

Original Research Article

<http://dx.doi.org/10.20546/ijcmas.2016.504.038>

Antibacterial Activity of *Solanum xanthocarpum* Leaf Extract

Shelly Rana*, Ved Prakash and Anand Sagar

Department of Biosciences, H. P. University, Shimla-171005, India

*Corresponding author

ABSTRACT

Keywords

Solanum xanthocarpum,
Leaf extracts,
Antibacterial
activity, Agar-well
diffusion.

Article Info

Accepted:
15 March 2016
Available Online:
10 April 2016

The antibacterial activity of plant *Solanum xanthocarpum* belonging to family Solanaceae, was evaluated *in-vitro* against some selected human pathogenic microorganisms (*Escherichia coli*, *Yersinia pestis*, *Pseudomonas aeruginosa* and *Staphylococcus aureus*) following agar-well diffusion method using different concentrations (30%, 50%, 70% and 100%). Two solvents methanol and acetone were used for extraction of different bioactive constituents from fresh leaves. It was concluded from the results that methanolic as well as acetone leaf extracts of *S. xanthocarpum* were quite effective in inhibiting the growth of *Staphylococcus aureus* which is a serious human pathogen causing infections in wounds. Therefore, the leaf extracts of this plant can be selected for further investigation to determine their therapeutic potential.

Introduction

Nature had bestowed us with a large variety of medicinal plants. The use of plants for medicinal purposes can be traced back to our history. There exists an abundant knowledge, information and benefits of herbal drugs in our ancient literature of Ayurveda (Traditional Indian Medicine) (Gagandeep *et al.*, 2010). In developing countries and especially in India low income people such as farmers, people of small isolated villages and native communities use folk medicine from some plants for the treatment of common infections (Fabricant and Farnsworth, 2001). These plants are ingested as decoctions, teas and juice

preparations to treat various infections. They are also made into a poultice and applied directly on the wounds or burns. Traditional healers consider these medicines as much cheaper and more effective than modern medicines (Abhishek *et al.*, 2010). Plants have a long history of potential antibiotics for the cure of diseases by antimicrobials, including antiviral, antibacterial and antifungal agents. Indians have been utilizing crude plants as source of medicine since ancient time. This property is primarily due to the bioactive compounds synthesized during secondary metabolism in plants. According to World Health

Organization (WHO), medicinal plants are the best source to obtain variety of drugs. About 80% of individuals from developed countries use traditional medicines which has bioactive compounds derived from medicinal plants hence such plants should be investigated further for better understanding of their properties, safety, efficacy and efficiency (Gavimath *et al.*, 2012). The present investigation is aimed to focus on the antibacterial activity of leaves of a valuable medicinal plant *Solanum xanthocarpum*.

S. xanthocarpum is known as Indian night shade or yellow Berried Night Shade plant. The common name is Kantakari synonym *Solanum surattense* and belongs to family Solanaceae. The plant is rich in many ingredients like alkaloids, phenolics, flavonoids, sterols, saponins and their glycosides and also carbohydrates, fatty acids, tannins and amino acids. The plant is known for its medicinal benefits since time memorial. Roots, leaves, stems, flowers and fruits are useful parts of Ayurvedic medicinal herb. Its roots are one of the important constituents of well known Ayurvedic preparation “Dasmula Ashva” (Amir and Kumar, 2004). Studies indicate that *S. xanthocarpum* possesses antifertility, antipyretic, anticancer, antiallergy, anti-inflammatory, antihistamine, hypoglycemic, antibacterial, antioxidant, antifungal properties (Yoshida and Oudhia, 2006)

Materials and Methods

Collection of Plant Material

Leaves of *S. xanthocarpum* were collected from village Kaloha, District Kangra, Himachal Pradesh, India. The collected plant material was brought to the laboratory for further analysis.

