International Journal of Pharmacy and Pharmaceutical Sciences

ISSN- 0975-1491 Vol 8, Suppl 1, 2016

Full Proceeding Paper

STUDY OF ANTIBACTERIAL ACTIVITY OF RESINS OF BOSWELLIA SERRATA ROXB EX COLEBR., COMMIPHORA MUKUL (HOOKS EX-STOCKS) ENGL., GARDENIA RESINIFERA ROTH. AND SHOREA ROBUSTA GAERTN

SMITA HENRY GAUREA, UJWALA CHINTAMANI BAPAT

St. Xavier's College, Mumbai, India
Email: smitagaurea@gmail.com

Received: 19 Nov 2015 Revised and Accepted: 12 Feb 2016

ABSTRACT

Objective: To evaluate the antibacterial activity of the resins of *Boswellia serrata*, *Commiphora mukul*, *Gardenia resinifera*, *Shorea robusta* against Gram-positive bacteria namely *Bacillus cereus* and *Staphylococcus aureus* and Gram-negative bacteria namely *Proteus vulgaris* and *Esherichia coli*.

Methods: Resin samples (20%) were separately prepared in ethanol, DMSO, acetone and chloroform by overnight soaking 2 g of sample in 10 ml of solvent, filtered next day and were tested for the antibacterial activity by following standard method (well diffusion). The MIC was determined for the samples exhibiting+ve activity.

Results: The study revealed that resin of *Shorea* did not inhibit the growth of both Gram+ve and Gram-ve bacteria. The resin of *Boswellia* and *Commiphora* showed activity against *B. cereus* and the MIC was found to be 20 mg/ml and 200 mg/ml respectively. Resin of *Gardenia* exhibited activity against *B. cereus* (MIC–20 mg/ml and *S. aureus* (MIC–100 mg/ml).

Conclusion: *Shorea* did not have any antibacterial activity. The resins of *B. serrata*, *C. mukul*, and *G. resinifera* exhibited activity against Gram-positive bacteria; comparable to standard antibiotic amoxicillin, but they did not have the activity against Gram-negative bacteria. The maximum zone of inhibition (ZOI) was observed against *B. cereus* by *Boswellia serrata* resin sample prepared in ethanol.

Keywords: Resins, *Boswellia serrata*, *Commiphora mukul*, *Gardenia resinifera*, *Shorea robusta,* antibacterial activity, Gram positive, Gram negative

INTRODUCTION

Resins are found as exudations from the trunk of various trees. They are amorphous mixtures of essential oils, oxygenated products of terpenes and carboxylic acids and are insoluble in water. They probably play a role in plant defense mechanisms [1]. Resins usually dissolve in alcohol, ether or carbon disulphide and other solvents and are chemically related to terpenes or essential oils. The literature survey indicates that resins obtained from the plants belonging to families Dipterocarpaceae [2], Burseraceae [3] and Rubiaceae [4] are traditionally used for rheumatism, obesity, dysentery, etc. Sridhar *e. al* (2012) reported significant anticancer activity of *Gardenia resinifera (G. resinifera)* resin [5]. Although resins of *Boswellia serrata* (*B. serrata*) [6, 7] *Commiphora mukul* (*C. mukul*) [8], *Gardenia resinifera* [5] and *Shorea robusta* [9] have been reported to have medicinal properties, these resins have not been sufficiently explored for their biological activity. The present study aims to evaluate and compare the antibacterial activity of resins of *B. serrata*, *C. mukul*, *G. resinifera* and *S. robusta*. A detailed study of these resins may reveal information on their possible use in medicines.

MATERIALS AND METHODS

Collection of plant resins, authentication, and their morphological studies

The resins and the twigs of the plants were collected from wild. *B. serrata* and *C. mukul* were collected in spring from Jambughoda sanctuary, Gujarat. The resin of *G. resinifera* was collected in winter and summer from Borivali National Park, Mumbai and that of *S. robusta* in winter from Panchmari, Madhya Pradesh.

