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Antibiotic nature of an alkaloid and flavonoids from *Solanum dulcamara* L.

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Abstract: The alkaloid β-solamarine (mp 250^0 C) from *Solanum dulcamara* Linn have shown pronounced activity against selected fungi (*Trichophyton rubrum*, *T. mentagrophytes*, *Microsporum gypseum* and *Candida albicans*) and crude flavonoids have shown activity against bacteria (*Escherichia coli*, *Enterobacter aerogens*, *Proteus mirabilis* and *Staphylococcus aureus*). Free flavonoids were found active against *P.* mirabilis and *Staphylococcus aureus* but no activity was observed against E. coli and E. aerogens. However bound flavonoids were found active against all the four bacteria tested. Maximum amount of alkaloid was isolated from roots (0.032 mg g^{-1} dry wt), followed by stem (0.027 mg g^{-1} dry wt), leaves (0.022 mg g^{-1} dry wt), flowers (0.005 mg g^{-1} dry wt) and berries (0.001mg g^{-1} dry wt).

Key words: *Solanum dulcamara*, Flavonoid, Antimicrobial activity, β-solamarine

Introduction

Dermatophytoses poses a serious problem to the socio economically backward population. Superficial infections caused by keratinophilic fungi are called ring worm infections or Tinea infection (Powell, 1900). The disease is pre-dominant in tropical to subtropical regions of the world due to their prevailing moisture and temperature conditions which further aggravate the problem (Venugopal and Venugopal, 1994a,b, 1995). Similarly, problems also develop due to bacterial diseases in the prevailing areas mentioned earlier. Due to various side effects and high cost of synthetic drugs, interest has been infested in the use of herbal medicine which has been reported to have no side effects (Kishore and Dubey, 1988). Recently some products of higher plant origin have been shown to be an effective source of chemotherapeutic agent, with no adverse side effects and with pronounced antimicrobial activity. Secondary metabolites, specifically alkaloids of plant origin have been reported to have a powerful effect on the physiology of animals and have served men as medicine since earliest time (Ramawat, 2000).

Plants of solanaceae family are well known for their potential metabolite contents but yet the work is fragmentary and more study is required to be done in this regards. In the present study attempts have been made to extract and study the antidermatophytic and antibacterial activity of an alkaloid and crude flavonoids from *Solanum dulcamara* L. respectively.

Materials and Methods

Plant material: In the present studies, the plant material of *Solanum dulcamara* L. was collected from Mount Abu Rajathan and has been identified with the help of departmental Herbarium of Botany Department, University of Rajathan, Jaipur. Different parts of the plants (root, stem, leaves, flower and berries) were washed, shade dried and powered for extraction of alkaloid and flavonoids.

Test microorganisms

Dermatophytes: *Trichophyton rubrum* (Castellan Sabourad), *T. mentagrophytes* (Robin Blanchard), *Microsporum gypseum* (Bodin Gujrat and Crigorakis) and *Candida albicans* (Berkhout).

Bacteria: *Escherichia coli*, *Enterobacter aerogens*, *Proteus mirabilis* and *Staphylococcus aureus*.

Test microorganisms were procured from SMS Medical College, Jaipur and/or IMTECH, Chandigarh. Dermatophytes were maintained on SDA (Sabaraud dextrose agar) medium whereas bacteria were maintained on NA (Nutrient agar) medium.

Test extracts: Extraction of alkaloid and flavonoids was carried out by well established methods of Harborne (1984), Subramanian and Nagarajan (1969) respectively. Alkaloid (β-solamarine) was identified through TLC, PTLC, melting point and IR spectral studies.

Biological screening: Identified alkaloid from roots (containing maximum alkaloid content) was screened against selected dermatophytes whereas crude flavonoids were screened against bacteria (Gram+ve and Gram - ve) using the filter paper disc method (Gould and Bowie, 1952; Jain and Sharma, 2003). Sterile discs were impregnated with selected amount of extract and standard antibiotics separately. Discs were placed on inoculated agar plates and were kept for incubation at 37^{o}C for 24 hr for bacteria and 28^{o}C for 48 hr for fungi. Standard antibiotics Griseofulvin, Ketoconazole and Nystatin were selected for antifungal activity, whereas Streptomycin and Gentamycin for antibacterial activity. Studies were carried out in triplicate, inhibition zones were measured and average value of activity index was calculated as follows:

Activity index = Inhibition zone of sample / inhibition zone of standard.

