



Antibacterial and Antifungal Studies of *Mirabilis jalap* Leaf Extracts

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Abstract

Five different crude extracts: petroleum ether, chloroform, ethyl ether, ethanol and aqueous extract of *Mirabilis jalap* have been studied for both *in vitro* antibacterial and antifungal activities. The different extracts showed remarkable inhibitory action against various gram positive and gram negative bacteria and two fungal species. The methanolic extract of the leaves of *Mirabilis jalap* was screened for its antimicrobial activity. Antimicrobial activity was detected by observing the growth response of different organisms to the methanolic extract. It was generally based on the inhibition of growth of microorganisms which were measured with a desired concentration of the plant extract of *Mirabilis jalap* to be examined with the standard concentration preparation. Positive antifungal activity was observed with the methanolic extract against fungal organism *Candida albicans*.

Key words: Antibacterial, Antifungal, Methanolic extract, *Mirabilis jalap*

Introduction

Mirabilis jalap (Nyctaginaceae) is a traditional perennial herbaceous medicinal plant commonly known as Trisandhi or Four O'clock Flower. It is a perennial herb or undershrub plant with thickened and tuberous roots. Stems are swollen at nodes, leaves are ovate, cordate, flowers are arranged in clusters, funnel shaped, simple or double, fragrant with white, yellow, purple or red in colour. They have the tendency to change the colour accordingly. They are mainly purgative and are used as substitute or adulterant in the preparations. In powdered form, the root possess a distinct odour and is slightly acrid in taste. When the powder is moistened it is irritant to skin and mucous membrane. The roots contain resins (3%). The leaves and stems of the plant are reported to be cooked with pork and used as tonic. Bruised leaves are employed for poulticing abscesses [1]. The plant is used for its antitumour and virus inhibitory activity. The plant mainly contains triterpenes. Mirabilis Antiviral Protein was isolated from roots. It showed antiproliferative effect on tumour cells.

Miraxanthins I-IV, indicaxanthin and vulgaxanthin were isolated from flower part of the plant [2]. It has antifungal, antimicrobial, antiviral, antispasmodic, antibacterial, diuretic, carminative, cathartic, hydragogues, purgative, stomachic, tonic and vermifuge

Properties [3] this plant contains alamine, alphaamyrins, arabiose, beta-amyrins, campesterol, daucosterol and dopamine [4], and is used to treat conjunctivitis, edema, fungal infections, inflammation, pains and swellings. A survey of literature revealed no methodical reports on antibacterial and antifungal activity of various extracts of *Mirabilis jalap* leaves. The present study is therefore an attempt to assess efficacy of this indigenous herb in its different concentrations against various gram positive and gram negative bacteria and fungi.

Materials and Methods

Plant Material

The leaves of *Mirabilis jalap* were collected from the wild forest of Toranmal and were authenticated from proper sources bearing the specimen number PARC/2009/340.

Preparation of Various Extracts

Air-dried powdered leaves (1 kg) were exhaustively extracted by Soxhlet's apparatus successively by increasing order

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of polarity with petroleum ether, chloroform, ethyl acetate and ethanol. The aqueous extract was prepared by cold maceration of 250 g of the shade-dried leaf powder in 500ml of chloroform water (1:99) for 7 days. The various extracts obtained were filtered, concentrated, dried in vacuum and the residue stored in a refrigerator at 2-8° C for use in subsequent experiments.

Preliminary Phytochemical Screening

The dry extracts were subjected to various chemical tests [5, 6] to detect the presence of different phytoconstituents.

Antibacterial and Antifungal Studies

The various extracts were tested for their effect on gram +ve bacteria such as *Staphylococcus aureus*, *Bacillus subtilis* and gram – ve bacteria such as *Escherichia coli* and *Pseudomonas aeruginosa*. Fungi used for the present study were *Aspergillus niger* and *Candida albicans*. Minimum inhibitory concentration of the extracts was evaluated by cup plate diffusion method for antibacterial and antifungal activity [7, 8]. 0.1 ml of overnight grown nutrient broth culture of the bacteria was transferred aseptically to sterile glass Petri dish. Sterile molten nutrient agar (45 °C) was then poured, mixed uniformly rotating the plate and allowed to solidify. Cups were made out in the centre of the seeded nutrient agar plate using a sterile cork borer (6mm). The various extracts of the *Mirabilus jalap* leaf of different concentrations viz. 50, 100, 200, 400 mg/ml were made using dimethyl sulphoxide (DMSO) as a diluting solvent. The samples were added with a sterile micropipette to each of the cups. The plates were then incubated at 37 °C for 24 hrs. Plates with cups containing only DMSO served as a control. Antibacterial actions of various extracts were compared with the known antibiotic like Streptomycin. The diameters of the inhibitory Zones were

recorded after incubation and average values of these observations were recorded. Antibacterial activity of various extracts of *Mirabilus jalap* leaf is given in Table 1. In case of antifungal activity, the different fungal species were subcultured on sterile Sabouraud's broth. Suspensions of subcultured organisms were made following the above-mentioned procedure adopted for antibacterial activity. The plates of fungi were incubated at 25 °C for 3-4 days. Antifungal activity of various extracts of *Mirabilus jalap* is given in Table 2.

