicine; <sup>2</sup>Department of Biology, College of Science, University of Diyala, Diyala, Iraq

Corresponding Author\*: [raad.md80@gmail.com](mailto:raad.md80@gmail.com)

### ABSTRACT

In view of the fact that ancient time, plants have been a tremendous source of medicine. *Lantana camara* has scientifically studied for various therapeutic activities like antioxidant, antipyretic, larvicidal, insecticidal, antimicrobial, wound healing and anti-hyperglycemic. The inhibitory effects of different extracts of leaves, immature and mature fruits of *Lantana camara* on the isolated bacterial strains in Mueller Hinton agar, using disc and well diffusion methods were studied. Inhibition zones were measured in mm 24 hours of incubation. All the dependent extracts have been found to inhibit the growth of tested bacterial strains. In general, regardless the method of study and type of extraction and parts of the plant, *E.coli* showed the most sensitivity, followed by *Pseudomonas aeruginosa*, *Staphylococcus aureus*, *Proteus*, *Bacillus subtilis* respectively and lastly *Klebsiella*. In disc method, *E. coli* and *Pseudomonas aeruginosa* were the most sensitive, followed by *Proteus* and finally the least sensitive were each of *Bacillus subtilis*, *Staphylococcus aureus* and *Klebsiella*. While in well method, *E. coli* and *Staphylococcus aureus* were the most sensitive, followed by each of *Pseudomonas aeruginosa* and *Proteus*, and lastly, the least sensitive was *Klebsiella*. Against mature fruit extract, the most sensitive strain was *E. coli*, followed by each of *Pseudomonas*, *Staphylococcus aureus* and *Bacillus subtilis*, and lastly the least sensitive was *Proteus*. Against immature fruit extract, *S. aureus* was the most sensitive, followed by each of *Proteus*, *Pseudomonas*, *E. coli*, *Bacillus subtilis* and lastly the least sensitive was *Klebsiella*. *E.coli* was the most sensitive followed by each of *Pseudomonas* and *Proteus*, and lastly *Staphylococcus aureus* and *Klebsiella*. Against aqueous extract, *E. coli* was the most sensitive, followed by each of *Pseudomonas*, *Proteus* and *Staphylococcus* and finally the least sensitive was *Bacillus*, while *Klebsiella* showed no sensitivity. While against alcohol extract, each of *E. coli*, *Bacillus*, *Staphylococcus* and *Pseudomonas* showed the same level of sensitivity, followed by *Klebsiella* and finally the least sensitive was *Proteus*.

**Key words:** *Lantana camara*, Antibacterial, pathogenic bacteria.

## INTRODUCTION

The emergence of organisms resistant to nearly all classes of antimicrobial agents has become a serious public health concern in the past several years. The discovery of antimicrobial agents from plants based on the evaluation of traditional plant extracts is very important research topic (Didem *et al.*, 2012).

In last few decades, many of traditionally known plants have been extensively studied by advanced scientific techniques and reported for various medicinal properties viz., anticancer, anti-inflammatory, antidiabetic, anthelmintic, antibacterial, antifungal, hepatoprotective, antioxidant and larvicidal activities (Kumar *et al.*, 2010).

Extracts from the leaves have been reported to have antimicrobial, fungicidal, insecticidal and nematocidal activity (Saksena and Trioathi, 1985; Begum *et al.*, 1995; Sharma *et al.*, 1999; Deena and Thoppil, 2000). Leaves extract exhibit anti-proliferative, antimicrobial, fungicidal, insecticidal and nematocidal activity (Saxena *et al.*, 1992; Begum *et al.*, 1995; Sharma *et al.*, 1999; Dayet *et al.*, 2003).

*Lantana camara* flower extract possess strong antibacterial activity. Yellow, lavender, red, and white *Lantana camara*, flowers displayed almost similar antibacterial activities (Deepak *et al.*, 2009). The chloroform extract of *lantana camara* showed activity against all three strains of *Mycobacterium tuberculosis* (Claude *et al.*, 2009). Recently Ashish *et al.*, (2011) have reported that the leaves extracts of *Lantana camara* are active against various Gram positive and Gram negative bacteria. The

extract of flower, leaf, stem and root of *Lantana camara* showed antibacterial activity against *E. coli*, *P. aeruginosa*, *S. aureus* and *S. saprophiticus* (Mary, 2011).

