

ANTIBACTERIAL POTENTIALS OF *Solanum indicum*, *Solanum xanthocarpum* and *Physalis minima*.

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ABSTRACT:

In the present study, three plants belonging to family Solanaceae including *Solanum indicum*, *Solanum xanthocarpum* and *Physalis minima* were evaluated for antimicrobial potentials against some selected pathogenic microorganisms. Five different solvents like ethanol, methanol, acetone, petroleum ether and aqueous were used for extraction of different bioactive constituents from fresh leaves by both hot and cold processes. The results suggested that different solvent extracts during study showed antibacterial potentials. The highest antibacterial activity was shown by methanolic and ethanolic extracts prepared by heat treatment of fresh leaves of *Physalis minima*, as compared to other solvents against all the selected strains. The fresh leaves of *Solanum indicum* showed moderate antibacterial activity when used with ethanol and methanol against *Bacillus spp.*, *Corynebacterium diphtheriae*, *Streptococcus spp.*, *Pseudomonas spp.*, and *Salmonella typhimorium*. While the plant extracts of *Solanum xanthocarpum* showed least antibacterial activity.

Keywords: Antibacterial, extract, solvent and well-diffusion

INTRODUCTION:

For a long period of time plants have been a valuable source of natural products for maintaining human health especially in the last decade with more intensive studies for natural therapies. In the last few years plants have been used as antimicrobial agents because of their antimicrobial traits. This property is due to the bioactive compounds synthesized during secondary metabolism in plants. According to

World Health Organization medicinal plants would be the best source to obtain variety of drugs. About 80% of individuals from developed countries use traditional medicine which has bioactive compounds derived from medicinal plants hence such plants should be investigated for better understanding of their properties, safety, efficacy and efficiency. The use of plant extracts with known antimicrobial properties can be of great significance in therapeutic usage.

Making antibacterial drug therapy effective, safe and affordable has been the focus of interest during recent years.

There are several reports on antimicrobial activity of different herbal extracts. Considering the above aspects an attempt has been made to carry out the screening for preliminary antibacterial activity of different plants used in Indian folk medicine.

The aim of the study was to screen the antibacterial potentials of crude extracts of different solvents of some of the plants belonging to solanaceae family. In the present study three plants belonging to family Solanaceae viz, *Solanum indicum*, *Solanum xanthocarpum* and *Physalis minima* were evaluated for their antibacterial potentials.

The plant *Solanum indicum* is much branched perennial under shrub up to 1.8m height, found mostly throughout warmer parts of India, Africa and Asia up to an elevation of 1500m. It is Stiff, prickly herb; prickles stout, re-curved. The leaves are 7.5- 15cm long, 2.5-10cm broad, alternate, lobed, entire, spines present on petiole and midrib. *Solanum xanthocarpum* is a very spiny diffused herb with a height of up to 1.2m. The young branches are densely covered with minute star-shaped hair, while the mature branches are zigzag, covered with yellow, sharp shining prickles and spread close to the ground.

Physalis minima is a small, delicate, erect, annual, pubescent herb, 1.5m tall. The leaves are petiolate, ovate to cordate, pubescent, delicate, exstipulate, acuminate, having reticulate palmate venation and undulate margins, dorsal surface of the leaves is dark green and the ventral surface is light green in color.

Solanum indicum Linn. are the major sources of phenolic compounds in the human diet. Soluble phenolic acids were extracted with methanol [1]. Different solvent extracts of *Solanum indicum* exhibits anti-hypersensitive activity [2]. *Solanum indicum* has an anti-inflammatory, anticancer and wound-healing potentials [3]. It has been used in folk medicine for the treatment of inflammation,

toothache, ascites, oedema and wound infection. [4].

Solanum xanthocarpum exhibits larvicidal property, it kills *Anopheles spp*, *Aedes spp*. & *Culex spp*. which are the important mosquito vectors prevalent in arid regions [5]. The methanolic extract of *Solanum xanthocarpum* showed significant antinociceptive activity in mice [6]. It exhibits antifungal property, It shows cidal effect on *Aspergillus flavus*, *A.niger* and *A.fumigatus*. [7]. Fruit extract of *Solanum xanthocarpum* was evaluated for its toxicity against *Alternaria brassicae*, the causal agent of Alternaria blight of Indian mustard [8]. The anti diabetic potentials of aqueous extract of *Solanum xanthocarpum* fruits was studied in normal and streptozotocin-induced hyperglycemic rats [9].

