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POTENTIAL OF *TERMINALIA CATTAPA, GUAIACUM OFFICINALE, CONOCARPUS ERECTUS AND PROSOPIS JULIFLORA* AGAINST VARIOUS PATHOGENIC MICROORGANISMS

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ABSTRACT

A number of plants contain various metabolites that have great medicinal importance. Green Biotechnology deals with the detection of those therapeutic compounds. Researchers focused on the isolation and mass production of these valuable compounds and to find the ways to use them in medicines in order to treat various disorders. In the present study, we used the ethanolic and methanolic extracts of *Terminalia cattapa, Guaiacum officinale, Conocarpus erectus, Prosopis juliflora, Ziziphys nummularia,* and *Moringa oleifera* to deterimine antimicrobial potential of these plants against pathogenic clinical isolates. Results showed that all the tested pathogens were inhibited by *Terminalia cattapa;* whereas *Conocarpus erectus* and *Prosopis juliflora* also showed antimicrobial activity against various pathogens. *Guaiacum officinale* only inhibited the growth of *Escherichia coli* while no inhibitory effect was observed by the extracts of *Ziziphys nummularia* and *Moringa oleifera.*

Keywords: Antimicrobial, Ethanolic extracts, Methanolic extracts**,** Pathogens.

INTRODUCTION

Plant-based products are inexpensive, safe and known to have multi-target effects (Abdel Hameed *et al*., 2012). There are wide varieties of medicinal plants whose medical effects are still unexplored. These plants could be the source of potential drugs with unique mechanism (Saadullah *et al*., 2016).

Due to the emergence of antibiotic resistant strains, there is a need to search more potent natural substance having antimicrobial activity against drug resistant bacteria (Abdallah, 2016). Research suggested that in developing countries, life-threatening diseases have been sharply increased; hence, the searching of novel antimicrobial natural products is on demand (Rahman *et al*., 2009).

Phenolic compounds have been known to have antimicrobial and antioxidant potential and these compounds are present in various plants. According to the biochemical analysis of *Conocarpus erectus*, it is found that it contains high range of phenolic compounds (Bashir *et al*., 2015; Hussein, 2016). In addition, *Moringa oleifera* has been highlightened for the treatment of various respiratory disorders (Kalpana *et al*., 2013). Similarly, *Guaiacum officinale* has been reported to have pharmacological importance due to the presence of saponins; the parts of the plants are used to treat rheumatoid and also possess anti-cancer and hypocholesterolmic agents (Maneechai and Pikulthong, 2017). Tannins are present in the leaves of *Prosopis juliflora* and known to have anti-bacterial and anti-fungal activities (Santos *et al*., 2013). *Terminalia catappa* is another plant which has been used to treat diabetes along with its anti-cancer properties (Kankia *et al*., 2014). Moreover, antimicrobial and anti-inflammatory responses are also the characteristics of *Zizyphus nummularia*; the plant also has been used to reduce obesity (Kumar *et al*., 2011).

There are various opportunistic microorganisms that have been involved in severe infections. *Escherichia coli* and *Staphylococcus aureus* can easily cause infections especially in immune-compromised patients (Doring *et al*., 2000). Some other microorganisms are food borne pathogens likewise *Salmonella*, *Listeria monocytogens*, *Shigella* and various species of *E. coli*. Some of them are involved in urinary tract infections while others are responsible for respiratory, ear and eye infections (Bachir and Benali, 2012; Sharma *et al*., 2009). Proteus species have been known to involve in rheumatoid arthritis as well as in urinary tract infections (Kadhim *et al*, 2016).

Therefore, the present study was designed to investigate the antibacterial potential of various plants extracts. The extracts were checked on various clinical isolates and the potential of those plants to inhibit the growth of those microorganisms have been studied.

MATERIALS AND METHODS

Materials

Leaves of *Conocarpus erectus, Moringa oleifera, Guaiacum officinale, Prosopis juliflora, Zizyphus nummularia* and *Terminalia catappa* were collected from different areas of Karachi such as North Nazimabad and Gulshan-e-Iqbal. Bacterial strains isolated from patient samples were collected from Dr. Essa Laboratory, North Nazimabad, Karachi.

