Annals of Clinical Case Studies

ISSN 2688-1241

Short Communication

Valuation of Antimicrobial Activity of *Morus Alba* L.

Genovese C, Scarpaci KS, D'angeli F, Caserta G and Nicolosi D*

Department of Biomedical and Biotechnological Sciences, Microbiology section, University of Catania, Italy

Abstract

Morus alba L. is a plant belonging to the moraceae family knows as white mulberry. It is a species native to China and used in silk production, in traditional Chinese medicine and its fruits are used for fresh consumption. The different parts of the plant contain considerable amounts of amino acids, vitamins, minerals, steroids, saponins, alkaloids, glycosides, and phenolic compounds including: terpenoids, flavonoids, anthocyanins, and tannins. These compounds can be associated with many pharmacological activities: anti-oxidative, anti-diabetic, anti-stress, nephroprotective, antimicrobial, anti-mutagenic, anticancer, anxiolytic, hepatoprotective, anthelmintic, antimicrobial, immune-modulatory and cholesterol lowering effects. In this study we investigated the possible antimicrobial activity of different *Morus alba* L. leaf extract against Gram- positive and Gram-negative strains.

Keywords: *Morus alba*; Extract; Antimicrobial activity; Gram-positive strains; Gram-negative strains

Introduction

The high and irrational consumption of antibiotics has created a growing problem in the therapeutic field. It has led to the evolution of new resistant strains of bacteria that are more lethal and strong against the pharmacological therapies compared to the original strains. The development of drug resistance is a serious problem which requires carrying out research and development of new drugs to fight drug-resistant bacteria.

Medical plants have many active compounds that have a positive impact on the treatment of disease caused of bacteria. The exploration of plant-based antimicrobials has led to the development of new therapeutic strategies to overcome the problem of antimicrobial resistance [1-3].

Morus spp. are widely distributed in Asia, Europe, Africa and America and are being utilized for development of different food products as well as for the treatment of various diseases. *Morus* spp. is largely used because the presence of numerous phytochemicals contained in leaves, fruits and rook. The leaves has used for their Anti-diabetic, hypoglycemic, anti-obesity, anti-inflammatory, antioxidant, antibacterial, hepatoprotective, vasoactive, neuroprotective, anticancer, nephroprotective and cytoprotective activities. The fruits has used for their anti-diabetic, hypoglycemic, hyperglycemic, anti-obesity, hyper-lipidemic, antioxidant, hypolipidemic, anticancer, nephroprotective, antiviral and cytoprotective activities. The rook bark has used for their anti-diabetic, hypoglycemic, anti-inflammatory, antibacterial, hypolipidemic, anticancer and antiviral activities [4-6].

Citation: Genovese C, Scarpaci KS, D'angeli F, Caserta G, Nicolosi D. Valuation of Antimicrobial Activity of *Morus Alba* L. Ann Clin Case Stud. 2020;2(1):1017.

Publisher Name: Medtext Publications LLC

Manuscript compiled: Feb 24th, 2020

***Corresponding author:** Daria Nicolosi, Department of Biomedical and Biotechnological Sciences-Microbiology section, University of Catania, Sofia, Catania, Italy, Tel: 390954781241; E-mail: dnicolosi@unict.it

Morus alba L. is a plant belonging to the moraceae family knows as white mulberry. It is a species native to China and used in silk production, in traditional Chinese medicine and its fruits are used for fresh consumption. The different parts of the plant contain considerable amounts of amino acids, vitamins, minerals, steroids, saponins, alkaloids, glycosides, and phenolic compounds including: terpenoids, flavonoids, anthocyanins, and tannins. These compounds can be associated with many pharmacological activities: anti-oxidative, anti-diabetic, anti-stress, nephroprotective, antimicrobial, anti-mutagenic, anticancer, anxiolytic, hepatoprotective, anthelmintic, antimicrobial, immune-modulatory and cholesterol lowering effects. Through phytochemical analysis it was possible to identify the active compounds related to specific pharmacological activities, among which: polyphenolic constituents like prenylated flavonoids, benzofurans and Diels-Alder type can be correlated with hepatoprotective, cytotoxic and antioxidant activities; 1-deoxynojirimycin and its derivatives have antiviral, anticancer, anti-obesity and anti-diabetic activities; cyanidin-3-O-β-D-glucopyranoside have anti-inflammatory and antioxidant activities; chlorogenic acid, rutin, quercetin-3-O-(6-Omalonyl)-b-D-glucoside and isoquercitrin can significantly lower the cardiovascular risks; Moracin C and Moracin M can be correlated with antimicrobial activity; anthocyanin compounds, linoleic acid and dietary fiber have hepatoprotective activity and protect against cytotoxicity [7,8].