The plant specimens were identified and authenticated at Blatter Herbarium, Mumbai. The accession numbers of the respective herbarium specimens along with their collector's names are given below:

1. *B. serrata*–specimen no.19722 of E. Blatter
2. *C. mukul*-specimen no.10370 0f H. Santapau
3. *G. resinifera*–specimen no.404a of Y. A. Merchant
4. *S. robusta*–specimen no.976 of Y. A. Merchant

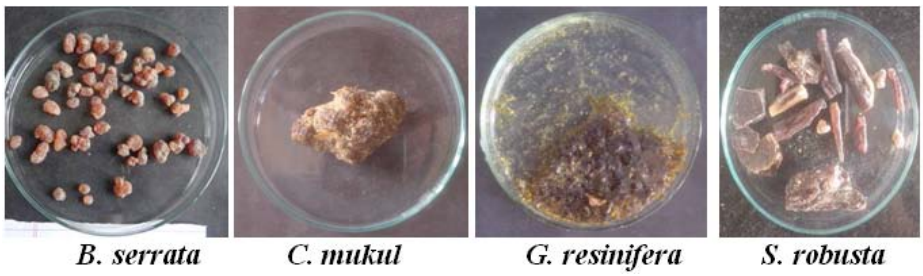

Fig. 1: Resins of *B. serrata*, *C. mukul*, *G. resinifera* and *S. robusta* (Images of plant resins taken in laboratory)

Preparation of resin samples

The resin samples were prepared by soaking separately 2 g each of resin in 10 ml of different solvents viz. ethanol, DMSO, acetone, and chloroform, overnight to obtain 20% extracts. The solutions were then filtered through Whatman no. 1 filter paper and the filtrates (resin samples) were used to test the antibacterial activity.

Antibacterial activity

The organisms [Gram-ve bacteria, *Escherichia coli* (NCIM No. 2931) and *Proteus vulgaris* (NCIM No. 2813), and Gram+ve *Staphylococcus aureus* (NCIM No. 5021) and *Bacillus cereus* (NCIM No. 2106)] were obtained from National Collection of Industrial Microorganisms (NCIM), National Chemical Laboratory (NCL), Pune. Nutrient agar used was from Himedia Laboratories Pvt. Ltd. Among the different methods tried to obtain mat growth and to test the antimicrobial activity of the samples, the spread plate method using a cotton swab and well diffusion method showed good results. Hence, further studies were carried out using these methods. 20 µl of the sample, solvent (served as a negative control) and amoxycillin [(10 mcg/disc) obtained from Hi-Media (served as a positive control)] were added separately in different wells made in the plates spread with the organism. The plates were incubated at 37°+2 °C for 24 h. and the diameter of the zone of inhibition (ZOI) was measured after 24 h. The MIC was determined for the samples to exhibiting+ve antibacterial activity (inhibiting the growth of the organisms i.e. ZOI>10 mm). Resin samples (20 %) were diluted with the respective solvents to obtain 5, 10 and 15% concentrations. The samples were further diluted to get the required dilutions ranging from 0.5 to 4%. The MIC was determined by testing the diluted samples using spread plate [11] and well [12] methods. The experiments were replicated thrice for confirmation of results.

RESULTS AND DISCUSSION

The resin samples prepared in different solvents when tested for their antibacterial activity showed following results.

a) *Boswellia serrata*

The resin samples of *B. serrata* prepared in different solvents did not show inhibition of growth of *E. coli*, *P. vulgaris* and *S. aureus*. However samples prepared in Ethanol and acetone inhibited the growth of *B. cereus* (fig. 2).

