# ANTAGONISTIC STUDY OF *LANTANA CAMARA* (LINN) AGAINST WITH PATHOGENIC BACTERIA

**Geeta Shrestha Vaidya*** and **Nabin Bhattarai***
*Nepal Academy of Science and Technology (NAST), Khumaltar, Lalitpur, Nepal.

**Abstract:** A research work of antagonistic effect of water solvent and organic solvent (Ethanol of different concentration 50 % and 100 %) of extracts of *Lantana camara* were studied against with pathogenic fifteen strains of bacteria.

Among fifteen species, of bacteria most of them were inhibited by *L.camara* extracts and only two species such as *Klebsella oxytoca* and *Klebsella pneumoniae* did not showed antibacterial activity with same extract with same concentration. Extracts obtained from the organic solvent and water solvent showed the different antagonistic properties with the same bacterial strains. Those bacterial strains which were inhibited their growth by water solvent could not inhibited by organic solvent extracts. This depends on presence of polar and non-polar bioactive compounds in the extracts. It also depends on polar and non-polar solvents used for the plant extract. Organic solvent extracts showed antibacterial effect towards *Pseudomonas aeruginosa, Staphylococcus* sp., *Bacillus cereus, Bacillus subtilis, Bacillus thurengiensis, Escherichia coli, Staphylococcus aureus, Proteus mirabilis* and water solvent extracts showed antibacterial effect towards *Pseudomonas aeruginosa, Staphylococcus* sp., *Citrobacter frundi, Proteus* sp., *Bacillus subtilis, Enterobacter aerogenes, Salmonella paratyphie, Staphylococcus aureus, Shigella dysenteria.* Both solvent extracts showed high antibacterial effect towards *Staph aureus, Staphylococcus* sp. and *Pseudomonas aeruginosa.*

Both plant extracts showed selective antibacterial effect with different strains of bacteria, which shows that these are confined to cure the same bacterial diseases.

**Key words:** *Lantana camara*; Pathogenic bacteria; Antimicrobial; Organic and water solvent; Concentration.

## INTRODUCTION

Green plants represent a reservoir of effective chemo-therapeutants and can provide valuable sources of natural drugs, natural pesticides and biofertilizers (Balandrin *et al.* 1985; Hostettman and Wolfender 1997) The use of traditional medicine is widespread in Nepal and much of the population still relying on it. In Nepal each and every plant has their own value such as antibacterial, antiviral, antifungal and biofertilizer properties. This can be explained by such factors as the lack of doctors, aelopathic medicines and expensive fertilizers. The use of plant preparations in this tradition has been well documented (Manandhar, 1985, 1986, 1987, 1989a, b, c, 1990a, b; Bhattarai, 1993; Shrestha and Joshi, 1993), although only a few species have been screened for biological activity (Bhakuni *et al*., 1969).

During the past decade, potent agents against bacterial, fungal and viral infections have become available. Extracts of plants and phytochemicals are getting more importance as potential sources for inhibiting different diseses during the recent decade. But the increasing clinical use has been associated with the emergence of drug resistant strains (Reusser 1996; Tisdale, 2000). Additionally dose-limiting toxic effects are observed. Plants have a long evolution of resistance against viral agents and lead to alternative directions in drug development. Despite the tremendous progress in human health, diseases cause by bacteria and residual toxicity of chemical pesticides is still a major threat to the public health. *Bacterial* pathogens have evolved numerous defense mechanisms against antimicrobial agents and resistance to old and newly produced drugs. So, there is challenge to us and urgent need to discover new antibiotics, biopesticide and biofertilizer from any new resource. The increasing failure of chemotherapeutics and antibiotic resistance exhibited by pathogenic microbial infectious agent has led to the screening of several medicinal plants for potential antimicrobial activity (Scazzocchia *et al*., 2001).