Material and Methods

Genovese et al. [9] investigate the possible antimicrobial activity of different *Morus alba* L. leaf extract against 30 Gram- positive strains (*Staphylococcus aureus*, *S. epidermidis*, *Enterococcus faecalis*) and 30 Gram-negative strains (*Escherichia coli*, *Pseudomonas aeruginosa*, *Proteus mirabilis*), using ciprofloxacin as standard antibiotic. The four extracts were obtained by a process of maceration, for 24 h under constant shaking at room temperature. The process of maceration was repeated for three times, so as to increase the amount of extracts. The first extract was produced by 10 g of powdered leaves in 100 ml of acetone, the second extract was produced by 10 g of powdered leaves in 100 ml of ethanol 96%, the third extract was produced by 10 g of powdered leaves in 100 ml of ethyl acetate and the fourth extract was produced by 10 g of powdered leaves in 100 ml of methanol. The four extract were filtered and evaporated to dryness under reduced pressure

with a rotator evaporator (Stuart RE300). The antimicrobial activity was determined using 96-well micro plate's method, according to the recommendations of the Clinical and Laboratory Standards Institute.

Results

The results of the testing are shown that the ethyl extract of *Morus alba* L. leaf was inactive against all Gram-positive and Gram-negative tested strains. Acetone extract has shown the best bacterial growth inhibitory activity on Gram-positive. Tested strains, but don't show activity against the Gram-negative tested strains. Ethanol extract has shown a good bacterial growth inhibitory activity on Gram-positive tested strains, but don't show any activity against Gram-negative tested strains. Methanol extract has shown a low bacterial growth inhibitory activity on Gram-positive tested strains and no activity against Gram negative tested strains (Table 1) [10-12].

Conclusion

The research of active antimicrobial compounds from plants has always been of great interest in the research of new drugs useful in infectious diseases. The analysis show how the *Morus alba* L. extract can be useful for the treatment of infection of Gram-positive strains tested and for the development of new compounds active against antimicrobial resistance bacteria. Also show how the use of *Morus alba* L. extract is not useful against Gram-negative strains tested, because all extract was ineffective on the inhibition of bacteria growth. The inactivity of the extract can be attributed to the presence of a Gram-negative cell membrane that limits the diffusion of active compounds. *Morus alba* L. shows limited antimicrobial activity, however could be useful in research and development of new drugs to fight antimicrobial resistant Gram-positive strains.

References

1. Pisoschi AM, Pop A, Georgescu C, Turcus V, Olah NK, Mathe E. An overview of natural antimicrobials role in food. Eur J Med Chem. 2018;143:922-35.
2. Chandra H, Bishnoi P, Yadav A, Patni B, Mishra A, Nautiyal AR. Antimicrobial resistance and the alternative resources with special emphasis on plant-based antimicrobials a review. Plants (Basel). 2017; 6(2).
3. Khameneh B, Iranshahy M, Soheili V, Bazzaz BSF. Review on plant antimicrobials: a mechanistic viewpoint. Antimicrob Resist Infect Control. 2019;8(1):118.
4. Dhiman S, Kumar V, Mehta CM, Gat Y, Kaur S. Bioactive compounds, health benefits and utilization of Morus spp.–a comprehensive review. J Horticult Sci Biotech. 2020;95(1):8-18.
5. D'urso G, Mes JJ, Montoro P, Hall RD, de Vos RC. Identification of bioactive phytochemicals in mulberries. Metabolites. 2020;10(1).
6. Gurbuz I, Ozcelik B, Gunbatan T, Akkol EK, Sahinoz M, Akaydin G. Antibacterial, antifungal and enzyme inhibitory effects of selected plants from Turkey. Pak J Pharm Sci. 2018;31(6):2471-6.
7. Hussain F, Rana Z, Shafique H, Malik A, Hussain Z. Phytopharmacological potential of different species of Morus alba and their bioactive phytochemicals: A review. Asian Pac J Trop Biomed. 2017;7(10):950-6.
8. Zhang H, Ma Z, Luo X, Li X. Effects of mulberry fruit (*Morus Alba* L.) consumption on health outcomes: A mini-review. Antioxidants (Basel). 2018;7(5):69.
9. Genovese C, Tempera G, Nicolosi D, Di Giacomo C, Tomasello B, Ragusa S, et al. Antibacterial activity of Morus alba L. leaf extracts. 2016.
10. Wu SC, Han F, Song MR, Chen S, Li Q, Zhang Q, et al. Natural flavones from Morus Alba against methicillin-resistant Staphylococcus aureus via targeting the proton motive force and membrane permeability. J Agric Food Chem. 2019;67(36):10222-34.
11. Zuo GY, Yang CX, Han J, Li YQ, Wang GC. Synergism of prenylflavonoids from Morus alba root bark against clinical MRSA isolates. Phytomedicine. 2018;39:93-9.
12. Krishnamoorthy G, Leus IV, Weeks JW, Wolloscheck D, Rybenkov VV, Zgurskaya HI. Synergy between Active Efflux and Outer Membrane Diffusion Defines Rules of Antibiotic Permeation into Gram-Negative Bacteria. mBio. 2017;8(5).

Table 1: Antimicrobial activity of *Morus alba L.* leaf extracts compared to standard antibiotic Ciprofloxacin.