Different varieties of *L. camara* plants (leaves and flowers) were reported for antibacterial activity. Three different solvent extract of leaves and flowers of four different varieties of *L. camara* exhibited significant antibacterial activity against *E. coli*, *Bacillus subtilis* and *P. aeruginosa* while poor antibacterial activity against *Staphylococcus aureus* (Ganjewalla *et al.*, 2009).

Ethanol extracts of *L. camara* leaves and roots were reported for antibacterial activity by micro dilution method. The extracts exhibited antimicrobial activity against *Staphylococcus aureus*, *Proteus vulgaris*, *Pseudomonas aeruginosa*, *Vibrio cholerae*, *Escherichia coli* and two multi-resistant strains *E. coli* and *S. aureus* (Barreto *et al.*, 2010).

Methanolic extracts of different parts of *L. camara* were screened for antimicrobial activity against 10 bacteria and 5 fungi by disc diffusion method and both showed highest activity against Gram positive *Bacillus cereus* and Gram negative *Salmonella typhi* (Badakhshan *et al.*, 2009).

The plants that exhibit great activity could be considered as a source of potential antimicrobial compounds. Crude plant extract that were used in traditional folk medicine are still widely used to treat infections for their antimicrobial properties. Therefore it is worthwhile to study plants and plants products for activity against microorganisms (Kan *et al.*, 2009).

## **MATERIALS AND METHODS**

### **Plant materials**

Fresh leaves, mature, immature fruits of *Lantana camara* were collected from garden in Baqubah city, Diyala, Iraq.

### **Preparation of extracts**

Fresh leaves, mature and immature fruits of the plants were air dried at room temperature before grinding them to powder form with the help of mechanical grinder. 25 g of the air dried powder of each of leaves, mature and immature fruits powder were filled in the thimble and extracted successively with 300 ml of ethanol solvent using a Soxhlet extractor for 72 hours. Each extract was first filtered using Whatman No. 1 filter paper. The filtrate was evaporated under reduced pressure in vacuum evaporator. The dried crude extracts were sterilized overnight by UV radiation and stored at room temperature in amber color glass vials until used for antibacterial testing (Harborne, 1984; Okeke *et al.*, 2001; Karaman *et al.*, 2003).

### **Preparation of the concentrations**

One gram of solvent residue was dissolved with 10% dimethyl sulfoxide (DMSO) solution and used in the study for the antibacterial activity (Okeke *et al.*, 2001; Karaman *et al.*, 2003; Mingarro *et al.*, 2003). The concentrations of 50, 100 and 200mg/ml were used in this study.

### **Test bacterial strains**

The following bacterial strains were used as test organisms: *Staphylococcus aureus*, *Bacillus subtilis*, *E. coli*, *Pseudomonas aeruginosa*, *Klebsiella* and *Proteus vulgaris*. All the bacterial strains were obtained from Department of Microbiology, College of Veterinary

Medicine, University of Diyala, Diyala, Iraq.

### **Screening of extracts for antibacterial activity**

The antibacterial effects were tested by well and disc diffusion method (Bauer *et al.*, 1966).

Disc diffusion method was used to determine minimal inhibitory concentration. The bacteria to be tested were inoculated into Mueller Hinton broth, and incubated for 3-6 hours at 35°C. Petri dishes containing Muller Hinton Agar were impregnated with these bacterial suspensions by streaking over the surface of the agar media using a sterile cotton swab to ensure uniform inoculation. Different concentrations of extracts (50, 100, 200 mg/ml) were prepared in dimethyl sulphoxide. Discs of 5 mm diameter were impregnated with different concentrations of each extract. The discs were then aseptically applied to the surface of the agar plates at well spaced intervals. Blank disc impregnated with DMSO was used as negative control and disc of standard antibiotics as positive control. The plates were incubated at 37°C for 24 hours. The zones of inhibition as well as the minimum inhibitory concentration were measured in mm (Srinivasa *et al.*, 2001; Masika and Afolayan, 2002; Karaman *et al.*, 2003).