Processing of Plant Material

The collected *S. xanthocarpum*'s leaves were plucked from the plant and washed thoroughly under tap water and then with 2% Mercuric chloride. The leaves were cut into smaller pieces for quick drying. Cleaned leaves were shade dried for 15-20 days. The dried plant material was crushed into fine powder with the help of pestle mortar. Finally the fine powder was stored in air tight container at room temperature.

Preparation of Methanolic and Acetone Leaf Extracts of *Solanum xanthocarpum*

The dried leaf material (50 g) was pulverized in a blender to get a coarse powder and soaked separately in 300 ml of methanol and acetone separately in Erlenmeyer flask. The flasks were covered with aluminium foil and allowed to stand for 3-5 days for extraction. These extracts were filtered through Whatman filter paper no. 1 and evaporated at 40°C using rotary evaporator. The extracts were collected and stock solution of conc. 50 mg/ml was prepared.

Procurement of Bacteria

Bacterial strains used for determining antimicrobial activity of leaf extracts of *S. xanthocarpum* procured from Department of Biotechnology, Himachal Pradesh University, Summer Hill Shimla, India. Pathogens used for the study were *Escherichia coli*, *Staphylococcus aureus*, *Pseudomonas aeruginosa* and *Yersinia pestis*.

Revival of Pathogen

The collected pathogens were revived in nutrient broth and stored in nutrient agar slants at 4°C.

Screening the Antibacterial Activity of Methanolic and Acetone Extracts of *Solanum xanthocarpum*

Screening of leaf extract (methanol and acetone) of *Solanum xanthocarpum* was done using agar-well diffusion method. Nutrient agar medium (Beef extract 1g, Yeast extract 2g, Sodium Chloride 1g, Peptones 5g, Agar 20g, Distilled Water 1000 ml) was used throughout the investigation. The medium was autoclaved at 121.6°C for 30 minutes and poured into petriplates. Bacteria were grown in nutrient broth for 24 hours.

A 100µl of bacterial suspension was spread on each nutrient agar plate. Agar wells of 8 mm diameter were prepared with the help of sterilized stainless steel cork borer in each petriplate. The wells in each plate were loaded with 30%, 50%, 70% and 100% concentration of prepared extracts of *Solanum xanthocarpum*. The petriplate kept as control contained pure solvent in the well. The plates were incubated at $37\pm 2^{\circ}\text{C}$ for 24 hours in the incubation chamber. The zone of growth inhibition was calculated by measuring the diameter of the inhibition zone around the well (in mm) including the well diameter. The readings were taken in perpendicular direction for all the three replicates and the average values were tabulated. Percentage inhibition of growth of bacterial microorganisms was calculated after subtracting control from the values of inhibition diameter using control as standard (Hemashenpagam and Selvaraj, 2010).

Percentage of growth inhibition = $(\text{Control} - \text{Test} / \text{Control}) \times 100$

Control = average diameter of bacterial colony in control.

Test = average diameter of bacterial colony in treatment sets (Kannan *et al.*, 2009).

Results and Discussion

The present study brings out that methanolic and acetone leaf extract of *Solanum xanthocarpum* proved itself as good antibacterial agent. The methanolic extracts of *S. xanthocarpum* showed considerable growth inhibition of test bacteria at different concentrations (30%, 50%, 70%, 100%) as compared to acetone leaf extract of the plant. The methanolic extract of *Solanum xanthocarpum* was found to be most effective against *S. aureus* at (18mm at 100%) followed by (15mm at 70%), (13mm at 50%), (11mm at 30%), and it offered minimum inhibition in *P. aeruginosa* (13mm at 100%), (11mm at 70%), (9mm at 50%) and (9mm at 30%) as given in table 1. The acetone extract of *Solanum xanthocarpum* was found to be most effective against *S. aureus* at (16mm at 100%) followed by (14mm at 70%), (13mm at 50%), (10mm at 30%), and it showed minimum inhibition towards *P. aeruginosa* (12mm at 100%), (11mm at 70%), (9mm at 50%) and (Nil at 30%) as shown in table 2.

