Journal of Bioresource Management

Volume 4 | Issue 3 Article 1

Divulging the Antimicrobial and Antidiabetic Potential of Bombax ceiba L.

Hafiz Tahsin Ullah Jan
Department of Pharmacy, Quaid-i-azam University, Islamabad, Pakistan, hafiztahsinullahjan@gmail.com

Syeda Saniya Zahra
Department of Pharmacy, Faculty of Biological Sciences, Quaid-i-Azam University (45320), Islamabad, Pakistan, saniya166@gmail.com

Bakht Nasir
Department of Pharmacy, Faculty of Biological Sciences, Quaid-i-Azam University (45320), Islamabad, Pakistan, bakhtnasir61@yahoo.com

Muhammad Waleed Baig
Department of Pharmacy, Quaid-i-Azam University ISlamabad, Pakistan, mwbg7@yahoo.com

Madiha Ahmed
Shifa College of pharmaceutical sciences, Shifa tameer-e-millat university,Islamabad, Pakistan, pharmacist_madiha@hotmail.com

Recommended Citation

Jan, H., Zahra, S. S., Nasir, B., Baig, M., & Ahmed, M. (2017). Divulging the Antimicrobial and Antidiabetic Potential of Bombax ceiba L., *Journal of Bioresource Management, 4* (3).
DOI: 10.35691/JBM.7102.0073
ISSN: 2309-3854 online

Divulging the Antimicrobial and Antidiabetic Potential of Bombax ceiba L.

J. Bioresource Manage. (2017) 4(3): 1-6.

DIVULGING THE ANTIMICROBIAL AND ANTIDIABETIC POTENTIAL OF *BOMBAX CEIBA* L.

Hafiz Tahsin Ullah Jan[1], Saniya Zahra[1], Bakht Nasir[1], Muhammad Waleed Baig[1] and Madiha Ahmed[2]*

[1]Department of Pharmacy, Faculty of Biological Sciences, Quaid-i-Azam University (45320), Islamabad, Pakistan
[2]Shifa College of Pharmaceutical Sciences, Shifa Tameer-e-Millat University, Islamabad, Pakistan
* Corresponding Email: pharmacist_madiha@hotmail.com

ABSTRACT

Current study is intended to investigate the antimicrobial and antidiabetic potential of *Bombax ceiba* L. Antileishmanial potential was assessed via MTT colorimetric method while antifungal activities were found out through disc diffusion method. The antidiabetic potential was investigated by α-amylase inhibition assay. Considerable antifungal activity (in the range of 10-12 mm ZOI) was demonstrated by CH: M extracts of both flower and stem bark, and CH extract of root bark against *A. niger* Whereas M: EA, AC extracts of leaf, EA extract of stem bark, NH, CH:E, M:EA extracts of root bark and NH extract of root wood exhibited the antifungal potential (ZOI from 10-12 mm) against *F. solani*. The most potent α-amylase inhibitory activity was shown by EA extract of leaf part with 66.69 ± 0.95% inhibition (IC_{50} 190 ± 4.5 µg/ml). Selected plant is a potential source of antileishmanial, antifungal and antidiabetic agents. This information can be further utilized for the purpose of bioactivity guided isolation of biologically active principles of *B. ceiba* L.

Key Words: *Bombax ceiba* L., Folklore, Antidiabetic, Antimicrobial.