### **Statistical analysis**

All values are expressed as the mean  $\pm$  the standard error of the mean (SEM). The data were analyzed by using one way analysis of variance ANOVA, and then the test of the least significant differences between the means of inhibitory zones (Steel and Torrie, 1985). The significant level of test was  $P < 0.05$ .

## RESULTS

Different extracts of *Lantana camara* were tested against local clinical isolates of bacterial strains using disc and well diffusion methods. All the extract prepared from the leaves, immature and mature fruits of *Lantana camara* have been found to inhibit the growth of bacterial strains.

The results revealed that aqueous extract *Lantana camara* leaves by well method showed significant inhibitory activity against *E.coli*, *Staphylococcus*

*aureus* and *Proteus vulgaris*, as there were significant differences at 200mg/ml in comparison with 50mg/ml concentration. While in disc diffusion method all tested bacteria did not show any significant sensitivity. As compared with disc diffusion method, only *S. aureus* showed significance difference at 50 mg/ml and *Proteus vulgaris* at 100 and 200 mg /ml concentration (Table 1).

Table 1: The sensitivity of isolated pathogenic bacterial strains to aqueous extract *Lantana camara* leaves.

Bacterial sp.	Well concentration			Disc Concentration		
	50	100	200	50	100	200
<i>E.coli</i>	5.67±	7.33±	9.67±	7.00±	9.00±	10.0±
	0.34a	1.34a	1.46b	2.00a	3.00a	3.00a
<i>Bacillus subtilis</i>	6.00±	8.00±	9.33±	7.00±	8.33±	8.67±
	1.16a	1.73a	1.67a	1.16a	0.34a	0.34a
<i>Staph. Aureus</i>	7.00±	8.67±	11.33±	8.33±	9.67±	9.67±
	0.58aA	0.88a	1.86b	0.34aB	0.88a	1.46a
<i>P. aeruginosa</i>	7.00±	8.67±	9.00±	7.33±	7.67±	8.33±
	1.53a	1.86a	1.53a	1.20a	1.46a	1.20a
<i>Klebsiella</i>	7.33±	9.33±	9.67±	7.67±	8.33±	9.00±
	0.34a	1.46a	2.34a	1.34a	1.20a	1.00a
<i>Proteus</i>	6.33±	7.33±	9.00±	9.67±	11.0±	11.33±
	0.88aA	0.88aA	0.34bA	1.86aA	0.34aB	1.20aB

Values are M ± MSE. a, b, and c referred to significant difference between concentrations, while A, B, referred to the significance different between the methods. The level of significance was P < 0.05.

The results revealed that alcoholic extract of leaves of *Lantana camara* by well method showed significantly inhibitory effects at concentrations of 100mg/ml and 200mg/ml in comparison with 50mg/ml concentration against *E.coli*, while in case of *Pseudomonas aeruginosa* there was a significant difference only at 200mg/ml in comparison with 50mg/ml. Meanwhile *Klebsiella* showed a significance difference

in sensitivity at 200mg/ml in comparison with 50mg/ml and 100mg/ml. In disc method, *Pseudomonas aeruginosa* exhibited sensitivity at 200mg/ml in comparison with 100mg/ml and *Proteus vulgaris* at 100mg/ml, and 200mg/ml in comparison with 50mg/ml. In comparison between well and disc methods, only *Pseudomonas aeruginosa* showed significant difference in sensitivity at concentrations of 100mg/ml and 200mg/ml (Table 2).

Table 2: The sensitivity of isolated pathogenic bacteria to alcoholic extract of leaves of *Lantana camara*.

Bacterial sp.	Well concentration			Disc Concentration		
	50	100	200	50	100	200
<i>E. coli</i>	6.00± 00a	8.33± 0.88b	8.67± 0.88b	8.67± 1.86a	9.67± 2.34a	10.67± 2.34a
<i>Bacillus subtilis</i>	9.67± 0.67a	11.33± 0.88a	12.33± 1.46a	10.00± 0.58a	10.33± 0.67a	11.0± 0.58a
<i>Staph. aureus</i>	10.0± 1.53a	11.67± 1.67a	12.0± 1.53a	9.33± 0.67a	9.33± 1.20a	10.0± 0.58a
<i>P. aeruginosa</i>	5.0± 1.53aA	6.67± 1.46aA	8.33± 0.34bA	8.33± 2.48aA	9.67± 0.34aB	10.67± 0.34bB
<i>Klebsiella</i>	8.00± 0.58a	8.67± 0.34a	9.67± 0.34bc	7.33± 1.46a	9.67± 0.67a	9.67± 0.34a
<i>Proteus</i>	7.00± 0.58a	9.67± 1.20b	13.0± 2.08b	6.33± 1.20a	9.00± 0.58b	10.0± 0.58b

Values are M ± MSE. a, b, c referred to significant difference between concentrations, while A, B, referred to the significance different between the methods. The level of significance was P < 0.05.