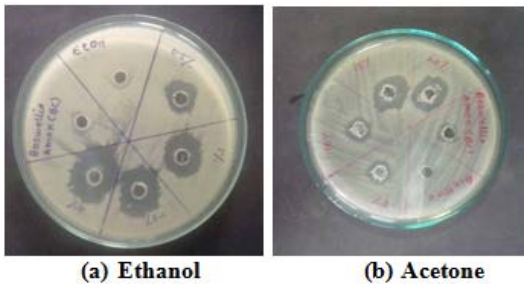

Fig. 2: Antibacterial activity of resin samples of *Boswellia serrata* against *B. cereus*

Both the samples showed the ZOI greater than that of amoxicillin. Among the two samples, the Ethanol sample showed greater ZOI than that of acetone sample. The ZOI obtained with increasing concentrations from 5 to 20 % of Ethanol sample, showed no statistically significant difference. Hence, the lower concentrations of the samples were tested against *B. cereus*. The lower concentrations are ranging from 1 to 5 % also showed similar results. Further dilutions of the sample were made to obtain 0.5 to 2.0 % and were tested for the antibacterial activity. The results exhibited a statistically significant increase in the ZOI as the concentration increased from 0.5 to 2.0 %. Hence, the MIC of the Ethanol sample for *B. cereus* was 20 mg/ml.

B. serrata resin essential oil has been reported to have considerable inhibitory effect against tested organisms [7]. This is in contrast to the results obtained by the investigators except for *B. cereus*. Rajendra *et al.* (2013) and Hasson et. al (2011) also observed significant antibacterial activity against *S. aureus* and *E. coli* [13, 6]. Moderate activity of this resin against *E. coli, S. aureus* and *Proteus sp*. was observed by Shareef [14].

b) *Commiphora mukul*

The resin sample of *C. mukul* prepared in EtOH, acetone, and DMSO did not inhibit the growth of said bacteria; whereas, the sample prepared in chloroform exhibited the antibacterial activity against *B. cereus.* Since there was a statistically significant increase in the ZOI as the concentration of the sample was increased from 5 to 20 %, the MIC was found to be 200 mg/ml against *B. cereus.* (fig. 3). Ishnava *et al.* (2010) obtained significant antibacterial activity against Gram-positive and moderate activity against Gram-negative bacteria [15]. Abdallah *et al.* (2009) also reported antibacterial activity of methanolic and ethyl acetate extracts against *S. aureus*; but no activity in petroleum ether and aqueous extracts [8].

Fig. 3: Antibacterial activity of resin samples of *Commiphora mukul* against *B. cereus*

c) *Gardenia resinifera*

The resin samples of *G. resinifera* prepared in different samples exhibited the inhibition of growth of *B. cereus* and *S. aureus*. When compared, the samples prepared in ethanol and DMSO exhibited the greater ZOI. Hence, the MIC of these samples against *B. cereus* and *S. aureus* was determined. The statistical analysis indicated that the MIC for ethanol and DMSO samples were 2 mg/ml against *B. cereus* and 100 mg/ml against *S. aureus* (fig. 4.).

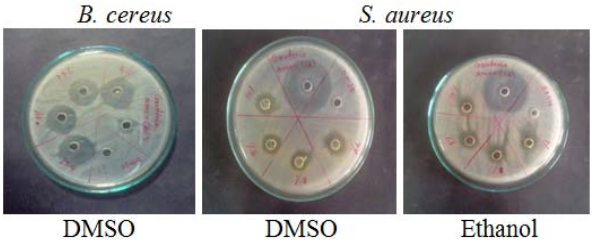

Fig. 4: Antibacterial activity of resin samples of *Gardenia resinifera* against *B. cereus* and *S. aureus*

d) *Shorea robusta*

The resin samples of *Shorea robusta* prepared in different solvents did not inhibit the growth of organisms tested. However, Murthy *et al.* (2011) had reported a strong and broad spectrum of antibacterial activity of oleoresin of *Shorea robusta against* a *number of* pathogenic organisms [19].