The antimicrobial potentials of solanaceae family members are due to presence of tannins as one of the bioactive compound [10].

The crude methanol extract and chloroform fraction of the whole plant of *Physalis minima* was investigated for anti-inflammatory, analgesic and antipyretic activities in albino mice and Wistar rats of either sex at 200 and 400 mg/kg, respectively [11]. *Physalis minima* exhibited anticancer potentials [12]. It has potent alpha glycosidase inhibitory activity and would be effective in suppression of elevation in blood glucose after oral administration of maltose to rats [13].

MATERIALS AND METHODS:

Plant materials used:

Leaves of *Solanum indicum*, *Solanum xanthocarpum* and *Physalis minima* were used for the preparation of crude extracts for antibacterial studies.

Microorganisms selected:

The activity of the plant crude extract was studied for a broad range of microorganisms. i.e. Gram's positive including *Corynebacterium diphtheriae*, *Staphylococcus aureus*, *Streptococcus spp*. and *Bacillus spp*. as well as Gram's negative microorganisms including *Escherichia coli*.

Klebsiella pneumoniae, *Pseudomonas spp.* and *Salmonella typhimorium*.

Maintenance of Microorganisms:

The microorganisms were maintained on sterile nutrient agar slants in refrigerator and used as stock culture when it was required for performing this study.

Preparation of culture suspension:

Fresh culture was obtained by sub-culturing the microorganisms from stock culture on nutrient agar slants & incubated for 24 hours at 37°C. After 24 hours, a loop full of the culture was added in 3ml of sterile saline to prepare culture suspension.

Preparation of Plant extracts:

Fresh leaves were collected from the plant just before one day of antibacterial assay. The leaves were washed with water, air dried, powdered and then soaked overnight in appropriate amount of respective solvent. (10gms of leaves in 20ml of solvent.) On the next day, the soaked leaves were boiled with the same solvent in water bath for 30 minutes to make it concentrated. The extract was cooled and filtered through muslin cloth.

Method of bioassay:

Activity of the prepared plant extract was tested using agar well diffusion method. The antimicrobial assay was carried out by making 3 wells of 7mm diameter in the sterile nutrient agar plate containing test organism with the help of sterile cork borer. 0.1ml of plant extract was added in 2 wells and in the third well only a drop of solvent

was added as control by using sterile pipettes. The plates were incubated at 37°C for 24 hours in an incubator to allow diffusion of extract in the medium. After 24 hours zone of inhibition of organisms was measured in millimeters.

RESULTS & DISCUSSION:

1) *Solanum indicum*:

Among Gram's positive organisms, the maximum zone of inhibition was exhibited by ethanol and aqueous extracts prepared by heat and cold treatment on *Corynebacterium diphtheriae*.

Among Gram's negative organisms, the maximum zone of inhibition was exhibited by petroleum ether extracts prepared by heat and cold treatment on *Klebsiella pneumoniae*, methanolic extract prepared by heat and cold treatment on *Pseudomonas spp.* and heat treated methanolic extract on *Salmonella typhimorium*

***Solanum xanthocarpum*:**

Among Gram's positive organisms, the maximum zone of inhibition was exhibited by ethanol extracts prepared by heat treatment on *Corynebacterium diphtheriae*. Among Gram's negative organisms, the maximum zone of inhibition was exhibited by methanolic extracts prepared by cold treatment on *Escherichia coli* and *Pseudomonas spp.* and methanolic extract prepared by heat treatment on *Klebsiella pneumoniae*. Treatment on *Escherichia coli* and *Salmonella typhimorium*. The ethanolic extract prepared by heat treatment on *Pseudomonas spp.* and petroleum ether extract prepared by heat treatment on *Pseudomonas spp.*

***Physalis minima*-**

Among Gram's positive organisms, the maximum zone of inhibition was exhibited by methanol extracts prepared by heat treatment on *Streptococcus spp.*

Among Gram's negative organisms, the maximum zone of inhibition was exhibited by methanolic extracts prepared by heat.

The present study was conducted to get preliminary information on the antibacterial activity of methanol, ethanol, petroleum ether, acetone and aqueous extracts of *Solanum indicum*, *Solanum xanthocarpum* and *Physalis minima* leaves and for this the well diffusion method was adopted.

The results suggest that different solvent extracts used for the study showed antibacterial activity. The extract from fresh leaves prepared in methanol and ethanol has greater antibacterial activity than in acetone, petroleum ether and aqueous.