In comparison between aqueous and alcohol extract of leaves of *Lantana camara* by well diffusion method, *Bacillus subtilis* exhibit sensitivity at 50mg/ml and 100mg/ml while *Proteus vulgaris* at concentration of 200mg/ml only. *Staphylococcus aureus* showed sensitivity of significance level at 50mg/ml. In disc method, *Bacillus subtilis* exhibited significant difference of sensitivity at 50mg/ml, 100mg/ml and 200mg/ml. *Proteus vulgaris* at 100mg/ml only and *Pseudomonas aeruginosa* at 200 mg/ml only (Table 1 and 2).

The result of study revealed that aqueous extract of immature fruit of

*Lantana camara* by Well diffusion method showed that *S. aureus* and *Bacillus subtilis* were significantly sensitive at 200mg/ml in comparison with 50mg/ml and 100mg/ml. *Proteus vulgaris* at 100mg/ml and 200mg/ml in comparison with 50mg/ml. *Pseudomonas aeruginosa* at 200 mg/ml in comparison with 50mg/ml. *E. coli* showed significant difference at 100mg/ml and 200mg/ml in comparison with 50mg/ml. In disc method, *Proteus vulgaris* at 200mg/ml in comparison with 50mg/ml and 10 mg/ml. *E. coli* at 200 mg/ml in comparison with 50mg/ml. In comparison between well and disc methods, *S. aureus* showed significance difference at 100 mg/ml. *Proteus vulgaris* at 100mg/ml and 200mg/ml (Table 3).

Table 3: The sensitivity of isolated pathogenic bacteria to aqueous extract of immature fruit of *Lantana camara*.

Bacterial sp.	Well concentration			Disc Concentration		
	50	100	200	50	100	200
<i>E. coli</i>	5.67±	9.00±	11.33±	6.67±	7.67±	9.00±
	0.34a	1.74b	1.86bc	1.20a	0.67a	0.58a
<i>Bacillus subtilis</i>	6.00±	7.00±	9.67±	8.00±	9.33±	9.67±
	1.00a	1.16b	0.67bc	2.08a	1.20a	0.34a
<i>Staph. Aureus</i>	6.33±	7.33±	9.33±	8.00±	8.67±	9.00±
	0.88a	0.34aA	0.88bc	0.58a	0.67 aB	0.58 a
<i>P. aeruginosa</i>	5.33±	8.33±	11.33±	6.67±	7.67±	8.67±
	1.77a	1.46a	1.86b	2.41a	2.85a	3.39a
<i>Klebsiella</i>	7.67±	8.67±	9.67±	7.67±	8.00±	8.33±
	0.88a	0.88a	0.88a	0.67a	0.00a	0.34 a
<i>Proteus</i>	8.33±	11.0±	14.0±	6.67±	7.67±	10.33±
	0.34aA	1.00bA	1.53Ba	1.34aA	0.88aB	0.34bB

Values are  $M \pm MSE$  .a, b, and c referred to significant difference between concentrations, while A,B, referred to the significance different between the methods. The level of significance was  $P < 0.05$ .

The result of the study revealed that the sensitivity of isolated pathogenic bacteria to alcoholic extract of immature fruit of *Lantana camara* by well method against *S. aureus* showed a significant difference in sensitivity at 200 mg/ml in comparison with 50mg/ml and 100 mg /ml. *Bacillus subtilis* at 100 and 200 mg /ml in comparison with 50 mg/ml. *E. coli* at 200

mg/ml in comparison with 100 mg /ml. In disc method, *S. aureus*, *Proteus*, *Pseudomonas aeruginosa* showed sensitivity at 200 mg/ml in comparison with 50 mg/ml while *Klebsiella* was sensitive at 200mg/ml. In comparison between well and disc methods, there was significant differences of *Klebsiella* at 50mg/ml, 100mg/ml and 200mg/ml (Table4).