It was concluded from the results that methanolic as well as acetone leaf extract of *S. xanthocarpum* were quite effective in inhibiting the growth of *Staphylococcus aureus* which is considered as a serious human pathogen causing infections in wounds. Possible reason for this antibacterial activity of *S. xanthocarpum* are presence of alkaloids, phenolics and flavanoids in its leaves (Abhishek *et al.*, 2010). Majority of phytochemical components are known to produce the therapeutic activity like antibacterial, antifungal and antioxidant etc. (Sahoo *et al.*, 2010). These findings are in accordance with the work carried out by Salie (1996) and Kannabiran (2009). It has been established that our work also coincides to the work already reported by Aliero and Afolayan

(2006). Our study was also found to correlate with the results of on phytochemicals extracted from the leaves of *S. xanthocarpum* (Kumar *et al.*, 2003).

Thus it serves as an encouragement towards development of new drugs for the benefit of mankind.

Table.1 Percent Inhibition of Growth of Human Pathogenic Bacterial *spp.* at different Concentrations of Methanolic Extract of *Solanum xanthocarpum*

Concentration of methanolic extract of <i>S. xanthocarpum</i> (In %)	Inhibition zone diameter (In mm)			
	<i>S. aureus</i>	<i>E. coli</i>	<i>Y. pestis</i>	<i>P.aeruginosa</i>
Control	Nil	Nil	Nil	Nil
30	11	9	9	9
50	13	10	10	9
70	15	13	13	11
100	18	15	15	13

Each data represent mean of three replicates

Figure.1 Antibacterial Activity of Methanolic Leaf Extract of *S. xanthocarpum* against Various Human Pathogenic Bacterial Strains

