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COMPARATIVE ANTIMICROBIAL ACTIVITY OF LAWSONIA INERMIS, MIMOSA PUDICA, CESTRUM DIURNUM AND SOLANUM XANTHOCARPUM

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ABSTRACT

The antimicrobial activity of Lawsonia inermis, Mimosa pudica, Cestrum diurnum and Solanum xanthocarpum was determined by agar disc diffusion method against five strains of microbes: Bacillus pumilus, Micrococcus luteus, Escherichia coli, Pseudomonas aeroginosa and Candida albicans. All the selected plants exhibited antimicrobial activity but the degree of their potency varied. The results showed that Cestrum diurnum and Mimosa pudica showed more antimicrobial activity as compared to Lawsonia inermis and Solanum xanthocarpum.

KEY WORDS: Antimicrobial activity, zone of inhibition, agar disc diffusion.

INTRODUCTION

Nature had endowed us with a large variety of medicinal plants. The use of these plants for medicinal purposes can be traced back to our history. There exists a plethora of knowledge, information and benefits of herbal drugs in our ancient literature of Ayurvedic (Traditional Indian Medicine), Siddha, Unani and Chinese medicine. A wide variety of synthetic drugs are available these days however, development of resistance to such drugs continues to be alarming worldwide. Hence there is a need today to shift our focus from synthetic medicines to herbal medicines.[8]

Lawsonia inermis is a flowering plant belonging to family Lythraceae. It produces a burgundy dye molecule, lawsone which is concentrated mainly in leaves. The main uses of henna are as a cooling agent, astringent, antifungal and anti-bacterial herb for the skin and

hair. It has also been used as a dye and preservative for hair, skin and fingernails as well as leather and clothes. Its core chemical components are 2-hydroxynapthoquinone (lawsone, tannic acid, mucilage and gallic acid. Out of these ingredients, the main one is 2-hydroxynapthoquinone (lawsone). About 0.5-1.5% of henna is made of lawsone. Gallic acid as found to be the most potent antibacterial agent followed by lawsone.[1,4,9]

Mimosa pudica belongs to the family Mimosaceae is a stout stragling prostrate shrubby plant with the compound leaves sensitive to touch. Leaves and stems of the plant have been reported to contain an alkaloid mimosine, leaves also contain mucilage and root contains tannins. *Mimosa pudica* is used for its anti-hyperglycemic, anti-diarrhoeal , anti-convulsant and cytotoxic properties . The plant also contains turgorins, leaves and roots are used in the treatment of piles and fistula. Paste of leaves is applied to hydrocele. Cotton impregnated with juice of leaves is used for dressing sinus. Plant is also used in the treatment of sore gum and is used as a blood purifier. In ayurvedic and unani system of medicine, this plant has been used in diseases arising from corrupted blood and bile, billious fever, piles, jaundice, leprosy, ulcers, small pox.[6]

Cestrum diurnum belonging to family Solanaceae is a single or multistemmed shrub that is also known as Day Jasmine. There are several application of the plant that have been well documented in several literatures and the toxicity of the species to humans and livestock has been frequently reported by Stone, 1970; Little et al., 1974. The leaves contain a calcinogenic glycoside called 1,25-dihydroxycholocalciferol that leads to a vitamin D toxicity and elevated serum Ca2+ and deposition of calcium in soft tissues (Mello, 2003). Phytochemical analysis shows presence of glycosides and terpenes.[5]

Solanum xanthocarpum belonging to family Solanaceae commonly known as Yellow Berried Nightshade is a prickly diffuse bright green perennial herb, woody at the base, 2–3m height found throughout India. The fruits are known for several medicinal uses like anthelmintic, antipyretic, laxative, antiinflammatory, antiasthmatic and aphrodisiac activities. The stem, flowers and fruits are prescribed for relief in burning sensation in the feet accompanied by vesicular eruptions. The hot aqueous extract of dried fruits is used for treating cough, fever and heart diseases. The fruit paste is applied externally to the affected area for treating pimples and swellings. It contains several steroidal alkaloids like solanacarpine, solanacarpidine, solancarpine, solasonine and solamargine. Other constituents like caffeic acid coumarins like aesculetin and aesculin, steroids carpesterol, diosgenin, campesterol,

daucosterol and triterpenes like cycloartanol and cycloartenol were reported from the fruits. The antispasmodic, antitumor, cardiotonic, hypotensive, antianaphylactic and cytotoxic activities were also reported.[10]