Table 4: The sensitivity of isolated pathogenic bacteria against the alcohol extract of immature fruit of *Lantana camara*.

Bacterial sp.	Well concentration			Disc Concentration		
	50	100	200	50	100	200
<i>E. coli</i>	7.67±	7.00±	9.67±	7.67±	9.00±	9.33±
	1.34a	0.58a	0.88b	1.56a	2.08a	2.19a
<i>Bacillus subtilis</i>	8.33±	9.67±	10.67±	9.67±	12.33±	12.33±
	0.34a	0.67b	0.67b	1.34a	1.67a	2.03a
<i>Staph. aureus</i>	9.00±	9.67±	12.67±	8.33±	9.67±	12.33±
	0.58a	0.34a	1.20bc	1.67a	1.86a	1.46b
<i>P. aeruginosa</i>	5.33±	6.00±	7.67±	6.00±	7.00±	9.33±
	1.77a	2.08a	1.86a	1.53a	1.53a	0.88b
<i>Klebsiella</i>	7.67±	8.33±	9.00±	9.67±	10.0±	10.67±
	0.88A	0.88A	0.58A	0.34aB	0.00aB	0.34bcB
<i>Proteus</i>	7.67±	8.33±	9.33±	5.33±	7.33±	9.00±
	0.88a	0.88a	1.46a	1.77a	0.88a	1.00a

Values are  $M \pm MSE$  .a, b, and c referred to significant difference between concentrations, while A, B, referred to the significance different between the methods. The level of significance was  $P < 0.05$ .

In comparison between aqueous and alcohol extract of immature fruits of *Lantana camara* by well method, sensitivity of *S.aureus* was at 50mg/ml, 100mg/ml and 200mg/ml, *Bacillus subtilis* at 50mg/ml and 100mg/ml, *Proteus vulgaris* at 100mg/ml and 200mg/ml. In disc method, *S. aureus* showed sensitivity at 200mg/ml. *Klebsiella* at 50mg/ml and 200mg/ml (Table 3 and 4).

The results of the study revealed that aqueous extract of mature fruit of *Lantana camara* by well method showed that *S.aureus* was sensitive at 200mg/ml in comparison with 50mg/ml. *E. coli* and *Pseudomonas aeruginosa* at 200mg/ml in

comparison with 50 and 100mg/ml and at 100 in comparison with 50mg/ml. *Proteus vulgaris* only at 200 mg/ml in comparison with 50mg/ml. In disc method, *E.coli* and *Pseudomonas aeruginosa* showed sensitivity at 200mg/ml in comparison with 50mg/ml and 100mg /ml. In comparison between well and disc methods, aqueous extract of mature fruits, *S.aureus* at 100mg/ml and 200mg/ml. *E. coli* showed sensitivity at 50mg/ml, 100mg/ml, 200mg/ml, while *Pseudomonas aeruginosa* showed the sensitivity at 100mg/ml and 200mg/ml (Table 5) .

Table 5: The sensitivity of isolated pathogenic bacteria to aqueous extract of mature fruit of *Lantana camara*.

Bacterial sp.	Well concentration			Disc Concentration		
	50	100	200	50	100	200
<i>E. coli</i>	6.00± 0.00aA	7.0± 0.58bA	9.00± 0.58bcA	9.67± 0.67aB	10.0± 0.00aB	11.33± 0.34bcB
<i>Bacillus subtilis</i>	6.00± 0.58a	6.67± 0.88a	7.33± 1.67a	7.67± 1.46a	9.00± 2.08a	9.67± 2.41a
<i>Staph. aureus</i>	10.67± 0.88a	12.33± 1.46a	15.0± 1.16b	8.67± 1.34a	9.00± 0.58a	10.0± 1.16a
<i>P. aeruginosa</i>	6.00± 1.00aA	8.33± 0.34bA	11.0± 1.0bcA	6.33± 0.67aA	6.33± 0.88aB	8.33± 0.67bcB
<i>Klebsiella</i>	7.00± 1.53a	9.33± 1.20a	10.67± 1.86a	8.33± 1.46a	9.33± 1.46a	10.33± 0.88a
<i>Proteus</i>	8.00± 0.85a	9.00± 1.00a	11.0± 1.16b	7.00± 2.52a	8.00± 1.53a	10.67± 0.67a

Values are M ± MSE .a, b, and c referred to significant difference between concentrations, while A, B, referred to the significance different between the methods. The level of significance was P < 0.05.