The extracts prepared by heat treatment were remarkably effective than cold treatment extracts against all the selected microorganisms. The result of the present study revealed that *Physalis minima* leaves extract had broad spectrum antibacterial effects producing zone of inhibition more than 20mm. *Solanum indicum* and *Solanum xanthocarpum* on the other hand does not appear to possess appreciable antimicrobial effects on Gram's positive and Gram's negative bacteria. The anti-bacterial action of various extracts of *Solanum indicum*, *Solanum xanthocarpum* and *Physalis minima* leaves indicated their potentials as antibacterial herbal remedies due to the cumulative effect of all the bioactive compounds present in the plants. Further work is needed to locate the active principle from the various extracts and their phytochemical studies.

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Solvent Organisms	Methanol		Ethanol		Petroleum ether		Acetone		Aqueous	
	HT	CT	HT	CT	HT	CT	HT	CT	HT	CT
BC	15.5	13.5	14.5	12.0	-	-	-	-	-	-
CD	10.0	12.0	22.5	21.5	14.5	13.0	19.5	15.5	25.5	22.5
SA	10.5	9.5	-	-	14.0	15	-	-	-	-
SC	15.0	14.0	16.0	13.0	15.0	14.0	13.0	9.5	-	-
EC	-	-	10.5	12.0	13.0	12.0	-	-	-	-
KP	-	-	-	-	17.0	16.0	12.0	10.0	-	-
PM	16.0	16.5	12.5	14.0	9.5	9.5	-	-	-	-
ST	17.0	15.5	9.0	9.5	11.0	10.0	-	-	-	-

Table 1: The antimicrobial activity of fresh leaves extract of *Solanum indicum* against selected microorganisms.

Note:BC-*Bacillus spp.*, CD-*Corynebacterium diphtheriae*, SA-*Staphylococcus aureus*, SC-*Streptococcus spp.*, EC-*Escherichia coli*, KP-*Klebsiella pneumoniae*, PM- *Pseudomonas spp.*, ST-*Salmonella typhimorium*, HT- heat treatment, CT-cold treatment, mm-millimeters

Solvents Organisms	Methanol		Ethanol		Petroleum ether		Acetone		Aqueous	
	HT	CT	HT	CT	HT	CT	HT	CT	HT	CT
BC	9.5	9.0	8.5	9.5	8.0	8.0	9.5	9.5	-	-
CD	8.5	9.5	14.0	12.0	9.0	12.0	11.5	11.0	-	-
SA	10.0	9.5	11.0	10.0	11.0	10.0	12.0	11.0	-	-
SC	9.5	8.5	8.0	8.5	12.0	8.5	9.0	9.0	-	-
EC	12.0	13.0	9.5	9.0	9.5	9.0	8.5	9.0	-	-
KP	13.0	11.0	12.5	11.0	12.5	11.0	11.0	10.0	-	-
PM	12.0	13.0	11.5	11.0	11.5	11.0	9.5	10.0	-	-
ST	10.0	9.5	9.5	9.0	9.5	10.0	11.0	11.0	-	-

Table 2: The antimicrobial activity of fresh leaves extract of *Solanum xanthocarpum* against selected microorganisms

Solvents Organisms	Methanol		Ethanol		Petroleum ether		Acetone		Aqueous	
	HT	CT	HT	CT	HT	CT	HT	CT	HT	CT
BC	22.5	19.0	23.5	21.5	13.5	16.0	15.0	22.5	14.5	14.5
CD	20.5	18.0	23.5	17.0	14.0	12.5	21.5	20.5	17.0	18.0
SA	12.5	15.0	17.5	12.0	17.5	15.0	15.5	14.5	14.5	12.5
SC	27.5	20.0	20.0	14.0	20.0	12.5	17.5	21.0	17.5	18.0
EC	27.5	20.0	22.5	21.0	22.5	16.5	16.5	24.0	24.0	19.0
KP	22.0	21.0	24.5	20.0	24.5	24.0	13.5	21.0	20.0	16.5
PM	20.0	20.0	27.0	24.0	27.0	20.0	10.5	24.0	16.5	13.0
ST	27.5	15.5	16.0	12.0	16.0	13.0	15.0	14.5	22.5	16.0

Table 3: The antimicrobial activity of fresh leaves extract (hot treatment) of *Physalis minima* against selected microorganisms