	Minimal Inhibitory Concentrations (mg/mL)				
Concentration ranges (µg/ml)	**[1000 to 1.95]**	**[1000 to 1.95]**	**[1000 to 1.95]**	**[1000 to 1.95]**	**[8 to 0.016]**
Gram-positive strains	Acetone	Ethanol 96%	Ethyl acetate	Methanol	Ciprofloxacin
S. aureus 052/167	500	500	>1000	1000	0.25
S. aureus 052/169	1000	>1000	>1000	>1000	0.5
S. aureus 052/171	500	>1000	>1000	>1000	0.5
S. aureus 052/174	1000	>1000	>1000	>1000	0.5
S. aureus 052/178	250	500	>1000	500	0.25
S. aureus 052/179	500	500	>1000	1000	0.5
S. aureus 052/181	250	250	>1000	250	0.016
S. aureus 052/185	1000	>1000	>1000	>1000	1
S. aureus 052/188	1000	>1000	>1000	>1000	1
S. aureus ATCC 29213	1000	>1000	>1000	>1000	0.25
S. epidermidis 052/158	250	>1000	>1000	>1000	4
S. epidermidis 052/161	250	>1000	>1000	>1000	4
S. epidermidis 052/165	30.5	61.25	>1000	150	0.25
S. epidermidis 052/168	30	61.25	>1000	125	0.25
S. epidermidis 052/170	500	>1000	>1000	>1000	4
S. epidermidis 052/172	31.25	62.5	>1000	125	0.25
S. epidermidis 052/177	500	1000	>1000	>1000	4
S. epidermidis 052/182	1000	>1000	>1000	>1000	8
S. epidermidis 052/186	1000	>1000	>1000	>1000	8
S. epidermidis ATCC 35984	15.62	62.5	>1000	125	0.016
E. faecalis 052/086	500	>1000	>1000	>1000	4
E. faecalis 052/195	250	500	>1000	1000	2
E. faecalis 052/211	>1000	>1000	>1000	>1000	8
E. faecalis 052/218	>1000	>1000	>1000	>1000	4
E. faecalis ATCC 29212	250	500	>1000	>1000	1
E. faecium 052/102	>1000	>1000	>1000	>1000	8
E. faecium 052/125	250	500	>1000	>1000	2
E. faecium 052/143	500	>1000	>1000	>1000	4
E. faecium 052/160	>1000	>1000	>1000	>1000	8
E. faecium ATCC 35667	500	500	>1000	>1000	1

	Minimal Inhibitory Concentrations (mg/mL)				
Concentration ranges (µg/ml)	**[1000 to 1.95]**	**[1000 to 1.95]**	**[1000 to 1.95]**	**[1000 to 1.95]**	**[8 to 0.016]**
Gram-negative strains	Acetone	Ethanol 96%	Ethyl acetate	Methanol	Ciprofloxacin
E. coli 007/070	>1000	>1000	>1000	>1000	4
E. coli 014/065	>1000	>1000	>1000	>1000	8
E. coli 014/070	>1000	>1000	>1000	>1000	4
E. coli 042/023	>1000	>1000	>1000	>1000	4
E. coli 042/025	>1000	>1000	>1000	>1000	8
E. coli 042/030	>1000	>1000	>1000	>1000	8
E. coli 052/119	>1000	>1000	>1000	>1000	4
E. coli 052/118	>1000	>1000	>1000	>1000	4
E. coli 052/120	>1000	>1000	>1000	>1000	4
E. coli ATCC 25922	>1000	>1000	>1000	>1000	0.5
P. aeruginosa 001/136	>1000	>1000	>1000	>1000	4
P. aeruginosa 001/138	>1000	>1000	>1000	>1000	4
P. aeruginosa 018/070	>1000	>1000	>1000	>1000	≥8
P. aeruginosa 018/077	>1000	>1000	>1000	>1000	≥8
P. aeruginosa 018/081	>1000	>1000	>1000	>1000	≥8
P. aeruginosa 018/083	>1000	>1000	>1000	>1000	≥8
P. aeruginosa 027/109	>1000	>1000	>1000	>1000	≥8
P. aeruginosa 027/114	>1000	>1000	>1000	>1000	≥8
P. aeruginosa 027/115	>1000	>1000	>1000	>1000	≥8
P. aeruginosa ATCC *27853*	>1000	>1000	>1000	>1000	1
P. mirabilis 019/164	>1000	>1000	>1000	>1000	0.5
P. mirabilis 019/166	>1000	>1000	>1000	>1000	0.5
P. mirabilis 036/040	>1000	>1000	>1000	>1000	0.016
P. mirabilis 036/042	>1000	>1000	>1000	>1000	0.016
P. mirabilis 036/043	>1000	>1000	>1000	>1000	0.016
P. mirabilis 042/027	>1000	>1000	>1000	>1000	0.016
P. mirabilis 042/030	>1000	>1000	>1000	>1000	0.016
P. mirabilis 119/108	>1000	>1000	>1000	>1000	1
P. mirabilis 119/111	>1000	>1000	>1000	>1000	1
P. mirabilis ATCC 29212	>1000	>1000	>1000	>1000	0.016