The results of the study revealed that alcohol extract of mature fruits of *Lantana camara* by well method showed that *S. aureus* and *Bacillus subtilis* showed a significant difference of sensitivity at concentrations 100mg/ml and 200mg/ml in comparison with 50mg/ml. In disc method, *E. coli* at concentrations of 200mg /ml in comparison with 50mg/ml and 100mg/ml.

*Bacillus subtilis* at 200mg/ml in comparison with 50mg /ml. In comparison between well and disc methods, *S.aureus* was found sensitive at 50mg/ml, *Bacillus subtilis* at 100mg/ml and 200mg/ml (Table 6).

In comparison of aqueous and alcohol extract of mature fruit of *Lantana camara* by well method, *Pseudomonas aeruginosa* at 200mg/ml, *Bacillus subtilis*

and *E. coli* at 50 mg/ml and 100mg /ml. In disc method, *E. coli* at 100 mg/ml and

200mg/ml (Table 5 and 6).

Table 6: The sensitivity of isolated pathogenic bacteria to alcohol extract of mature fruit of *Lantana camara*.

Bacterial. sp	Well concentration			Disc Concentration		
	50	100	200	50	100	200
<i>E. coli</i>	9.00±	10.67±	12.33±	9.00±	9.33±	10.33±
	1.73a	1.77a	2.03a	0.58a	0.34a	0.34bc
<i>Bacillus subtilis</i>	7.33±	8.33±	9.00±	8.00±	10.67±	11.33±
	0.34Aa	0.34bA	0.58bA	1.53aA	0.88aB	0.67bB
<i>Staph. aureus</i>	9.33±	10.33±	12.33±	7.67±	9.67±	11.0±
	0.34a	0.34b	1.46b	0.88a	2.03a	2.31a
<i>P. aeruginosa</i>	4.67±	6.67±	7.33±	5.67±	5.33±	6.00±
	1.46a	1.20a	1.20a	0.67a	2.03a	2.31a
<i>Klebsiella</i>	7.33±	7.67±	9.00±	8.00±	9.00±	10.0±
	1.46a	0.88a	1.73a	1.53a	2.00a	2.00a
<i>Proteus</i>	7.00±	8.67±	11.33±	6.33±	7.00±	9.33±
	2.52a	3.53a	2.73a	2.19a	2.52a	2.34a

Values are M ± MSE. a, b, and c referred to significant difference between concentrations, while A, B referred to the significance different between the methods. The level of significance was P < 0.05.

## DISCUSSION

In our study all the prepared extracts have been found to inhibit the growth of tested bacterial strains. In general regardless the method of study and type of extraction and parts of the plant, *E. coli* showed the most sensitivity, followed by *Pseudomonas aeruginosa*, *Staphylococcus aureus*, *Proteus vulgaris*, *Bacillus subtilis* and *Klebsiella*. Immature extract was the most effective followed by mature, and leaves extract. There was no significant difference between well and disc methods, and between alcohol and aqueous extract.

The results indicated that the most sensitive organisms were *Staphylococcus aureus*, *Pseudomonas aeruginosa* and *E. coli*. Chloramphenicol showed antimicrobial activity against all tested strains (Milin *et al.*, 2012). The antibacterial activity of *Lantana camara* extracts varies with the method in use. It is suggested that the crude preparation of the leaves of the plant

containing both the active and none active components to have other efficacy than semi-crude or pure plant substances (Kafaru, 1994). The wide variety of activity of the ethanolic extracts over the water extracts significant because of the leaves of plants are of traditional uses. The antibacterial activity is passively because of the presence of secondary metabolites existed in the plant. Hence, it is difficult to explain the limited spectrum of activity of other extracts compared with the ethanolic extract since all the extracts had the secondary metabolites (Begum *et al.*, 1995).