INTRODUCTION

The antimicrobial properties of plants are known since ancient times, while efforts to validate these properties started from early 1900s.Traditional approaches are being adopted against microbial diseases. Antimicrobial properties of various plants have been estimated previously. Evaluation of antimicrobial potential of folklore plants has attracted the attention of researchers (Dorman, 1999). The management of diabetes is a universal challenge because successful cure of this disease has not been discovered yet. Multiple medicines have been formulated but none of the patients have been completely cured from diabetes. Moreover, these medications produce various unwanted effects. Thus, an increasing trend has been found towards folklore plants. The traditional medicines have been found as potential candidates for management of diabetes (Malviya et al., 2010). Undertaken study intends to investigate the antimicrobial and antidiabetic potential of a folklore plant, *Bombax ceiba*

L.“*Bombax*” (Greek word; silkworm) “*ceiba*” (silk cotton tree) is a medicinal plant locally called “Sumbal” in Pakistan (Family *Bombacaceae*). It is a fast growing, strong tree which attains about 40 m of height (Gupta , 2012; Sint et al., 2013). In December, it sheds all leaves and in January it blossoms into bright crimson flowers. It grows best in valleys and in regions where rainfall is about 60 to 450 cm annually (Rameshwar et al., 2014). *B. ceiba* L. is a tropical and subtropical tree native to South and East Asia, Indian subcontinent, western Africa and Northern Australia. It is naturally distributed in Myanmar, Pakistan, India, Taiwan, China, Moluccas, Philippine, Java, Borneo, Sulawesi, Lesser Sunda Island, and New Guinea (Sint et al., 2013). All old systems of medicine such as Ayurveda, Unani, Siddha and traditional Chinese system of medicine contain its marked traditional uses (Ravi et al., 2010). This study aims to provide scientific evidence for the profound background of ethnobotanical uses and also compare some vital chemical constituents present in various parts of *B. ceiba* L. Previously, the studies reported antidiabetic (Tiwari and Rana, 2015) antianemial (Kalita et al., 2015) hepatoprotective (Ravi et al., 2010), antilithiatic (Shelke et al., 2014), *in vitro* anti-inflammatory (Rameshwar et al., 2014)**,** antimicrobial (Krishnaraju AV et al., 2005), hypotensive (Saleem et al., 2003) and antipyretic activities (Hossain et al., 2011) of *B. ceiba* L. In folklore medicine, it is utilized for nocturnal emission, blood purification, semen problems, over bleeding in menstruation, leucorrhoea, skin blemish, acne, pigmentation, weakness, wounds, improve breast milk, cold and cough (Rameshwar et al., 2014).

METHODOLOGY

Preparation of extracts

Plant was collected and sorted to remove unwanted substances, rinsed with tap water and shade dried. The dried parts were pulverized separately by commercial miller to coarse powder. The sonication aided maceration technique was employed for extraction by using fourteen different solvents either alone or 1:1 combination. The accurately weighed plant powder (50 g) was soaked in 200 ml solvent using Erlenmeyer flask at room temperature for 72 hrs with frequent agitation on ultrasonic bath (temperature 25°C, frequency 25 kHz). After 3 days, plant material was strained by muslin cloth and then filtered through Whatmann No. 1 filter paper. Finally, filtrates were concentrated (at room temperature) and dried in vacuum oven (Mermant, Germany). The crude extracts were then stored at -20°C. The different solvents employed for extraction process included; n-hexane (NH), chloroform (CH), ethyl acetate (EA), chloroform : methanol (CH:M), chloroform : ethanol (CH:E), acetone : ethyl acetate (AC:EA), methanol : ethyl acetate (M:EA), ethanol : ethyl acetate (E:EA), acetone (AC), methanol (M), ethanol (E), acetone : distilled water (AC:W), methanol : distilled water (M:W) and distilled water (W).

Antimicrobial assays

Antileishmanial assay

The antileishmanial potential of crude extracts was assessed *via* MTT colorimetric assay as documented previously by Zahra et al., (2017).

Antifungal assay

Antifungal potential of the test samples of *B. ceiba* was investigated *via* agar disc diffusion method Zahra et al., (2017).

Antidiabetic assay

α-Amylase inhibition assay

Antidiabetic potential of test extracts was determined by α-amylase inhibition assay following the standard protocol with minor modifications (Nasir et al., 2017).