Results and Discussion

During experimental studies, an alkaloid (m.p. 250^{o}C) was isolated from different parts (root, stem, leaves, flowers and berries of *Solanum dulcamara*). The maximum amount of alkaloid was isolated from root (0.032 mg g^{-1} dry wt.), followed by stem (0.027 mg g^{-1} dry wt.), leaves (0.022 mg g^{-1} dry wt.), flowers (0.005 mg g^{-1} dry wt.) and berries (0.001 mg g^{-1} dry wt.) mentioned in Table 2. Steroidal alkaloids have been isolated from tissue culture of *S. dulcamara.* These alkaloids were identified as soladulcidine, slasodine (Emike and Eilert, 1986). Solanine have also been isolated and identified from *S. dulcamara* (Khanna *et al.*, 1988). In the present study β-solamarine was isolated and identified from different parts of selected plant.

The alkaloid showed antidermatophytic activity against all the four dermatophytes studies and were compared with their

Table - 1: Antimicrobial activity of flavonoids and alkaloids of *Solanum dulcamara*

Test compounds → / Test microorganism ↓	Free Flavonoids		Bound Flavonoids		β-solamarine	
	IZ	AI	IZ	AI	IZ	AI
T. rubrum	ND	-	ND	-	70	2.8
T. mentagrophytes	ND	-	ND	-	76	2.17
M. gypseum	ND	-	ND	-	80	2.85
C. albicans	ND	-	ND	-	40	2.00
E. coli	-ve	-	24	0.96	ND	-
E. aerogenes	-ve	-	15	0.75	ND	-
P. mirabilis	10	0.4	28	1.12	ND	-
S. aureus	13	0.86	38	2.53	ND	-

IZ: Inhibition zone (mm, including 6 mm diameter of disc), AI: Activity Index, IZ of standard drug streptomycin against *E. coli*: 25 mm; *P. mirabilis*: 25 mm; *E. aerogenes*: 20 mm; *S. aureus*: -ve; IZ of standard drug gentamycin against *S. aureus*: 15 mm; IZ of griseofulvin against *T. rubrum*: 70 mm, *M. gypseum* 28 mm; ketoconazole against *T. mentagrophytes*: 35 mm; nystatin against *C. albicans*: 20 mm

Table - 2: Alkaloid (mg g^{-1} dry weight) from different parts of *Solanum dulcamara*

Plant parts	Alkaloid content
Roots	0.032± 0.001
Stems	0.022± 0.002
Leaves	0.022± 0.001
Flowers	1 0.005± 0.031
Berries	0.001± 0.000

The values are mean of three replicate ±SE

standard drugs commonly in use as their control. Griseofulvin for infections caused by *T. rubrum* and *M. gypseum*, Ketoconazole for *T. mentagrophytes* and Nystatin for *Candida albicans*. Best efficacy was observed against *M. gypseum* with inhibition zone much larger than that of standard Griseofulin. *T. mentagrophytes* was the second most susceptible fungi to the alkaloid. Its inhibition zone was quite larger than inhibition zone of standard Ketoconazole. Similarly, inhibition zone produced for *T. rubrum* was much larger than inhibition zone of standard Griseofulvin. The least susceptible fungus to the alkaloid was *C. albicians* but still showed good response as compared to the standard Nystatin. In this case the inhibition zone of *C. albicians* was just double than that of standard Nystatin (Table 1).

Anti-inflammatory activity of *S. dulcamara* has been demonstrated by Tunon *et al*. (1995). Antibacterial activity of aqueous extracts of *S. dulcamara* has been shown by Turker and Usta (2008). Anti-microbial studies of aqueous and ethanol extracts of stem, leaves, flowers and roots from *S. dulcamara* was carried out by Borcherdt *et al*. (2008). Various crude extracts from *S. dulcamara* have also been evaluated for antibacterial activity (Babu *et al*., 2007).

Resultsof the present antibacterial study reveal that free flavonoids showed positive response against *P. mirabilis* and *S. aureus* whereas response shown by *Escherichia coli* and *Enterobacter aerogens* was almost negative. However, bound flavonoids showed better results against all the test bacteria. Inhibition zones were almost equal (*E. coli* 24mm, *E. aerogens* 15mm) or more (Proteus mirabilis 28 mm, *Staphylococcus aureus* 38mm) as compared to the Streptomycin (*E. coli* 25mm. *P. mirabilis* 25 mm *E. aerogenes* 20 mm and S. aureus - nil) and Gentamycin against *S. aureus* (15mm).