*Lantana camara* have therapeutic potential due to the presence of natural agents, majority of their activity is due to bioactive compounds viz., flavones, isoflavones, flavonoids, anthocyanins, coumarins, lignans, catechins, isocatechins, alkaloids, tannin, saponins and triterpenoids (Deepak *et al.*, 2009). Different varieties of *L. camara* plants leaves and flowers were reported for antibacterial activity. Three different solvent extract of leaves and

flowers of four different varieties of *L. camara* exhibited significant antibacterial activity against *E. coli*, *Bacillus subtilis* and *Pseudomonas aeruginosa* whereas poor antibacterial activity against *Staphylococcus aureus* (Deepak *et al.*, 2009).

Different extracts of *Lantana camara* were tested against local clinical isolates of bacterial strains using disc diffusion method. All the extracts prepared from the leaves of *Lantana camara* have been found to inhibit the growth of bacterial strains. Ethanolic extracts of the leaves were moderately active, while the other extracts of leaves exhibit little the good experimental results obtained justify the folk use of this plant species as a bactericidal (Milin *et al.*, 2012).

The chloroform extract of *Lantana camara* showed activity against all three strains of *Mycobacterium tuberculosis* (Claude *et al.*, 2009). Recently Ashish *et al.*, 2011 have reported that the leaves extracts of *Lantana camara* be active against various Gram positive and Gram negative. *Lantana camara* flower extract posses strong antibacterial activity. Yellow, lavender, red and white *Lantana camara*, flowers displayed almost similar antibacterial activities (Deepak *et al.*, 2009). The

chloroform extract of *lantana camara* showed activity against all three strains of *Mycobacterium tuberculosis* (Claude *et al.*, 2009). The extract of flower, leaf, stem and root of *Lantana camara* showed antibacterial activity against *E. coli*, *P. aeruginosa*, *S. aureus* and *S. saprophiticus* (Mary, 2011).

Ethanolic extracts of *L. camara* leaves and roots were reported for antibacterial activity. The extracts exhibited antimicrobial activity against *Staphylococcus aureus*, *Proteus vulgaris*, *Pseudomonas aeruginosa*, *Vibrio cholera*, *Escherichia coli* and two multi-resistant strains *E. coli* and *S. aureus* (Barreto *et al.*, 2010).

The extracts of flowers, leaf, stem, and root of *Lantana camara* possess strong antibacterial activity (Deepak, 2009).

## CONCLUSION

The present study supports the possible of *Lantana camara* as a medicinal plant. Ethanomedical and scientific reports about the medicinal properties of *L. camara* represent it as a valuable plant and establishing it as a candidate for the future drug development.

## REFERENCES

- Ashish, S.S., Quereshi, K., Sharma, K.H. (2011). Antimicrobial activity of *Lantana camara*. Jour. Experi. Sci. 2: 50- 54.
- Badakhshan, M.P., Sasidharan, S., Rameshwar, N.J., Ramanathan, S. (2009). Comparative study:

- Antimicrobial activity of methanol extracts of *Lantana camara* various parts. Pharmacog. Res. 1: 348- 351.
- Barreto, FS., Sousa, EO., Campos, AR., Costa, JGM., Rodrigues, FFG. (2010). Antibacterial activity of *Lantana camara* Linn and *Lantana montevidensis* Brig extracts from Cariri –ceara, Brazil. Journal of young Pharmacists. 2: 42-44.