Results

The five different crude extracts viz. petroleum ether, chloroform, ethyl ether, ethanol and aqueous extract of *Mirabilus jalap* leaf were tested against various gram +ve and gram –ve bacteria. The results illustrated in Table 1 revealed the ethanolic extract of *Mirabilus jalap* as most active against *S.aureus*, *E.coli* and *P. aeruginosa* in the dilution of 100 mg/ml. The ethyl acetate and chloroform extracts showed less activity than ethanol extract, but showed more activity than Pet. ether and water extracts. Table 2 revealed that the ethanolic and chloroform extracts are more active against *C. albicans* and *A. niger*, whereas pet. ether and ethyl acetate showed moderate activity. No activity was found in aqueous extract.

Discussion

Preliminary phytochemical screening revealed the presence of alkaloids, carbohydrates, Flavonoids, phenols, steroids, saponins tannins and terpenoids. From the antimicrobial screening it was found that the most ethanolic extract of *Mirabilus jalap* possessed significant antibacterial and antifungal activity when compared with the other extracts and standard drugs.

TABLE 1
Antibacterial Activity of *Mirabilis jalap* Leaf Extract

Treatment	Conc. mg/ml	Zone of Inhibition (in mm)			
		Gram +ve		Gram -ve	
		<i>S. aureus</i>	<i>B. subtilis</i>	<i>E. coli</i>	<i>P. aeruginosa</i>
Pet. ether extract	50	10	08	09	07
	100	08	11	10	09
	200	10	09	12	11
	400	13	14	15	17
Chloroform extract	50	08	09	07	08
	100	10	10	08	10
	200	10	13	10	12
	400	12	16	11	13
Ethyl acetate extract	50	09	08	09	08
	100	12	11	08	10
	200	13	15	12	13
	400	17	19	13	15
Ethanollic extract	50	09	10	09	10
	100	13	16	14	13
	200	17	19	21	19
	400	22	20	23S	22
Water extract	50	07	09	08	09
	100	08	10	10	11
	200	10	11	12	12
	400	12	16	14	15
Streptomycin	100	24	22	20	20

TABLE 2
Antifungal Activity of *Mirabilis jalap* Leaf Extract

Treatment	Conc. mg/ml	Zone of Inhibition (in mm)	
		<i>C. albicans</i>	<i>A. niger</i>
Pet. ether extract	50	11	11
	100	12	13
	200	13	16
	400	19	18
Chloroform extract	50	09	11
	100	12	13
	200	15	18
	400	19	22
Ethyl acetate extract	50	09	11
	100	11	12
	200	15	16
	400	19	21
Ethanollic extract	50	09	10
	100	13	16
	200	18	21
	400	22	25
Water extract	50	08	07
	100	09	11
	200	08	07
	400	10	09
Amphotericin	10	21	22

Conclusion:

Thus, it can be concluded that while screening of various extracts of *Mirabilis jalap* leaf against various gram +ve and gram -ve bacteria and fungi, ethanol extracts exhibited very satisfactory inhibitory activity. Further studies involving the isolation, characterization and purification of the chemical compounds of the plant and screening for antibacterial and antifungal may result in the development of a potent entity which will be of lower toxicity and a high therapeutic value to the mankind. These activities may be due to the presence of phytoconstituent present in the extract and the exact constituent responsible for the activity can be confirmed with the help of isolation techniques.

REFERENCES

- [1] The wealth The Wealth of India (Anonymous), Vol. II; B, Publications and Information Directorate, New Delhi, 2005.
- [2] Khare, C. P., *Encyclopedia of Indian Medicinal Plants*, Springer Verlag Berlin Heidelberg, New York, 2004.
- [3] Dimayuga, R. E., *Pharmaceutical Biol.* 1998, 36, 33-43.
- [4] Yang, S. W., *J Nat Prod.* 2001, 64, 313-17.
- [5] Kokate, C.K., *Practical Pharmacognosy*, Vallabh Prakashan, New Delhi, 1994.
- [6] Harborne, J.B., *Phytochemical Methods*, Chapman and Hall, London, 1998.
- [7] Paech, K. and Tracey, M.V., (Eds.) (1955). *Modern Methoden der Pflanzenanalyse*, Vol. III. Springer Verlag, Berlin, p.626.
- [8] Spooner, D.F., and Sykes, G., (1972). *Methods in Microbiology*, Vol. VII B, Academic Press, London and New York, p. 216.