RESULTS AND DISCUSSION

Leishmaniasis is spread through a vector, sand fly (Durrani et al., 2012) and has a high annual incidence of cutaneous (1–1.5 million cases) and visceral leishmaniasis (500,000 cases) (Desjeux et al., 2004). Leishmaniasis is endemic in 88 countries (Khan et al., 2011) including Pakistan, India, Afghanistan and Sudan (Murray et al., 2005). Therefore, the screening was performed, in which W extract of leaf exhibited significant antileishmanial activity with 80 ± 3.5% mortality at 20 μg/ml concentration with an IC_{50} 3.5 ± 0.23 μg/ml. The standard used was amphotericin B (IC_{50} 0.01 ± 0.001 μg/ml) at final concentration of 0.33 μg/ml. All other extracts were found to be inactive except stem wood's M and AC extracts which showed some antileishmanial activity with 55 ± 2.5 and 50 ± 2.1% mortality respectively. The result depicts that the compounds with most potent activity are concentrated in the most polar extract i.e. water. Antileishmanial capability of different solvent extracts of *B. ceiba* L. was assessed for the first time according to the best of our knowledge. So, this information should be utilized for further isolation and characterization of pure compounds with potential to develop antileishmanial drugs in future.

The antifungal potential for *B. ceiba* L. was explored via disc diffusion method. The results demonstrated that extract of *B. ceiba* L. showed potential activity against the tested fungal strains. Considerable antifungal activity (in the range of 10-12 mm ZOI) was demonstrated by CH:M extracts of both flower and stem bark, and CH extract of root bark against *A. niger*. Whereas against *F. solani*, M:EA, AC extracts of leaf, EA extract of stem bark, NH, CH:E, M:EA extracts of root bark and NH extract of root wood exhibited the antifungal potential (ZOI from 10-12 mm). However a few extracts (namely; NH, CH, EA, E:EA, M and W) of root wood part exclusively showed activity against *A. fumigatus* strain. No activity was observed against *Mucor sp.*, and *A. flavus* strains. In literature, the moderate (10-14 mm ZOI) antifungal activity has been reported against *Candida albicans* and *A. niger* by methanol, n-hexane and chloroform root extracts of *B. ceiba* (Islam et al., 2011). The significant potential of subject plant can be exploited as a vital source of antifungal leads.

The adverse effects associated with insulin and oral hypoglycemics have led researchers to focus on the alternative sources of new antidiabetic agents (Patel et al., 2012). The 84 extracts of *B. ceiba* L. were therefore screened for α-amylase inhibition activity and results were shown as percent α-amylase inhibition (Figure 1).