*Lantana Camara* L is perennial shrub, exotic to the Nepal, due to its adverse growth it is also called unwanted shrub ( Shrestha Vaidya *et al.*, 2005*)*. In Nepal, *Lantana camara* extract and its powder widely used to check the plant diseases whether it is bacterial or fungal as well as to increase the fertility of the soil and also used to cure human diseases (Shrestha Vaidya *et al.*, 2009, 2006). Extensive studies have shown that medicinal plants

*Author for Correspondence:* Geeta Shrestha Vaidya, Nepal Academy of Science and Technology (NAST), Khumaltar, Lalitpur, Nepal. E-mail: geetashrestha1@hotmail.com.

of several parts of the world contain compounds active against viruses that cause human diseases (Semple *et al.,* 1998; Kott *et al*., 1999; Sindambiwe *et al.*, 1999). Thus plants used also in Nepalese traditional medicine were analysed (Taylor *et al.*, 1996a,b). Thus the present investigation represents a preliminary screening *Lantana camera* against the different pathogenic bacterial strains.

## MATERIALS AND METHODS

Generally plant extracts were extracted with the different kinds of solvents such as organic and water solvents, in present study both solvents extract i.e. water solvent and organic solvent extract were used. For extraction, fresh leaves and current stems of the *Lantana camara* were collected from the road side and dried on the shed condition and then grinded in grinder in powder form (Shrestha Vaidya *et al.*, 2009). For water solvent extraction, 500 gm of shade dried *Lantana camera* plant powder soaked in 2500 ml distilled water for 3 days, squeezed and filtered with the help of cotton cloth. Water content of this filtrate evaporated till the solution in semisolid form. Semi solid solution poured in petridish and kept in dessicater which contained silica gel for residual water absorption from extract. From this dried extract 50% (0.5gm/1ml) and 100% (1gm/1ml) concentrated solution were made by using distilled water.

For organic solvent extract, 25 gm shed dried powder of *Lantana camara* was taken and placed in soxhlet glass tube, poured ethanol and run the soxhlet apparatus. This mixture of extract evaporated and dried with the help of Rotary vaccum evaporator and placed in dessicator for residual absorption of water from extract. Generally all the extract made on same solution which is used to extract the plant extract but in this research ethanol was used. From this dried extract 50% (0.5gm/1ml) and 100% (1gm/1ml) concentrated solution were made on ethanol ( Shrestha Vaidya *et al*., 2008).

Fifteen identified bacterial strain were collected from NIST. They were cultured into Nutrient Broth solution and incubated for 3-4 hours for their maximum growth. The bacterial broth solution compared to the turbidity of the 0.005% solution of the $BaCl_2$ (Barium chloride) solution, the turbidity of the bacterial growth solution not more than the turbidity of the $BaCl_2$ solution and swapped on the MHA (Muller Hinton Agar) media finely with the help of the cotton swap. After completion, bored the swapped media with the help of sterile borer and formed well on the media. 50 µl extract and control solution poured with the help of the micro pipette on each well, left for sometime for diffusion ( Shrestha and Piya, 2002). All the plates incubated at 37 $^0$C for 24- 48 hours. A control well was made on each plate by applying distilled water for water solvent and ethanol for organic solvent extract.

## RESULTS

All concentrations of *L. camera* extracts showed selective effect towards the bacterial strains. Among the fifteen sp of bacteria most of them are inhibited the growth with *L. camera* extracts and only two sp *Klebsella oxytoca, Klebsella pneumoniae* did not showed antibacterial activity with same extract. Extracts obtained from the organic solvent and water solvent showed the different antimicrobial properties with the same bacterial strains. Those bacterial strains which inhibited their growth by water solvent could not inhibited by organic solvent extracts. This depends on presence of polar and non-polar bioactive compounds in the extract. It also depends on polar and non-polar solvents used to extract the plant extract. Organic solvent extract showed antibacterial effect towards *Peudomonas aeruginosa*, *Staphylococcus* sp, *Bacillus subtilis*, *Bacillus cereus*, *E. coli*, *Staplococcus aureus*, *Bacillus thurengiensis*, *Proteus mirabilis* and water solvent extract showed antibacterial effect towards *Peudomonas aeruginosa*, *Staphylococcus* sp, *Citrobacter Frundi*, *Proteus* sp, *Bacillus subtilis*, *Enterobacter aerogenes*, *Salmonella paratyphie*, *Staplococcus aureus*, *Shigella dysenteria.* Altogether 13 sp out of 15 are inhibited their growth with *L. camera* extracts. Both solvent extracts showed high antibacterial effect towards *Staph aureus, Staphylococcus sp,* and *Pseudomonas aeruginosa.*