CONCLUSION

Present study reveals that the resin samples of *Boswellia serrata* prepared in ethanol and acetone (MIC–20 and 200 mg/ml respectively), of *Commiphora mukul* prepared in chloroform (MIC–200 mg/ml) and of *Gardenia resinifera* prepared in ethanol and

DMSO (MIC-20 mg/ml) significantly inhibited the growth of *B. cereus*. The ethanol and DMSO (MIC-100 mg/ml) samples of the resin of *Gardenia resinifera* also exhibited antibacterial activity against *S. aureus*. The resin samples of *Shorea robusta* did not possess antibacterial activity. Thus, these resins (except *S. robusta*) may be used as drugs after testing their cytotoxicity (if any) in order to assess their tolerance.

CONFLICT OF INTERESTS

There is no conflict of interest among authors of this publication

ACKNOWLEDGEMENT

Thanks to the Principal, St. Xavier's college for providing the facility and Mr. Anil and Santosh for helping in collecting the resin from plants.

REFERENCES

1. Murthy TK. Minor forest produces used in pharmaceutical and other industries. Hyderabad: Pharma Med Press; 2010.
2. Nadkarni KM. The Indian Materica Medic. Vol. I. 3rd ed. Ahmedabad: Popular Prakashan; 1976.
3. Joshi SG. Medicinal plants. New Delhi, Calcutta: Oxford and IBH publishing Co. Pvt. Ltd.; 2000.
4. National Institute of Science Communication, CSIR (IN). The Wealth of India-A Dictionary of Indian Raw materials and Industrial Products. Vol. IV. New Delhi: CSIR; 1976.
5. Sridhar PG, Harikiran L, Appa RA, Narsimha RN. Evaluation of anticancer activity of Dikamaliartane-A, A Cycloartane isolated from dikamali, a gum resin. Int J Pharm Pharm Sci 2012;4:501-4.
6. Hasson SS, Al-Balushi MS, Sallam TA, Idris MA, Habbal O, Al-Jabri AA. *In vitro* antibacterial activity of three medicinal plants-*Boswellia* (Luban) species. Asian Pac J Trop Biomed 2011;1: S178-S182.
7. Alam M, Khan H, Samiullah L, Siddque KM. A review on Phytochemical and pharmacological studies of Kundur (*Boswellia serrate* Roxb ex Colebr.)–A Unani drug. J Appl Pharm Sci 2012;2:148-56.
8. Abdallah EA, Khalid AS, Ibhrahim N. Antibacterial activity of oleo-gum resins of *Commiphora molmol* and *Boswellia papyrifera* against methicillin-resistant *Staphlococcus aureus* (MRSA). Sci Res Essay 2009;4:351-6.
9. Murthy KSR, Lakshmi N, Ramulu DR. Biological activity and phytochemical screening of the oleoresin of *Shorea robusta* Gaertn. f. Trop Subtrop Agroecosyst 2011;14:787-91.
10. Kokate CK, Purohit AP, Gokhale SB. Pharmacognosy. 46th ed. Pune: Nirali Prakashan; 2007.
11. Mahadlek J, Phachamud T, Wessapun C. Antimicrobial studies of *Sonneratia caseolaris* using different agar diffusion method. Res J Pharm Biol Chem Sci 2012;3:404-10.
12. Ramakrishnan G, Kothari R, Jayakar B, Venkata Rathnakumar T. *In vitro* antibacterial activity of different extracts of leaves of *Coldenia procumbens*. Int J PharmTech Res 2011;3:1000-4.
13. Rajendra CE, Harish Kumar DH, Yeshoda SV, Mahaboob Ali Nadaf, Hanumanthraju N. Comparative evaluation of antimicrobial activities of methanolic extract of *Curcuma longa* and *Boswellia serrata*. Int J Res Pharm Chem 2013;3:534-6.
14. Shareef Ali A. Evaluation of antibacterial activity of essential oils of *Cinnamomum* sp. And *Boswellia* sp. J Basrah Res (Sci) 2011;37:60-70.
15. Ishnava KB, Mahida YN, Mohan JSS. *In vitro* assessments of antibacterial potential of *Commiphora* wightii (Arn.) Bhandari. gum extract. J Pharmacogn Phytother 2010;2:91-6.