MATERIALS AND METHODS

Solvents and chemicals used

Plant material and extraction procedure: Healthy, disease free, medicinal plant materials *Lawsonia inermis, Mimosa pudica*, *Cestrum diurnum* and *Solanum xanthocarpum* collected from herbal garden at Jamia Hamdard, New Delhi and they were taxonomically identified and the Voucher specimen has been stored. The plant material i.e. leaves were dried under shade with occasional shifting and then powdered with a mechanical grinder and stored in an airtight container. The powder obtained was subjected to extraction by taking powdered plant material in a macerating chamber using 80% methanol for extraction. After 2-3 days the solution was filtered and allowed to concentrate under vacuum. The extracts were evaporated on water bath until they become highly viscous syrup like substance. The extracts have been subjected to preliminary phytochemical screening for identifying plant metabolites like alkaloids, flavonoids, glycosides, saponins, tannins, sterols and terpenes.

Test microorganisms: Microorganisms used in the study include: gram +ve bacteria *Bacillus pumilus and Micrococcus luteus,* gram –ve bacteria *Escherichia coli and Pseudomonas aeroginosa* and a fungus *Candida albicans.*

Determination of antimicrobial activity: The extracts of the different plants were subjected to antimicrobial assay using the agar disc diffusion method. In this, different dilutions of extracts were prepared. Discs (6 *mm* diameter) of whatman filter paper were used. All the Petri dishes, medium and paper discs were sterilized using autoclave at 121◦C at 15 lbs for 15 minutes. Nutrient agar was poured into Petri plates and allowed to cool in a laminar hood with the precaution to avoid any sort of atmospheric contamination. When the medium got solidified, a loopful of freshly subcultured micro-organisms were spread on the surface of the plates separately. The paper discs impregnated with herbal extracts were placed carefully at the centre of Petri plates containing solidified nutrient agar. Then the Petri plates were kept in the incubator and allowed to incubate for specified time at 37^0C. After incubation the zone of inhibition for all the extracts was measured using vernier calliper.[2,3,7]

RESULTS

The results obtained by the present study revealed that herbal plant extracts posses potential antimicrobial activity against *Bacillus pumilus, Micrococcus luteus, Escherichia coli, Pseudomonas aeroginosa* and *Candida albican.*. When tested by agar disc diffusion method, the 70% methanolic leaf extract of *Lawsonia inermis, Mimosa pudica, Cestrum diurnum* and *Solanum xanthocarpum* showed activity against the stated microbes. Phytochemical analysis showed presence of alkaloids, tannins and flavonoids in *Lawsonia inermis*, alkaloids, flavonoids, glycosides, triterpenes and absence of tannins and sterols in *Mimosa pudica*, glycosides and terpenes in *Cestrum diurnum*, alkaloids, saponins and phytosterols in the *Solanum xanthocarpum* (Table 1).

The *Lawsonia inermis* 200mg/ml extract showed zones of inhibition of 0.64cm, 0.61cm, 0.8cm, 0.73cm, 0.71cm for *E.coli, P.aeroginosa, M.luteus, C.albicans, B.pumilus* respectively. The *Lawsonia inermis* 300mg/ml extract showed zones of inhibition of 0.8cm, 0.7cm, 1.35cm, 1.2cm, 1.32cm for *E.coli, P.aeroginosa, M.luteus , C.albicans, B.pumilus* respectively. The *Mimosa pudica* 200mg/ml extract showed zones of inhibition of 0.8cm, 1.1cm, 1.4cm, 1.5cm, 1.3cm for *E.coli, P.aeroginosa, M.luteus , C.albicans, B.pumilus* respectively. The *Mimosa pudica* 300mg/ml extract showed zones of inhibition of 1.3cm, 1.5cm, 1.6cm, 1.9cm, 1.6cm for *E.coli, P.aeroginosa, M.luteus , C.albicans, B.pumilus* respectively. The *Cestrum diurnum* 200mg/ml extract showed zones of inhibition of 0.9cm, 1.0cm, 0.8cm, 1.4cm, 1.0cm for *E.coli, P.aeroginosa, M.luteus , C.albicans, B.pumilus* respectively. The *Cestrum diurnum* 300mg/ml extract showed zones of inhibition of 1.2cm, 1.4cm, 1.3cm, 1.9cm, 1.2cm for *E.coli, P.aeroginosa, M.luteus , C.albicans, B.pumilus* respectively. The *Solanum xanthocarpum* 200mg/ml extract showed zones of inhibition of 0.5cm, 0.6cm, 0.7cm, 1.3cm, 0.8cm for *E.coli, P.aeroginosa, M.luteus , C.albicans, B.pumilus* respectively. The *Solanum xanthocarpum* 300mg/ml extract showed zones of inhibition of 0.7cm, 0.8cm, 1.0cm, 1.6cm, 1.2cm for *E.coli, P.aeroginosa, M.luteus , C. albicans, B.pumilus* respectively. (Table 2)