Though plants have been evaluated for antimicrobial properties but in most of the studies crude extracts were taken for the testing. In the present investigation flavonoids and an alkaloid β-solamarine from the plant, were tested for antibiotic potential. Moreover, antidermatophytic properties of the plant have been explored for the first time in the present study.

The study confirms the pronounced antidermatophytic and antibacterial activity of the alkaloid and flavonoids, of *S. dulcamara* respectively which might be the source of future drug for dermatophytic and bacterial diseases without any side effects and would be more cost effective than the existing drugs.

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References

Babu, S., Satish, S., Mohana, D.C., Raghvendra, M.P. and Raveeshankar : Antibacterial evaluation and phytochemcial analysis of some Iranian medicinal plants against plant pathogenic *Xanthomonas pathovars*. *J. Agric. Technol.*, **3**: 307-316 (2007).

Bhadauria, S.and Kumar, P.: Effect of plant extracts of two medicinal plants against Candida albicans. Flora & Fauna 5:95-96 (1999).

Borchardt, J.R., Wyse, D.L., Sheaffer, C.C., Kauppik, L., Fulches, R.G. and Ehlke, N.J.: Antimicrobial activity of native and neutralized plants of Minnesota and Wisconsin. *J. Med. Plant Res.,* **205**: 98-110 (2008).

Datta, B. K., Rahman, I. and Das, I.K.: Antidermatophytic effect of pyrogallo. Geobios 25:152-154 (1998).

Emike, A. and Eilert, U. : Steroidal alkaloids in tissue cultures and regenerated plants of *S. dulcamara*. *Plant Cell Reports*, **5**: 31-34 (1986).

Gould, J.C. and Bowie, J.H.: The determination of bacterial sensitivity of antibiotic. *Edinib. Med. J*., **59**:178-180 (1952).

Harsh M.L. and T.N. Nag: Antimicrobial principles from in vitro tissue culture Lloydia 4:365-368 (1984).

Harborne, J.C.: Phytochemical Methods: A guide to Modern Techniques of Plant Analysis, 2nd Edn., Chapman and Hall Ltd., London, New York (1984).

Jain, N. and Sharma, M. : Broad spectrum antimycotic drug for the treatment of ringworm infection in human beings. *Curr. Sci.,* **85**:30-34 (2003).

Khanna, P., Kumar P. and Singhvi, S.: Isolation and characterization of solanine from *in vitro* tissue cultures of *S. tuberosum* L. and *S. dulcamara* L. *Ind. J. Pharmaceutical Sci.,* **50**: 38-39 (1988).

Kishore, N. and Dubey, N.K.: Fungitoxicity of some higher plants against *Trichophyton rubrum* and *Epidermophyton floccosum*. *Ind. J. Pharma. Sci.,* **50:** 323-325 (1988).

Powell, A.: Ringworm in Assam Indian. *Med. Gaz.,* **35**: 109 (1900).

Ramawat, K.G. and Merillon, J.M.: Biotechnology Secondary Metabolites. Oxford and IBH Publishing Co. Pvt Ltd. New Delhi (2000).

Subramanian, S.S. and Nagarjan, S.: Flavonoids of the seeds of *Crotolaria retusa* and *Crotolaria striata*. *Current Science*, **38**: 65 (1969).

Turker, A.V. and Usta, C.: Biological screening of some Turkish medicinal plant extracts for antimicrobial and toxicity activities. *Nat. Prod. Res.*, **22**: 136-146 (2008).

Tunon, H., Olavsdottes, C. and Bohlin, L.: Evaluation of anti inflammatory activity of some Swedish medicinal plants. Inhibition of prostaglandin biosynthesis and PAF - induced exocytosis. *J. Ethnopharmacol.*, **48**: 61-76 (1995).

Venugopal, P.V. and Venugopal, T.V.: Antidematophytic activity of neem (*Azadirachta indica*) leaves *in vitro*. *Ind. J. Pharmacol.*, **26**: 141-143 (1994a).

Venugopal, P.V. and Venugopal T.V.: Antidermatophytic activity of allylamine derivatives. *Ind. J. Pathol - Microbiol.*, **37**: 381-388 (1994b).

Venugopal, P.V. and Venugopal, T.V.: Antidermatophytic activity of garlic, (*Allium sativum*) *in vitro*. *Int. J. Derm.*, **34**: 278-279 (1995).