Preparation of extract

The medicinal plants leaves were washed thoroughly with running water 2-3 times followed by distilled sterile water. The leaves were air dried at room temperature and ground to coarse powder. The powdered material of 10mg is dissolved in 50 mL ethanol and methanol separately. The extracts were stored in air tight containers. Restrain the extracts for one month at room temperature. After one month the extract was filtered with Watman filter paper in a beaker and dried at 70°C on water bath for two to three days. Dried extracts were stored in refrigerator until used.

Antimicrobial assay

The antimicrobial activity of the medicinal plants extract was performed by agar disc diffusion method. Stock solution was prepared; agar media was prepared and then solidified. The surface of the agar in each plate was swabbed with a different test organism in nutrient broth. The extract on the disks were then placed on the surface of the swabbed agar media and the diameter of the zone of inhibition was measured after 24 h of incubation at 37^{o}C. The antibacterial activity was present on the plates indicated by the wall surrounding by inhibition zone of the plant extract. And the inhibition zones were measured in millimeter (mm).

RESULTS AND DISCUSSION

Researchers are interested in the medicinal properties of plants due to two major reasons. Firstly, the possibility of finding new phytochemicals in order to make novel antimicrobial drugs; secondly, to generate awareness by the misuse of antibiotics likewise over dosages as well as the emergence of resistant strains against the traditional antibiotics (Neelavathi *et al*., 2013).

The present study was conducted to determine the medicinal effect of various plants by extracting the components via ethanol as well as by methanol. Results obtained by the experiments revealed that all the treatments i.e. ethanolic and methanolic extracts of the plant leaves exhibited inhibitory effect on the growth of the tested bacteria, except the leaves extracts of *Ziziphys nummularia* and *Moringa oleifera*.

Terminalia cattapa a medicinal plant could plays an important role in pharmaceutical industry. Both ethanolic and methanolic extracts of the plant showed significant higher antimicrobial activity against *Klebsiella pneumonia* (Pus), *Proteus mirabilis* (Pus), *Klebsiella oxytoca* (Urine), *Klebsiella oxytoca* (Pus), *Escherichia coli* (Urine), *Klebsiella pneumonia* (Urine), *Escherichia coli* (Vaginal smear), *Pseudomonas aeruginosa* (Sputum)and *Proteus mirabilis* (Urine). Table 1 and Table 2 summarize the antimicrobial effects of *Terminalia cattapa* on various microorganisms.

In addition, *Prosopis juliflora* leaf extracts both methanol and ethanol, showed inhibition against the *Klebsiella pneumonia* (Pus), *Proteus mirabilis* (Pus), *Escherichia coli* (Urine), *Klebsiella pneumonia* (Urine) and *Proteus mirabilis* (Urine). The extracts of *P. juliflora* leaf exhibited pronounced activity against bacterial strains tested except *Klebsiella oxytoca* (Urine), *Klebsiella oxytoca* (Pus), *Escherichia coli* (Vaginal smear) and *Pseudomonas aeruginosa* (Sputum)as indicated by diameter of growth inhibition zones (Table 1 and 2).A large number of constitutive plant compounds have been reported to have antimicrobial activity. Well known examples include phenols, unsaturated lactones, saponins, cyanogenic glycosides and glucosinolates. Phytochemical analysis of ethanolic extracts of *P. juliflora* revealed presence of alkaloids, tannins, saponins, flavonoids, sterols and triterpenes. The presence of these phytochemicals in the investigated ethanolic extracts of *P. juliflora* would be responsible for the demonstrated antibacterial activity of the extracts (Odhiambo *et al*., 2015).