Table 1 Priliminary phytochemical screening of selected medicinal plants[6]

Plant constituent	LI	MP	CD	SX
Alkaloids	+	+	-	+
Flavanoids	+	+	-	+
Glycosides	-	+	+	-
Saponins	+	+	+	+
Tanins	+	-	-	-
Sterols	-	-	-	+
Triterpenes	-	+	+	-

Note: LI: Lawsonia inermis, MP: Mimosa pudica, CD: Cestrum diurnum and SX: Solanum xanthocarpum

Table 2 Zone of inhibition (in cm) for different dilutions of selected medicinal plant extracts

Extract concentrations	*B.pumilus*	*M.luteus*	*E.coli*	*P.aeroginosa*	*C.albicans*
CD 200mg/ml	1.0	0.8	0.9	1.0	1.4
CD300mg/ml	1.2	1.3	1.2	1.4	1.9
LI200mg/ml	0.71	0.8	0.64	0.61	0.73
LI300mg/ml	1.32	1.35	0.8	0.7	1.2
SX200mg/ml	0.8	0.7	0.5	0.6	1.3
SX300mg/ml	1.2	1.0	0.7	0.8	1.6
MP200mg/ml	1.3	1.4	0.8	1.1	1.5
MP300mg/ml	1.6	1.6	1.3	1.5	1.9
Standard					

Note: LI: Lawsonia inermis, MP: Mimosa pudica, CD: Cestrum diurnum and SX: Solanum xanthocarpum.

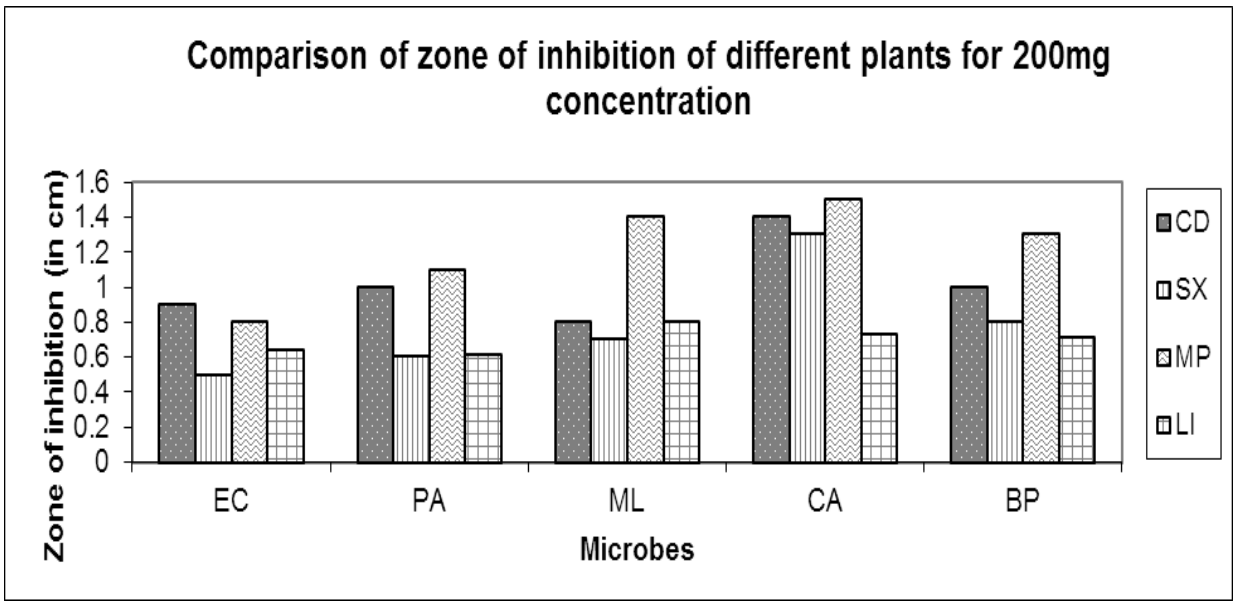

Figure 1 Graphical presentation of zone of inhibition (in cm) of selected medicinal plants for 200 mg concentration