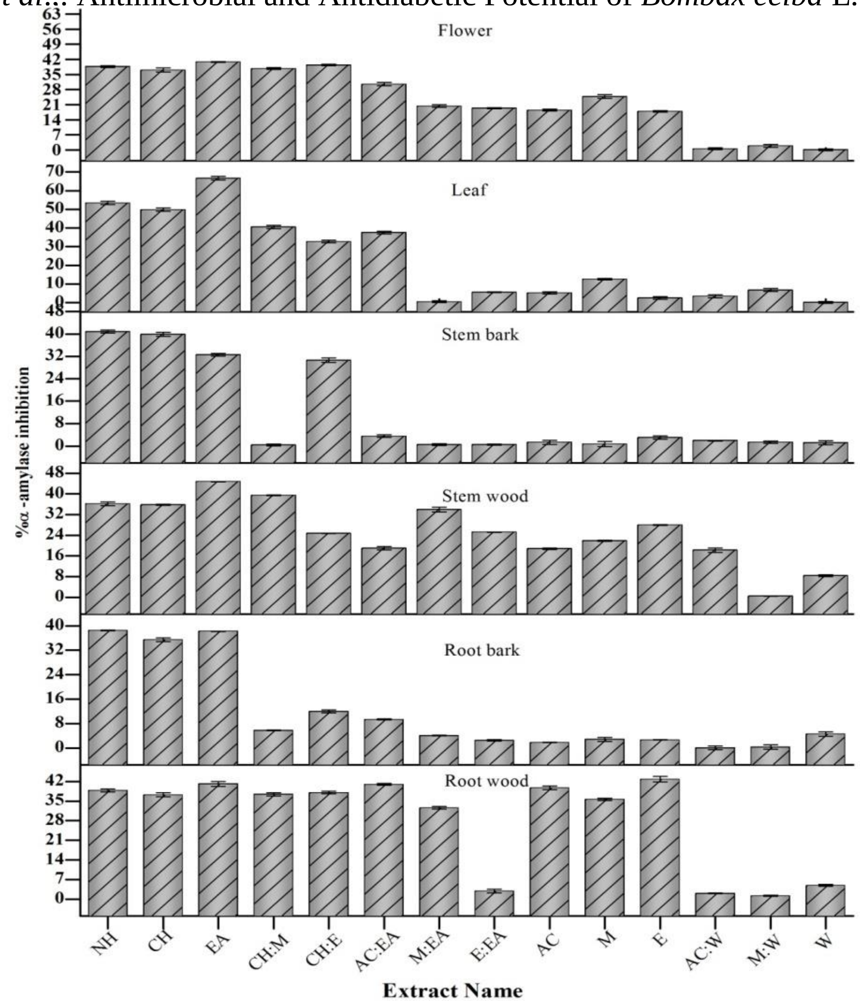

Figure 1: Comparison of α-amylase inhibition assay of different parts of *B. ceiba* L. crude extracts. The IC_{50} of acarbose (positive control) = 33.73 ± 0.12 µg/ml. The values are presented as mean ± standard deviation (*n* = 3).

The results showed that the plant exhibited considerable antidiabetic activity. The most potent α-amylase inhibitory activity was displayed by EA extract of leaf part with 66.69 ± 0.95% inhibition (IC_{50} 190 ± 4.5 µg/ml). Moderate α-amylase inhibitory activity (in the range of 35-55% inhibition) was demonstrated by the non-polar (NH, CH and EA) extracts of all parts of the plant. While almost no α-amylase inhibitory activity was observed in polar (M:W and W) extracts of all parts of the plant. Moreover, the extracts of moderate polarity exhibited either none or very less α-amylase inhibitory activity as compared to their non-polar counterparts. It indicates that compounds which have α-amylase inhibitory potential are congregated in non-polar extracts of the plant. Contrary to above, an in vivo hypoglycemic activity has been reported in Sprague-Dawley rats from shamimin, a C-flavonol glucoside, obtained from aqueous and methanolic extracts of leaf part of *B. ceiba* (Saleem R et al., 1999). This shows that the above investigation is targeting hypoglycemic effect by some other mechanism which is different from α-amylase inhibition. This information can be further utilized for large scale extraction studies for isolation of compounds with antidiabetic potential.

CONCLUSION

Selected plant was found to possess antimicrobial and antidiabetic potential. Bioassay guided isolation should be carried to isolate bioactive leads. Plant based green synthesis of nanoparticles is recommended as revealed by Nazli et al., (2018).

REFRENCES

Desjeux P (2004). Leishmaniasis: current situation and new perspectives. Comparat Immunol Microbiol Infect Dis 27: 305-18.

Dorman HJD, Deans SG (2000). Antimicrobial agents from plants: antibacterial activity of plant volatile oils. J. Appl. Microbiol 88: 308-316.

Durrani AZ, Durrani HZ and Kamal N (2012). Prevalence of *Leishmania* in sand fly in Pakistan. Pak J Zool 44: 61-65.

Gupta P, Goyal R, Chauhan Y and Sharma PL (2013). Possible modulation of FAS and PTP-1B signaling in ameliorative potential of *Bombax ceiba* against high fat diet induced obesity. BMC Complement Altern Med 13: 281.

Gupta R (2012). Plant Taxonomy: past, present and future. 1st ed, The Energy and Resources Institute (TERI), New Delhi.