Similarly, *Conocarpus erectus* shows a greater antimicrobial activity against the tested microorganisms; *Klebsiella pneumonia* (Pus), *Proteus mirabilis* (Pus), *Klebsiella oxytoca* (Urine), *Escherichia coli* (Urine) and *Proteus mirabilis* (Urine). According to the Nascimento *et al*. (2016), the aqueous extracts of *Conocarpus erectus* revealed presence of flavonoids, tannins and saponins and absence of alkaloids, coumarins, and triterpenes. On the other hand, *Moringa oleifera* and *Zizyphus nummularia* leaf extracts do not show any antimicrobial activity against the tested microorganisms while the ethanolic and methanolic extracts of *Guaiacum officinale* showed potential activity against only *Escherichia coli* (Urine).

Table 1 Antimicrobial activity of methanolic extracts of plants against various clinical isolates.

Strains	*Terminalia cattapa*	*Guaiacum officinale*	*Prosopis juliflora*	*Conocarpus erectus*	*Ziziphys nummularia*	*Moringa oleifera*
Methanolic Extracts (mm)						
Klebsiella pneumonia (Pus)	15 ± 0.26	0	10 ± 0.12	20 ± 0.46	0	0
Proteus mirabilis (Pus)	14 ± 0.19	0	27 ± 0.41	18.5 ± 0.17	0	0
Klebsiella oxytoca (Urine)	13 ± 0.16	0	0	15.5 ± 0.32	0	0
Klebsiellaoxytoca (Pus)	16 ± 0.21	0	0	0	0	0
Escherichia coli (Urine)	17 ± 0.35	17 ± 0.31	11 ± 0.11	18.2 ± 0.21	0	0
Klebsiella pneumonia (Urine)	16 ± 0.18	0	16 ± 0.25	0	0	0
Escherichia coli (Vaginal smear)	15 ± 0.31	0	0	0	0	0
Pseudomonas aeruginosa (Sputum)	16 ± 0.15	0	0	0	0	0
Proteus mirabilis (Urine)	19 ± 0.20	0	28 ± 0.29	19 ± 0.29	0	0

Table 2 Antimicrobial activity of ethanolic extracts of plants against various clinical isolates.

Strains	*Terminalia cattapa*	*Guaiacum officinale*	*Prosopis juliflora*	*Conocarpus erectus*	*Ziziphys nummularia*	*Moringa oleifera*
Ethanolic Extracts (mm)						
Klebsiella pneumonia (Pus)	17 ± 0.32	0	12.3 ± 0.35	18 ± 0.32	0	0
Proteus mirabilis (Pus)	13 ± 0.46	0	34 ± 0.49	13.5 ± 0.26	0	0
Klebsiella oxytoca (Urine)	15 ± 0.29	0	0	15 ± 0.38	0	0
Klebsiella oxytoca (Pus)	16 ± 0.11	0	0	0	0	0
Escherichia coli (Urine)	15 ± 0.36	21 ± 0.24	9.3 ± 0.16	15 ± 0.25	0	0
Klebsiella pneumonia (Urine)	14 ± 0.28	0	15 ± 0.28	0	0	0
Escherichia coli (Vaginal smear)	16 ± 0.47	0	0	0	0	0
Pseudomonas aeruginosa (Sputum)	14 ± 0.23	0	0	0	0	0
Proteus mirabilis (Urine)	18 ± 0.36	0	30 ± 0.52	13.5 ± 0.16	0	0

REFERENCES

Abdallah, E.M. (2016). Preliminary Phytochemical and Antibacterial Screening of Methanolic Leaf Extract of *Citrus aurantifolia*. *Pharm.Biotechnol.Curr. Res.*, 1(1): 1-5.

Abdel-Hameed, E.S., S.A. Bazaid, M.M. Shohayeb, M.M. El-Syed and E.A. Al-Wakil (2012). Phytochemical studies and evaluation of antioxidant, anticancer and antimicrobial properties of *Conocarpus erectus* L. growing in Taif, Saudi Arabia. *Eur. J. of Med. Plants.*, 2(2): 93-112.

Bachir, R.G. and M. Benali (2014). Antibacterial activity of the essential oils from the leaves of *Eucalyptus globulus* against *Escherichia coli* and *Staphylococcus aureus. Asian Pac. J .Trop. Biomed.*, 2(9): 739–742.