### Data Presentation

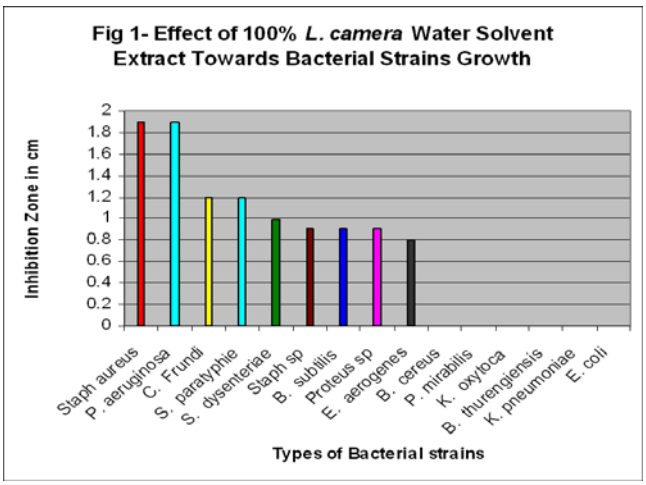
### Data presentation of the water solvent extract:

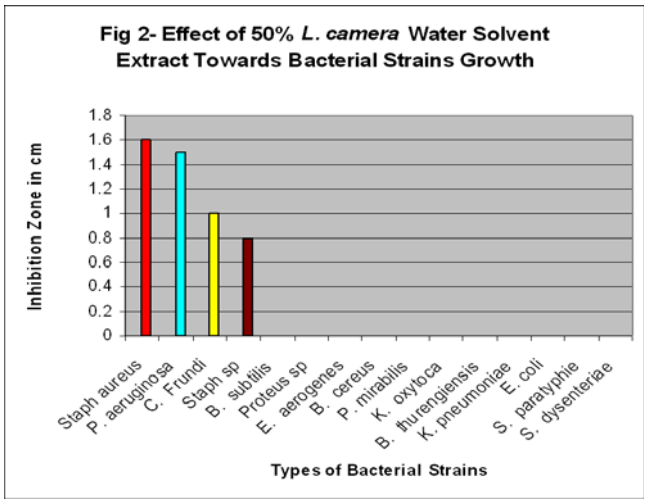
All output of this research work were presented on tabular form, the following bar diagrams showing the effect of plant extract towards different bacterial strains which is extracted from water solvent ( Fig. 1 and Fig. 2).

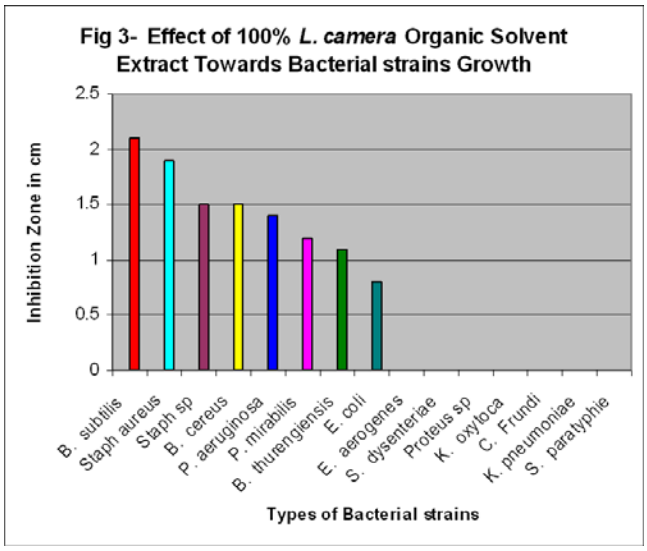
From the above bar diagrams, it was found that the concentration of the extract played main role to inhibit the bacterial growth. Higher the concentration of the extract showed higher concentration of the bioactive compounds. 100% plant extract inhibited the eight strains of the bacteria while the 50% plant extract inhibited the only four strains of the bacteria. The100% water solvent extract showed high antibacterial effect towards the *Staph aureus, Pseudomonas auroginosa, Citrobacter frundi* and *Salmonella paratyphie* while the 50% showed high antibacterial effect towards the S*taph aureus, Pseudomonas auroginosa, Citrobacter frundi* and *Staph sp.* This showed that the inhibitory effect of the extract depends on the concentration. Higher the concentration showed higher inhibitory effect while the lower concentration showed lower inhibitory effect towards bacterial strains.