Hossain E, Mandal SC and Gupta J (2011). Phytochemical screening and *in vivo* antipyretic activity of the methanol leaf extract of *Bombax malabaricum* DC. Trop J Pharm Res 10: 55-60.

Kalita GJ, Rout S, Mishra RK and Sarma P (2015). Traditionally used medicinal plants of Bajali sub-division, Barpeta District, Assam. J Med Plants Stud 3: 8-17.

Krishnaraju AV, Rao TV, Sundararaju D, Vanisree M, Tsay HS and Subbaraju GV (2005). Assessment of bioactivity of Indian medicinal plants using brine shrimp (*Artemia salina*) lethality assay. Int J Appl Sci Eng Res 3: 125-34.

Kumar N (2014). Medicinal plants used in unani system of medicine for various disorders tehsil Joginder Nagar (HP). Int J Res Biol Sci 4: 41-45.

Kumar S, Malik DK and Kumar R (2013). Antimicrobial effects of *Mangifera indica*, *Bombax ceiba, Syzygium cumini* and *Kalanchoe pinnata* against acne-inducing bacteria. Asian J Exp Biol Sci 4: 645-47.

Malviya N, Jain S, Malviya SAPNA (2010). Antidiabetic potential of medicinal plants. Acta Pol Pharm 67: 113-118.

Nasir B, Ahmad M, Zahra SS, Fatima H and Rehman TU (2017). Pharmacological evaluation of *Fumaria indica* (hausskn.) pugsley; a traditionally important medicinal plant. Pak J Bo **49**: 119-32.

Nazli A, Baig MW, Zia M, Ali M, Shinwari ZK, Haq IU (2018). Plant-based metallic nanoparticles as potential theranostics agents: bioinspired tool for imaging and treatment. IET nanobiotechnol 12: 869-878.

Patel D, Kumar R, Laloo D, Hemalatha S (2012). Diabetes mellitus: an overview on its pharmacological aspects and reported medicinal plants having antidiabetic activity. Asian Pac J Trop Biomed 2012: 411-20.

Rameshwar V, Kishor D, Tushar G, Siddarth G and Sudarshan G. A pharmacognostic and pharmacological overview on *Bombax ceiba*. Sch Acad J Pharm 3: 100-07.

Ravi V, Patel S, Verma N, Datta D and Saleem TM (2010). Hepatoprotective activity of *Bombax ceiba* Linn. against isoniazid and rifampicin-induced toxicity in experimental rats. Int J Appl Res Nat Prod 3: 19-26.

Saleem R, Ahmad M, Hussain SA, Qazi AM, Ahmad SI, Qazi MH (1999). Hypotensive, hypoglycaemic and toxicological studies on the flavonol C-glycoside shamimin from *Bombax ceiba*. Planta medica 65: 331-4.

Saleem R, Ahmad SI, Ahmed M, Faizi Z, Rehman SZU, Ali M and Faizi S (2003). Hypotensive activity and toxicology of constituents from *Bombax ceiba* stem bark. Biol Pharm Bull 26: 41-46.

Shelke TT, Bhaskar V, Gunjegaokar S, Antre R and Jha U (2014). A pharmacological appraisal of medicinal plants with antilithiatic activity. World J Pharm Pharm Sci 3: 447-56.

Sint KM, Adamopoulos S, Koch G, Hapla F and Miltiz H (2013). Wood anatomy and topochemistry of *Bombax ceiba* L. and *Bombax insigne* wall. Bioresources 8: 530-44.

Tiwari R and Rana C (2015). Phytomedicine for the diabetes: A traditional approach. Ann Phytomed 4: 108-10.

Zahra SS, Ahmed M, Qasim M, Gul B, Zia M, Mirza B and Haq IU (2017). Polarity based characterization of biologically active extracts of *Ajuga bracteosa* Wall. ex Benth. and RP-HPLC analysis. BMC Complement Altern Med 17: 443-58.