Bashir, M., M. Uzair and B.A. Chaudhry (2014). A review of phytochemical and biological studies on *Conocarpus erectus* (Combretaceae). *PJPR.*, 1(1): 1-8.

Döring, G., S.P. Conway, H.G.M. Heijerman, M.E. Hodson, N. Høiby, A. Smyth and D.J. Touw (2000). Antibiotic therapy against *Pseudomonas aeruginosa* in cystic fibrosis: A Eur. Consensus. *Eur. Respir. J.*, 16:749–767.

Hussein, R.A. (2016). Evaluation antioxidant and antibacterial activities of n-Butanol fraction of *Conocarpus erectus* L. leaves extract. *Int. J. Pharm. Med. Res.*, 4(6): 394-400.

Kalpana, S., S.Moorthi and S.Kumara (2013). Antimicrobial activity of different extracts of leaf of *Moringa oleifera* (Lam) against gram positive and gram negative bacteria. *Int.J.Curr.Microbiol.App.Sci*., 2(12): 514-518.

Kanki, A. H. I. (2014). Phytochemical screening and antibacterial activities of leaf extracts of *Terminalia catappa (*Umbrella Tree). *IJSR.*, 3(12): 2658-2661.

Khadim, W.A., M.J. Khadim and I.H. Hameed (2016). Antibacterial activity of several plant extracts against Proteus species. *IJPCR.*, 8(12): 1673-1684.

Kumar, S., V.K. Garg, N. Kumar, P.K. Sharma, S. Chaudhary and A.Upadhyay (2011). Pharmacognostical studies on the leaves of *Ziziphus nummularia* (Burm. F.). *Euro. J. Exp. Bio.*, 1(2): 77-83.

Maneechai, S. and V. Pikulthong (2017). Total phenolic contents and free radical scavenging activity of *Guaiacum officinale* L. extracts. *Pharmacogn J.*, 9(6): 929-931.

Nascimento, D.K.D., I.A. de Souza, A.F.M. de Oliveira, M.O. Barbosa, M.A.N. Santana, D.F. PJúnior, E.C. Lira and J.R.C. Vieira (2016). Phytochemical screening and acute toxicity of aqueous extract of leaves of *Conocarpus erectus* Linnaeus in Swiss Albino mice. *An. Acad. Bras. Cienc.,* 88 (3): 1431-1437.

Neelavathi, P., P. Venkatalakshmi and P. Brindha (2013). Antibacterial activities of aqueous and ethanolic extracts of *terminalia catappa* leaves and bark against some pathogenic bacteria. *Int. J. Pharm. Pharm. Sci.,* 5(1):114-120.

Odhiambo, R.S., K.G. Patrick, K.L. Helen, N.C. Gathu, N.F. Kimani, W.R. Waithaka and C. Kipyegon (2015). Antibacterial activity of ethanolic extracts of *Prosopis juliflora* against gram negative bacteria. *Euro. J. Exp. Bio.,* 5(11):43-46.

Rahman, M.M., M.M.I Sheikh, S.A. Sharmin, M.S. Islam, M.A. Rahman, M.M. Rahman and M. F. Alam (2009). Antibacterial activity of leaf juice and extracts of *Moringa oleifera* Lam. against some human pathogenic bacteria. *CMU.J.Nat.Sci.*, 8(2): 219-227.

Saadullah, M., B.A. Chaudary and M. Uzair (2016). Antioxidant, phytotoxic and antiurease activities, and Total phenolic and flavonoid contents of *Conocarpus lancifolius* (combretaceae). *Trop. J. Phamr. Res.*, 15 (3): 555-561.

Santos, E.T.D., M.L.A. Pereira, and R. Batista (2013). Antibacterial activity of the alkaloid-enriched extract from *Prosopis juliflora* pods and its influence on *in Vitro* ruminal digestion. *Int. J. Mol. Sci.*, 14: 8496-8516.

Sharma, A., S. Chandraker and V. Ramteke (2009). Antibacterial activity of medicinal plants against pathogens causing complicated urinary tract infections. *Indian J. Pharm. Sci.*, 71(2): 136–139.

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