### Data presentation of the organic solvent extract

The following bar diagrams showing the effect of plant extract towards different bacterial strains which is extracted from organic solvent (Fig 3 and Fig. 4).





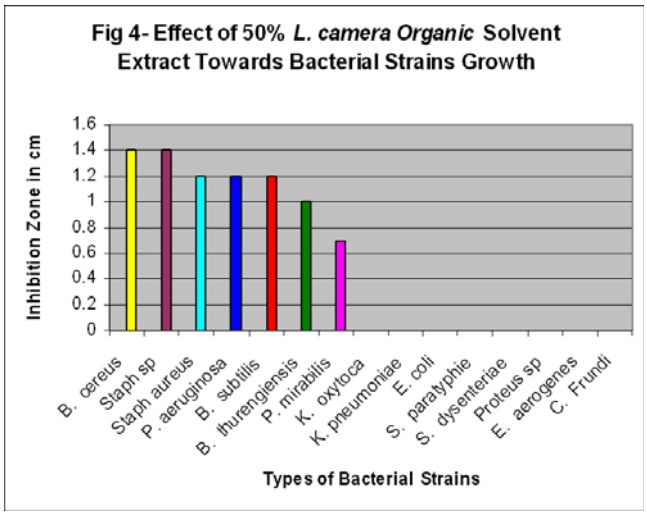




*Fig. 1. to Fig. 4. has shown extract of Lantana camara with water solvent and organic solvent with different bacterial strain.*

From the above bar diagrams, it was found that the concentration of the extract played main role to inhibit the bacterial growth. Higher the concentration of the extract showed higher concentration of the bioactive compounds. 100% plant extract inhibited the eight strains of the bacteria while the 50% plant extract inhibited the same bacterial strains also. Only *E. coli* did not show the antibacterial effect with the 50% plant extract.

The 100% organic solvent extract showed high antibacterial effect towards the *Staph aureus, Bacillus subtilis, Bacillus cereus, Staph sp*. while the 50% showed high antibacterial effect towards the same bacterial strains but less inhibitory zone in comparison to the 100% plant extract. Higher the concentration showed higher inhibitory effect while the lower concentration showed lower inhibitory effect towards bacterial strains.

Following photographs are showing zone of inhibition with different bacteria in different concentration.

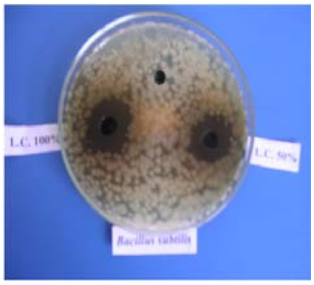


**Photo A**

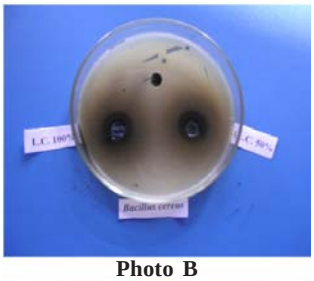


**Photo B**

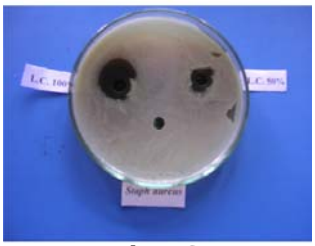


**Photo C**

## DISCUSSION

The major objective of this research was to investigate antagonistic effect of *Lantana camara* with different solvent in different concentration against with different Pathogenic bacteria.