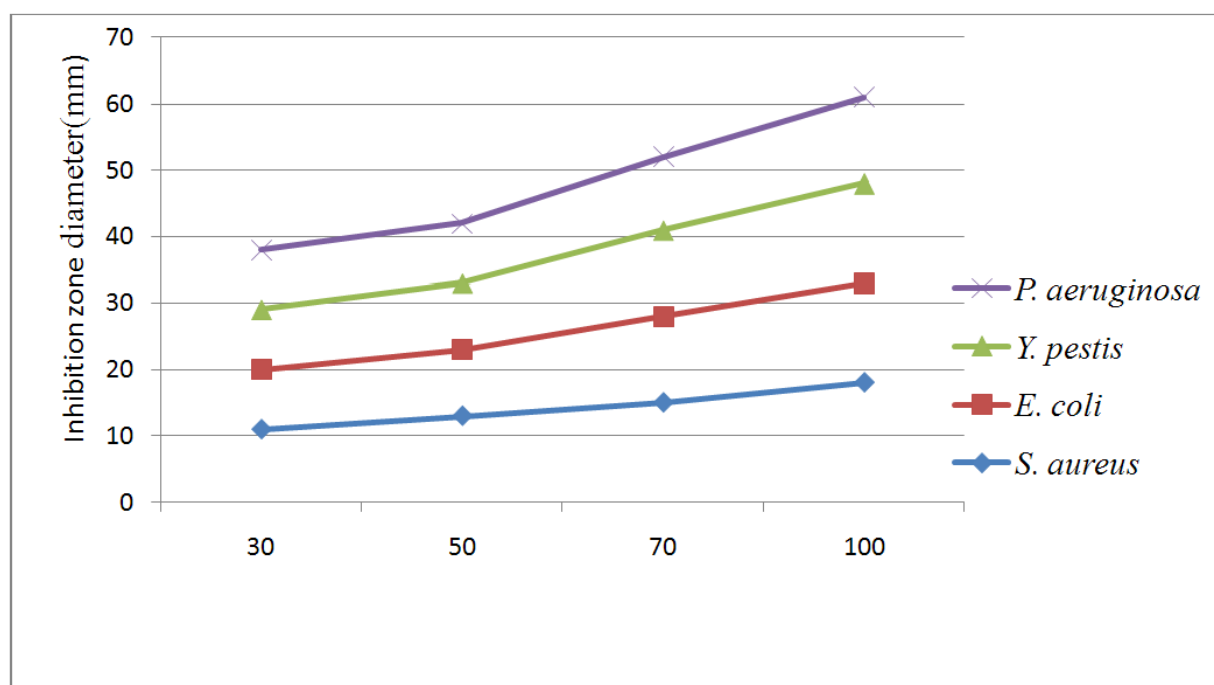
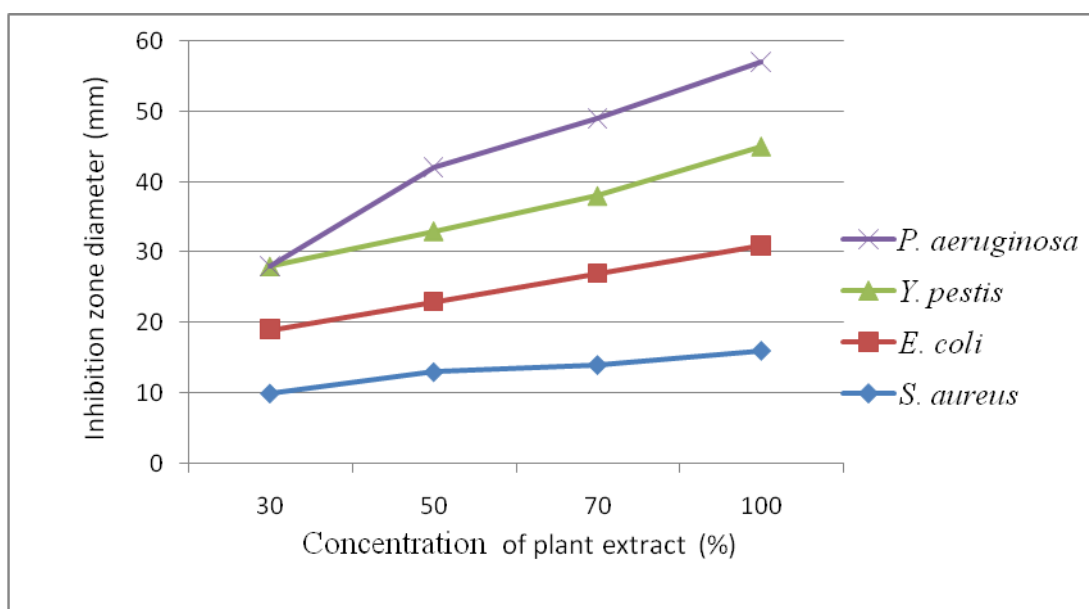


Table.2 Percent Inhibition of Growth of Human Pathogenic Bacterial *spp.* at Different Concentrations of Acetone Extract of *Solanum xanthocarpum*

Concentration of methanolic extract of <i>S. xanthocarpum</i> (In %)	Inhibition zone diameter (In mm)			
	<i>S. aureus</i>	<i>E. coli</i>	<i>Y. pestis</i>	<i>P.aeruginosa</i>
Control	Nil	Nil	Nil	Nil
30	10	9	9	Nil
50	13	10	10	9
70	14	13	11	11
100	16	15	14	12

Each data represent mean of three replicates

Figure.2 Antibacterial Activity of Acetone Leaf Extract of *S. xanthocarpum* against Various Human Pathogenic Bacterial Strains



Acknowledgement

We gratefully acknowledge the financial support provided for the present work by UGC Delhi in the form of BSR- Fellowship to the first author. The authors want to put on record their thanks to the chairperson, Department of Biosciences, Himachal Pradesh University, Summerhill Shimla for providing lab facilities.

References

- Aliero, A.A., Afolayan, 2006. Antimicrobial activity of *Solanum tomentosum*. *African J. Biotechnol.*, 369–372.
- Abhishek, M., Rakshanda, B., Prasad, G.B.K.S., Dua, V.K., Satish, K., Pavan, K.A. 2010. Antimicrobial activity of plants traditionally used as medicine against some pathogens.