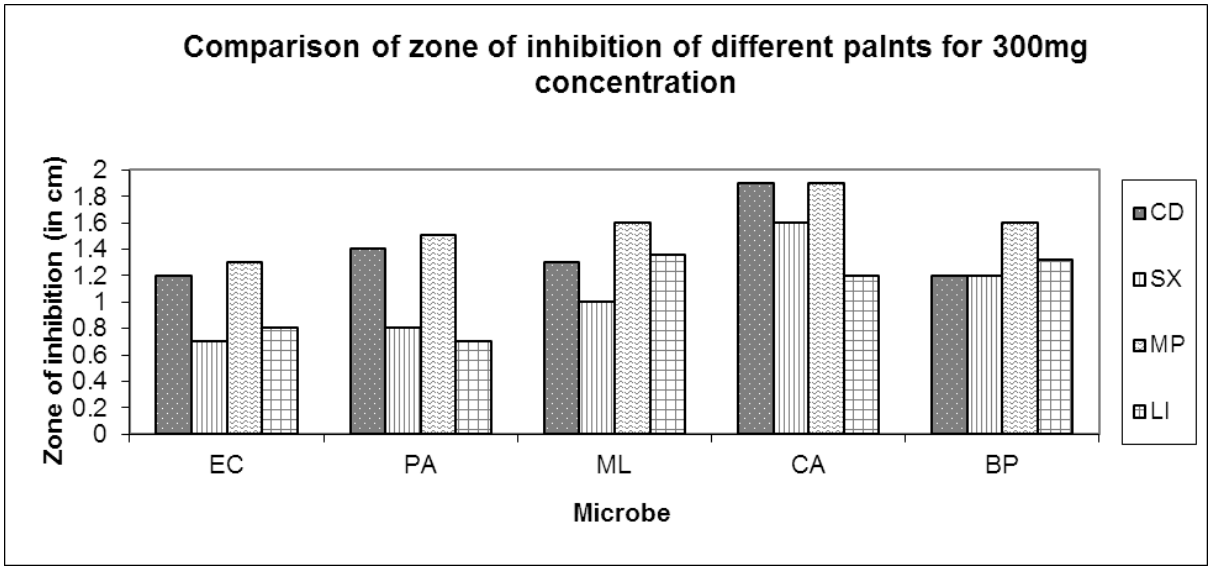

Figure 2 Graphical presentation of zone of inhibition (in cm) of selected medicinal plants for 300 mg concentration

DISCUSSION

Plants are an important source of potentially useful products for the development of new therapeutic agents. Many reports on antimicrobial activity of herbal plants are available. These reports give an idea of the antimicrobial potential of the medicinal plants. However, the idea of present study is to compare antimicrobial activity of plants: *Lawsonia inermis* , *Mimosa pudica* , *Cestrum diurnum and Solanum xanthocarpum* against *Escherichia coli, Micrococcus luteus, Candida albicans ,Bacillus pumilus* and *Pseudomonas aeroginosa,* about which not many reports have been found.

In the present study methanolic leaf extracts of *Lawsonia inermis* , *Mimosa pudica* , *Cestrum diurnum and Solanum xanthocarpum* were assayed by agar disc diffusion method against *Escherichia coli, Micrococcus luteus, Candida albicans ,Bacillus pumilus* and *Pseudomonas aeroginosa*. These plants have effectively proven their potential to inhibit microbial growth.
The results showed that *Cestrum diurnum* and *Mimosa pudica* displayed more antimicrobial activity as compared to *Solanum xanthocarpum* and *Lawsonia inermis*. This may be due to chemical constituents like alkaloids(mimosine) ,flavonoids , glycosides, triterpenes in mimosa pudica and saponins, phytosterols(names as listed in introduction) in *Solanum xanthocarpum*.

The results of present investigation clearly indicate that antibacterial and antifungal activity varies for different plants , also the source of plants determine the degree of activity because chemical constituents varies with the geographic source of collection of the plant.

Thus, the study righteously proves the use of herbal plants in the therapeutics. It thus serves as an encouragement towards development of new drugs for the benefit of mankind.

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