Generally all the plants show the antimicrobial properties against different microorganisms. The preliminary results obtained from the crude water and organic solvent extracts indicate that further investigation and screening is worthwhile. This antibacterial effect depends on solvents which are used to extract the plant extract. Extract obtained from organic solvents and water solvent shows the different antibacterial properties with same bacterial strains. Those bacterial strains inhibited their growth with organic solvent extract could not inhibited by the water solvent extract. This depends on the presence of polar non polar bioactive or inhibitory compounds on the extract. Organic solvent extracted more concentration of nonpolar bioactive compounds from the plant powder and water solvent extracted more concentration of polar bioactive compounds. So, presence of different concentration of polar and non-polar compounds on the extract showed different inhibitory effect towards same bacterial strains. In other way water solvent extracted more gm of extract that is mainly polar which inhibited the inhibitory effect of non polar compounds this is also vice versa.

Ethanol extract of *Lantana camara* exhibited varying degrees of inhibitory activity against gram positive bacteria but it was inactive against gram negative bacteria.Our report more or less consistent with the report of Basu *et al.*, (2005) and Shrestha Vaidya *et al.* (2009). *Lantana camara* extracts have also been found to be a powerful febrifuge (Liogier

1990). CasCassado, 1995 had reported that *Lantana* leaves and their leachates exert allelopathic effects in vetro and to a lesser extent in soil on seed germination, root elongation, and plant growth of many species. Shrestha Vaidya et *al.* (2009) had reported that extracts of *L.camara* with different solvent with different pathogenic bacteria had shown antagonistic effects.

## CONCLUSION

In Nepal, generally called *Lantana camara* Lin is an exotic and unwanted shrub. *Lantana* is now a major weed in many regions and it is regarded as one of the most serious weeds in plantation crops. Not only that, it is poisonous to cattle, goat and cow also with direct eating. Inumerable biologically active compounds are found in plants (Alade and Irobi 1993, Clark and Hufford 1993, Samy *et al.* 1999) that possess antibacterial properties (Brantner and Grein 1994, Samy and Ignacimuthu 1998). From these results, it can be concluded that *Lantana Camara* extracts showed effective antibacterial activity towards pathogenic bacterial strains. So it's extract useful and effective towards the control of human, animals and plants bacterial diseases**.**


## ACKNOWLEDGEMENTS

We thank to the Nepal Academy of Science and Technology (NAST), Khumaltar, Lalitpur , Nepal for support and providing facilities to complete this research work


## REFERENCES


Alade, P.I. and Irobi, O.N. 1993. Antibacterial activities of crude extracts of *Acalypha wilkesinan* from Manna Nigeria Hournal of Ethnopharmacology. **39:** 235-236.

Bhakuni, D.S., Dhar, M.L., Dhawan, B.N. and Mehrotra, B.N. 1969. Screening of Indian plants for biological activity, part II. *Indian Journal of Experimental Biology.* **7**: 250-262.

Bhattarai, N.K. 1993. Folk medicinal use of plants for respiratory complaints in central Nepal. *Fitoterapia.* **64**: 163-169.

Clark,A.M. and Hufford, C.D. 1993. Disco and development of novel prototype antibiotics for opertunistic infections related to the acquired immunodeficiency syndrome. In: Human Medical Agent from Plants. American chemical society. **534**: 228-241.

Kott, V., Barbini, L., Cruanes, M., Munoz, J.de D., Vivot, E.,Cruanes, J., Martino, V., Ferraro, G.M., Cavallaio, L., Campos, R. 1999. Antiviral activity in Argentine medicinal plants. *Journal of Ethnopharmacology.* **64**: 79–84.

Manandhar, N.P. 1985. Ethnobotanical notes on certain medicinal plants used by Tharus of Dang-Deokhuri District, Nepal. *International Journal of Crude Drug Research.* **23** (4): 153-159.

Manandhar, N.P. 1986. Ethnobotany of Jumla District, Nepal. *International Journal of Crude Drug Research.* **24** (2): 81-89.

Manandhar, N.P. 1987. Traditional medicinal plants used by tribals of Lamjung District, Nepal. *International Journal of Crude Drug Research.* **25**(4): 236-240.