- Rasayan J. Chem.*, 615–620.
- Amir, M., Kumar, S. 2004. Possible industrial applications of genus *Solanum* in twenty first century- A review. *J. Sci. Ind. Res.*, 116–124.
- Fabricant, D.S., Farnsworth, N.R. 2001. The value of plants used in traditional medicine for drug discovery. Environmental Health Perspectives. *Nat. Institute of Environ. Health Sci.*, 69–75.
- Gavimath, C.C., Kulkarni, S.M., Raorane, C.J., Kalsekar, D.P., Gavade, B.G., Ravishankar, B.E., Hooli, R.S. 2012. Antibacterial potentials of *Solanum indicum*, *Solanum xanthocarpum* and *Physalis minima*. *Int. J. Pharma. Appl.*, 14–41.
- Hemashenpagam, N., Selvaraj, T. 2010. Antibacterial potential of different extracts of *Solanum xanthocarpum* Chard and Wendt. *Pl. Arch.*, 387–390.
- Kannabiran, K., Kuma, M., Gunasekar, V. 2009. Evaluation of antimicrobial activity of saponin isolated from *Solanum xanthocarpum* and *Centella asiatica*. *Int. J. Nat. Engg. Sci.*, 22–25.
- Kannan, P., Ramadevi, S.R., Hopper, W. 2009. Antibacterial activity of *Terminalia chebula* fruit extract. *Afr. J. Microbiol.*, 180–184.
- Kumar, R.U., Velmurugank, D., Srinivasan, R., Krishna, R. 2003. Phytochemical and antimicrobial studies of extracts of *Solanum xanthocarpum*. *Ancient Sci. Life*, 1–5.
- Neelima, N., Devidas, N.G., Sudhaker, M., Kiran, V. 2012. Preliminary phytochemical investigations on the leaves of *Solanum xanthocarpum*. *Int. J. Res. Ayurveda and Pharm.*, 845–850.
- Oudhia, P., KaduPani, A. 2007. Specially Prepared Herbal Decoction for Body Wash Used by the Natives of Chhattisgarh, India (Accessed November 16, 2010).
- Prasanta, O.M., Singh, P.T. 2010. Phytochemistry of *Solanum xanthocarpum*: an amazing traditional healer. *J. Industrial and Scientific Res.*, 732–740.
- Rajkumar, S., Jebanesan, A. 2005. Repellency of volatile oils from *Moschosma polystachyum* and *Solanum xanthocarpum* against filarial vector *Culex quinquefasciatus*. *Trop. Biomed.*, 139–142.
- Sahoo, A.M., Chakraborti, C.K., Nayak, S., Kayal, S. 2011. Correlation between phytochemical screening and in vitro antibacterial activity study of *Rosa indica* leaves, *Int. J. Res. Ayurveda and Pharm.*, 1595–1597.
- Salie, F., Eagles, P.F.K., Leng, H.M.J. 1996. Preliminary antimicrobial screening of four South African Asteraceae species. *J. Ethnopharmacol.*, 27–33.
- Verbist, J.F., Monnet, R. 1974. Steroid alkaloids in *Solanum xanthocarpum*: Cultivated in the nantes region France. *Pl. Med.*, 269–280.
- Yoshida, T., Yokoyama, K., Namba, O., Okuda, T. 1991. Tannins and related polyphenols of Euphorbiaceous plants: 7 tirucallin-a, tirucallinb and euphorbin-f, monomeric and dimeric ellagitannins from *Euphorbia tirucalli* L. *Chem. Pharm.*, 1137–1143.

How to cite this article:

Shelly Rana, Ved Prakash and Anand Sagar. 2016. Antibacterial Activity of *Solanum xanthocarpum* Leaf Extract *Int.J.Curr.Microbiol.App.Sci*.2016. 5(4): 323-328.
doi: <http://dx.doi.org/10.20546/ijcmas.2016.504.038>