- Bauer, R.W., Kirby, W. D. K., Sherris, J.C., Turk, M. (1966). Antibiotic susceptibility testing by a standardized single disc method. *Am. J. Cl. Pathol.* 45: 493- 496.
- Begum, S., Mohammad, B.S., Siddiqui, S.S. (1995). Triterpenoids from the aerial parts of *Lantana camara*. *Journal of Natural Products.* 58: 1570- 1574.
- Claude, K., Paul, W., Moses, J., Olwa, O. (2009). The anti-mycobacterial activity of *Lantana camara* a plant traditionally used to treat symptoms of tuberculosis in Southy–Western Ugand. *African Health Sci.* 9: 40–45.
- Day, Md., Wiley, CJ., Playford, Z. MP. Zalucki, M.P. (2003). *Lantana–Current Management, Status and Future Prospects.* Australian Centre for International Agricultural Research, Canberra. 5: 1- 20.
- Deena, M.J., Thoppil, J.E. (2000). Antimicrobial activity of the essential oil of *Lantana camara*. *Fitoterapia.* 71: 453-455.
- Deepak, G., Silviya, S., Kishwar, H.K.H. (2009). Biochemical compositions and antibacterial activities of *Lantana camara* plants with yellow lavender, red and white flowers. *Eurasia. Jour. Bio.Sci.* 3: 69-77.
- DidemD, Berrin, O., Sanem, H., Mecit, V. (2012). Assessment of antioxidant, antibacterial, anti mycobacterial and antifungal activities of some plants used as folk remedies in turkey against dermatophytes and yeast – like fungi. *Turk. L. Biol.* 36: 672-686.
- Harborne, J. B. (1984). *Phytochemical methods. A Guide to modern technique of plant analysis.* II edition, Chapman and Hall, London, New York . 2<sup>nd</sup> ed.: 1 – 228.
- Ganjewalla, D., Sam, S., Khan, K.H.(2009). Biochemical compositions and antibacterial activities of *Lantana camara* plants with yellow, Lavender, red and white flowers. *EurAsian Journal of BioSciences.* 3: 69- 77.
- Kafaru, E. (1994). Immense help formative workshop. In *Essential Pharmacology.* 1st edition., Elizabeth Kafaru Publishers; Lagos, Nigeria. 31 -210.
- Kan, A., Ozcelik, B., Kartal, M. (2009). *In vitro* antiviral activities under cytotoxic diseases against herpes simple type- 1 and para influenza – 3 viruses of Cicerarietinum L . *Afr. J. Pharm. Pharmaco.*3: 627– 631.
- Karaman, I., Sahin, F., Gullile, M. (2003). Antimicrobial activity of aqueous and methanol extracts of *Juniperus Oxycedrus* L. *Journal of Ethanopharmacology.* 85: 5- 231.
- Kumar, G., Karthik, L., Rao, K.V.B. (2010). *In vitro* antimicrobial activity of latex of *Calotropisgigan* tea against

- pathogenic microorganisms. 3: 155-163.
- Mary, K. V. (2011). Studies on phytochemical screening and antibacterial activities of *Lantana camara*. Plant Sci. Feed. 1:74-79.
- Masika, P.J., Afolayan, A.J. (2002). Antimicrobial activity of some plants use for the treatment of livestock disease in the Eastern Cape. South Africa Journal of Ethanopharmacology. 83: 34 -129.
- Milin, K., A., Alka, V., Surendra, G. (2012). Antibacterial screening of extract of the leaves of *Lantana camara*. Indian J. L. Sci. 1: 97-99.
- Mingarro, D.M., Acero, N., Linares, F., Pozuelo, J.M., Mera, AC., Peres C. (2003). Biological activities from *Catalpa bignonioides* (Bignoniaceae). J. Ethnopharmacol. 87:163-167.
- Okeke, M.I., Iroegbu, G.U., Eze, E.N. (2001). Evaluation of extracts of the root of *Landolphia Overrience* for antibacterial activity. Journal of Ethanopharmacology. 78: 27-119.
- Saksena, N., Tripathi, H.H. (1985). Plant volatiles in relation to fungistasis. Fitoterapia. 56: 243- 244.
- Saxena, R.C., Dixit, O.P., Harsttan V. (1992). Insecticidal action of *Lantana camara* against *Callosobruchuschinrensis* (Coleoptera Bruchidae). Jou. Stored Pro. Res. 53: 230-235.
- Sharma, S., Singh, A., Sharma, O.P. (1999). An improved procedure for isolation and purification of lantadene A, the bioactive pentacyclic triterpenoid from *Lantana camara* leaves. Journal of Medicinal and Aromatic plant Sciences. 21: 686 – 688.
- Srinivasa, D., Nathan, S., Suresh, T., Permuasamy, O. (2001). Antimicrobial activity of certain Indian Medicinal Plants used in folk loric Medicine, J. Ethanopharmacol.74: 217- 220.
- Steel, R. G., Torrie, J. H. (1985). Principles and procedures of statistics, a Biometrical Approach, 2<sup>nd</sup> ed., McGraw – Ho; Inc, Singapore. 183.