Manandhar, N.P. 1989a. Medicinal plants used by Chepang tribes of Makawanpur District, Nepal. *Fitoterapia.* **60**(1): 61-68.

Manandhar, N.P. 1989b. Useful wild plants of Nepal. Franz Steiner Verlag Wiesbaden, GmbH, Stuttgart, Germany.

Manandhar, N.P. 1989c). Folk-lore medicine of Chitwan District, Nepal. *Ethnobotany.* **2**: 31-38.

Manandhar, N.P. 1990a. Traditional phytotherapy of Danuwar tribes of Kamlakhonj in Sindhuli District, Nepal. *Fitoterapia.* **61**(4): 325-331.

Manandhar, N.P. 1990b. Medicobotany of Gorkha District, Nepal - an elucidation of medicinal plants. *International Journal of Crude Drug Research.* **28**(1): 17-25.

Manandhar, N.P. 1994. An ethnobotanical survey of herbal drugs of Kaski District, Nepal. *Fitoterapia.* **65**(1): 7-13.

Reusser, P. 1996. Herpesvirus resistance to antiviral drugs: a review of the mechanism, clinical importance and therapeutic options. *The Journal of Hospital Infection.* **33**: 235–248.

Samy, P. and Ignacimuthu, R. 1998. Screening of 34 Indian medicinal plants for antibacterial properties . Journal of Ethnopharmacology. **62**: 173-182.

Shrestha Vaidya, G. and Piya, S. 2002. Study of Antagonistic Action of Two Ectomycorrhizal Fungi Isolated from Pine forest of Dadeldhura. Proc. Of International Seminar on Mountains, Kathmandu. P. 571-577.

Shrestha Vaidya, G., Shrestha, K. & Wallander, H. 2005. Antagonistic Study of Ectomycorrhizal Fungi Isolated from Baluwa Forest (Central Nepal) against with pathogenic Fungi and Bacteria. Scientific World. **3**(3): 49-52.

Shrestha Vaidya, G., Shrestha, K., Wallander, H. & Khadge, B.R. 2006. Study of Rhizospheric Microflora of Baluwa Forest of Kavre District (Central Nepal). **4**(4): 44-49.

Shrestha Vaidya, G., Shrestha, K., Khadgi B.R., Johnson, N.C. and Wallander, H. 2008. Organic matter stimulates arbuscular mycorrhizal fungi in *Bauhinia purpurea* and *Leucaena diversifolia* plantations on eroded slopes in Nepal **,** *Restoration Ecology.* **16**(1): 79-87.

Shrestha Vaidya, G., Shrestha, K. and Wallander, H. 2009. Evaluation of Antimicrobial Activity of *Lantana camara* Linn. Against Pathogenic Fungi and Bacteria ECOS Proceeding 2009 in Press.

Shrestha, I., and Joshi, N. 1993. Medicinal plants of the Lele village of Latipur District, Nepal. *International Journal of Pharmacognosy.* **31**(2): 130-134.

Sindambiwe, J.B., Calomme, M., Cos, P., Totte, J., Pieters, L., Vlietinck, A., Vanden Berghe, D. 1999. Screening of seven selected Rwandan medicinale plants for antimicrobial and antiviral activities. *Journal of Ethnopharmacology.* **65**: 71–77.

Semple, S. J., Reynolds, G. D., O'Leary, G. D., Flower, R.L.P. (1998), Screening of Australian medicinal plants for antiviral activity. *Journal of Ethnopharmacology.* **60**: 163–172.

Tisdale, M. 2000. Monitoring of viral susceptibility: new challenges with the development of influenza NA inhibitors. *Reviews in Medical Virology.* **10**: 45–55.

Taylor, R.S., Manandhar, N.P., Towers, G.H.N. 1995. Screening of selected medicinal plants of Nepal for antimicrobial activities. *Journal of Ethnopharmacology.* **46**: 153–159.

Towers, G.H.N. 1984. Interactions of light with phytochemicals in some natural and novel systems. *Canadian Journal of Botany.* **62**: 2900-2911.


❐